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COMPILATION OF DATA FROM EBR-II NATURAL-CIRCULATION-TEST PROCEDURE EX-140, SECTION IV, ADDENDUM 7C

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MASTER

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

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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 investigated in Experimental Breeder Reactor No. II. Before the loss-of-flow transient, the reactor was operated at 22.0 MWt (36.7% of the normal full-power value) and at 39.0% of normal full flow. All electrical power to the primary pumping system was terminated, causing the flow rate of the primary-system coolant to coast down. As the flow rate coasted down, the low-flow trip setting caused the reactor to scram. The transition from forced to natural-circulation flow was observed to be smooth, and the coolant temperatures throughout the reactor were observed to remain lower than the corresponding values at full-power operating conditions. 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.

I. INTRODUCTION

Experimental verification of a smooth transition into natural-circulation flow after a protected loss of all plant pumping power is of extreme importance in demonstrating the safety of a liquid-metal fast breeder reactor (LMFBR). To this end, a number of natural-circulation tests[1-6] have been conducted in Experimental Breeder Reactor No. II (EBR-II) as part of the experimentation with instrumented subassembly XX08.[7]

This test program can be broken down into two categories. The first consists of tests initiated from low reactor decay power levels (a maximum of 1.26% of the full operational power). Most of these tests[1-4] consisted of coastdowns from the flow level provided by the auxiliary electromagnetic (EM) primary pump (approximately 5.5% of normal full flow), which is in the reactor outlet pipe. These early tests, summarized in Ref. 8, were intended to provide information on the dependence of minimum natural-circulation flows and maximum coolant temperature 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 in the primary-system coolant.

The remaining test in the low-decay-power test category is referred to as XX08 Test 10.[5] This test was initiated with the auxiliary pump off and the primary-system mechanical pumps at high flow values. Four separate coastdowns were conducted as part of XX08 Test 10. The first three were initiated at approximately 100% of normal operating primary-system flow, but with different secondary-system flow rates through the IHX. That is, they had different initial temperature distributions in the IHX. The fourth coastdown of Test 10 was initiated at approximately 34% of the normal full operational flow. This value was selected because it was approximately the value at which the first of the second category of natural-circulation tests would be conducted. Thus Test 10 was designed to not only provide additional data on the effects of power level and initial temperature distribution, but also to provide a reference flow-coastdown curve for the second category of test.

The second natural-circulation-test category includes tests initiated with the reactor at some substantial fission power. This type of test would be more similar to an actual loss-of-pumping-power accident in an operating LMFBR. The first test in this category is referred to as XX08 Test 7A and is discussed in Ref. 6. The initial conditions for Test 7A were a reactor power level of 17.1 MWt (28.5% of the normal full-power value) and 32.1% of normal full operational flow. All temperatures reached during the test were below the normal full-power operating temperatures. Because Test 7A was successfully completed, the next test was planned to be conducted at a higher initial power level and a higher flow rate. In this manner the conditions existing in an LMFBR under full operating conditions can be approached in a logical test sequence.

The second test in the second category is described in this report. EBR-II Test Procedure EX-140, Section IV, Addendum 7C (hereafter called XX08 Test 7C) was conducted on February 12, 1979. As with the first test in this category (7A), this test included operation of the reactor at reduced power and flow for a sufficient time to build up a near-equilibrium inventory of fission products. After termination of electrical power to the primary-system pumps, the flow within the primary system started to decay. The low-flow trip setting on the high-pressure-plenum flow to the reactor then scrammed the reactor. Eventually the flow in the primary system coasted down to a natural-circulation level, with buoyancy differences essentially provided by the fission-product-decay power within the reactor and the heat-removal capability of the secondary-sodium coolant in the IHX.

II. PLANT CONDITIONS

For Test 7C the reactor was loaded in the run-99D configuration shown in Fig. 1. The primary-tank sodium temperature 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 flow rate equal to approximately 40% of the normal operating value and then increasing the reactor power. A final steady-state power of 22.0 MWt was eventually reached. This power represents 36.7% of the normal full power of 60.0 MWt. The reactor power was held at 22.0 MWt for approximately 3 h to establish a near-equilibrium state of the fission-product inventory throughout the reactor. During this time, the secondary-sodium and steam systems also reached near-equilibrium conditions.

After the reactor had been operating at the above conditions for the 3-h period, the electrical power to the auxiliary primary EM pump was removed, causing the primary-system flow rate to decrease slightly to 39.0%. The mixed mean reactor outlet coolant temperature increased to 840°F (449°C) at this time. The conditions in the secondary steam systems were not affected

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

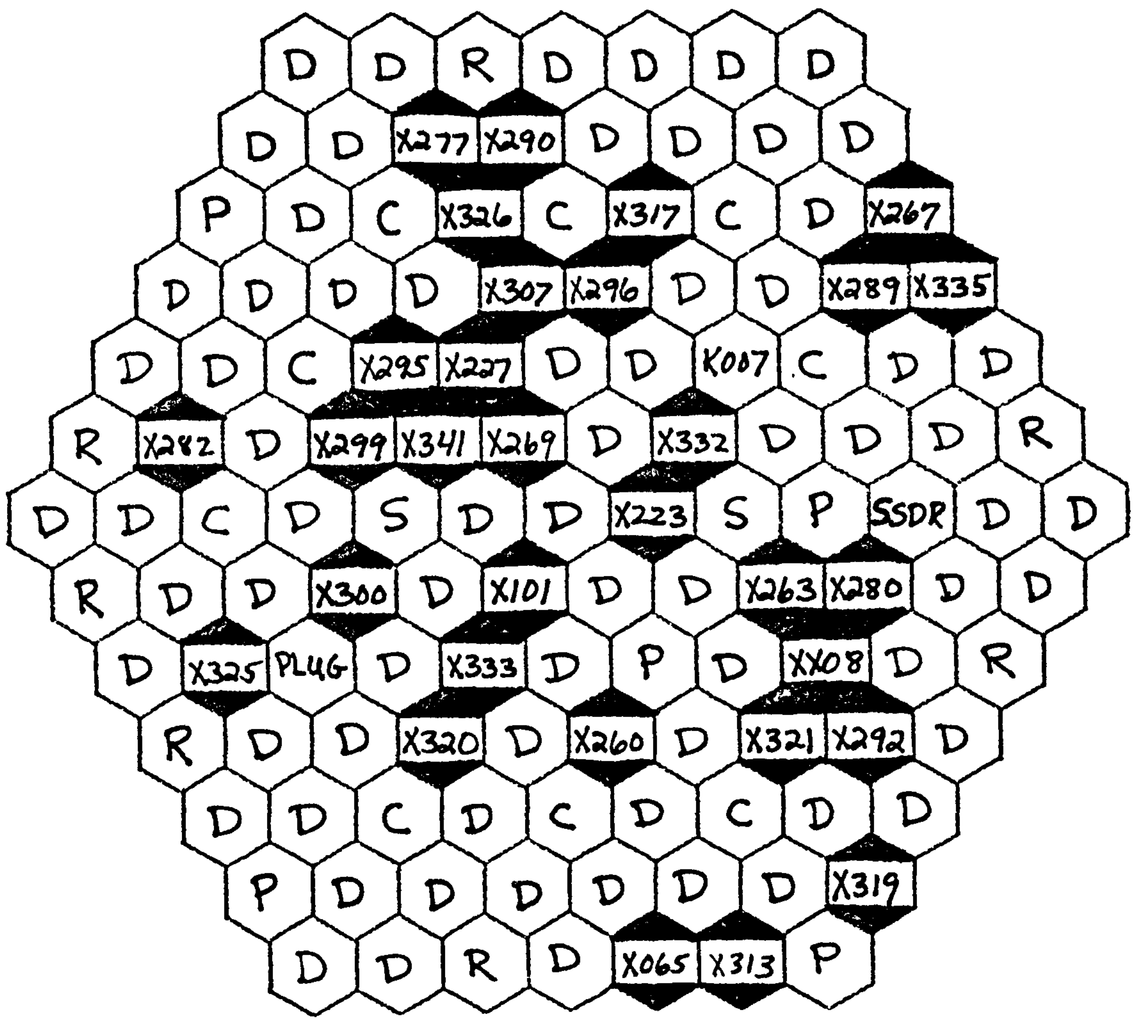


Fig. 1. Core Loading for Test 7C

by turning off the auxiliary pump. Table I lists several of the significant parameters during this part of the test.

Comparison of the data in Table I with the corresponding data for XX08 Test 7A[6] shows that the initial conditions for Test 7C were, as desired, more representative of full-power operating conditions than those for the earlier test. For example, the reactor power level was increased from 17.1 to 22.0 MWt and the primary-system flow was increased from 32.1 to 39.0% of the

TABLE I. Reactor Conditions before Coastdown of Test 7C

Reactor power	22.0 ± 0.3 MWt
Primary-system flow	3226 gpm[a] (39.0% of normal full flow)
Primary pump No. 1 speed	319 rpm
Primary pump No. 2 speed	318 rpm
Reactor inlet coolant temperature	665°F (352°C)
Mixed mean reactor outlet coolant temperature	840°F (449°C)
Secondary-system flow	2246 gpm[a] (37.4% of full flow[b])
IHX secondary-inlet temperature	577°F (303°C)
IHX secondary-outlet temperature	827°F (442°C)

[a] 1 gpm = 6.31×10^{-5} m^3/s.

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

normal full flow rate of 9000 gpm (0.568 m^3/s). The reactor inlet coolant temperature was essentially the same in the two tests, but the mixed mean reactor outlet coolant temperature was higher in Test 7C. The data for the secondary system reflect the more severe conditions in the primary system for Test 7C.

III. TEST SEQUENCE

Approximately 17 minutes after the auxiliary pump had been turned off, and with the reactor under the conditions noted in Table I, the primary pumps were tripped by manually opening the 2400-V breakers and the clutch breakers on the motor-generator set. A delay of approximately 1 s occurred between the opening of the breakers and the start of the flow coastdown. About 1 s after the coastdown was actually started (at 2.1 s after the breakers were opened), the reactor was scrammed by a low-flow trip on the flowmeter for high-pressure-plenum 2 (HPP2) of the reactor. The secondary-system flow was held constant at 37.4% during this time.

About 3 minutes after the primary-pump trip, it was noted that all temperatures in the primary system had reached their peak values and were slowly and steadily decreasing. To minimize the decrease in the primary-tank sodium temperature, the secondary-system pump was turned off and this system was allowed to coast down to its natural-circulation flow rate of approximately 2% of full flow. After several minutes of near-equilibrium conditions in the primary system, the auxiliary EM pump was turned on and the primary-system flow increased to approximately 5%. After an equilibrium state had been established for several minutes, the primary pumps were turned on to provide 100% of the normal full operational flow rate. From the data obtained at full flow, the instrumentation offsets and normalization factors were determined in the manner discussed in Sec. IV.

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 7C. Also shown in Table II are the calculated powers[9] and calculated flow rates for each of these subassemblies at the steady-state condition of 22.0 MWt total reactor power and 39.0% 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.

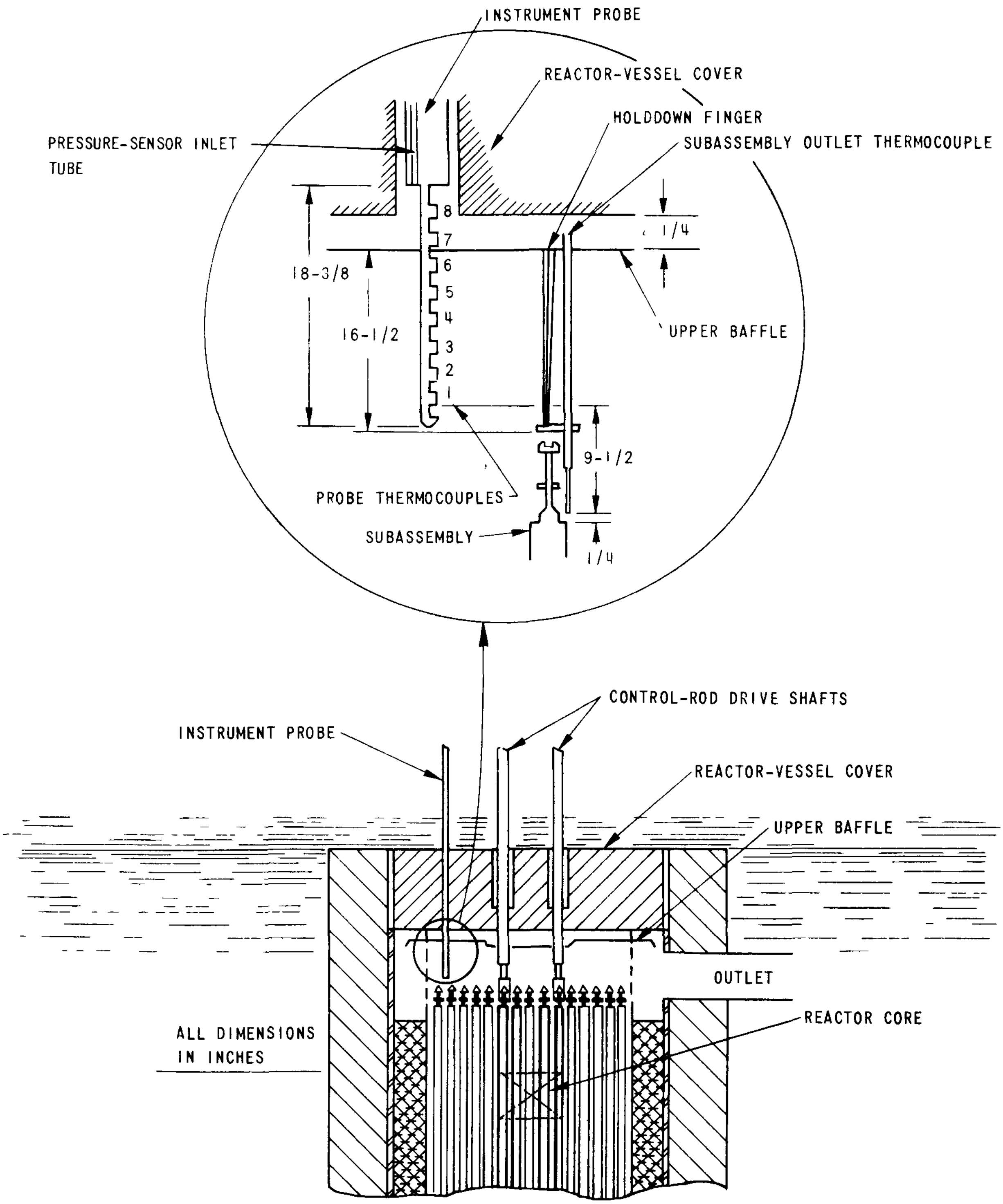


Fig. 2. Location of Subassembly Outlet Thermocouples and Orientation of Upper-plenum Instrument Probe in EBR-II. Conversion factor: 1 in. = 25.4 mm.

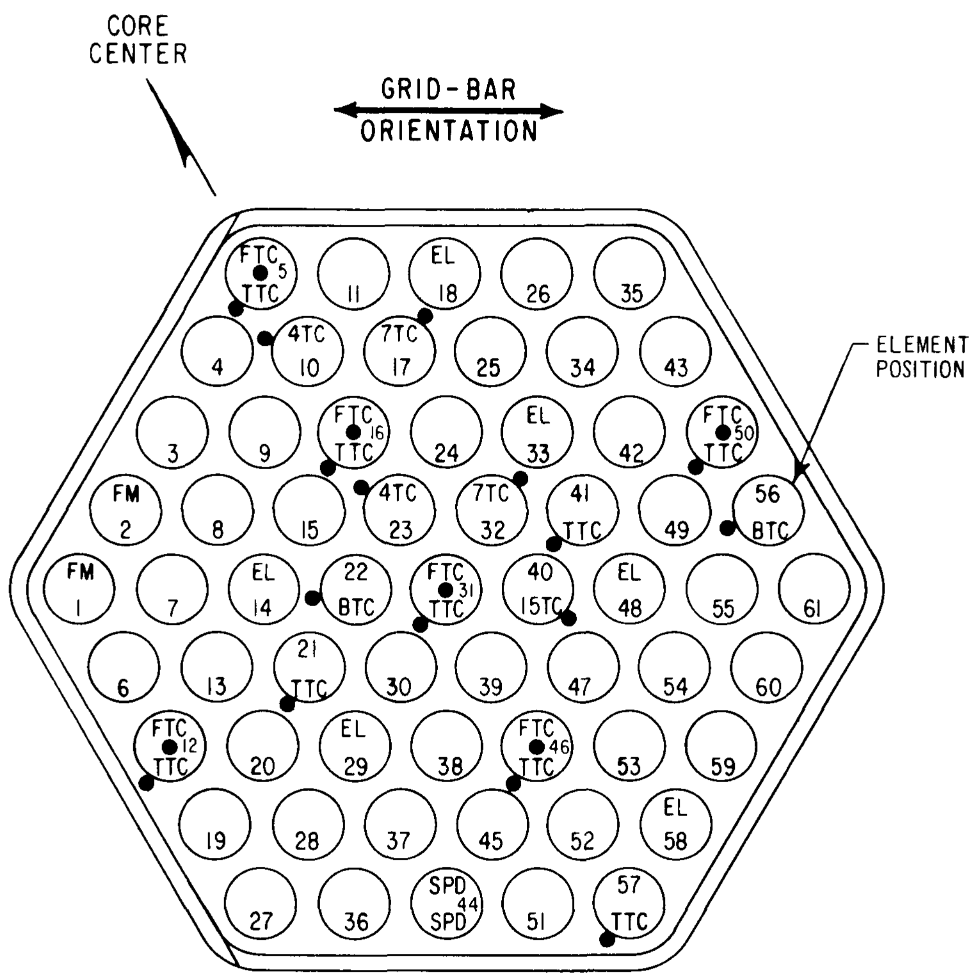
TABLE II. Locations and In-core Parameters of Subassemblies with SOT's during Test 7C

Location	Subassembly Type	Power, kWt	Flow, gpm[a]
1A1	Driver	275.9	51.84
2A1	Driver	275.0	50.69
2B1	X269A (structural experiment)	5.5	2.28
2C1	Driver	256.8	50.69
2E1	Driver	276.7	50.69
2F1	X101M (structural experiment)	6.6	4.89
3B1	X227A (37-pin oxide/bypass flow experiment)	121.1	19.98
3C1	Driver	270.9	43.69
3F1	X333 (19-pin oxide experiment)	90.3	8.69
4B1	Driver	259.8	33.63
4C3	Driver	251.0	33.63
4E1	Driver	256.0	33.63
4F1	X320 (structural experiment)	8.7	4.41
5A4	Driver	225.8	29.04
5C2	Driver	240.7	29.04
6C4	Driver	227.2	23.61
7A3	Driver	194.2	23.61
7D4	Driver	188.7	23.61
5D3	XX08	140.0	16.63

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

The coolant temperature in the reactor outlet plenum was measured by the "upper-plenum instrument probe." This probe is above the blanket subassembly in the 14D6 grid position and has thermocouples at eight different axial positions in the outlet plenum. The probe from which Test 7C data were obtained is essentially the same as that shown in Fig. 2.

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 inlet and 24 thermocouples at different radial and axial locations within the subassembly. Figure 3 shows the pattern of



	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

the XX08 instrumentation. Not shown in Fig. 3 are two thermocouples (OTC's) that measure the mixed mean outlet coolant temperature from XX08. The reader is referred to Ref. 7 for a more complete description of XX08.

As was noted previously, the final part of Test 7C 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 so that these readings could 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 in 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. 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 high-pressure-plenum (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 low-pressure-plenum 1 (LPP1) and the low-pressure-plenum 2 (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.

To quantify the offsets in these signals, a technique similar to that discussed in Refs. 1-5 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 supplied with 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. However, this difference is relatively slight, and no experimental data have verified it. Therefore, we concluded that we would achieve much greater accuracy by offsetting the HPP2 flowmeter rather than leaving the signal uncorrected.

Under conditions of fission-product-decay heat, 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 those in fueled subassemblies. 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 XX08-measured flow. It is likely, therefore, that the low-pressure-plenum flows reported in the appendix are slightly too low, especially at the auxiliary-pump flow level or lower. Nevertheless, 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 0.075, 4.110, and -1.492%, respectively. These values were used in preparing the figures presented in the appendix.

Table III lists the correction factors for instruments 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.

TABLE III. Correction Factors for Data from XX08 Test 7C

Parameter	Units	Correction Factors A	Correction Factors B
XX08 lower flowmeter	%	0.0	0.4270
XX08 upper flowmeter--signal 1	%	0.0	0.3240
XX08 upper flowmeter--signal 2	%	0.0	0.3236
XX08 FTC-5	°F	2.1	1.0
XX08 FTC-12	°F	1.5	1.0
XX08 FTC-16	°F	1.6	1.0
XX08 FTC-31	°F	0.8	1.0
XX08 FTC-46	°F	1.2	1.0
XX08 FTC-50	°F	1.2	1.0
XX08 BTC-22	°F	1.3	1.0
XX08 BTC-56	°F	1.6	1.0
XX08 4TC-10	°F	1.8	1.0
XX08 4TC-23	°F	3.7	1.0
XX08 7TC-17	°F	3.2	1.0
XX08 7TC-32	°F	2.5	1.0
XX08 15TC-40	°F	1.6	1.0
XX08 TTC-5	°F	3.5	1.0
XX08 TTC-12	°F	1.0	1.0
XX08 TTC-16	°F	1.9	1.0
XX08 TTC-21	°F	2.3	1.0
XX08 TTC-31	°F	2.9	1.0

TABLE III (contd)

Parameter	Units	Correction Factors A	Correction Factors B
XX08 TTC-41	°F	2.5	1.0
XX08 TTC-46	°F	0.1	1.0
XX08 TTC-50	°F	2.1	1.0
XX08 TTC-57	°F	0.5	1.0
XX08 OTC-1	°F	2.5	1.0
XX08 OTC-2	°F	-0.7	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	%	0.075	1.0024
Low-pressure-plenum-1 flow	%	4.110	1.0524
Low-pressure-plenum-2 flow	%	-1.492	1.0215
Total primary flow (541 E)	%	0.0	0.9892
Bulk-sodium temp (501 X)	°F	-1.6	1.0
Bulk-sodium temp (501 AA)	°F	0.9	1.0
Bulk-sodium temp (501 V)	°F	-0.6	1.0
Bulk-sodium temp (501 W)	°F	0.4	1.0
Bulk-sodium temp (501 T)	°F	0.4	1.0
Bulk-sodium temp (501 D)	°F	1.3	1.0
Bulk-sodium temp (501 E)	°F	7.2	1.0
Bulk-sodium temp (501 Q)	°F	6.6	1.0
Bulk-sodium temp (501 F)	°F	9.4	1.0
Bulk-sodium temp (530)	°F	1.9	1.0
Primary-pump inlet temp	°F	4.0	1.0
Primary-pump-1 outlet temp (540 C)	°F	-7.5	1.0
Primary-pump-1 outlet temp (540 D)	°F	-8.1	1.0
Primary-pump-2 outlet temp (540 A)	°F	-6.8	1.0
Primary-pump-2 outlet temp (540 E)	°F	-6.1	1.0
Primary-pump-2 outlet temp (540 F)	°F	-5.6	1.0
Low-pressure-plenum sodium temp (540 AR)	°F	0.9	1.0
Low-pressure-plenum sodium temp (540 AS)	°F	2.1	1.0
Low-pressure-plenum sodium temp (540 AV)	°F	2.3	1.0
High-pressure-plenum sodium temp (540 AT)	°F	0.8	1.0

TABLE III (contd)

Parameter	Units	Correction Factors A	Correction Factors B
Subassembly outlet temp, position 1A1	°F	1.8	1.0
Subassembly outlet temp, position 2A1	°F	7.7	1.0
Subassembly outlet temp, position 2B1	°F	3.2	1.0
Subassembly outlet temp, position 2C1	°F	0.4	1.0
Subassembly outlet temp, position 2E1	°F	2.4	1.0
Subassembly outlet temp, position 2F1	°F	5.3	1.0
Subassembly outlet temp, position 3B1	°F	2.2	1.0
Subassembly outlet temp, position 3C1	°F	-17.0	1.0
Subassembly outlet temp, position 3F1	°F	0.2	1.0
Subassembly outlet temp, position 4B1	°F	2.2	1.0
Subassembly outlet temp, position 4C3	°F	2.8	1.0
Subassembly outlet temp, position 4E1	°F	0.6	1.0
Subassembly outlet temp, position 4F1	°F	1.2	1.0
Subassembly outlet temp, position 5A4	°F	0.9	1.0
Subassembly outlet temp, position 5C2	°F	0.7	1.0
Subassembly outlet temp, position 6C4	°F	-0.5	1.0
Subassembly outlet temp, position 7D4	°F	3.0	1.0
Subassembly outlet temp, position 9E4	°F	2.9	1.0
Subassembly outlet temp, position 12E6	°F	0.0	1.0
Subassembly outlet temp, position 16E9	°F	-0.1	1.0
Upper-plenum-probe temp TC1	°F	2.2	1.0
Upper-plenum-probe temp TC2	°F	3.8	1.0
Upper-plenum-probe temp TC3	°F	1.6	1.0
Upper-plenum-probe temp TC4	°F	1.9	1.0
Upper-plenum-probe temp TC5	°F	2.2	1.0
Upper-plenum-probe temp TC6	°F	2.4	1.0
Upper-plenum-probe temp TC7	°F	2.3	1.0
Upper-plenum-probe temp TC8	°F	1.7	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	5.0	1.0
Reactor outlet temp (506 X)	°F	2.7	1.0

TABLE III (contd)

Parameter	Units	Correction Factors A	Correction Factors B
IHX primary-inlet temp (507 BK)	°F	1.4	1.0
IHX primary-inlet temp (507 BQ)	°F	4.1	1.0
IHX primary-outlet temp (540 AB)	°F	-1.1	1.0
IHX primary-outlet temp (540 AC)	°F	-1.1	1.0
IHX primary-outlet temp (540 AD)	°F	-1.2	1.0
IHX primary-outlet temp (540 AE)	°F	-0.8	1.0
IHX primary-outlet temp (540 AM)	°F	-1.4	1.0
IHX primary-outlet temp (540 AN)	°F	-0.7	1.0
IHX primary-outlet temp (540 AP)	°F	-0.8	1.0
IHX primary-outlet temp (540 AQ)	°F	-0.7	1.0
IHX top orifice plate (507 CP)	°F	1.0	1.0
IHX bottom orifice plate (507 CC)	°F	2.1	1.0
IHX bottom orifice plate (507 BX)	°F	1.1	1.0
IHX bottom orifice plate (507 EF)	°F	0.9	1.0
IHX bottom orifice plate (507 EG)	°F	1.5	1.0
IHX bottom orifice plate (507 CA)	°F	1.0	1.0
IHX bottom orifice plate (507 CG)	°F	1.4	1.0

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

The "Neutron Power (Log Range B)" signal (pages 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 = 0.749 were used for this purpose.

The secondary-sodium and steam signals are recorded without offset or normalization factor (i.e., A = 0.0 and B = 1.0).

V. TEST DATA

The data from XX08 Test 7C are presented in graphical form in the appendix. For each plot, time = 0 represents the time at which the primary pumps were tripped. 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.

Curves for pump speed versus time are shown on pages A40-A41. From these curves, it is apparent that about 35 s elapsed from the interruption of the electrical power supply until primary pump No. 1 reached zero speed. For primary pump No. 2, however, 42 s were required. During this 7-s period when pump No. 2 was still running down and pump No. 1 was stopped, a measurably increased proportion of the total primary flow was supplied by pump No. 2. This is illustrated by the "hump" in the flow-coastdown transient measured by the HPP2 flowmeter and shown on pp. A36-A37. Unfortunately, the flowmeter in the high-pressure-plenum inlet pipe from pump No. 1 (i.e., HPP1) is no longer functional. As a result, no direct experimental observations can be made of the flow rate through this line. Calculations of this phenomenon, however, indicate that the flow in the line from pump No. 1 reversed during this 7-s period--i.e., some coolant pumped into the plenum by primary pump No. 2 bypassed the reactor core and went into the plenum-inlet pipe from primary pump No. 1. As additional evidence of this behavior, the in-core flow rate as measured by XX08 (pp. A2-A5) shows a smooth coastdown characteristic and a gradual transition from forced to natural convective flow. The "hump" in the HPP2 flow did not cause a similar condition to appear in-core.

The thermal response of the primary coolant can be seen in the behavior of the XX08 top-of-core thermocouples (pp. A12-A21) and the subassembly outlet thermocouples (pp. A60-A79). For reference, the reactor inlet temperature was 665°F (352°C). Of particular interest are the responses of a thermocouple in an interior subchannel of the XX08 rod bundle (e.g., TTC-31, pp. A16-A17) and of a thermocouple next to the hex-can wall (e.g., TTC-57, pp. A20-A21). The initially hot interior subchannel and initially cool wall subchannel are observed to reach nearly the same peak temperature during the transient. This behavior, which has been repeatedly observed under low-flow conditions in EBR-II, is caused by intrasubassembly flow redistribution and transverse conduction and results in quite uniform transverse temperature gradients in subassemblies.

Pages A62-A63 and A68-A69 show the coolant temperatures at the outlet of two fueled subassemblies (2A1 and 4B1), one of which operated initially at a somewhat larger than average temperature rise, and the other at a smaller than average temperature rise. As was observed in a single subassembly, the transverse temperature differences between different subassemblies are seen to decrease during the natural-circulation transient. For these two fueled subassemblies, the initial at-power temperature rises differ by about 46%, but the temperature rises at the peak of the transient differ only by about 11%.

This significant flattening of the transverse reactor temperature profile is primarily due to buoyancy-induced flow redistribution and intersubassembly heat transfer. The effects of intra- and intersubassembly heat transfer are discussed in detail in Ref. 10, where similar data from other natural-circulation tests in EBR-II are presented.

Comparison of the data in the appendix with the corresponding data in Ref. 6 shows the effects of the increased initial power and flow on the peak transient temperatures. The more severe initial conditions of Test 7C resulted in somewhat higher peak temperatures. However, the peak transient temperatures remained below the corresponding steady-state temperatures. These results, along with the attendant calculational results, provide solid evidence that the transition from forced to natural-circulation flow continues to be smooth even with more severe initial conditions. The next series of XX08 natural-circulation tests will examine the dynamic effects of a primary-system flow coastdown and reactor scram followed sometime later by a flow coastdown in the secondary coolant system.

ACKNOWLEDGMENTS

We are very appreciative of the efforts of those people in the Operations and Analysis Department of the EBR-II Project who were instrumental in preparing for and conducting XX08 Test 7C. 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.

REFERENCES

1. 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).
2. 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).
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).
5. 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).
6. 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).
7. A. Smaardyk et al., *EBR-II Environmental Instrumented Subassembly XX08: Engineering and Assembly,* ANL-78-9 (May 1978).

8. 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 Joint ASME/AIChE 18th National Heat Transfer Conference, San Diego, CA, Aug. 6-8, 1979.

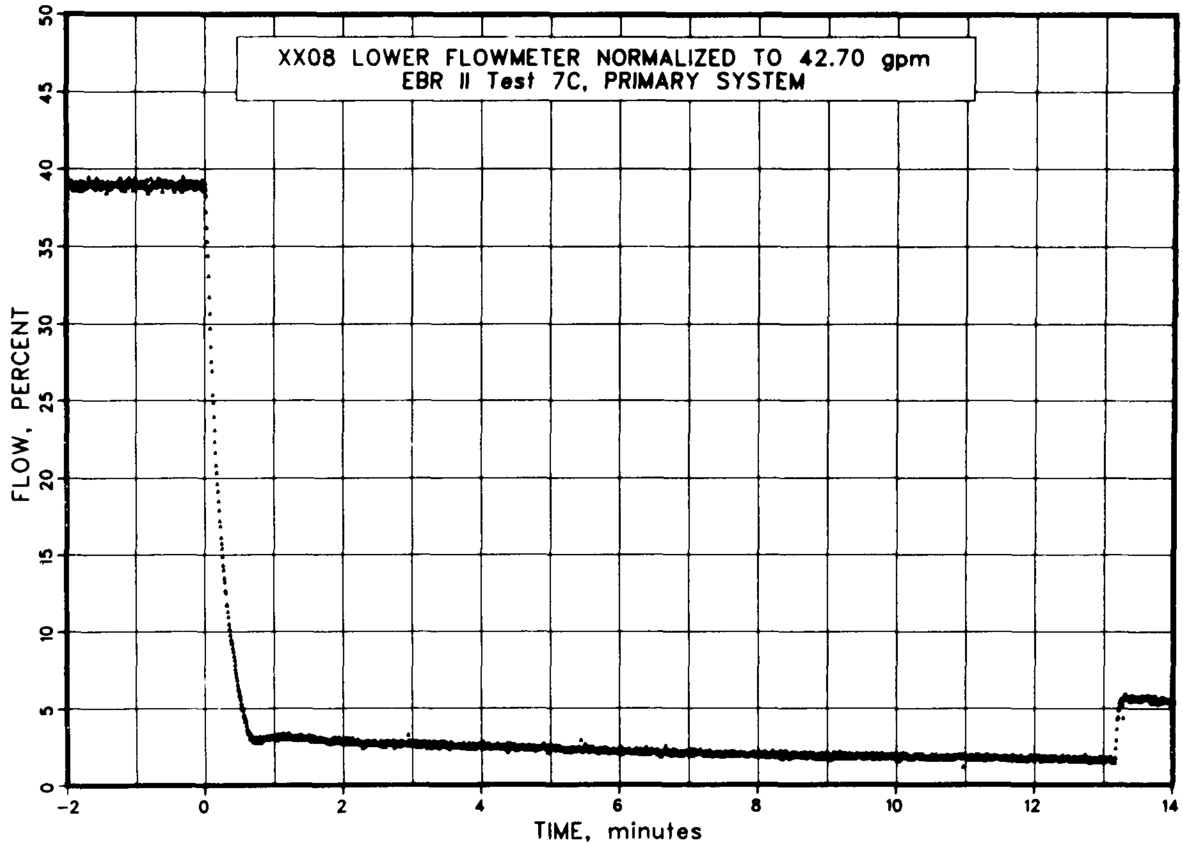
9. K. E. Phillips, personal communication (April 1979).

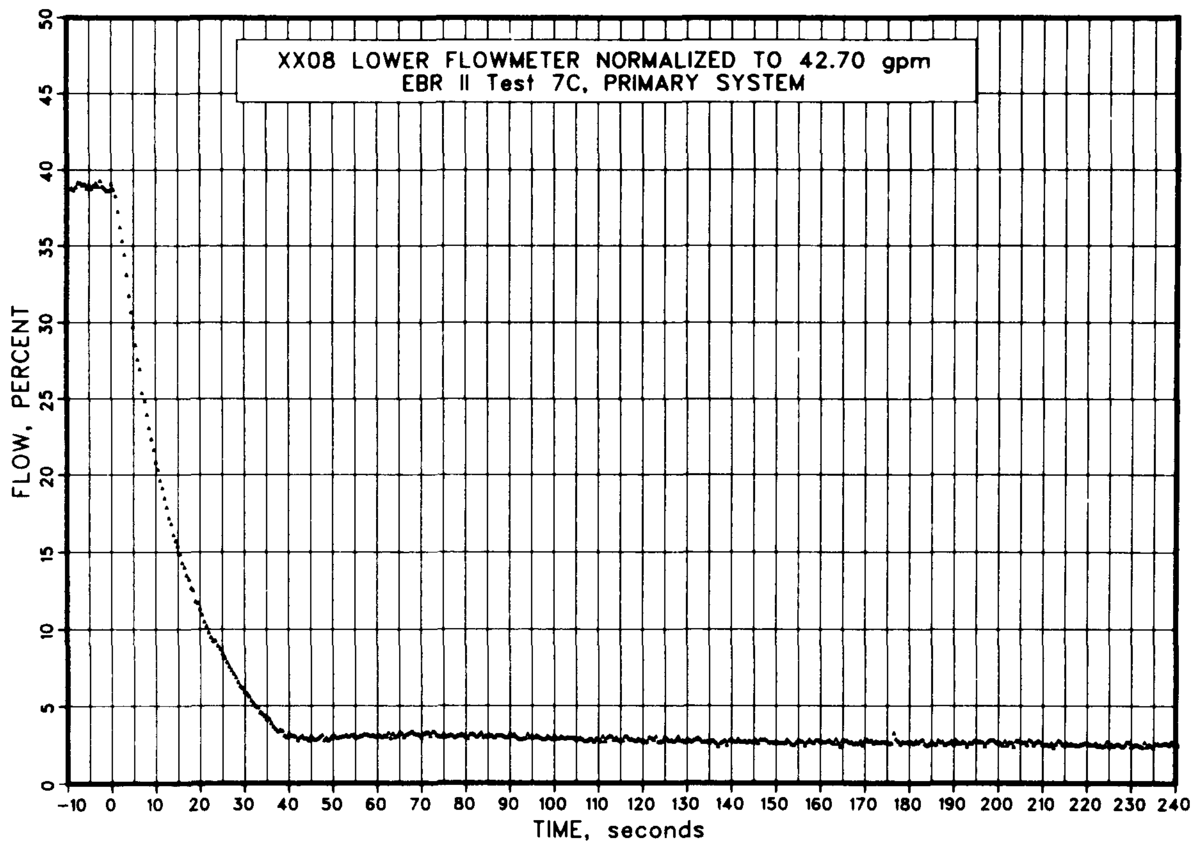
10. R. M. Singer and J. L. Gillette, *Measurements of Subassembly and Core Temperature Distributions in an LMFBR*, AIChE Symposium Series *73* (164), pp. 97-104 (1977).

APPENDIX

Plots of Data from Test 7C

The plots of data obtained during XX08 Test 7C are presented in the following order:


XX08 LOWER FLOWMETER NORMALIZED TO 42.70 gpm
EBR II Test 7C, PRIMARY SYSTEM
FLOW, PERCENT
TIME, minutes
0
5
10
15
20
25
30
35
40
45
50
-2
0
2
4
6
8
10
12
14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EBR II Test 7C, PRIMARY SYSTEM
FLOW, PERCENT
TIME, seconds
0
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10
15
20
25
30
35
40
45
50
-10
0
10
20
30
40
50
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70
80
90
100
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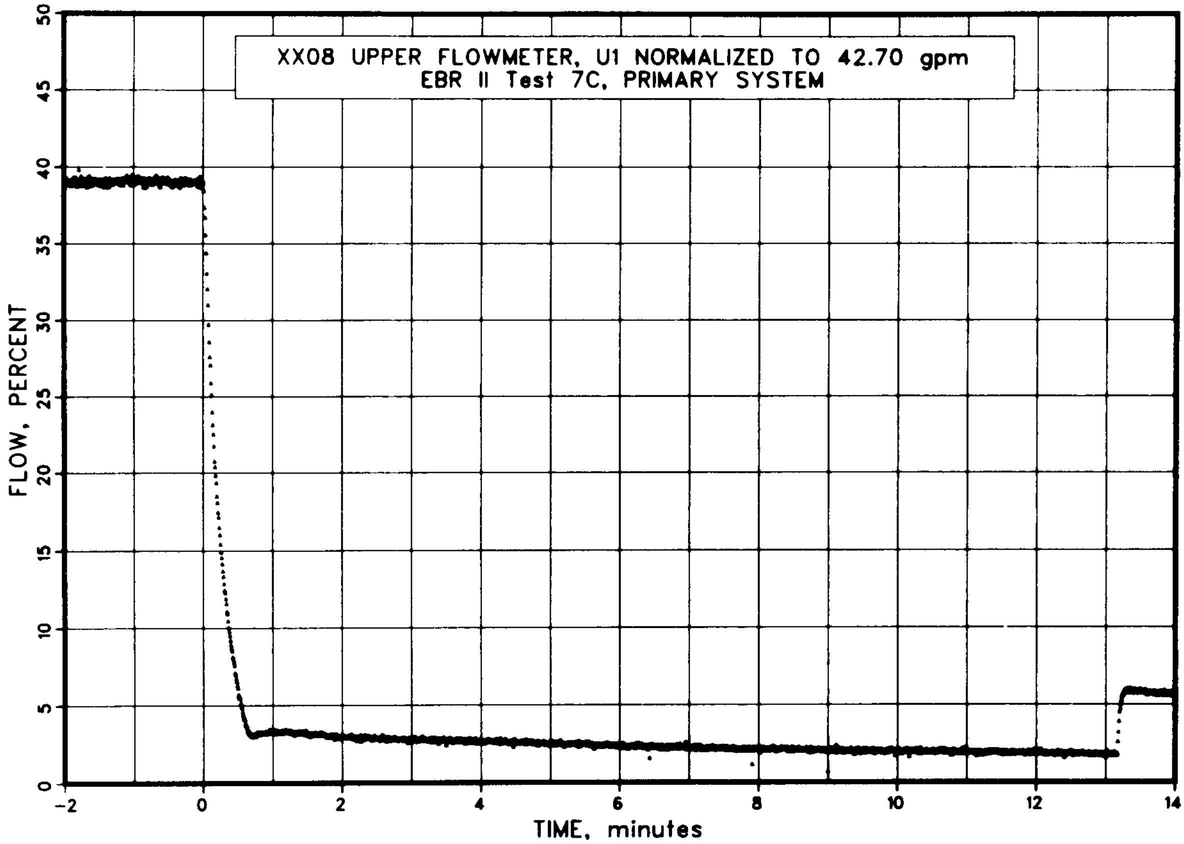
220
230
240


XX08 UPPER FLOWMETER, U1 NORMALIZED TO 42.70 gpm
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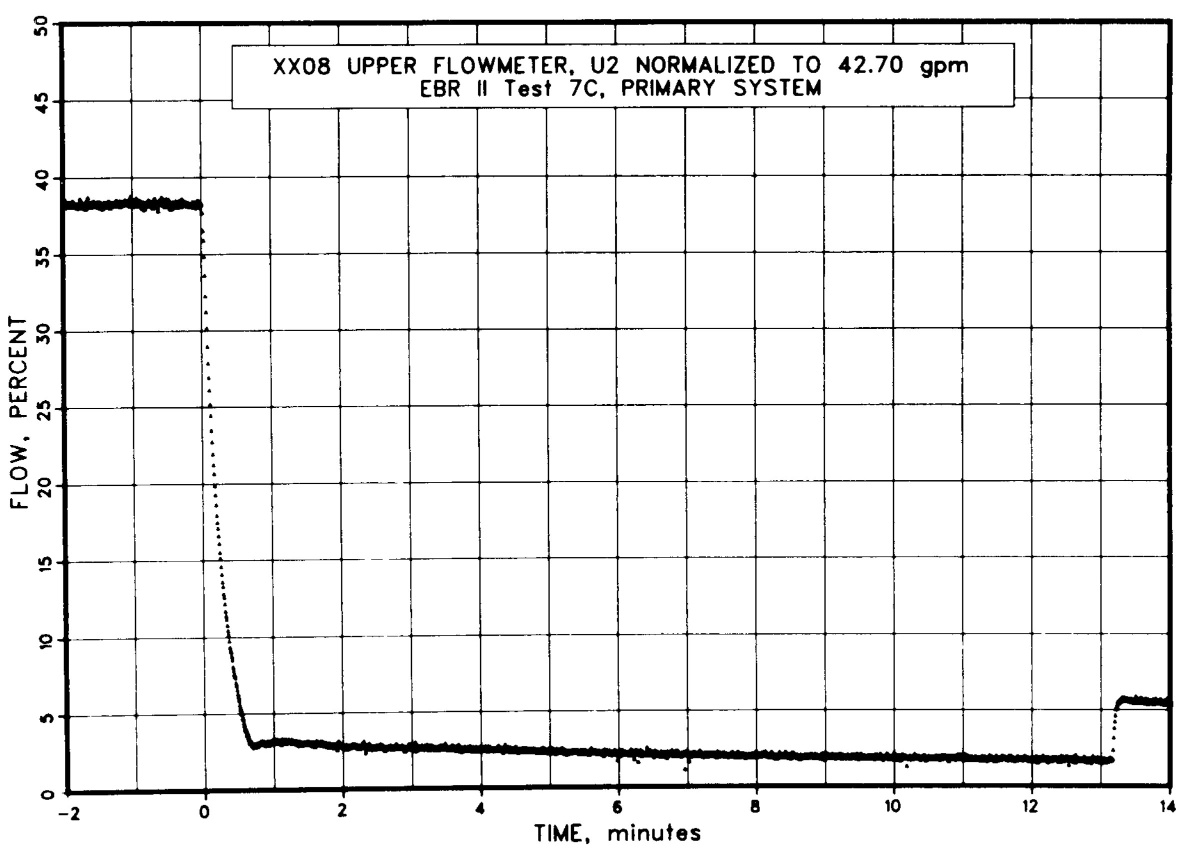
FLOW, PERCENT
TIME, minutes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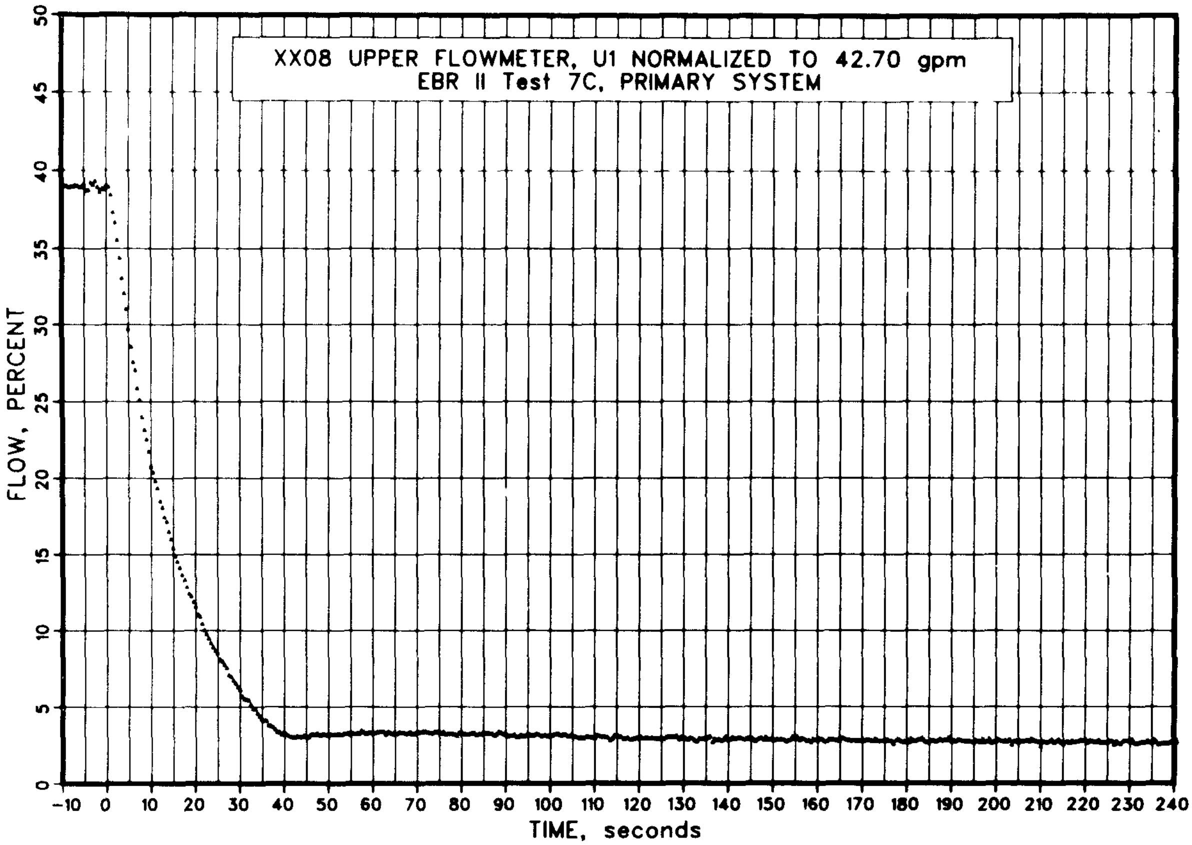
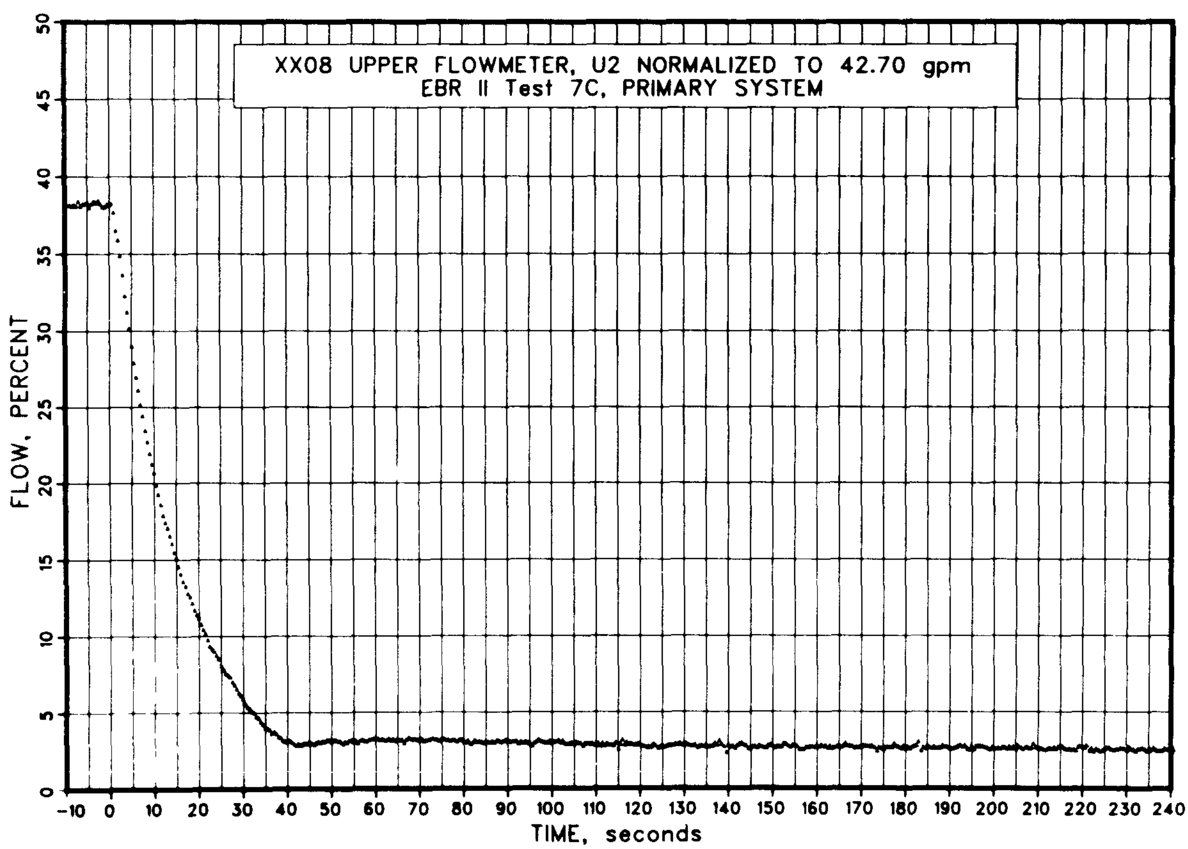
EBR II Test 7C, PRIMARY SYSTEM
FLOW, PERCENT
TIME, minutes


XX08 UPPER FLOWMETER, U1 NORMALIZED TO 42.70 gpm
EBR II Test 7C, 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
190
200
210
220
230
240


XX08 UPPER FLOWMETER, U2 NORMALIZED TO 42.70 gpm
EBR II Test 7C, PRIMARY SYSTEM
FLOW, PERCENT
TIME, seconds
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25
30
35
40
45
50
-10
0
10
20
30
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230
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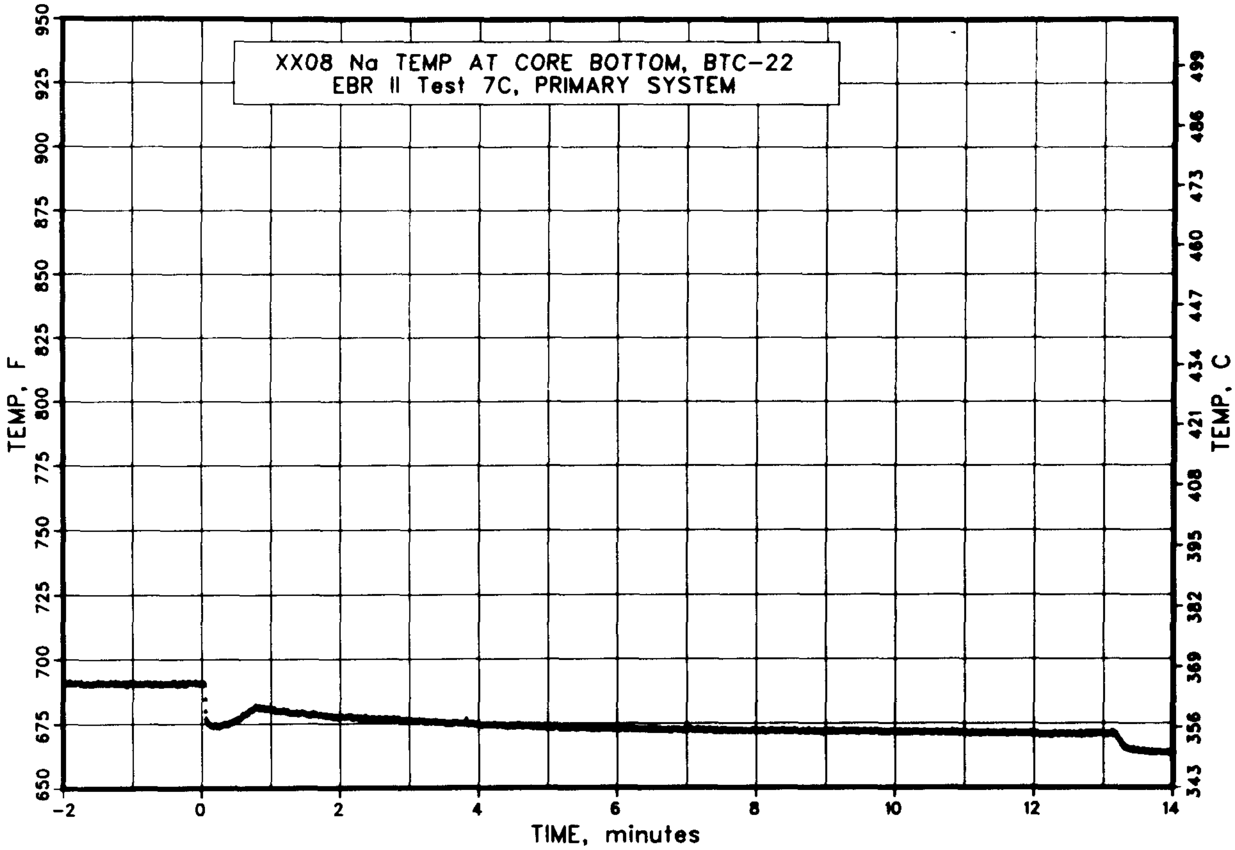
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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
950
925
900
875
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825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
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343
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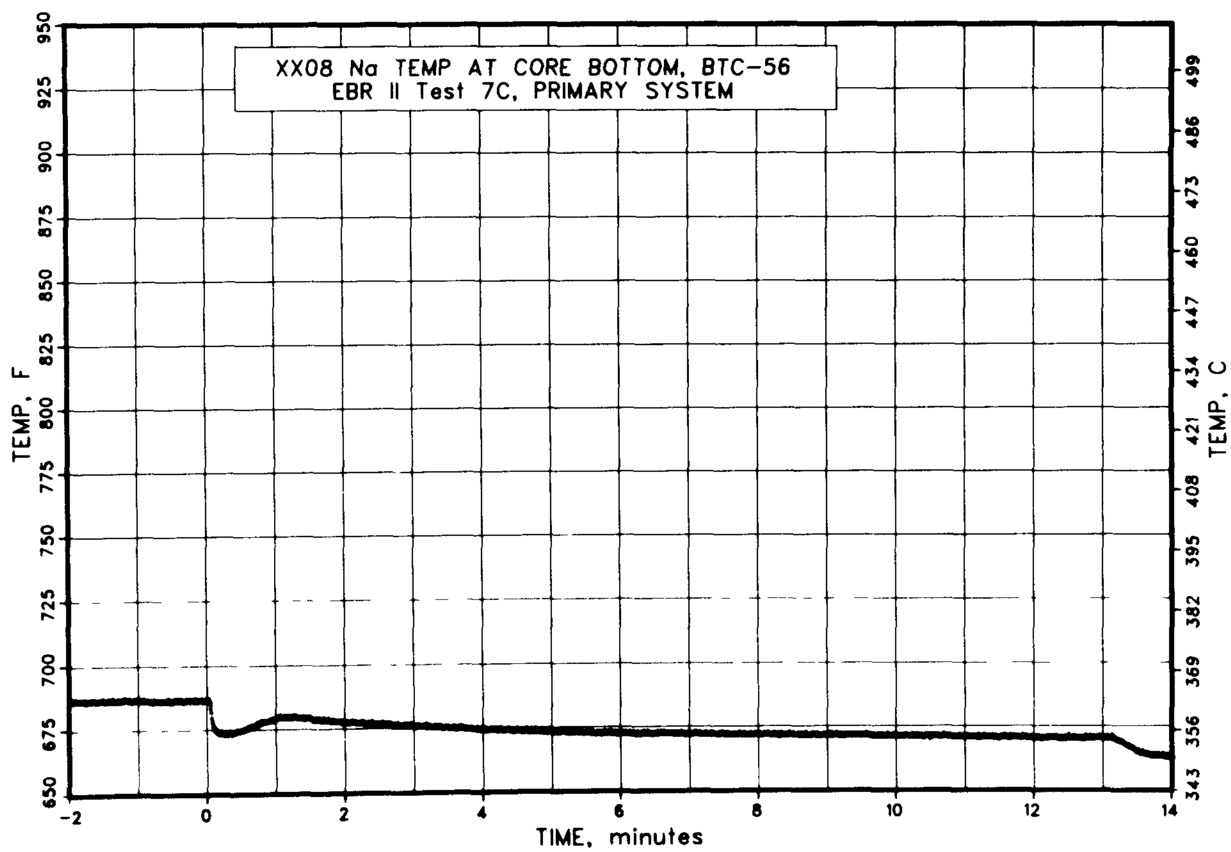
0
2
4
6
8
10
12
14


XX08 Na TEMP AT CORE BOTTOM, BTC-56
EBR II Test 7C, 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
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369
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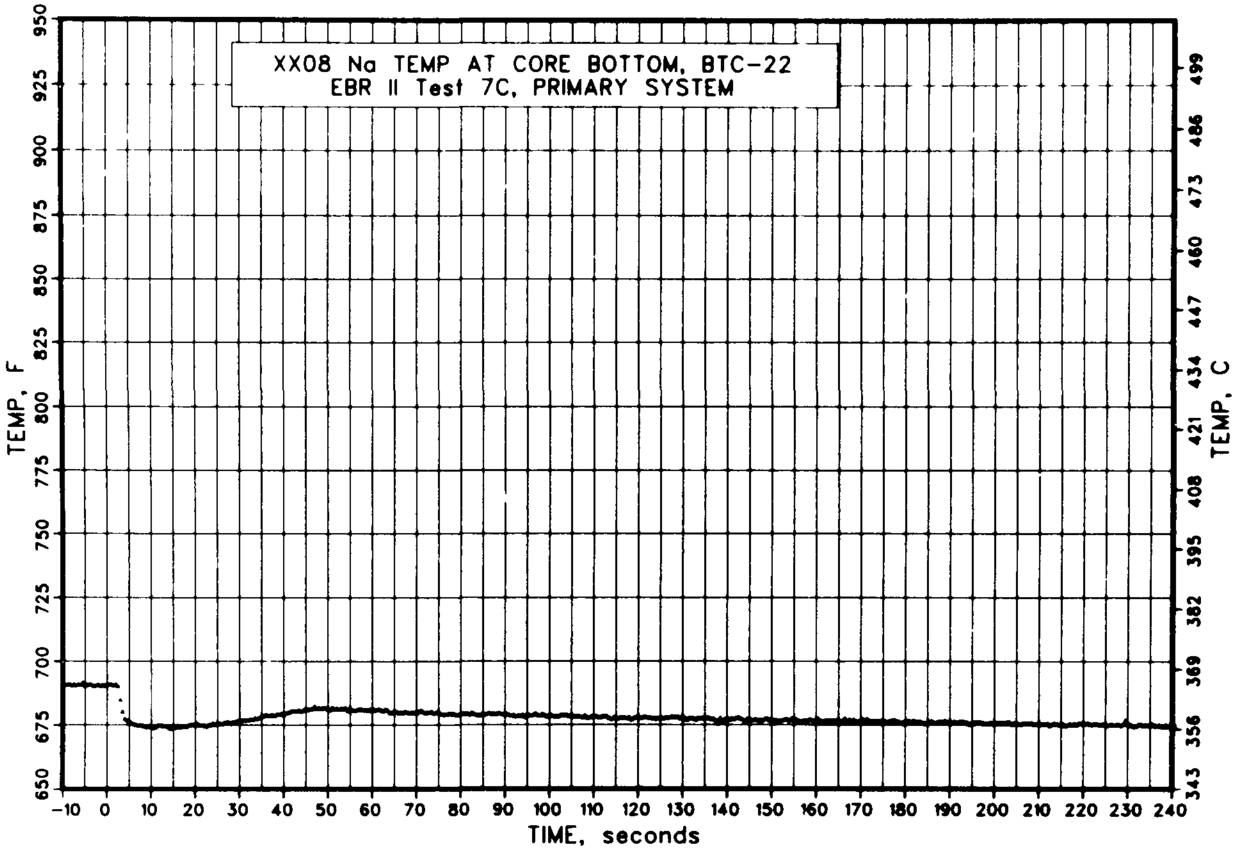
343
-2
0
2
4
6
8
10
12
14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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
650 675 700 725 750 775 800 825 850 875 900 925 950
TEMP, C
343 356 369 382 395 408 421 434 447 460 473 486 499
TIME, seconds
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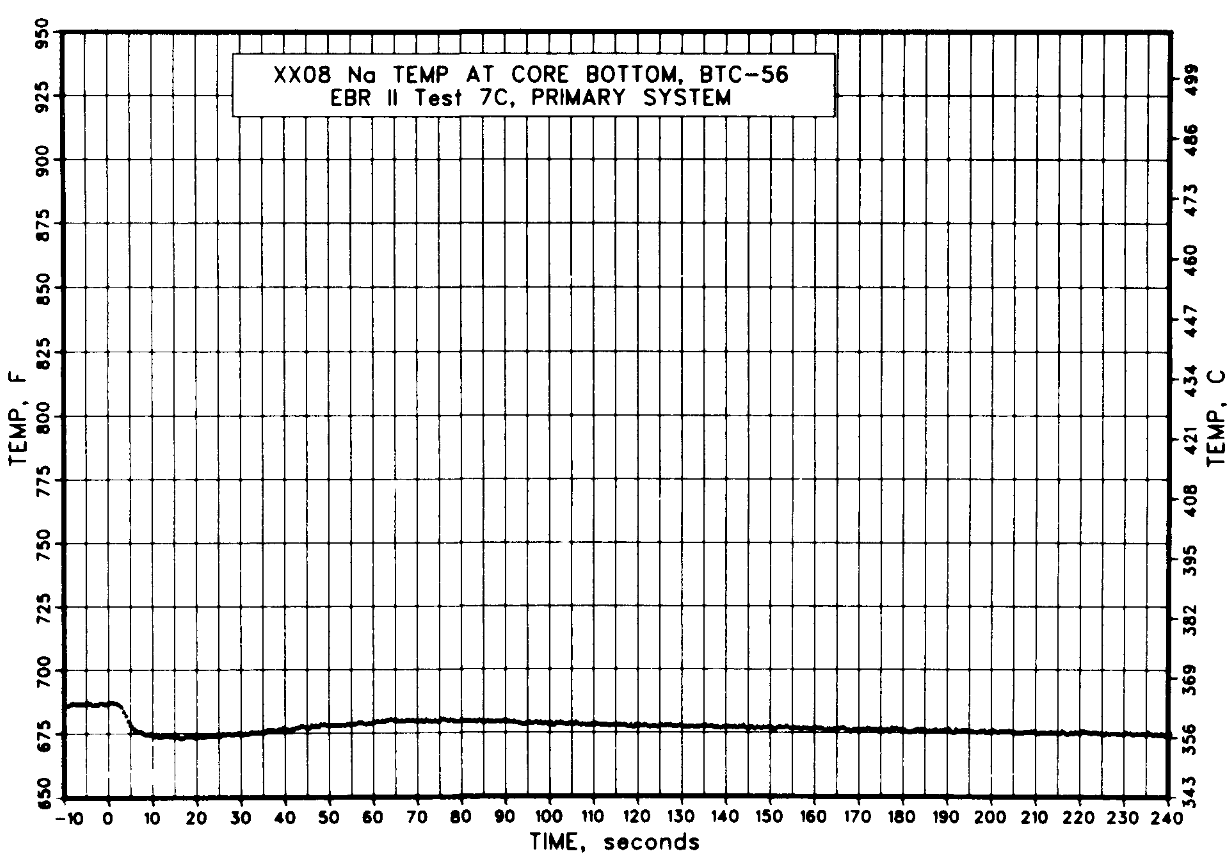
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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
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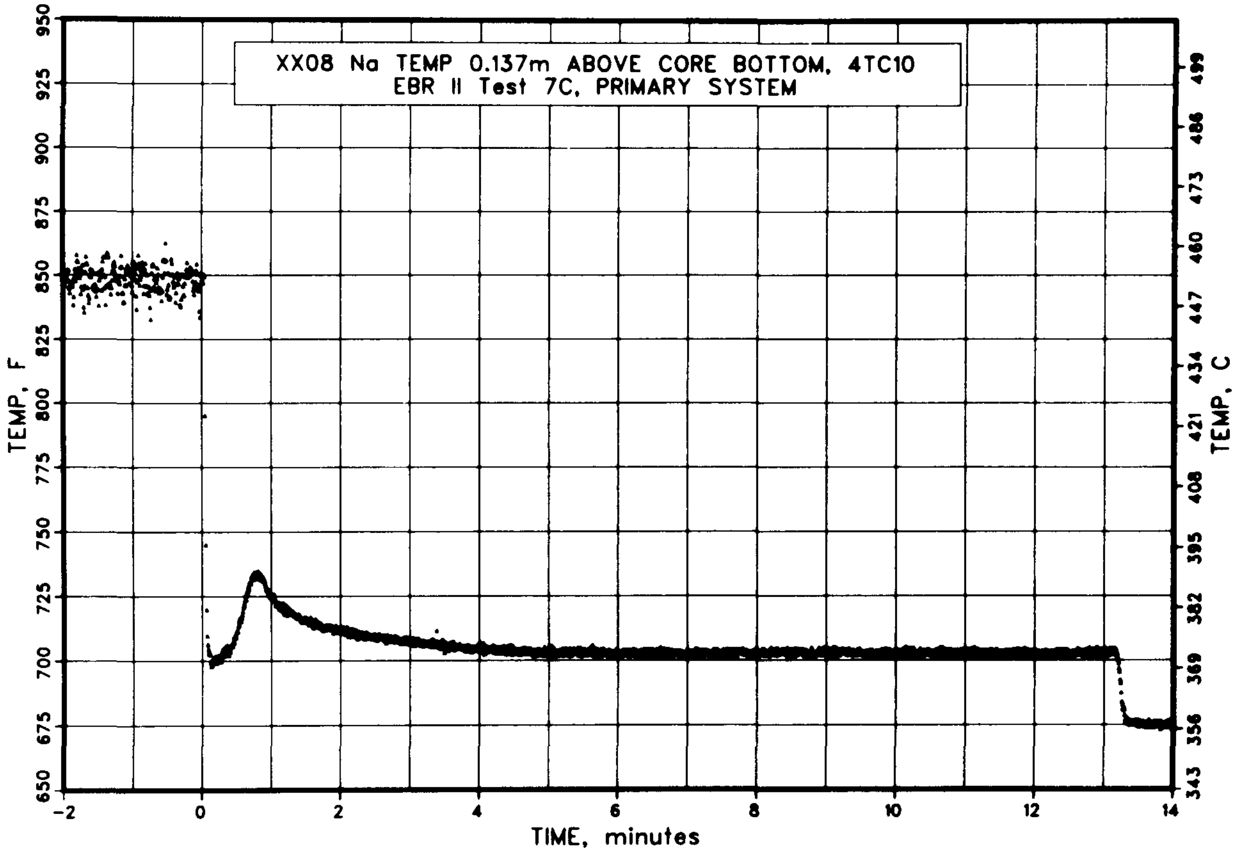
TEMP, C
343 356 369 382 395 408 421 434 447 460 473 486 499
TIME, seconds
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240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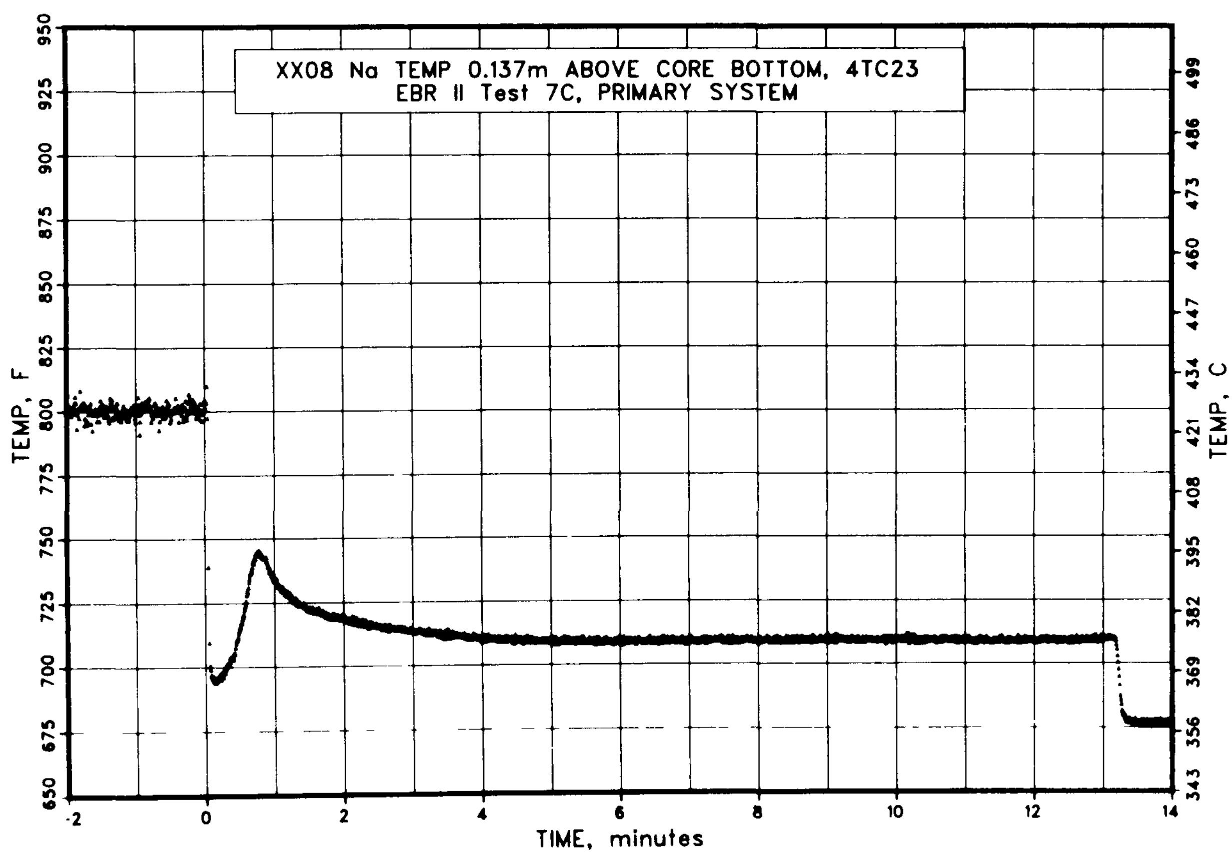
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
675
700
725
750
775
800
825
850
875
900
925
950
343
356
369
382
395
408
421
434
447
460
473
486
499
-2
0
2
4
6
8
10
12
14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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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675
700
725
750
775
800
825
850
875
900
925
950
343
356
369
382
395
408
421
434
447
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-2
0
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8
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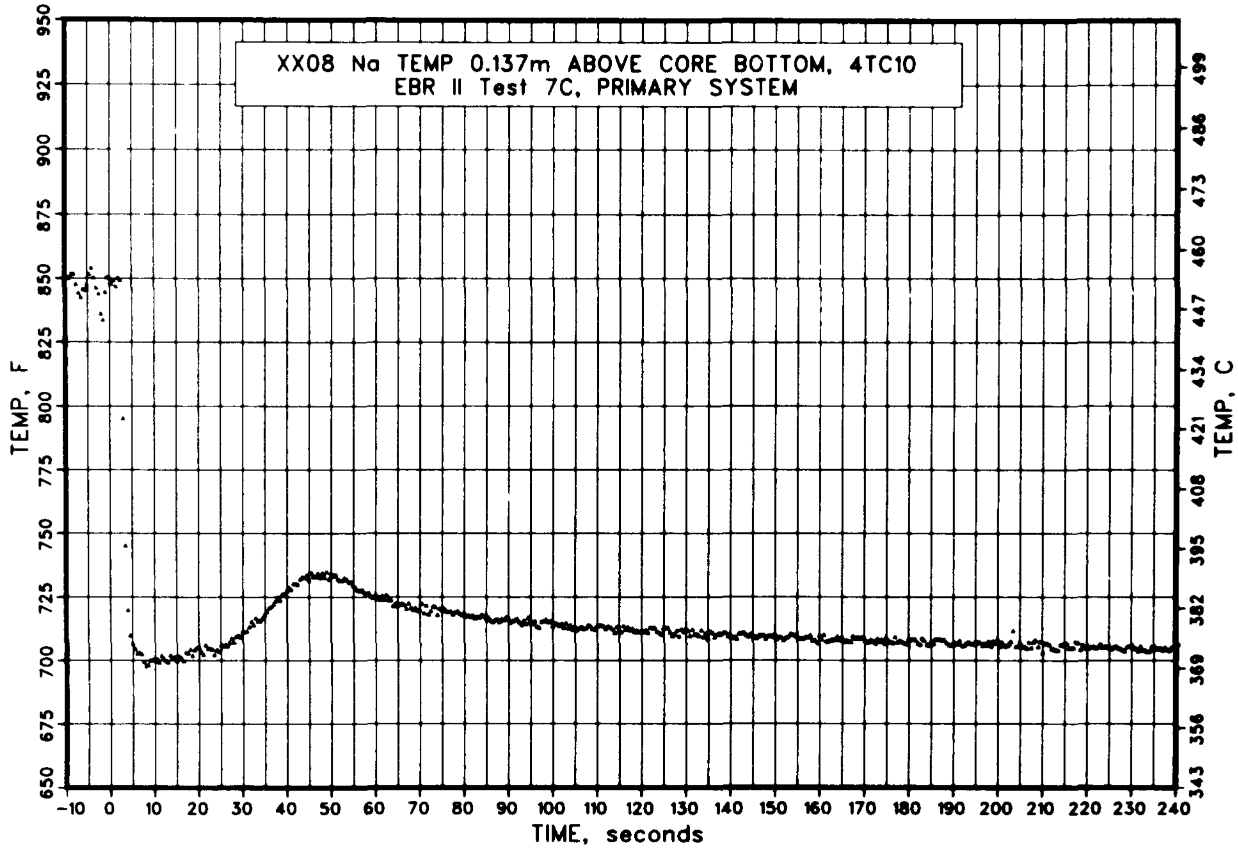
12
14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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
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850
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775
750
725
700
675
650
499
486
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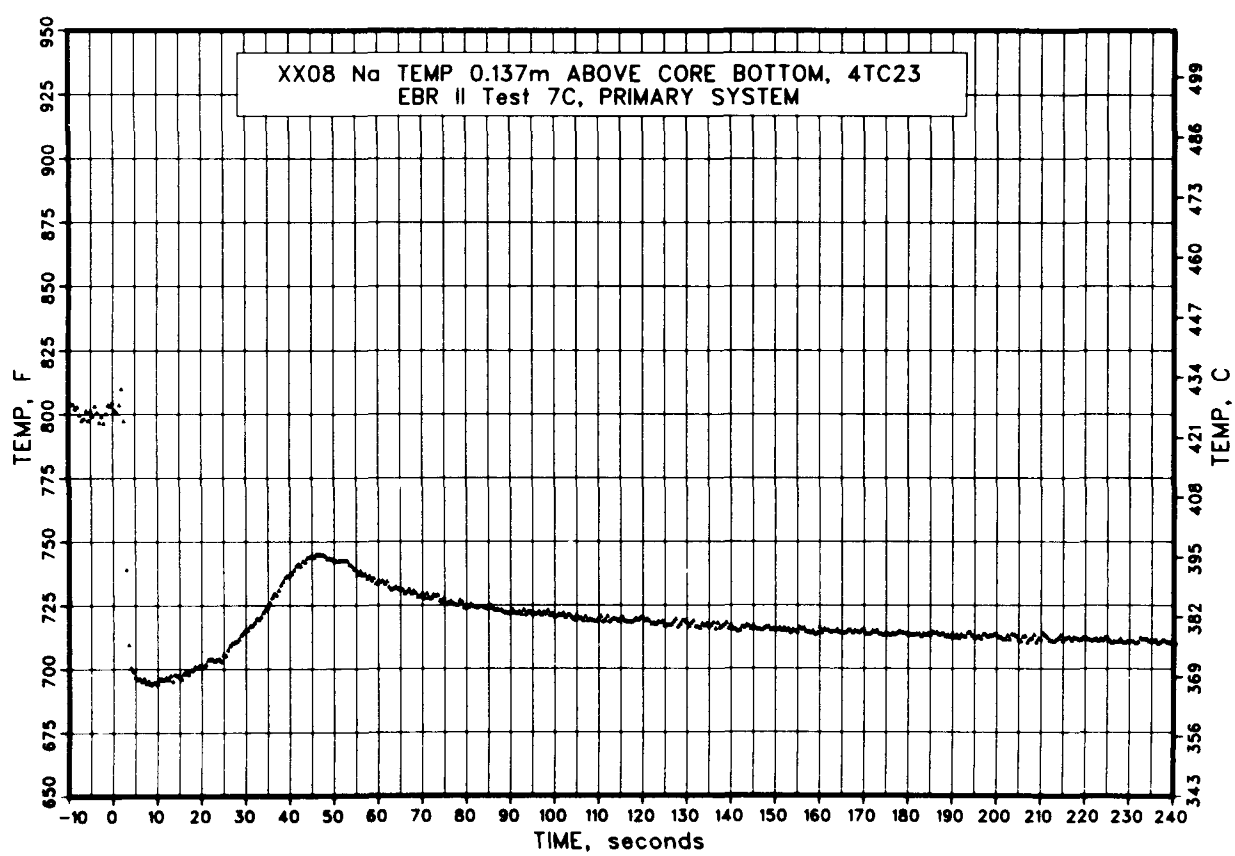
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TEMP, F
TEMP, C
TIME, seconds
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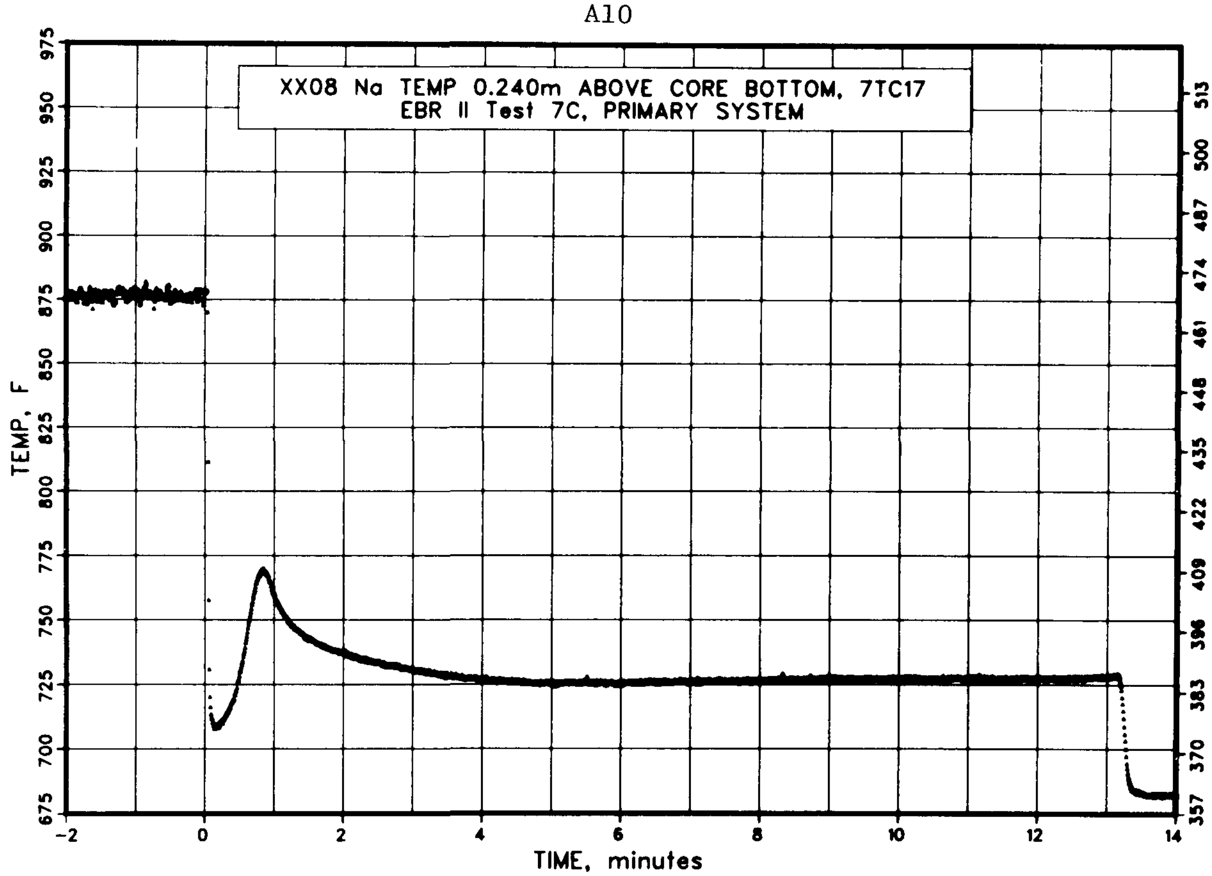
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240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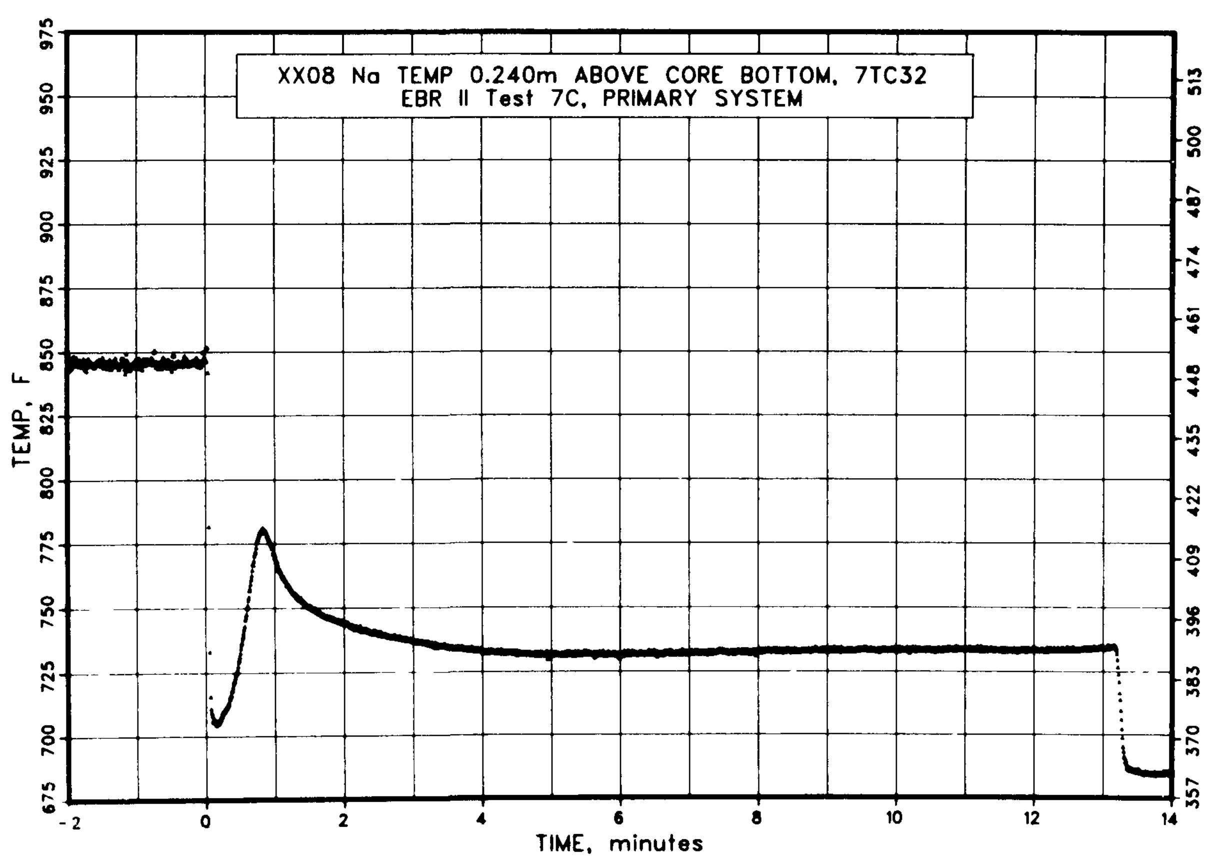
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14
TIME, minutes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EBR II Test 7C, PRIMARY SYSTEM
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925
900
875
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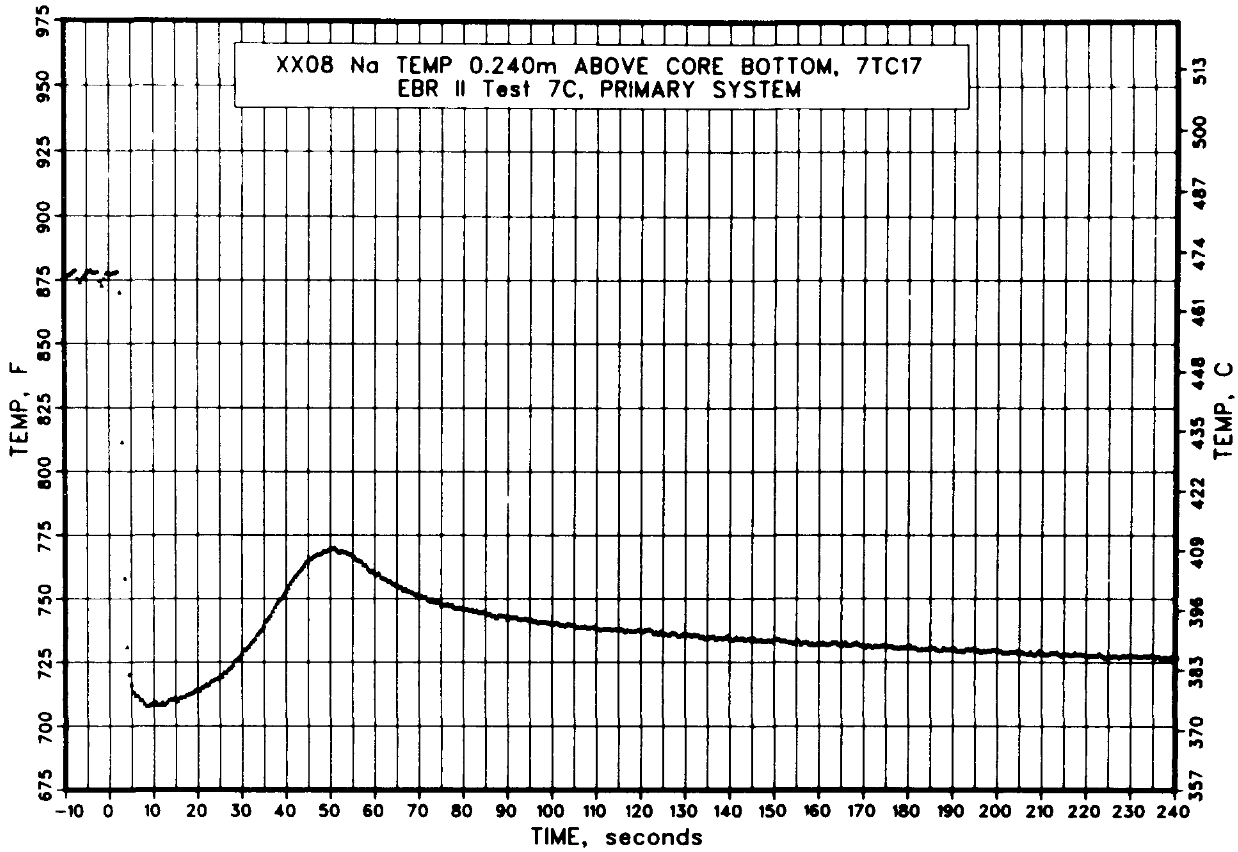
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14
TIME, minutes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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
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950
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900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
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435
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396
383
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357
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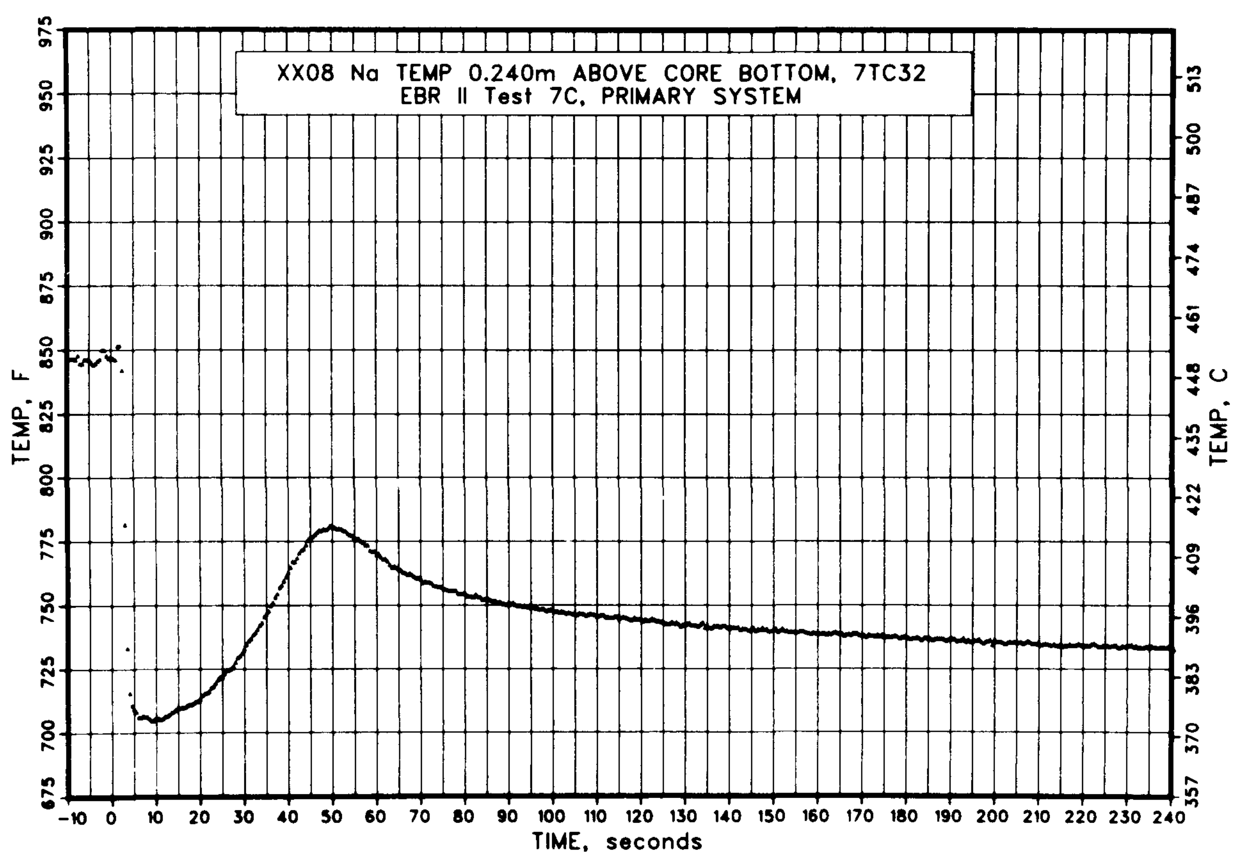
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TEMP, C
TIME, seconds
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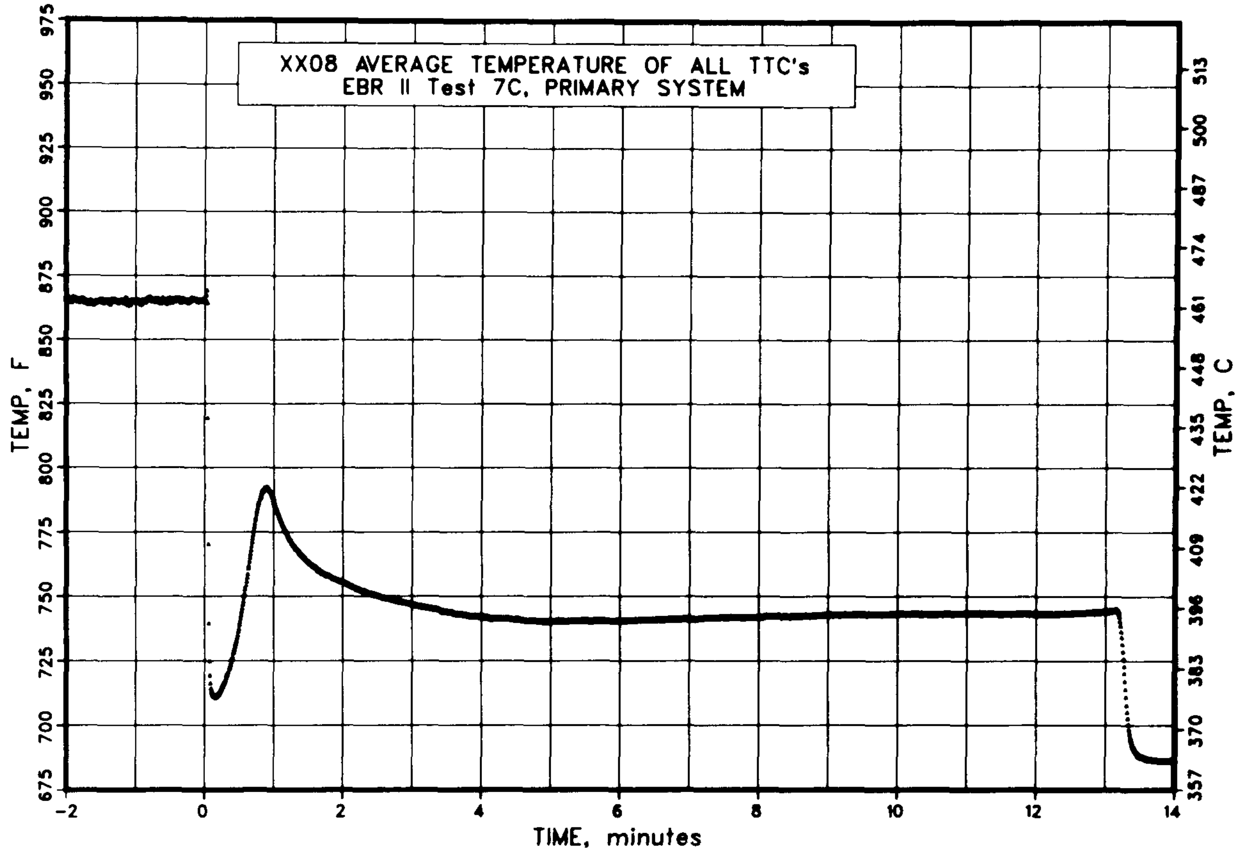
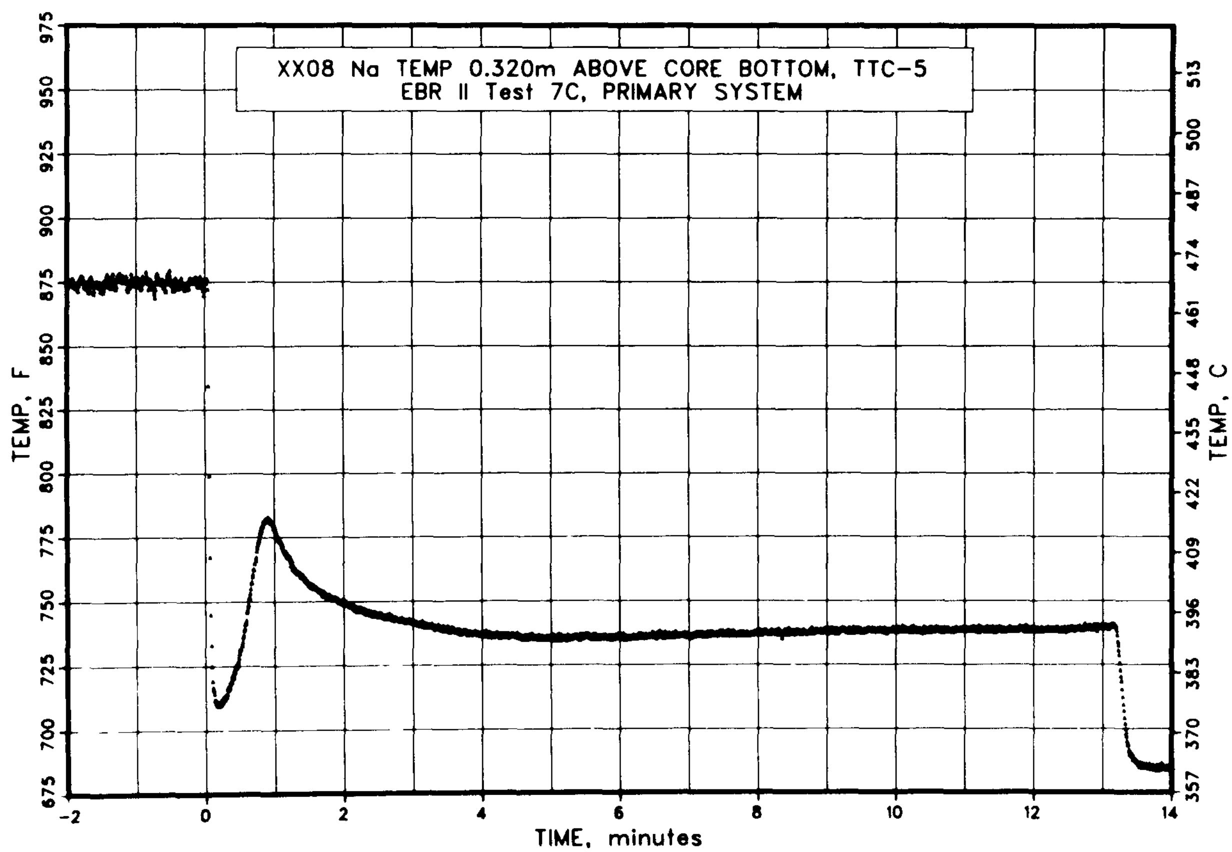
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240


XX08 AVERAGE TEMPERATURE OF ALL TTC's
EBR II Test 7C, 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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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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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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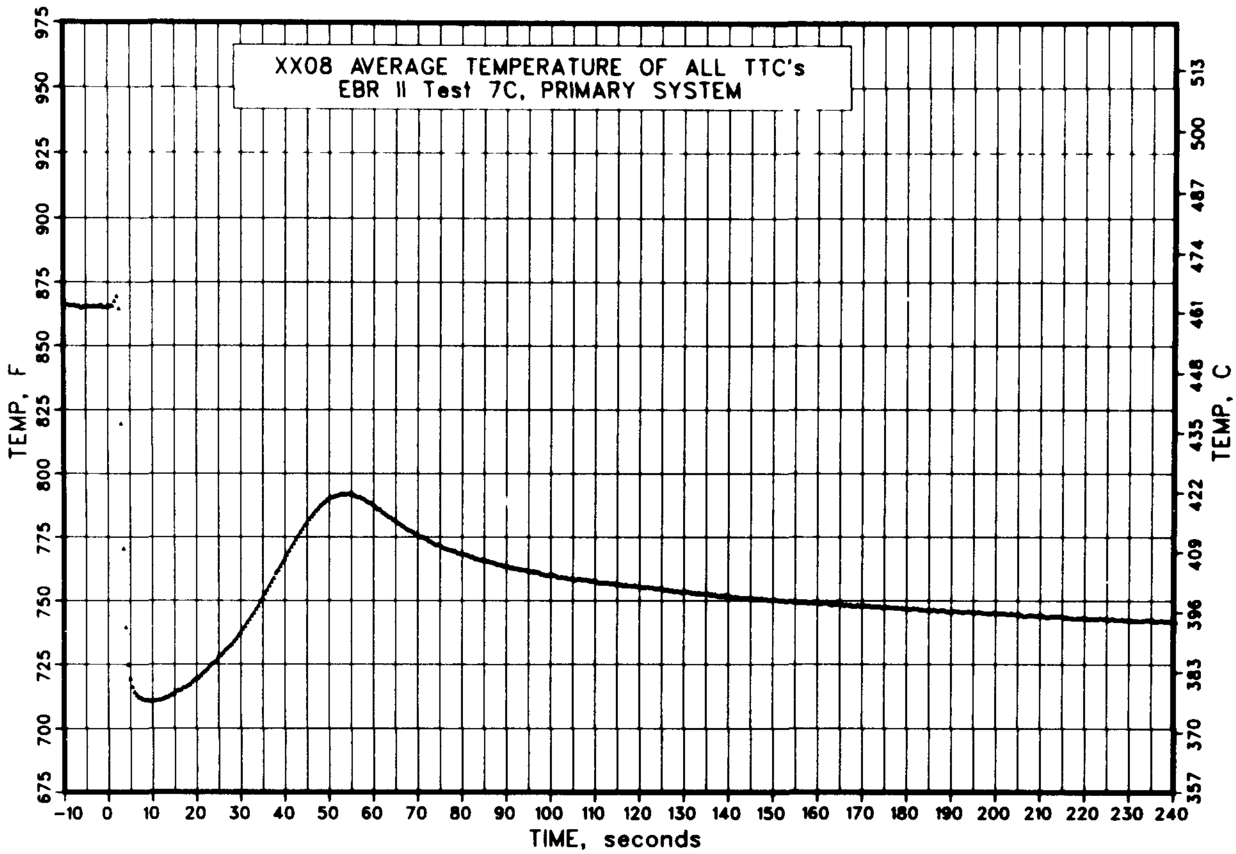
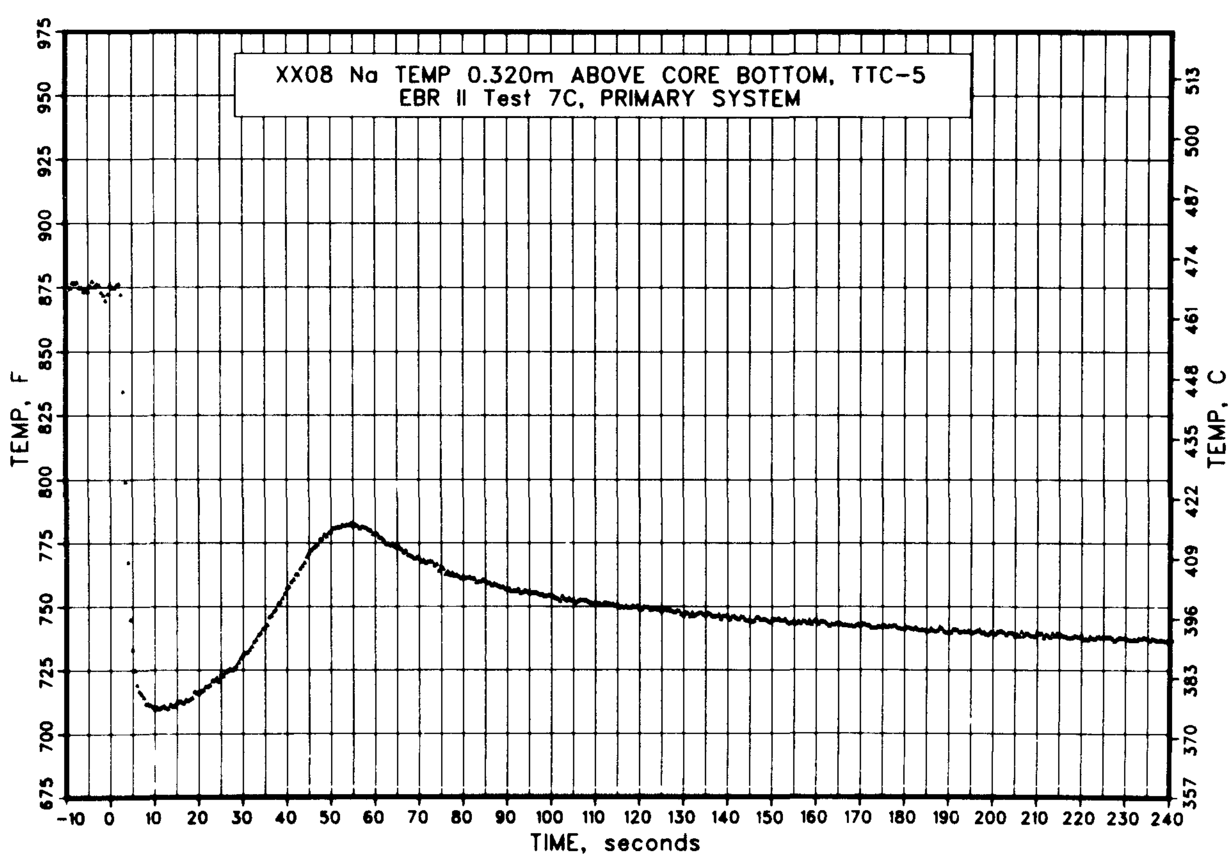
357
-2
0
2
4
6
8
10
12
14


XX08 AVERAGE TEMPERATURE OF ALL TTC's
EBR II Test 7C, 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 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
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700
725
750
775
800
825
850
875
900
925
950
975
357
370
383
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500
513
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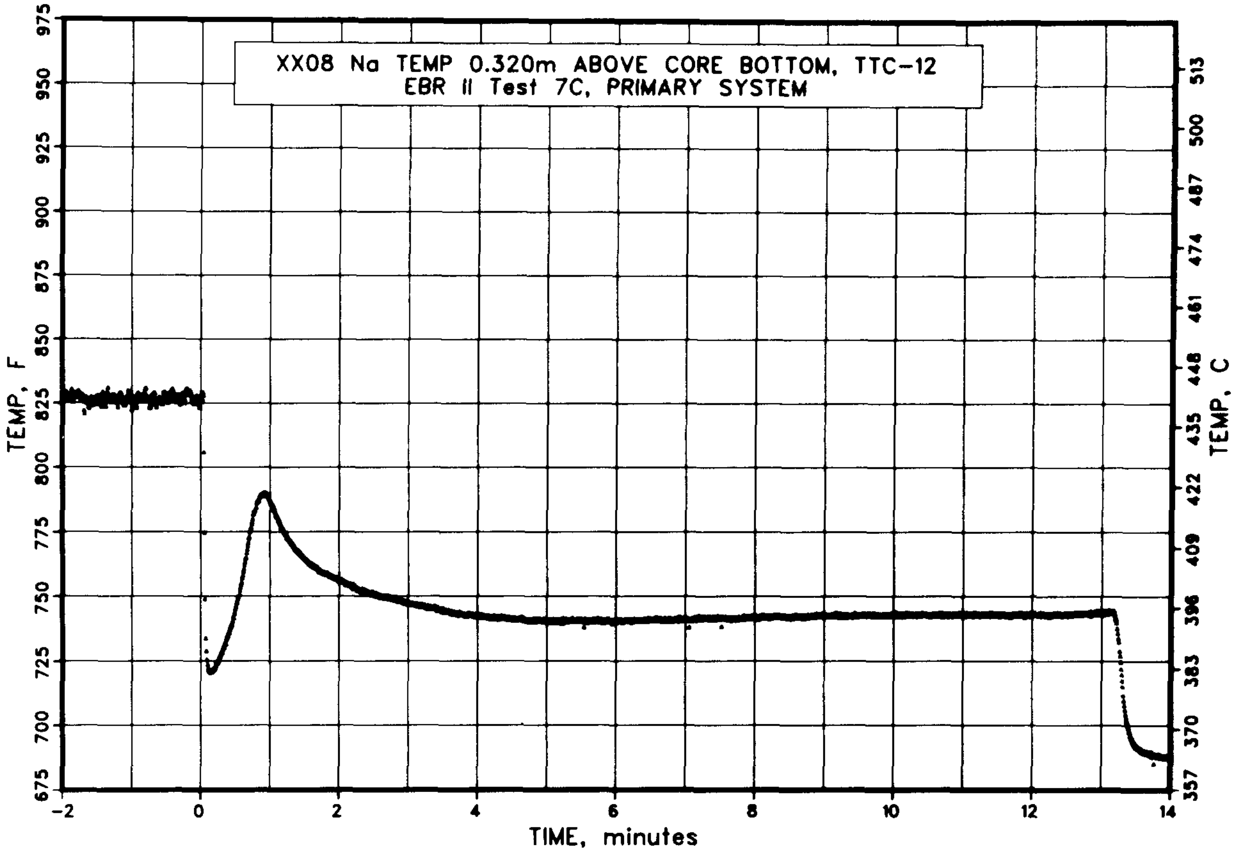
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EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
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409
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383
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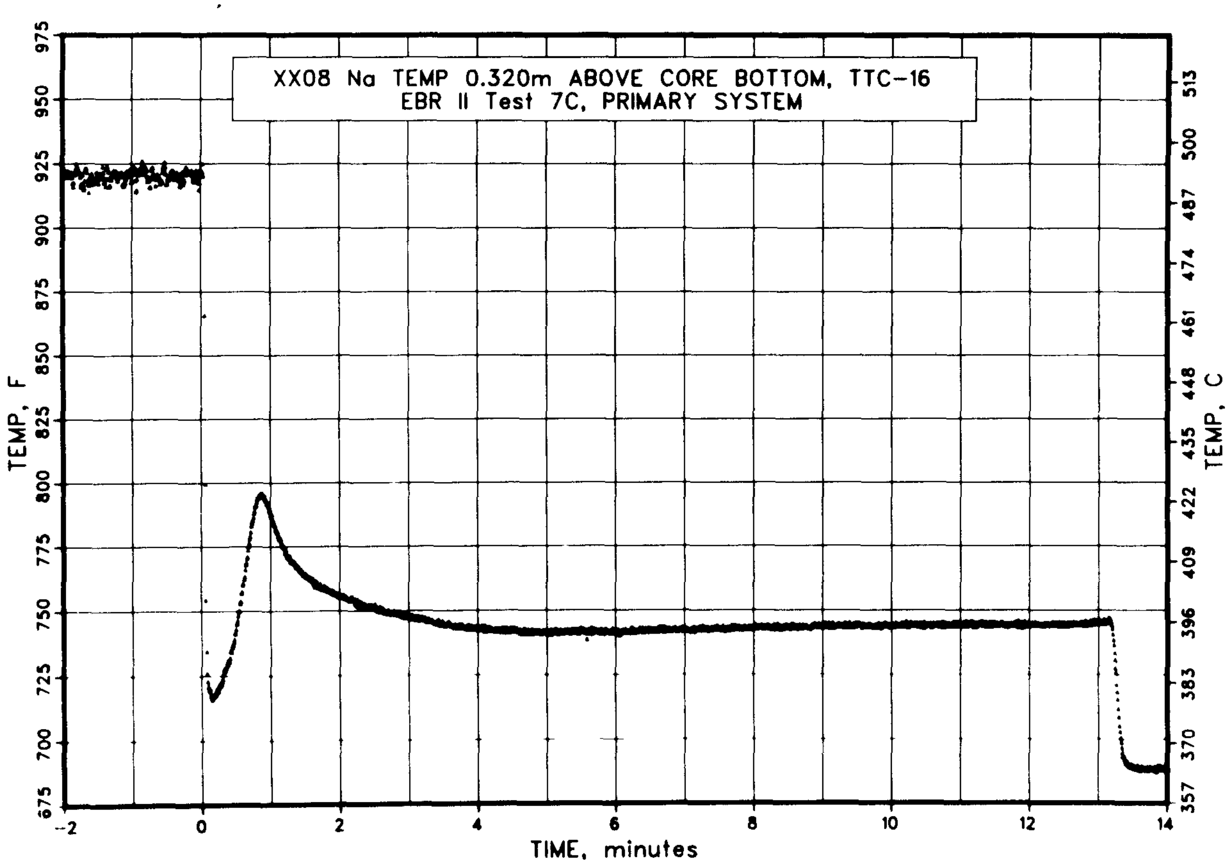
-2
0
2
4
6
8
10
12
14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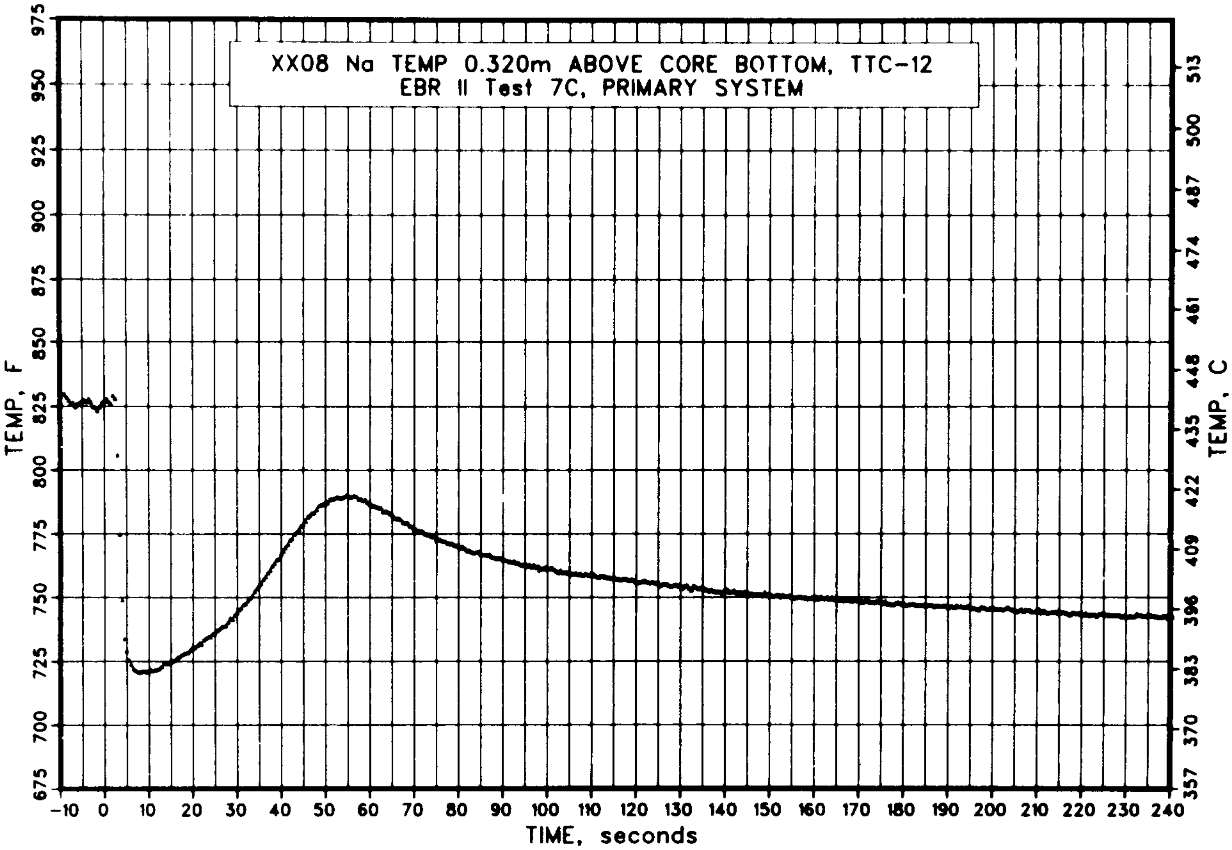
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14


XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-12
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TEMP, F
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900
875
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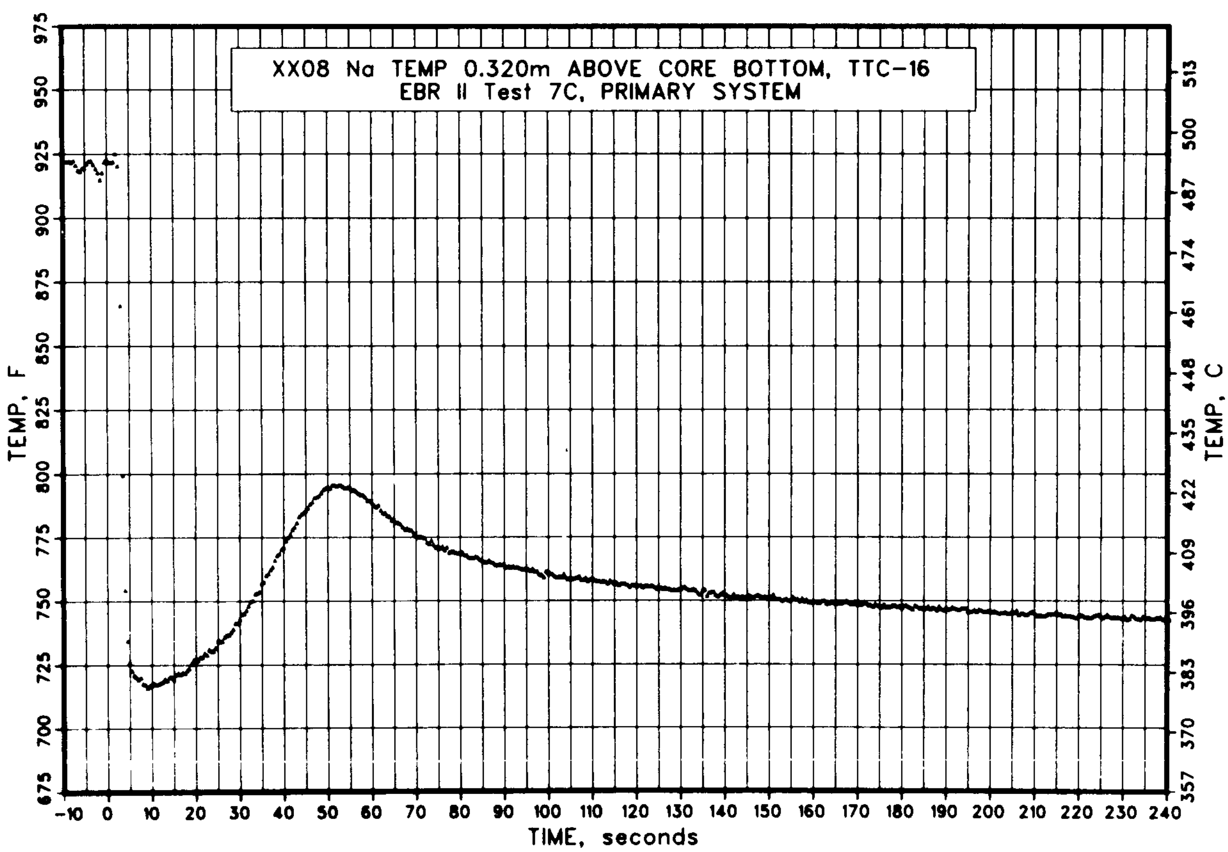
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds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950
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900
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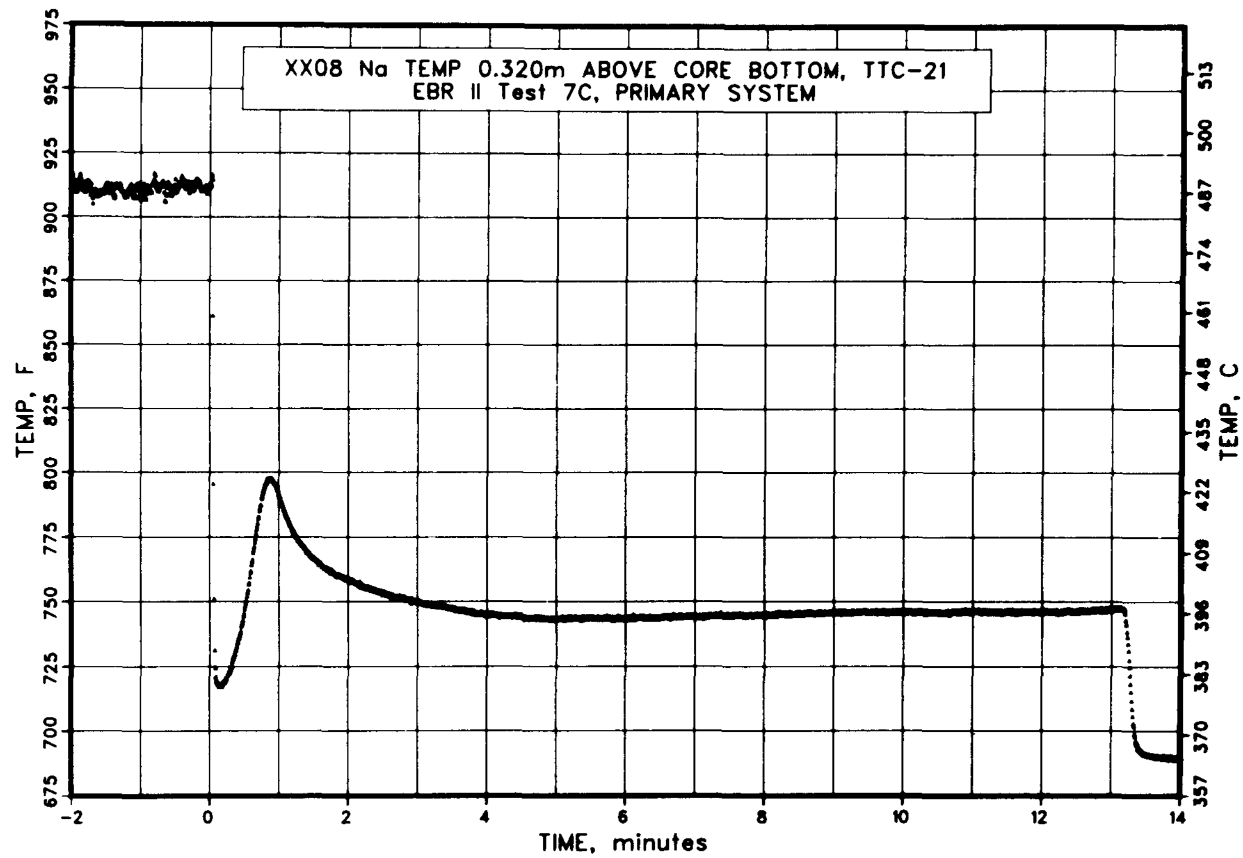
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds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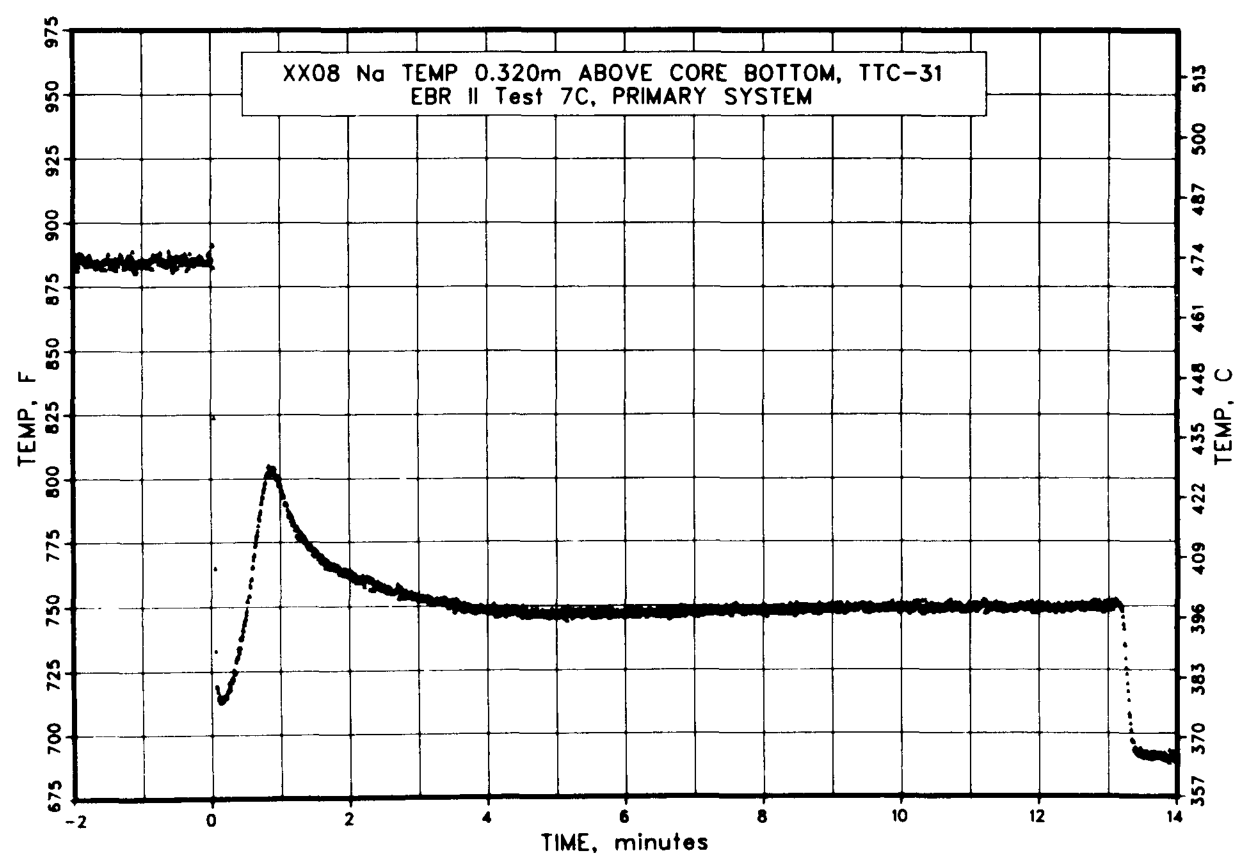
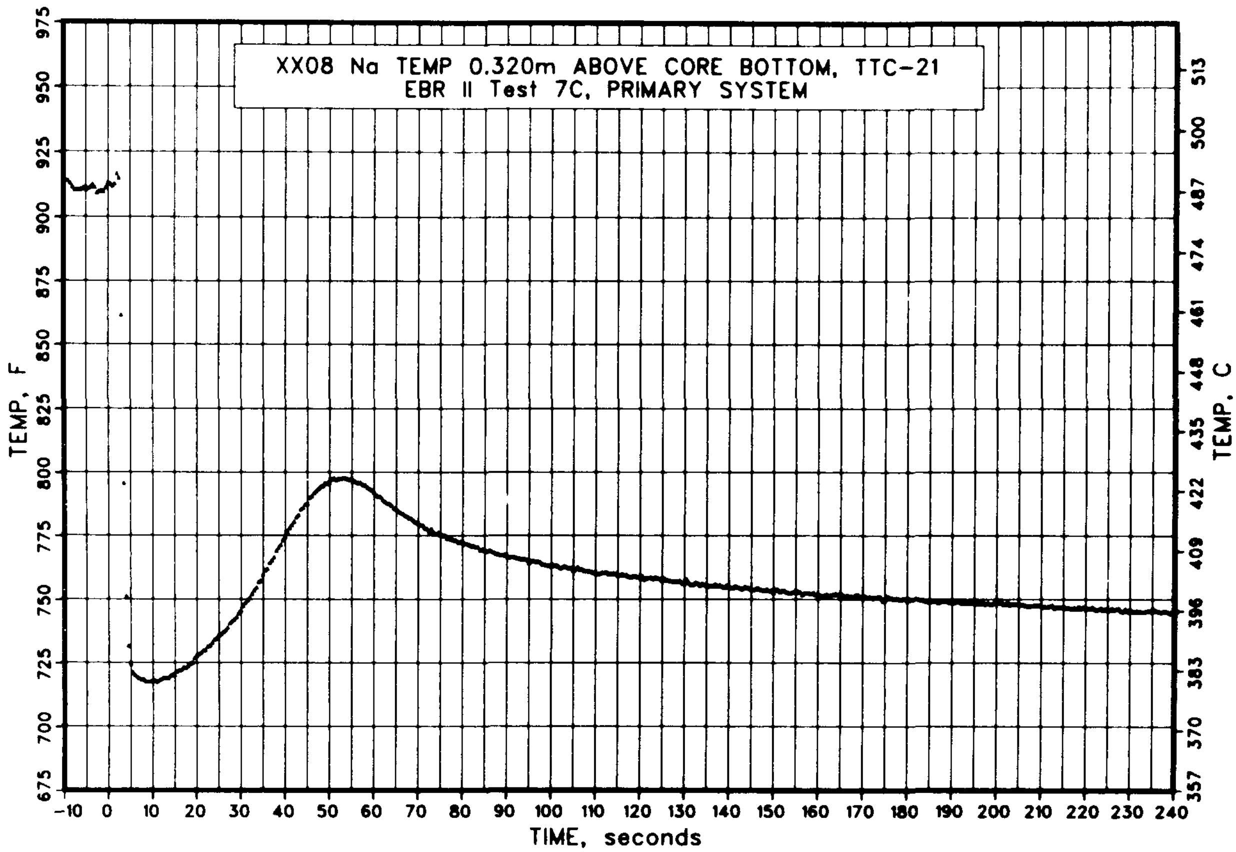
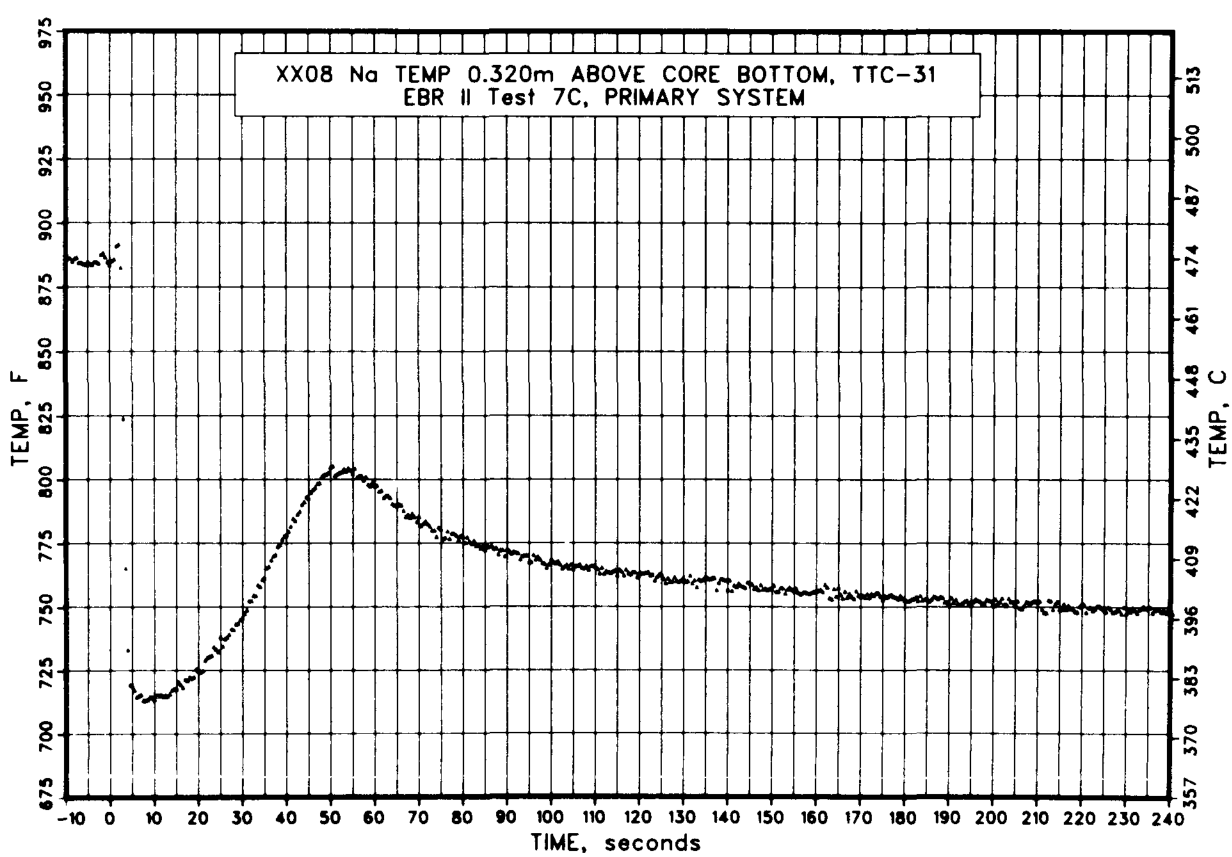
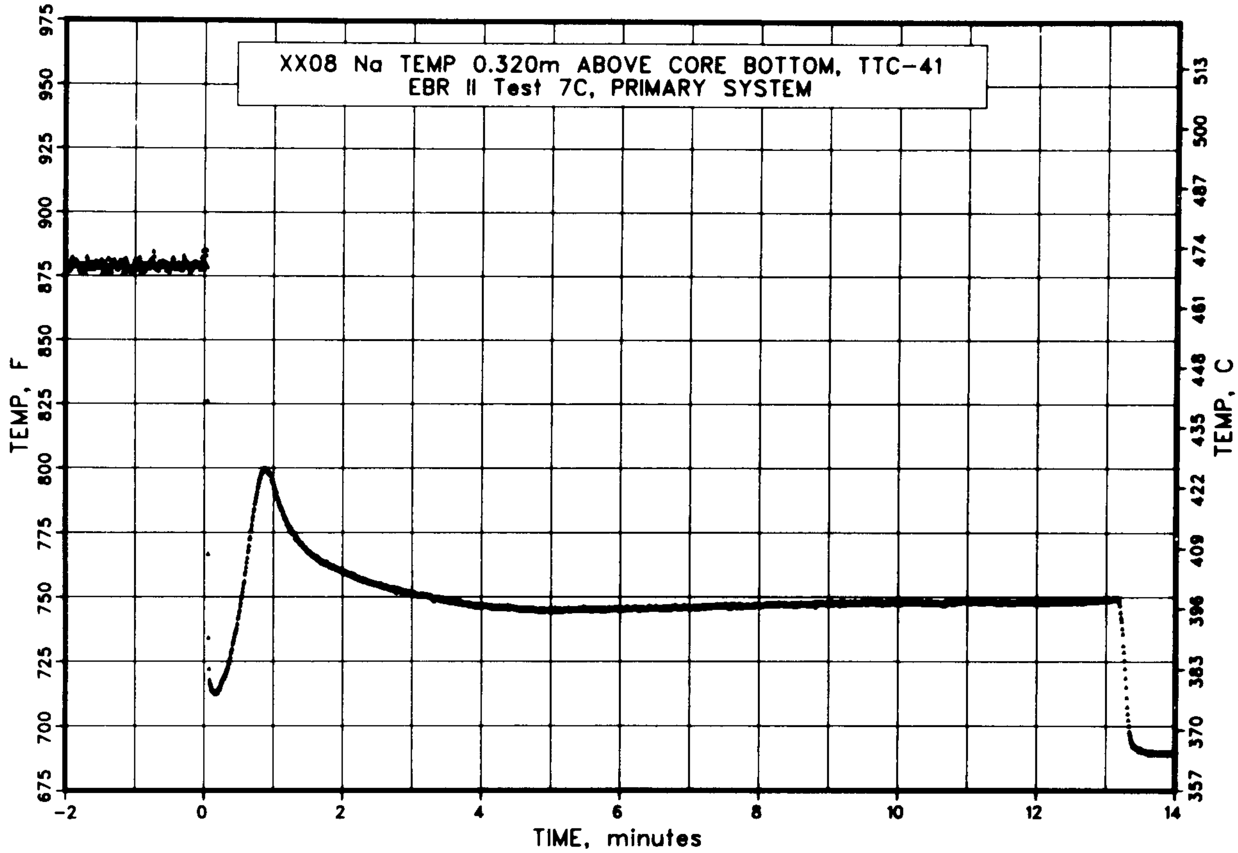
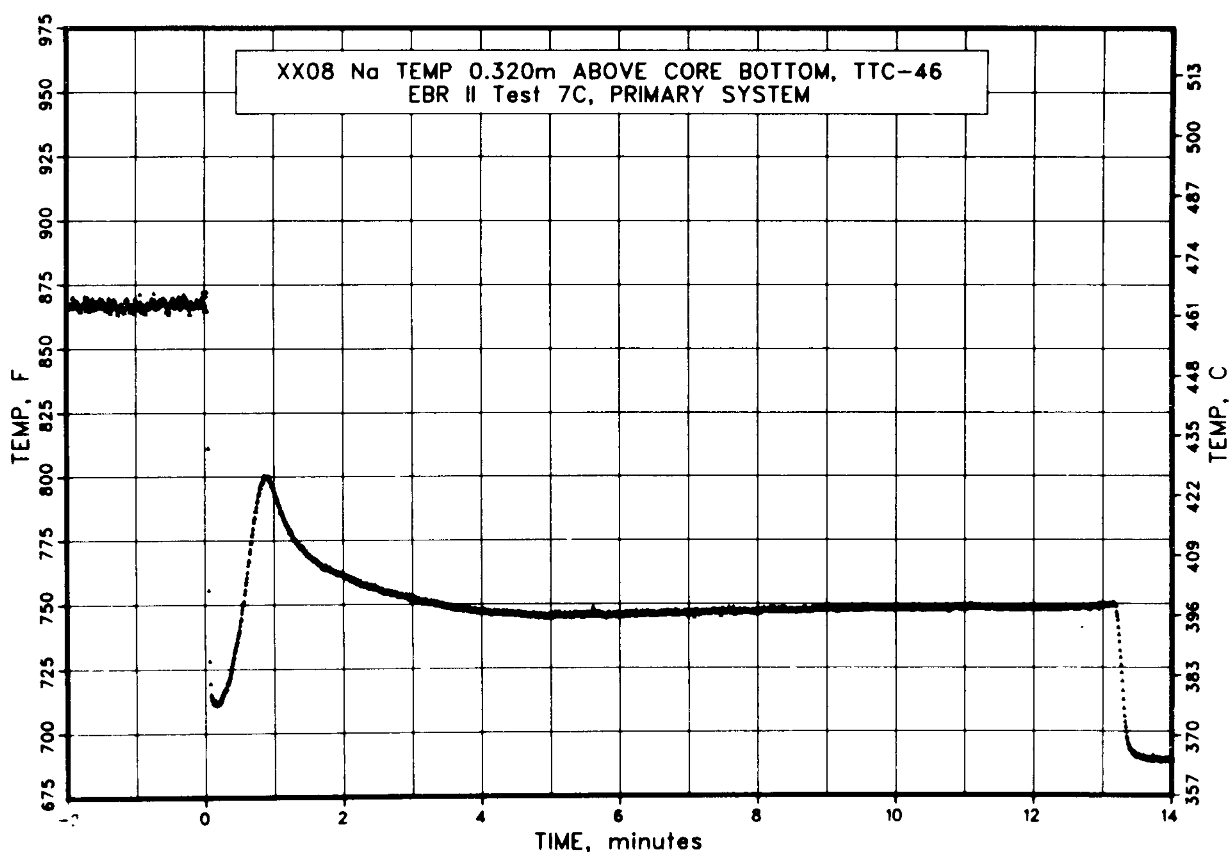
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

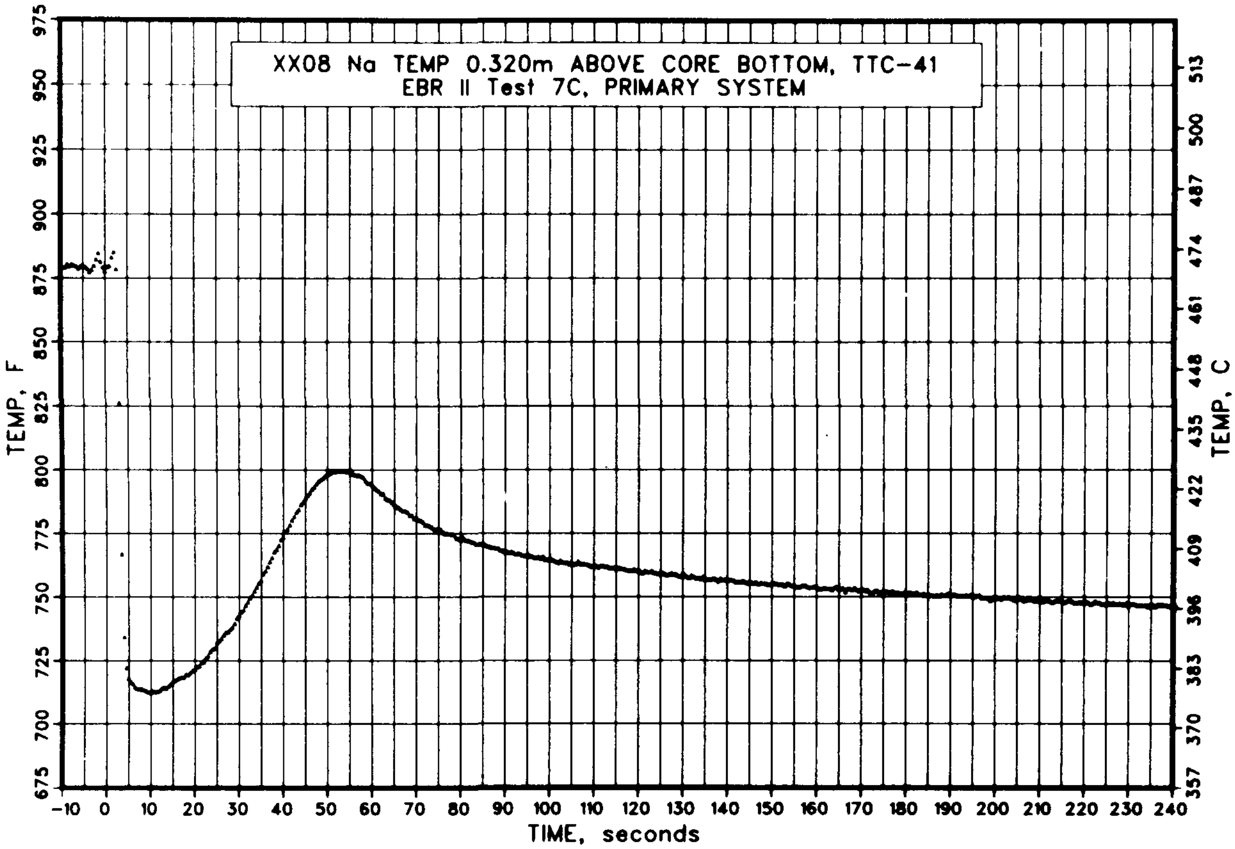

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-31
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

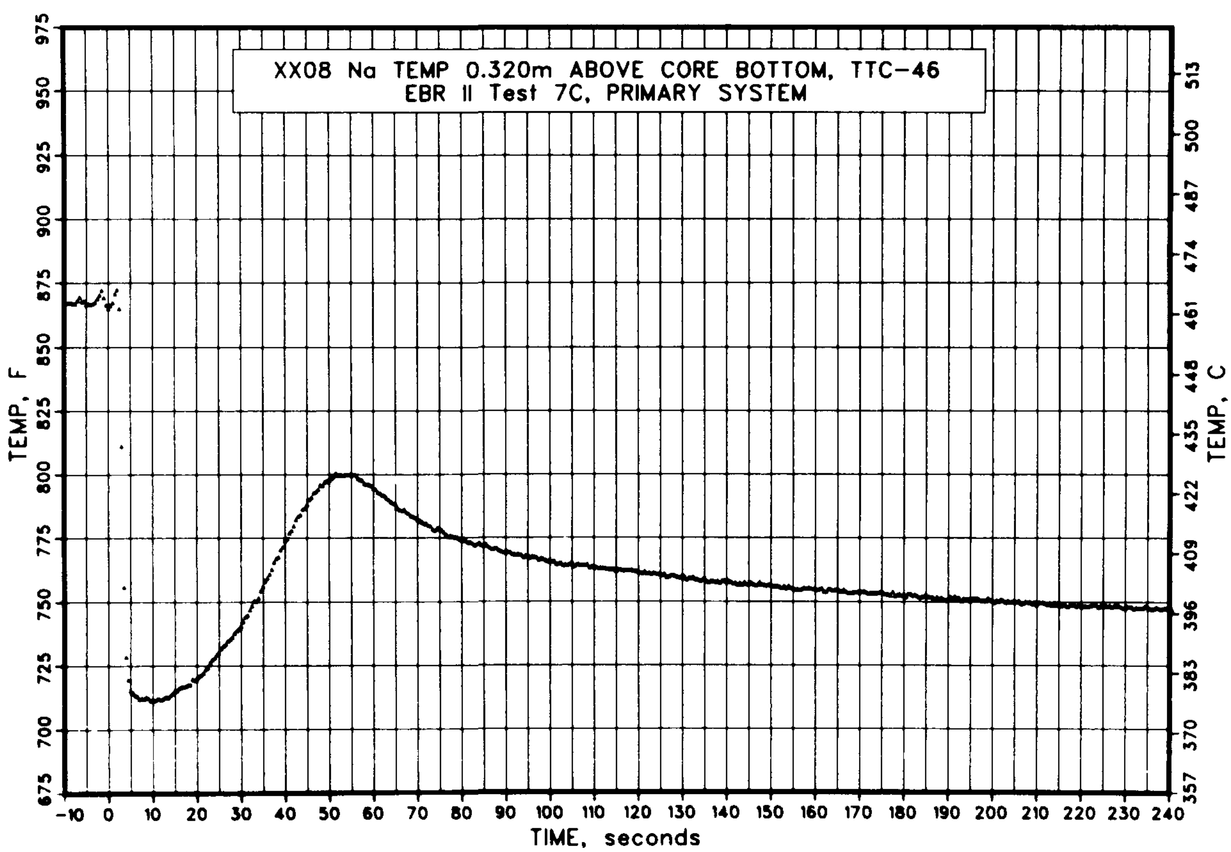

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-21
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

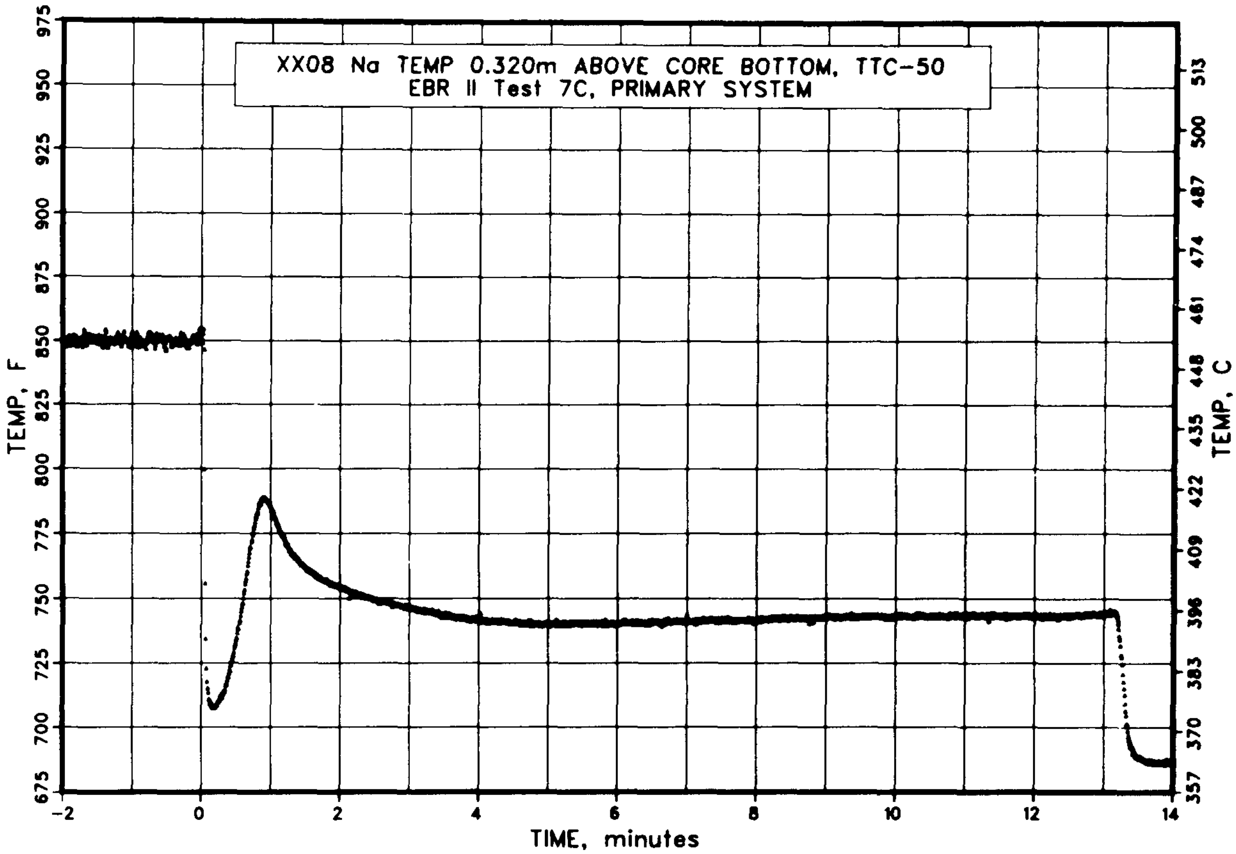

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-31
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

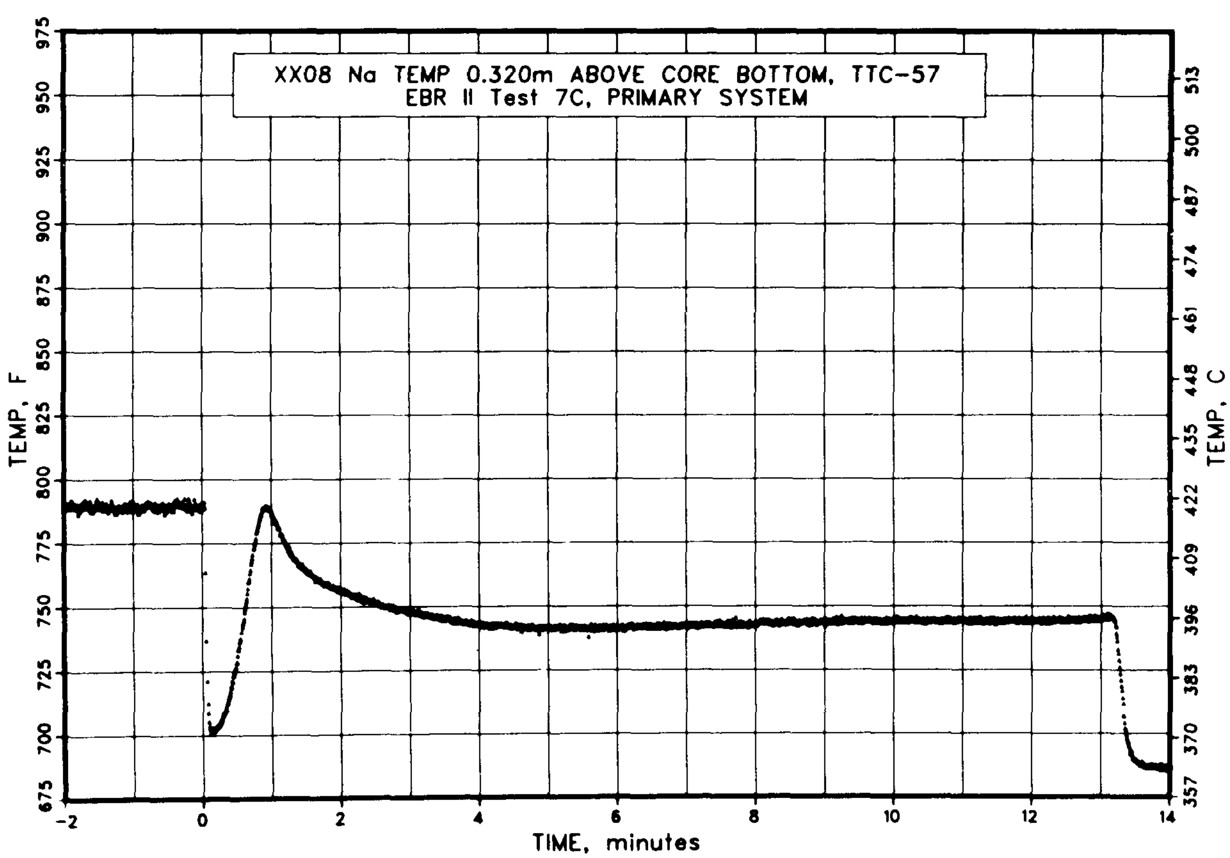

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-41
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

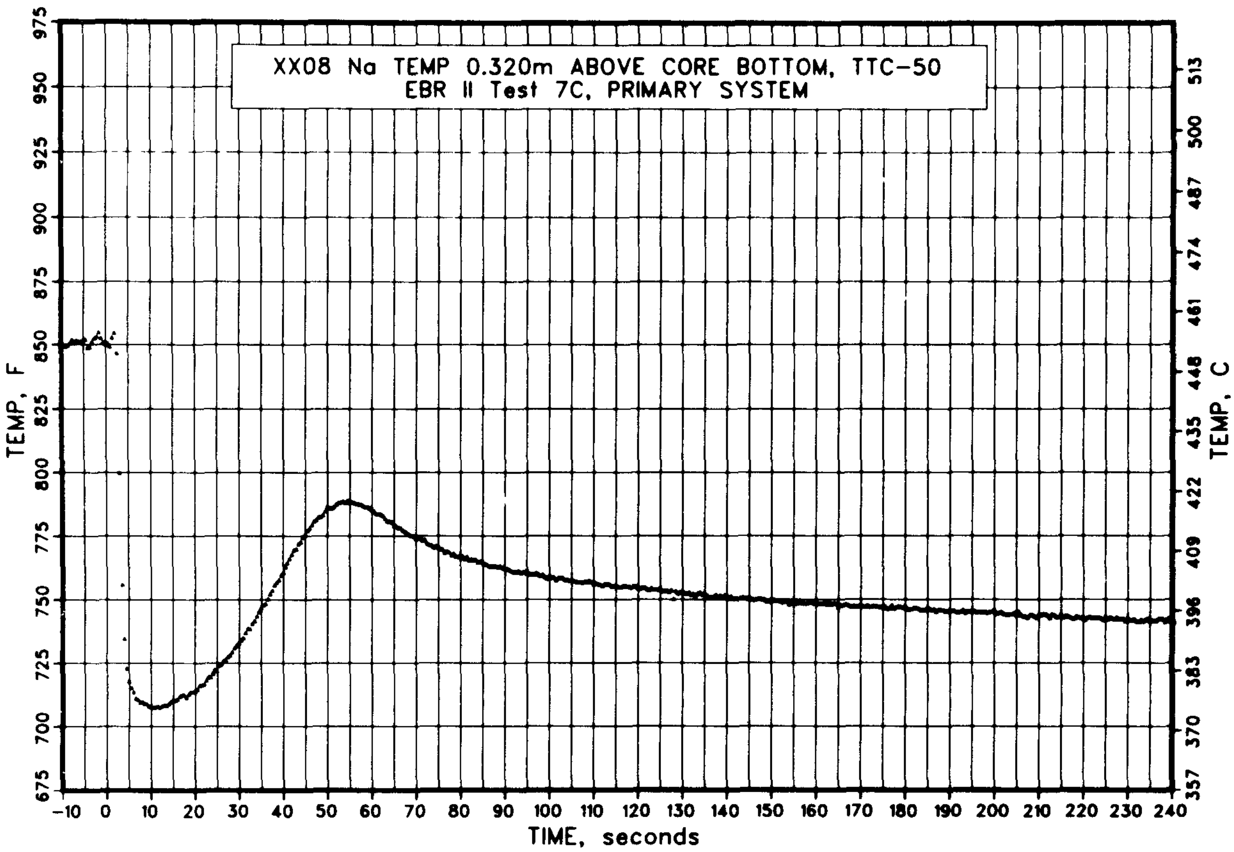

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-46
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

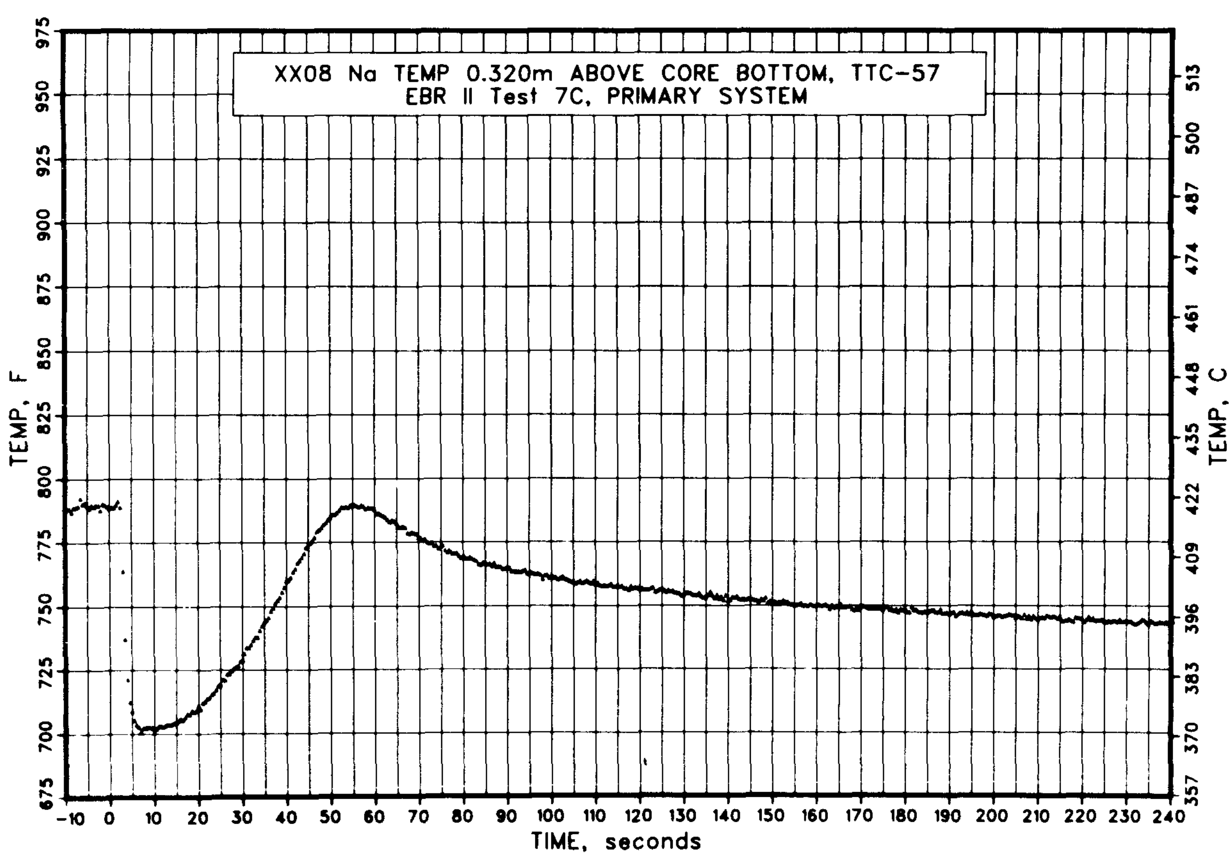

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-41
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

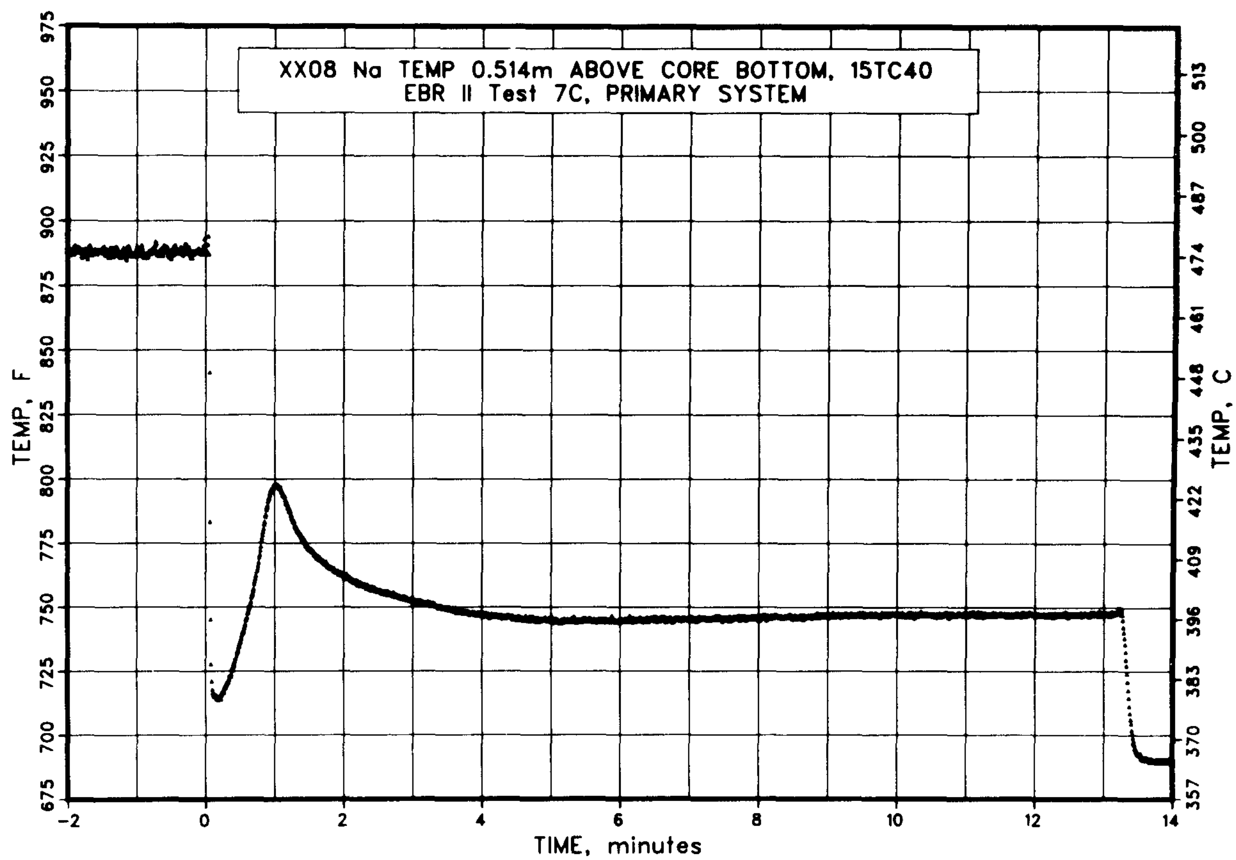

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-46
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

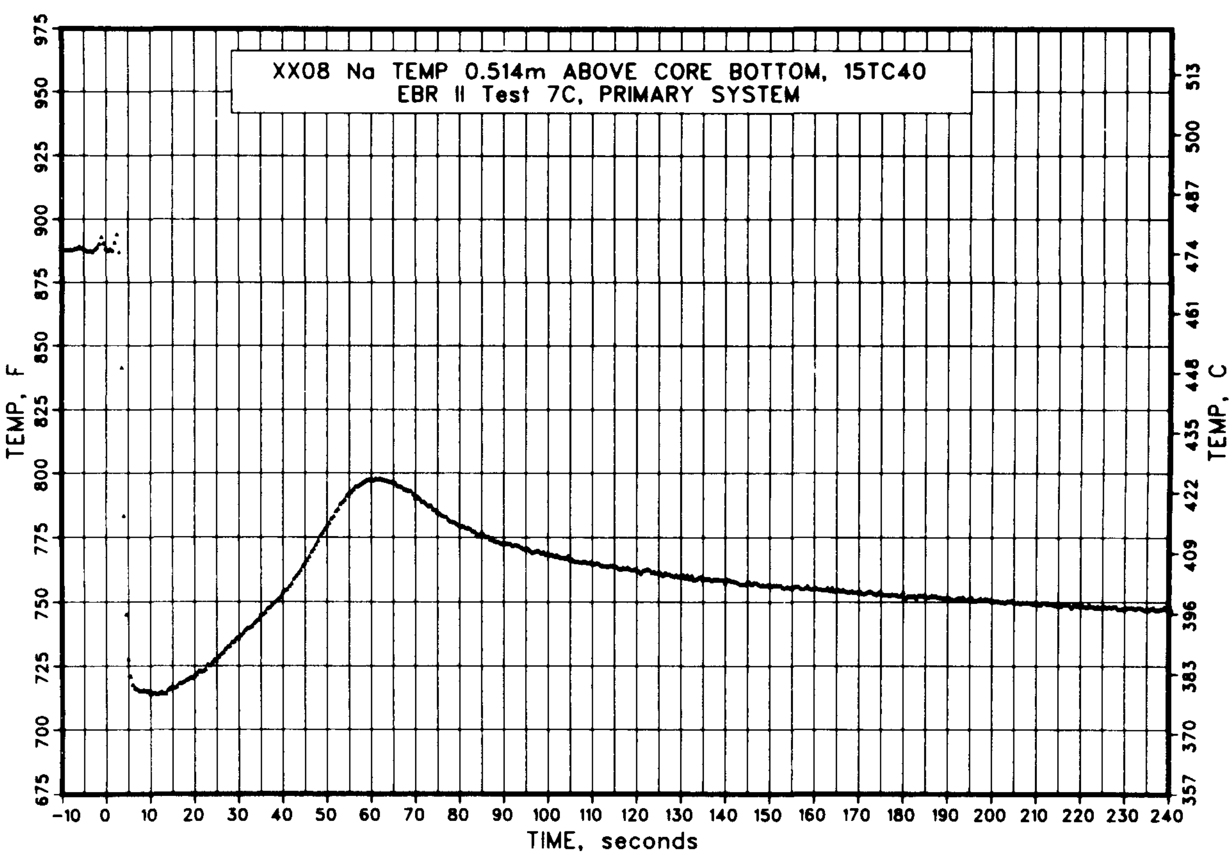

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-50
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

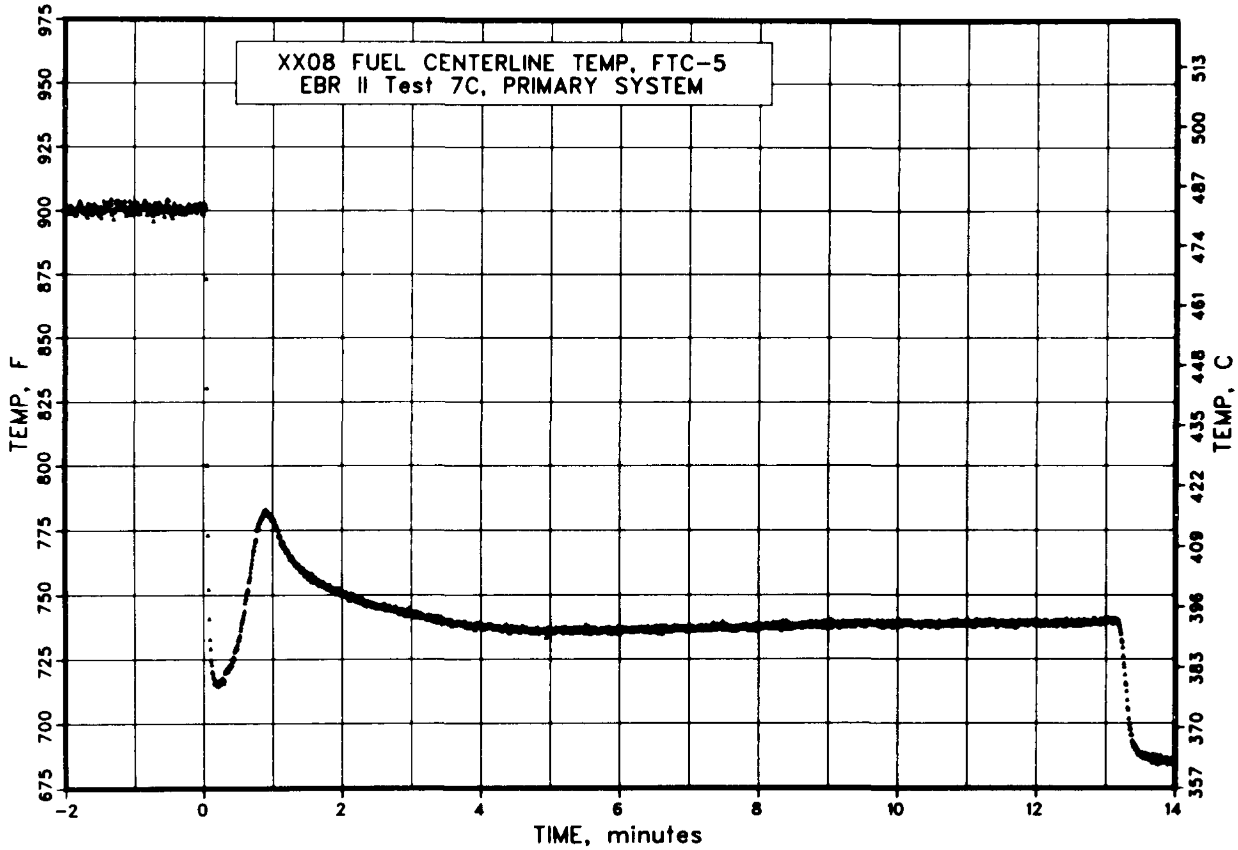

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-57
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

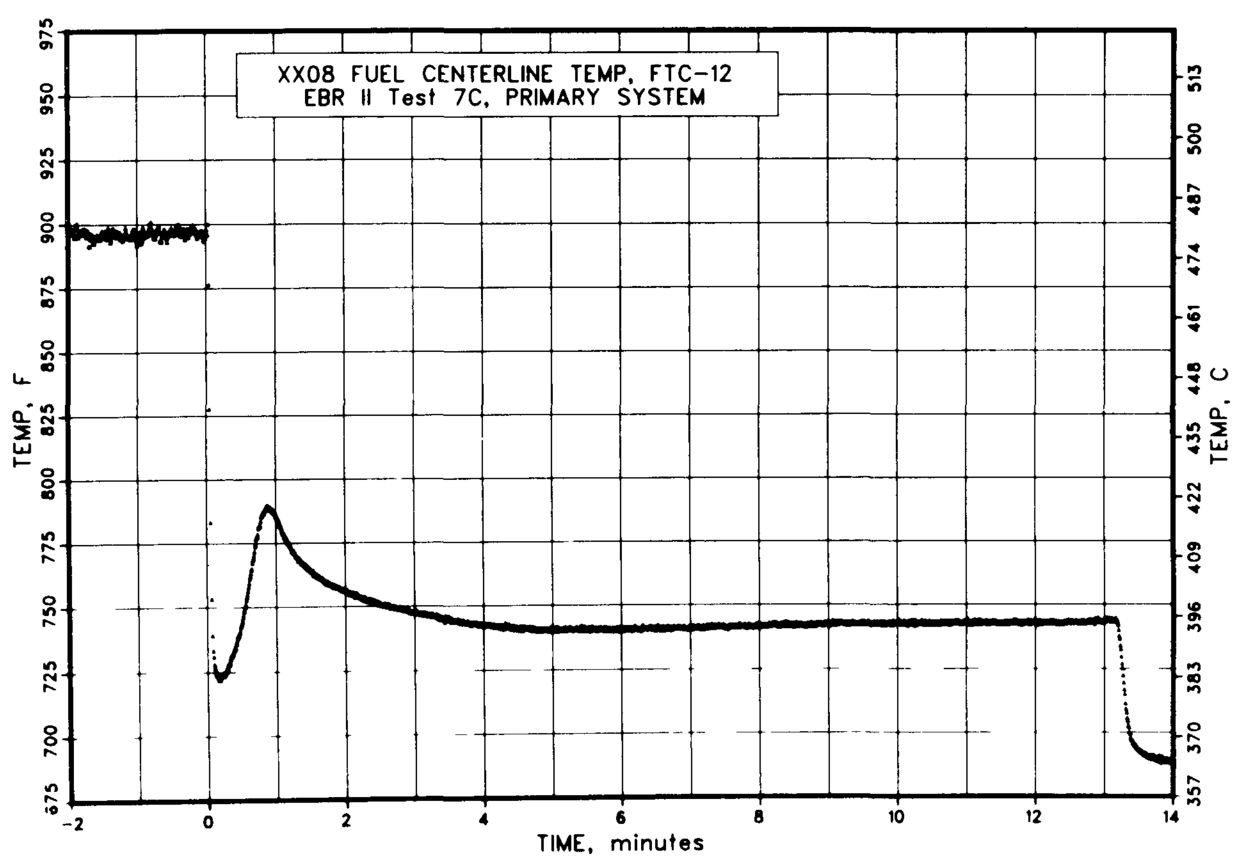

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-50
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

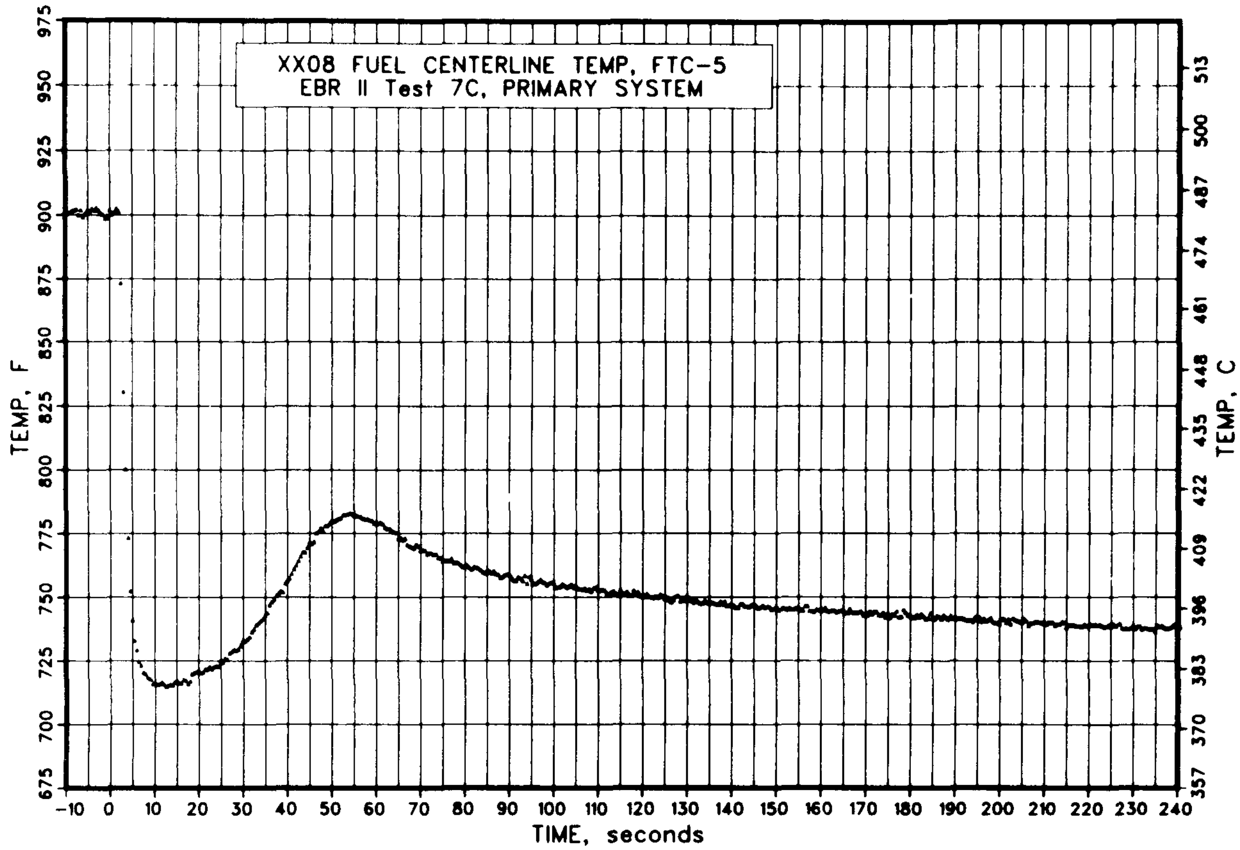

XX08 Na TEMP 0.320m ABOVE CORE BOTTOM, TTC-57
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

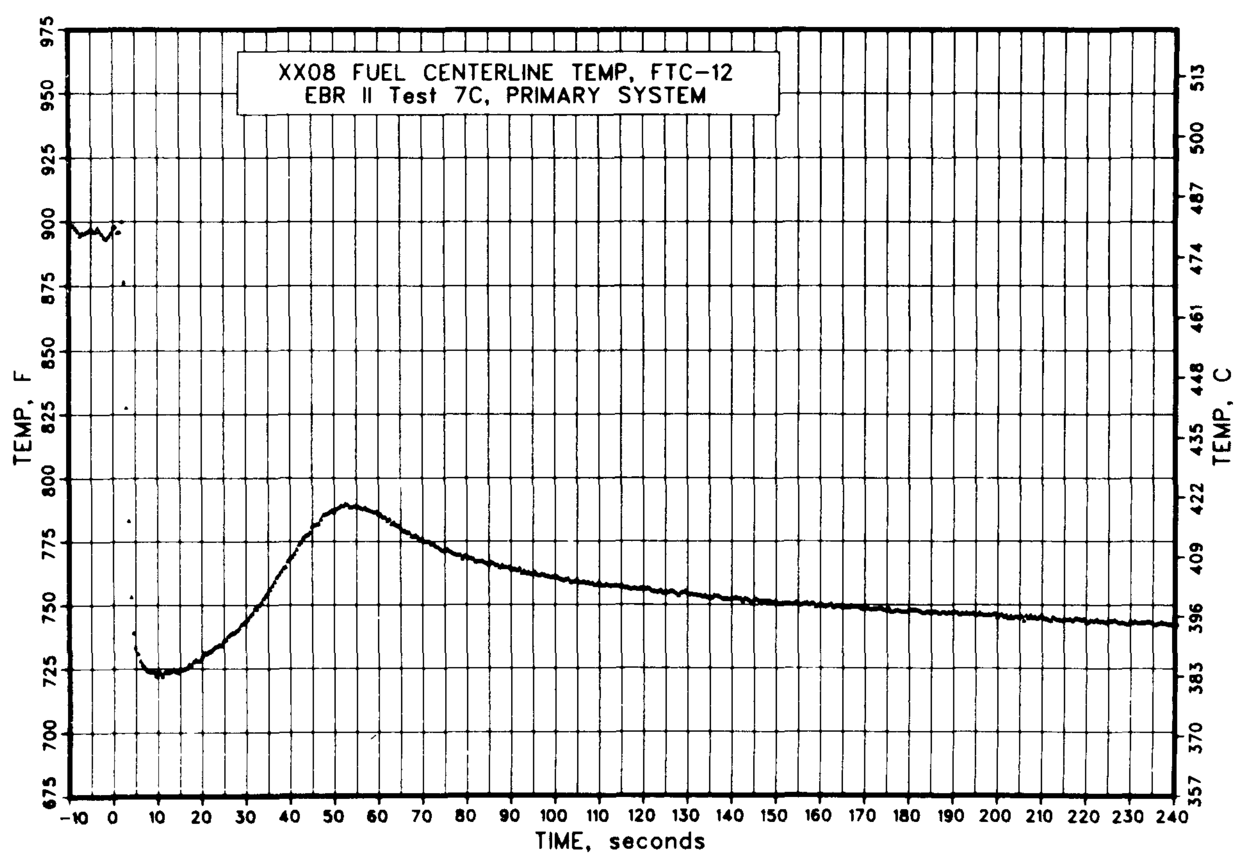

XX08 Na TEMP 0.514m ABOVE CORE BOTTOM, 15TC40
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14

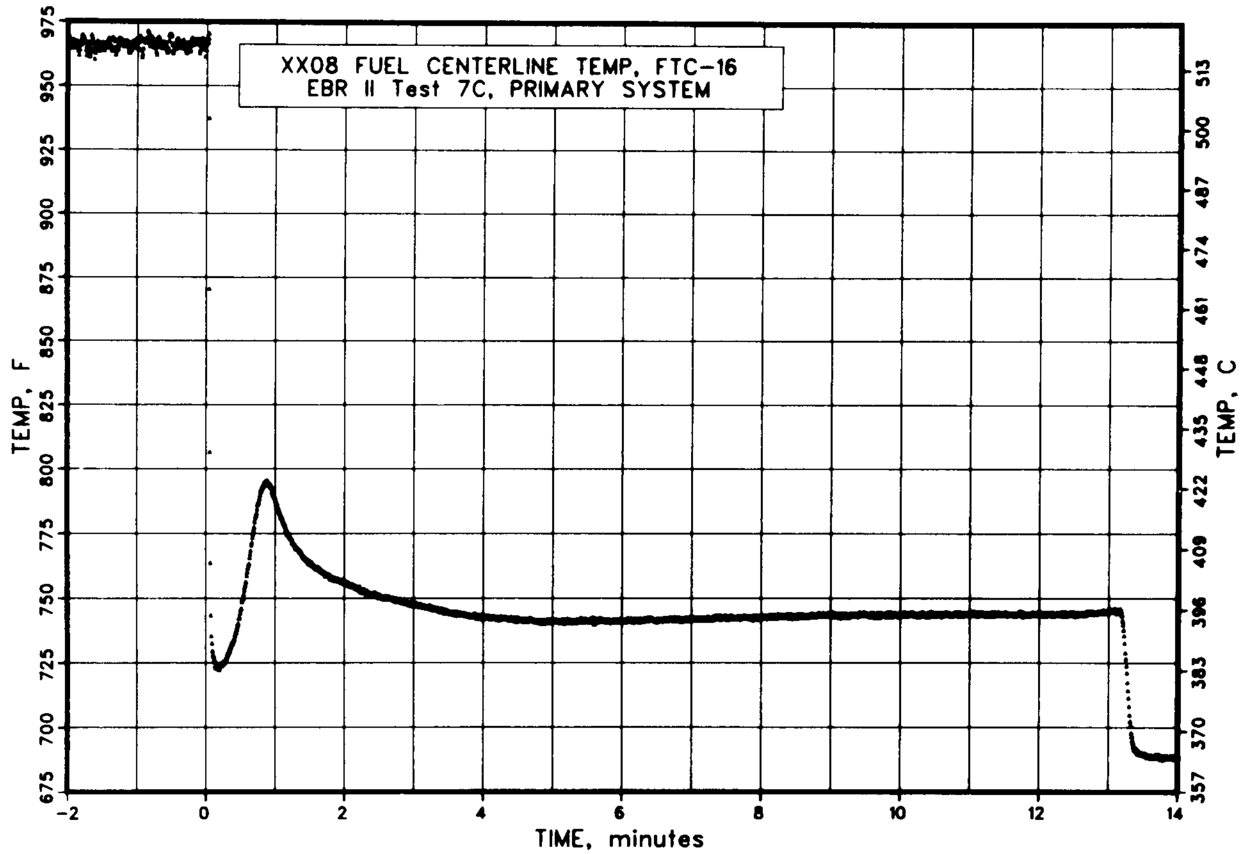

XX08 Na TEMP 0.514m ABOVE CORE BOTTOM, 15TC40
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

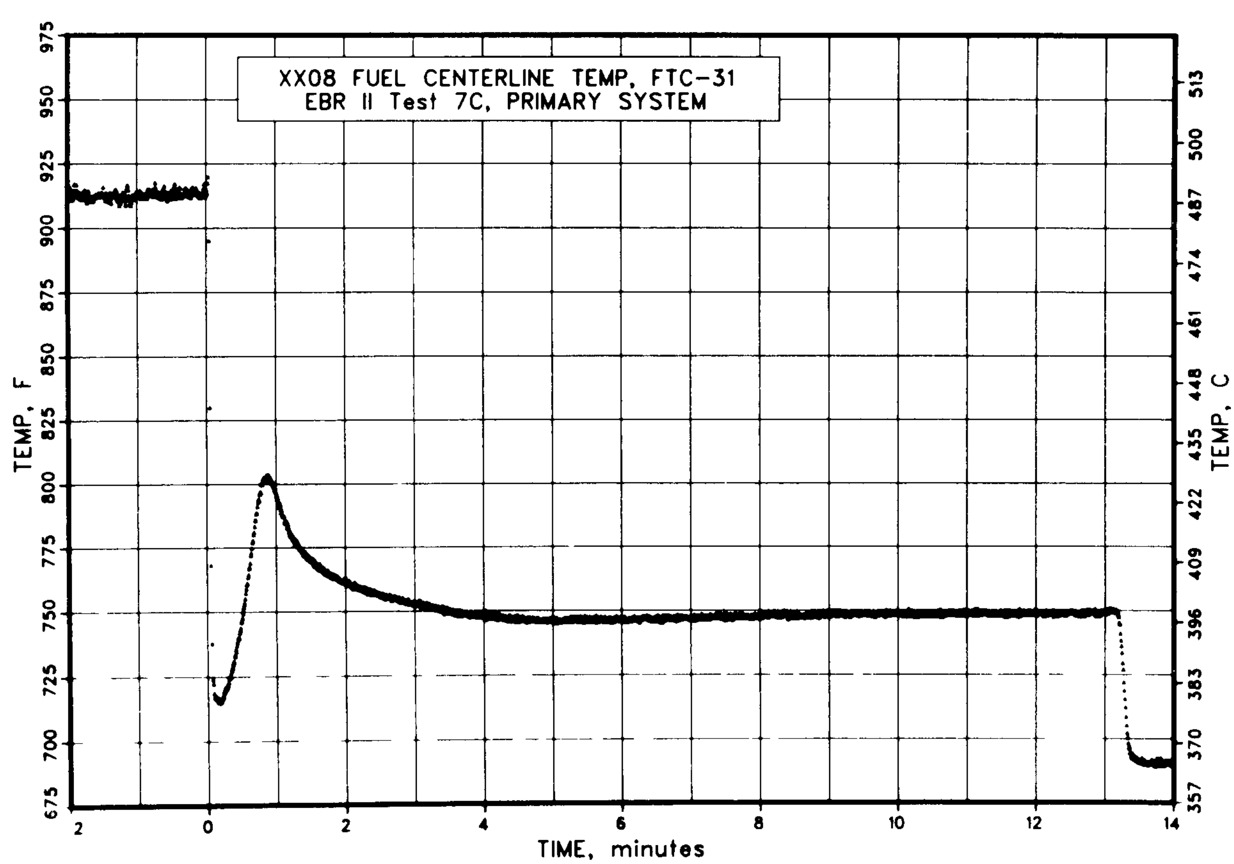

XX08 FUEL CENTERLINE TEMP, FTC-5
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14
TIME, minutes

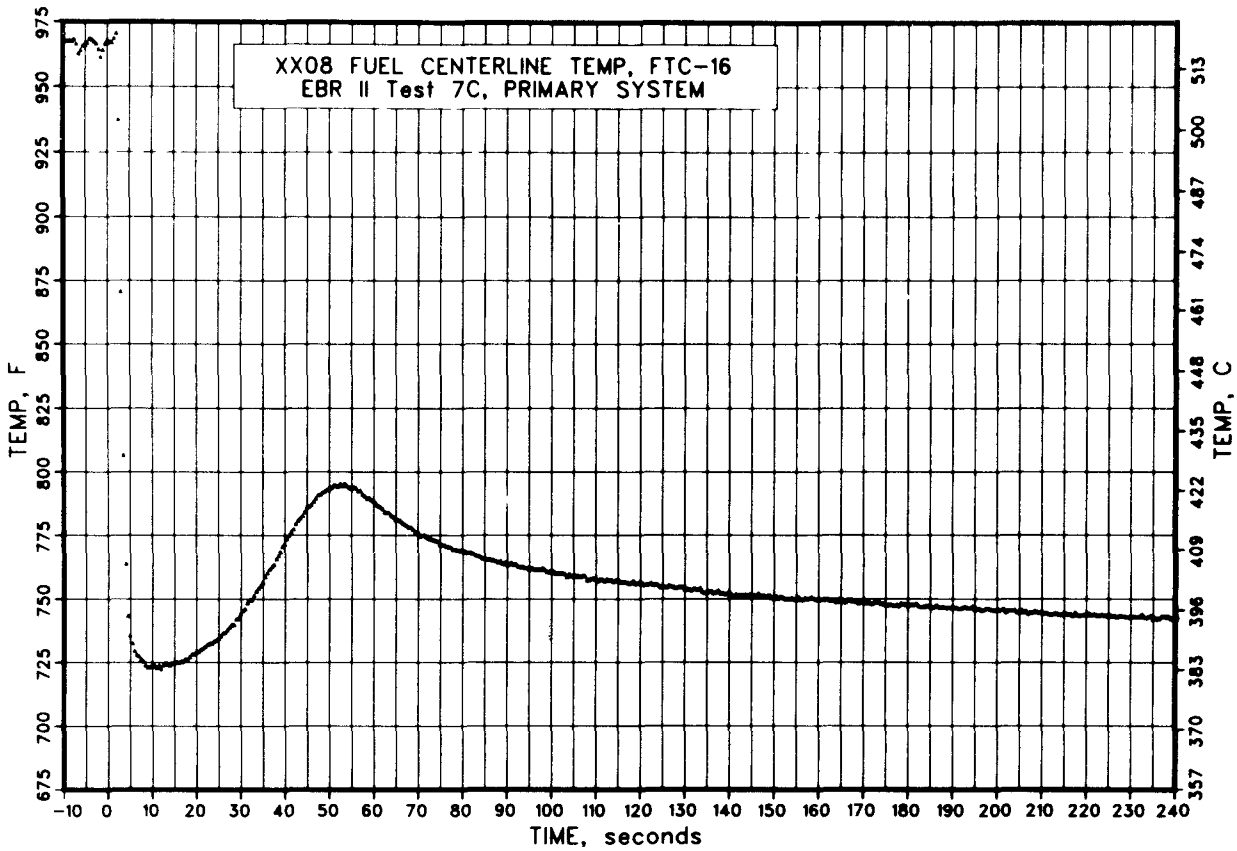

XX08 FUEL CENTERLINE TEMP, FTC-12
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14
TIME, minutes

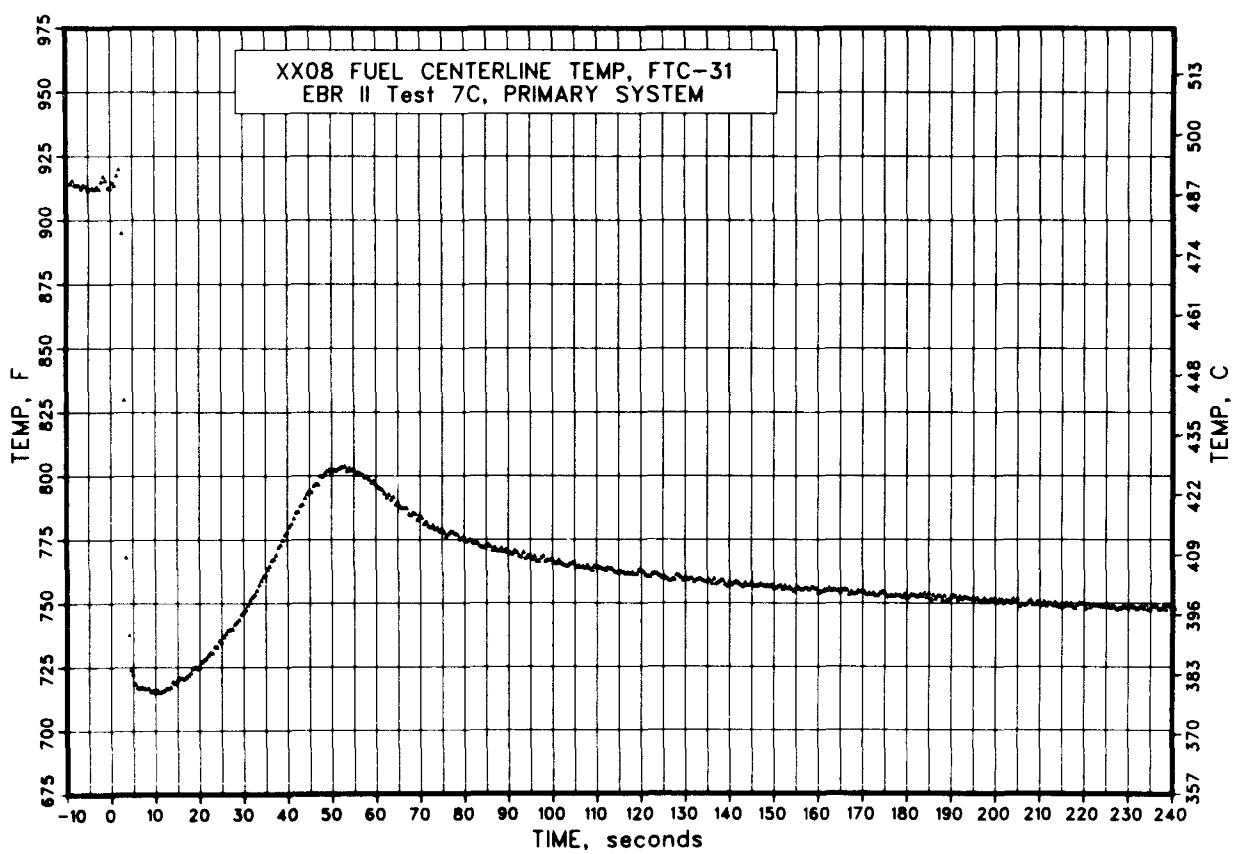

XX08 FUEL CENTERLINE TEMP, FTC-5
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

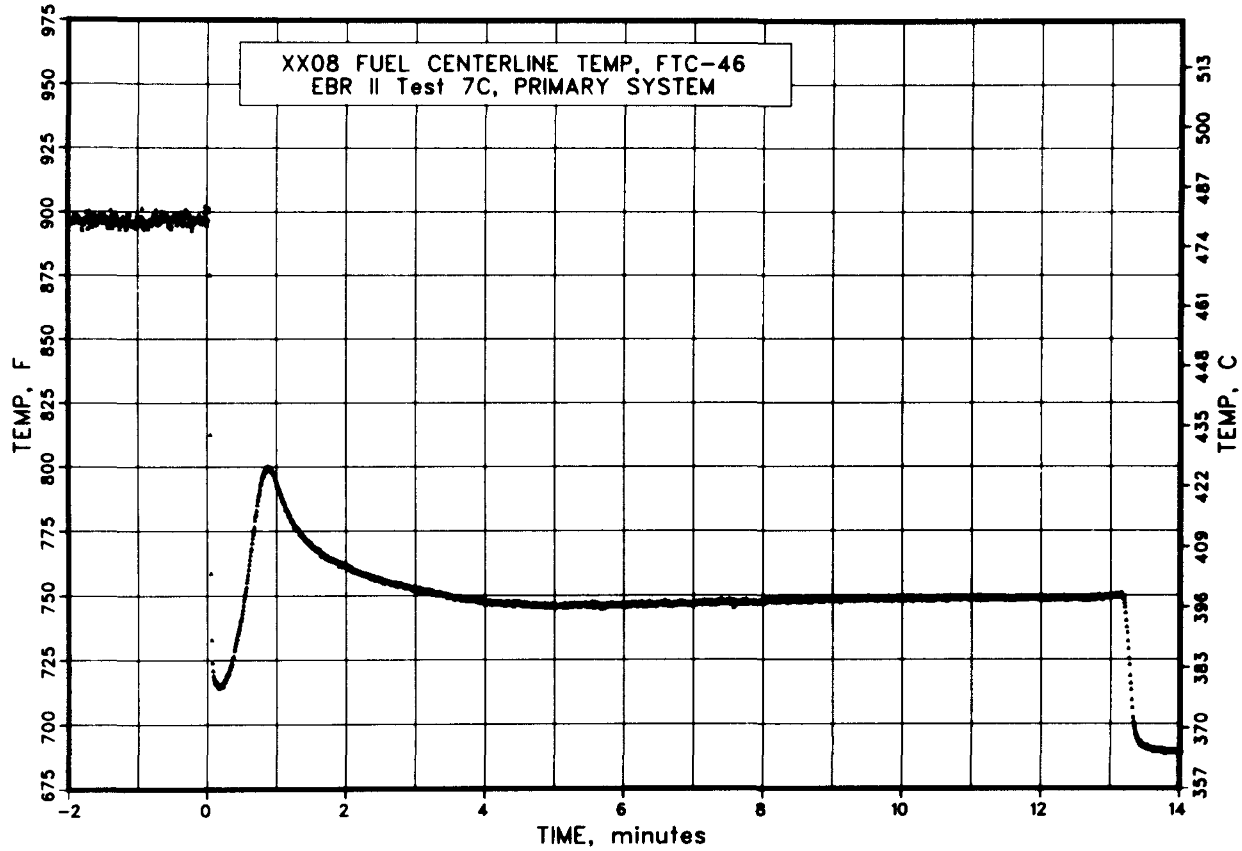

XX08 FUEL CENTERLINE TEMP, FTC-12
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

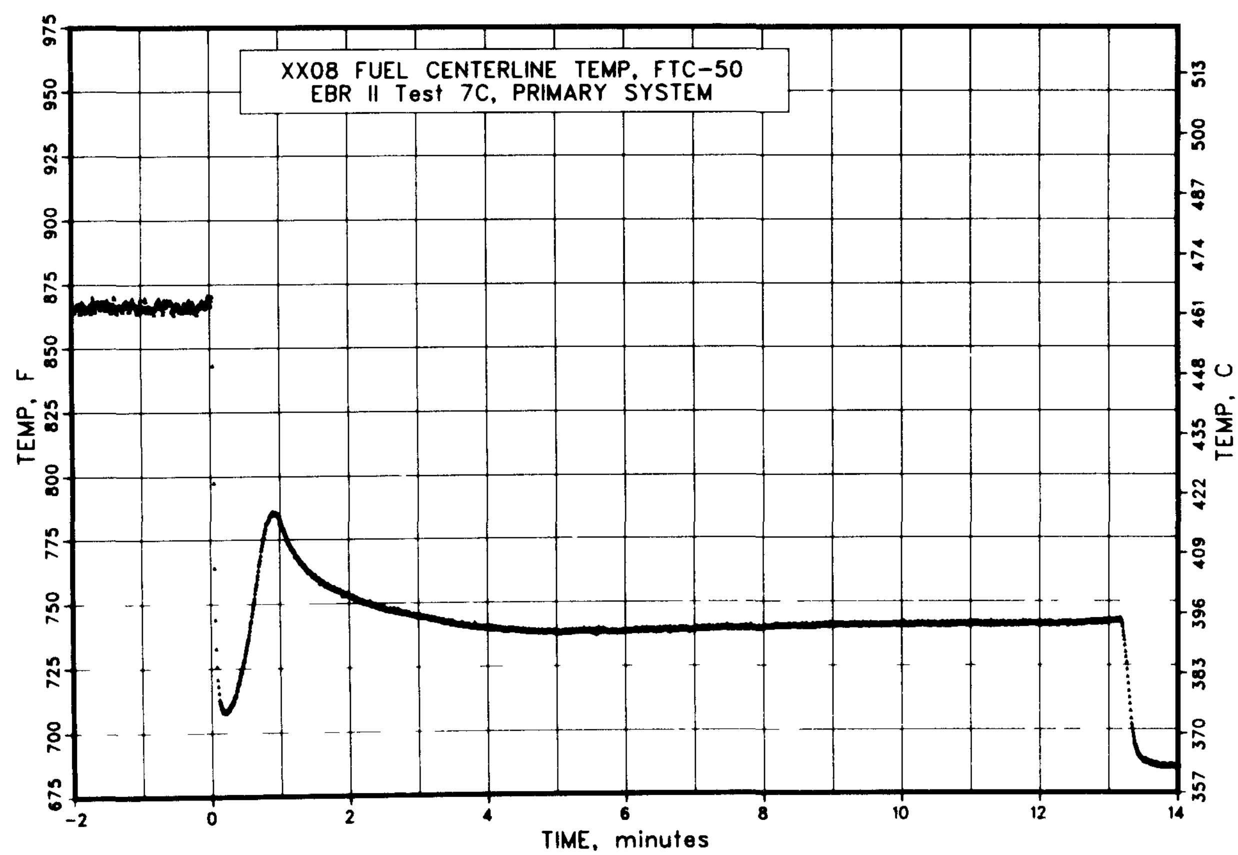

XX08 FUEL CENTERLINE TEMP, FTC-16
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14

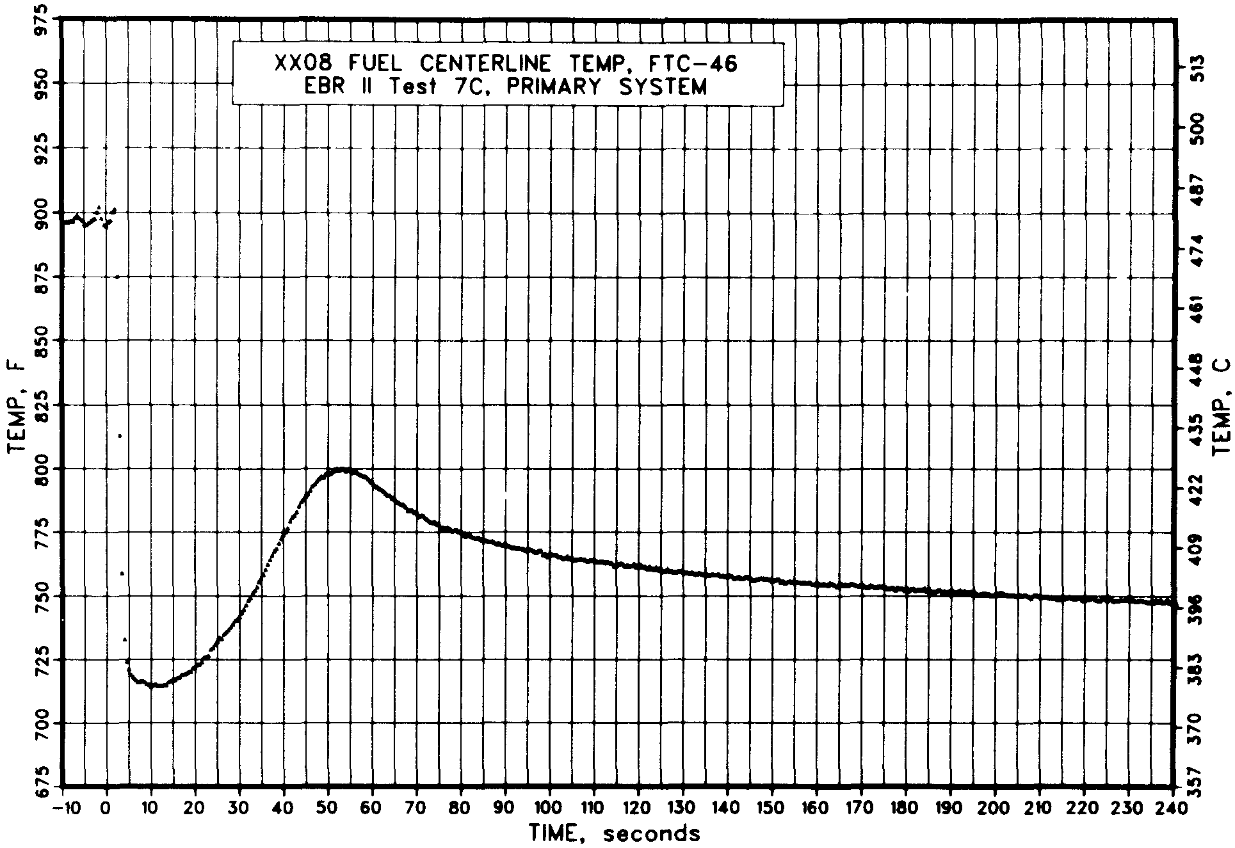

XX08 FUEL CENTERLINE TEMP, FTC-31
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
2
0
2
4
6
8
10
12
14

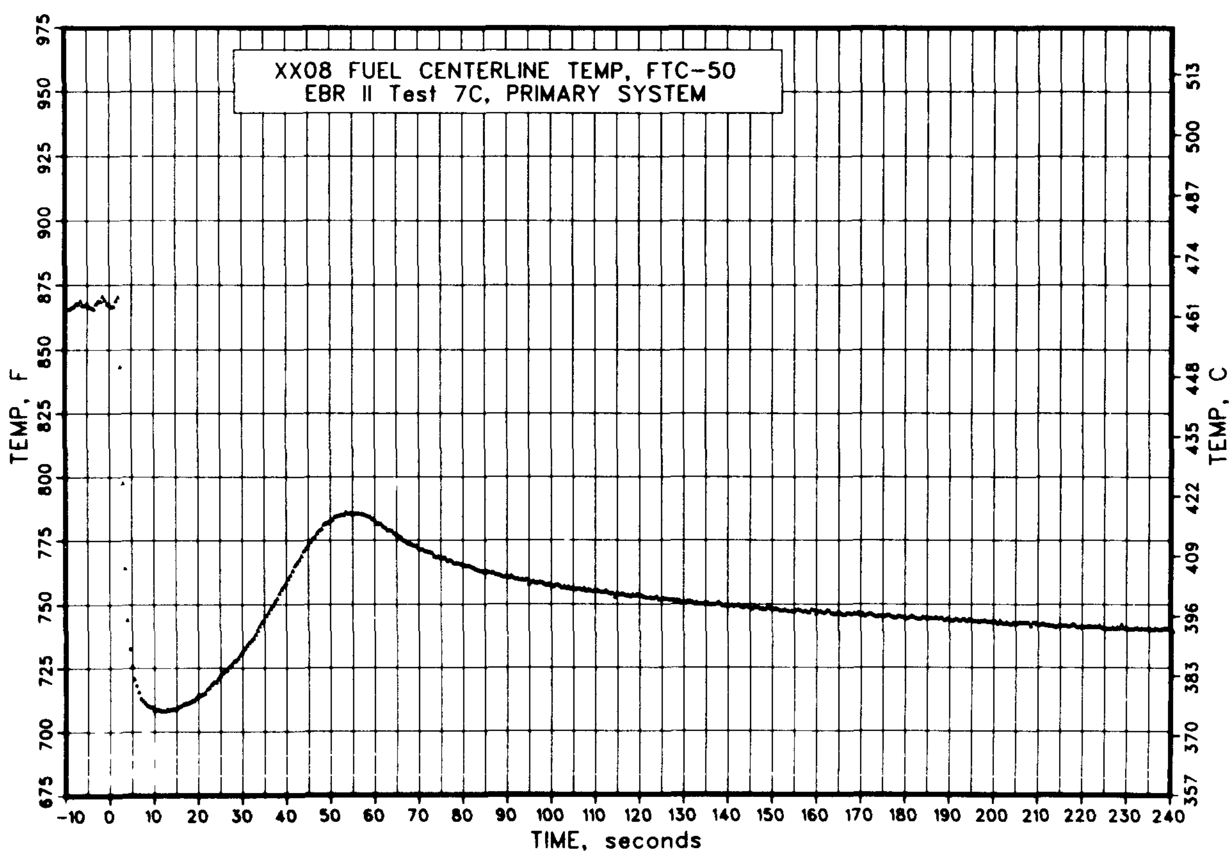

XX08 FUEL CENTERLINE TEMP, FTC-16
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

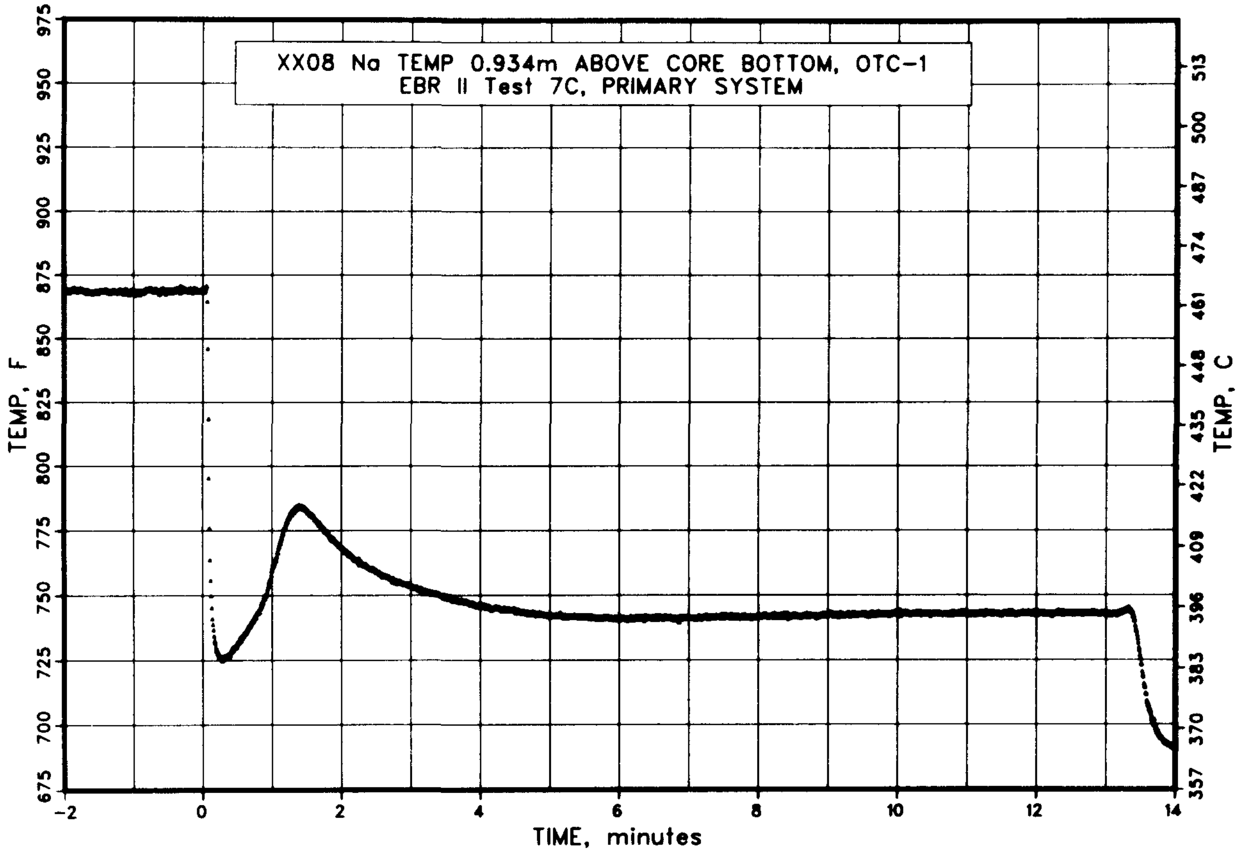

XX08 FUEL CENTERLINE TEMP, FTC-31
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

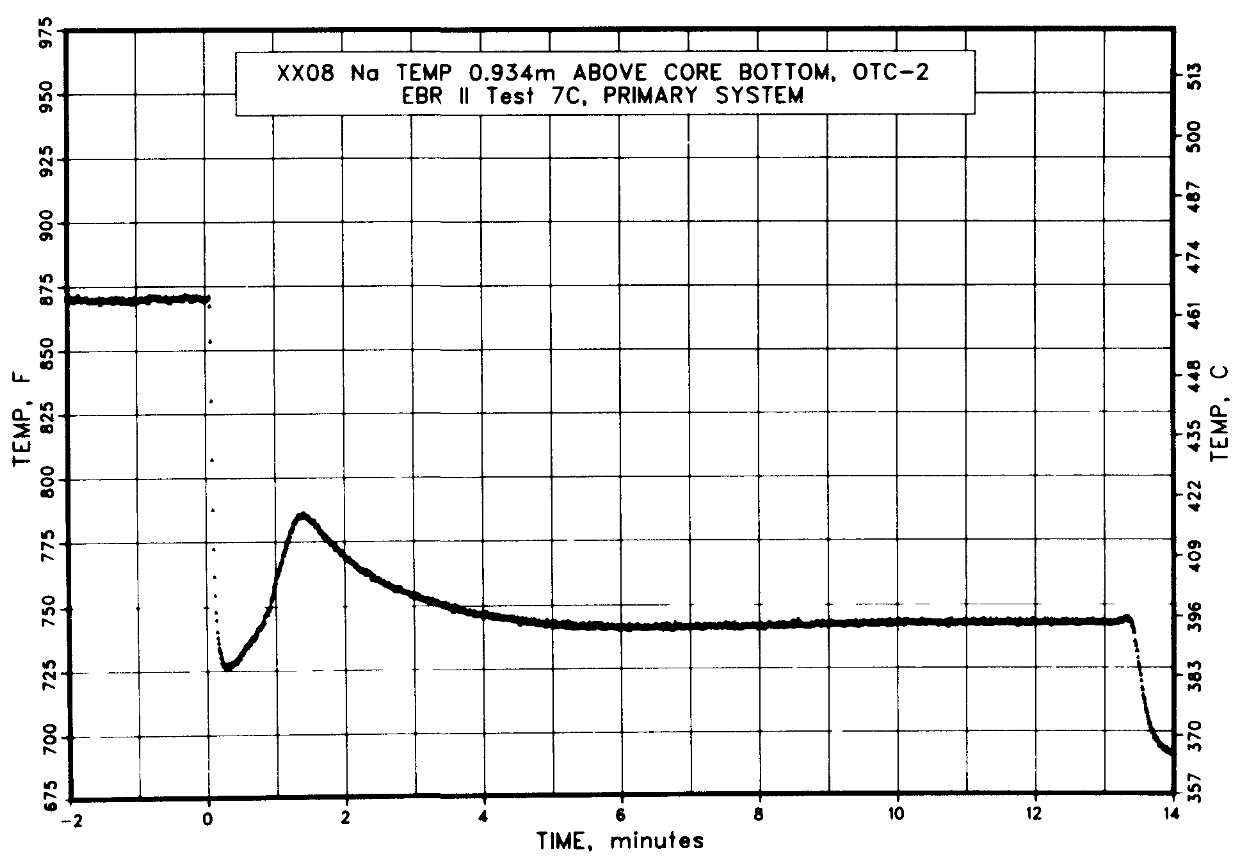

XX08 FUEL CENTERLINE TEMP, FTC-46
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14

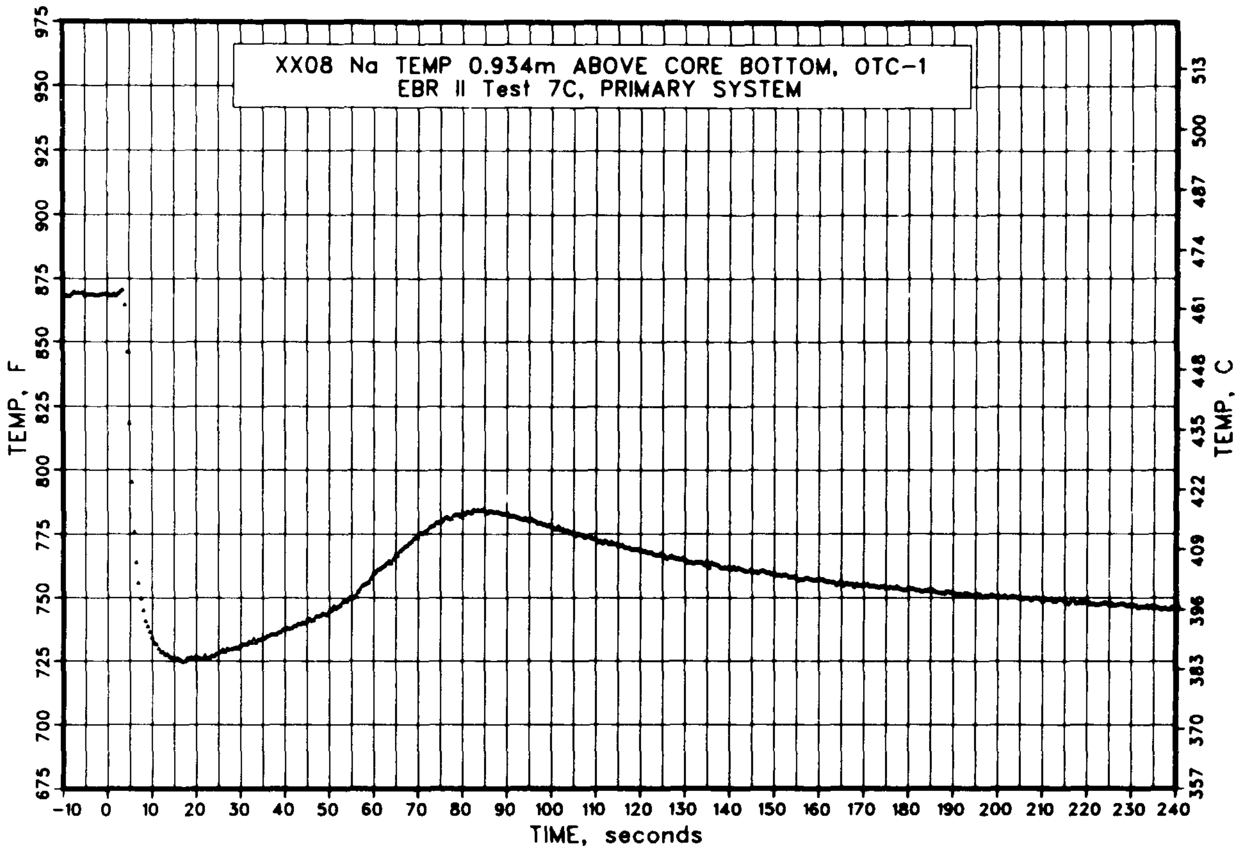

XX08 FUEL CENTERLINE TEMP, FTC-50
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14

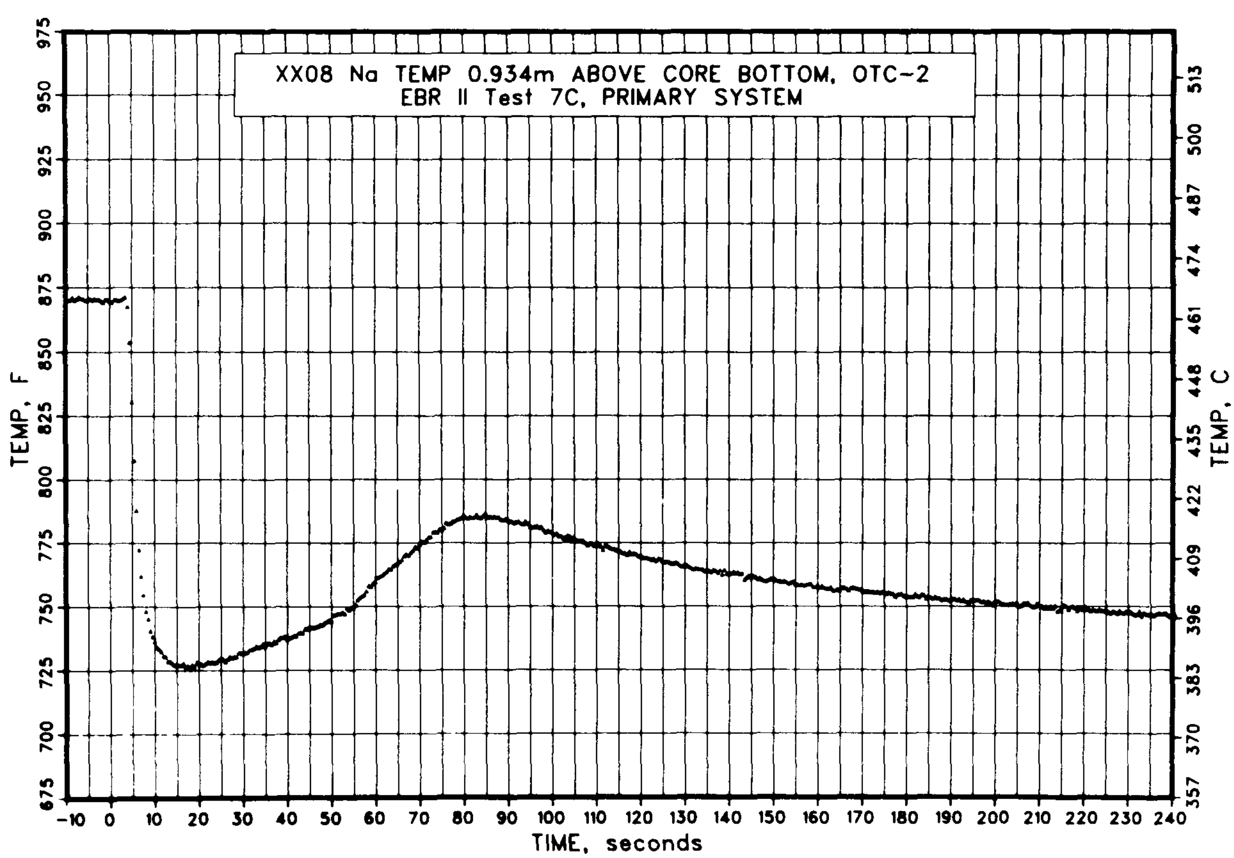

XX08 FUEL CENTERLINE TEMP, FTC-46
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975 950 925 900 875 850 825 800 775 750 725 700 675
TEMP, C
513 500 487 474 461 448 435 422 409 396 383 370 357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

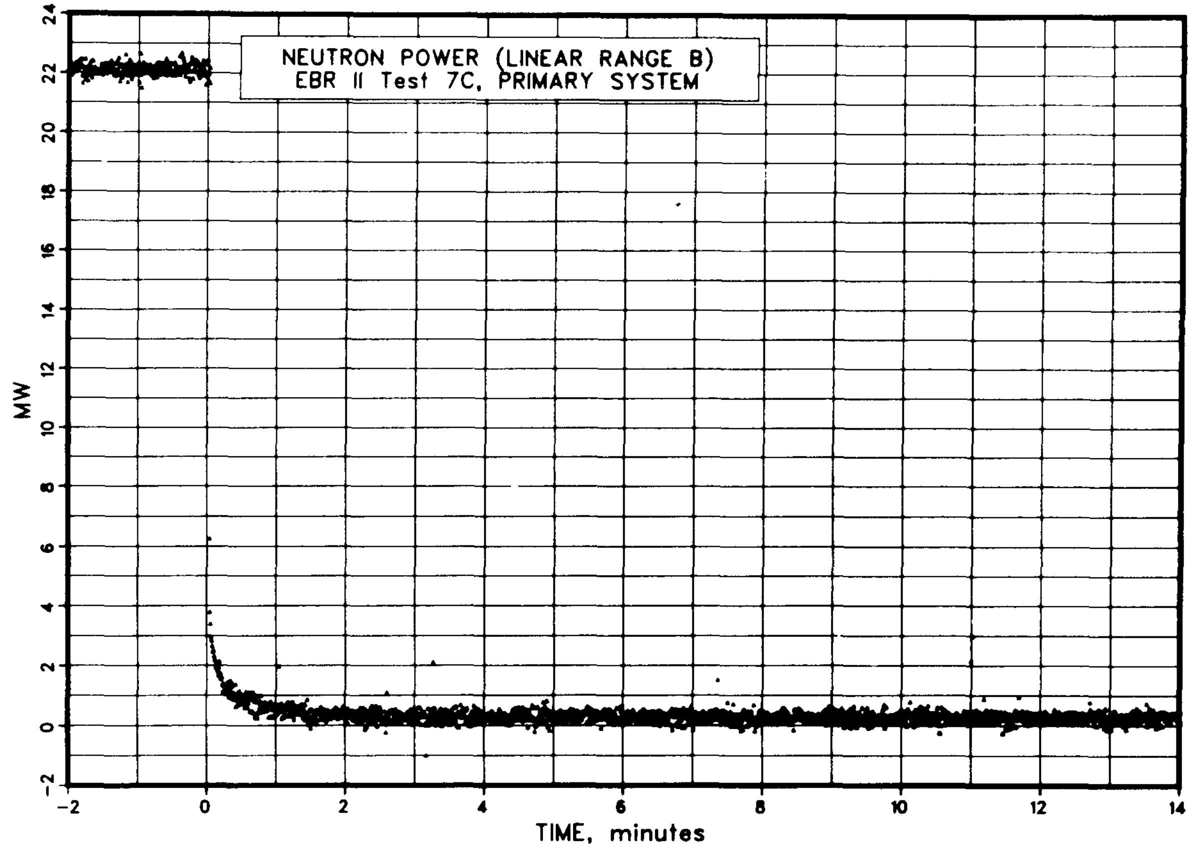

XX08 FUEL CENTERLINE TEMP, FTC-50
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975 950 925 900 875 850 825 800 775 750 725 700 675
TEMP, C
513 500 487 474 461 448 435 422 409 396 383 370 357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds


XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-1
EBR II Test 7C, 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

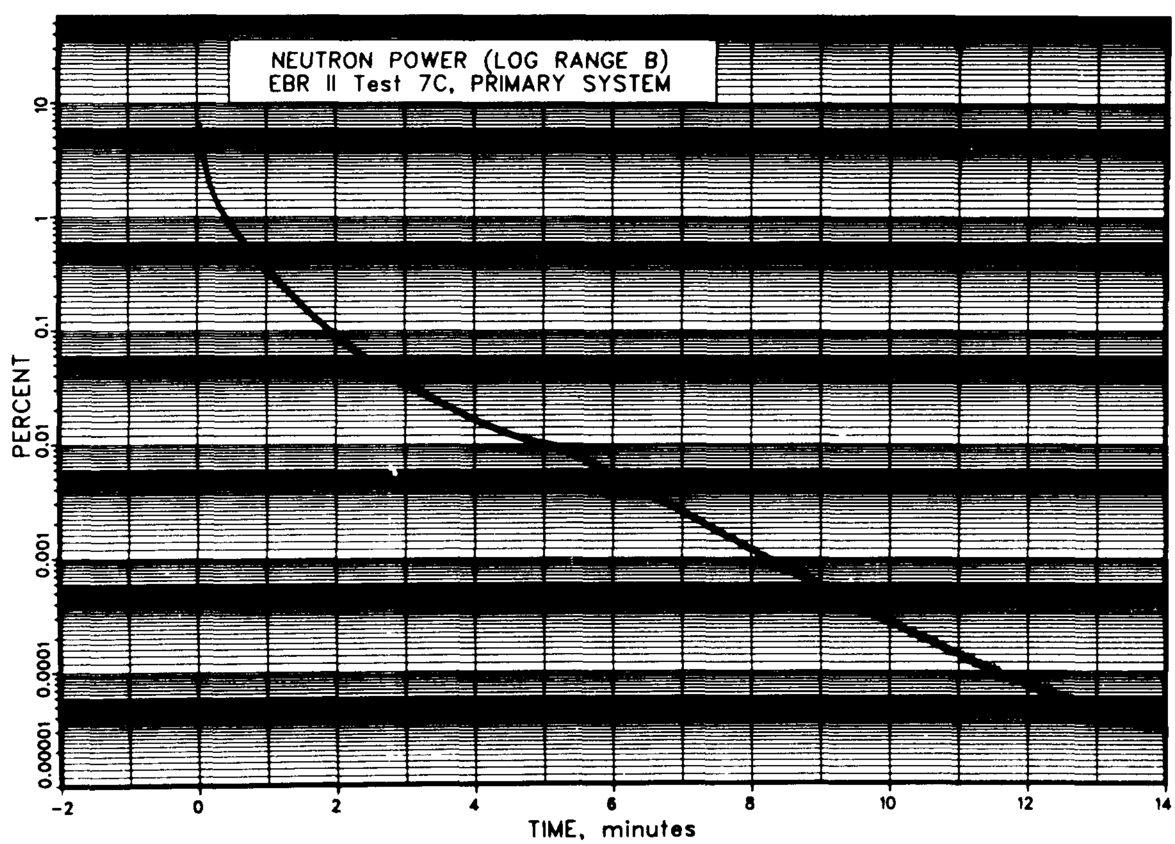

XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-2
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14


XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-1
EBR II Test 7C, 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 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

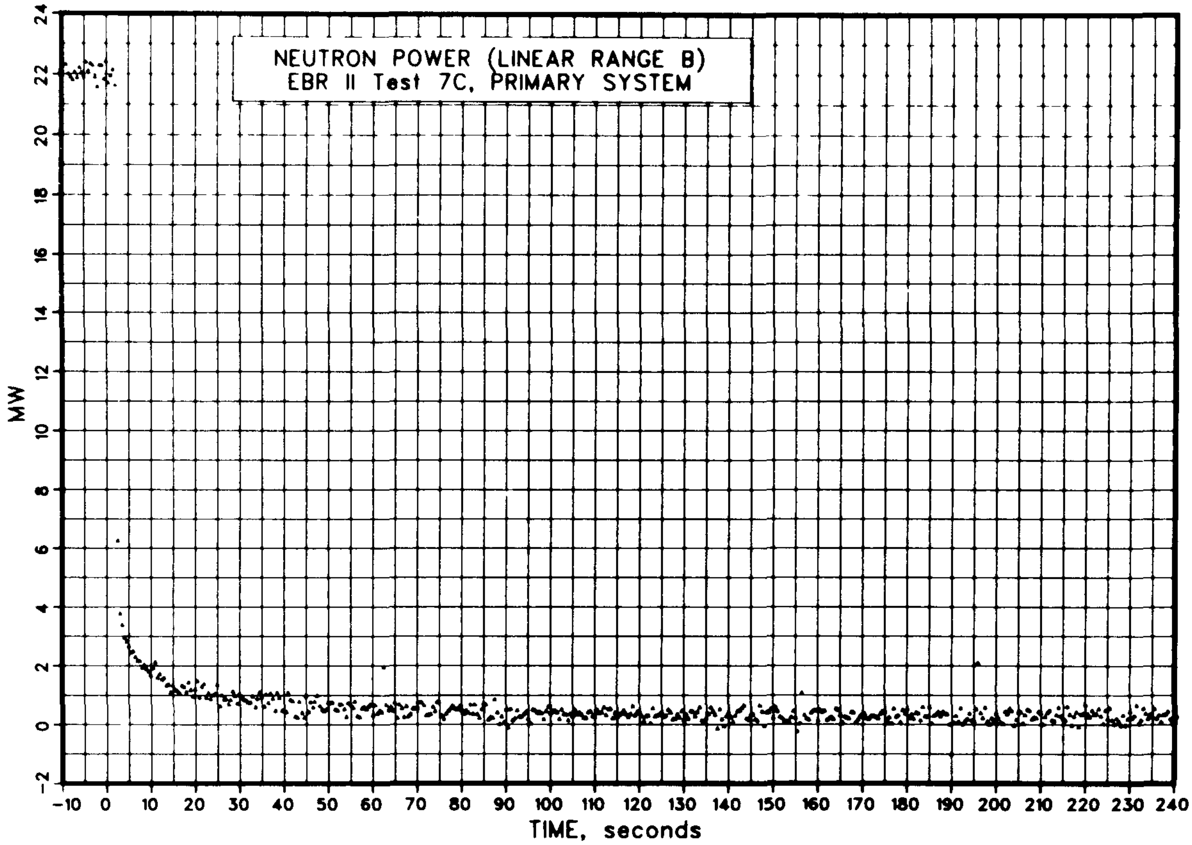

XX08 Na TEMP 0.934m ABOVE CORE BOTTOM, OTC-2
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
950
925
900
875
850
825
800
775
750
725
700
675
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

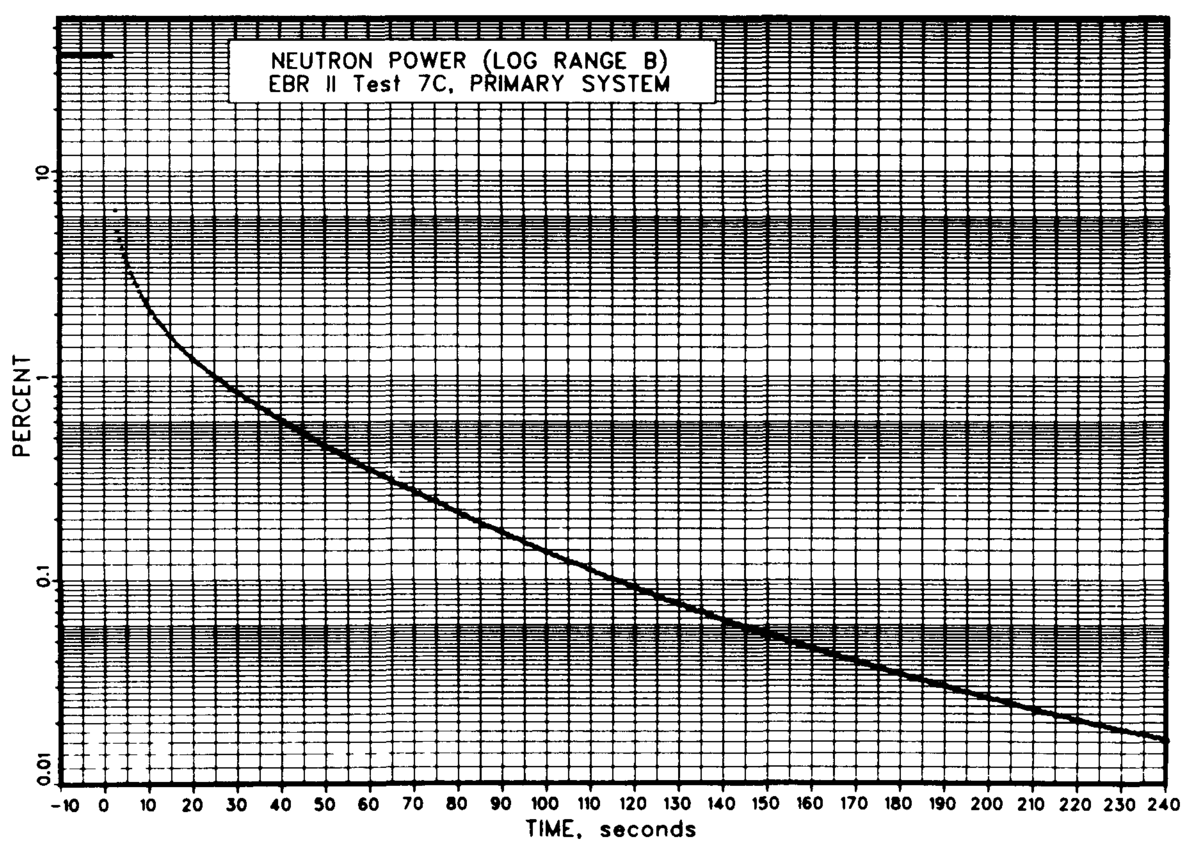


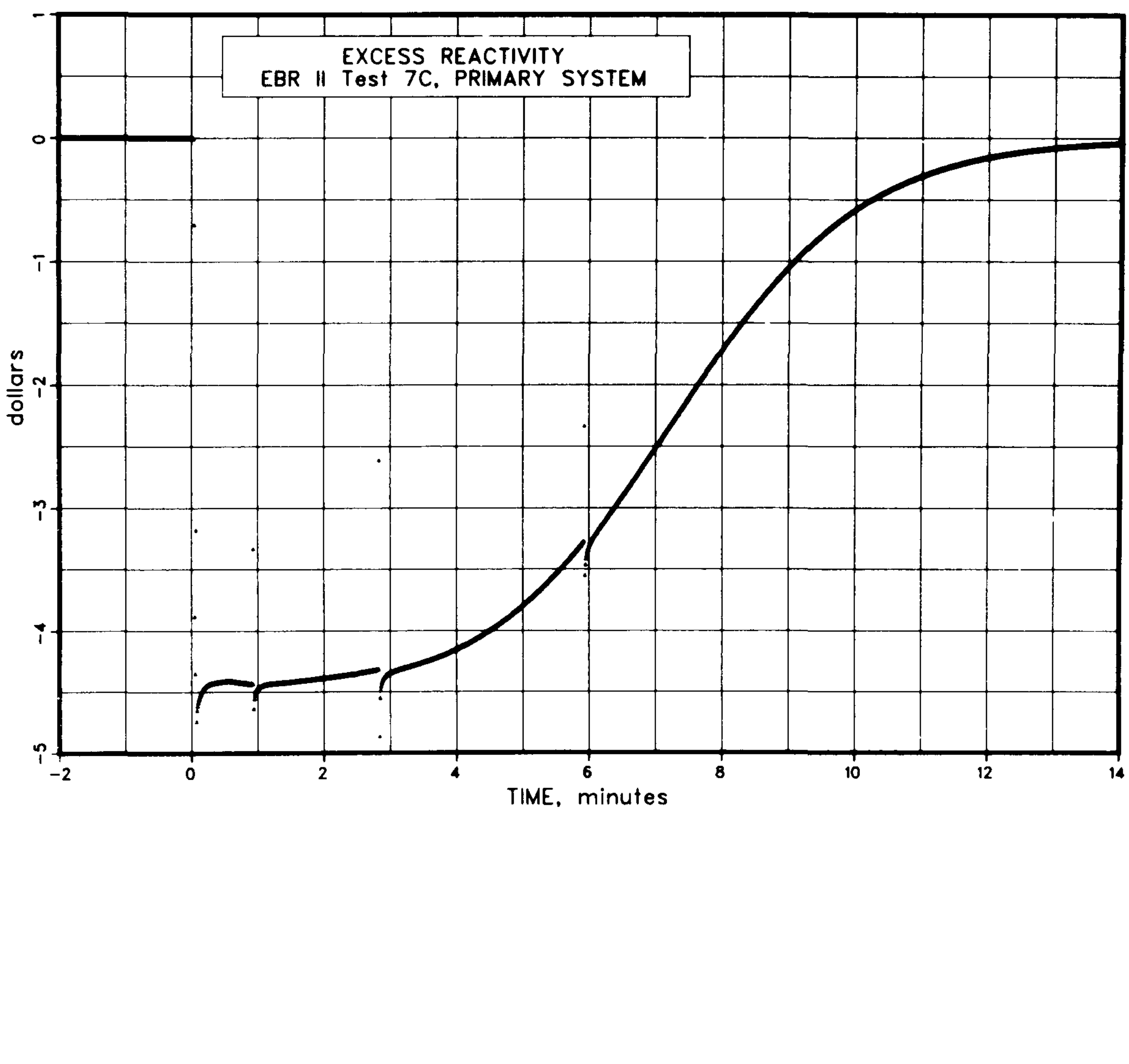
NEUTRON POWER (LINEAR RANGE B)
EBR II Test 7C, PRIMARY SYSTEM
MW
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME, minutes

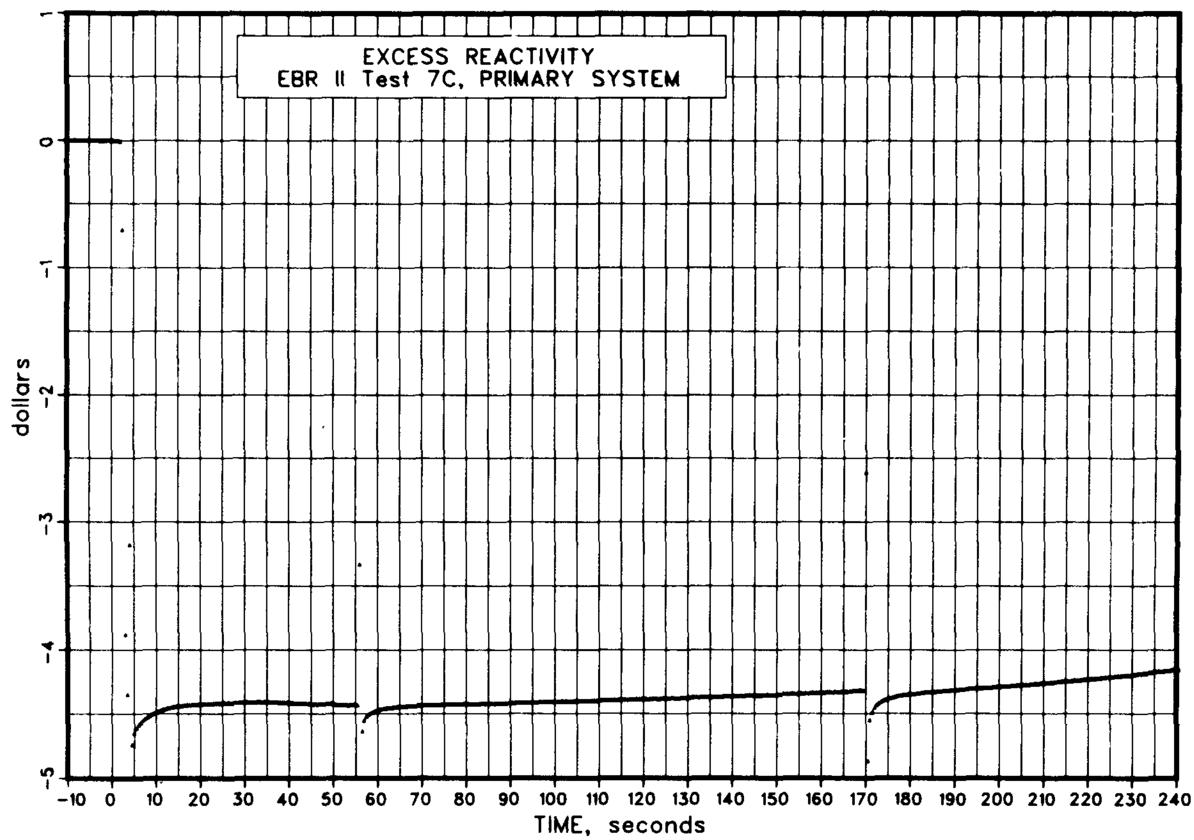


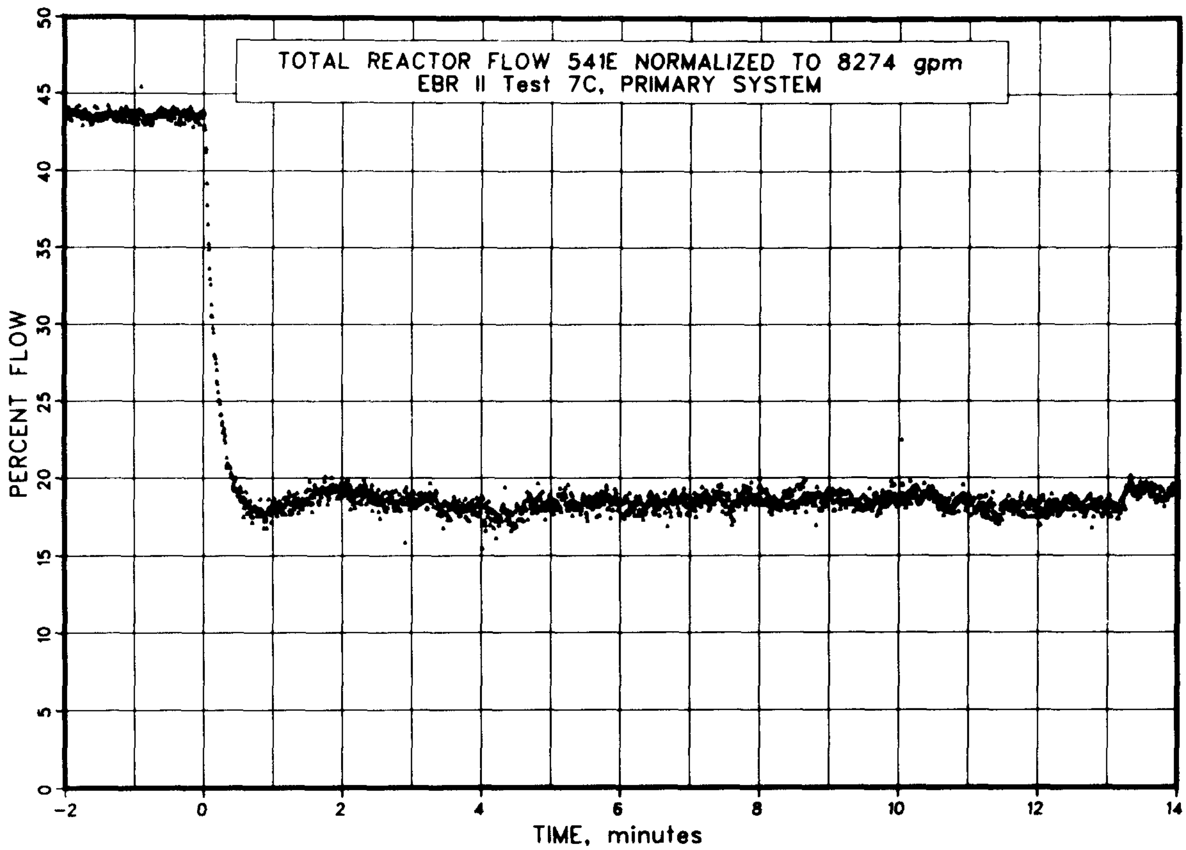
NEUTRON POWER (LOG RANGE B)
EBR II Test 7C, PRIMARY SYSTEM
PERCENT
0.00001
0.0001
0.001
0.01
0.1
1
10
TIME, minutes

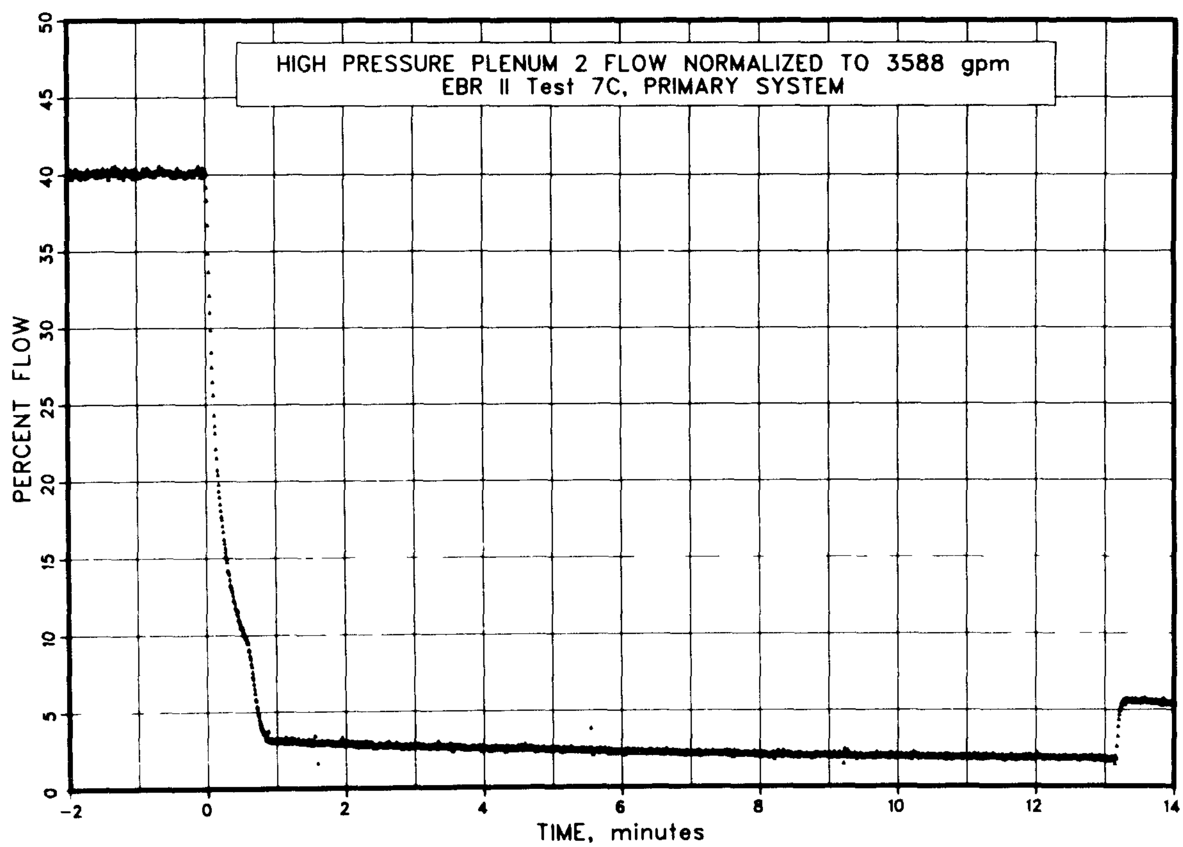

NEUTRON POWER (LINEAR RANGE B)
EBR II Test 7C, PRIMARY SYSTEM
MW
TIME, seconds

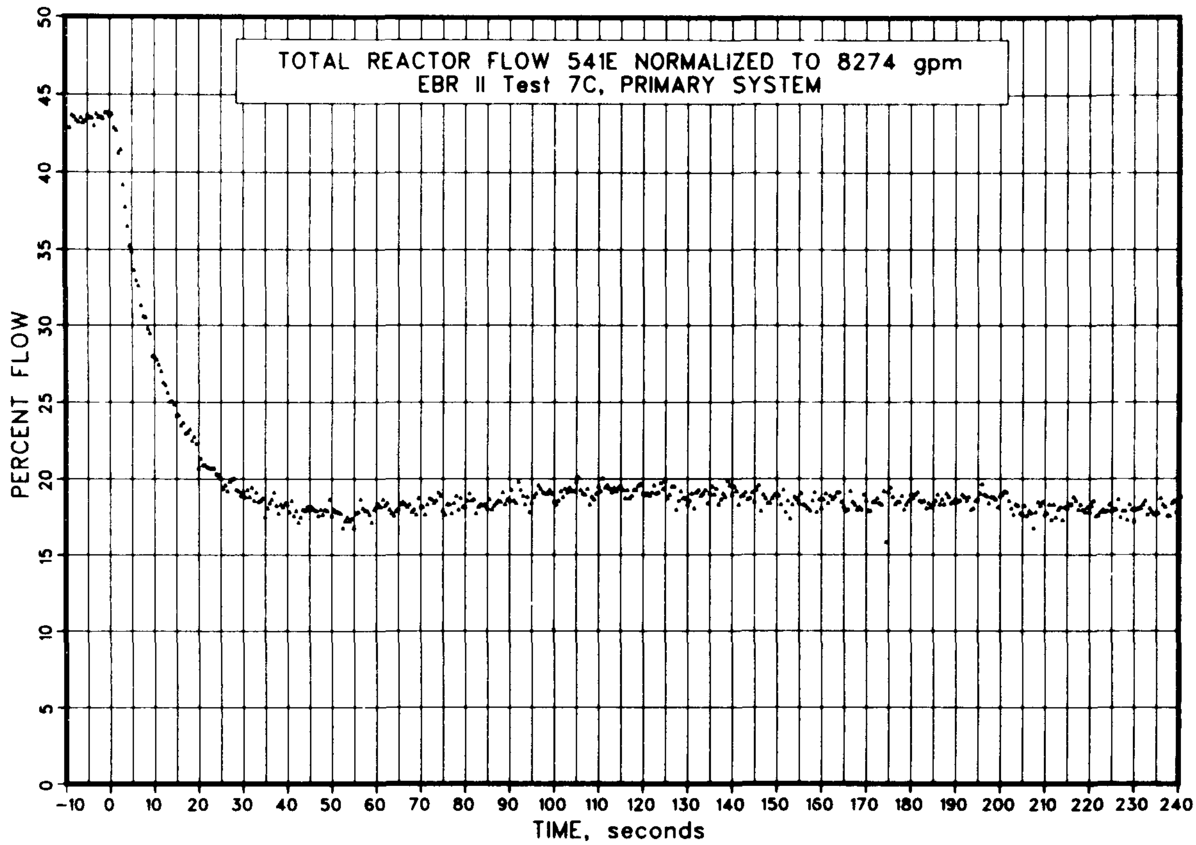

NEUTRON POWER (LOG RANGE B)
EBR II Test 7C, PRIMARY SYSTEM
PERCENT
TIME, seconds

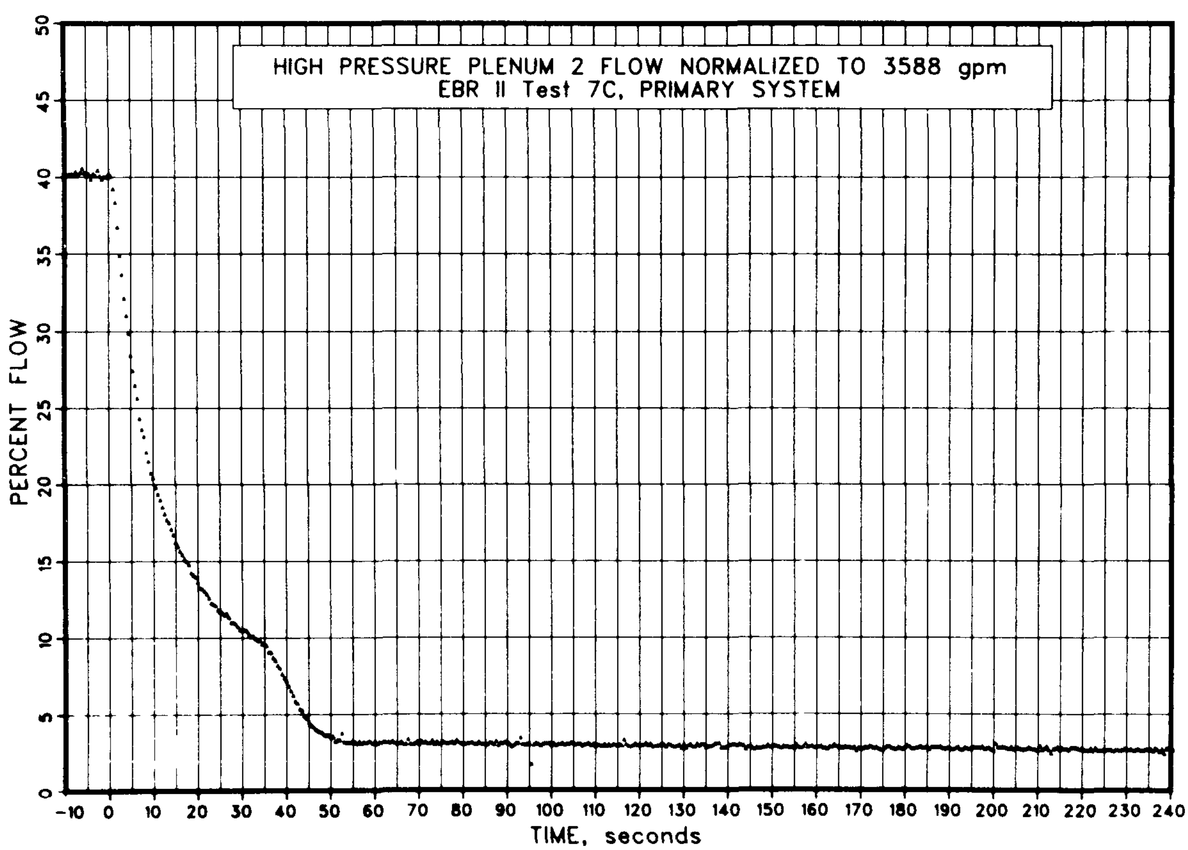

EXCESS REACTIVITY
EBR II Test 7C, PRIMARY SYSTEM
dollars
1
0
-1
-2
-3
-4
-5
-2
0
2
4
6
8
10
12
14
TIME, minutes

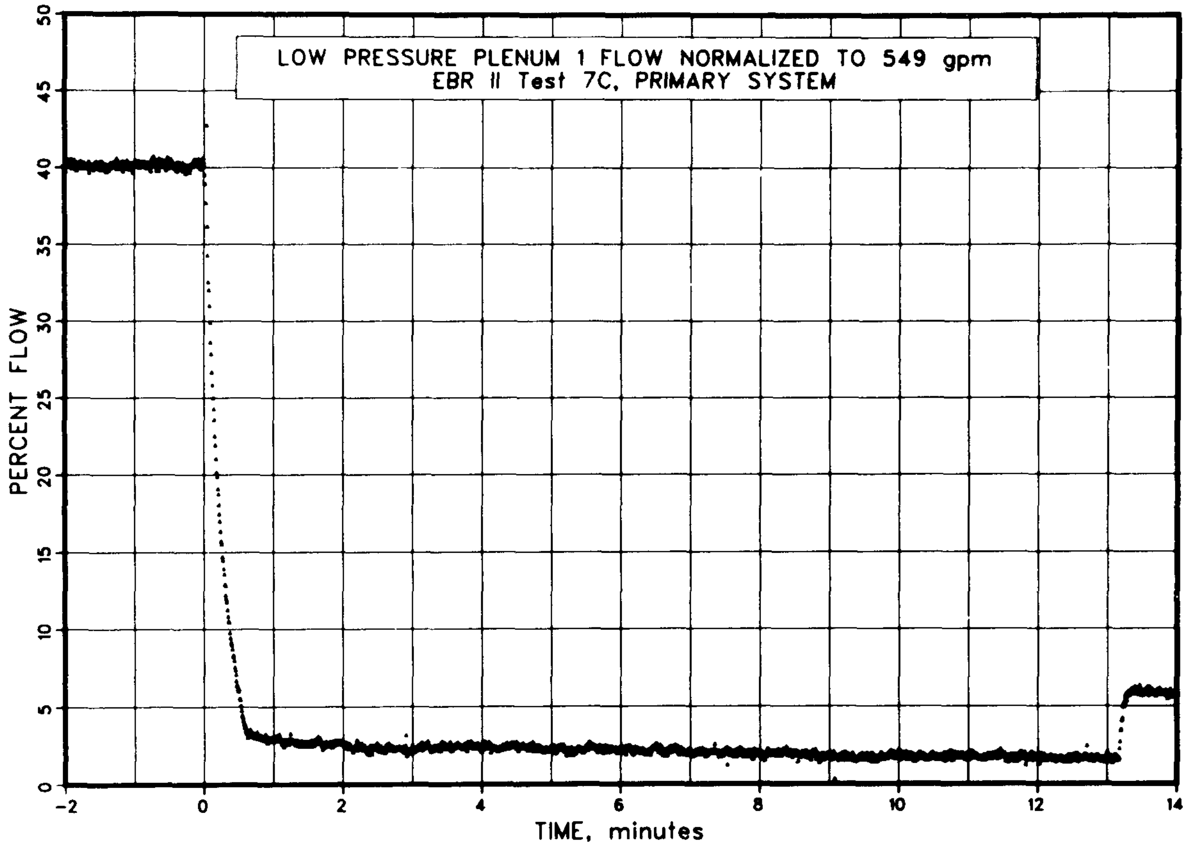

EXCESS REACTIVITY
EBR II Test 7C, PRIMARY SYSTEM
dollars
1
0
-1
-2
-3
-4
-5
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

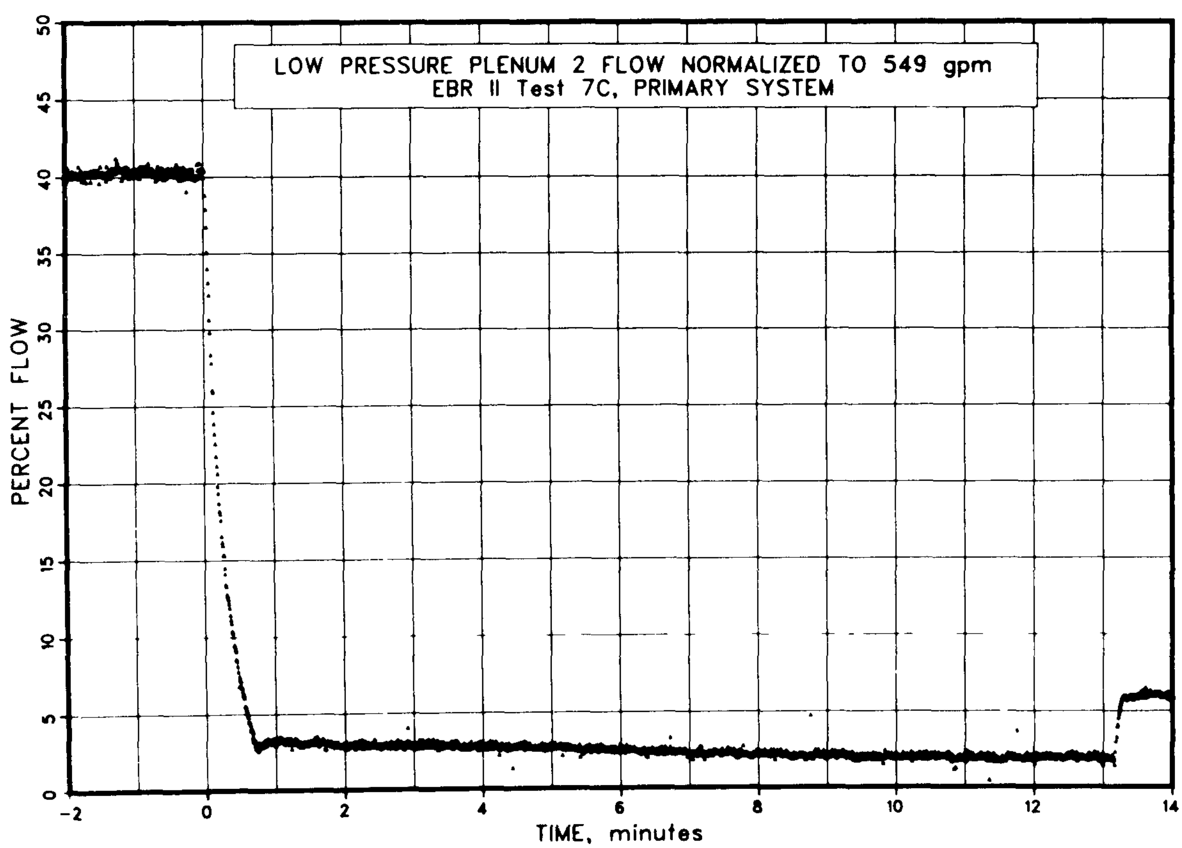

TOTAL REACTOR FLOW 541E NORMALIZED TO 8274 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, minutes

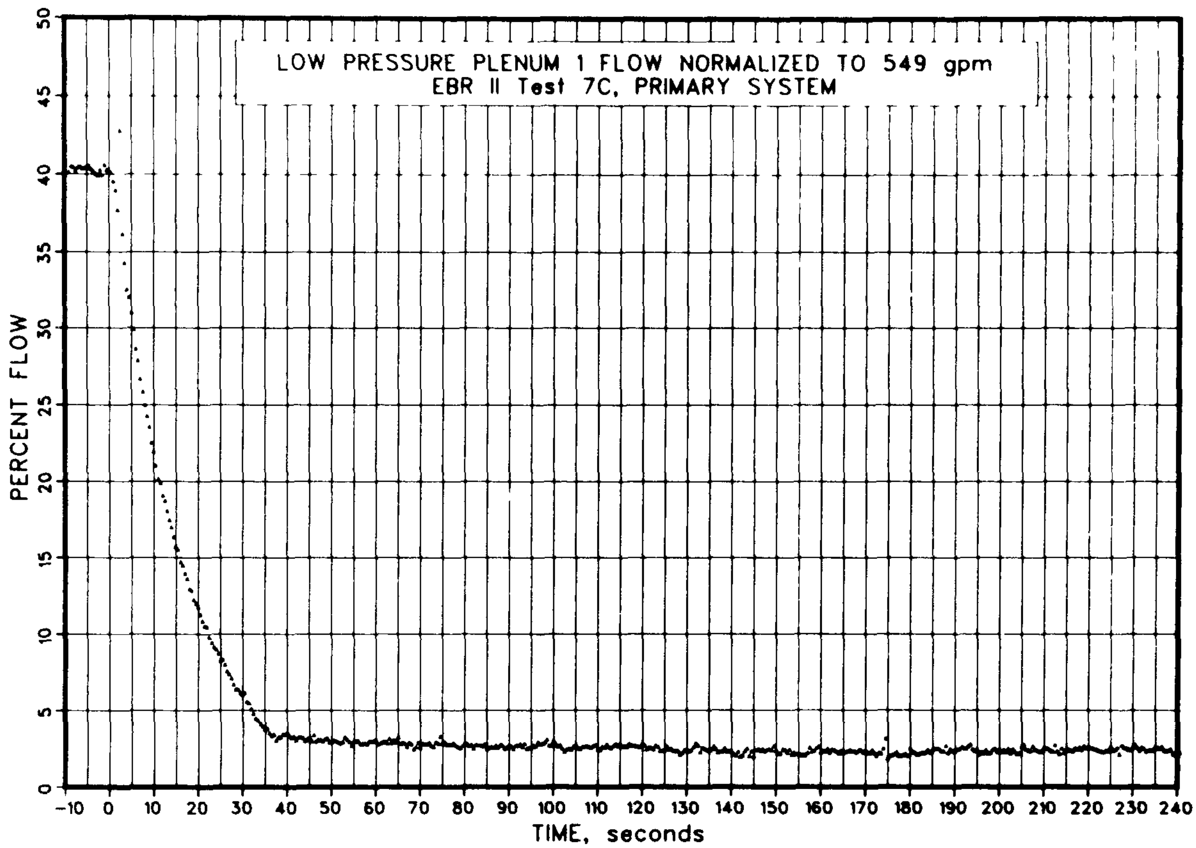

HIGH PRESSURE PLENUM 2 FLOW NORMALIZED TO 3588 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, minutes

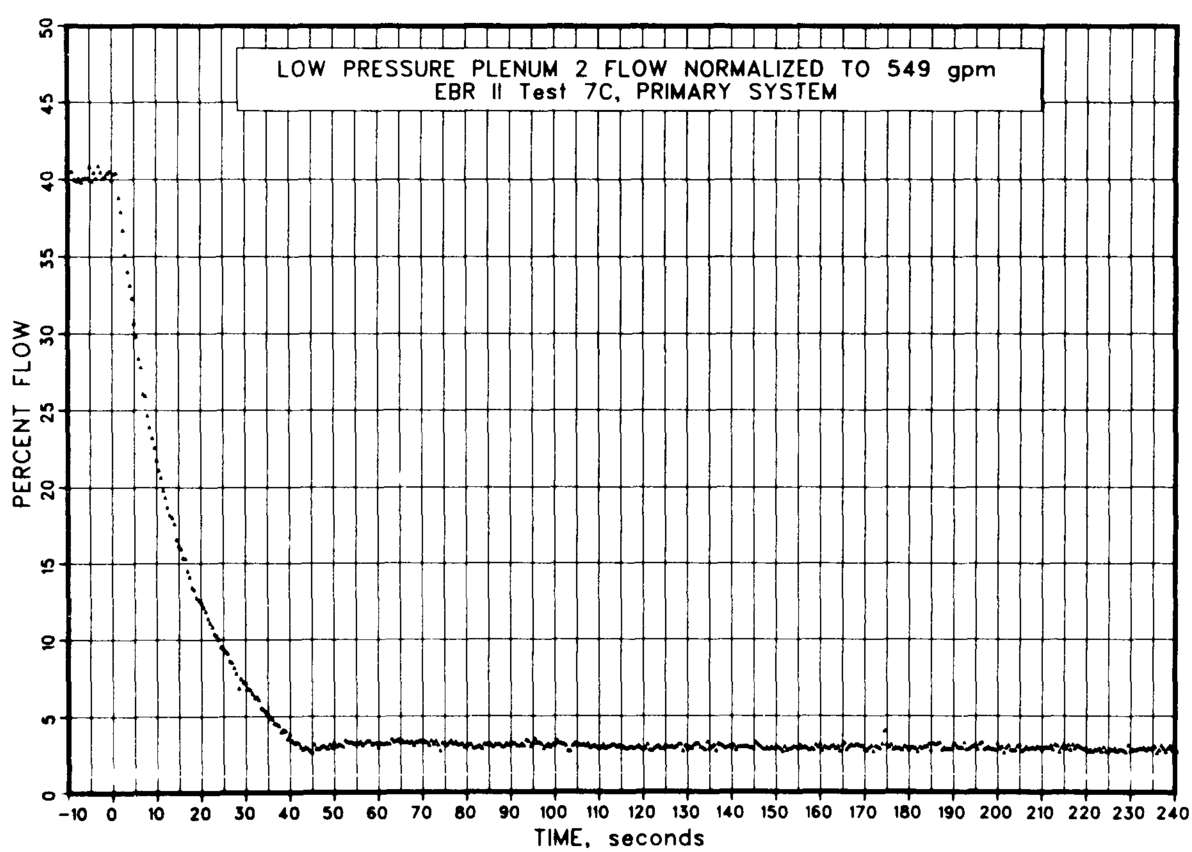

TOTAL REACTOR FLOW 541E NORMALIZED TO 8274 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, seconds

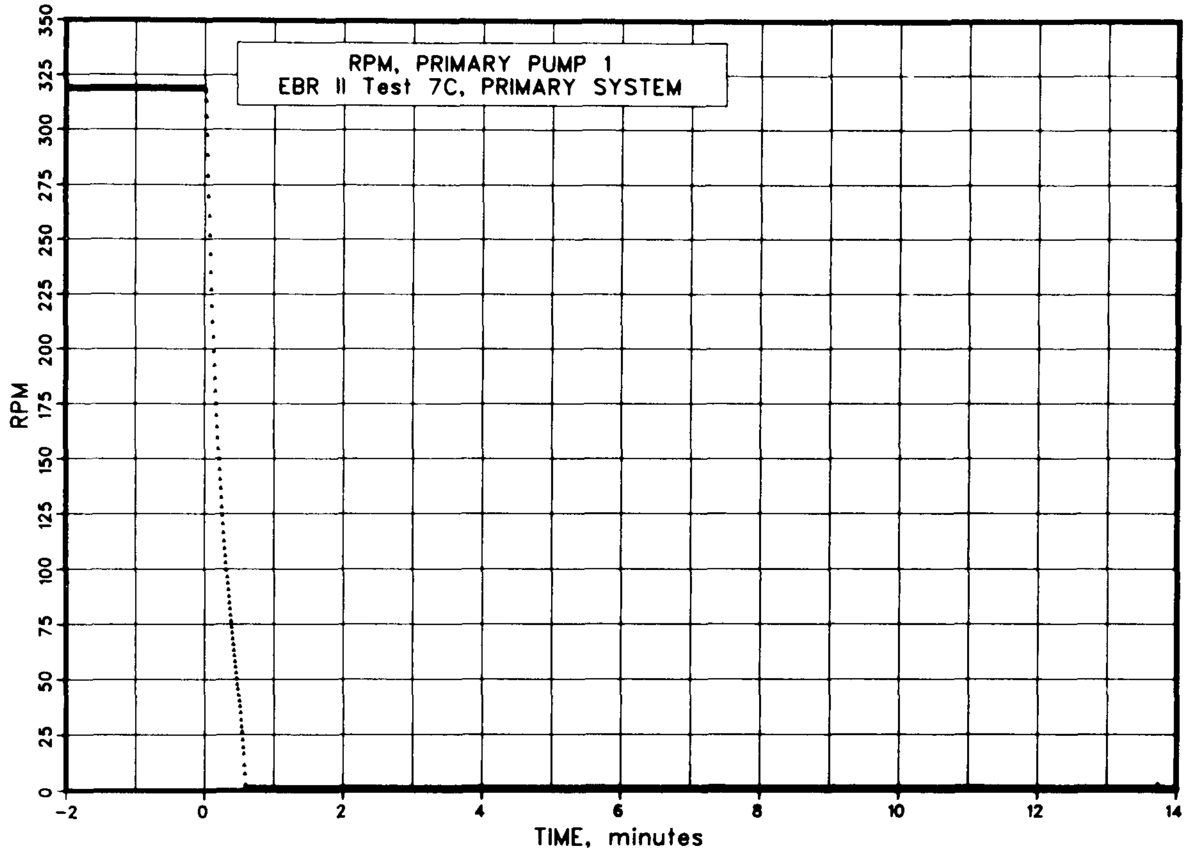

HIGH PRESSURE PLENUM 2 FLOW NORMALIZED TO 3588 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, seconds

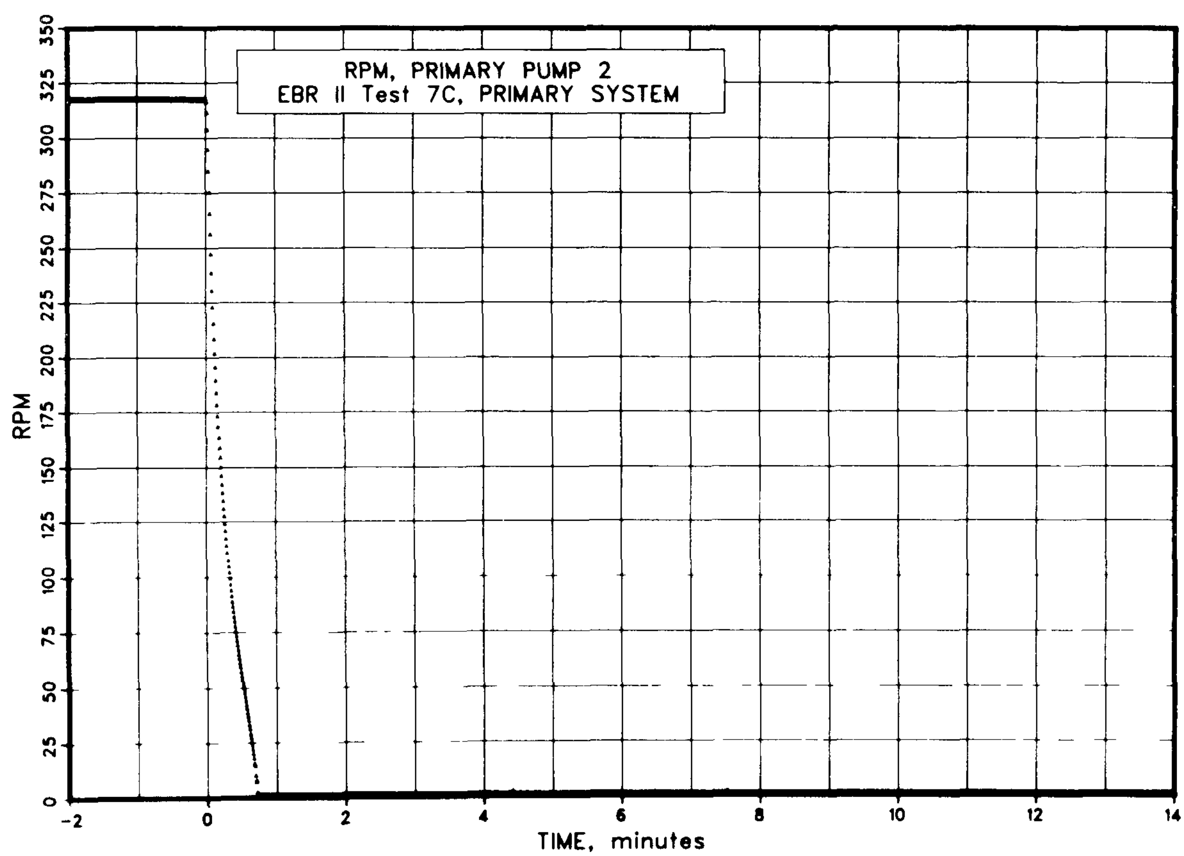

LOW PRESSURE PLENUM 1 FLOW NORMALIZED TO 549 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, minutes
0
5
10
15
20
25
30
35
40
45
50
-2
0
2
4
6
8
10
12
14

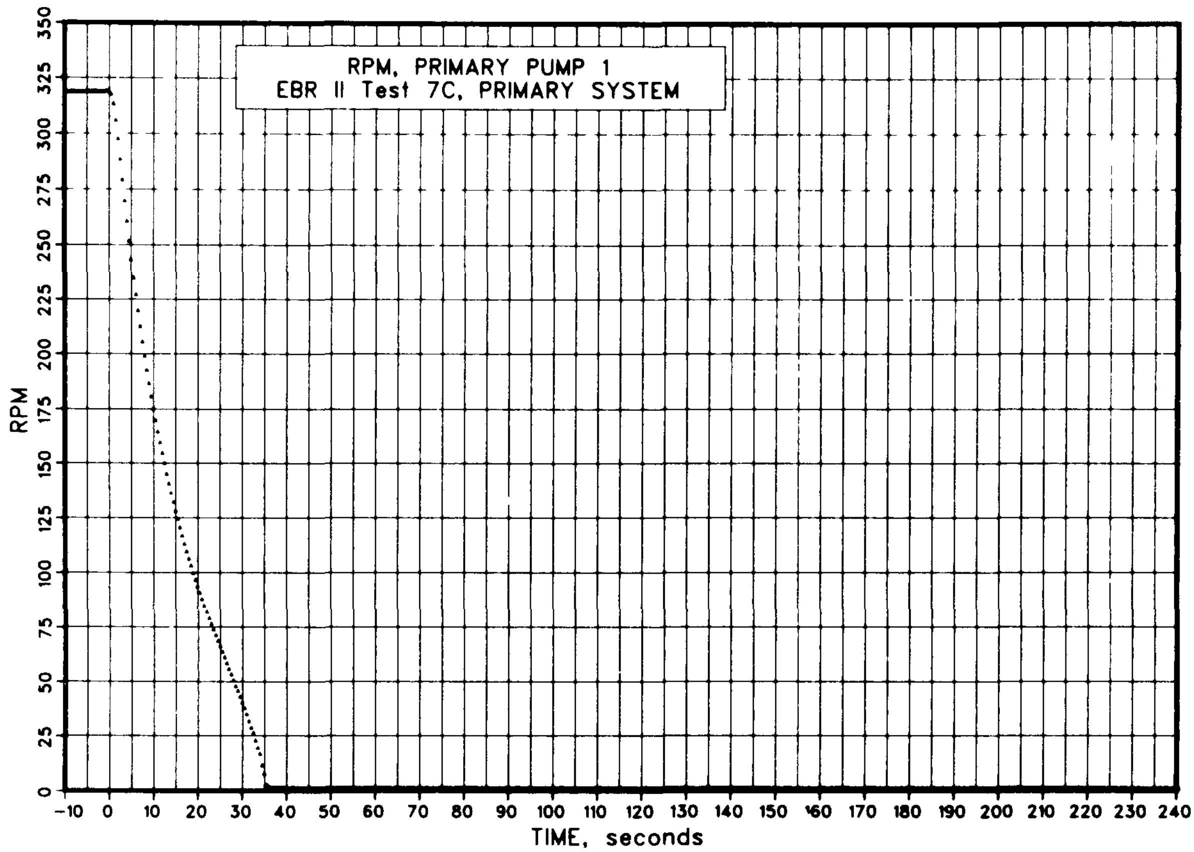

LOW PRESSURE PLENUM 2 FLOW NORMALIZED TO 549 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, minutes
0
5
10
15
20
25
30
35
40
45
50
-2
0
2
4
6
8
10
12
14

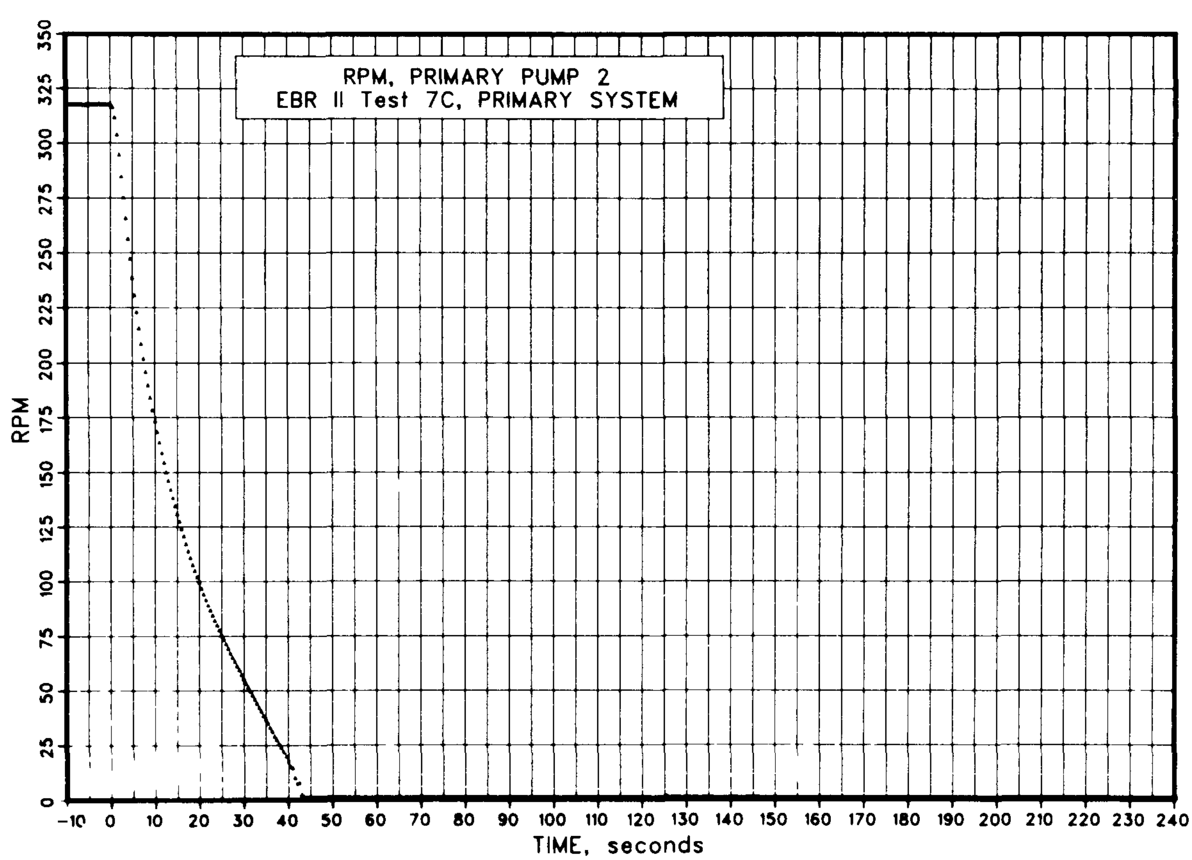

LOW PRESSURE PLENUM 1 FLOW NORMALIZED TO 549 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, seconds

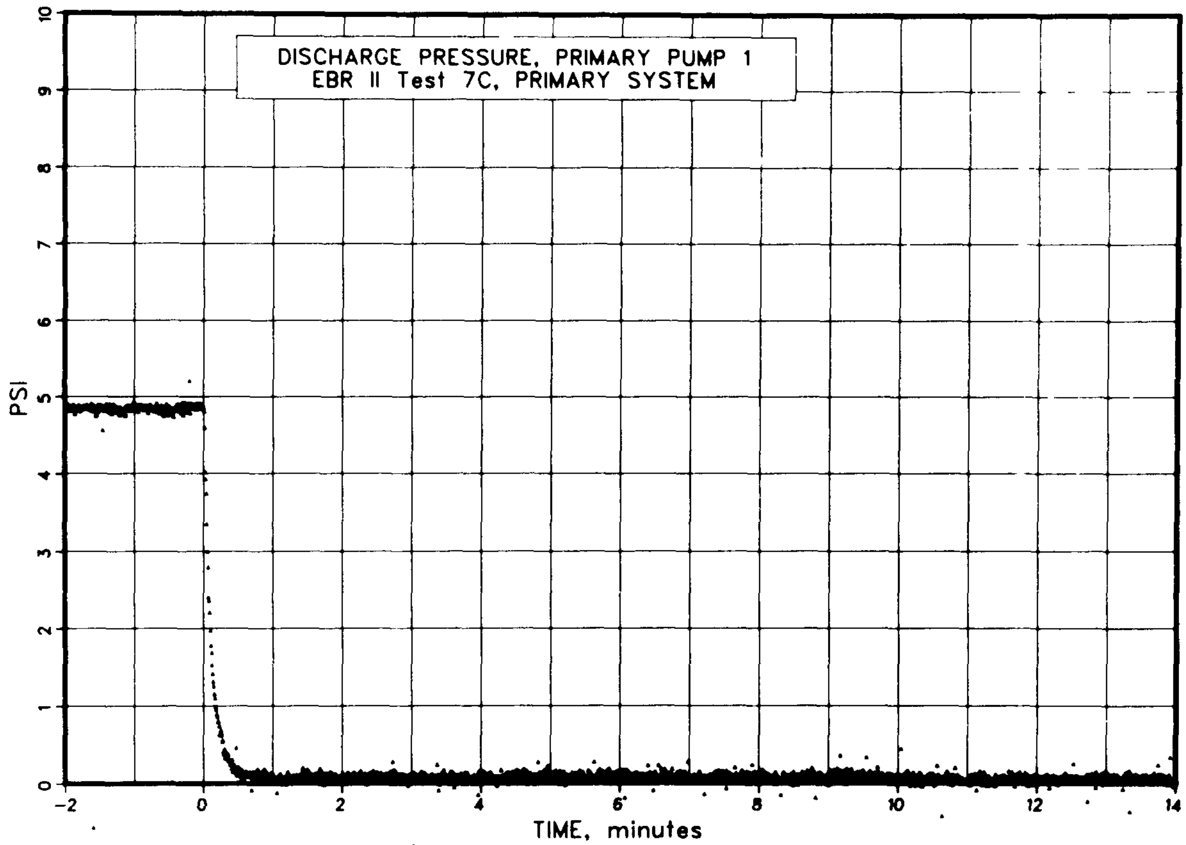

LOW PRESSURE PLENUM 2 FLOW NORMALIZED TO 549 gpm
EBR II Test 7C, PRIMARY SYSTEM
PERCENT FLOW
TIME, seconds

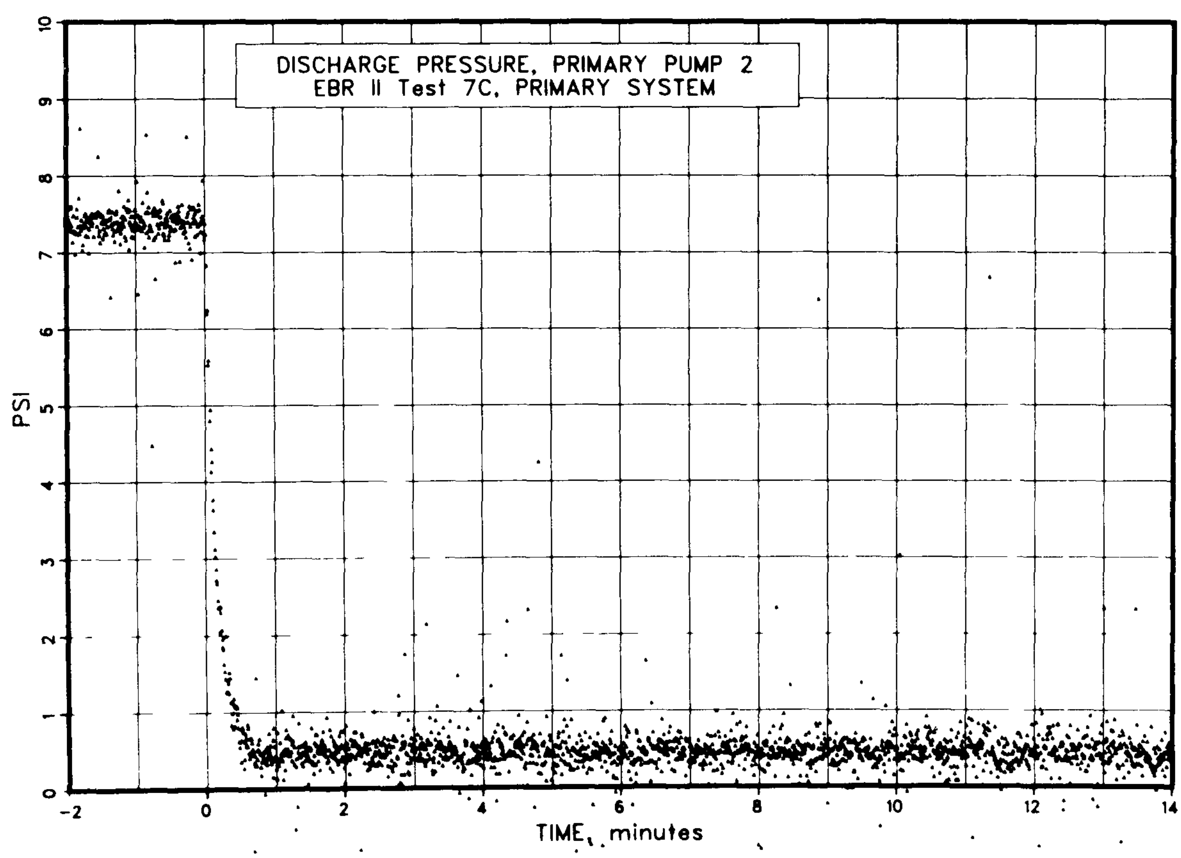

RPM, PRIMARY PUMP 1
EBR II Test 7C, PRIMARY SYSTEM
RPM
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
-2
0
2
4
6
8
10
12
14
TIME, minutes

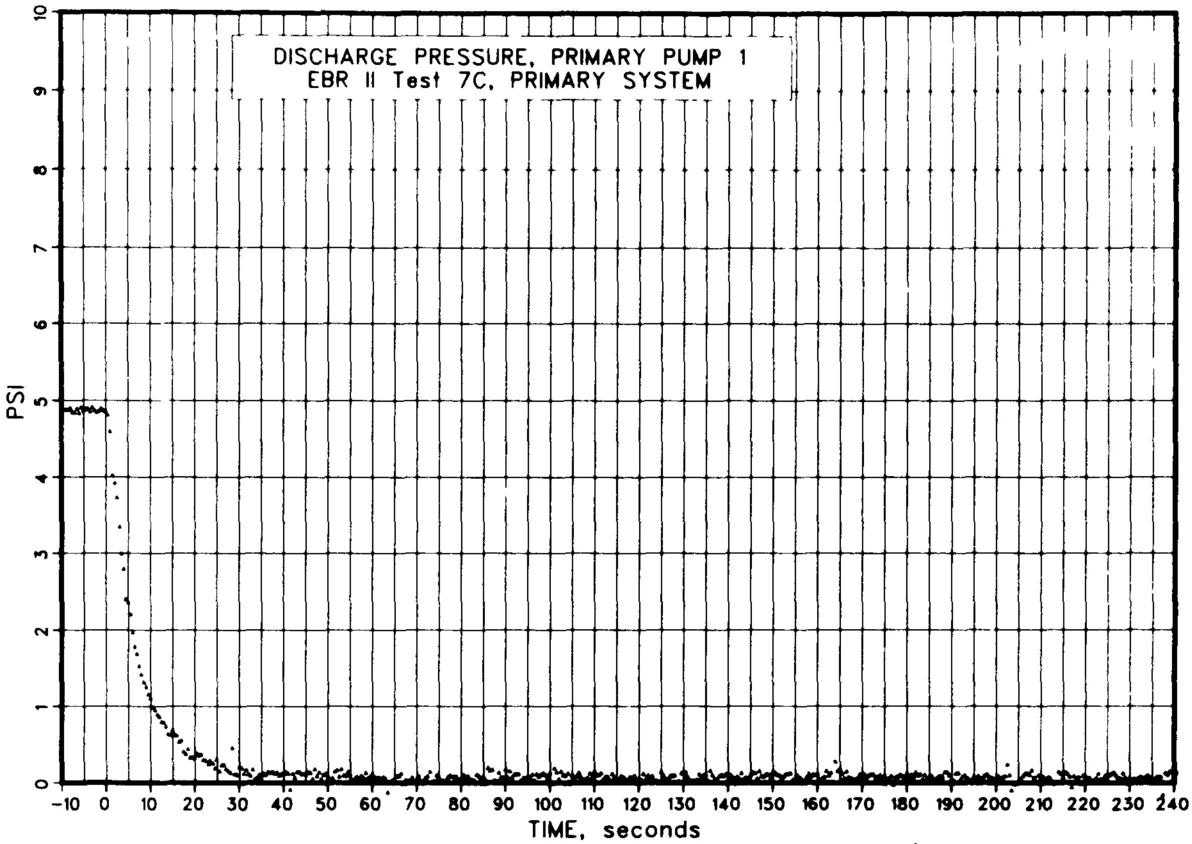

RPM, PRIMARY PUMP 2
EBR II Test 7C, PRIMARY SYSTEM
RPM
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
-2
0
2
4
6
8
10
12
14
TIME, minutes

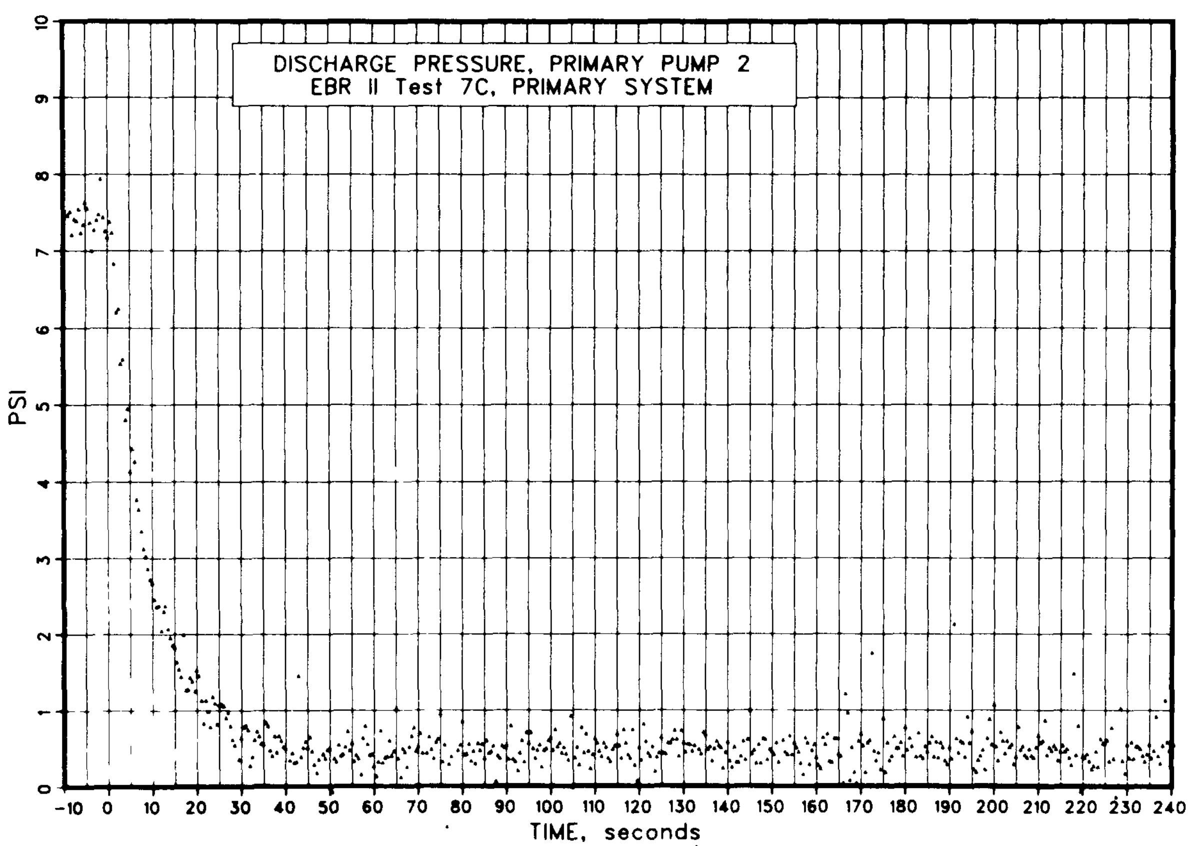

RPM, PRIMARY PUMP 1
EBR II Test 7C, PRIMARY SYSTEM
RPM
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

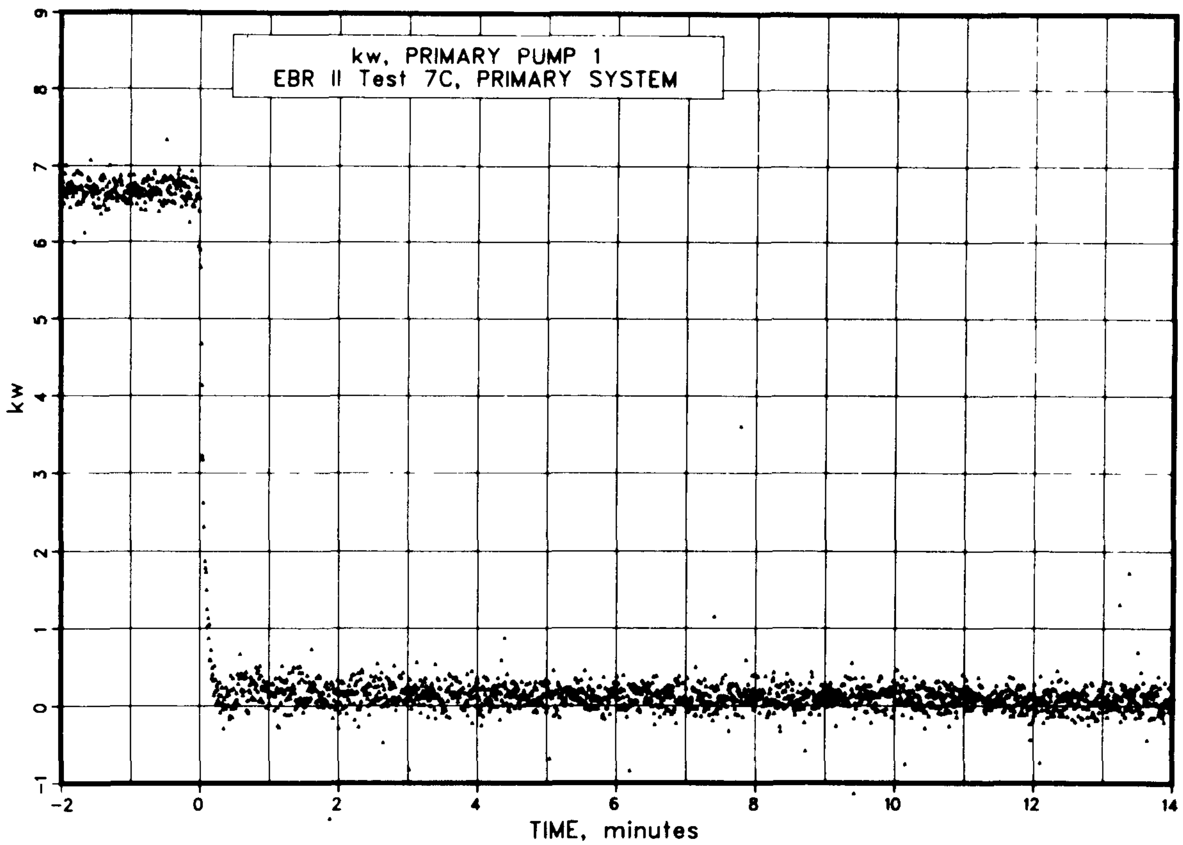

RPM, PRIMARY PUMP 2
EBR II Test 7C, PRIMARY SYSTEM
RPM
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

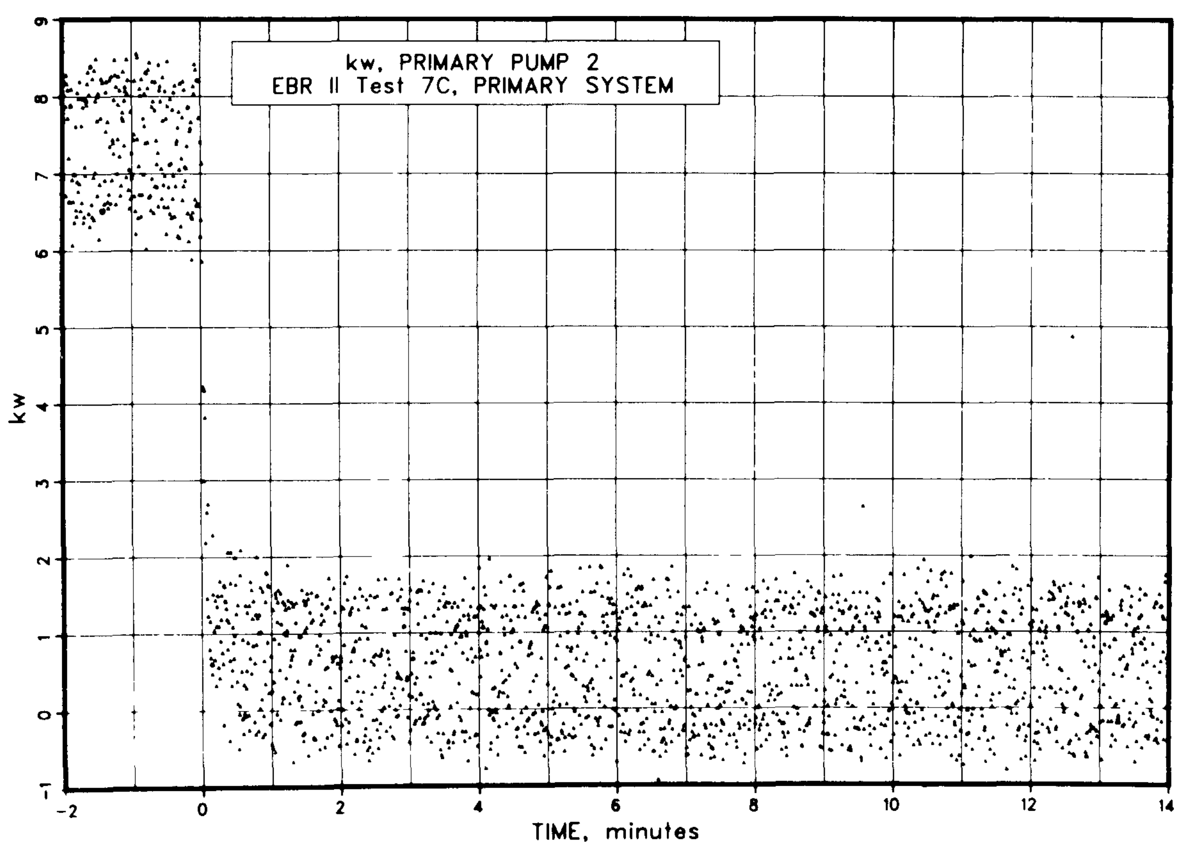

DISCHARGE PRESSURE, PRIMARY PUMP 1
EBR II Test 7C, PRIMARY SYSTEM
PSI
TIME, minutes

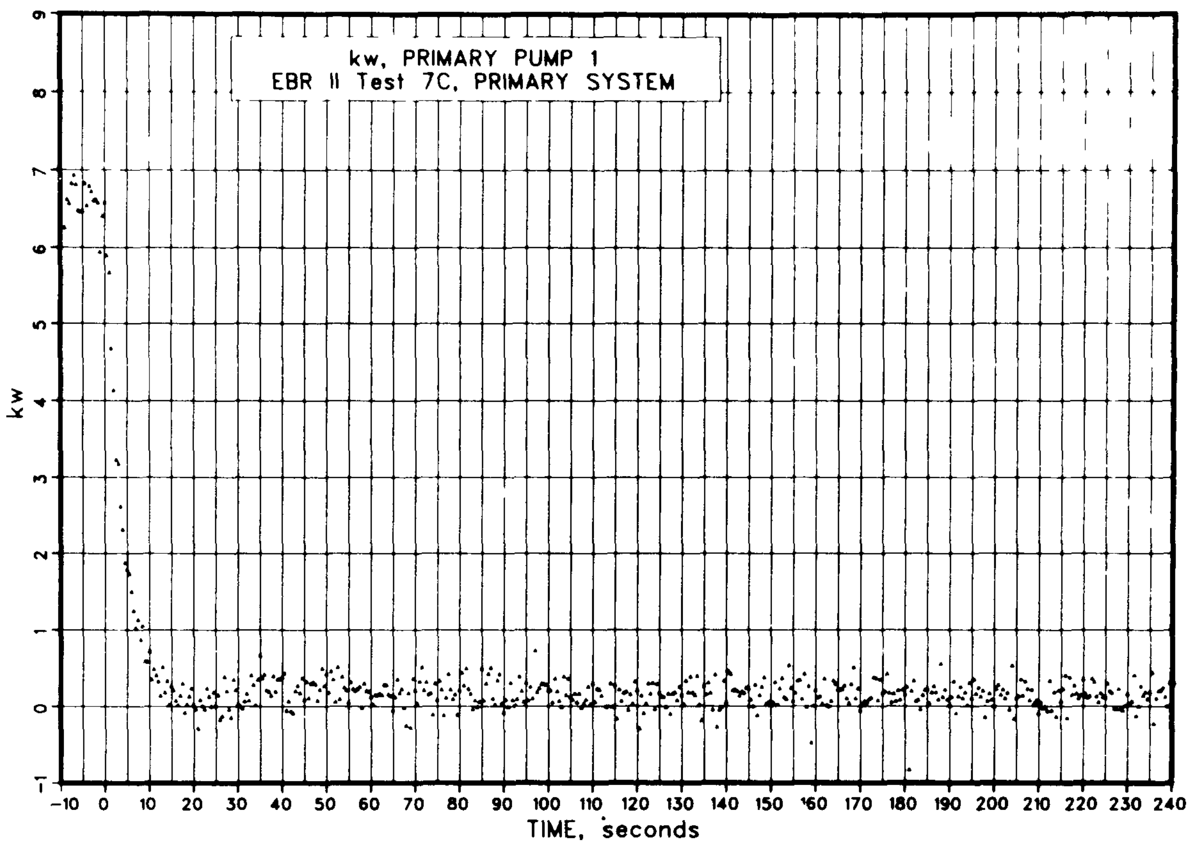

DISCHARGE PRESSURE, PRIMARY PUMP 2
EBR II Test 7C, PRIMARY SYSTEM
PSI
TIME, minutes

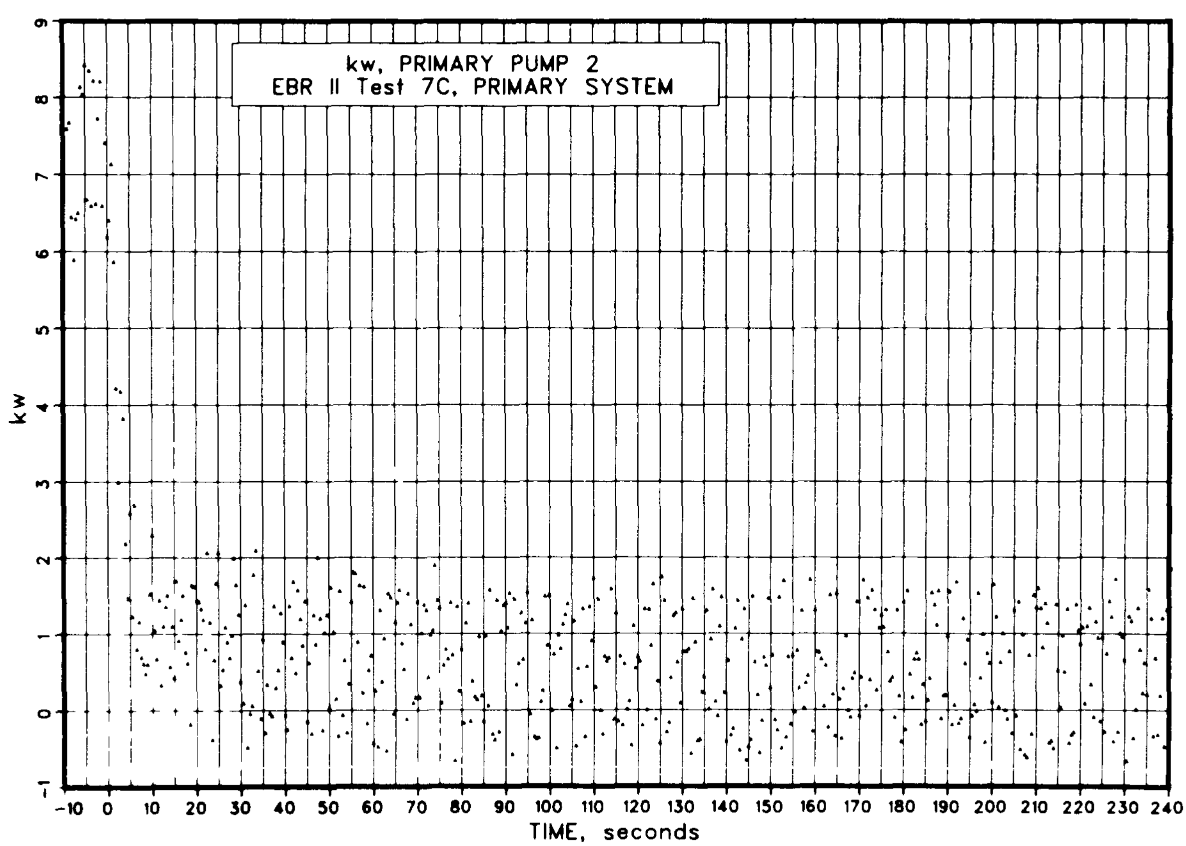

DISCHARGE PRESSURE, PRIMARY PUMP 1
EBR II Test 7C, PRIMARY SYSTEM
PSI
TIME, seconds

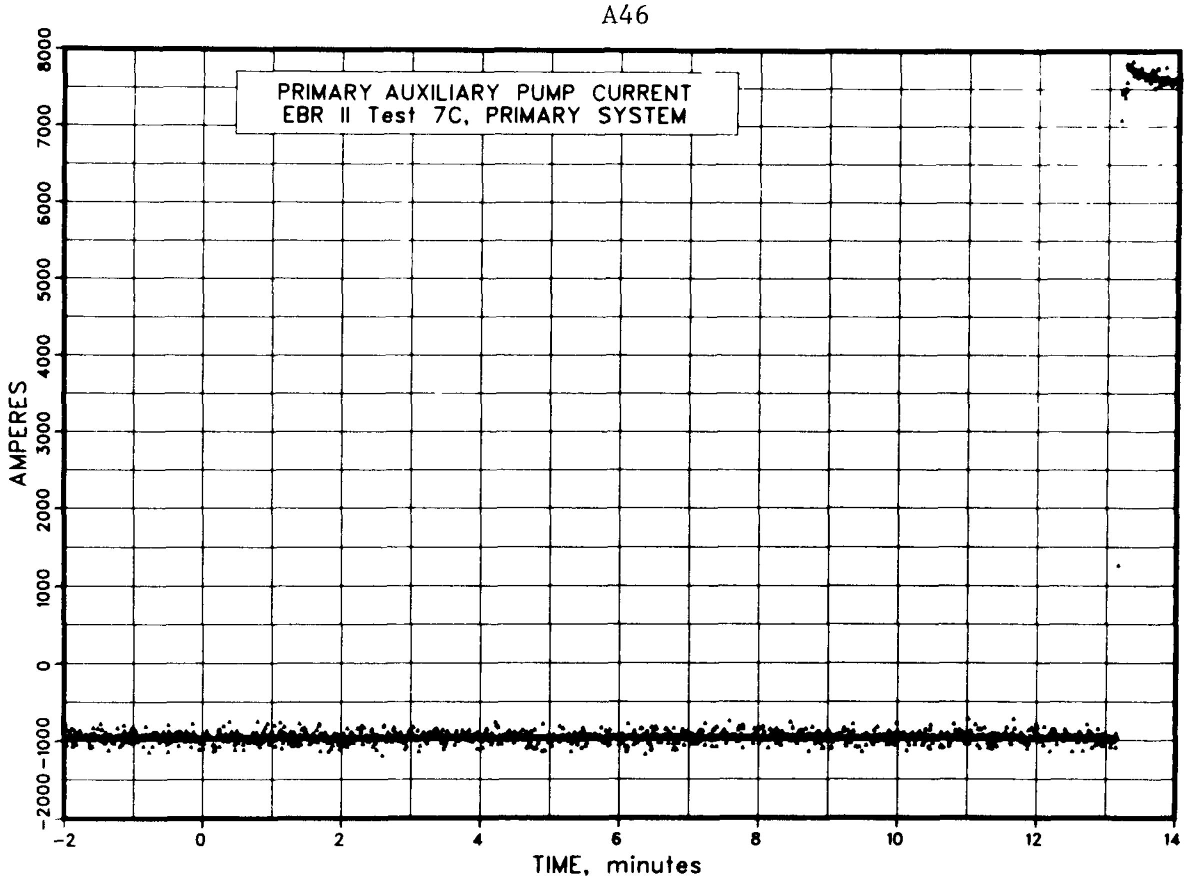

DISCHARGE PRESSURE, PRIMARY PUMP 2
EBR II Test 7C, PRIMARY SYSTEM
PSI
TIME, seconds

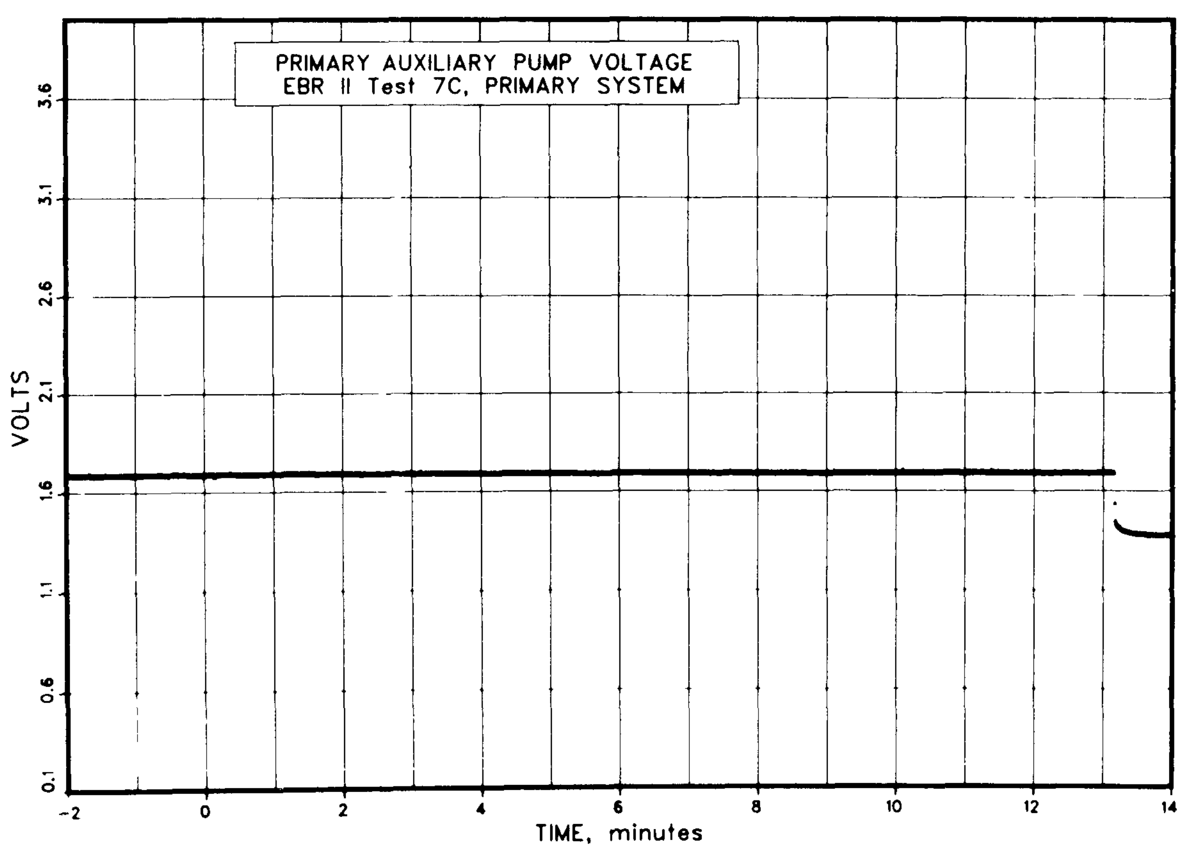

kw, PRIMARY PUMP 1
EBR II Test 7C, PRIMARY SYSTEM
kw
TIME, minutes
-1
0
1
2
3
4
5
6
7
8
9
-2
0
2
4
6
8
10
12
14

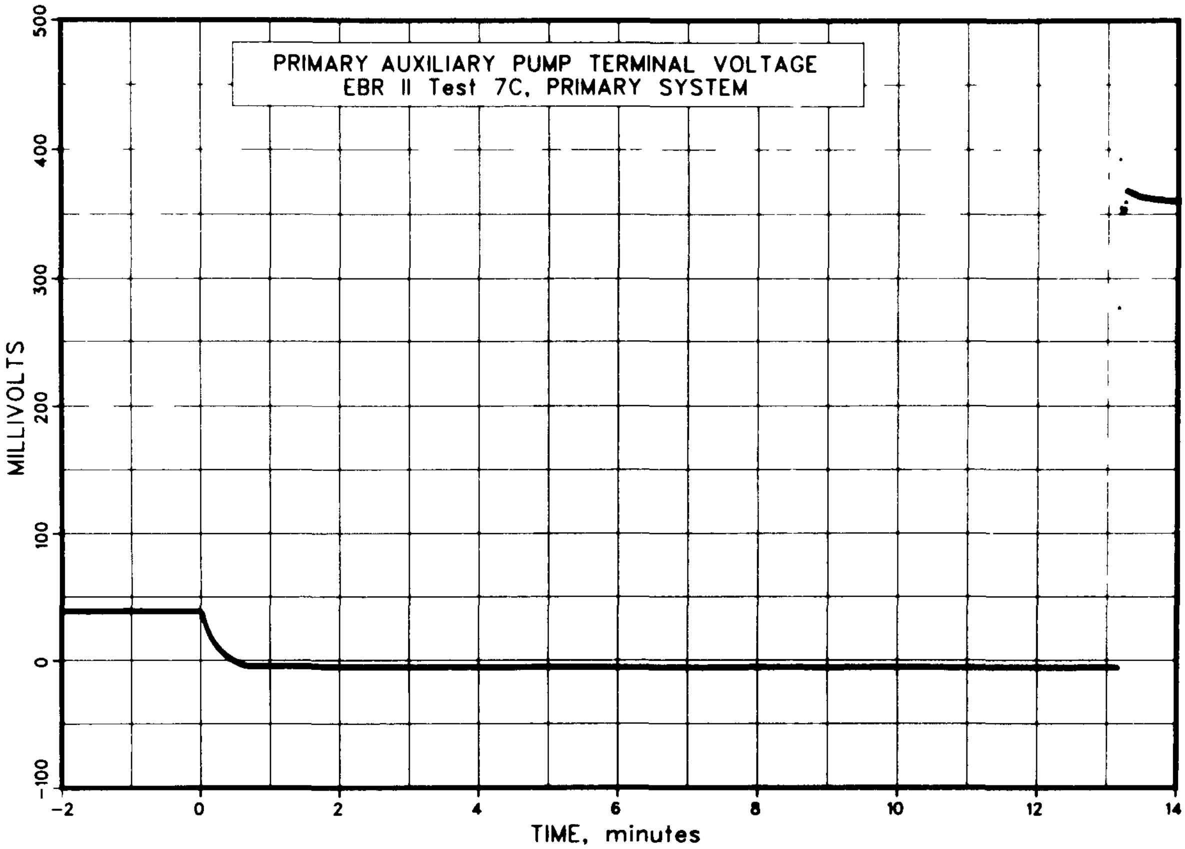

kw, PRIMARY PUMP 2
EBR II Test 7C, PRIMARY SYSTEM
kw
TIME, minutes
-1
0
1
2
3
4
5
6
7
8
9
-2
0
2
4
6
8
10
12
14


kw, PRIMARY PUMP 1
EBR II Test 7C, PRIMARY SYSTEM
kw
TIME, seconds

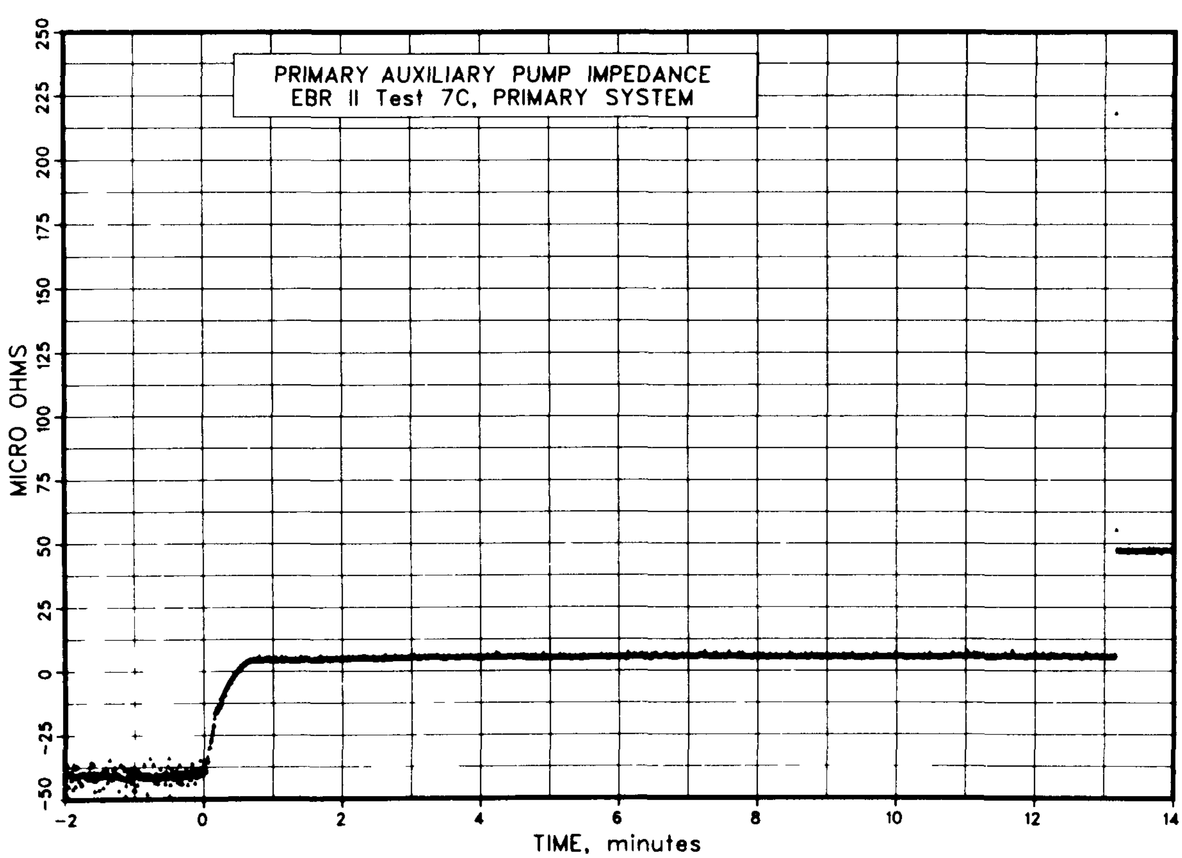

kw, PRIMARY PUMP 2
EBR II Test 7C, PRIMARY SYSTEM
kw
TIME, seconds


PRIMARY AUXILIARY PUMP CURRENT
EBR II Test 7C, PRIMARY SYSTEM
AMPERES
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2000
-2
0
2
4
6
8
10
12
14
TIME, minutes

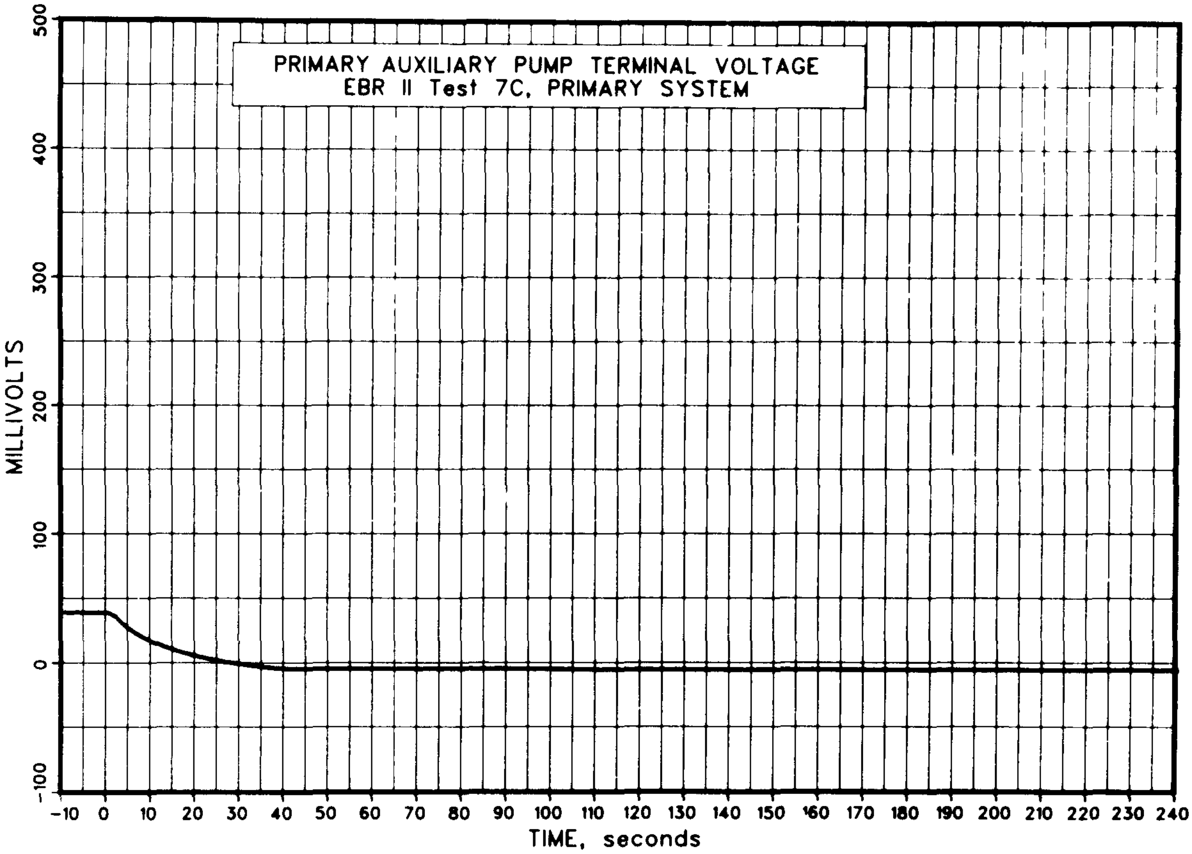

PRIMARY AUXILIARY PUMP VOLTAGE
EBR II Test 7C, PRIMARY SYSTEM
VOLTS
3.6
3.1
2.6
2.1
1.6
1.1
0.6
0.1
-2
0
2
4
6
8
10
12
14
TIME, minutes

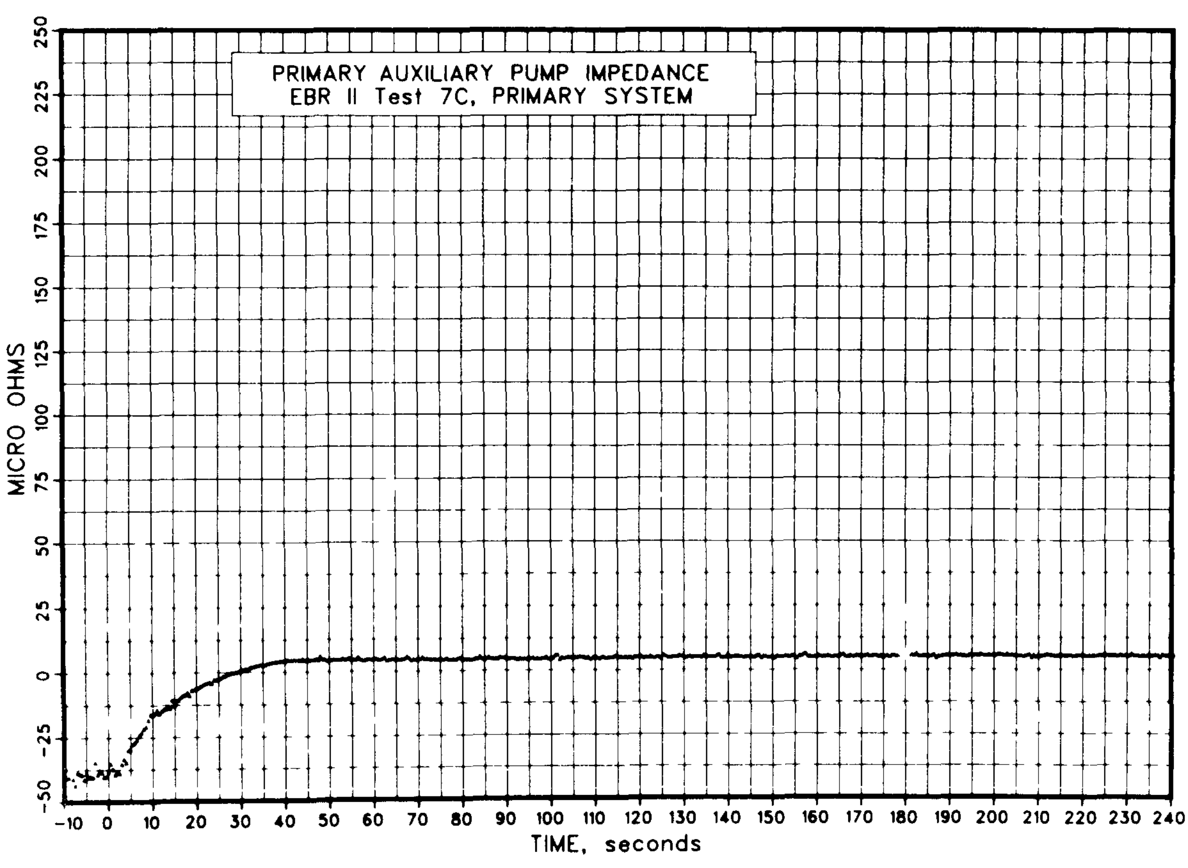


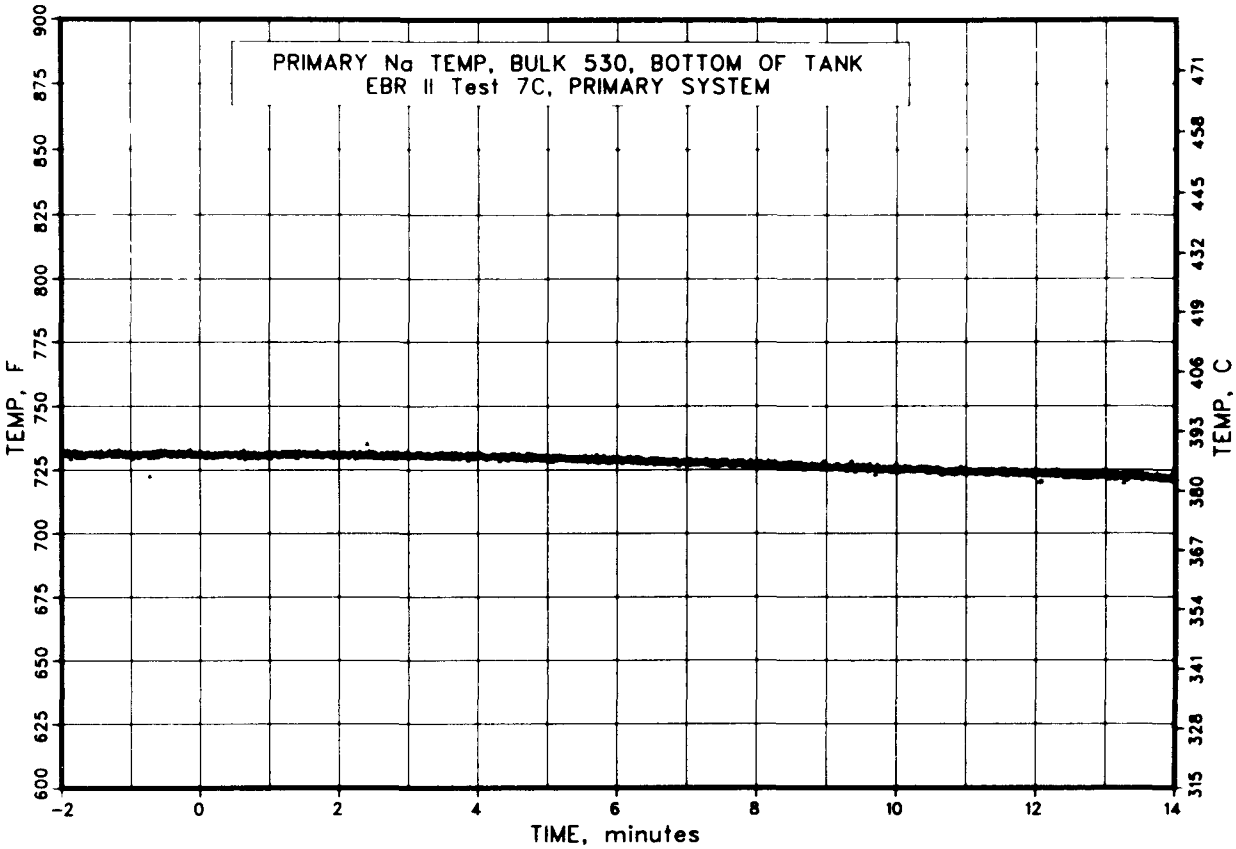
PRIMARY AUXILIARY PUMP TERMINAL VOLTAGE
EBR II Test 7C, PRIMARY SYSTEM
MILLIVOLTS
500
400
300
200
100
0
-100
-2
0
2
4
6
8
10
12
14
TIME, minutes

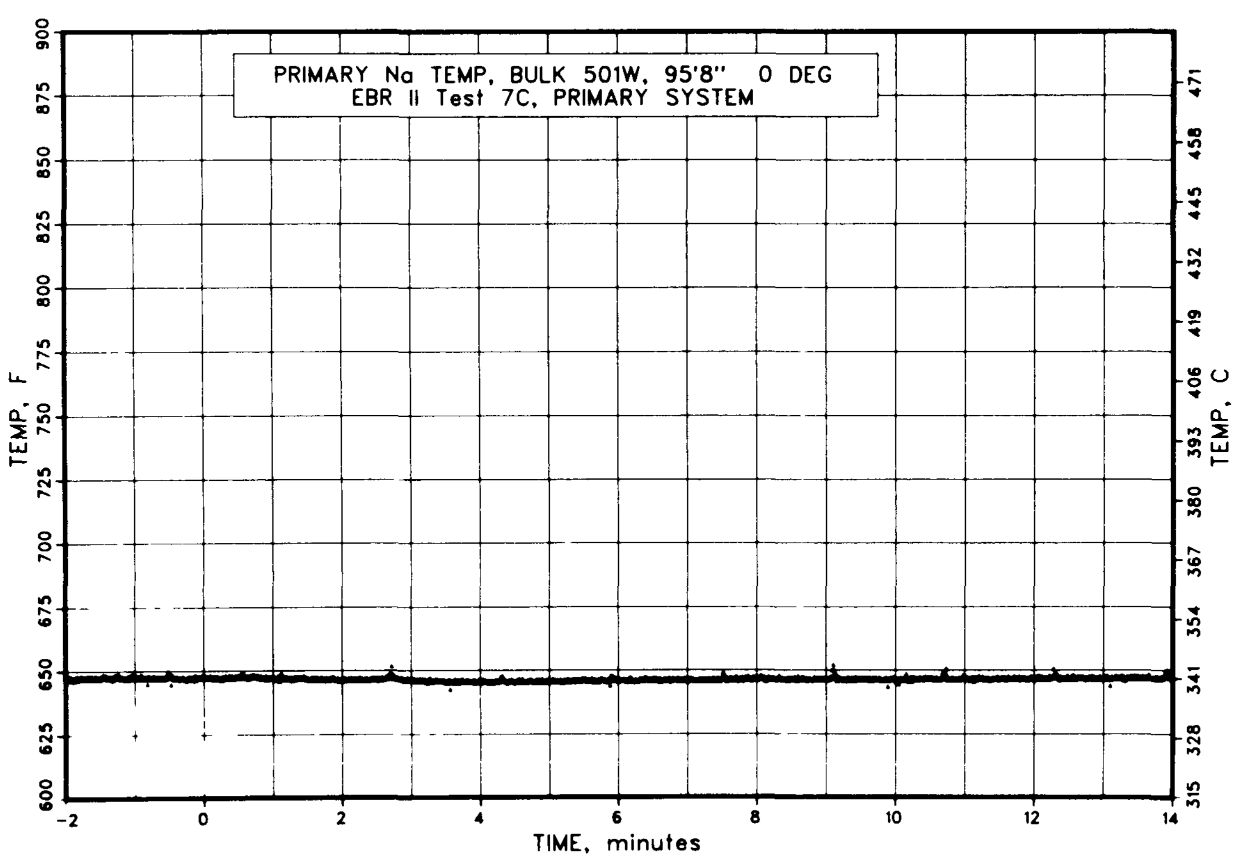


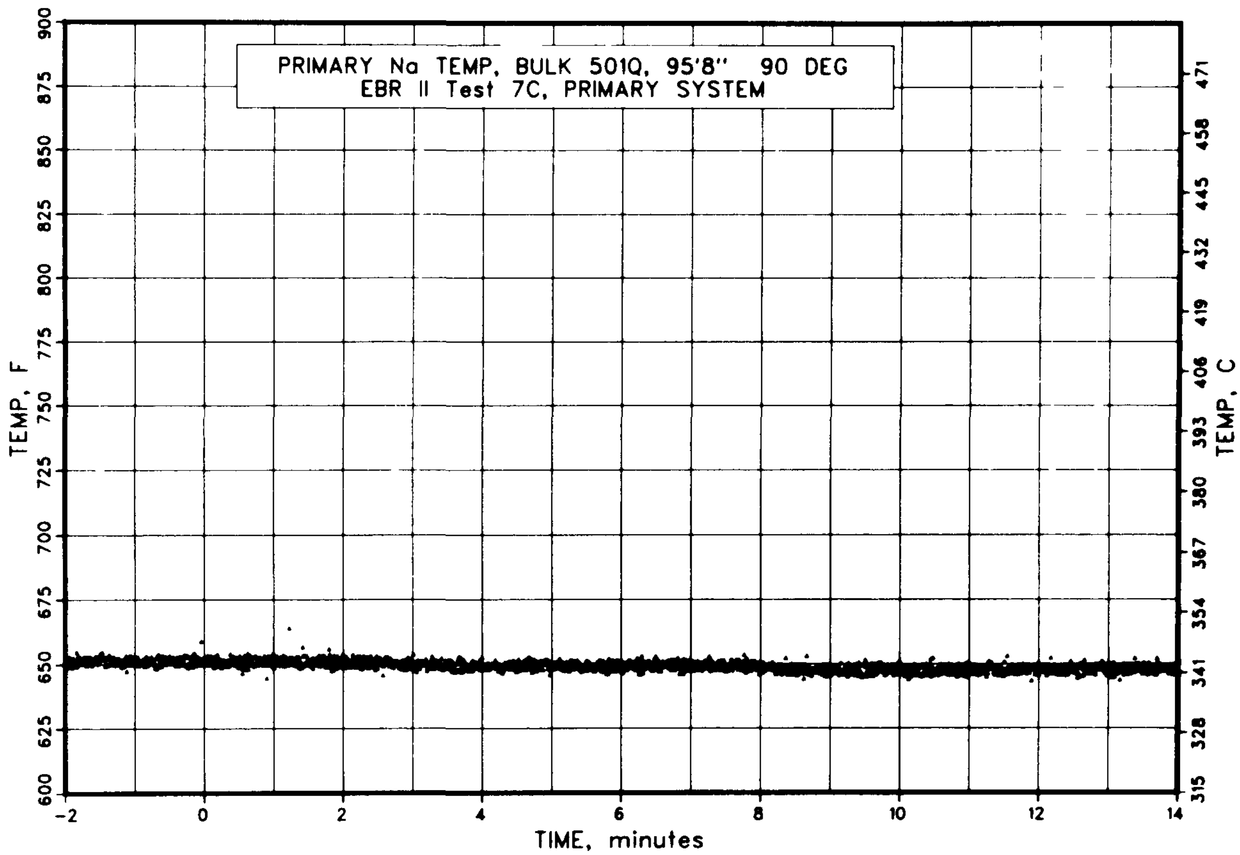
PRIMARY AUXILIARY PUMP IMPEDANCE
EBR II Test 7C, PRIMARY SYSTEM
MICRO OHMS
250
225
200
175
150
125
100
75
50
25
0
-25
-50
-2
0
2
4
6
8
10
12
14
TIME, minutes

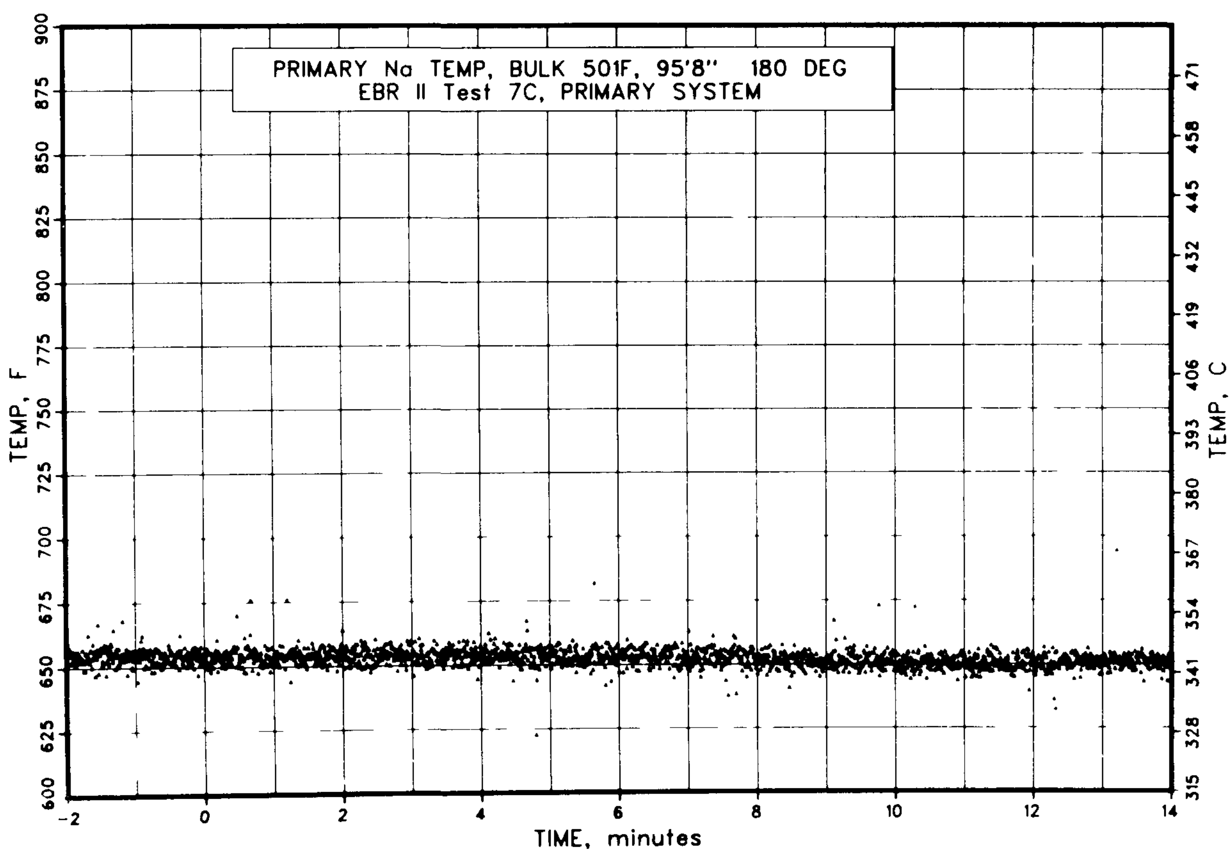

PRIMARY AUXILIARY PUMP TERMINAL VOLTAGE
EBR II Test 7C, PRIMARY SYSTEM
MILLIVOLTS
500
400
300
200
100
0
-100
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

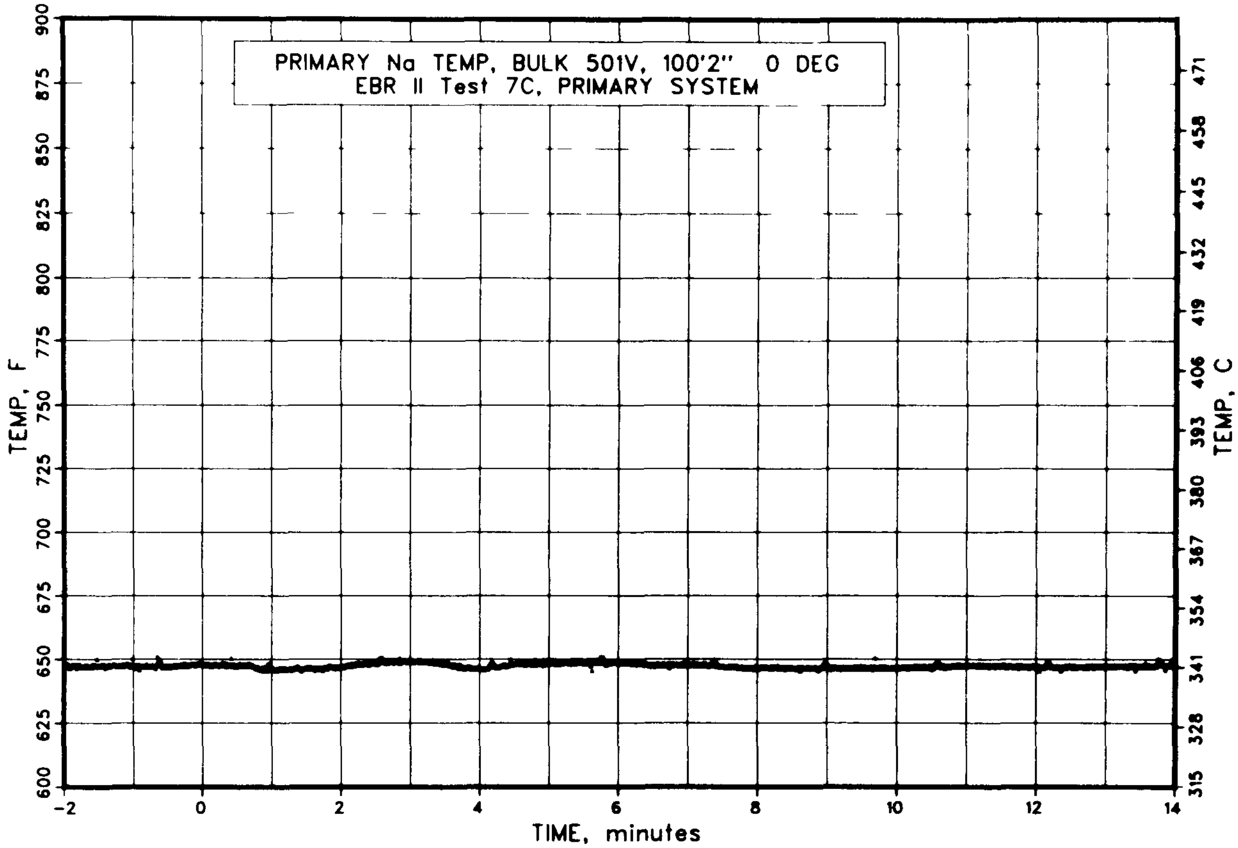

PRIMARY AUXILIARY PUMP IMPEDANCE
EBR II Test 7C, PRIMARY SYSTEM
MICRO OHMS
250
225
200
175
150
125
100
75
50
25
0
-25
-50
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

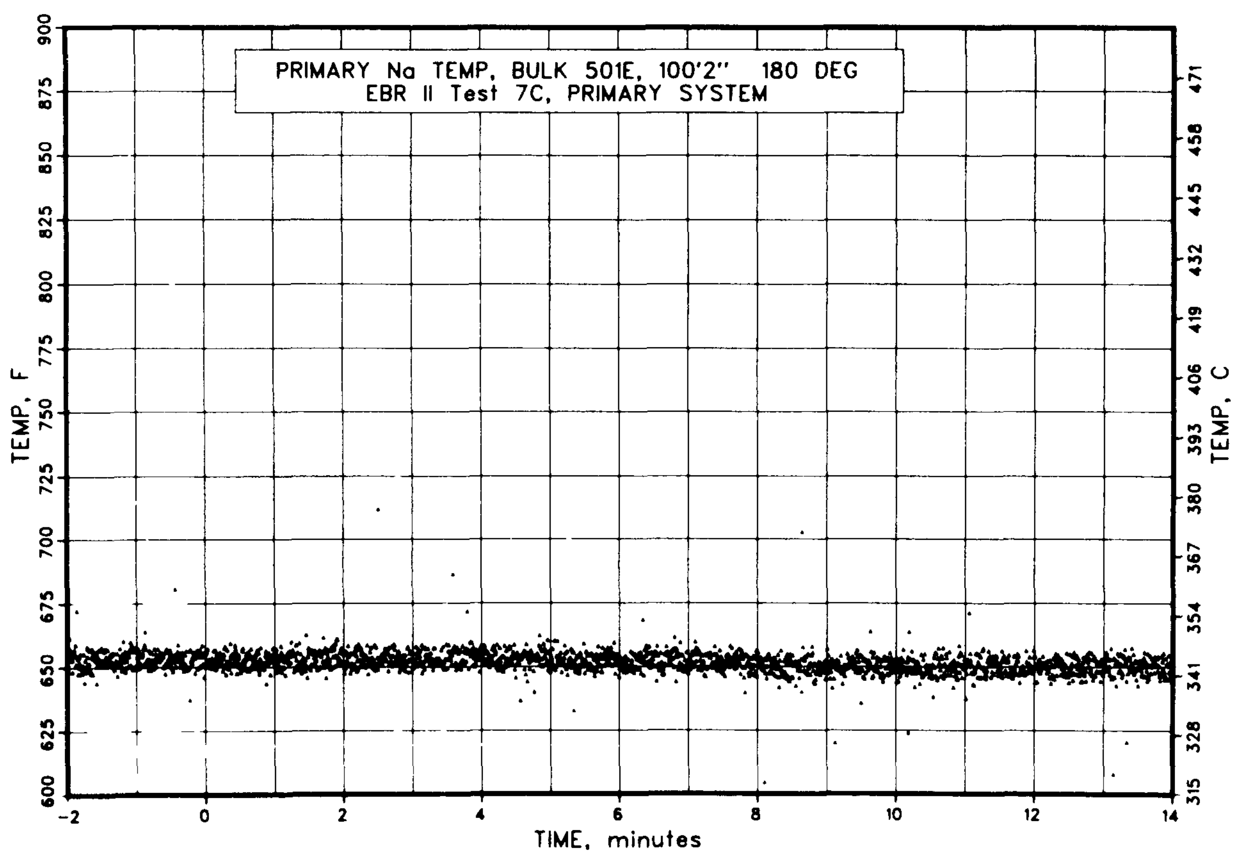

PRIMARY Na TEMP, BULK 530, BOTTOM OF TANK
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

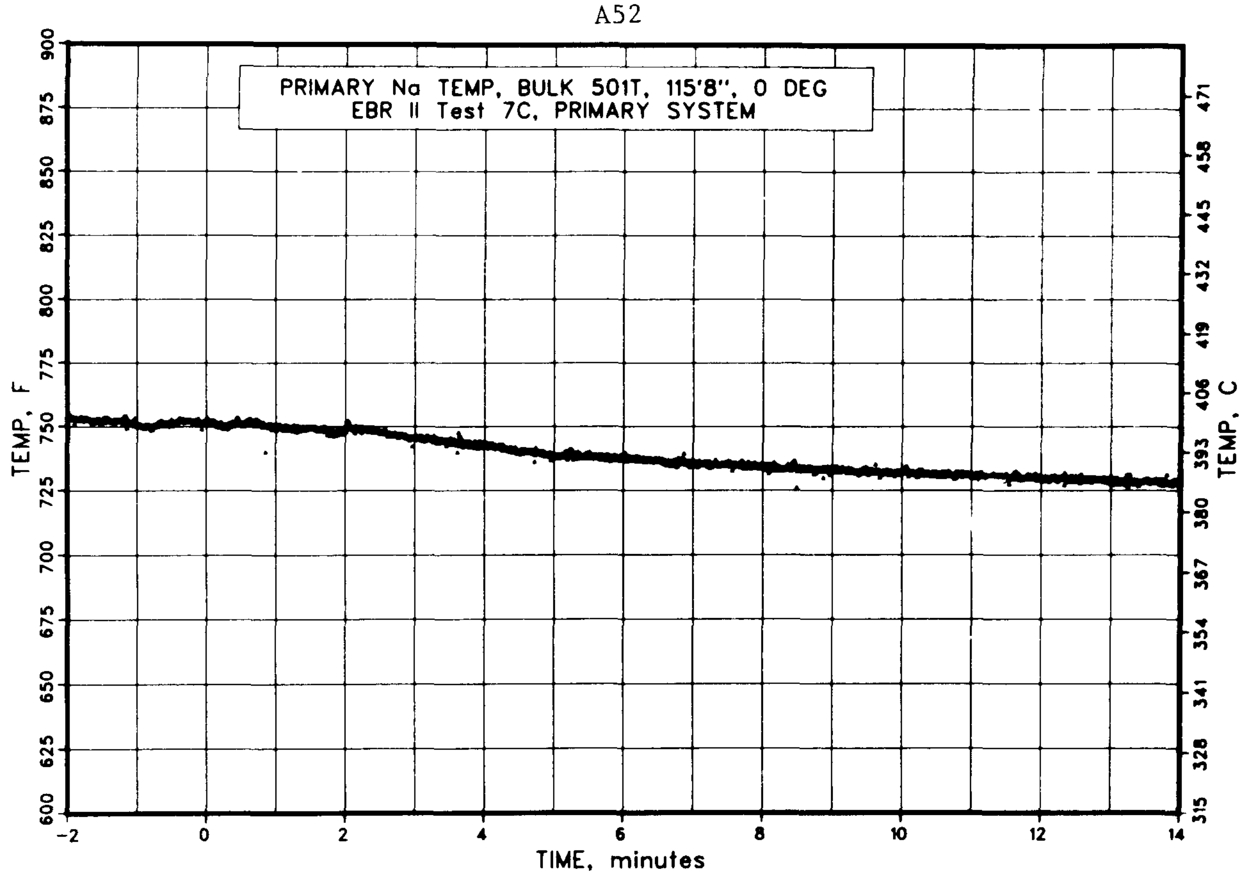

PRIMARY Na TEMP, BULK 501W, 95'8" 0 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

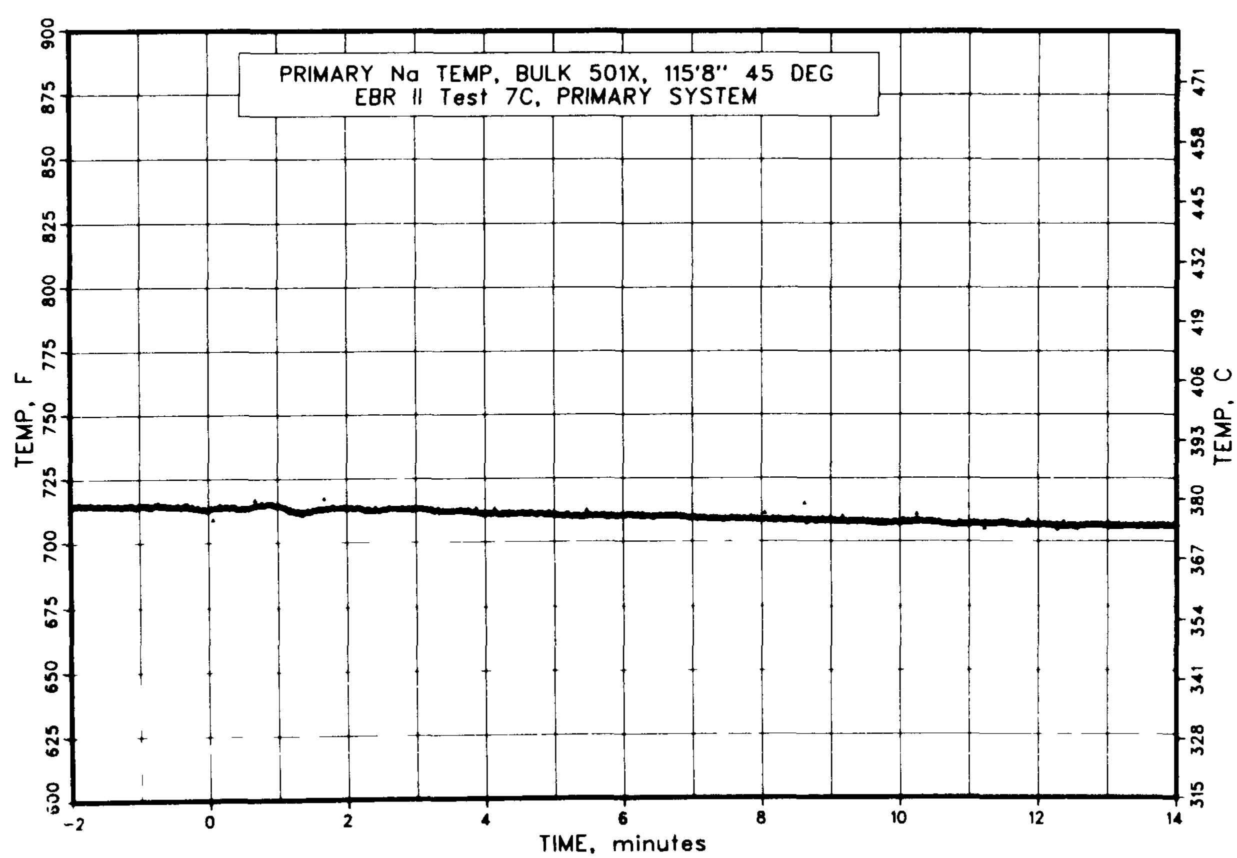

PRIMARY Na TEMP, BULK 501Q, 95'8" 90 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

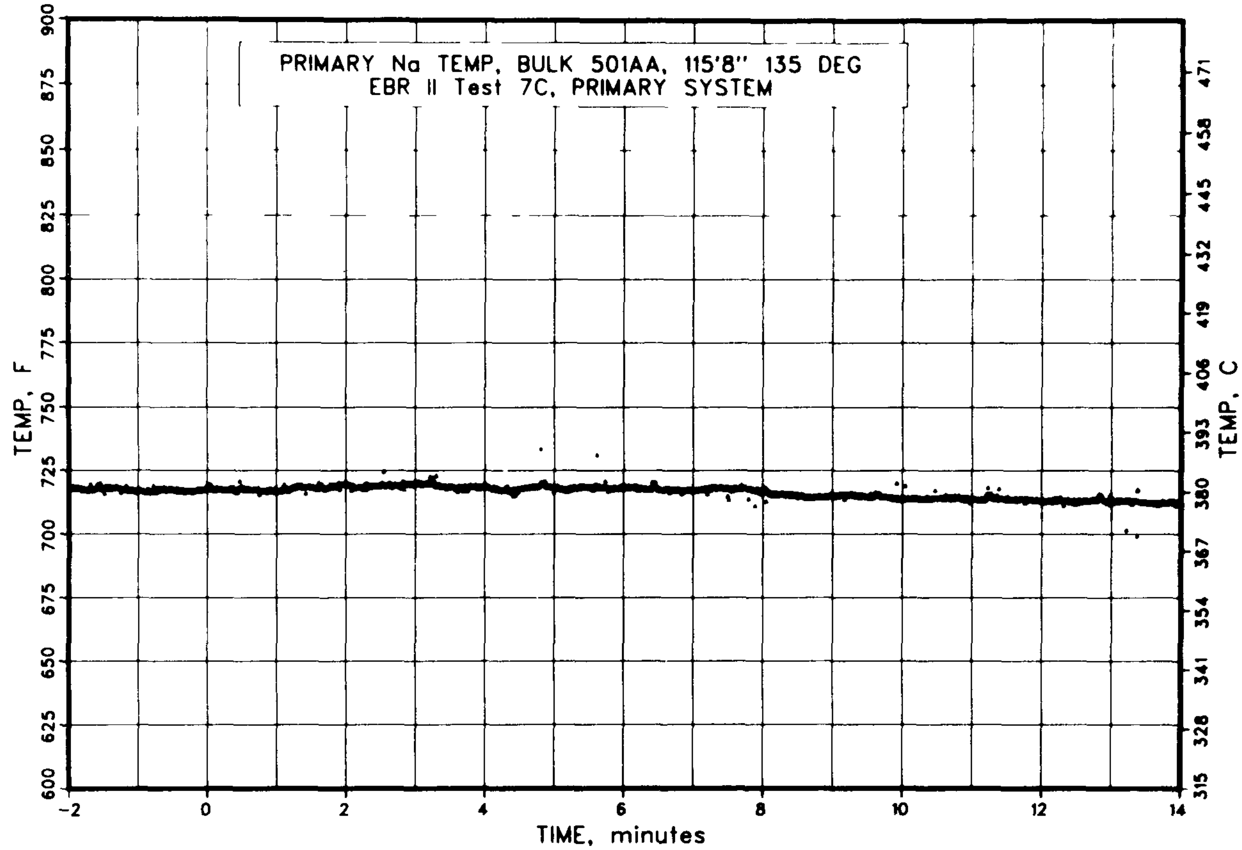

PRIMARY Na TEMP, BULK 501F, 95'8" 180 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

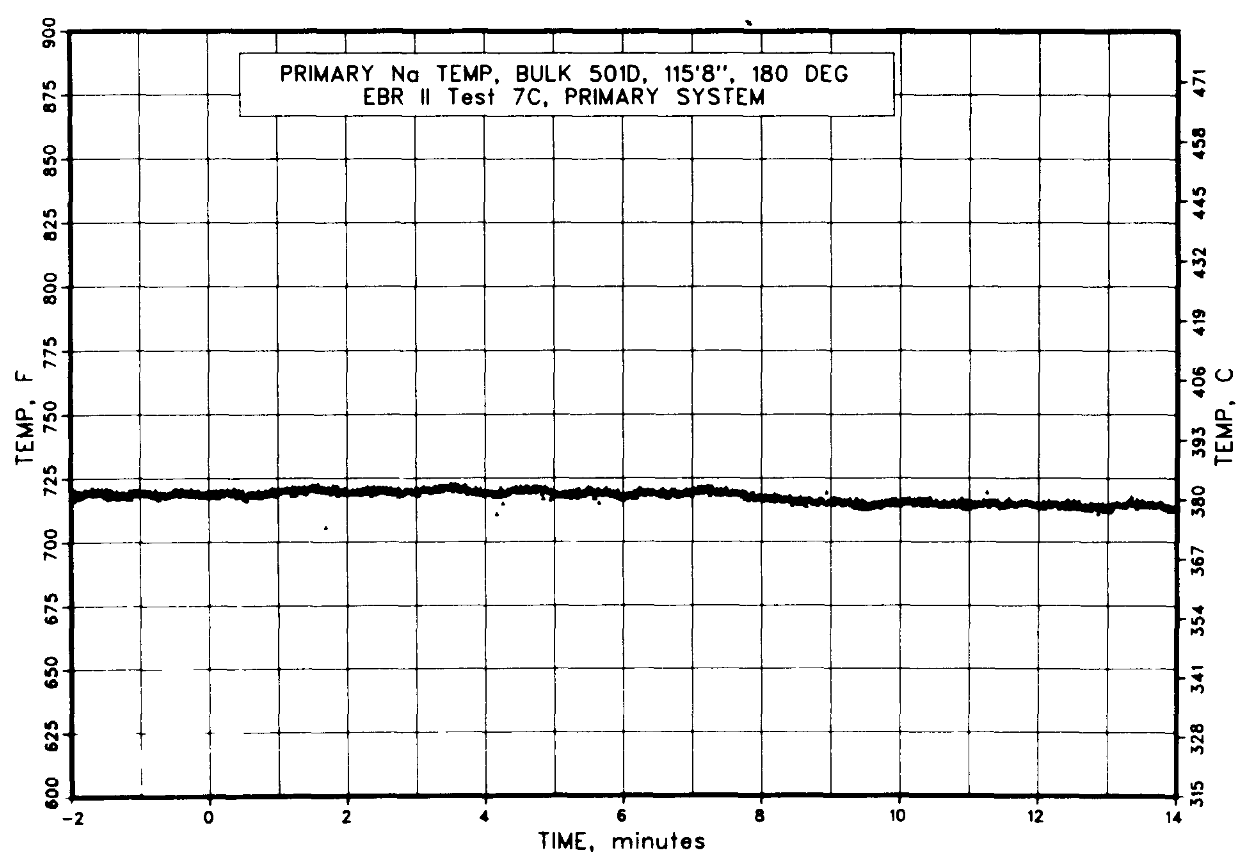

PRIMARY Na TEMP, BULK 501V, 100'2" 0 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

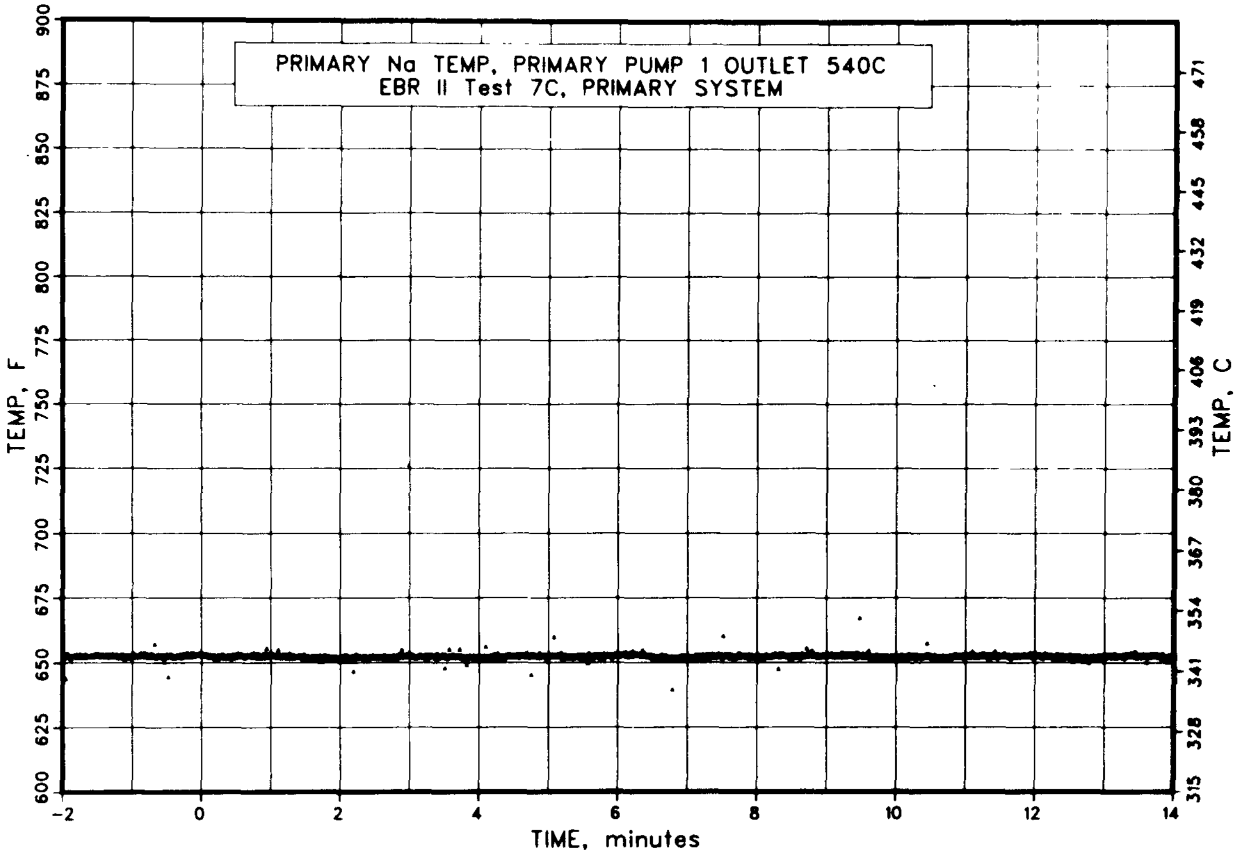

PRIMARY Na TEMP, BULK 501E, 100'2" 180 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

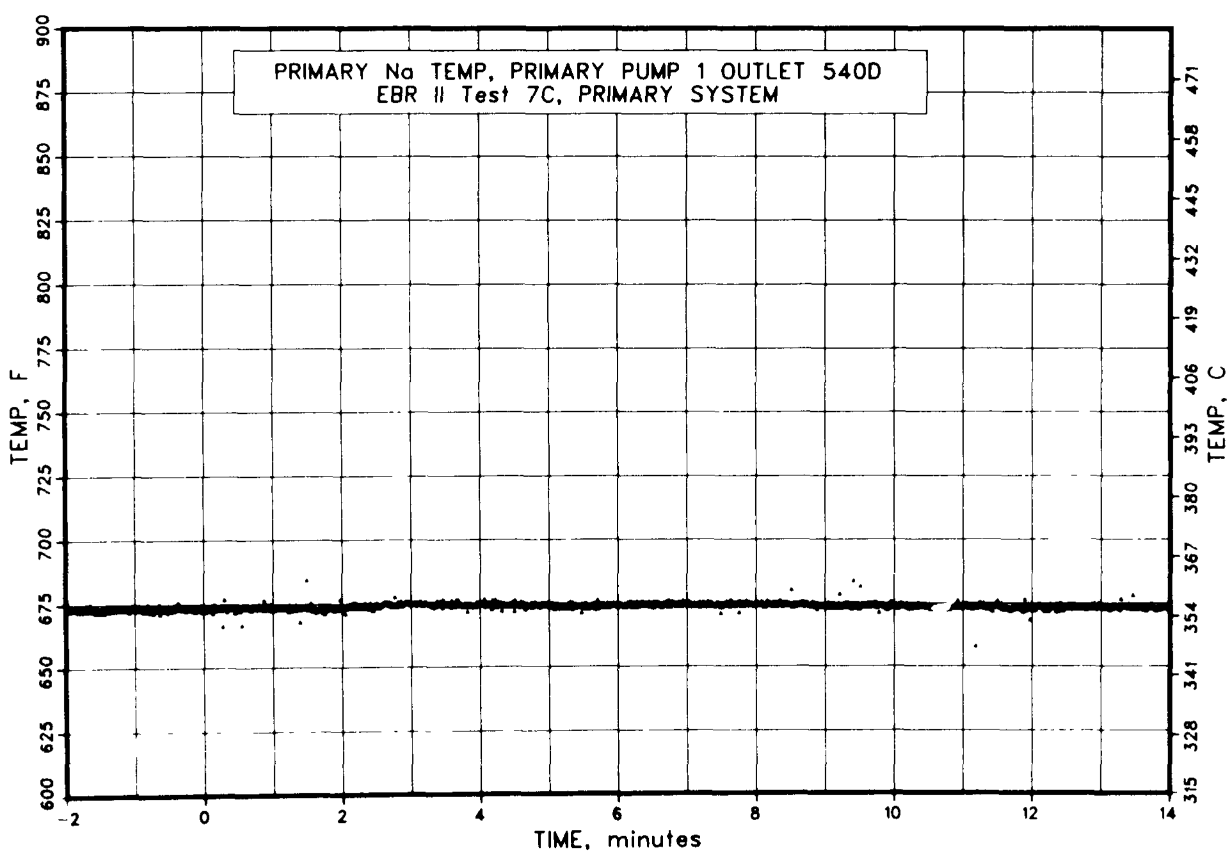

PRIMARY Na TEMP, BULK 501T, 115'8", 0 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

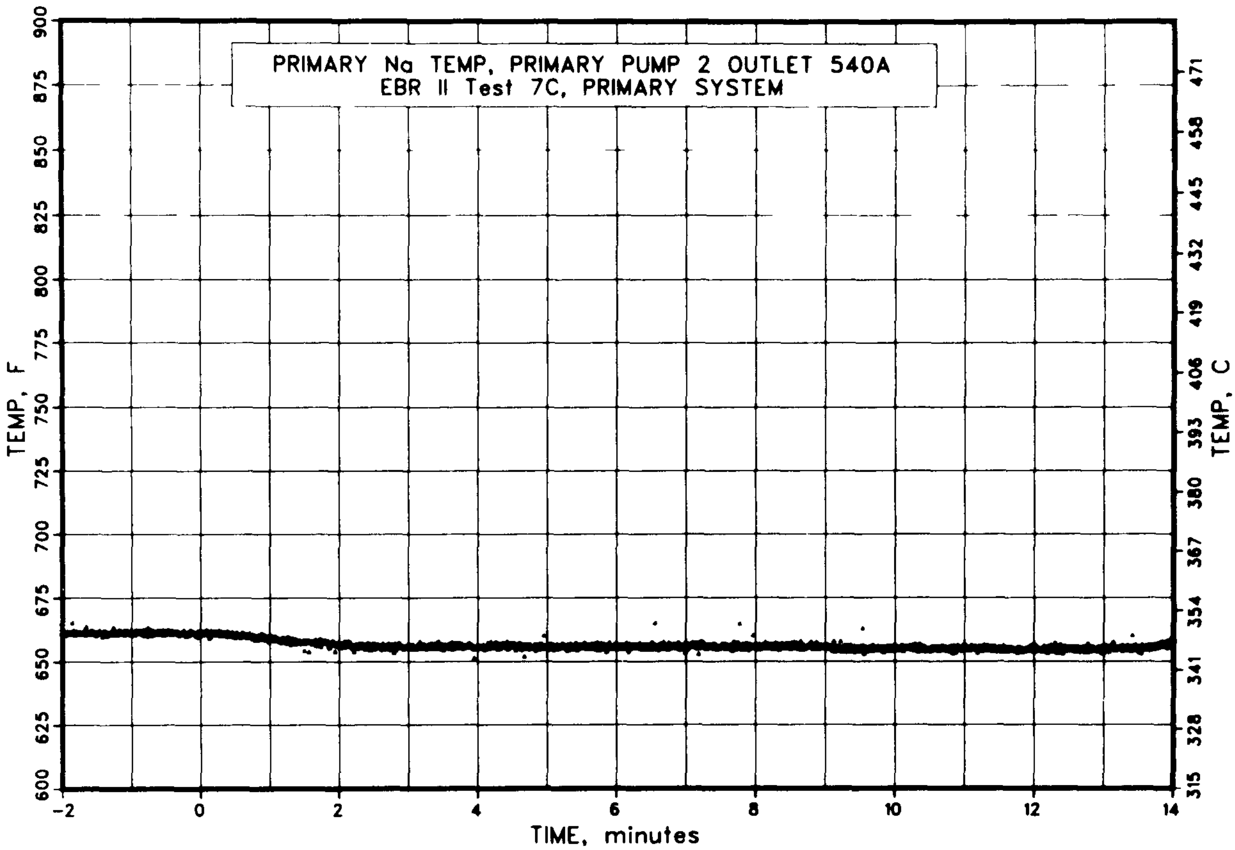

PRIMARY Na TEMP, BULK 501X, 115'8" 45 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

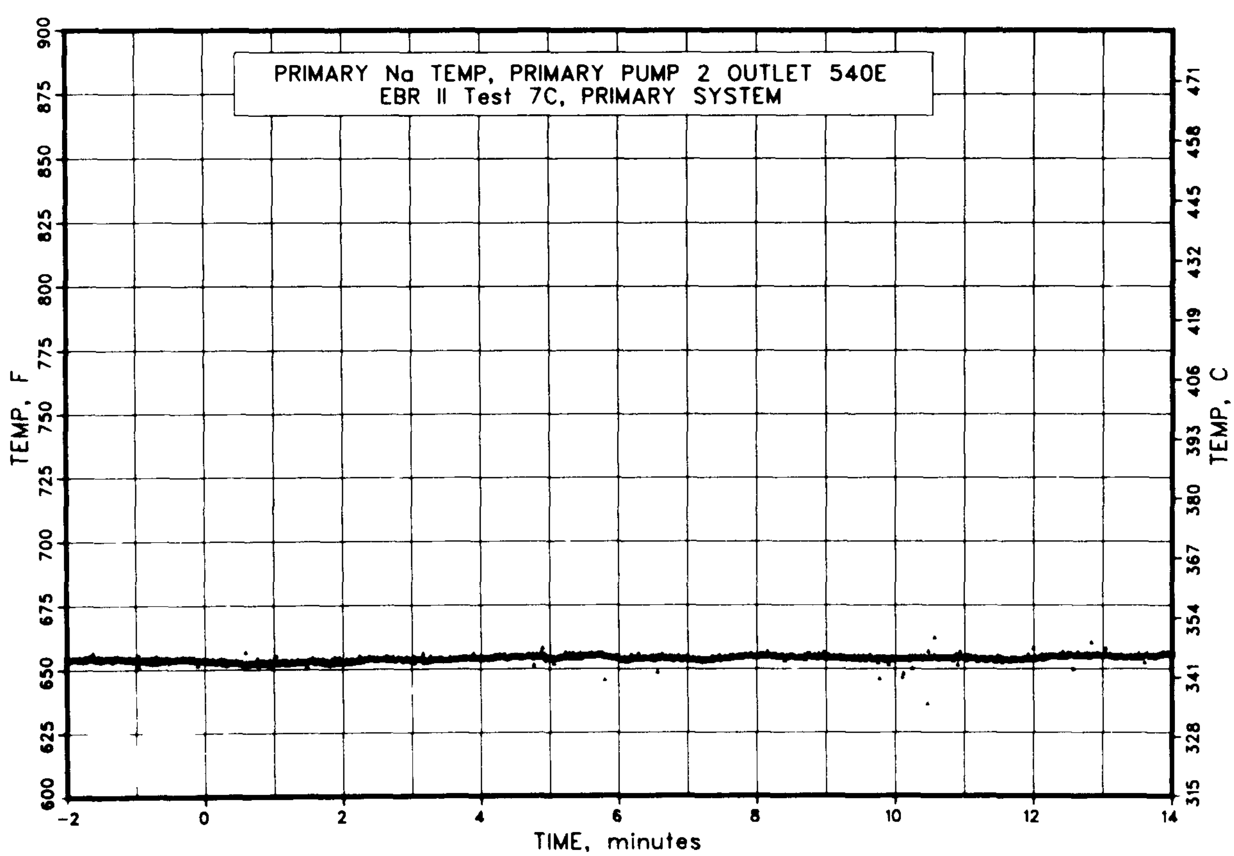

PRIMARY Na TEMP, BULK 501AA, 115'8" 135 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

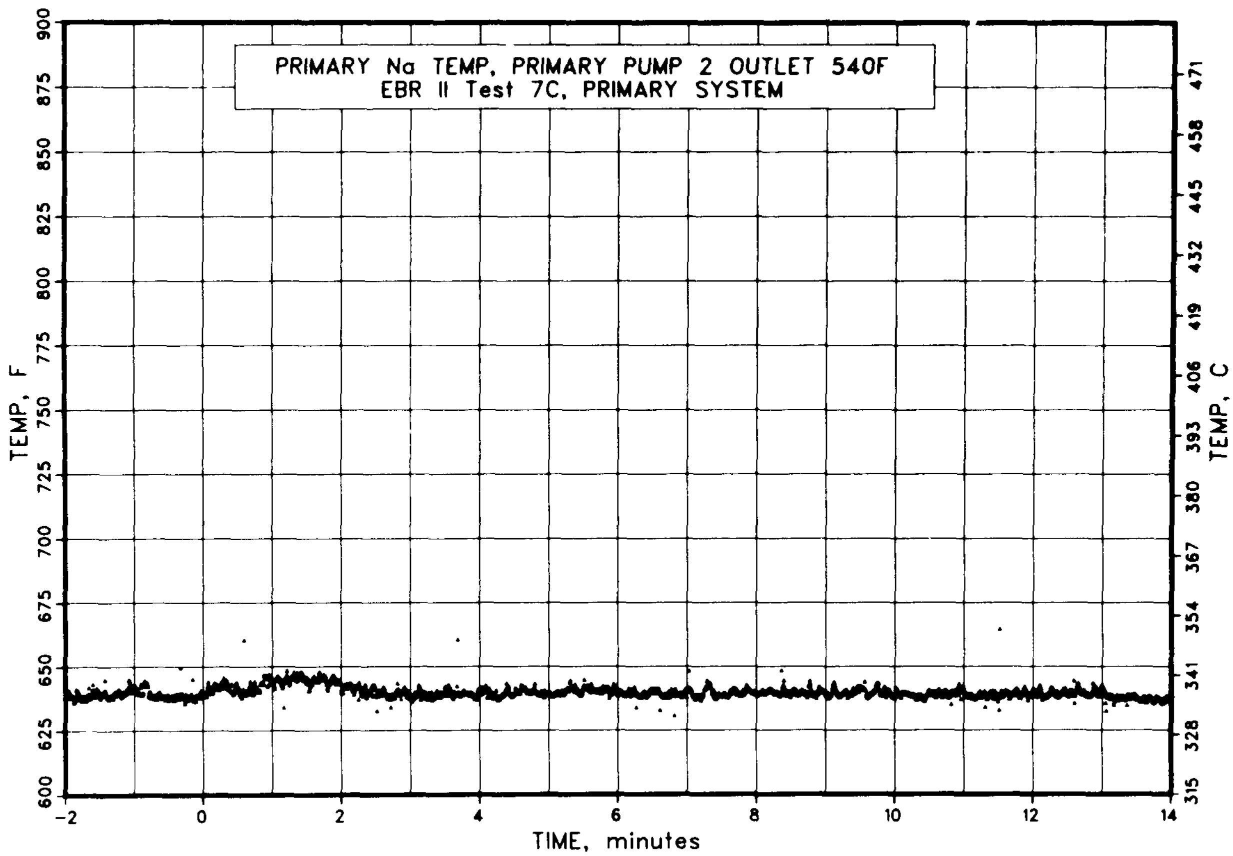

PRIMARY Na TEMP, BULK 501D, 115'8", 180 DEG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

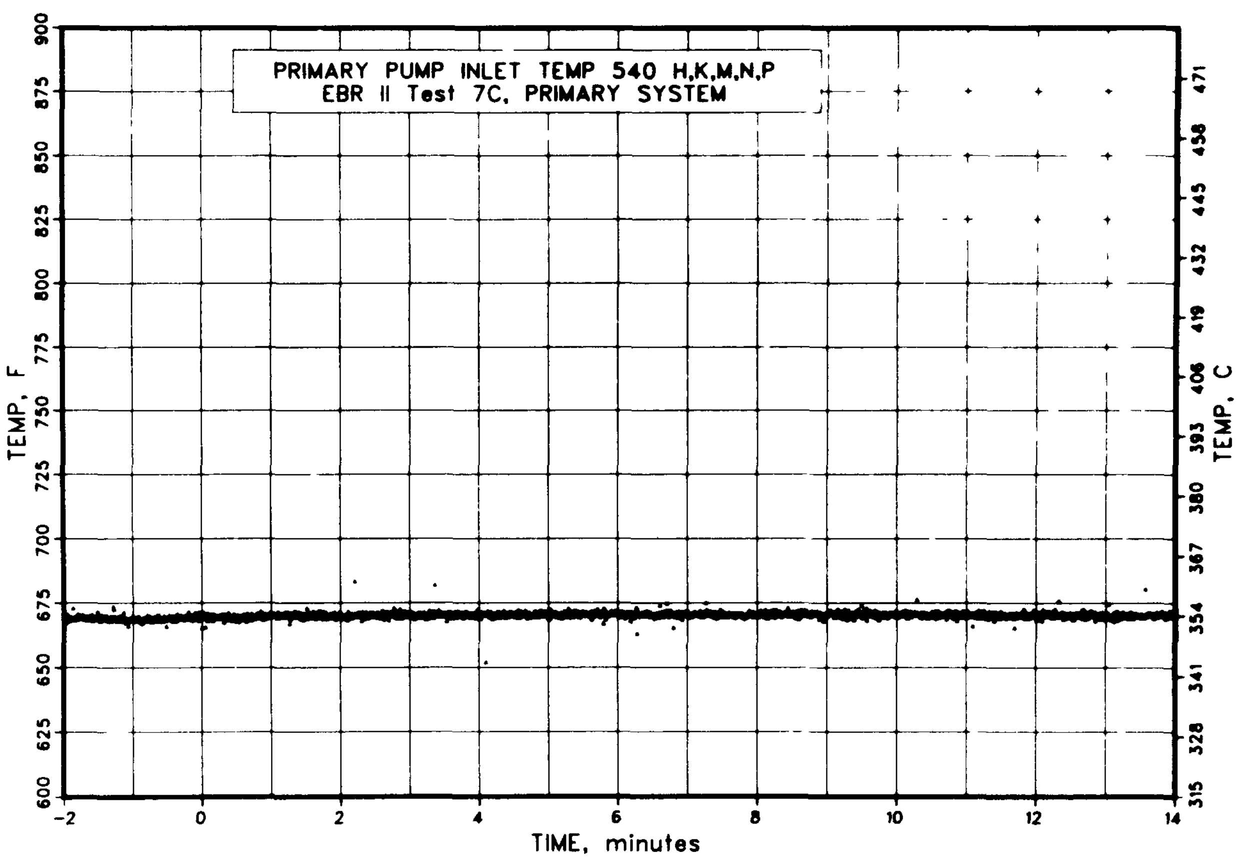

PRIMARY Na TEMP, PRIMARY PUMP 1 OUTLET 540C
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

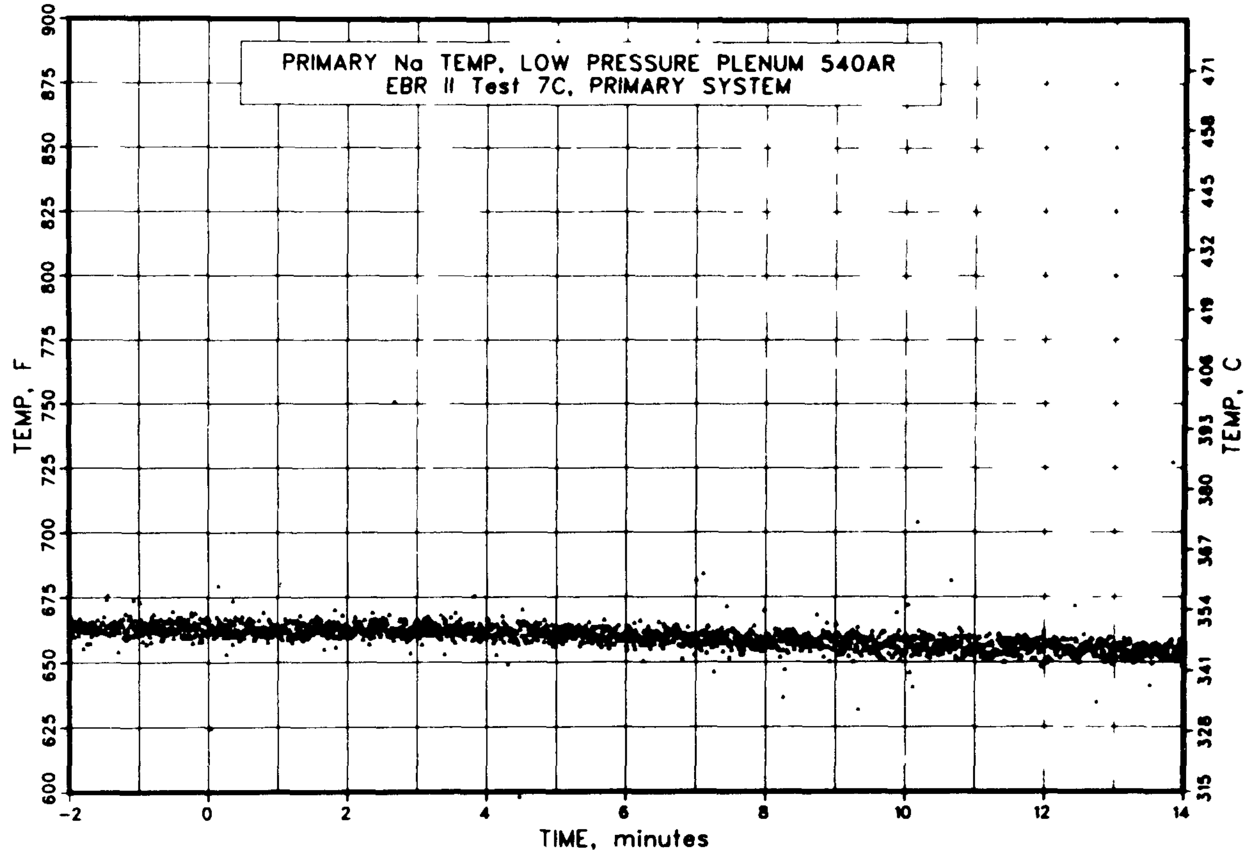

PRIMARY Na TEMP, PRIMARY PUMP 1 OUTLET 540D
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

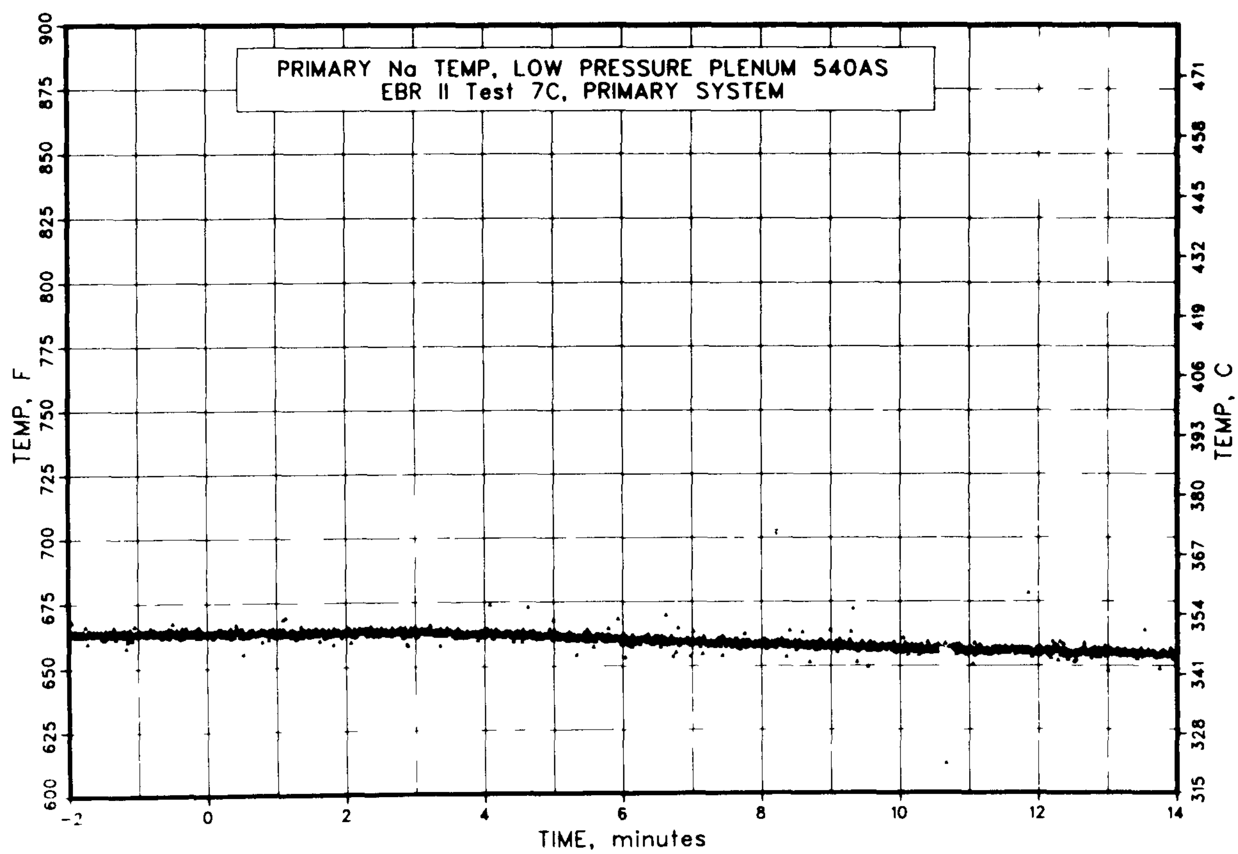

PRIMARY Na TEMP, PRIMARY PUMP 2 OUTLET 540A
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
900
875
850
825
800
775
750
725
700
675
650
625
600
TEMP, C
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14
TIME, minutes

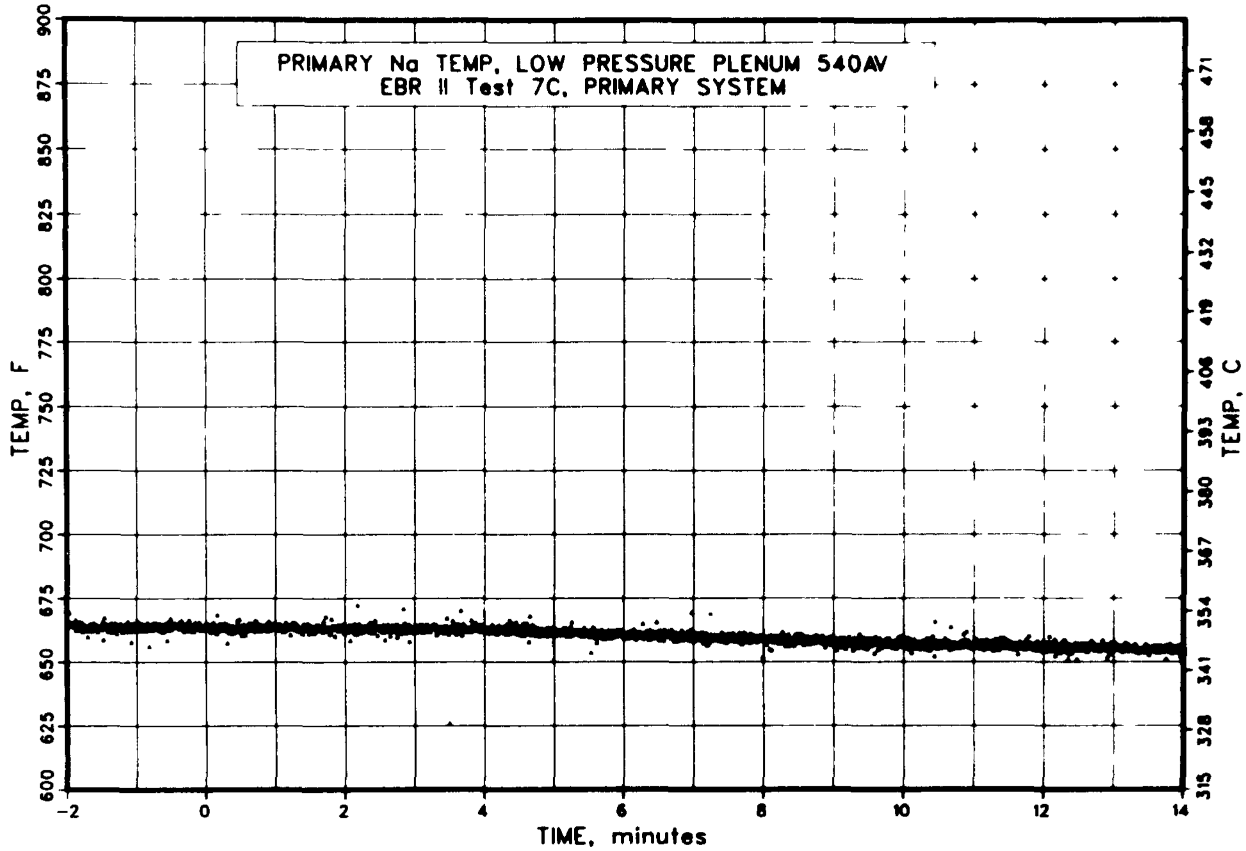

PRIMARY Na TEMP, PRIMARY PUMP 2 OUTLET 540E
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
900
875
850
825
800
775
750
725
700
675
650
625
600
TEMP, C
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14
TIME, minutes

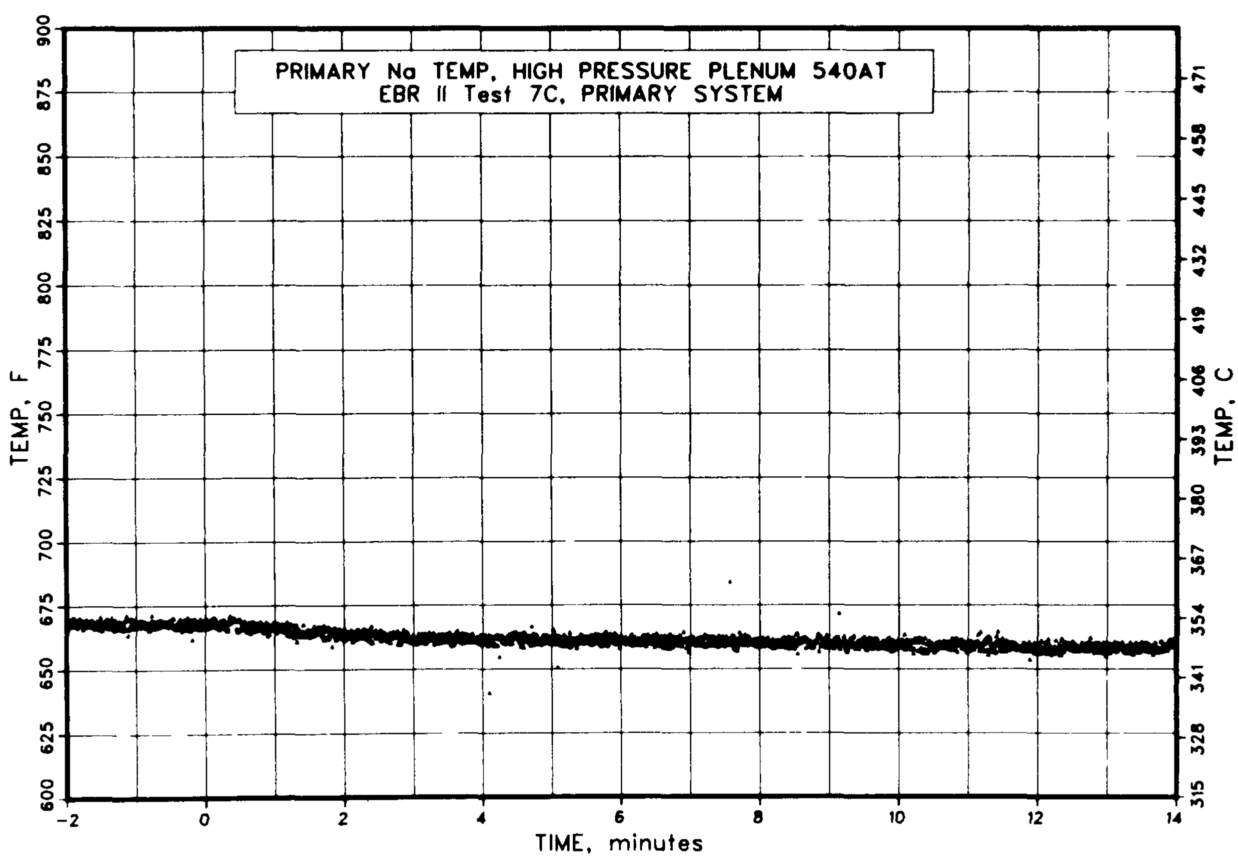

PRIMARY Na TEMP, PRIMARY PUMP 2 OUTLET 540F
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
900
875
850
825
800
775
750
725
700
675
650
625
600
TEMP, C
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14
TIME, minutes


PRIMARY PUMP INLET TEMP 540 H,K,M,N,P
EBR II Test 7C, 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
-2
0
2
4
6
8
10
12
14
TIME, minutes


PRIMARY Na TEMP, LOW PRESSURE PLENUM 540AR
EBR II Test 7C, 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


PRIMARY Na TEMP, LOW PRESSURE PLENUM 540AS
EBR II Test 7C, 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


PRIMARY Na TEMP, LOW PRESSURE PLENUM 540AV
EBR II Test 7C, 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


PRIMARY Na TEMP, HIGH PRESSURE PLENUM 540AT
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
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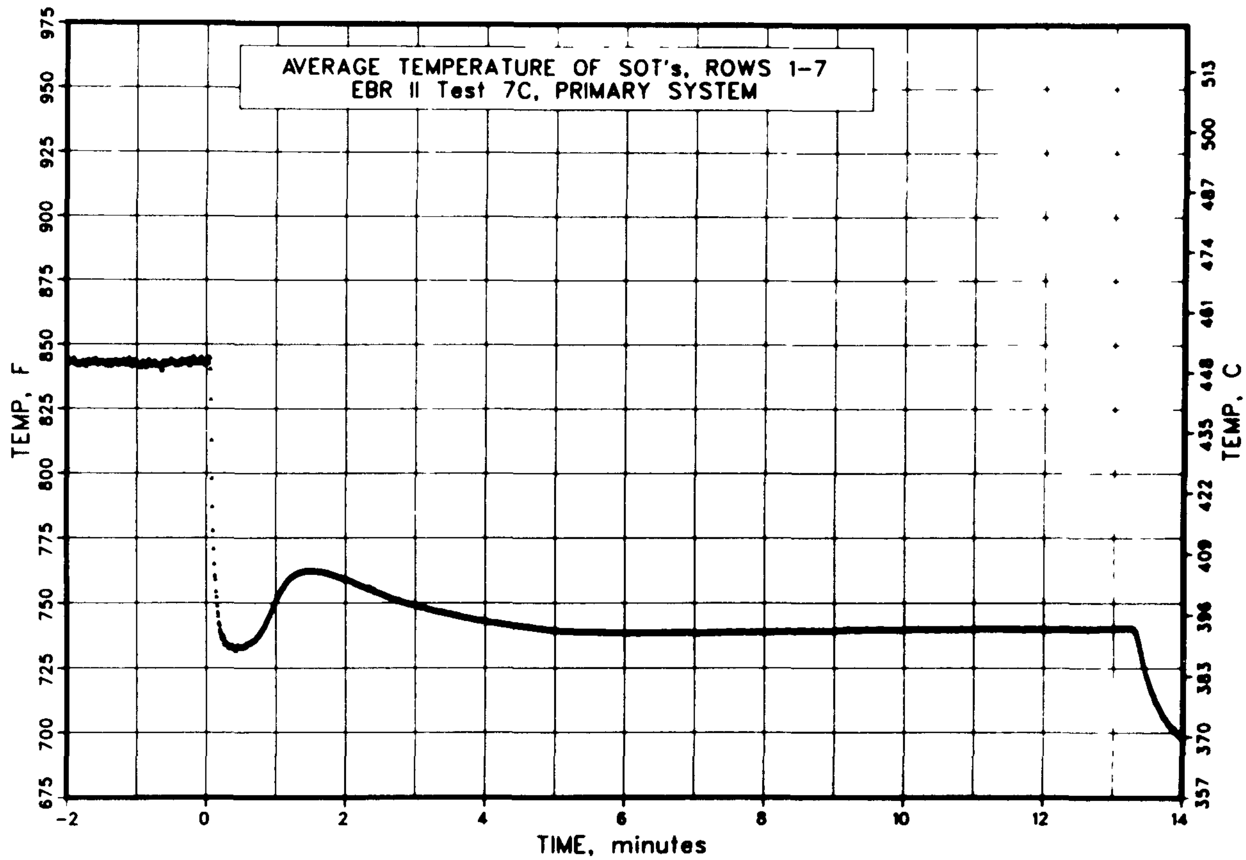
AVERAGE TEMPERATURE OF SOT's, ROWS 1-7
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
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775
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TEMP, C
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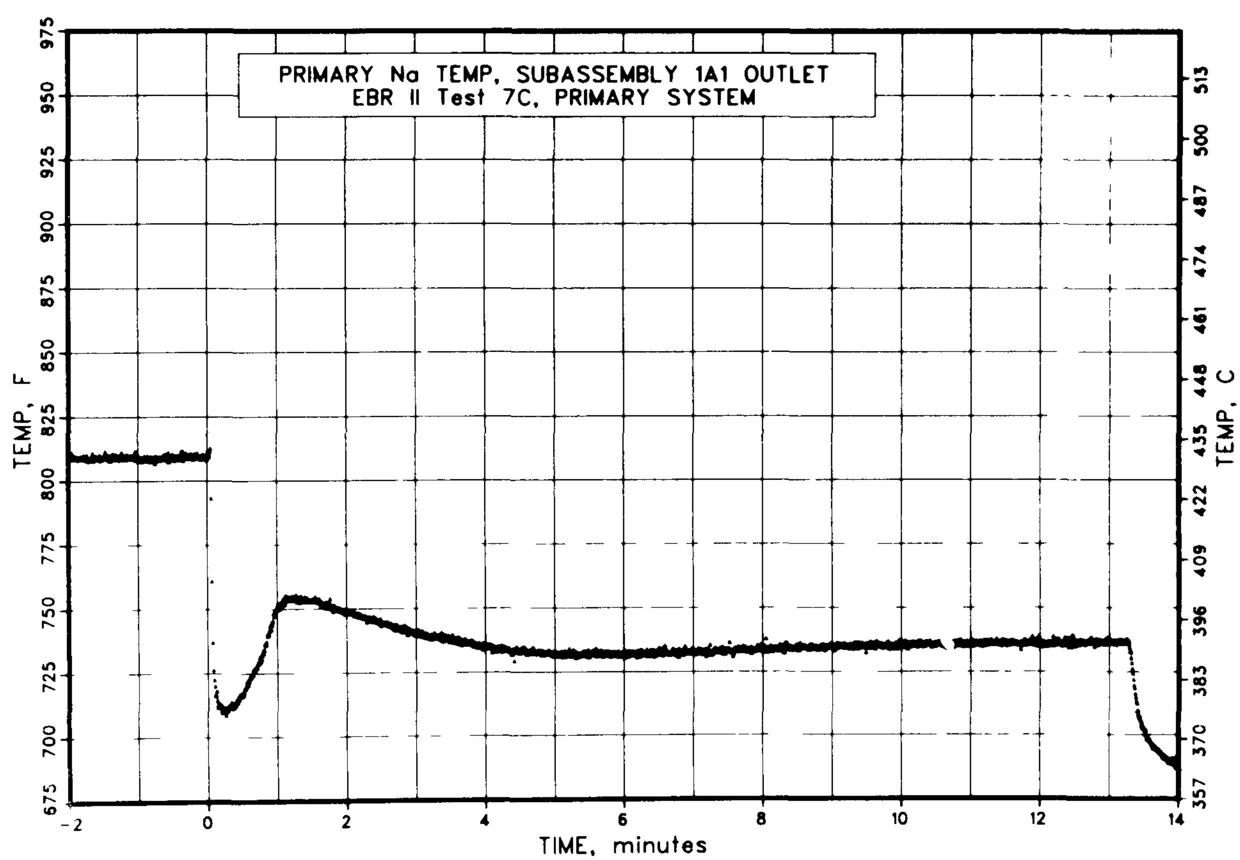
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 1A1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
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TEMP, C
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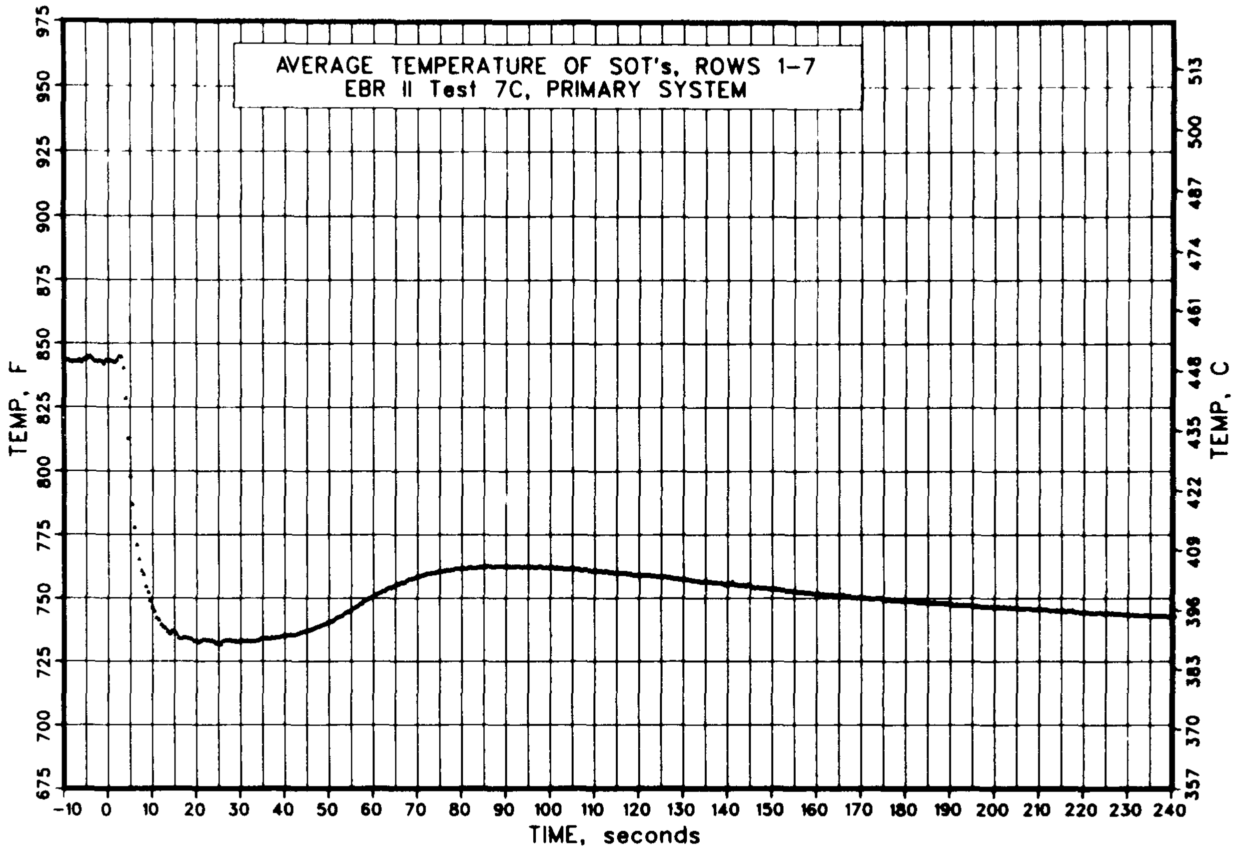
TIME, minutes


AVERAGE TEMPERATURE OF SOT's, ROWS 1-7
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
975
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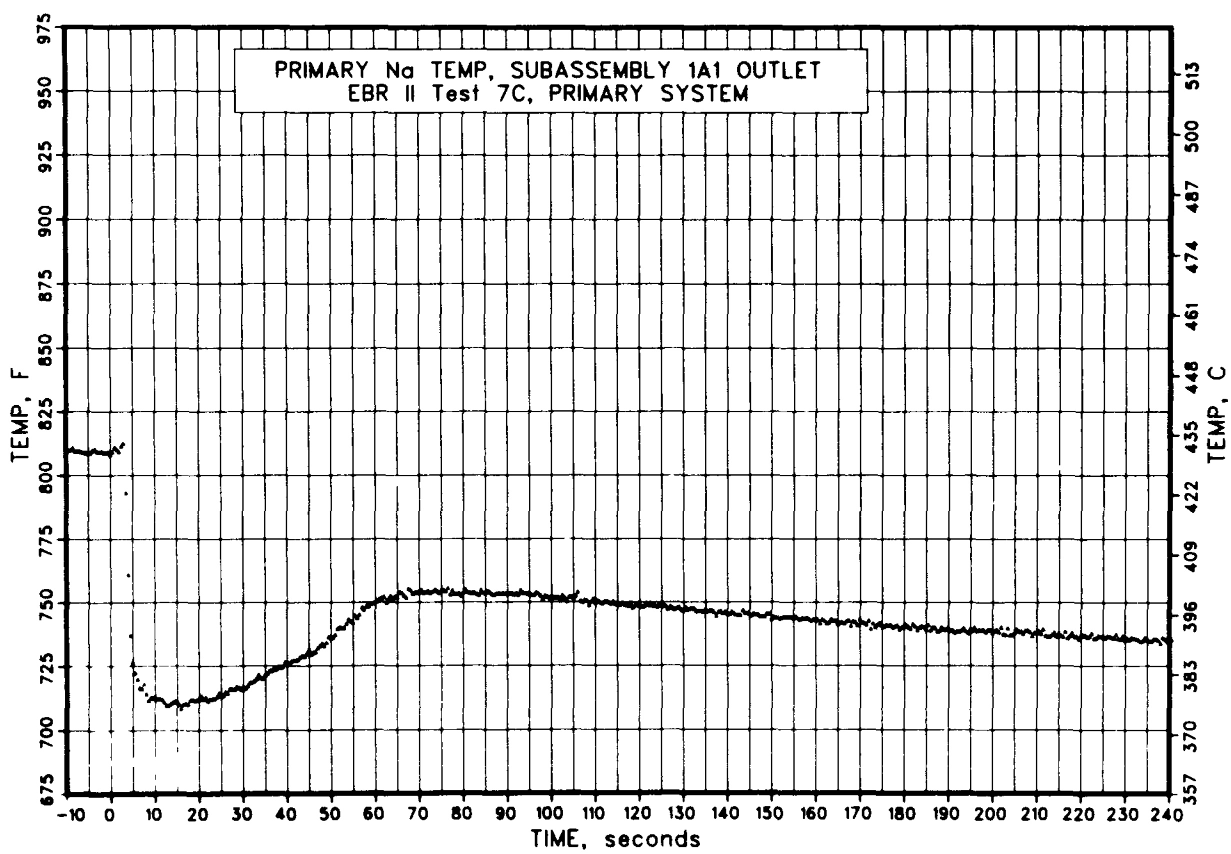
PRIMARY Na TEMP, SUBASSEMBLY 1A1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
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TIME, seconds
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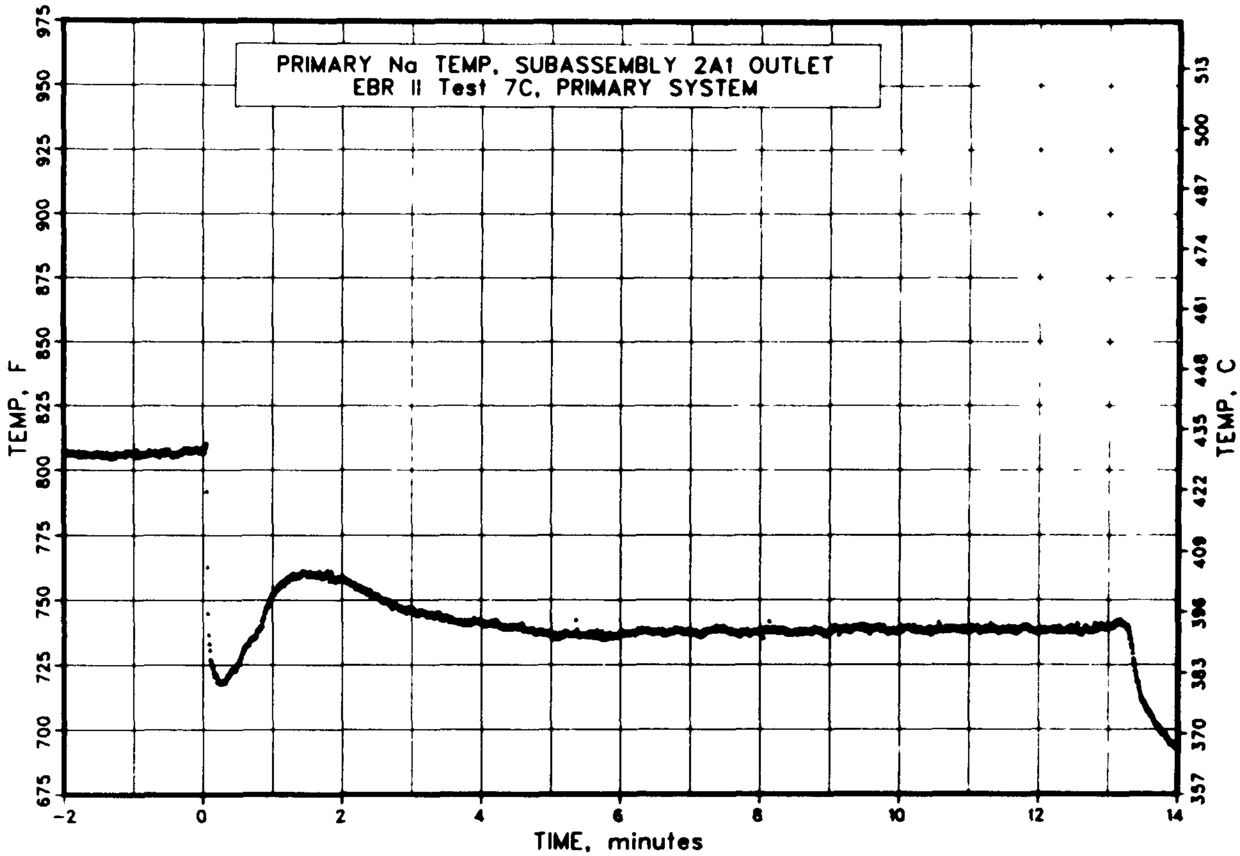
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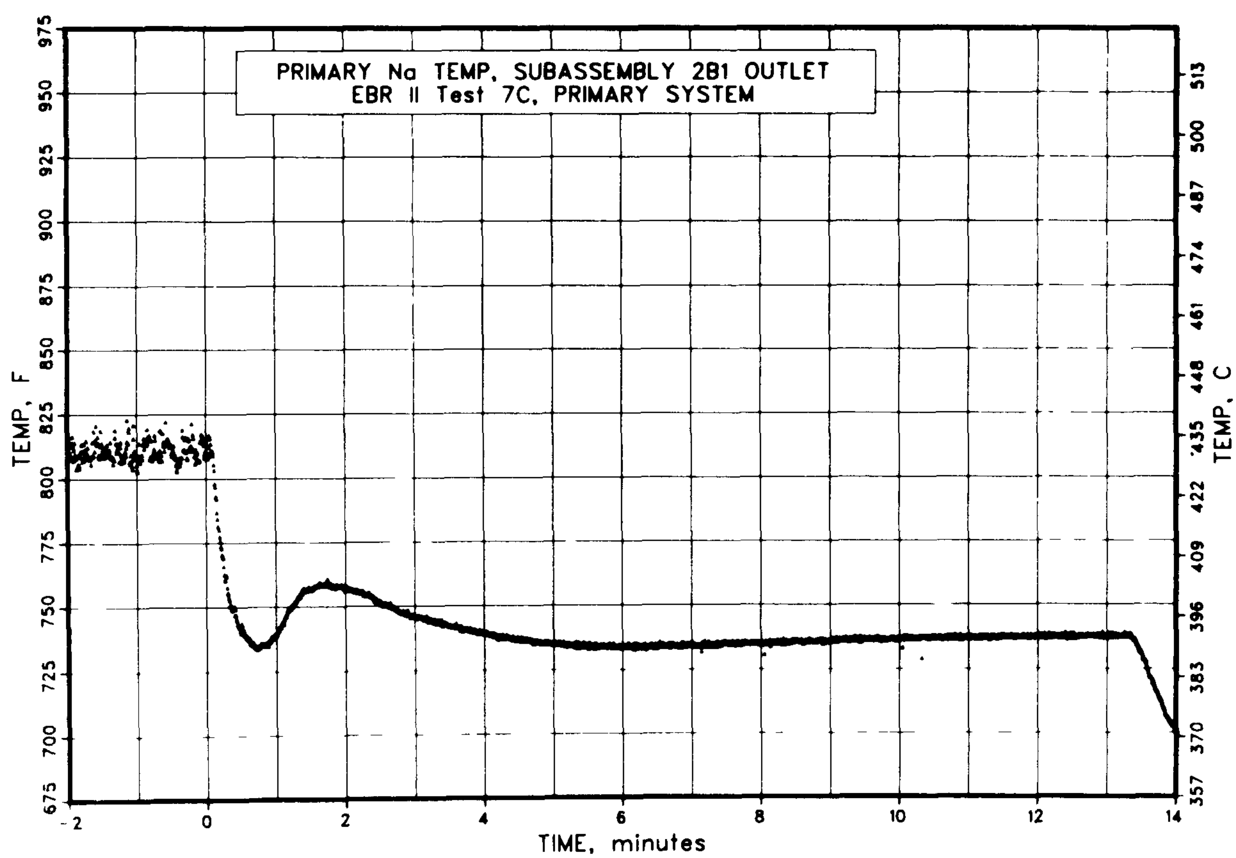
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TEMP, C
TIME, minutes
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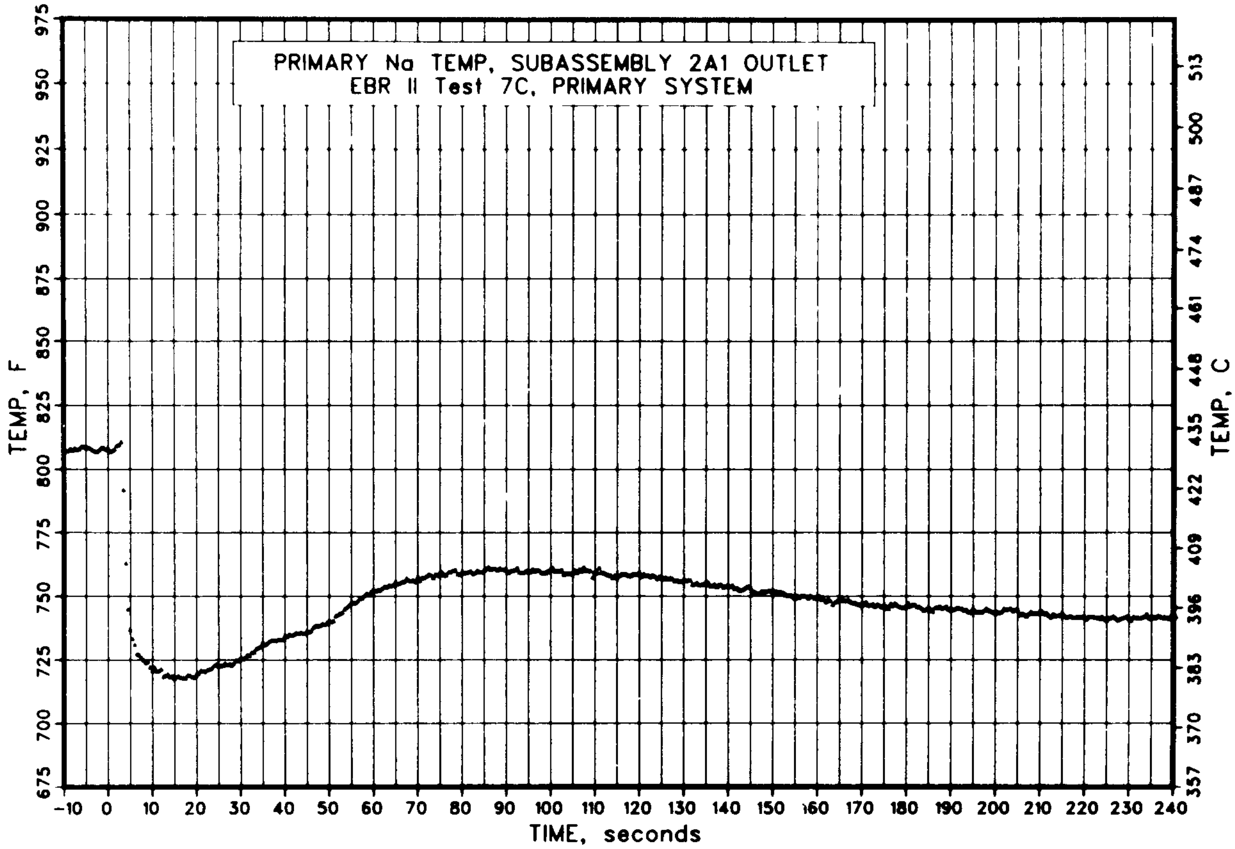
PRIMARY Na TEMP, SUBASSEMBLY 2A1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
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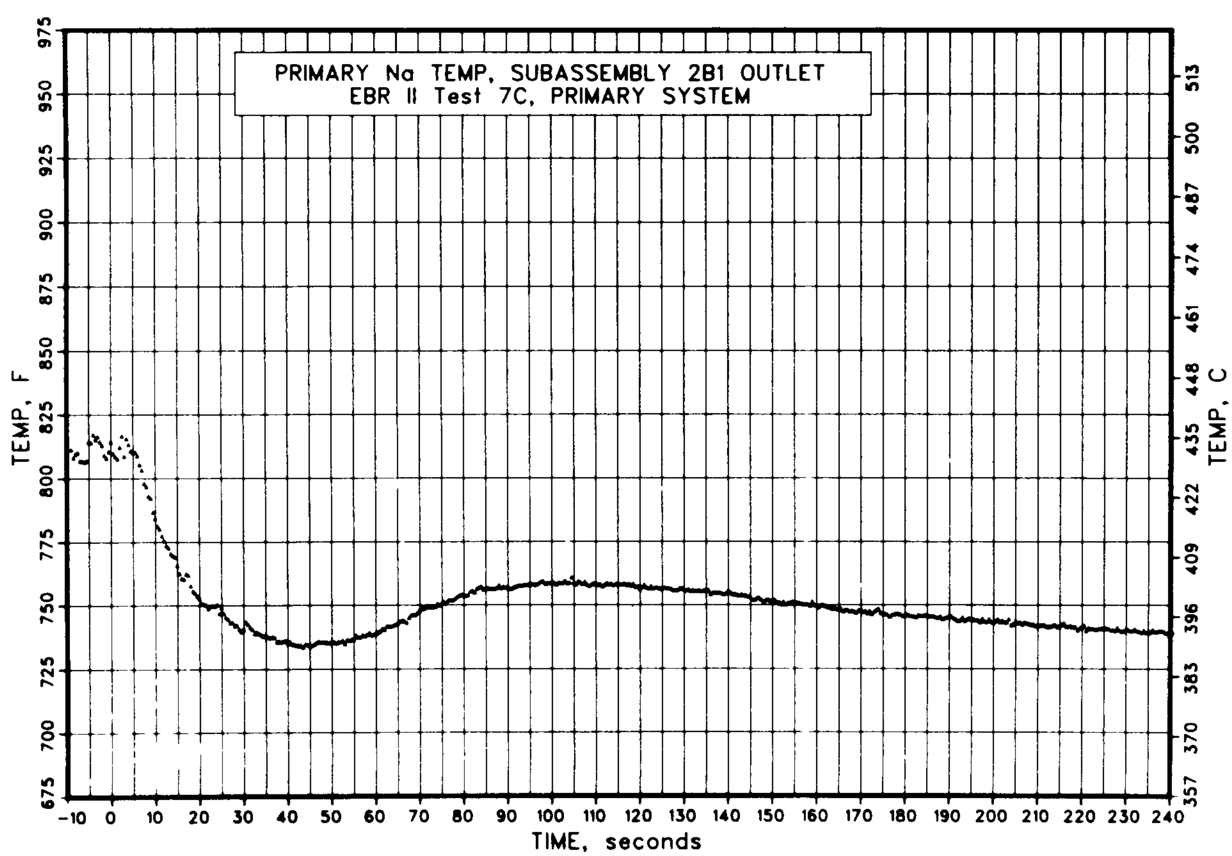
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 2B1 OUTLET
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TEMP, C
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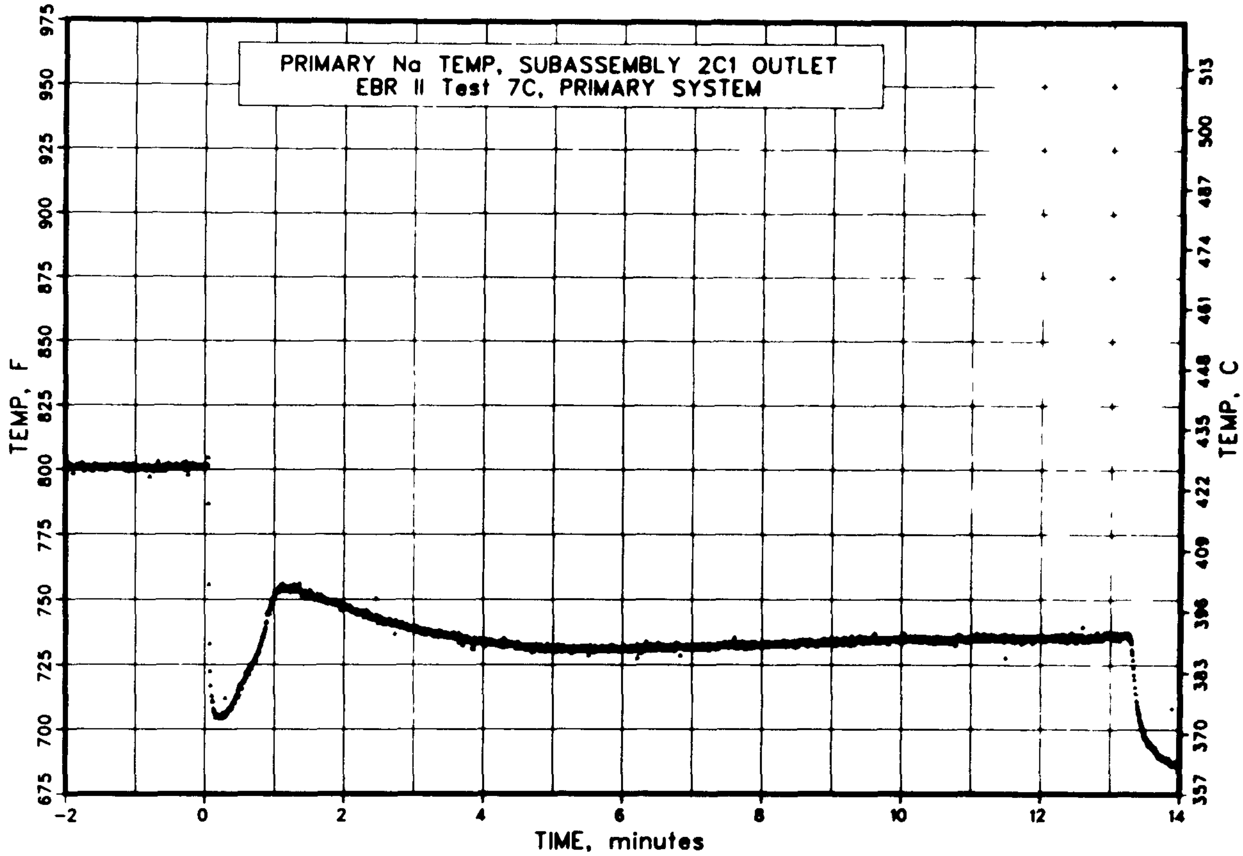
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 2C1 OUTLET
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TIME, minutes
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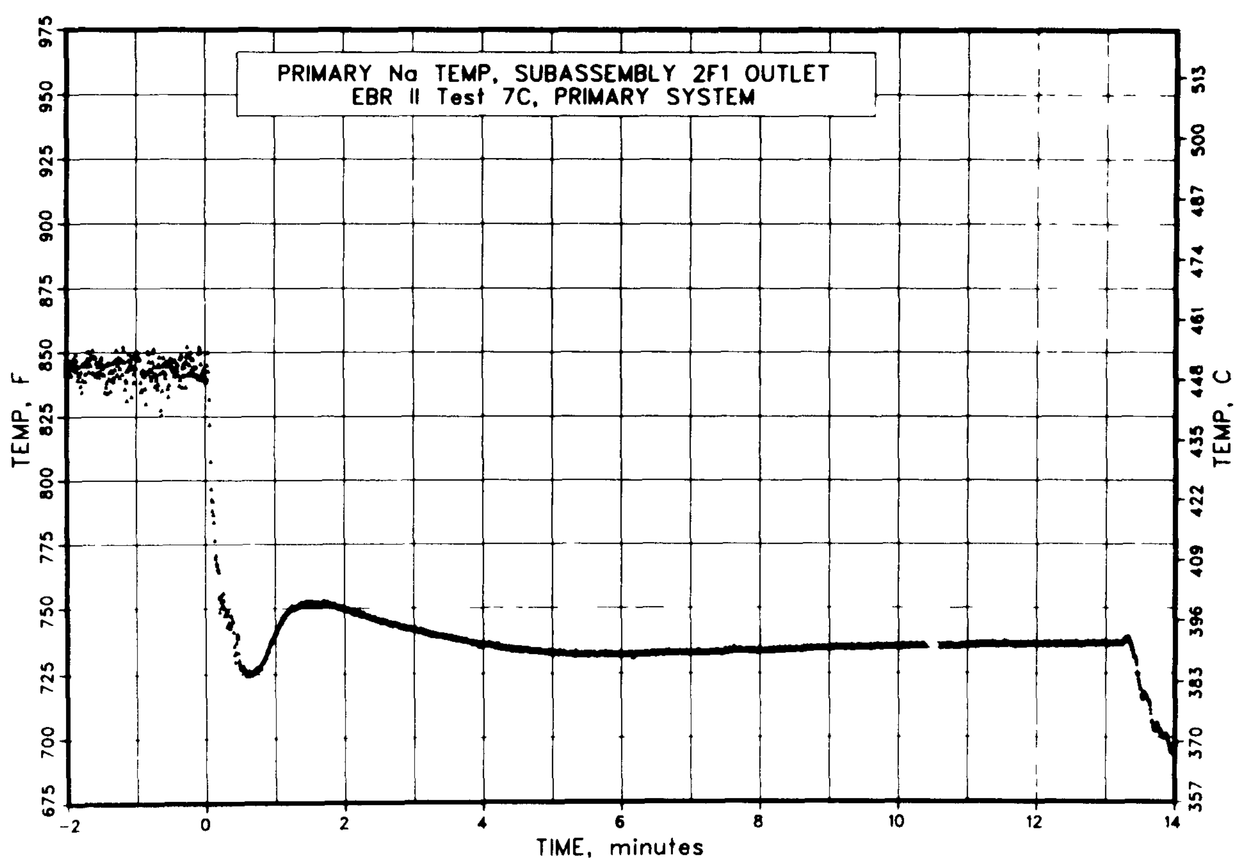
PRIMARY Na TEMP, SUBASSEMBLY 2F1 OUTLET
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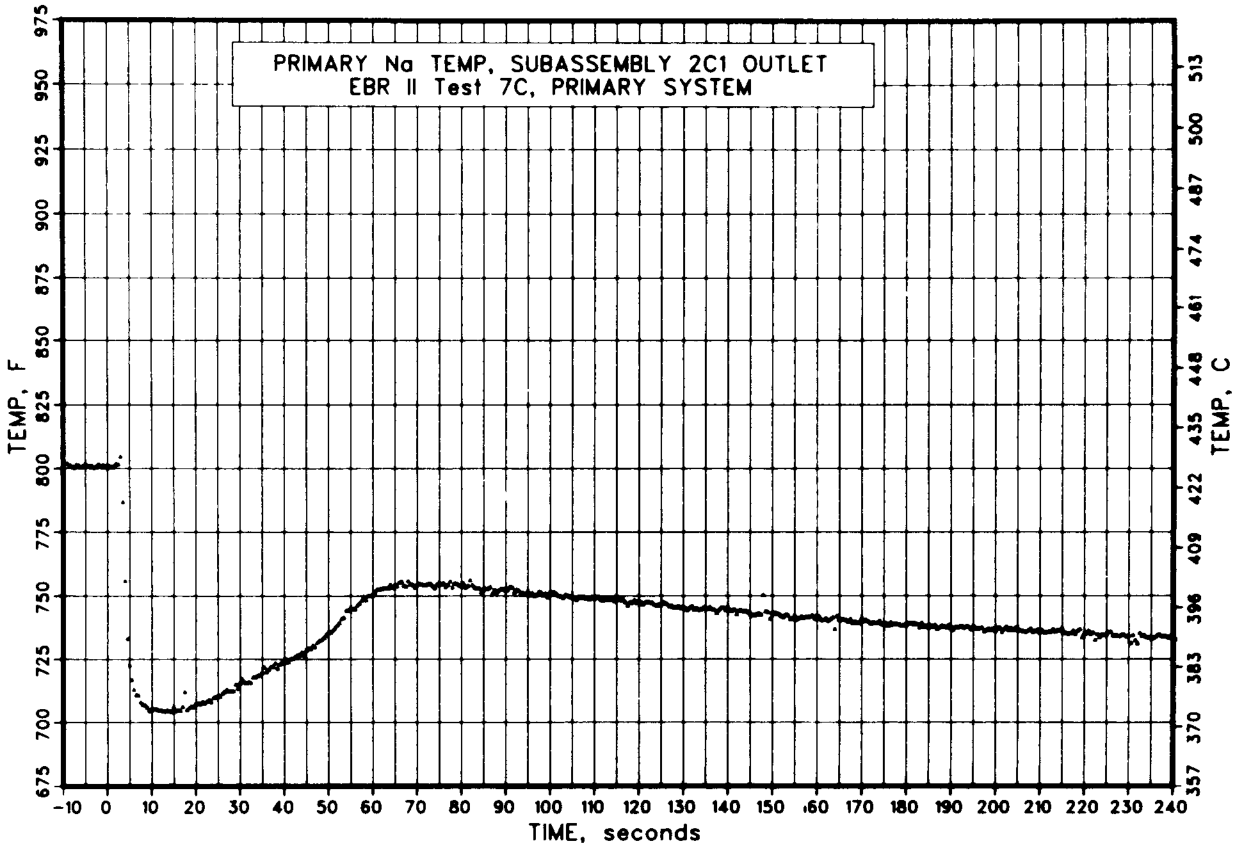
PRIMARY Na TEMP, SUBASSEMBLY 2C1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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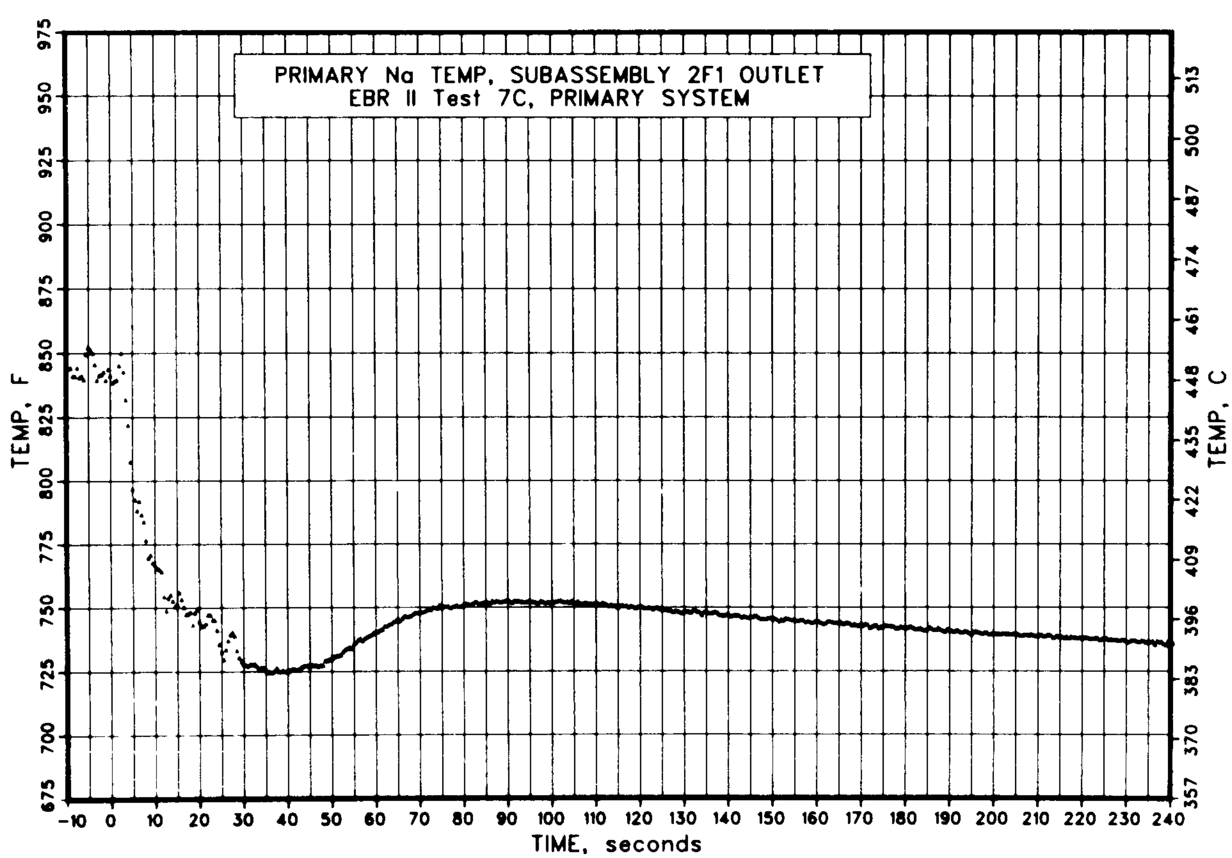
PRIMARY Na TEMP, SUBASSEMBLY 2F1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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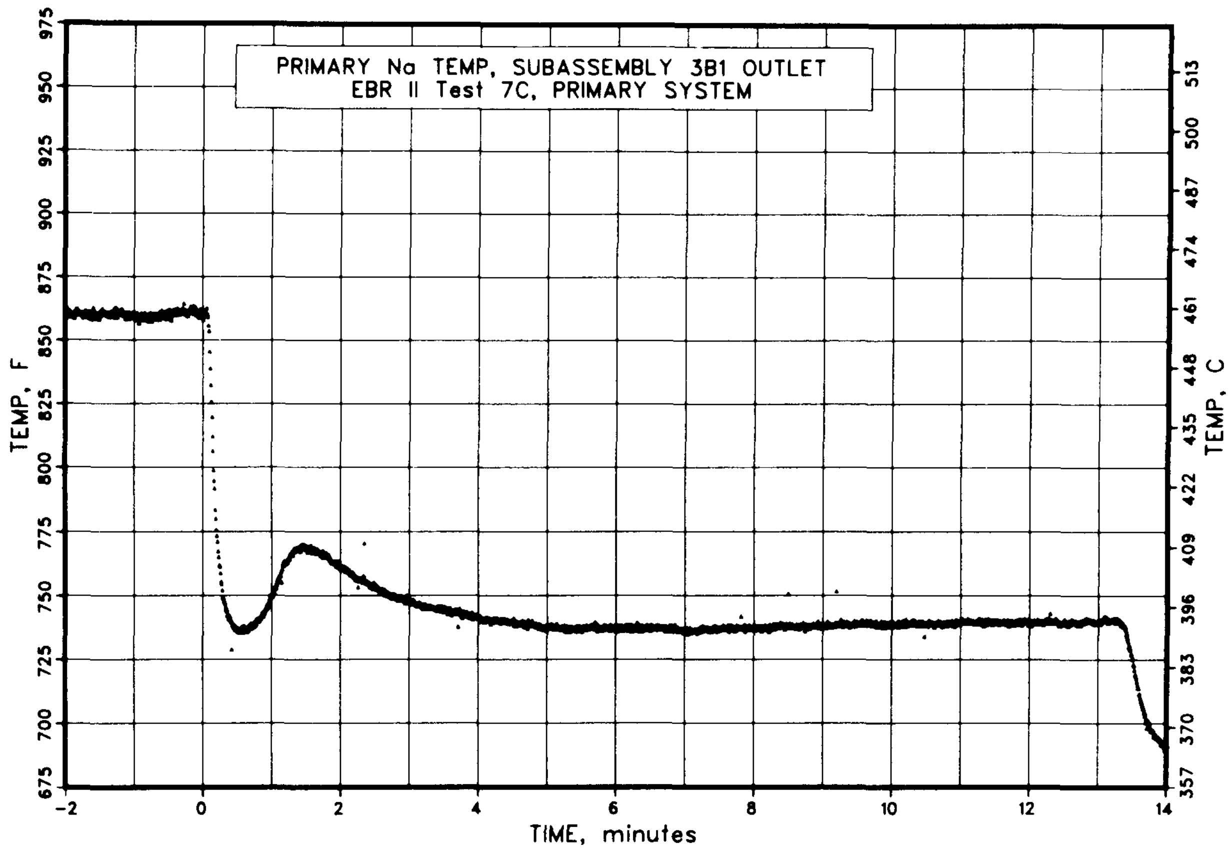
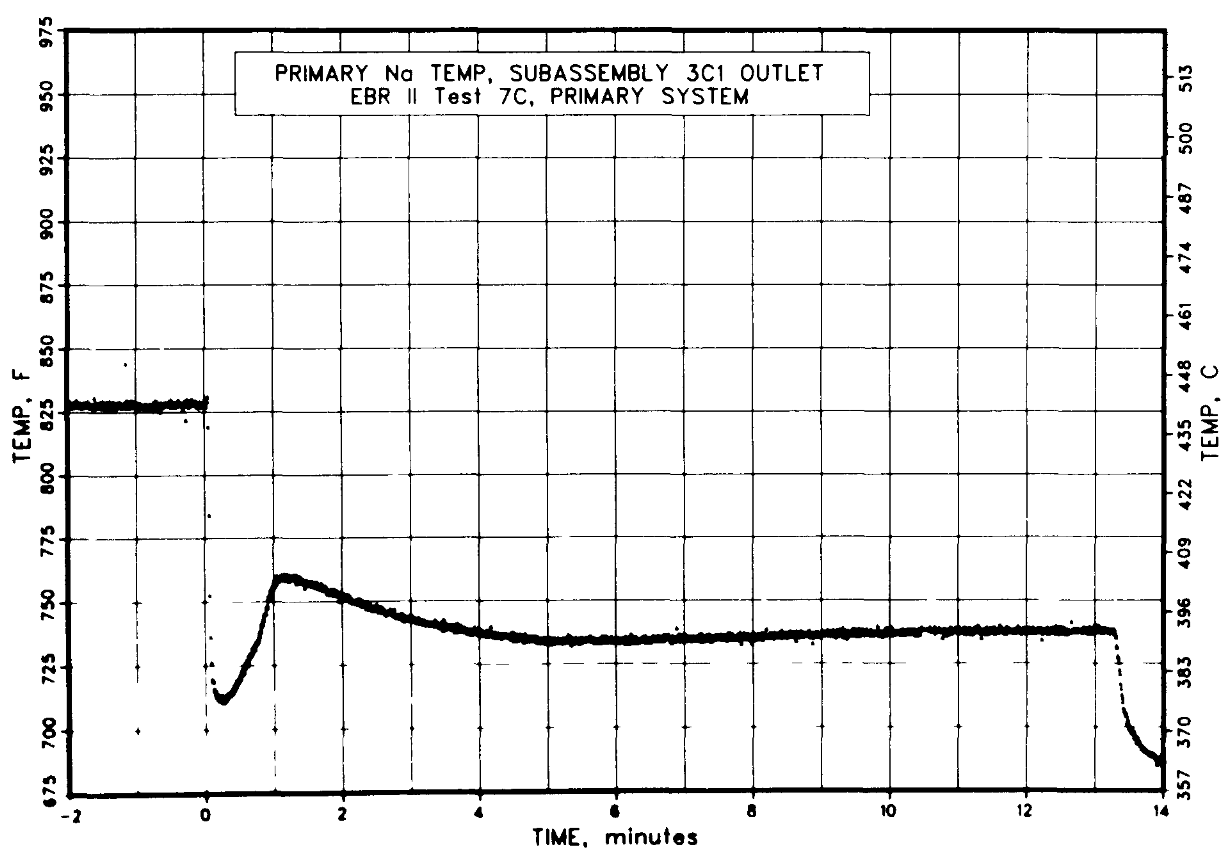

PRIMARY Na TEMP, SUBASSEMBLY 3B1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes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EBR II Test 7C, PRIMARY SYSTEM
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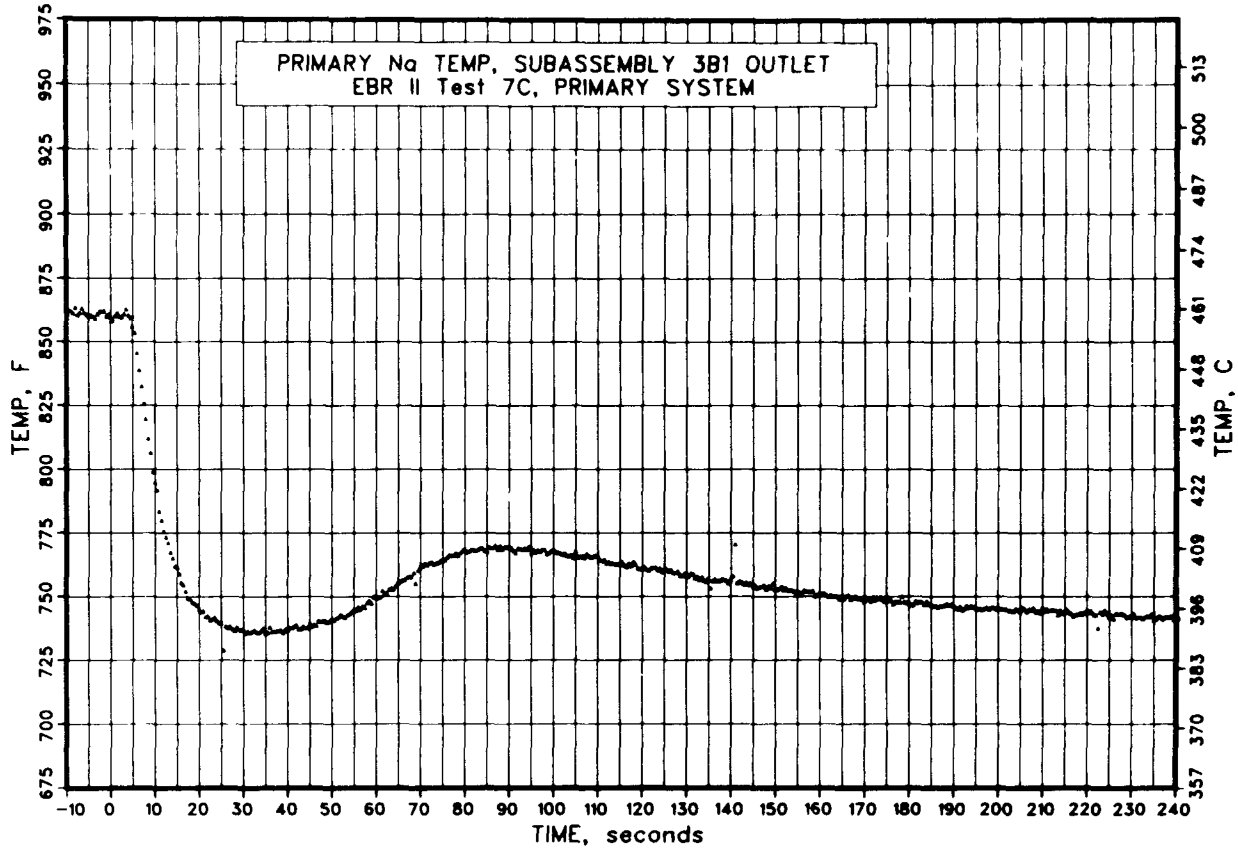
TEMP, C
TIME, minutes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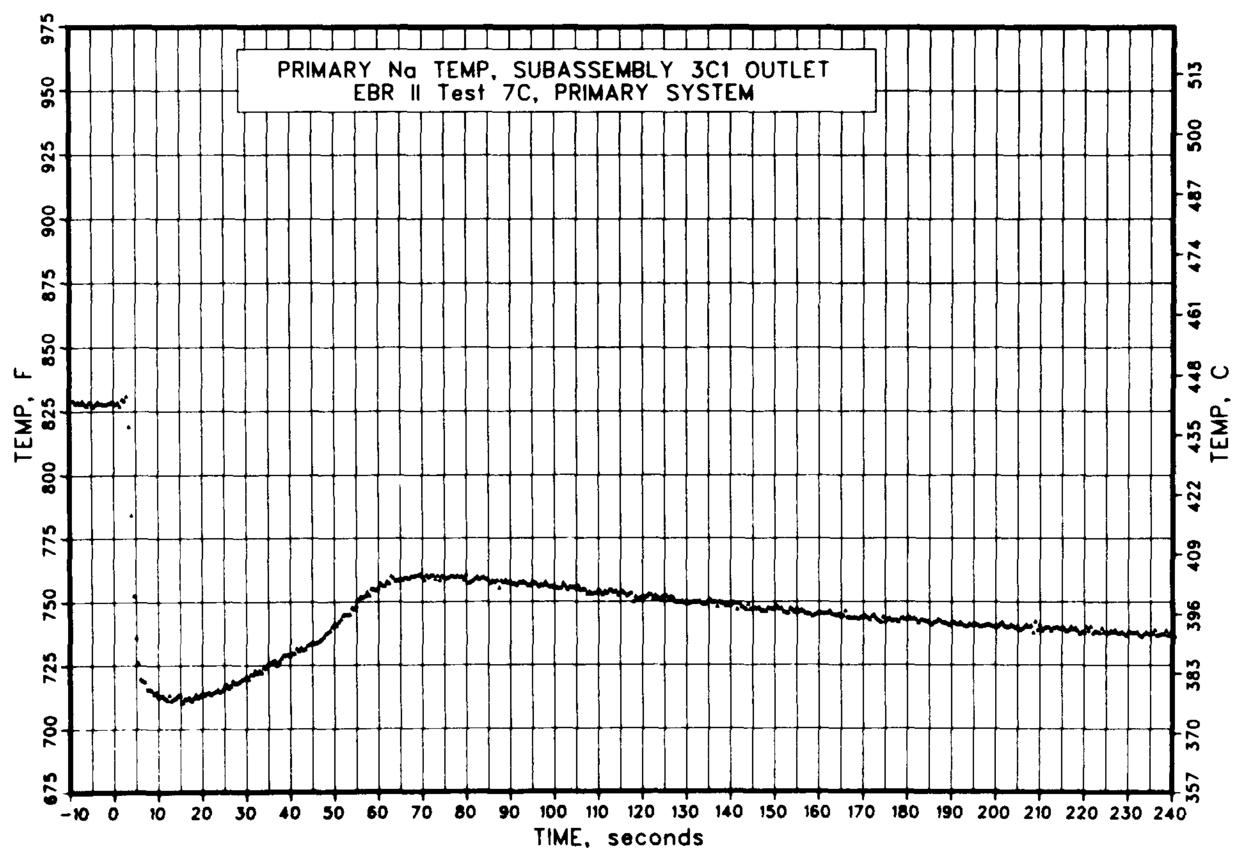
TEMP, F
TEMP, C
TIME, seconds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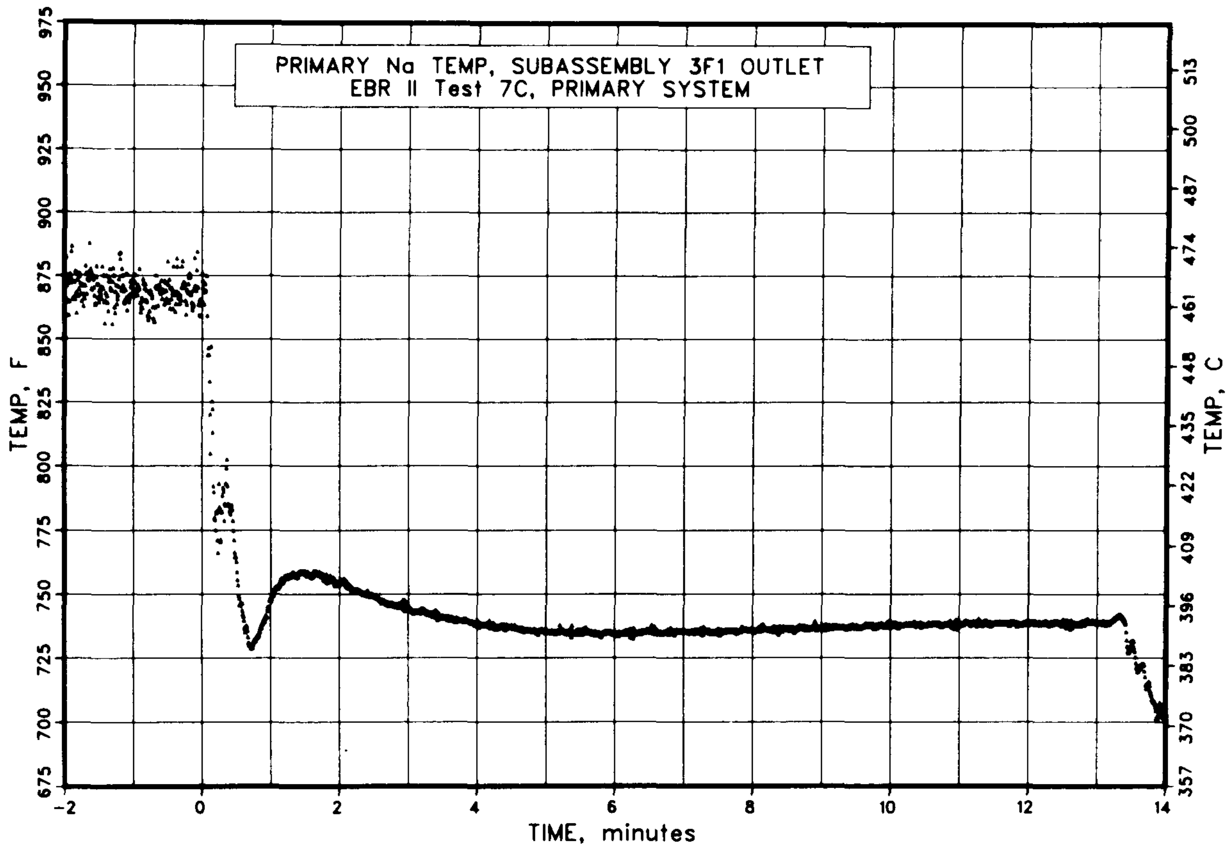
TEMP, C
TIME, seconds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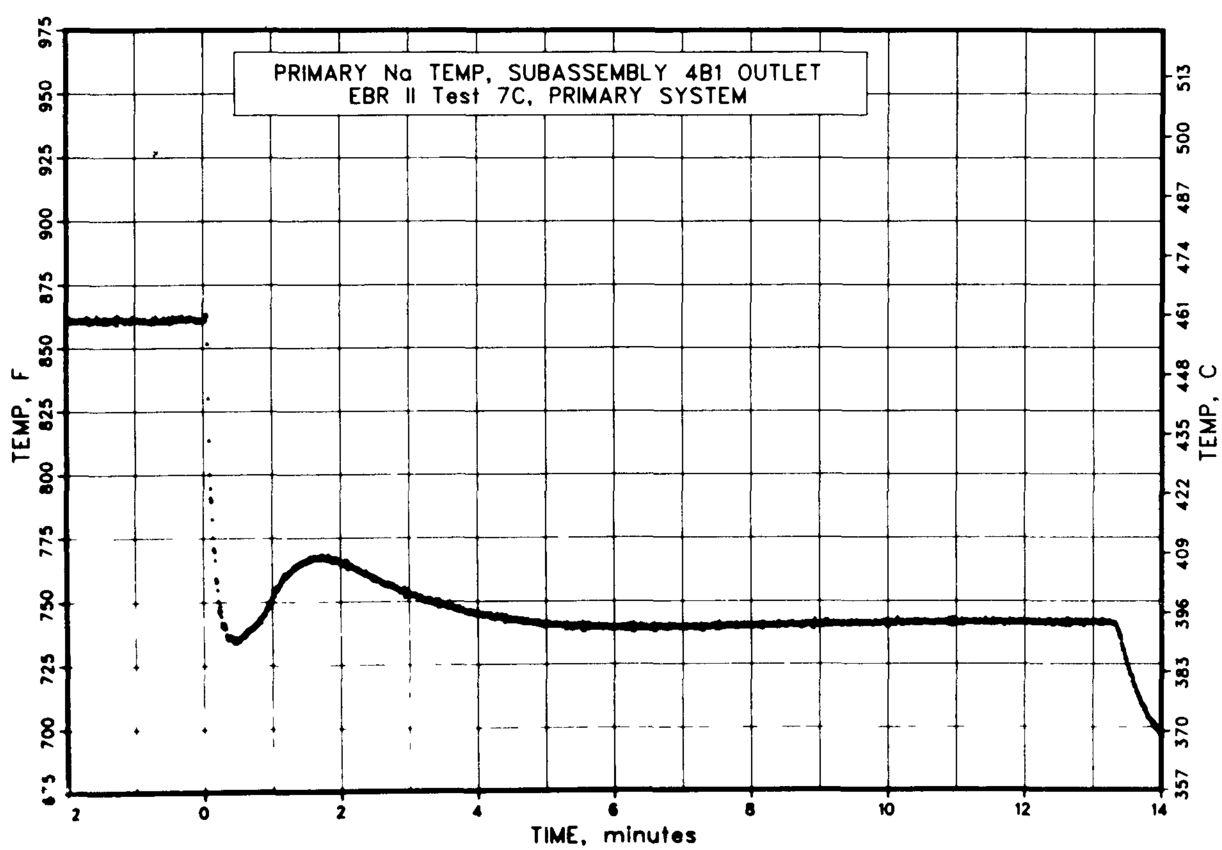
TIME, minutes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EBR II Test 7C, PRIMARY SYSTEM
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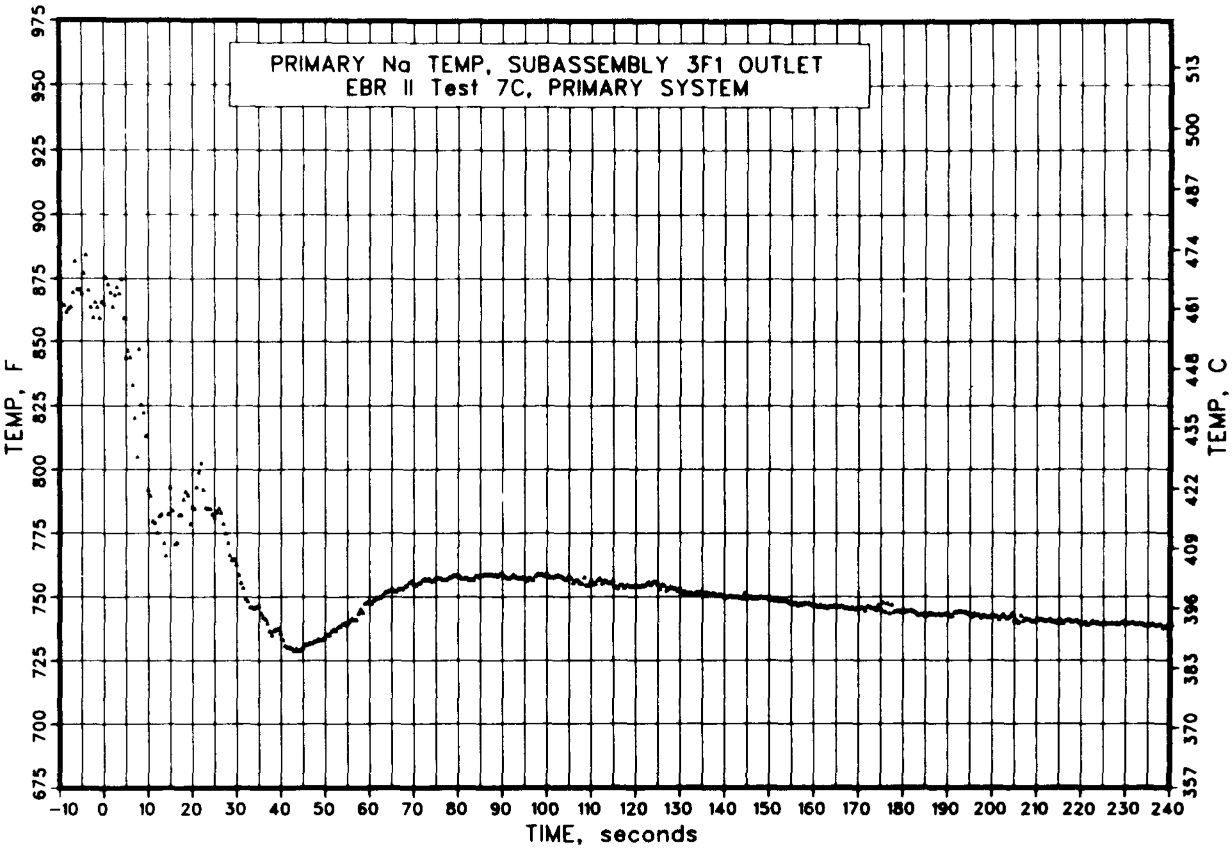
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 3F1 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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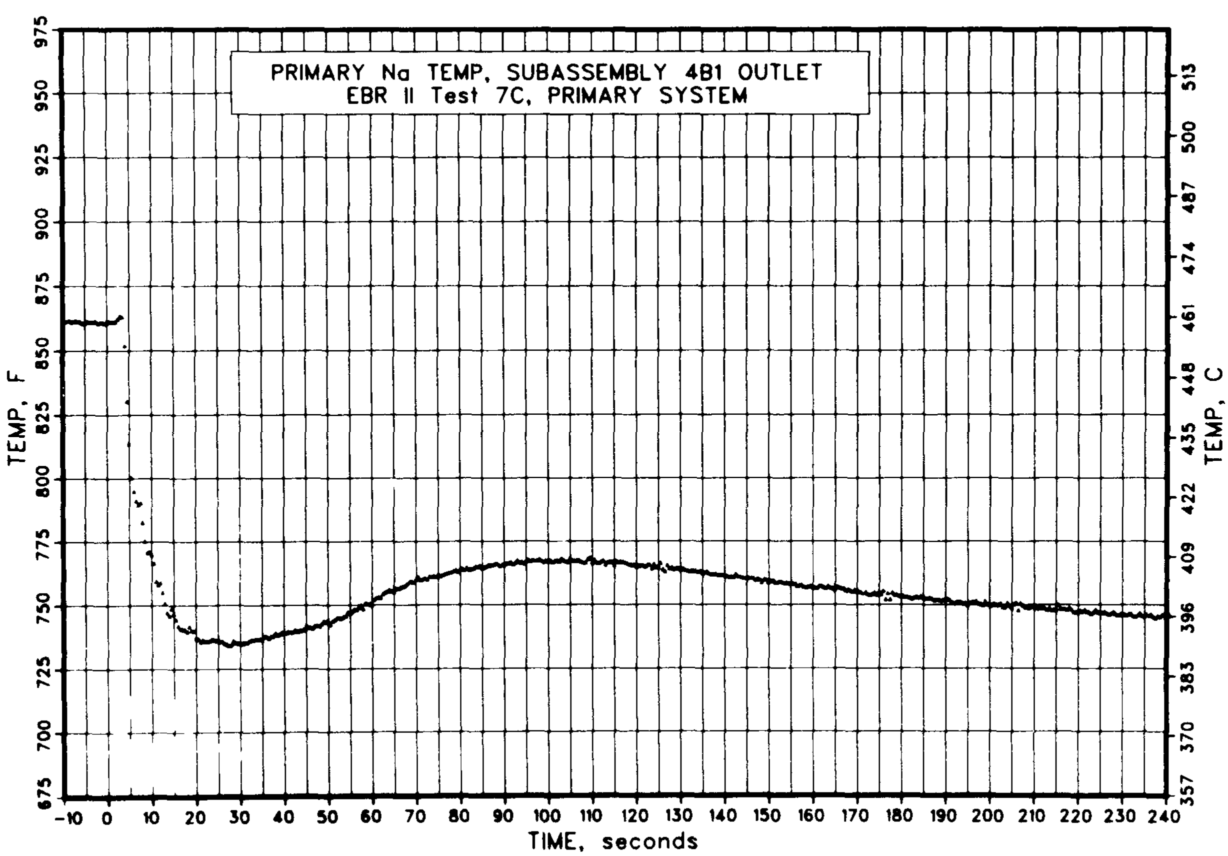
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EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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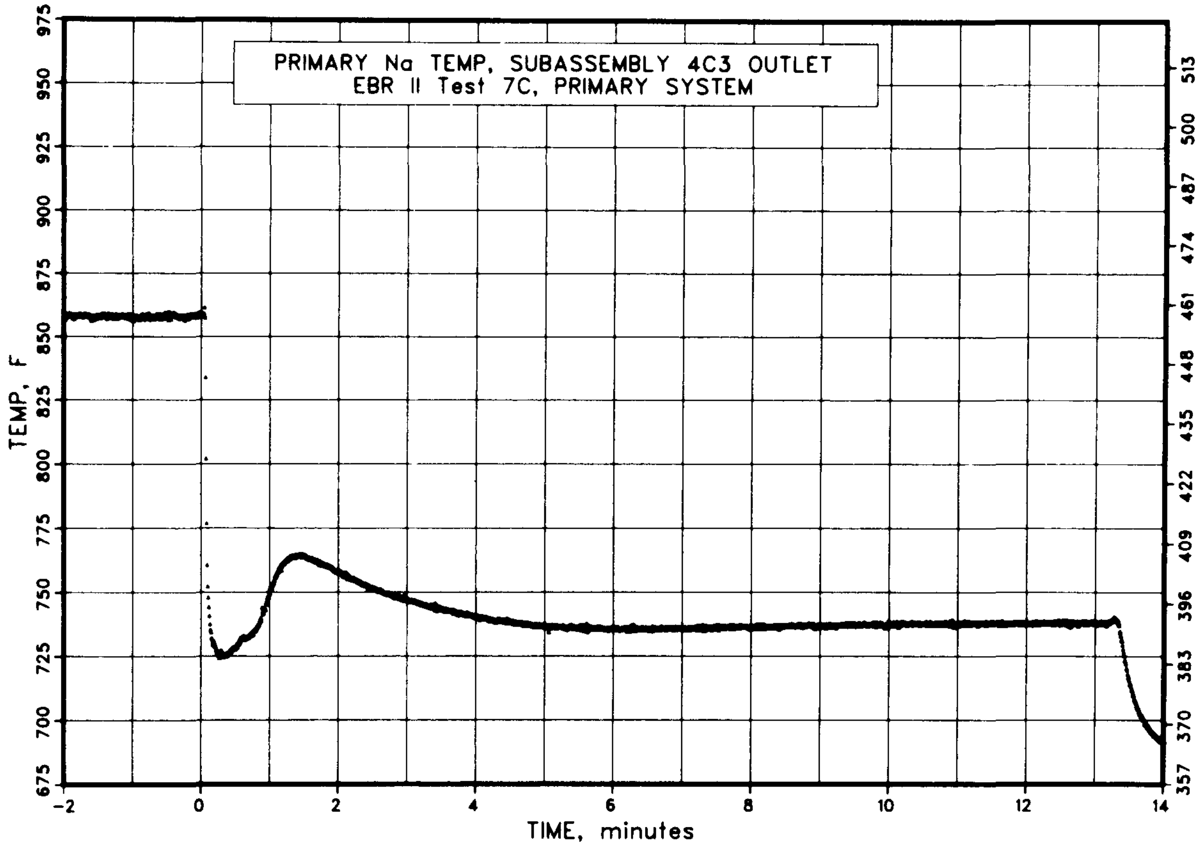
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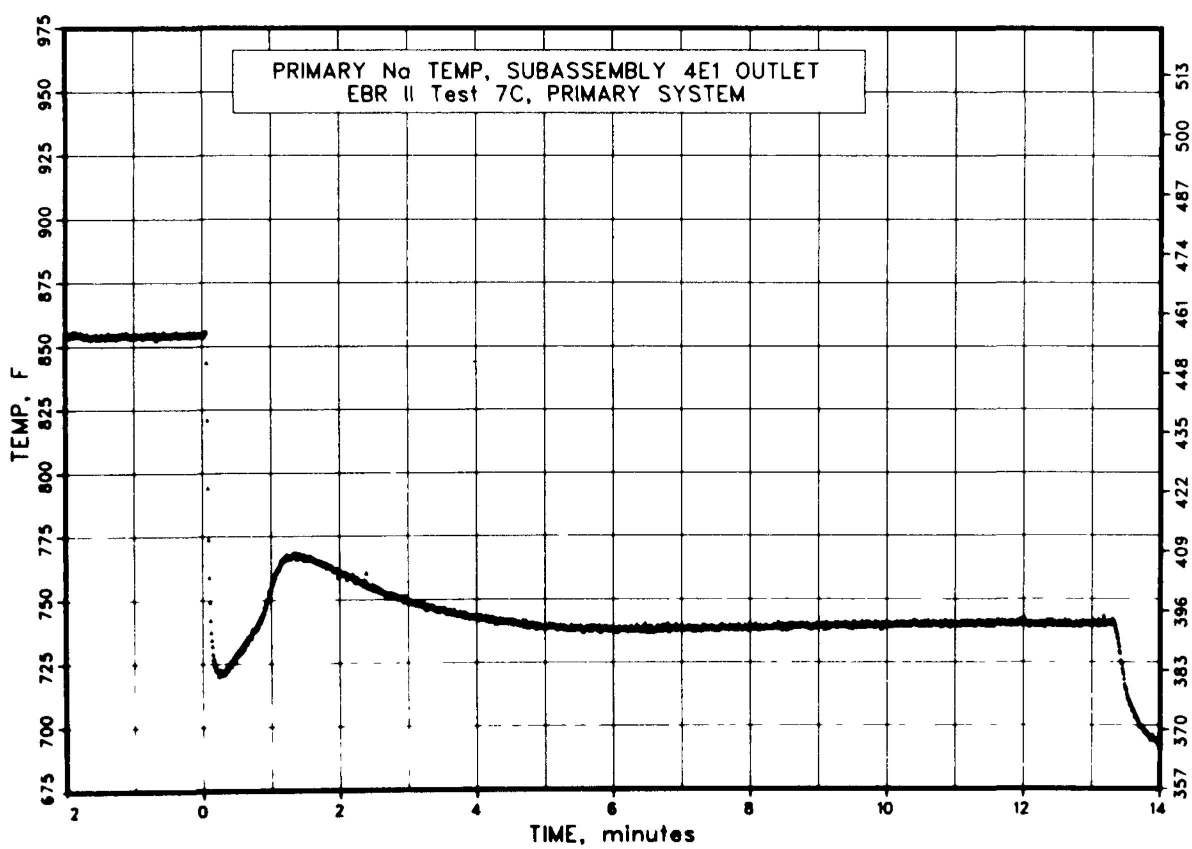
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 4E1 OUTLET
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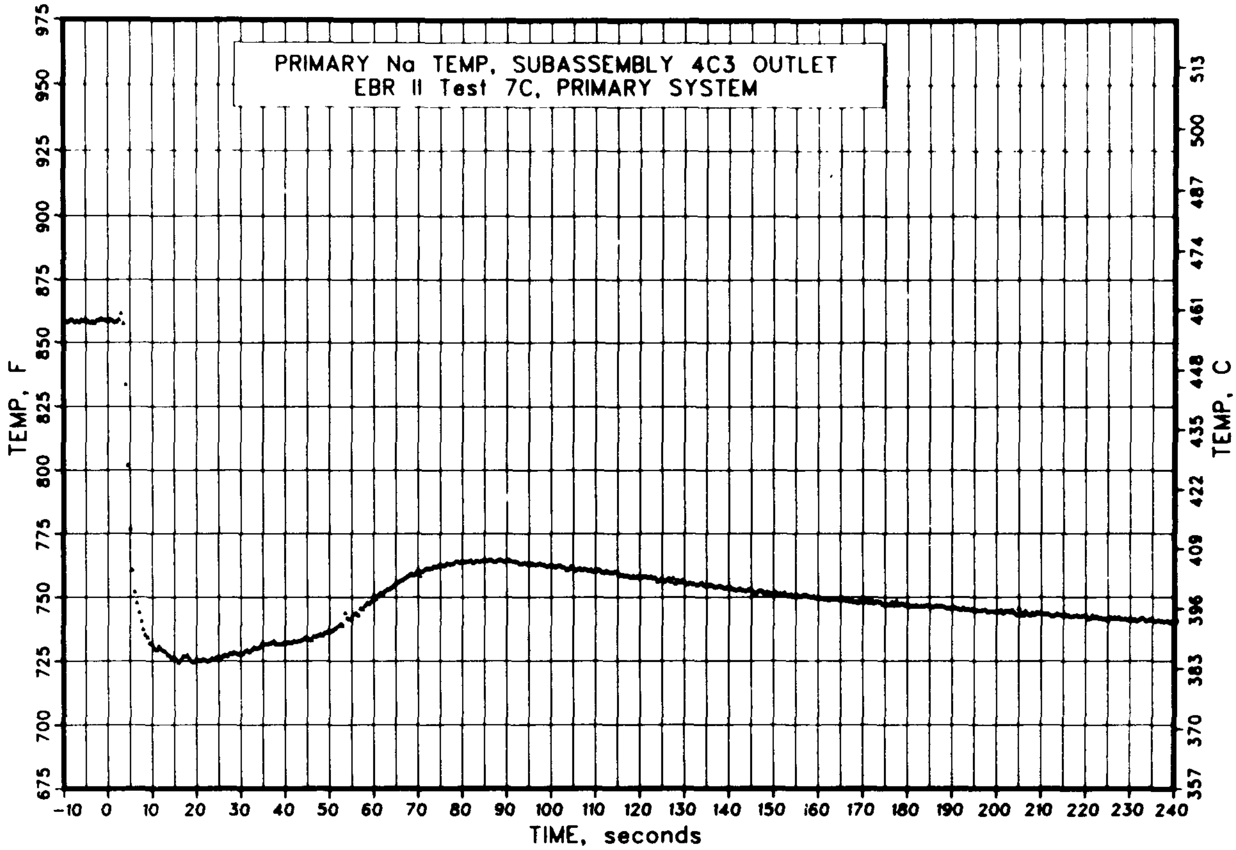
TEMP, F
TEMP, C
TIME, minutes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TEMP, C
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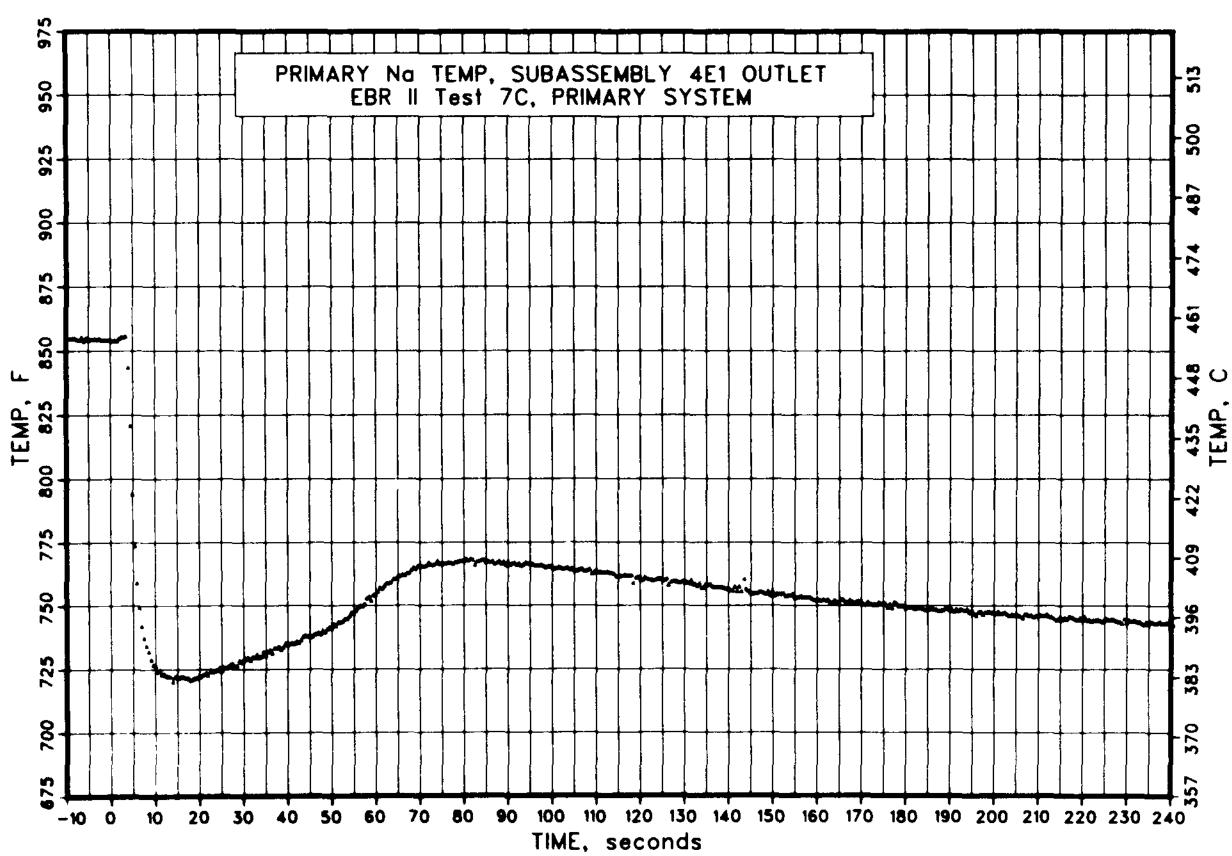
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EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, seconds
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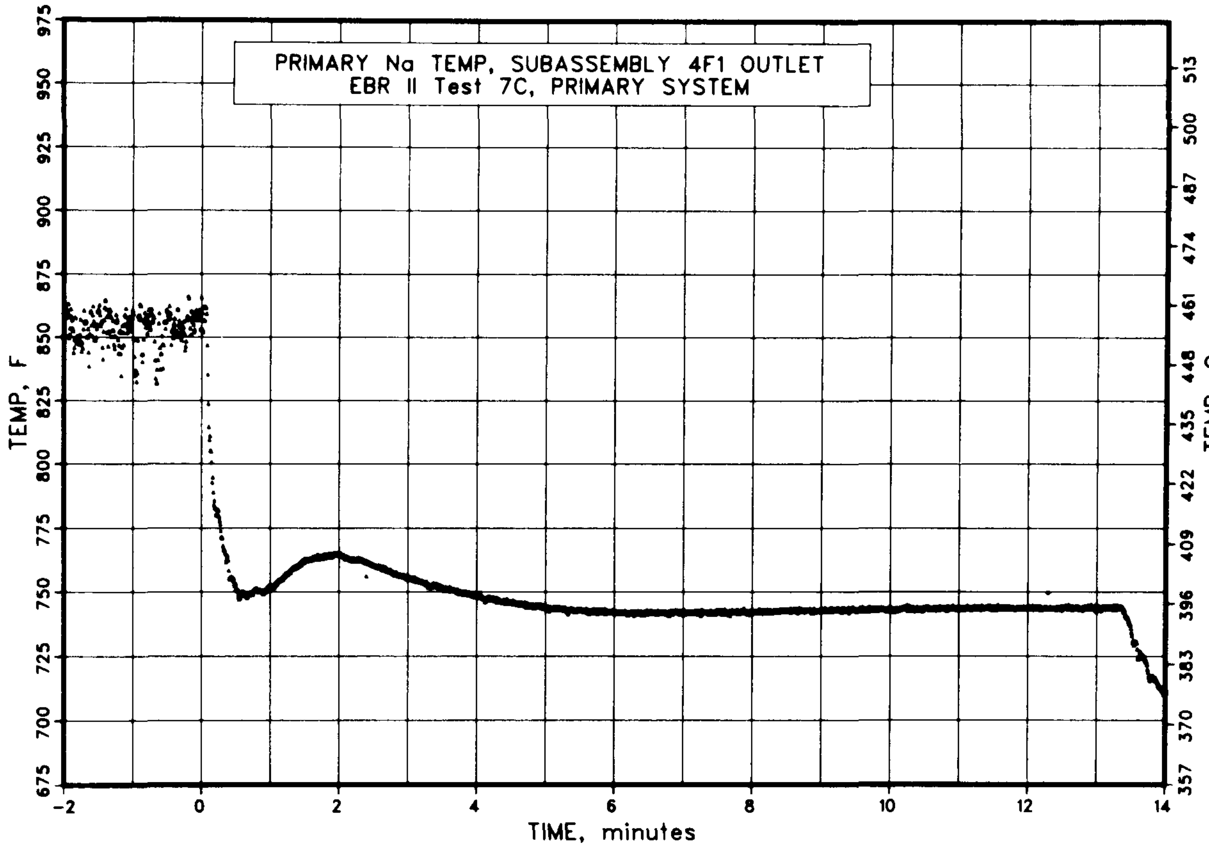
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EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, minutes
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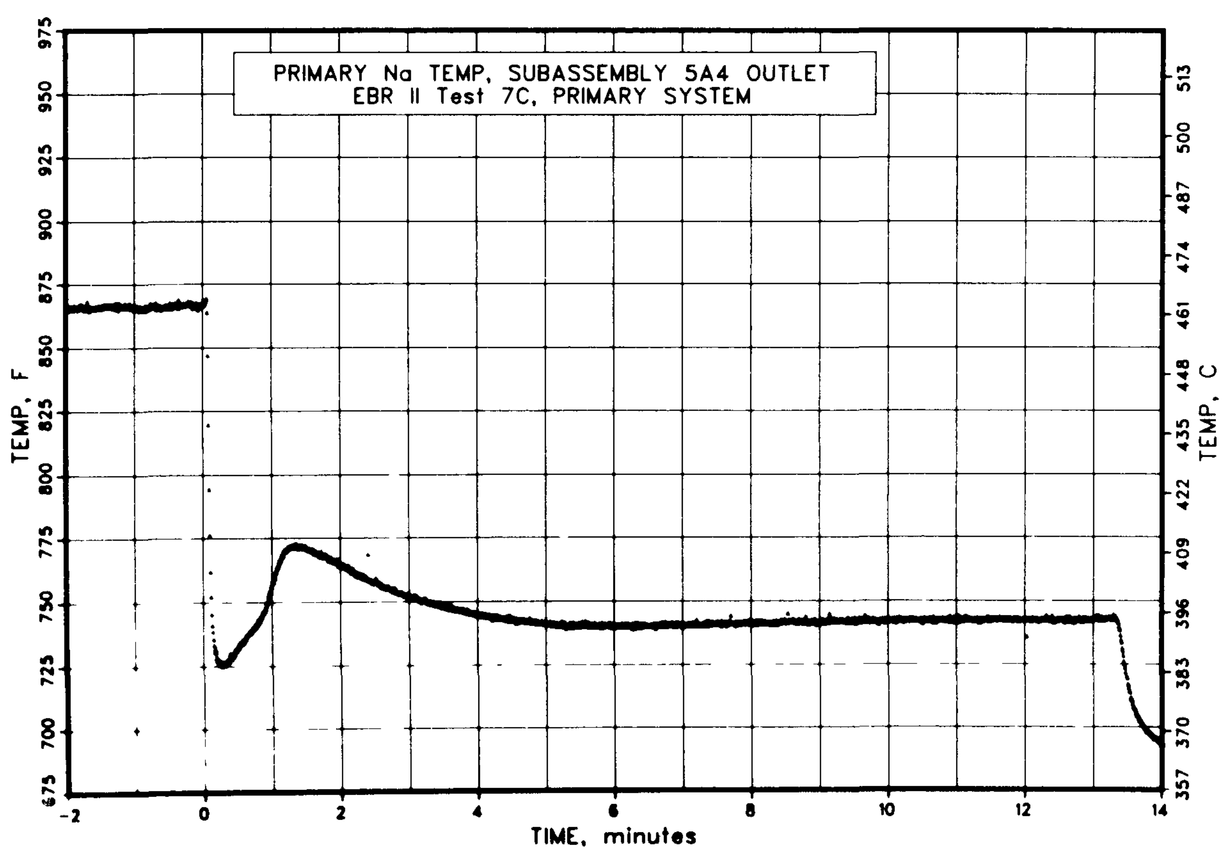
PRIMARY Na TEMP, SUBASSEMBLY 5A4 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
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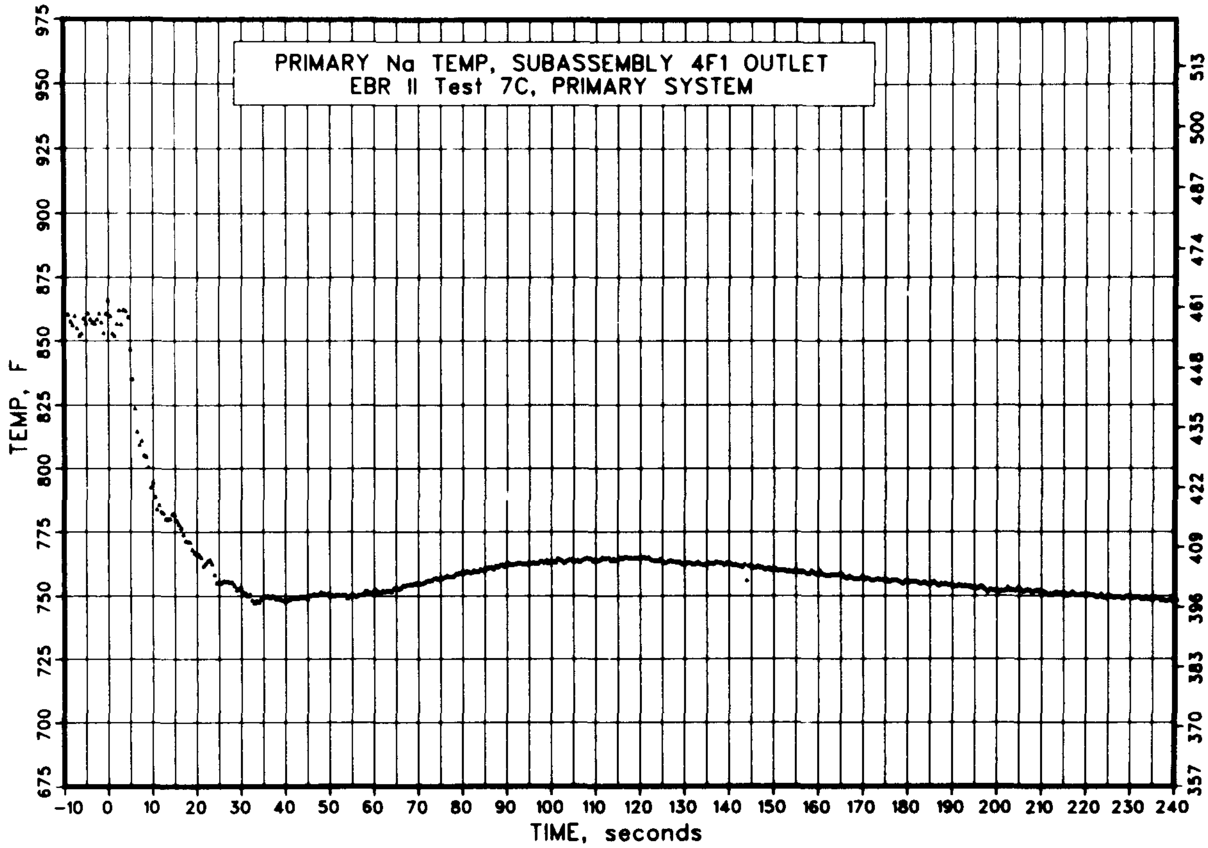
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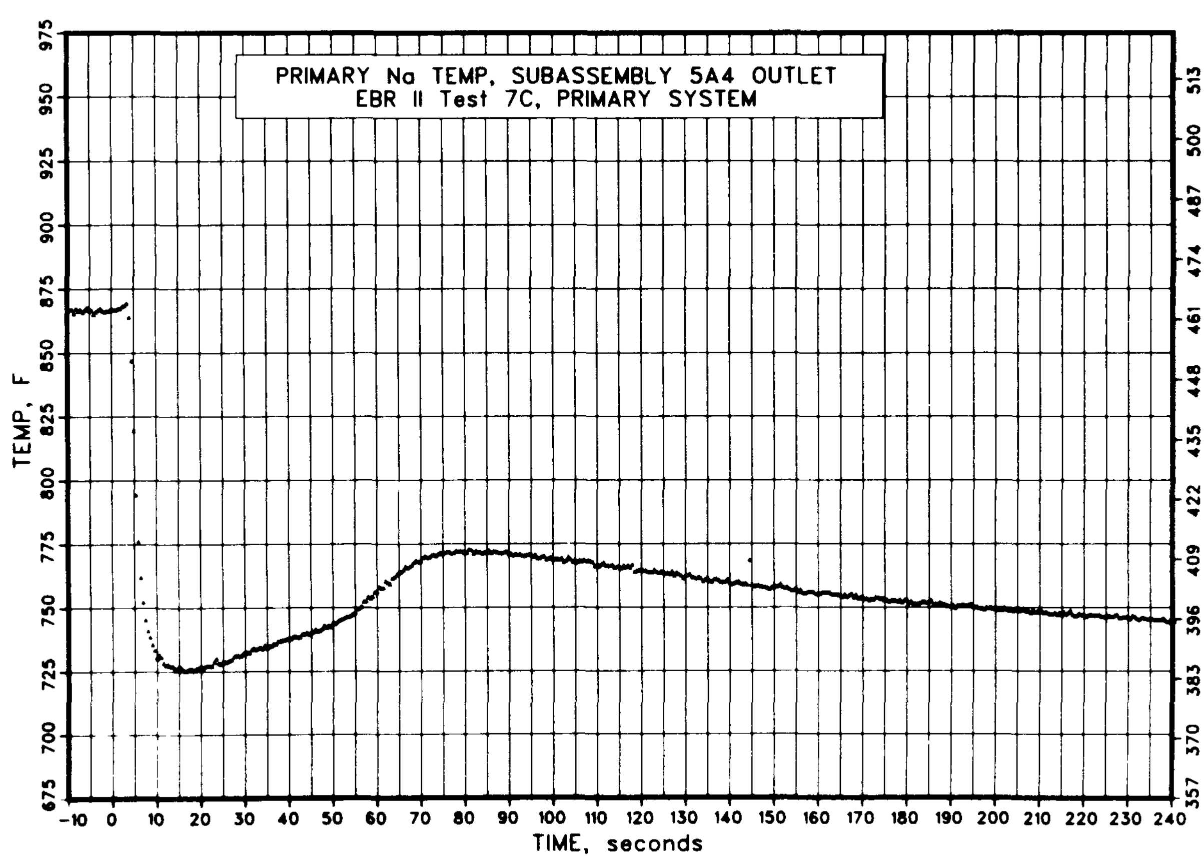
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds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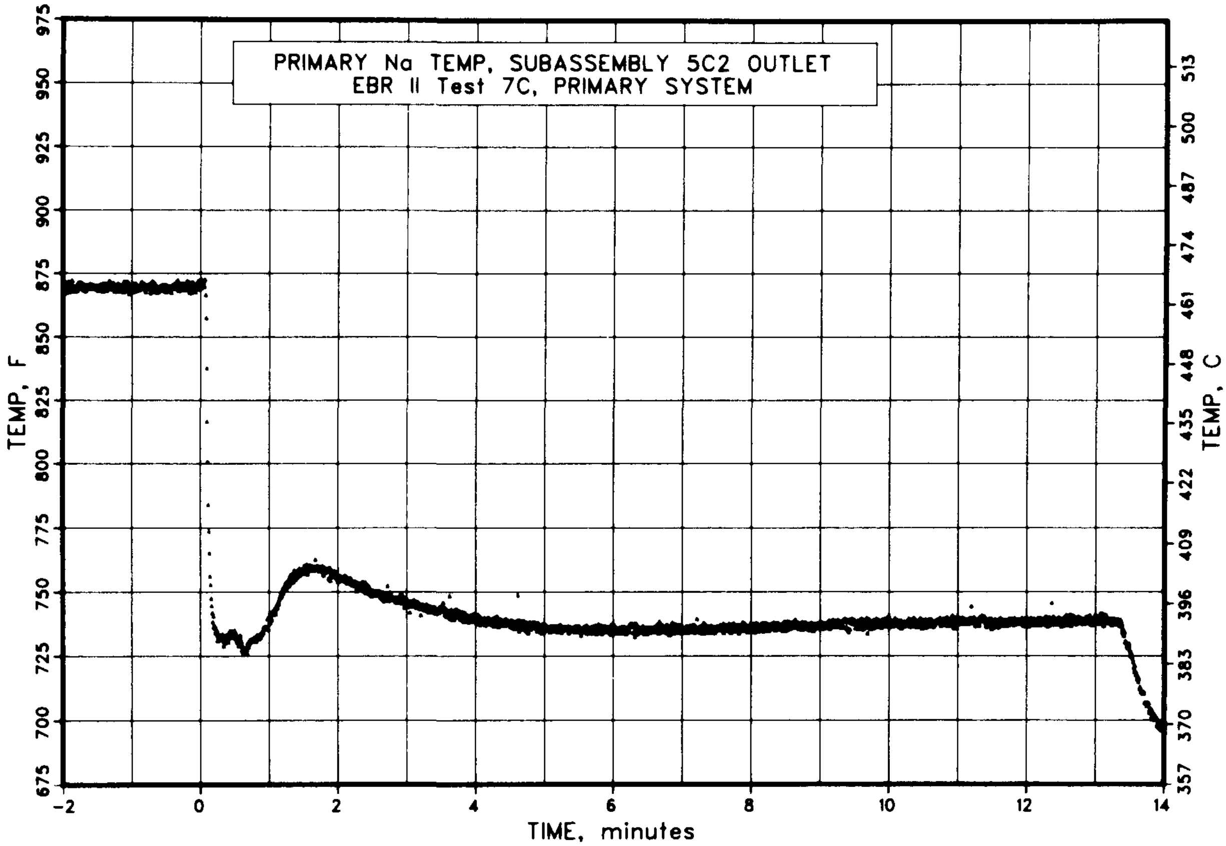
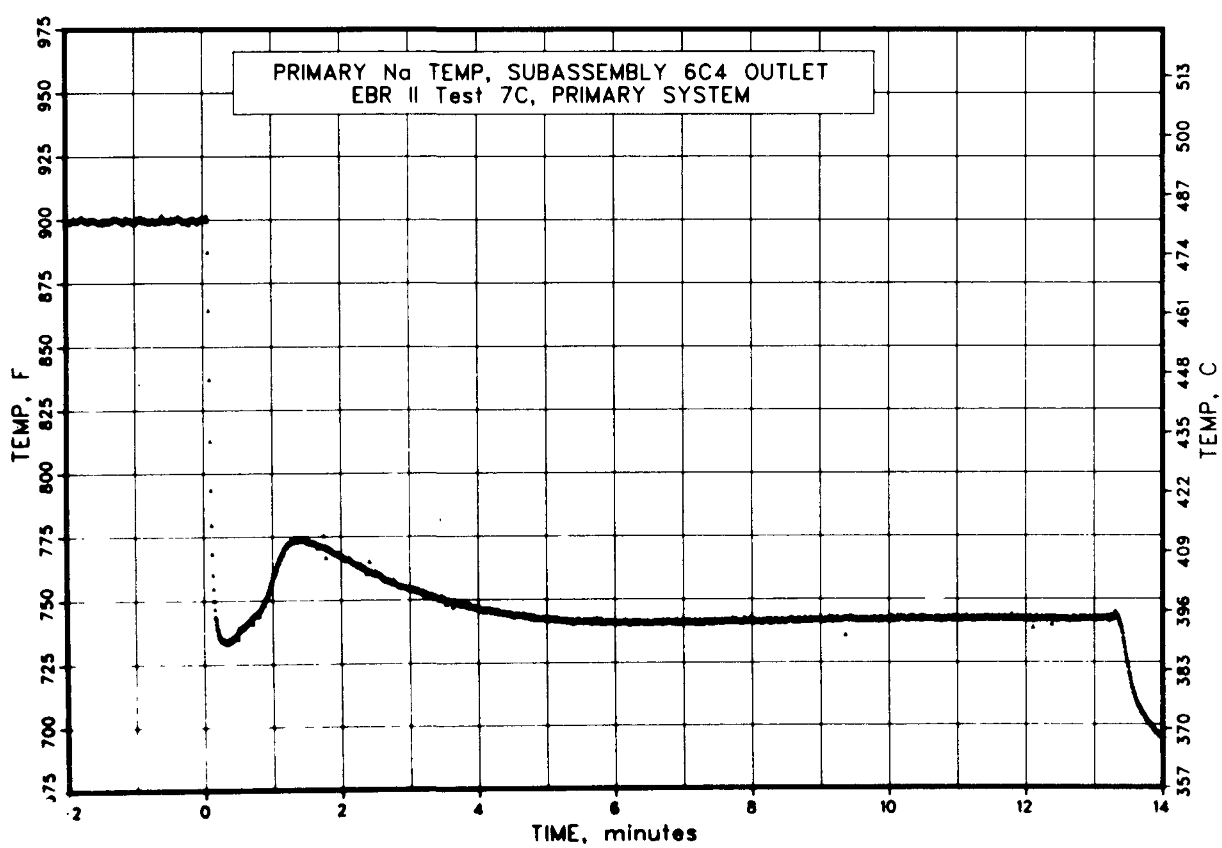
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 5C2 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, SUBASSEMBLY 6C4 OUTLET
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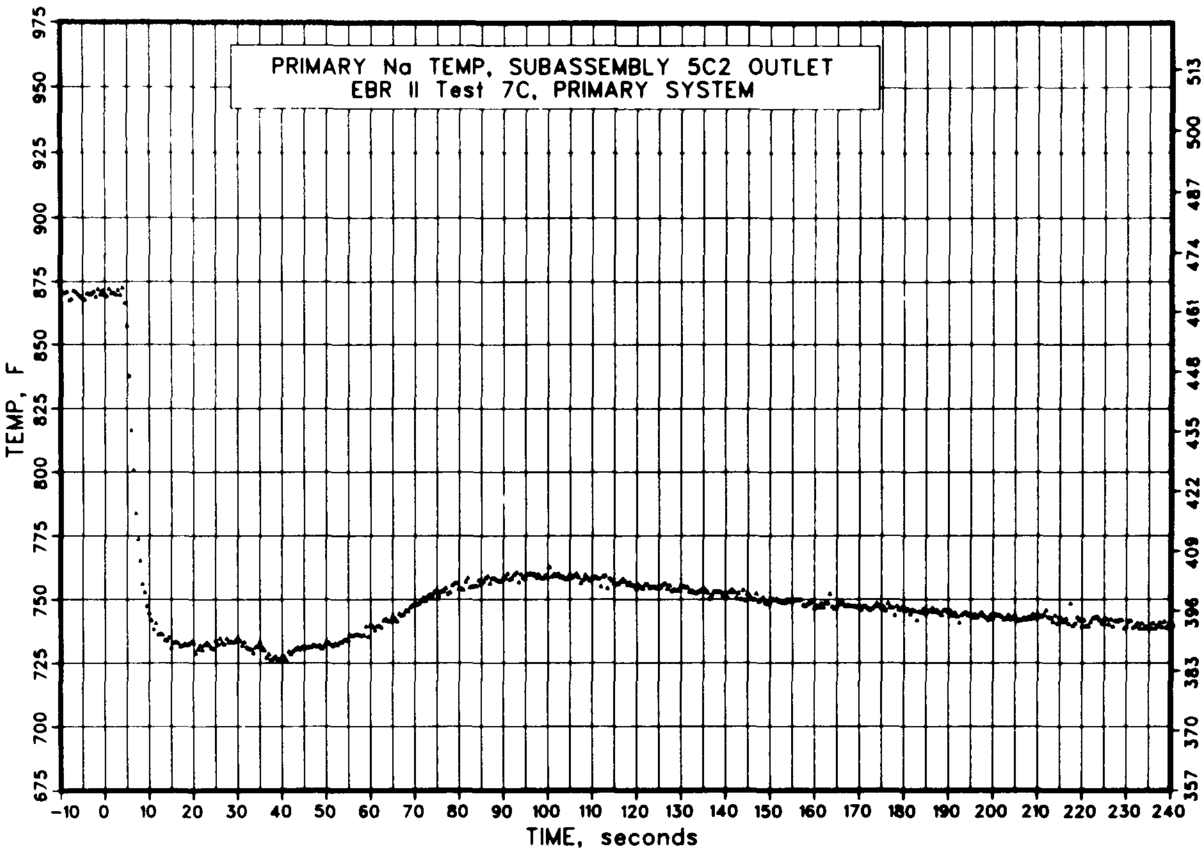
TEMP, F
TEMP, C
TIME, minutes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EBR II Test 7C, PRIMARY SYSTEM
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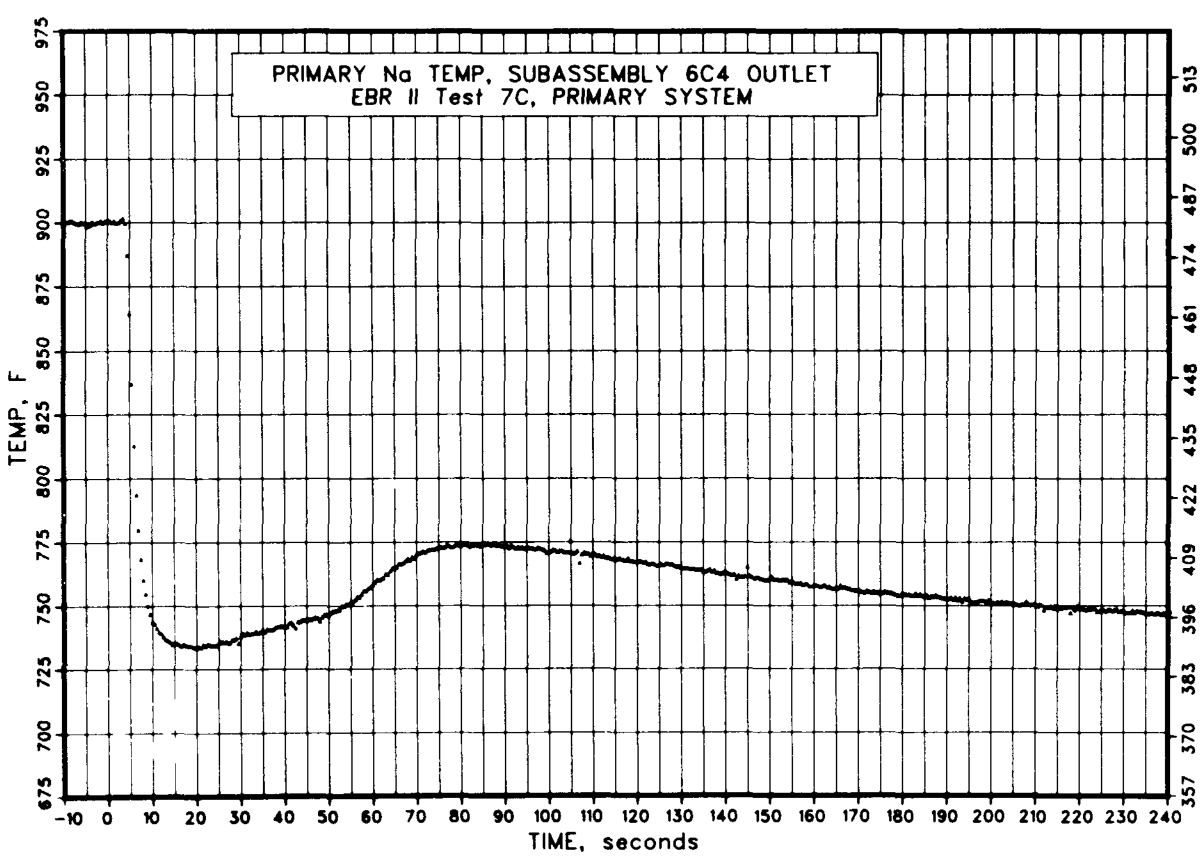
TEMP, C
TIME, seconds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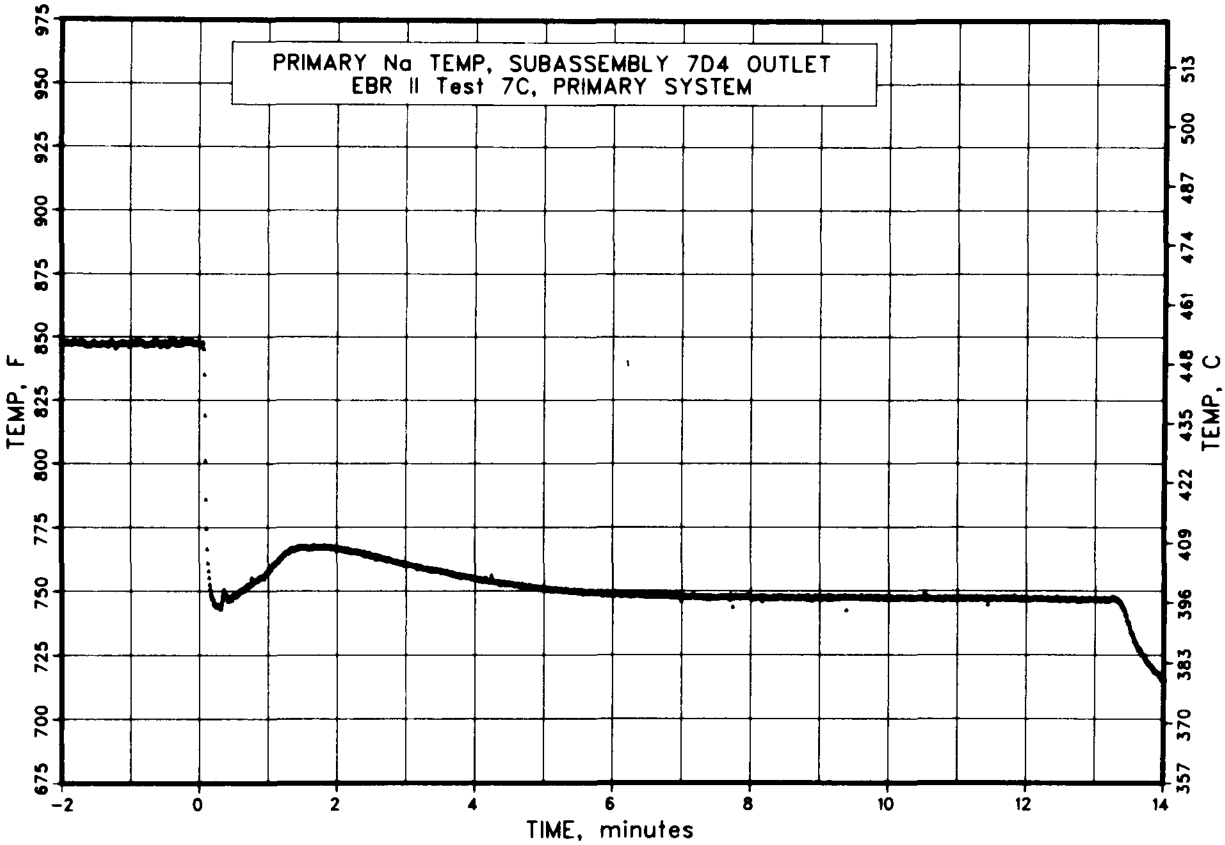
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds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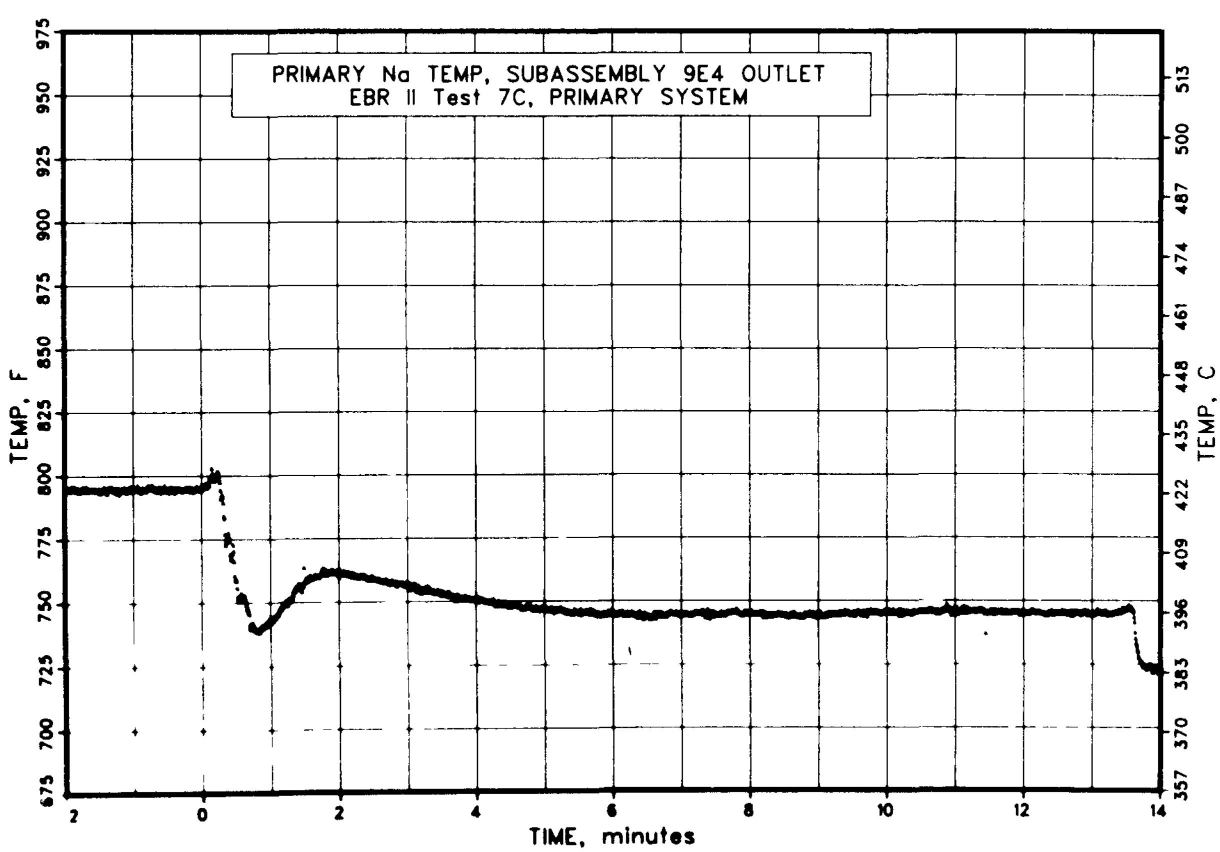
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EBR II Test 7C, PRIMARY SYSTEM
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TEMP, C
TIME, minutes
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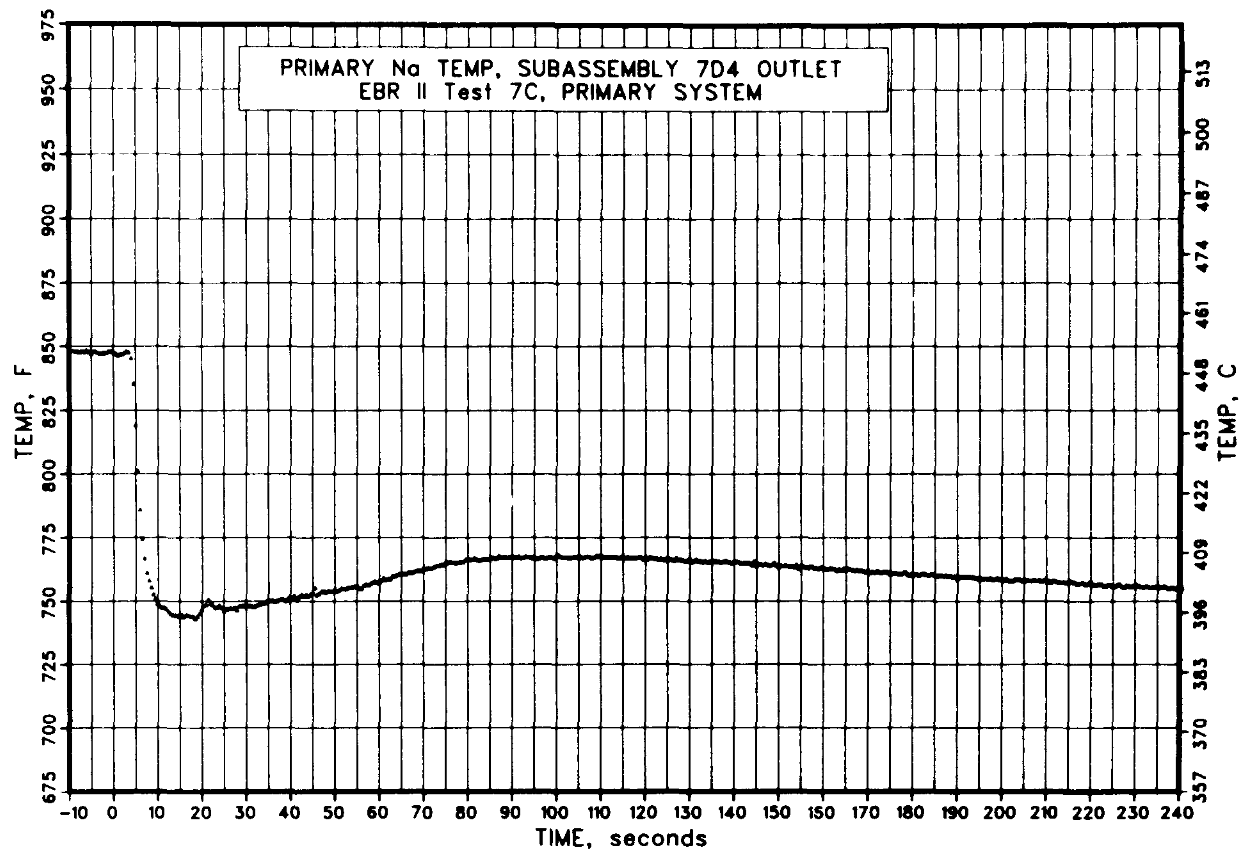
PRIMARY Na TEMP, SUBASSEMBLY 7D4 OUTLET
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TEMP, C
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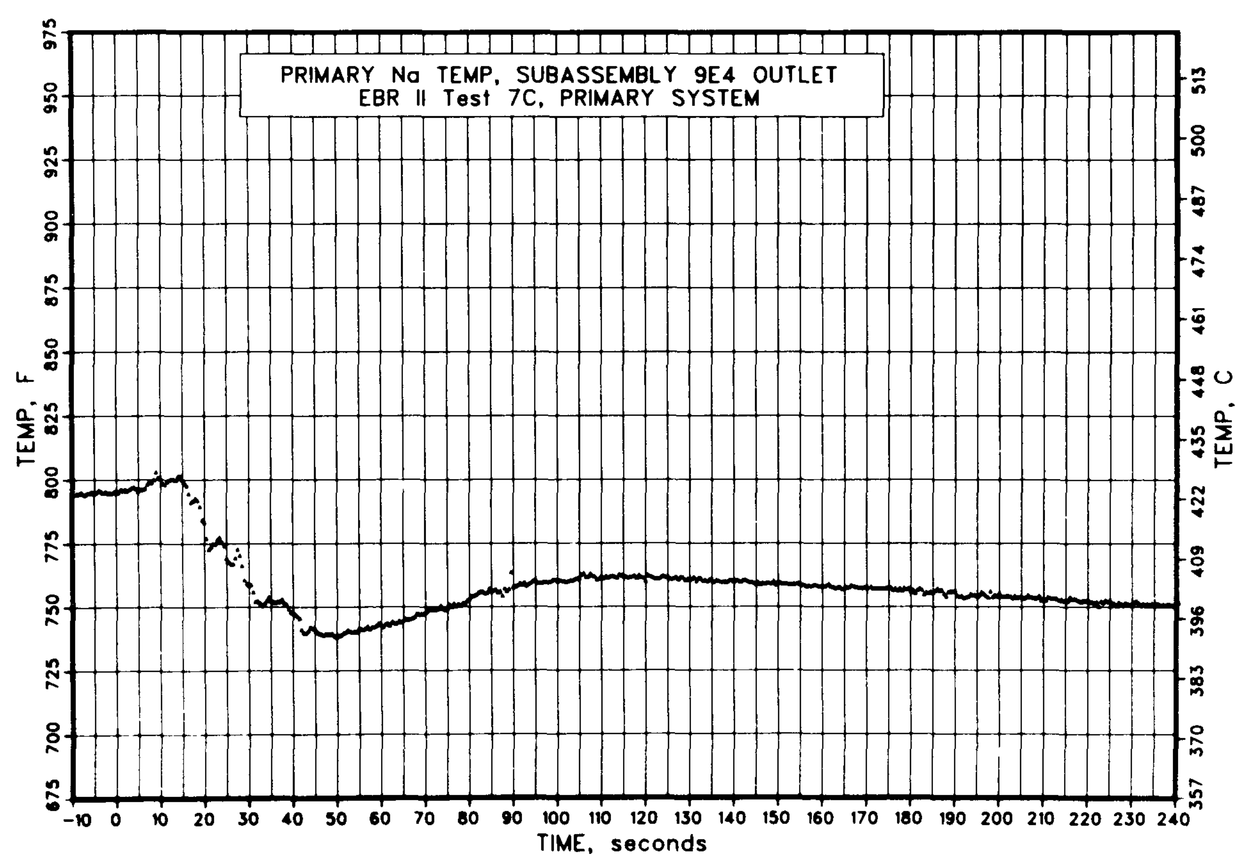
TIME, seconds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TEMP, C
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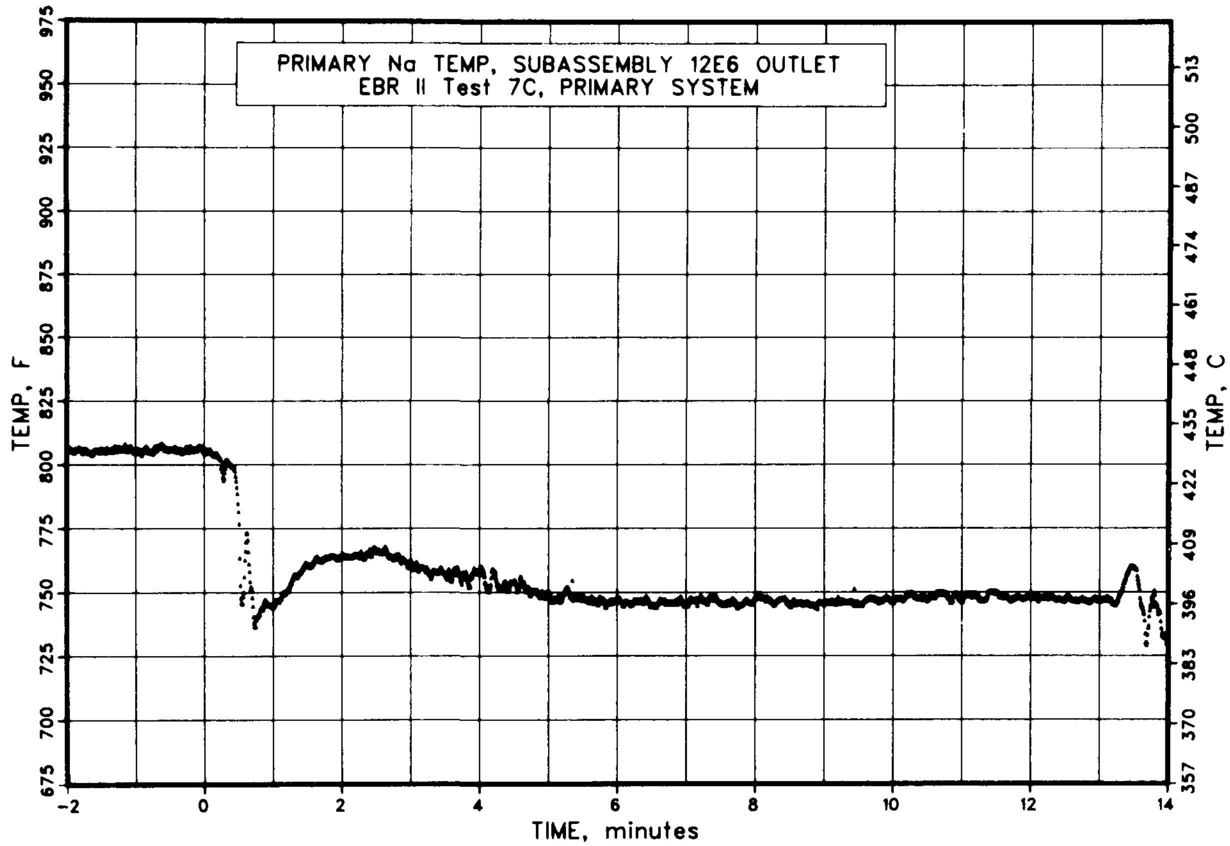
TIME, seconds


PRIMARY Na TEMP, SUBASSEMBLY 12E6 OUTLET
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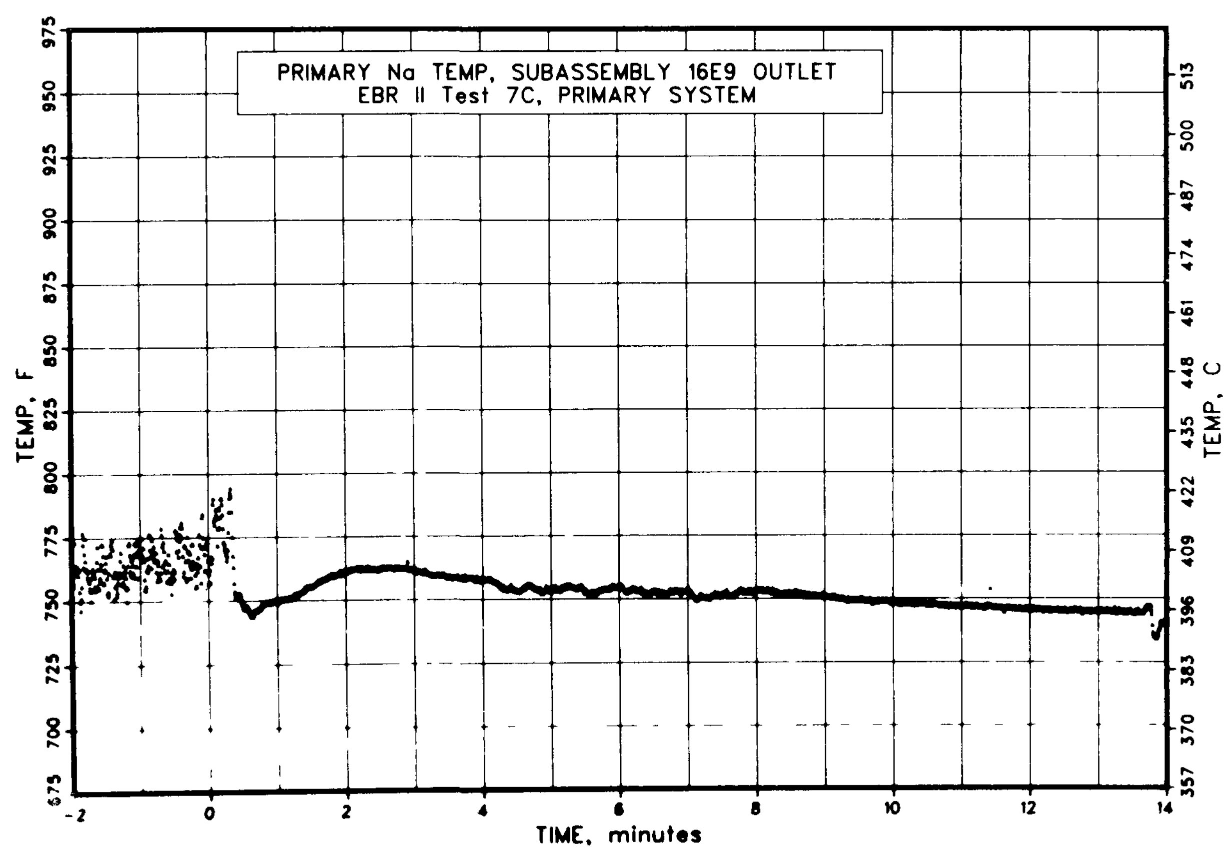
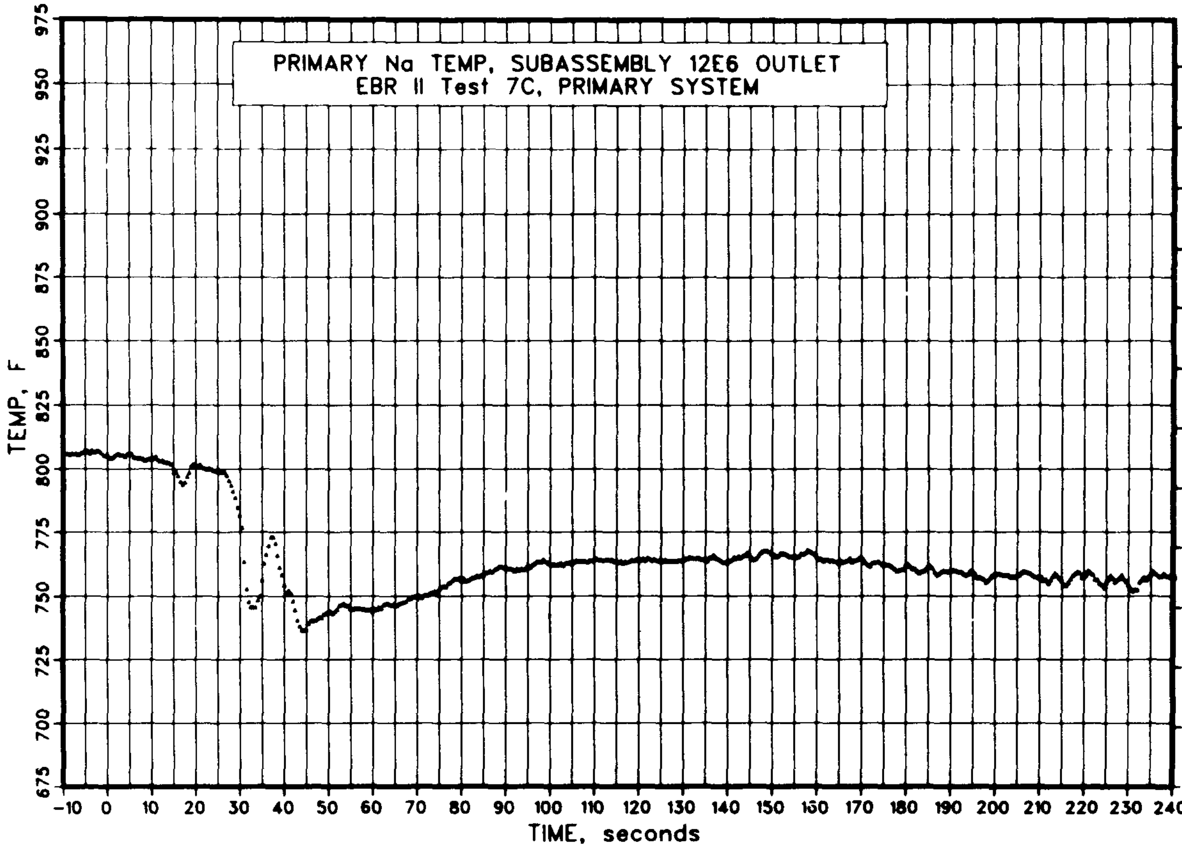
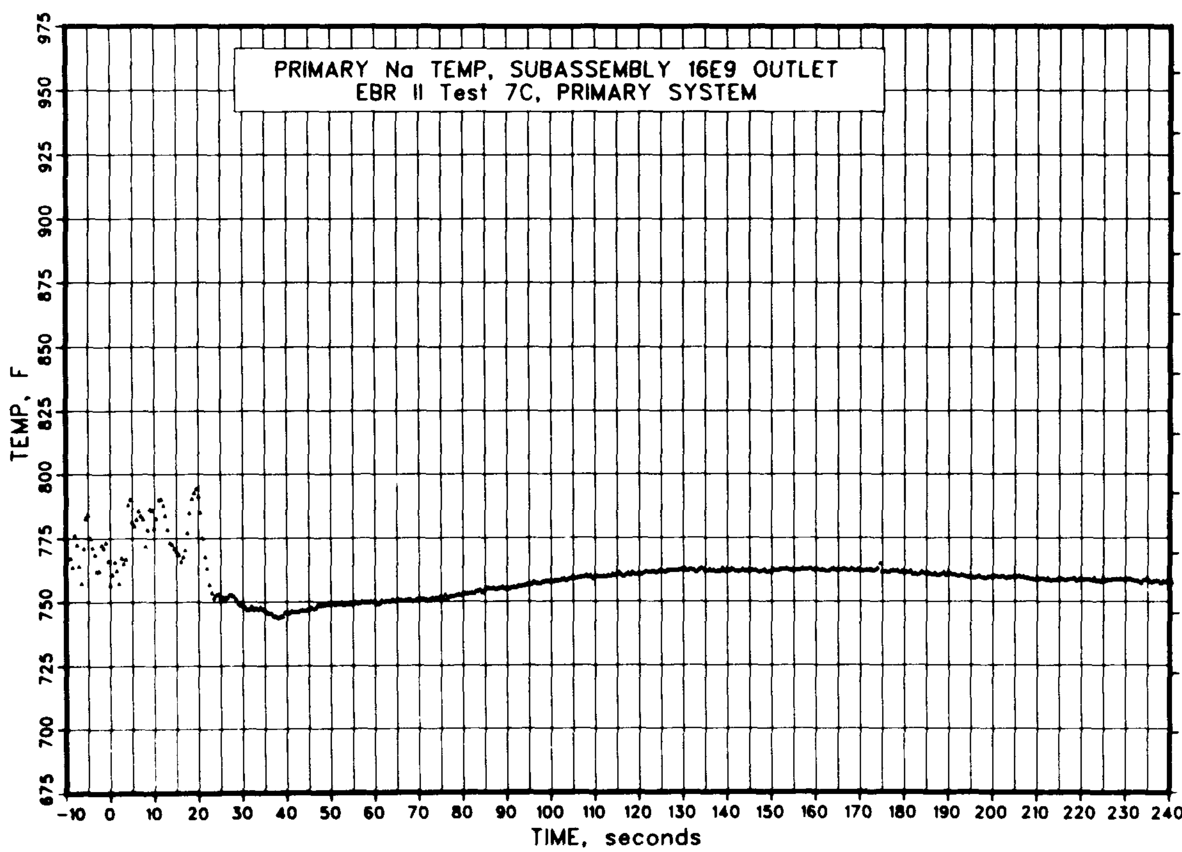
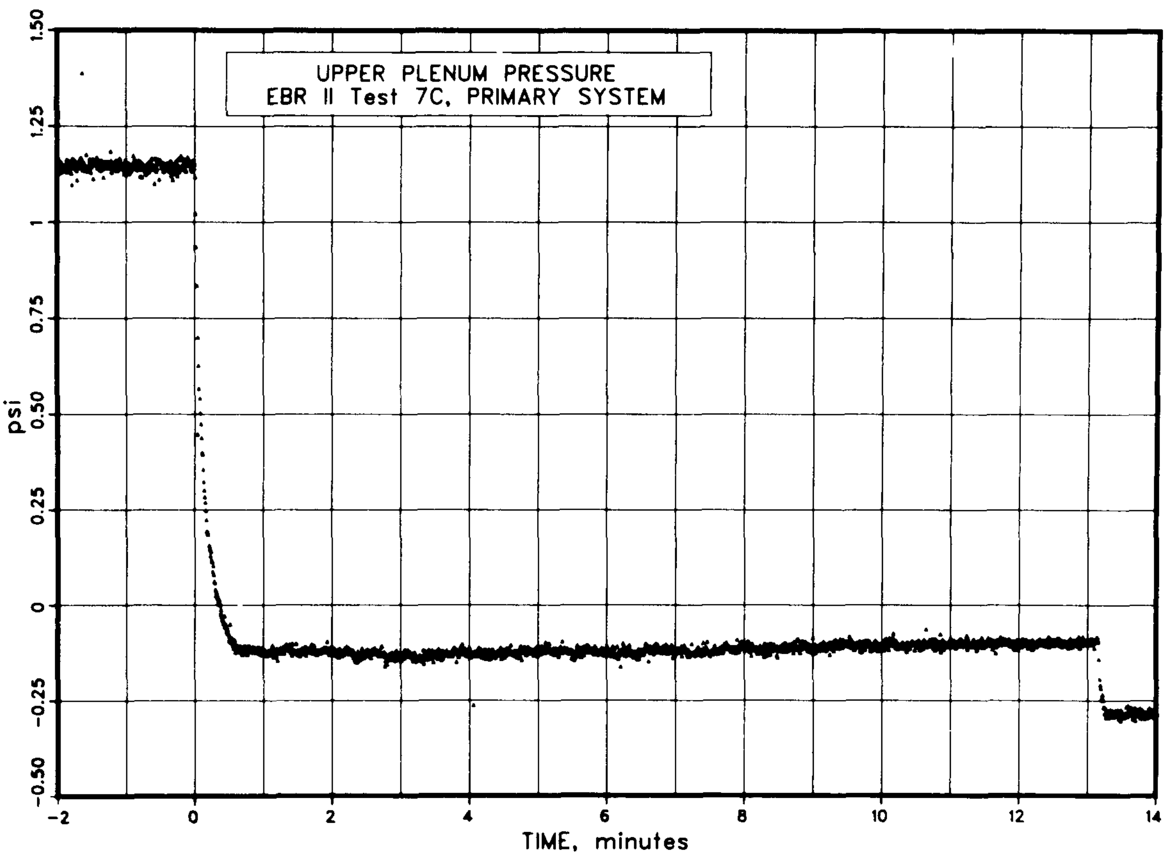
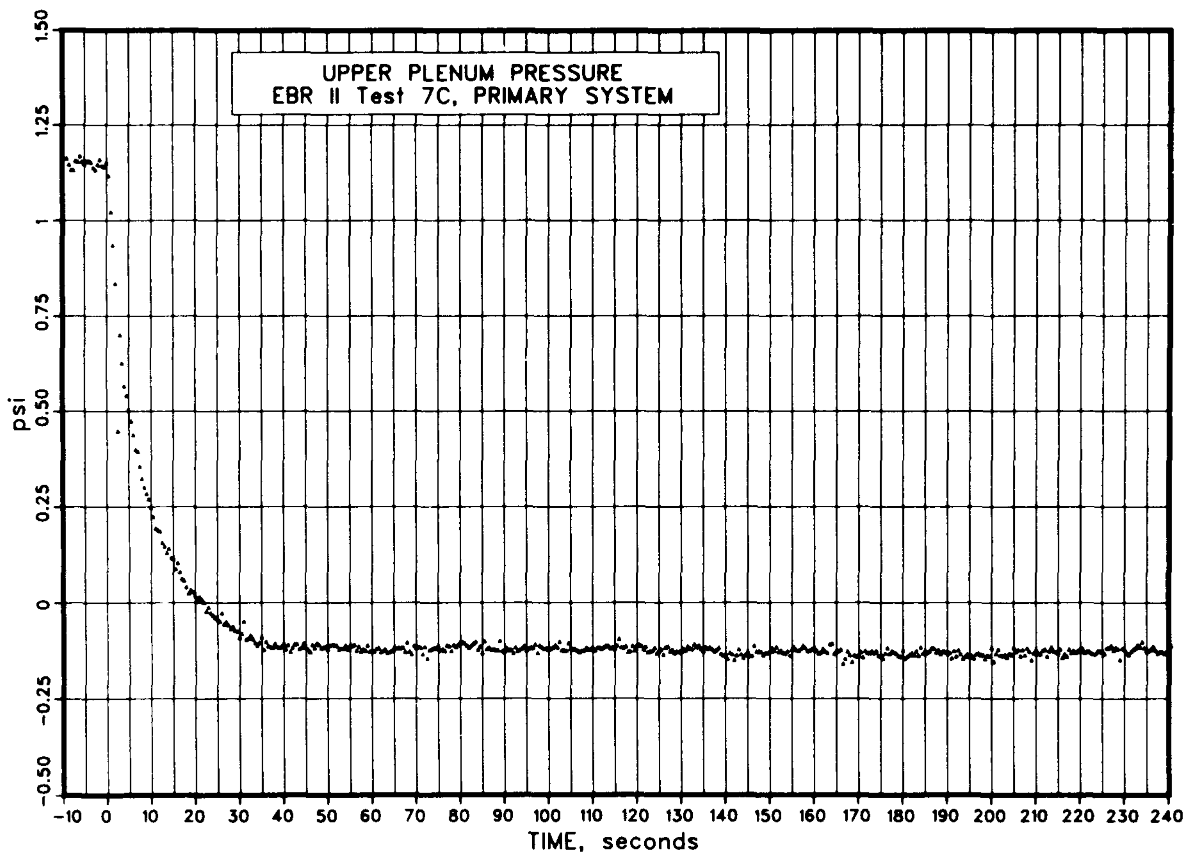
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14
TIME, minutes

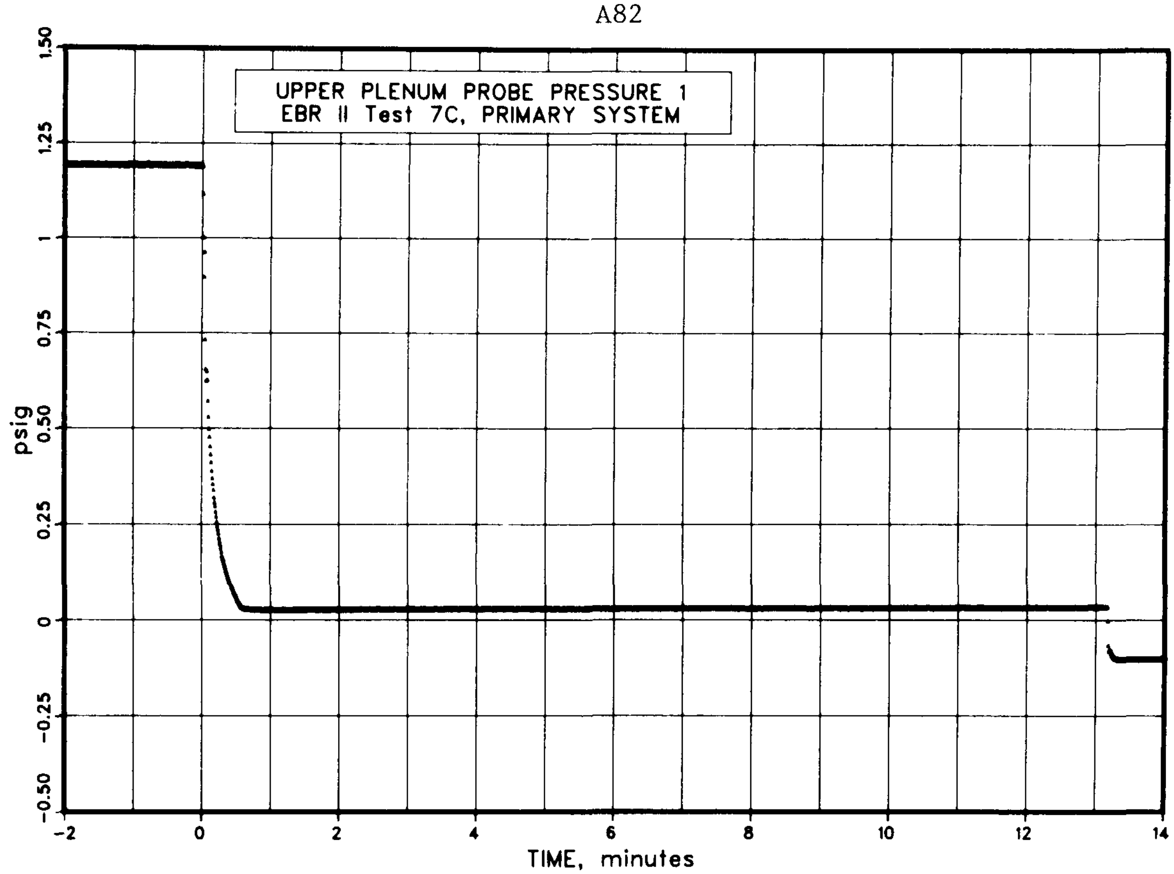

PRIMARY Na TEMP, SUBASSEMBLY 16E9 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-2
0
2
4
6
8
10
12
14
TIME, minutes

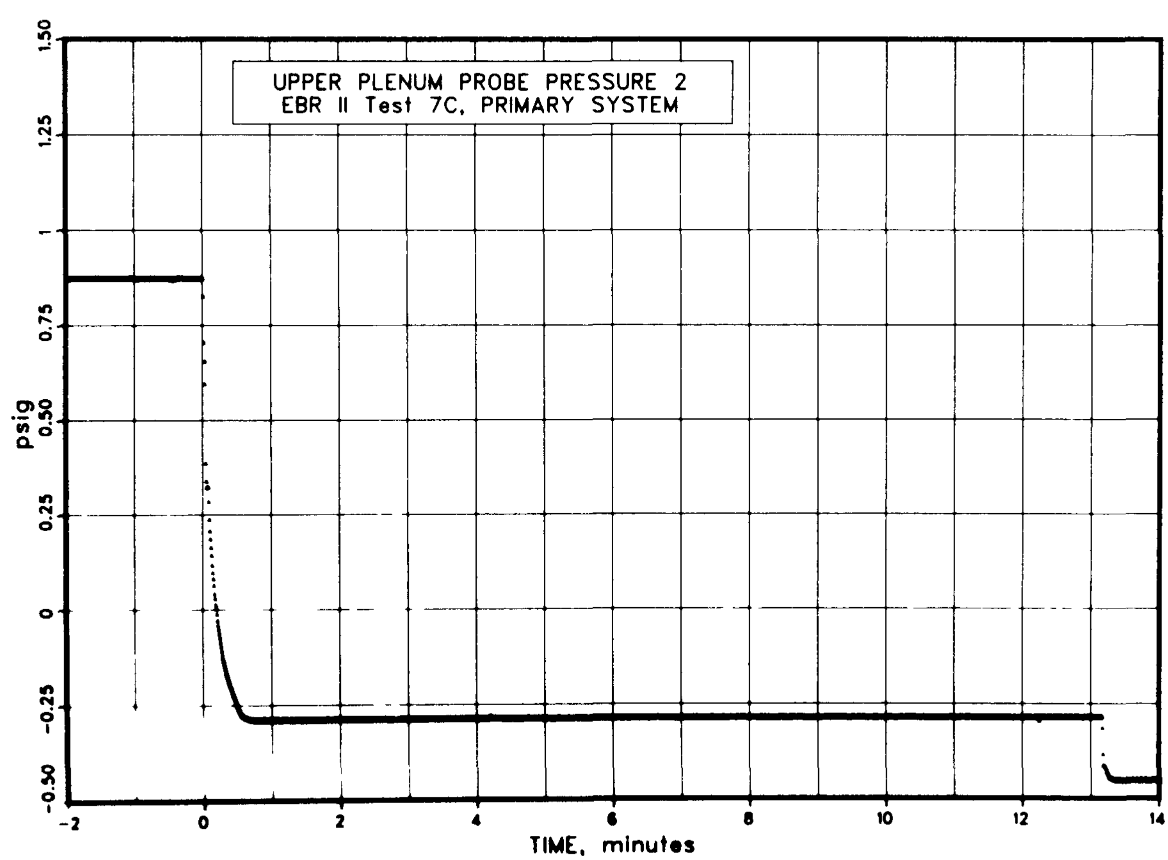

PRIMARY Na TEMP, SUBASSEMBLY 12E6 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

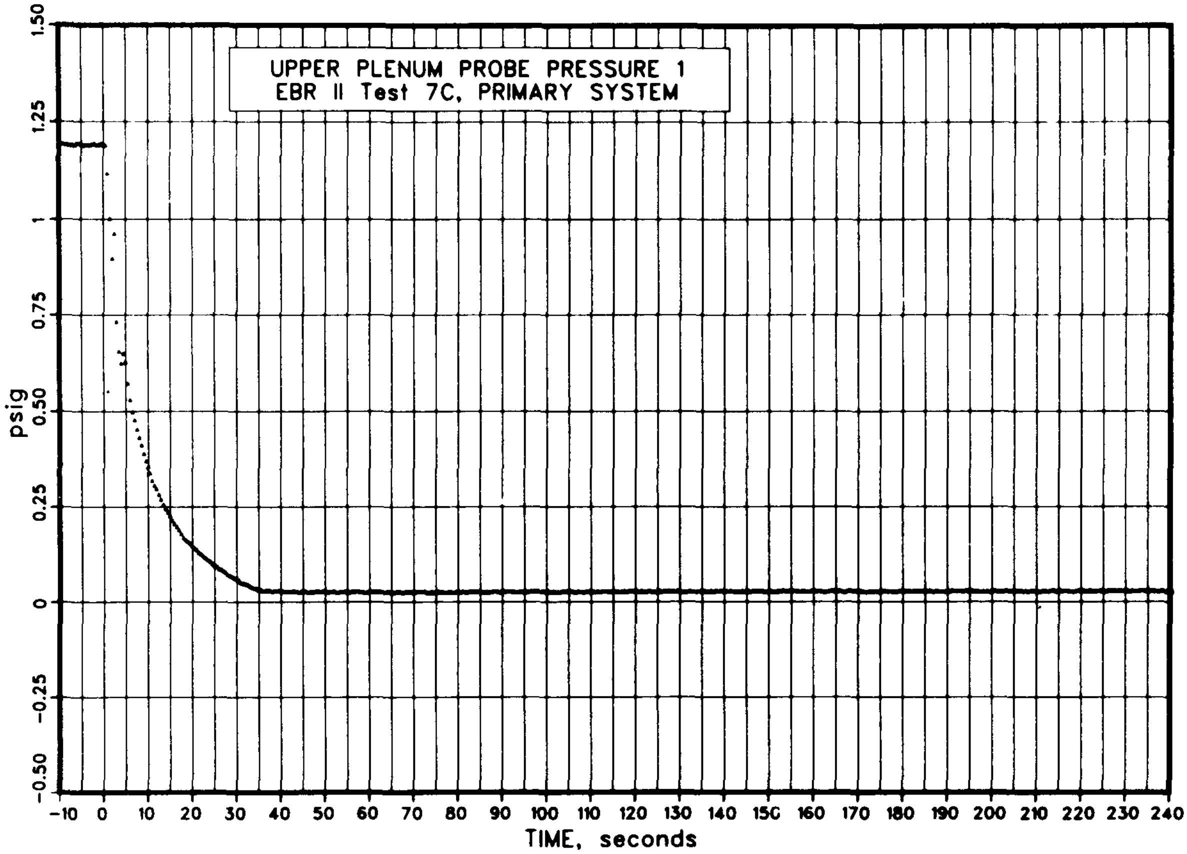

PRIMARY Na TEMP, SUBASSEMBLY 16E9 OUTLET
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
975
950
925
900
875
850
825
800
775
750
725
700
675
TEMP, C
513
500
487
474
461
448
435
422
409
396
383
370
357
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

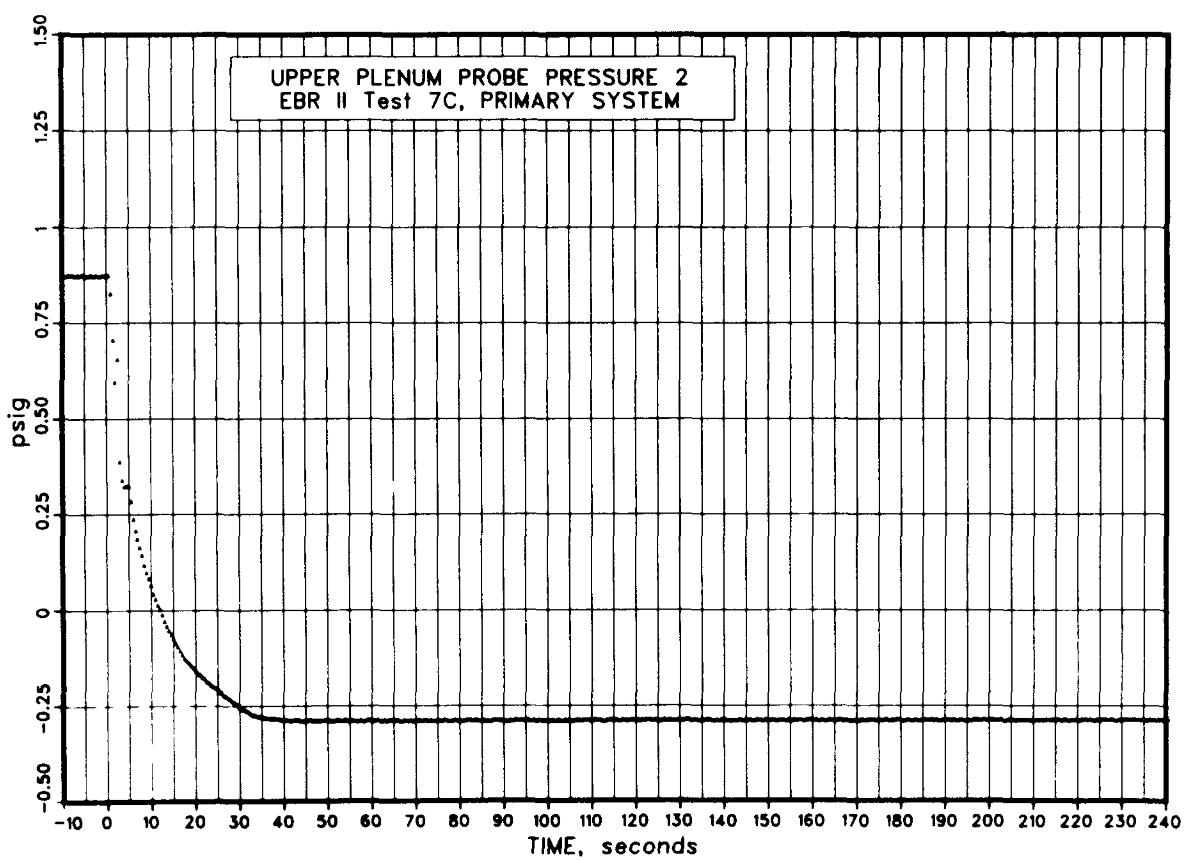

UPPER PLENUM PRESSURE
EBR II Test 7C, PRIMARY SYSTEM
psi
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-2
0
2
4
6
8
10
12
14
TIME, minutes

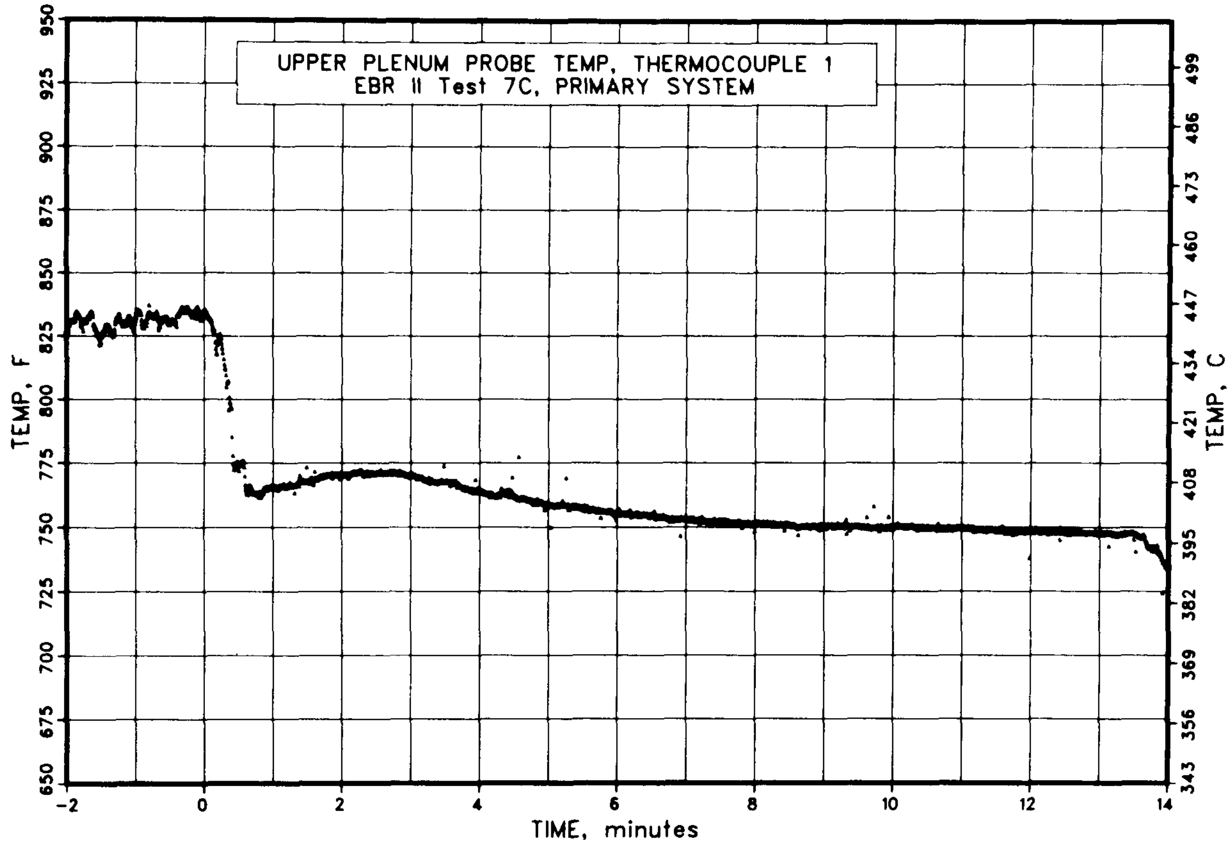

UPPER PLENUM PRESSURE
EBR II Test 7C, PRIMARY SYSTEM
psi
1.50
1.25
1
0.75
0.50
0.25
0
−0.25
−0.50
−10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

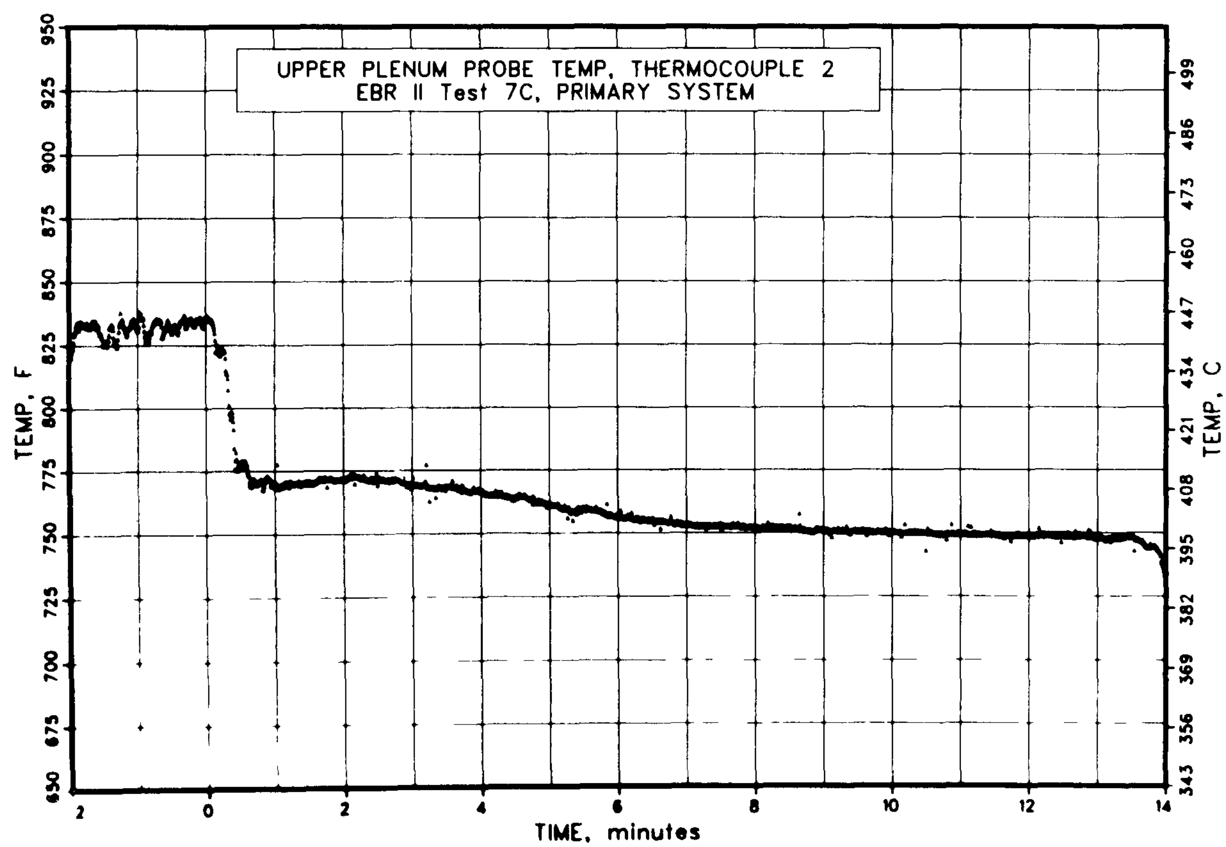

UPPER PLENUM PROBE PRESSURE 1
EBR II Test 7C, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-2
0
2
4
6
8
10
12
14
TIME, minutes

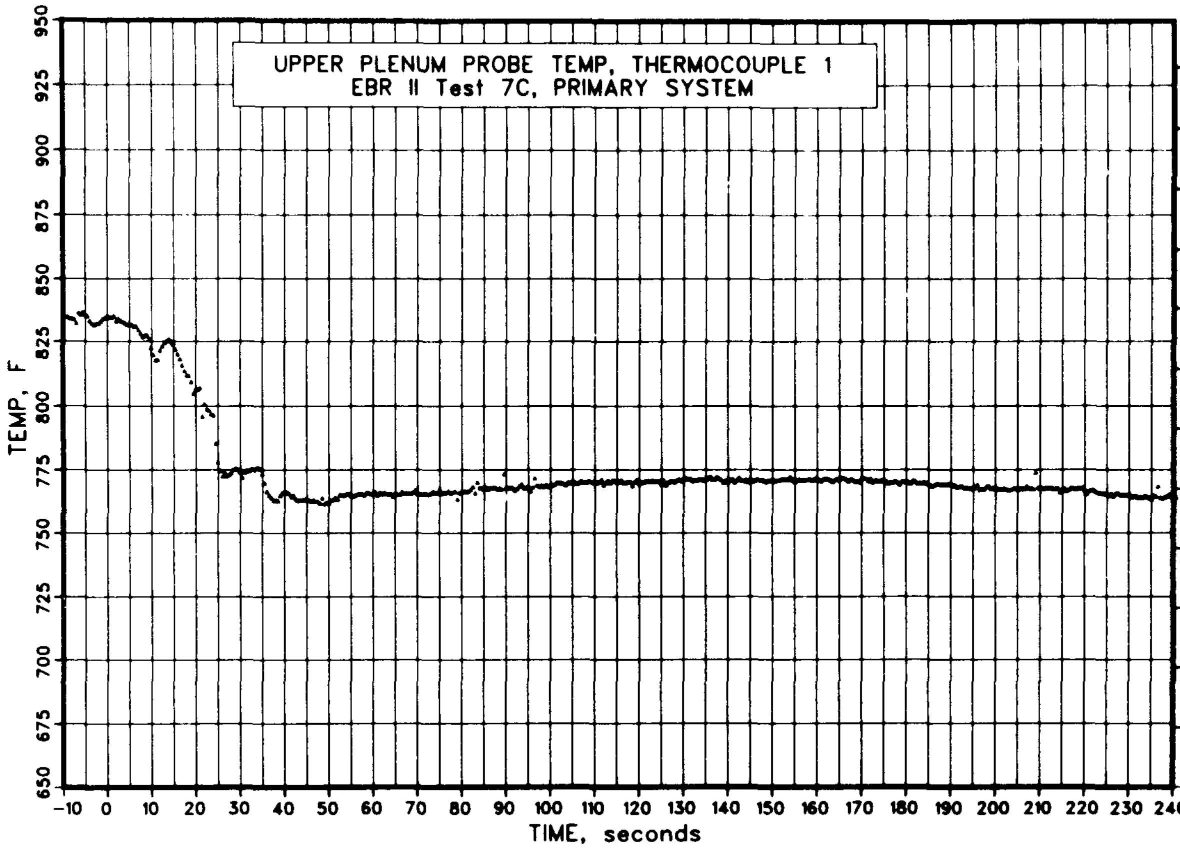

UPPER PLENUM PROBE PRESSURE 2
EBR II Test 7C, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-2
0
2
4
6
8
10
12
14
TIME, minutes

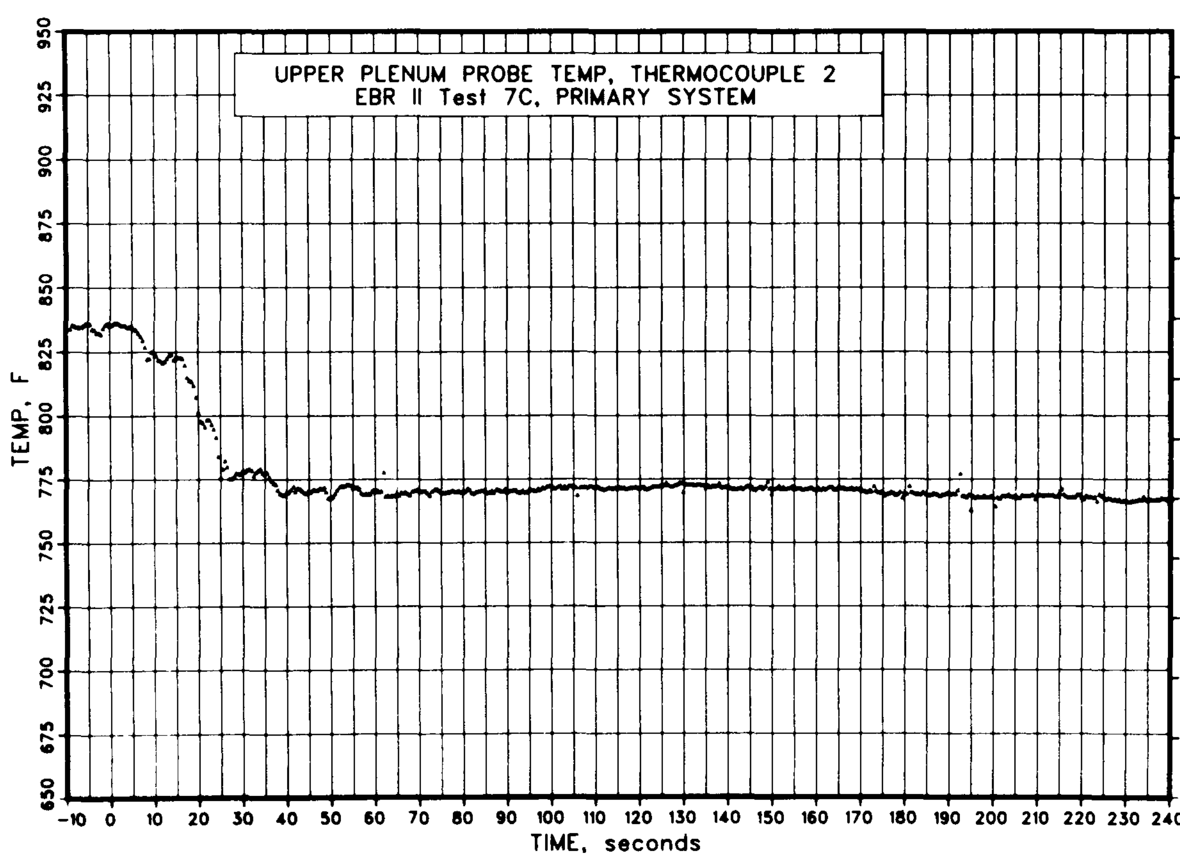

UPPER PLENUM PROBE PRESSURE 1
EBR II Test 7C, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

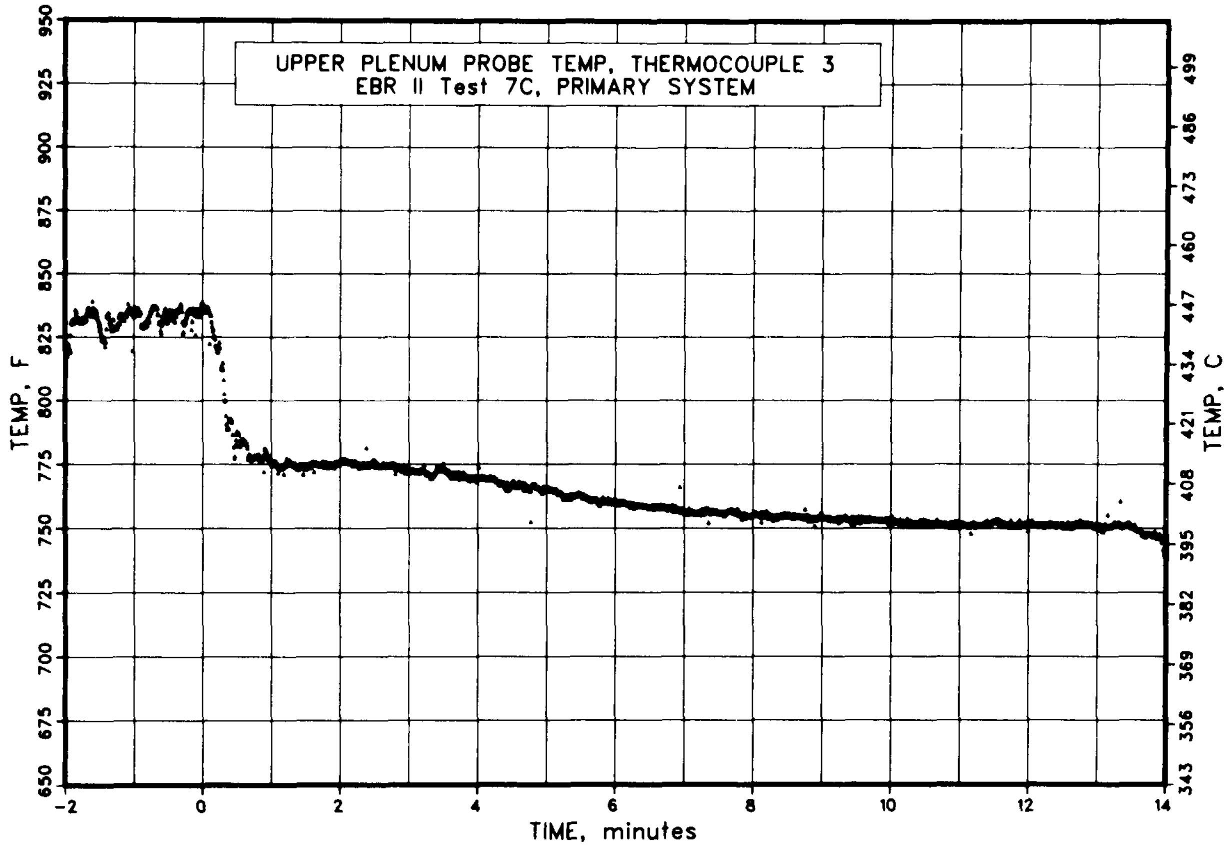

UPPER PLENUM PROBE PRESSURE 2
EBR II Test 7C, PRIMARY SYSTEM
psig
1.50
1.25
1
0.75
0.50
0.25
0
-0.25
-0.50
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

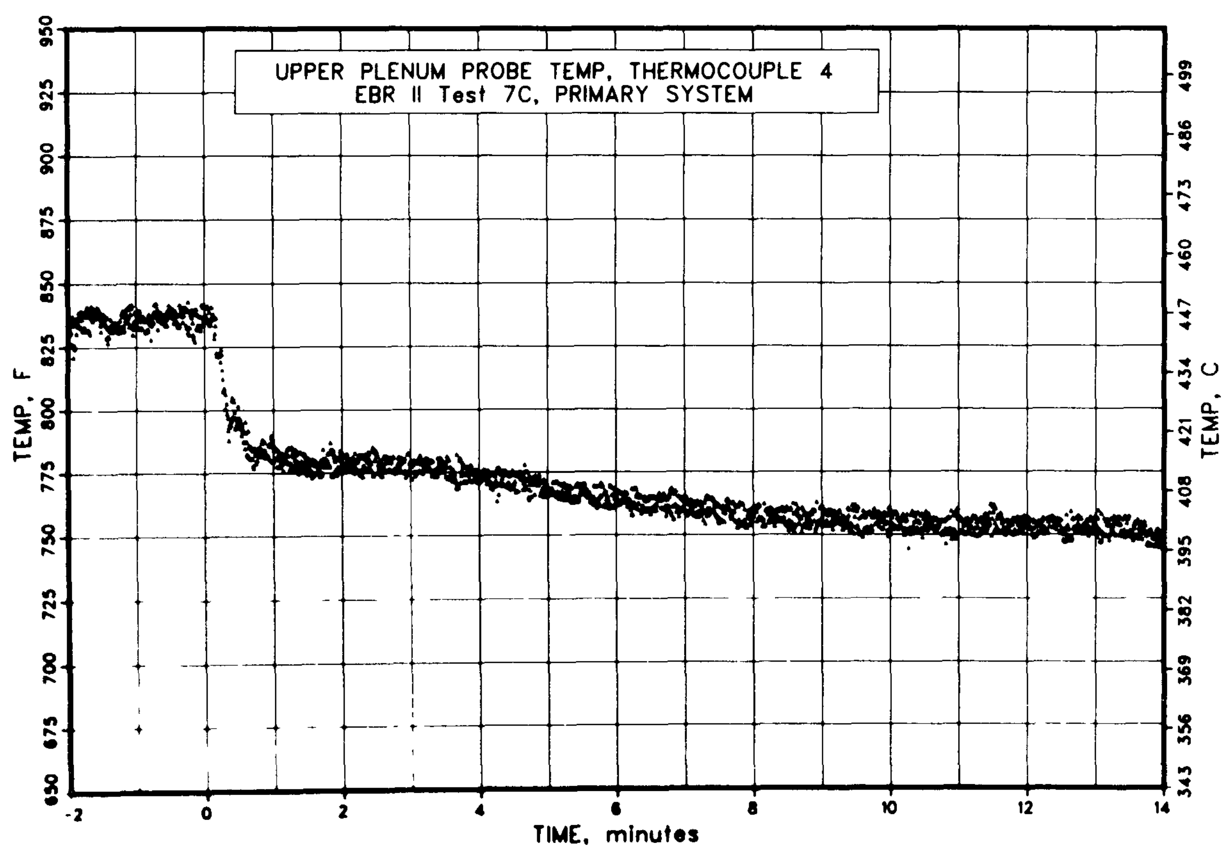

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 1
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
-2
0
2
4
6
8
10
12
14
TIME, minutes

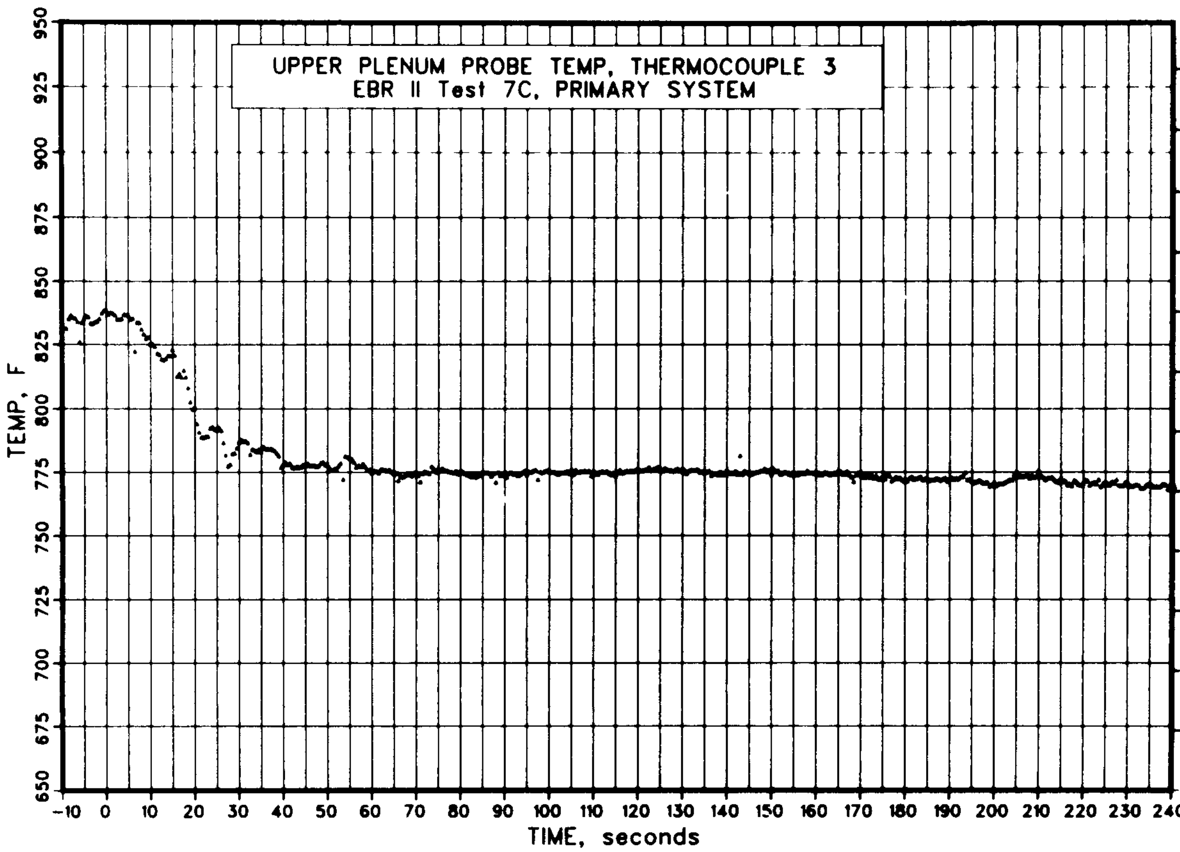

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 2
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
2
0
2
4
6
8
10
12
14
TIME, minutes

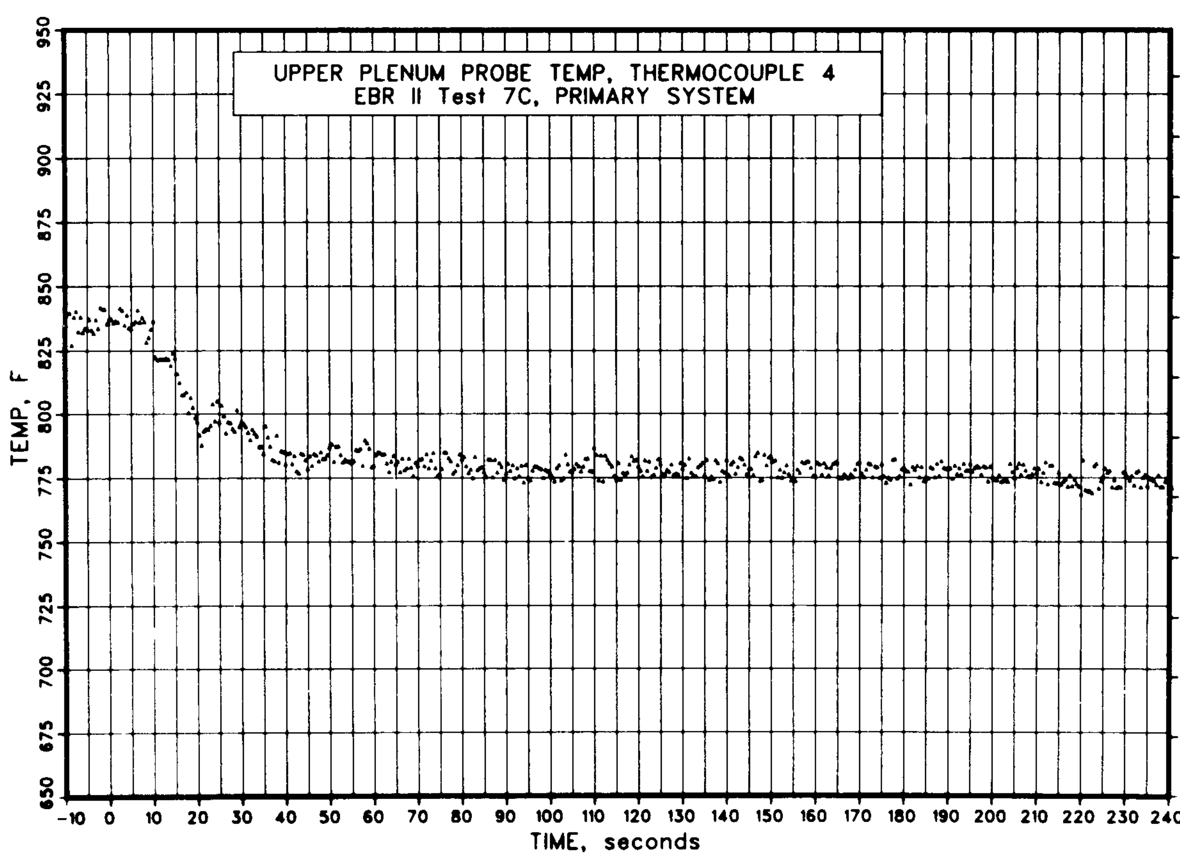

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 1
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

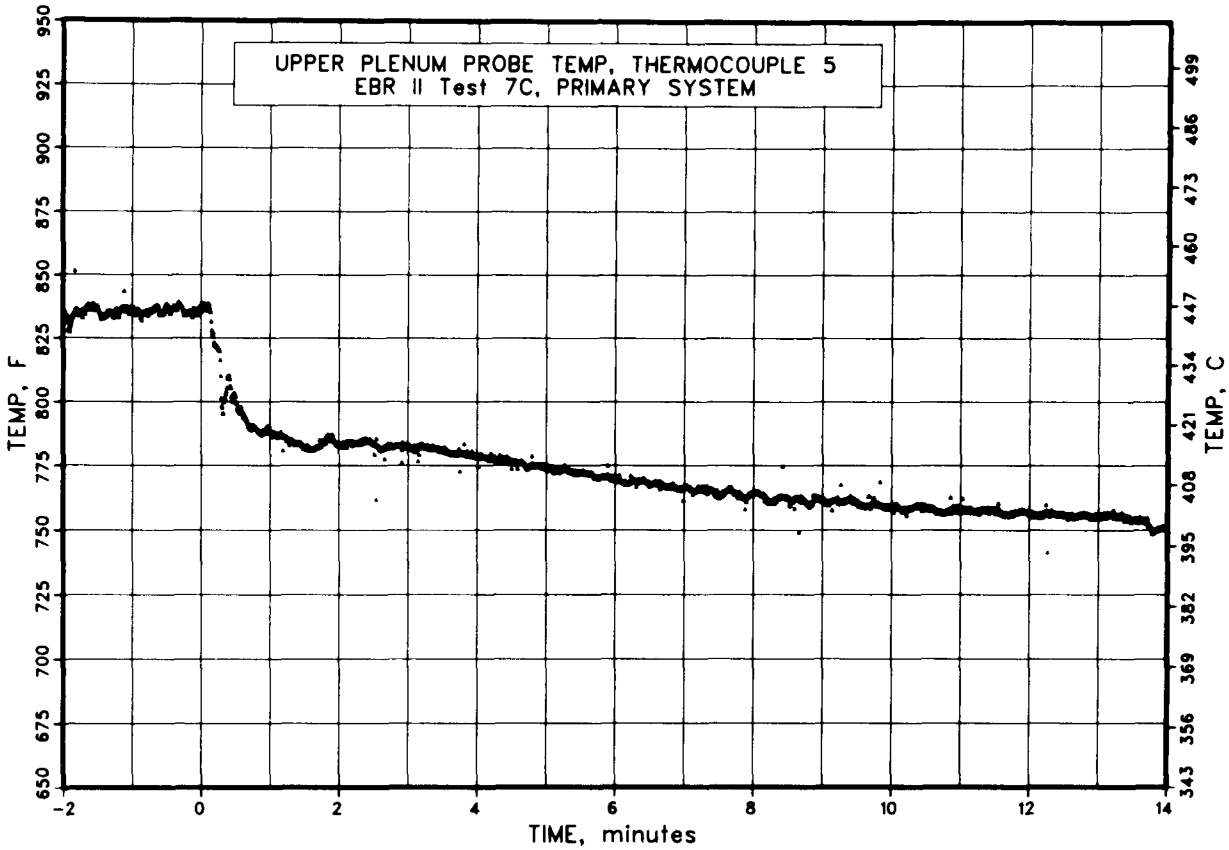

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 2
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

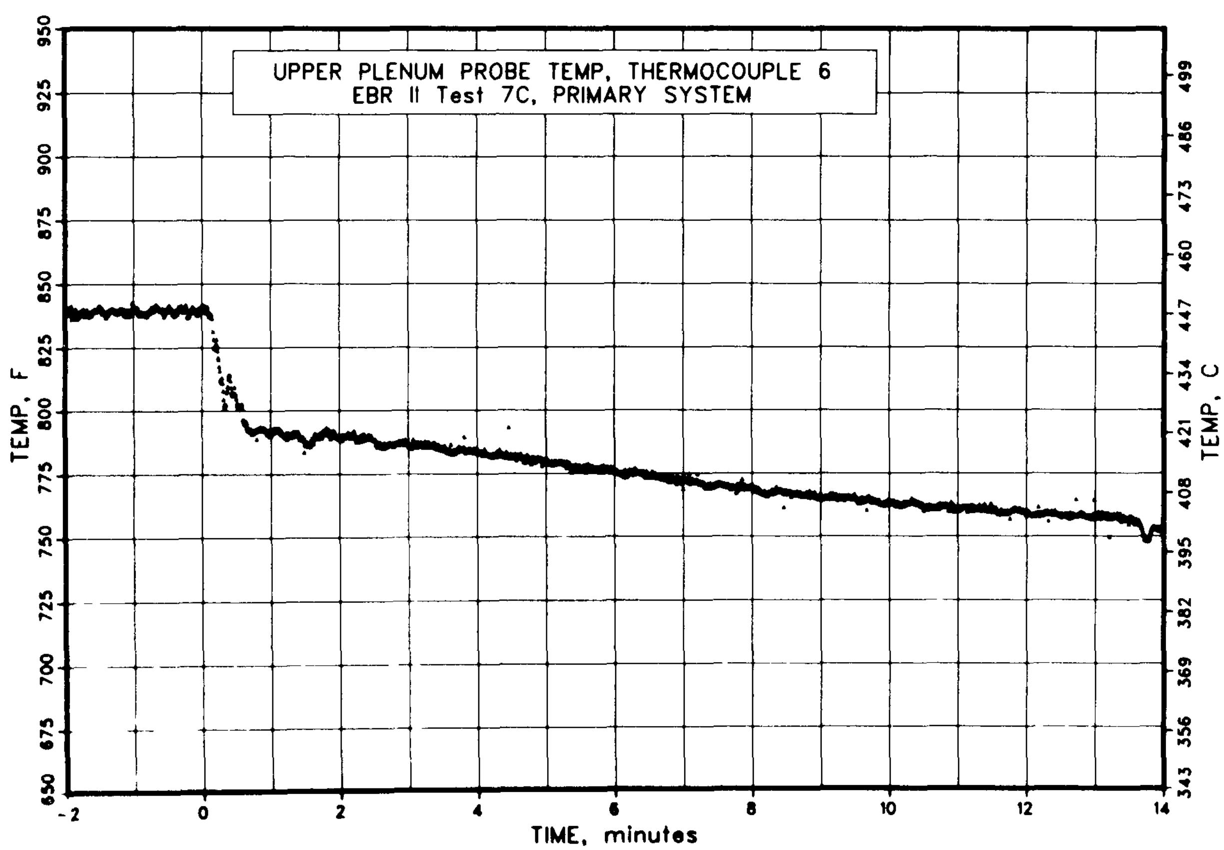

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 3
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

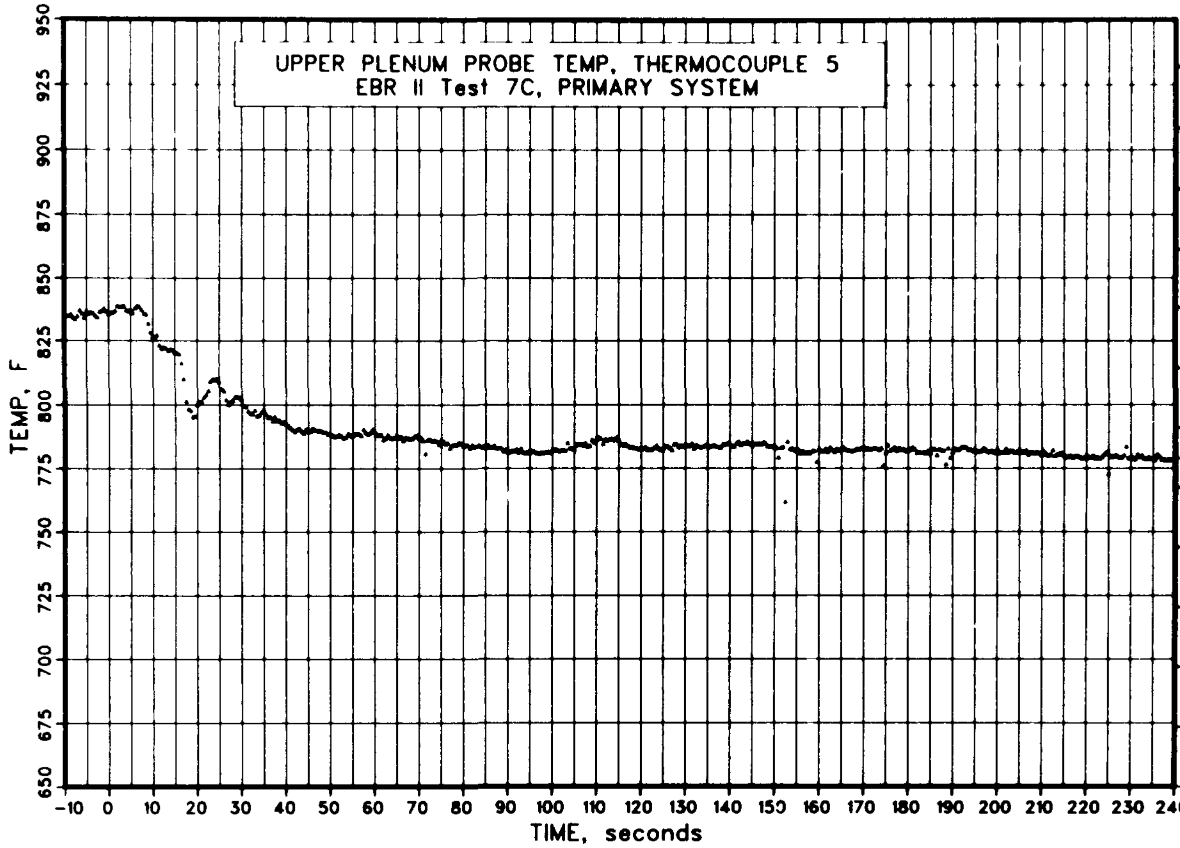

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 4
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

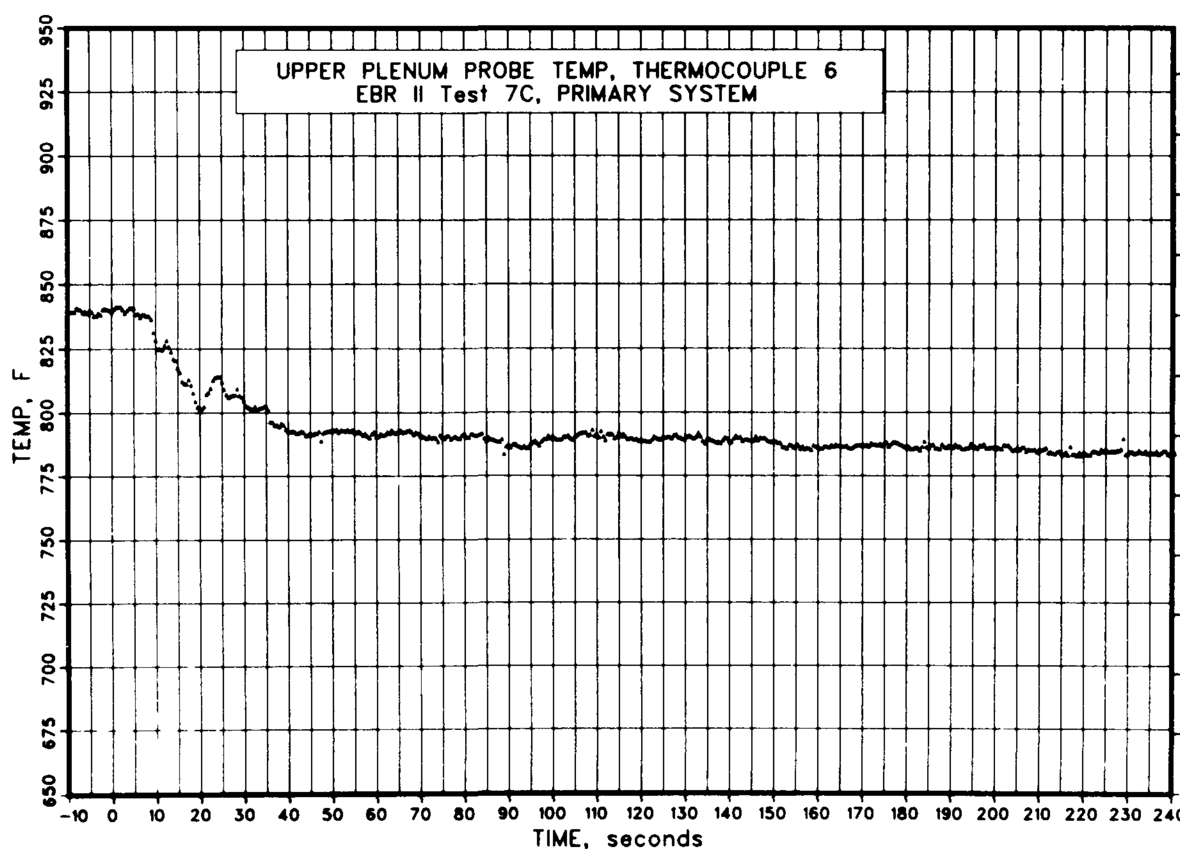

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 3
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
650
675
700
725
750
775
800
825
850
875
900
925
950
TEMP, C
343
356
369
382
395
408
421
434
447
460
473
486
499
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

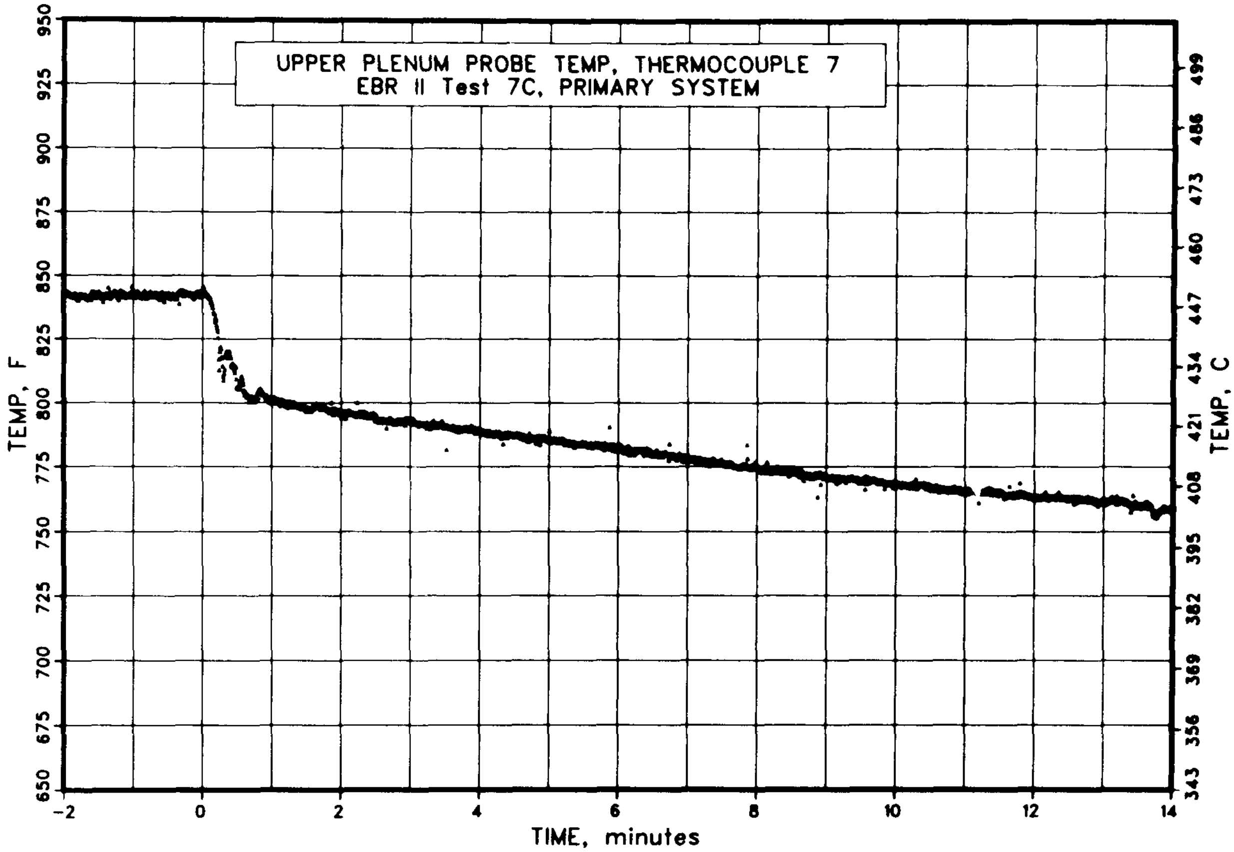

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 4
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
650
675
700
725
750
775
800
825
850
875
900
925
950
TEMP, C
343
356
369
382
395
408
421
434
447
460
473
486
499
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

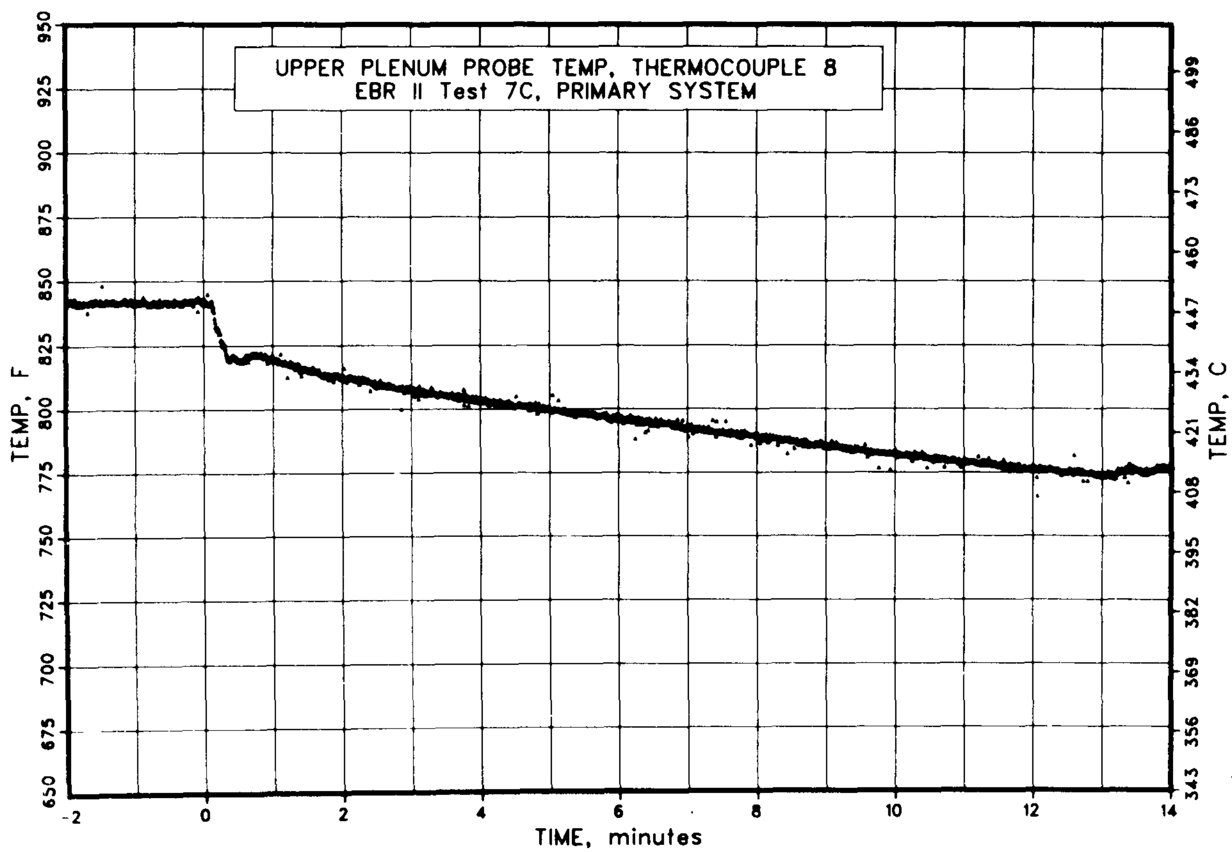

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 5
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
650
675
700
725
750
775
800
825
850
875
900
925
950
TEMP, C
343
356
369
382
395
408
421
434
447
460
473
486
499
TIME, minutes
-2
0
2
4
6
8
10
12
14


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 6
EBR II Test 7C, 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, minutes
-2
0
2
4
6
8
10
12
14


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 5
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 6
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 7
EBR II Test 7C, 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
6
8
10
12
14


UPPER PLENUM PROBE TEMP, THERMOCOUPLE 8
EBR II Test 7C, 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
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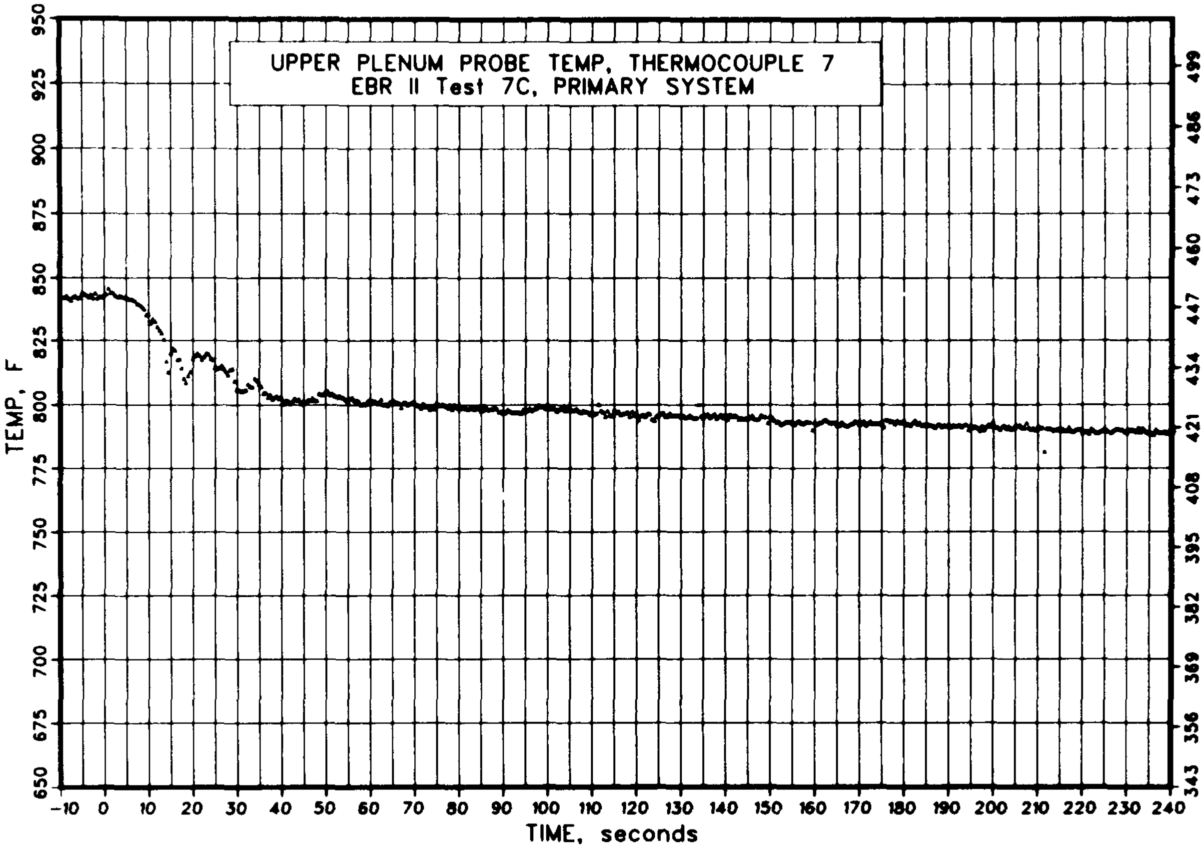
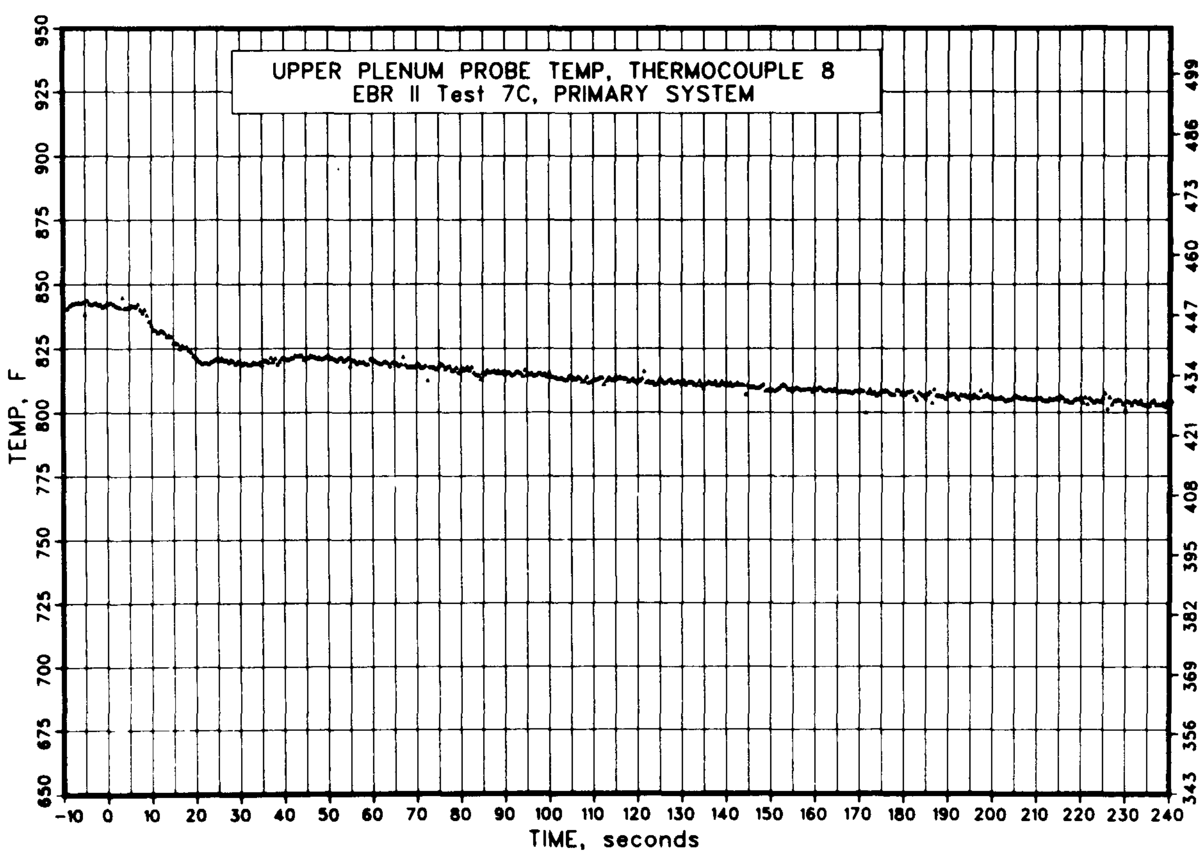
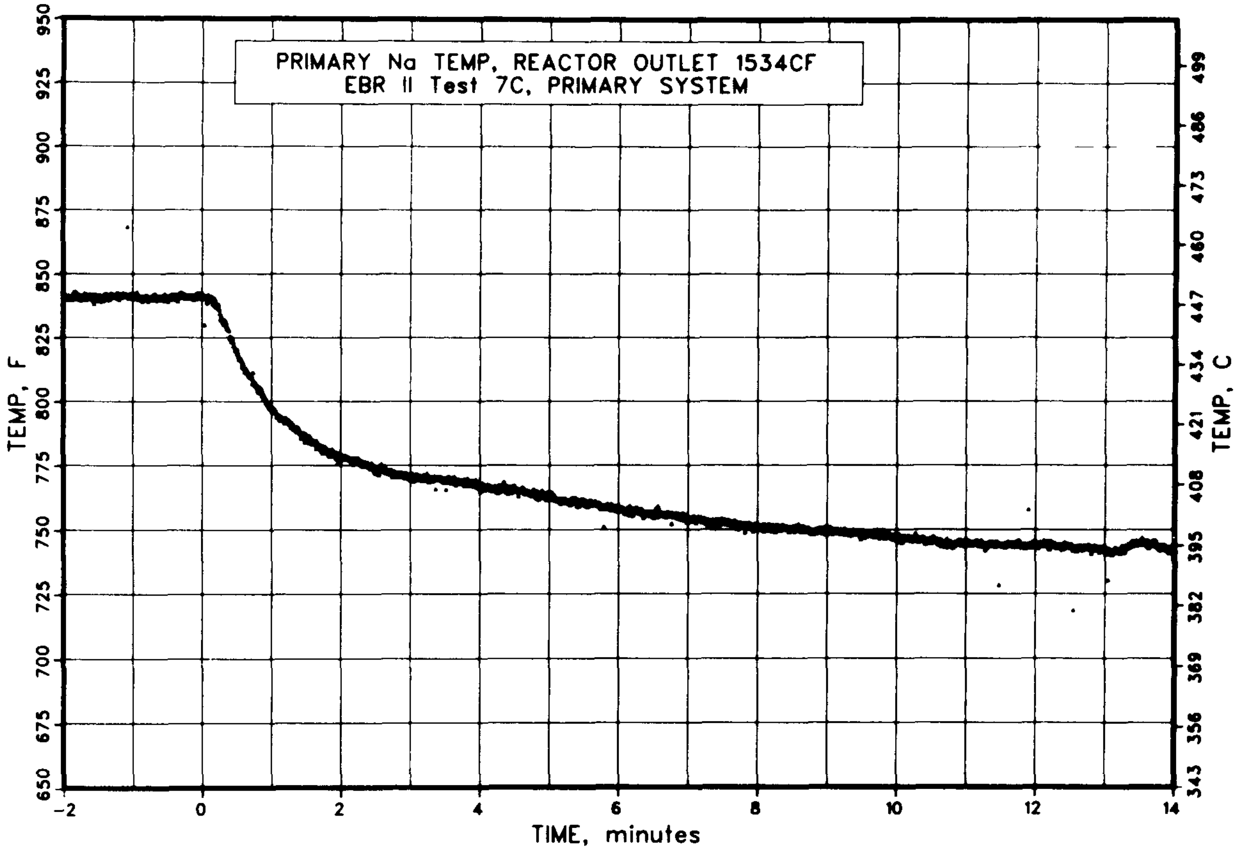
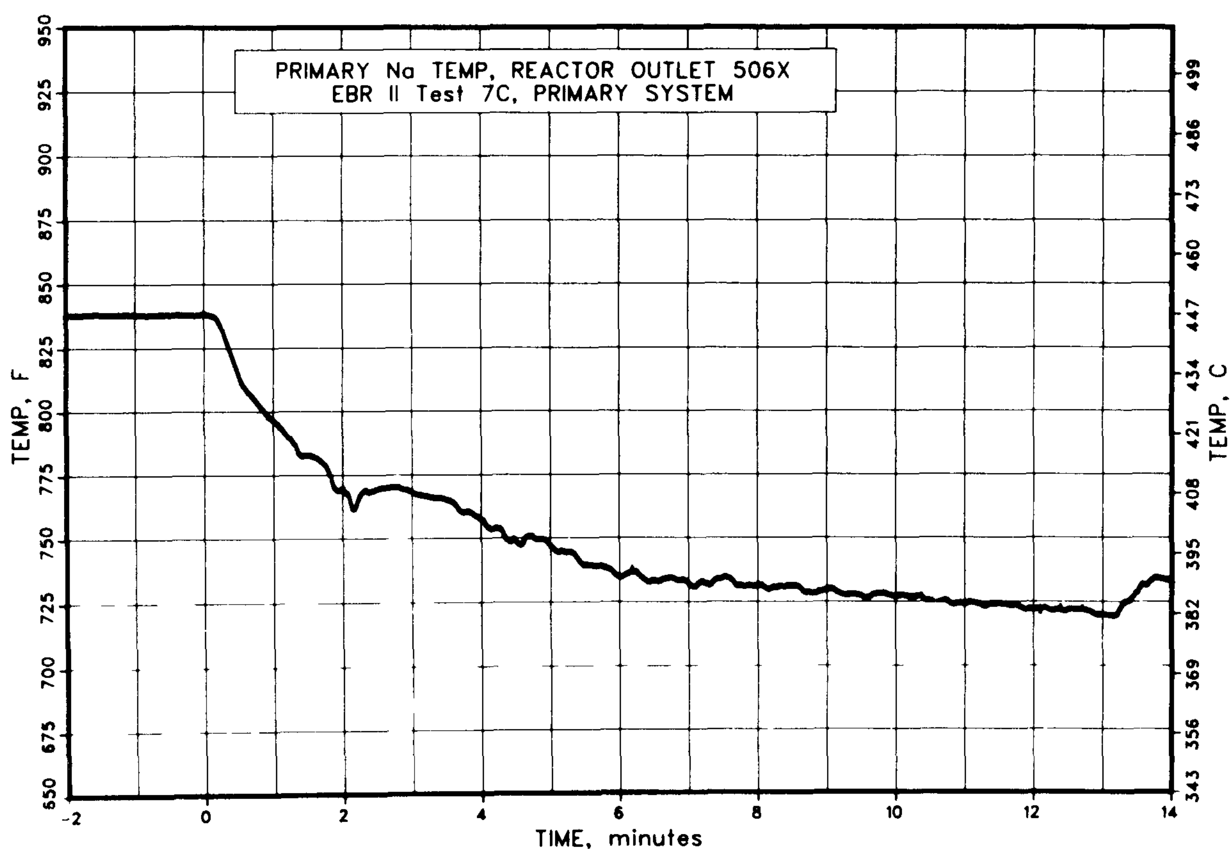
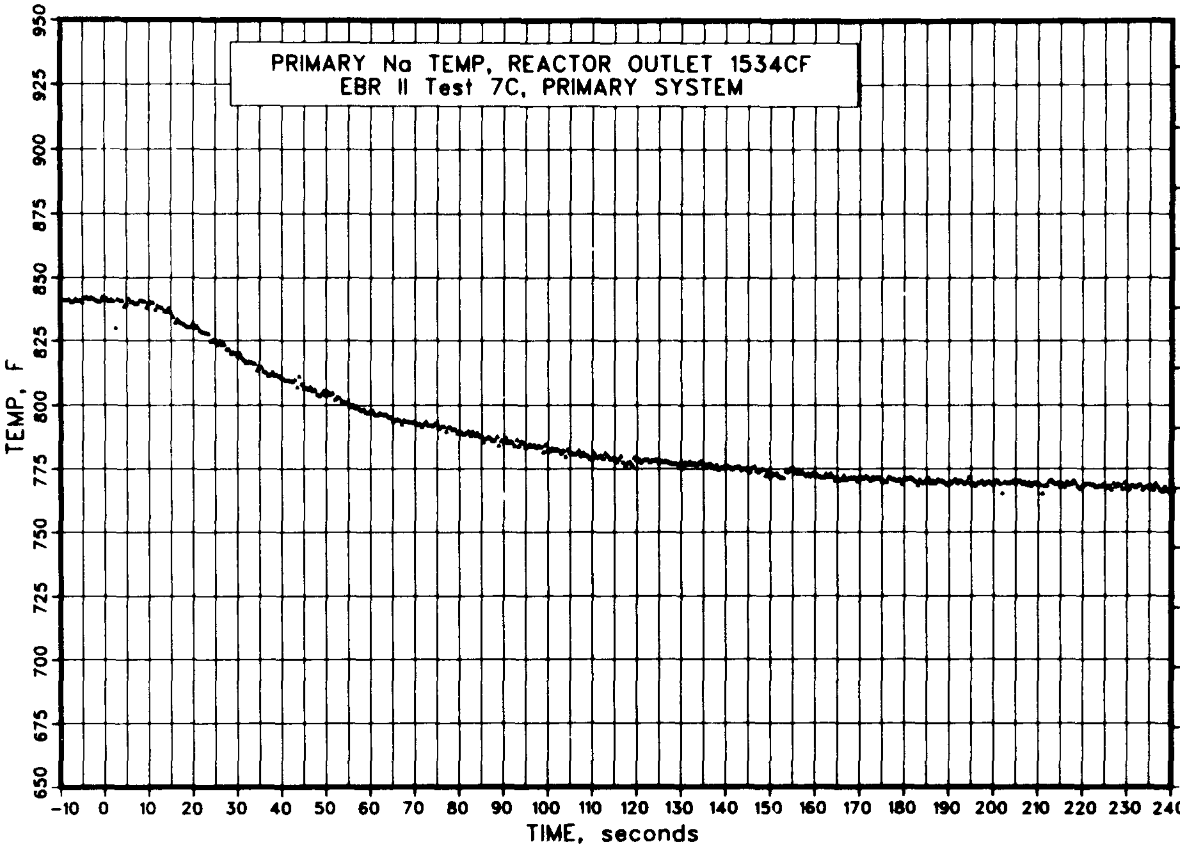
369
356
343
-2
0
2
4
6
8
10
12
14

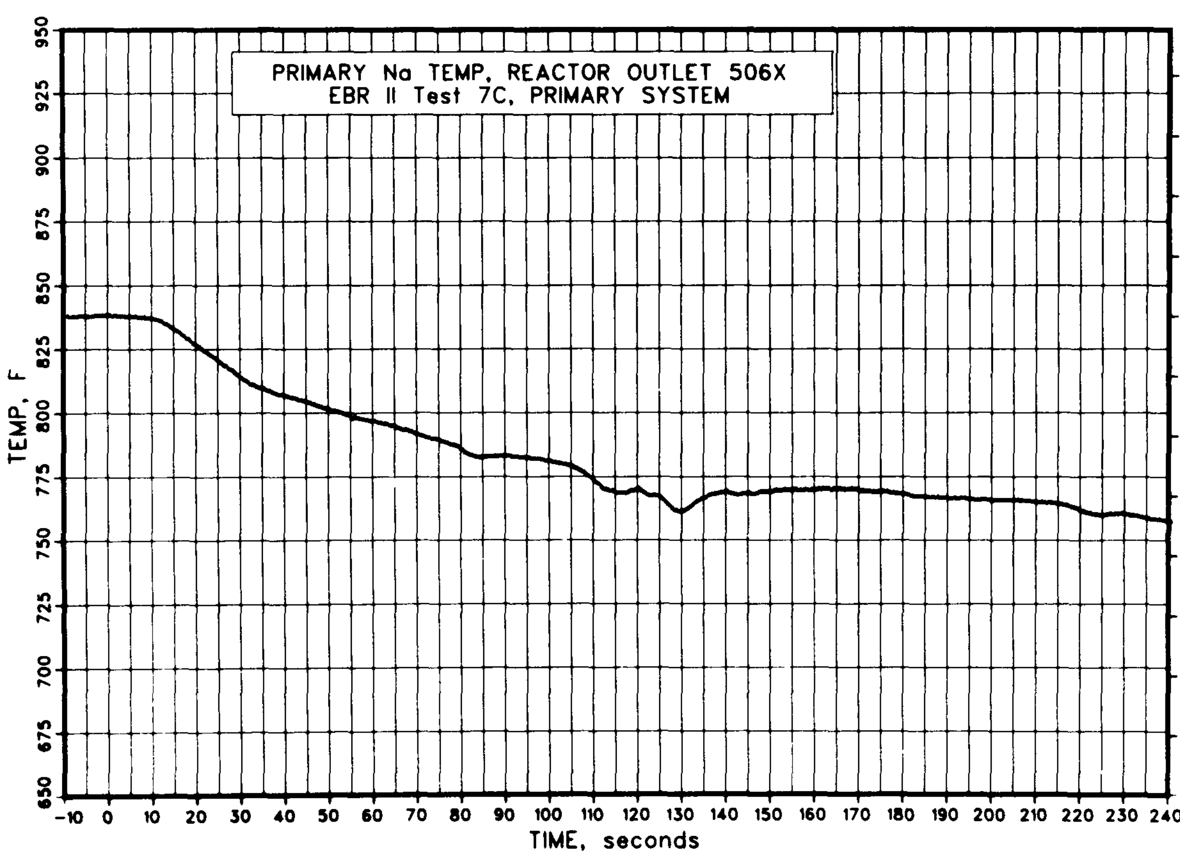

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 7
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

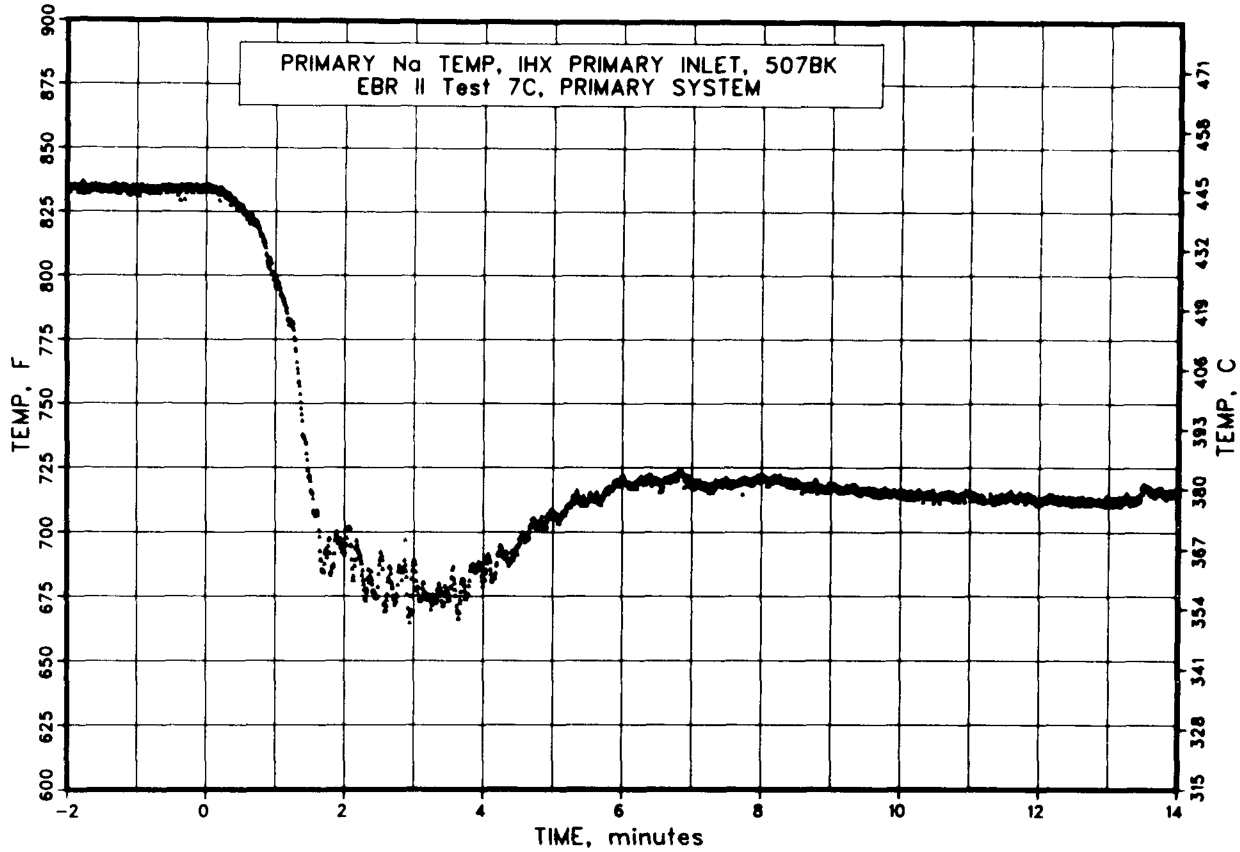

UPPER PLENUM PROBE TEMP, THERMOCOUPLE 8
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
950
925
900
875
850
825
800
775
750
725
700
675
650
499
486
473
460
447
434
421
408
395
382
369
356
343
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

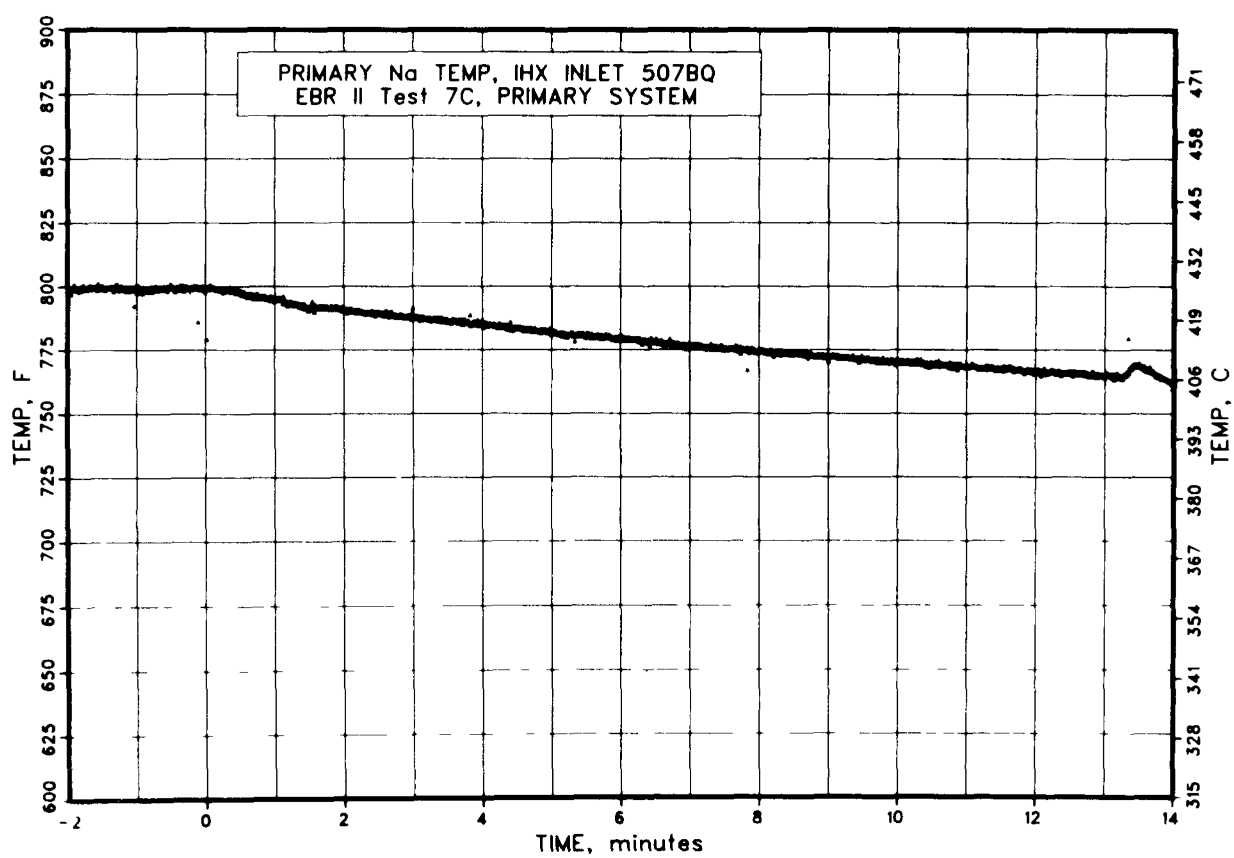

PRIMARY Na TEMP, REACTOR OUTLET 1534CF
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
-2
0
2
4
6
8
10
12
14
TIME, minutes

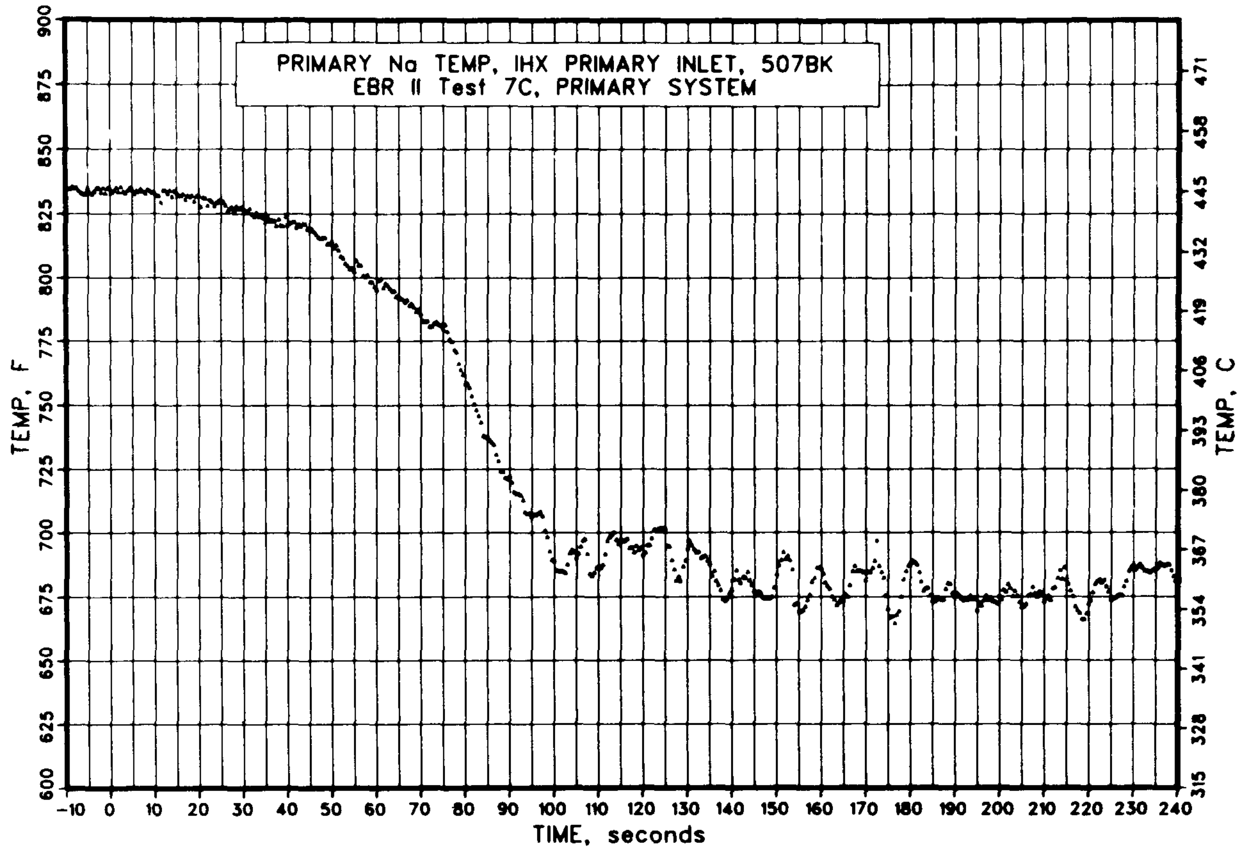

PRIMARY Na TEMP, REACTOR OUTLET 506X
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
950
925
900
875
850
825
800
775
750
725
700
675
650
TEMP, C
499
486
473
460
447
434
421
408
395
382
369
356
343
-2
0
2
4
6
8
10
12
14
TIME, minutes

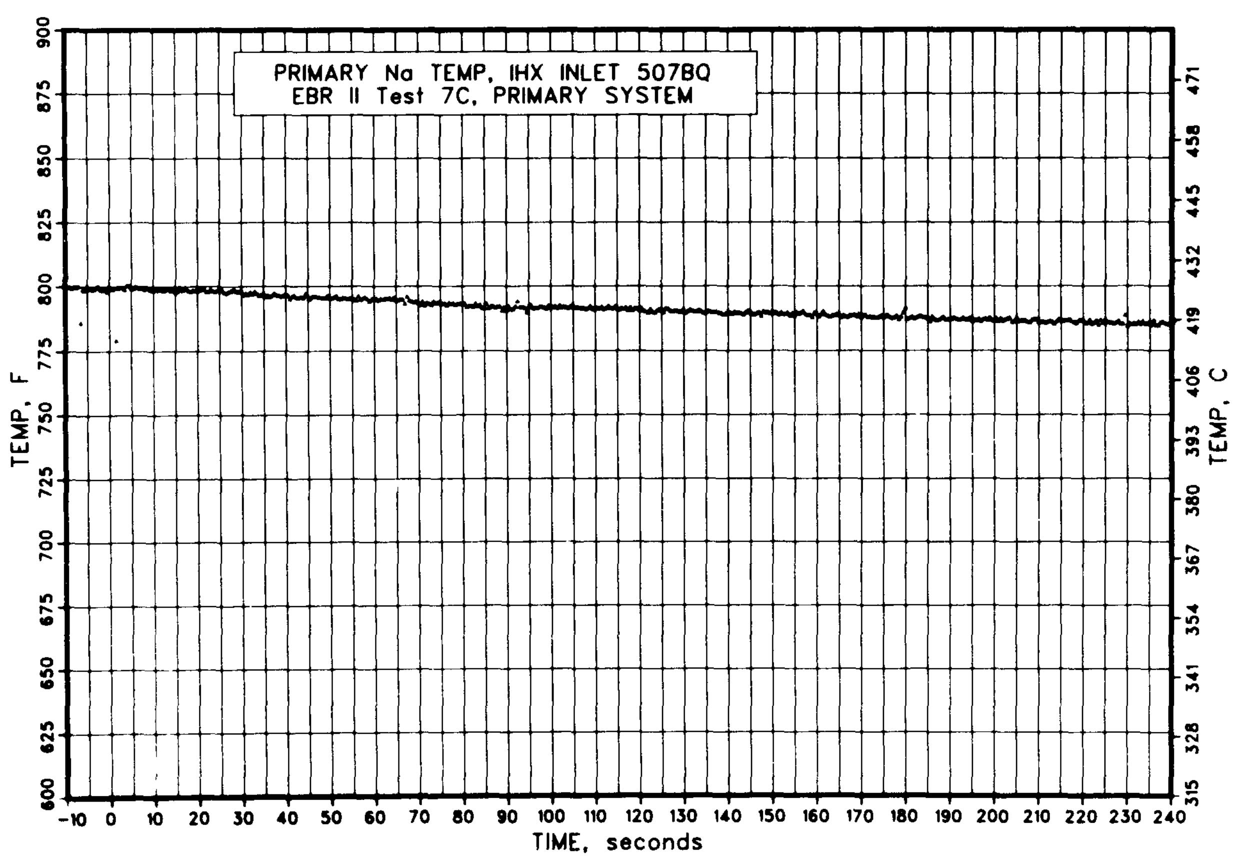

PRIMARY Na TEMP, REACTOR OUTLET 1534CF
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
650 675 700 725 750 775 800 825 850 875 900 925 950
343 356 369 382 395 408 421 434 447 460 473 486 499
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240


PRIMARY Na TEMP, REACTOR OUTLET 506X
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
650 675 700 725 750 775 800 825 850 875 900 925 950
343 356 369 382 395 408 421 434 447 460 473 486 499
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240


PRIMARY Na TEMP, IHX PRIMARY INLET, 507BK
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX INLET 507BQ
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes


PRIMARY Na TEMP, IHX PRIMARY INLET, 507BK
EBR II Test 7C, 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 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240


PRIMARY Na TEMP, IHX INLET 507BQ
EBR II Test 7C, 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
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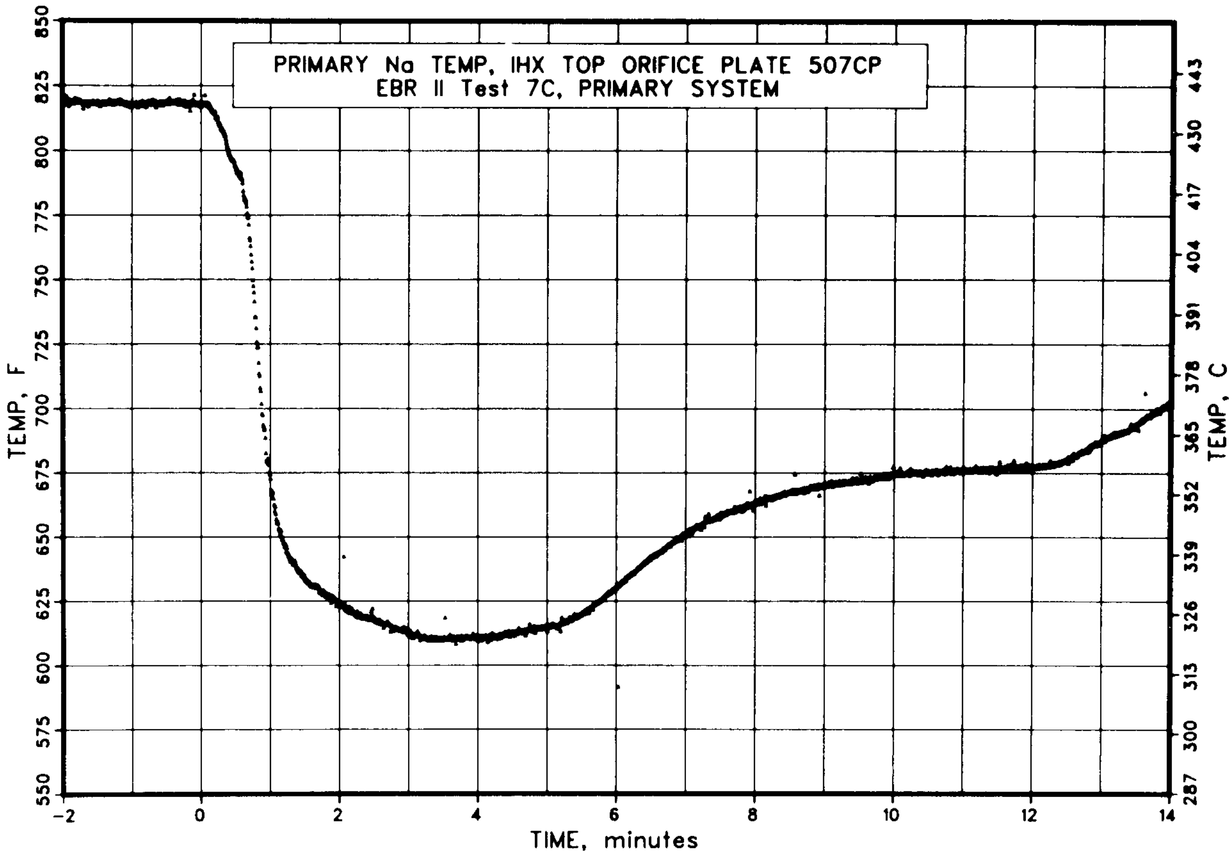
341
328
315
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240


PRIMARY Na TEMP, IHX TOP ORIFICE PLATE 507CP
EBR II Test 7C, 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
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339
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300
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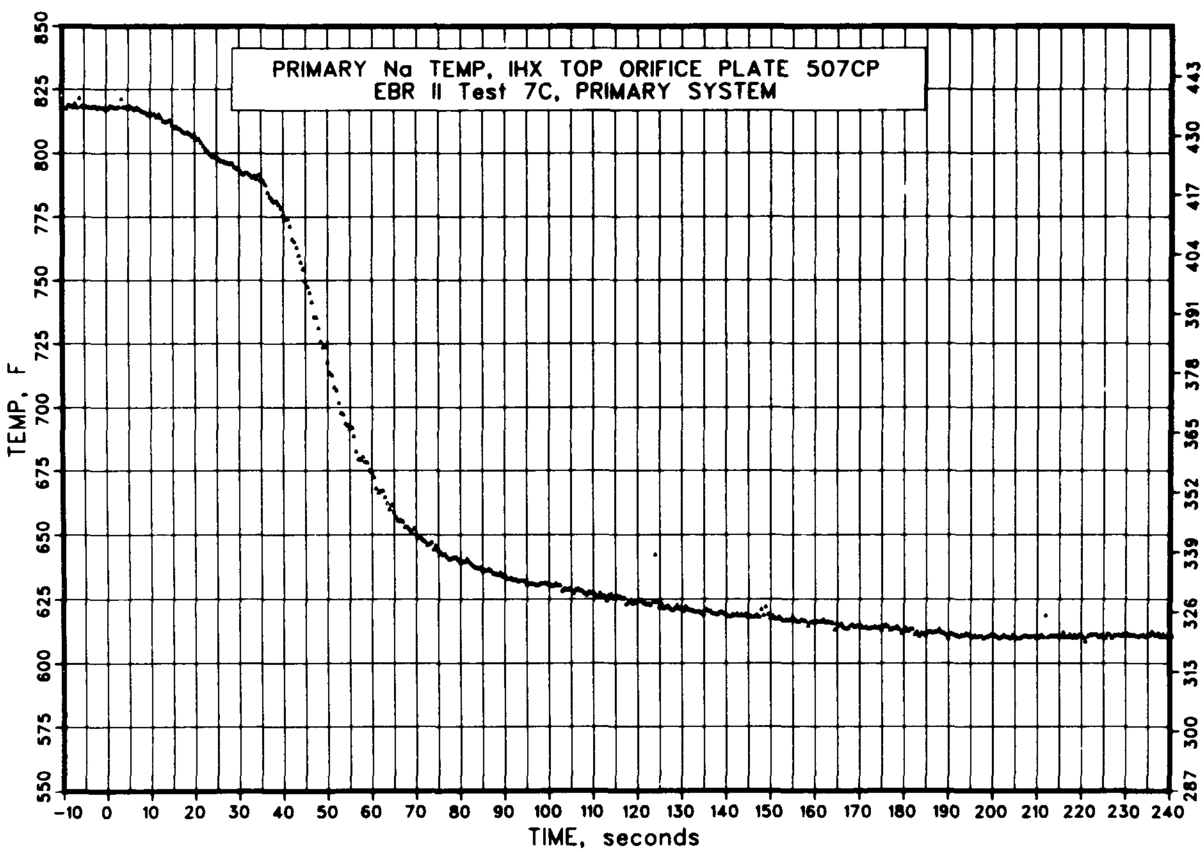
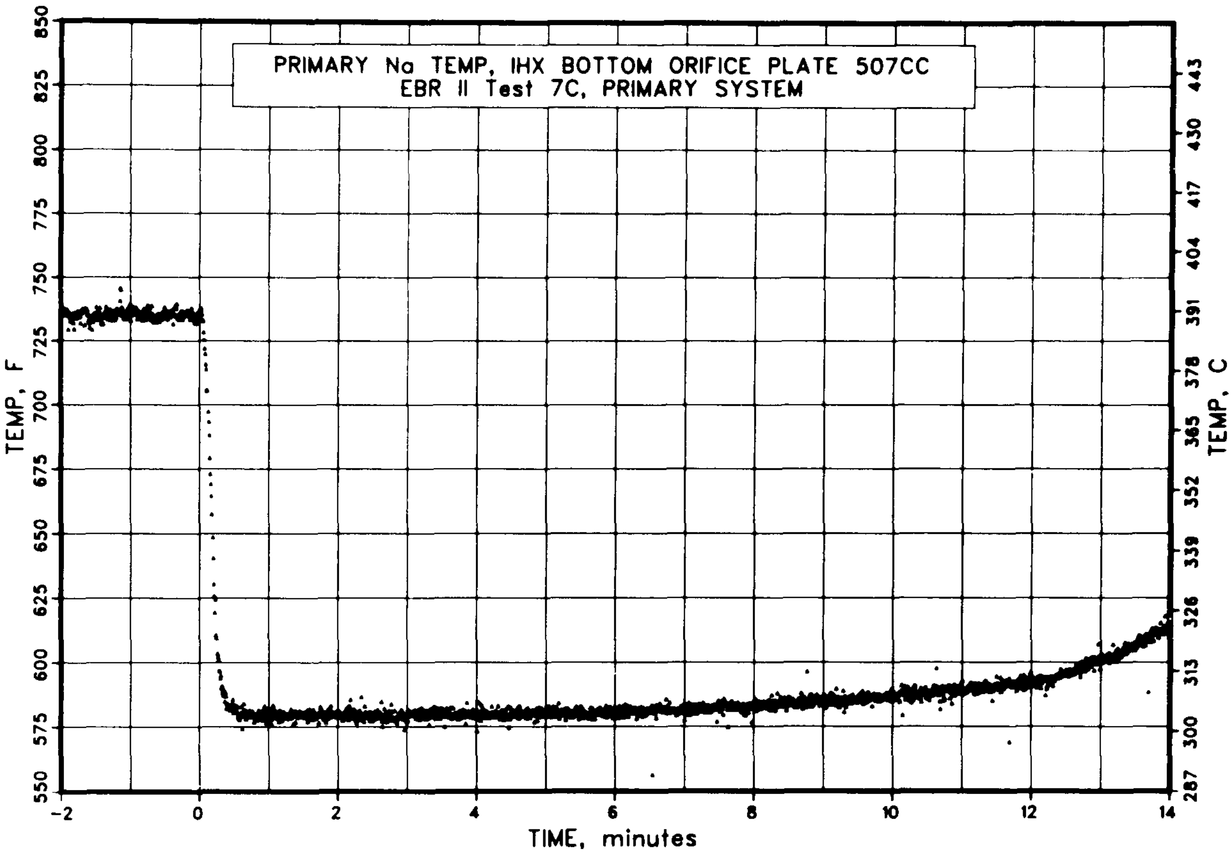
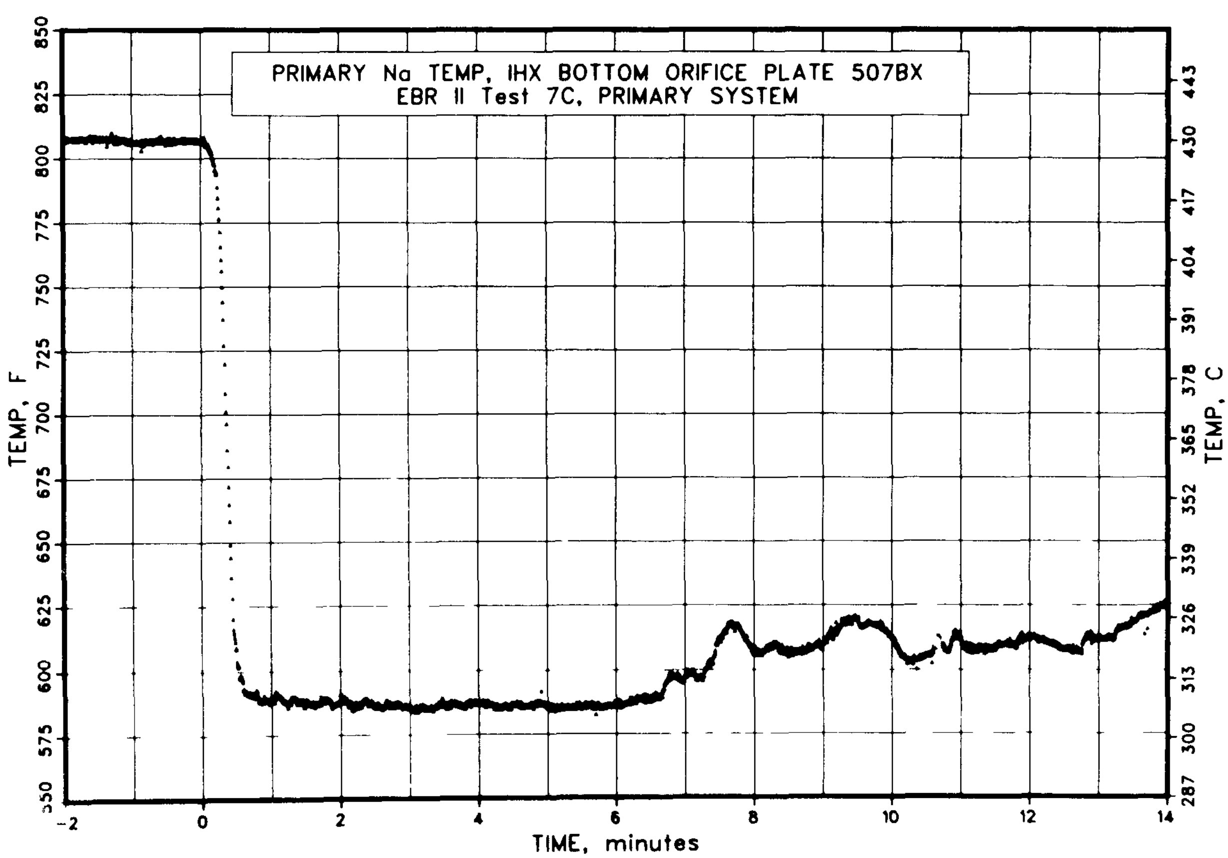
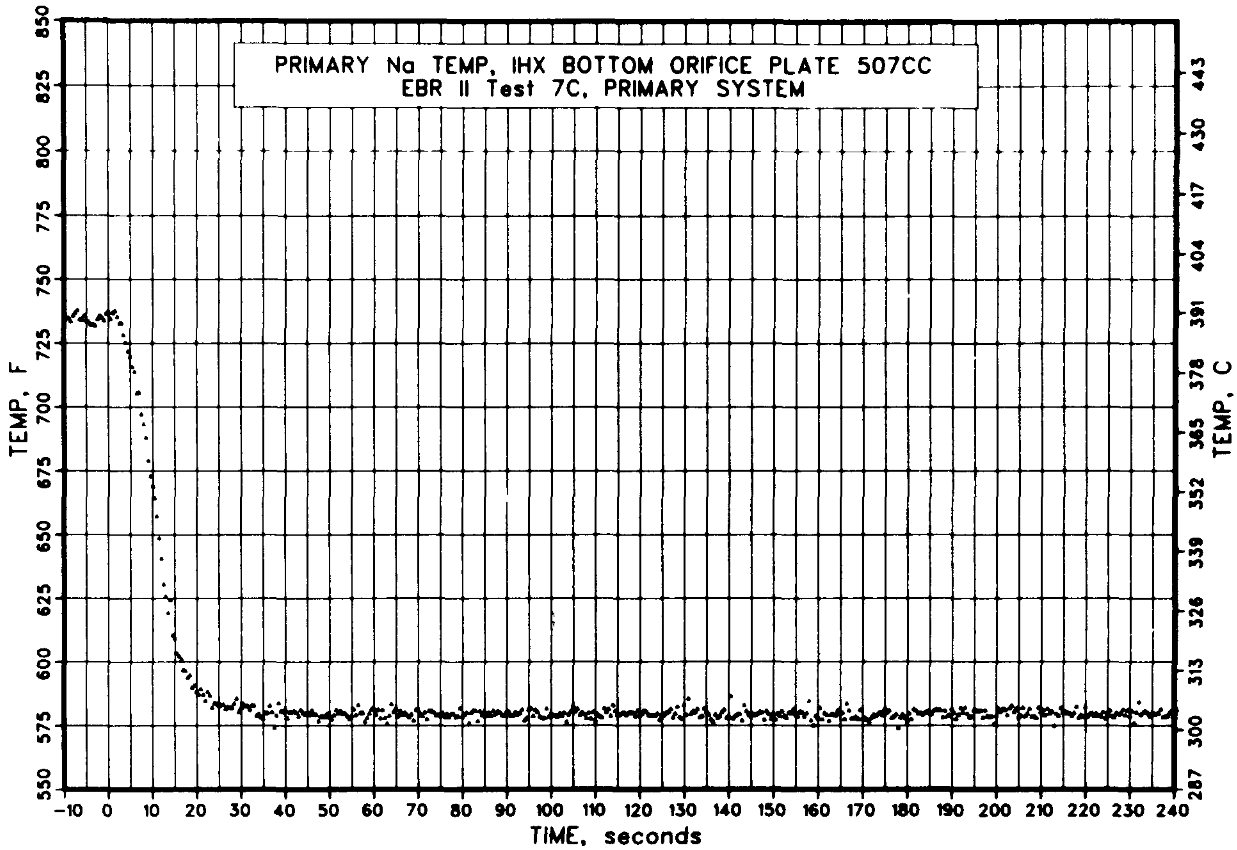
-2
0
2
4
6
8
10
12
14

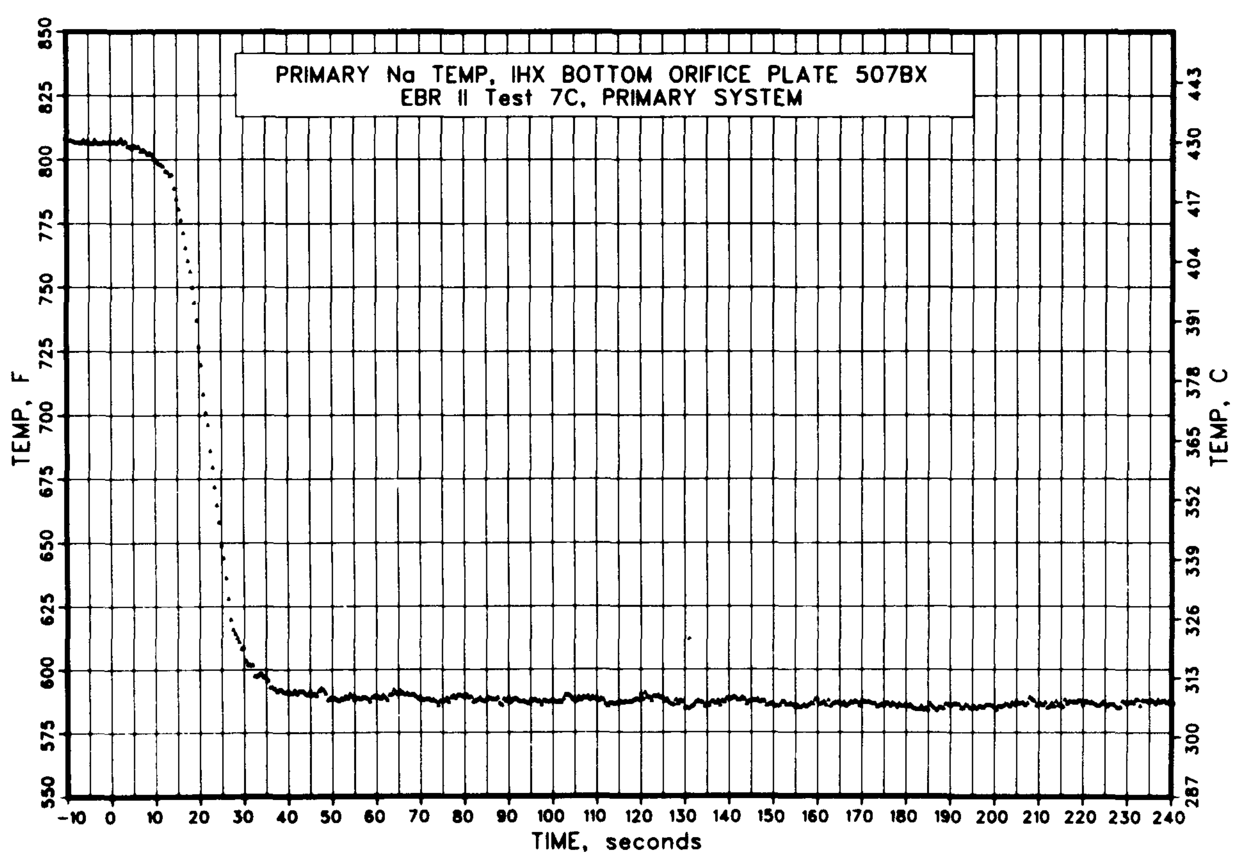


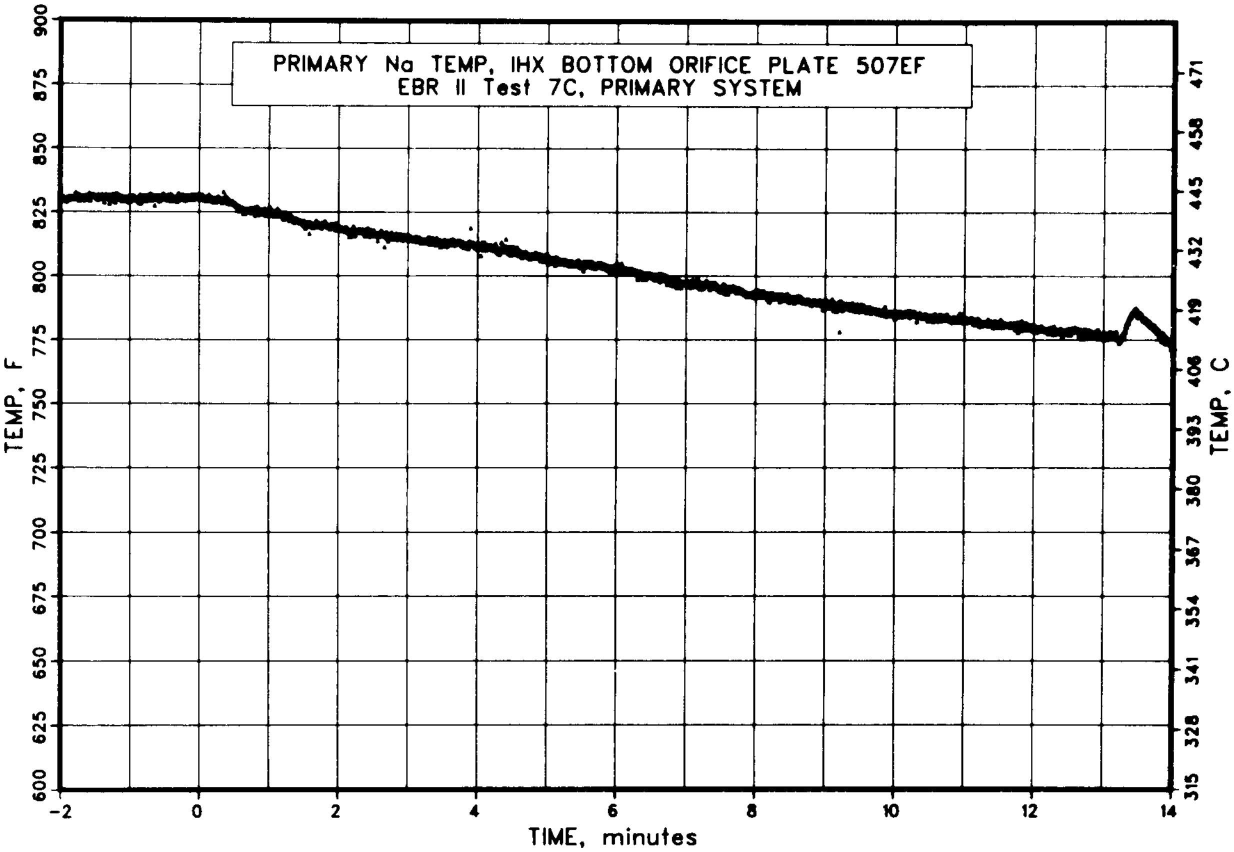
PRIMARY Na TEMP, IHX TOP ORIFICE PLATE 507CP
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
850
825
800
775
750
725
700
675
650
625
600
575
550
TEMP, C
443
430
417
404
391
378
365
352
339
326
313
300
287
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
TIME, seconds

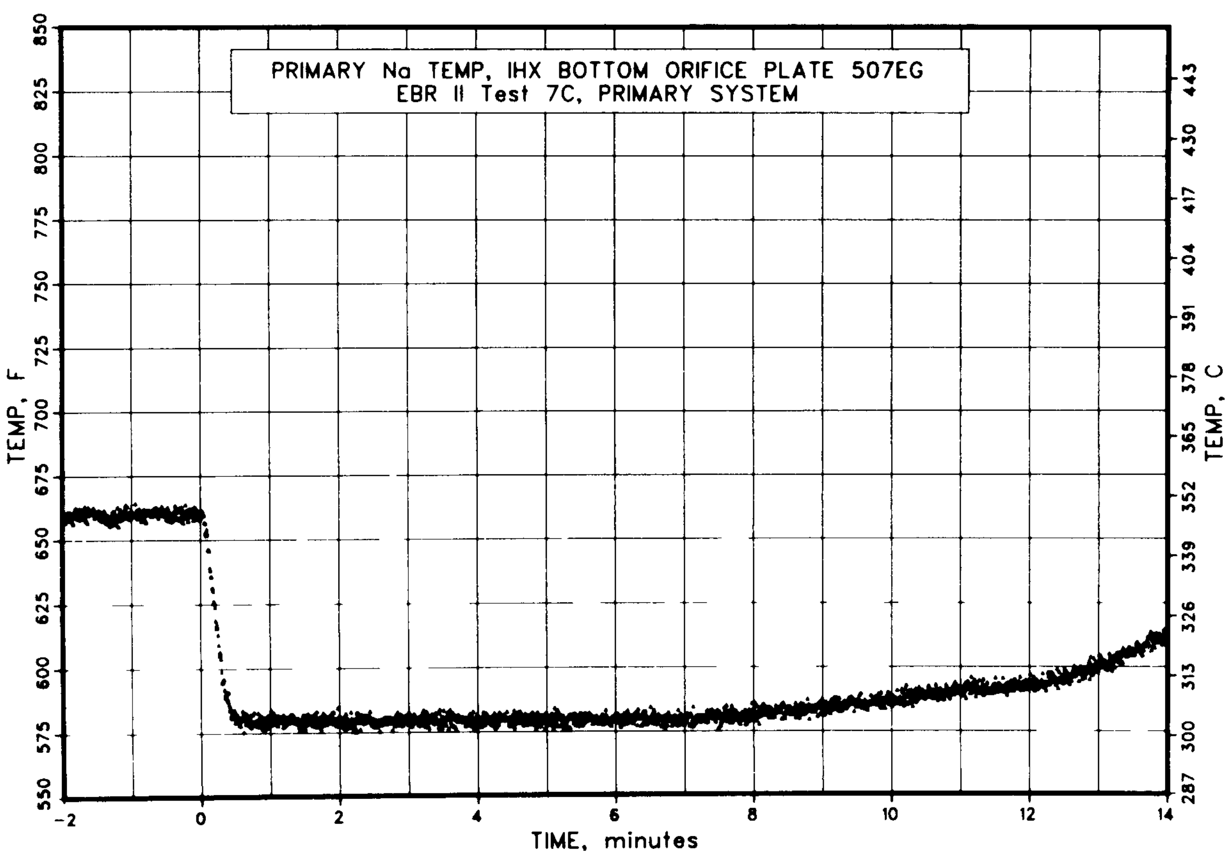

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CC
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

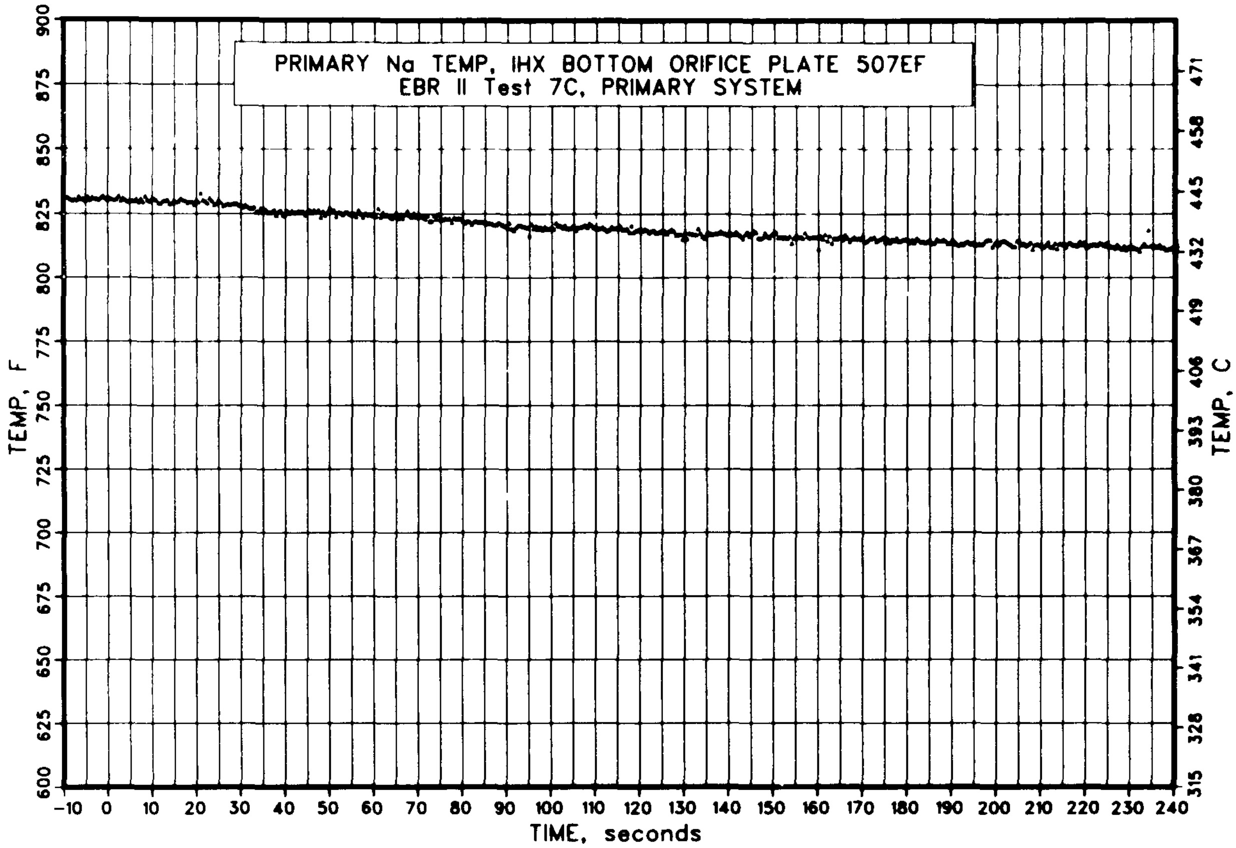

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507BX
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

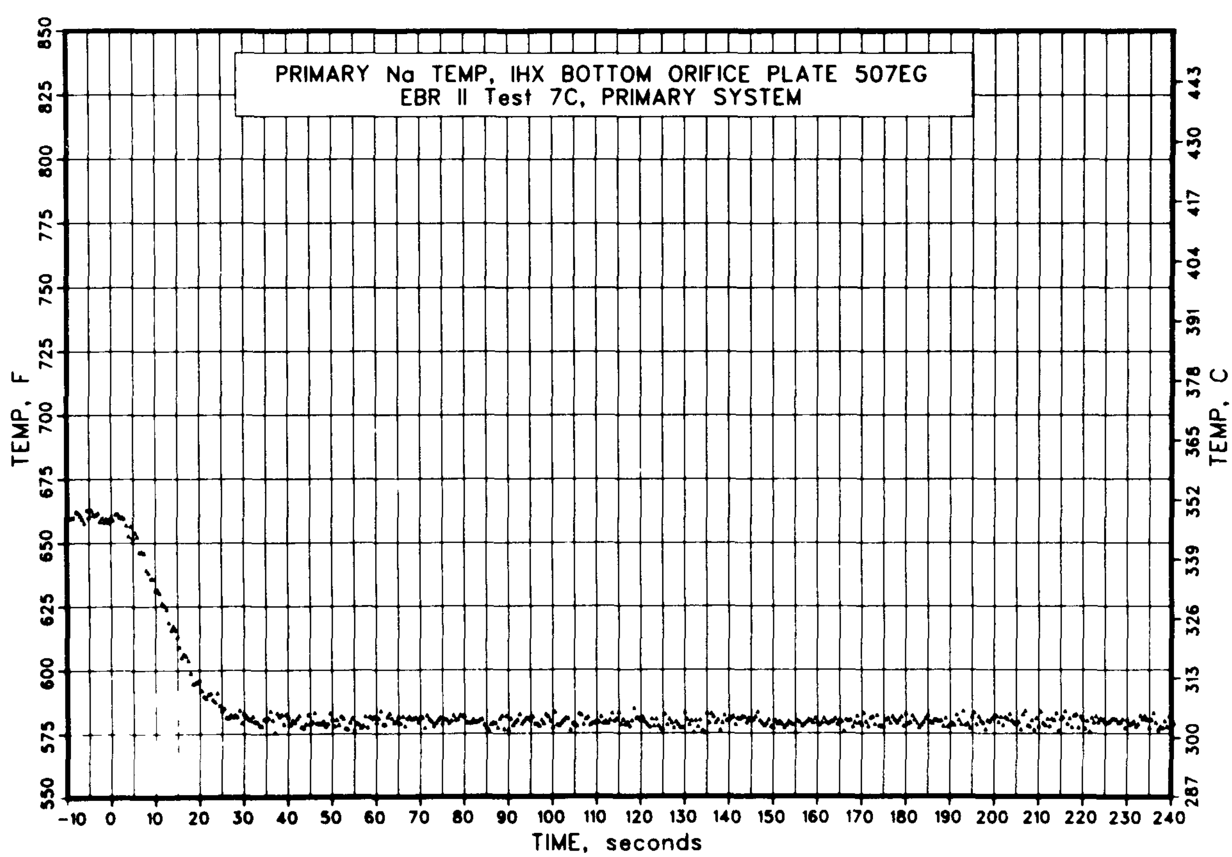

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CC
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
550 575 600 625 650 675 700 725 750 775 800 825 850
TEMP, C
287 300 313 326 339 352 365 378 391 404 417 430 443
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

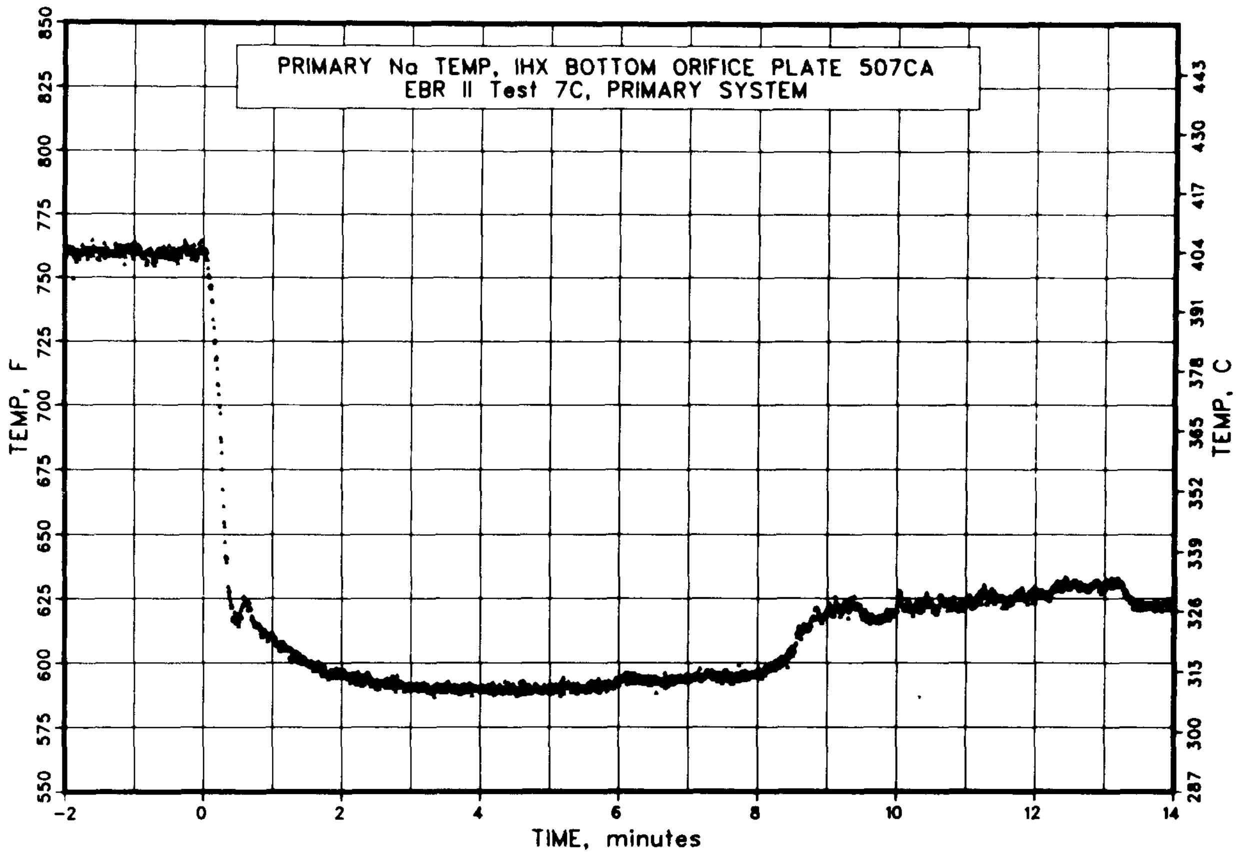

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507BX
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
550 575 600 625 650 675 700 725 750 775 800 825 850
TEMP, C
287 300 313 326 339 352 365 378 391 404 417 430 443
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240
TIME, seconds

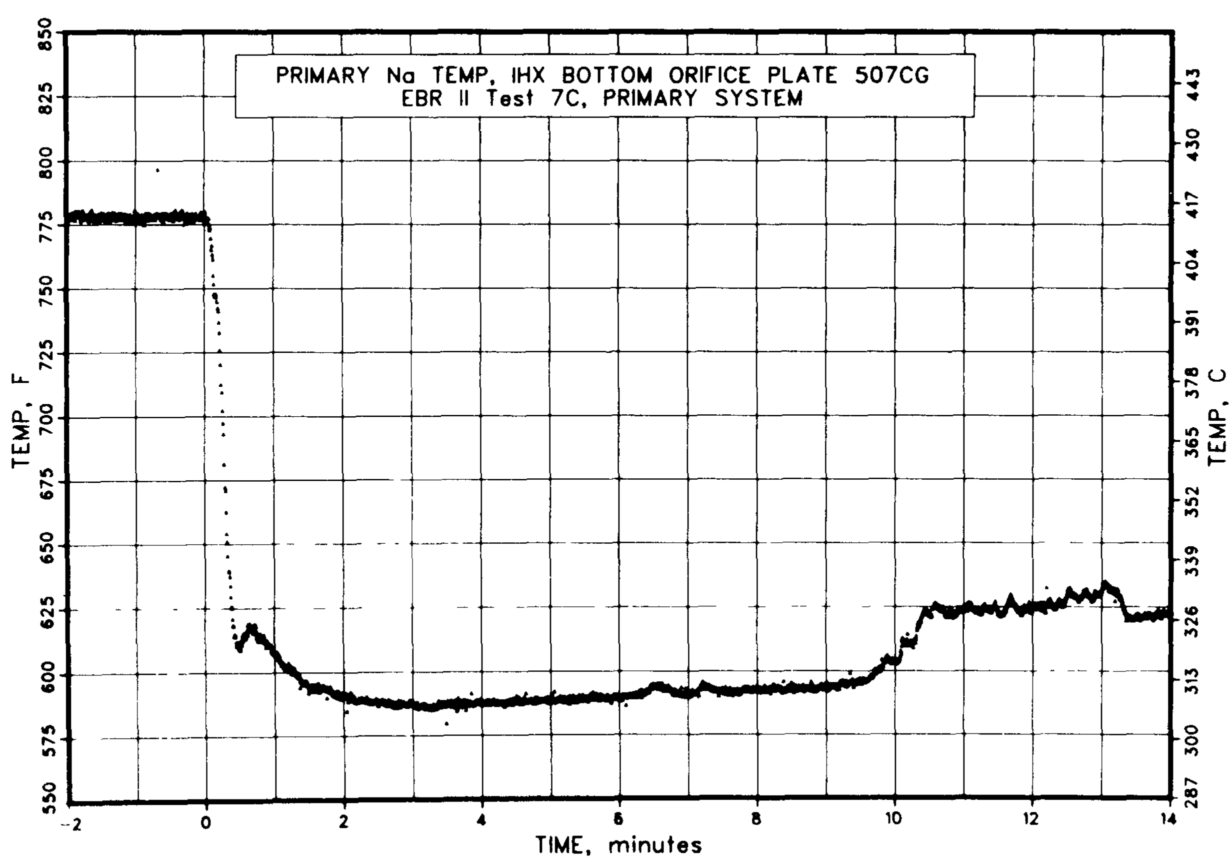

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EF
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
900
875
850
825
800
775
750
725
700
675
650
625
600
471
458
445
432
419
406
393
380
367
354
341
328
315
-2
0
2
4
6
8
10
12
14

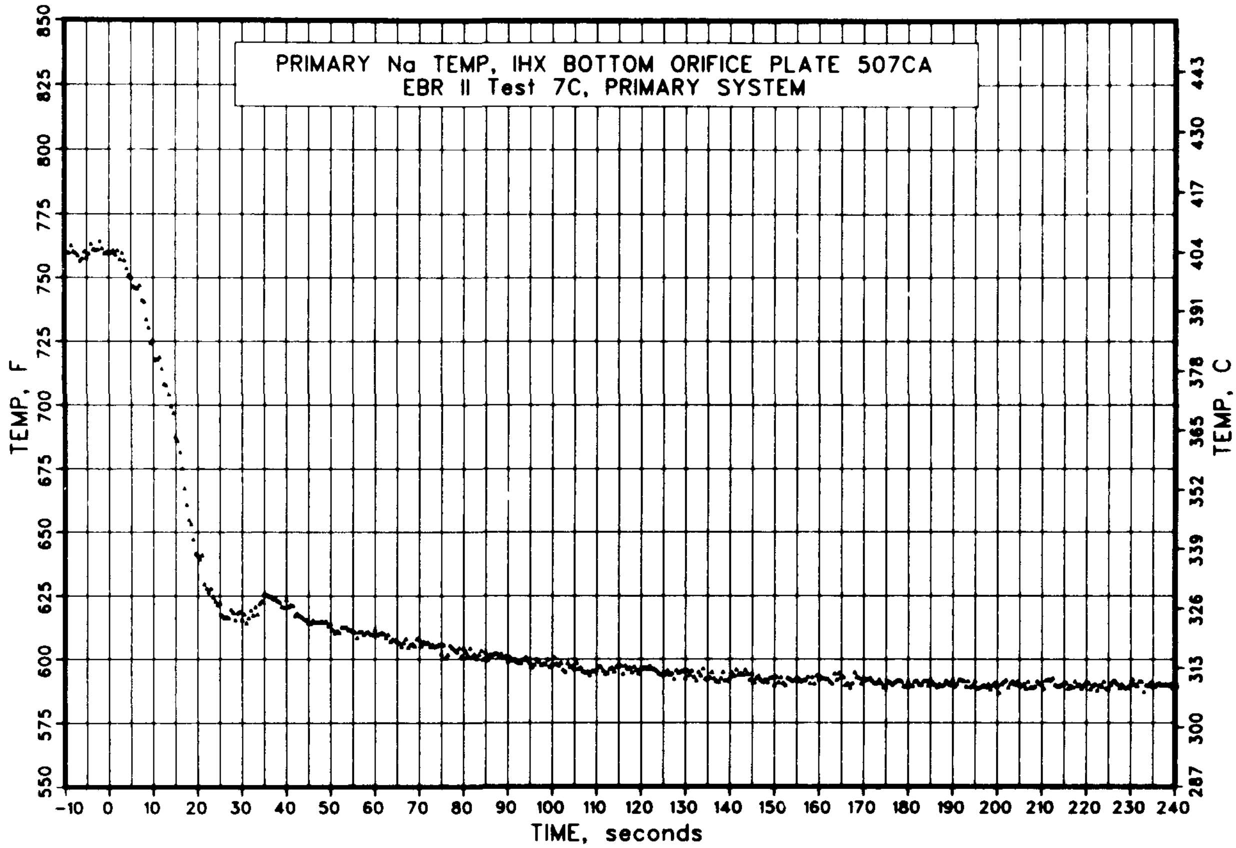

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-2
0
2
4
6
8
10
12
14

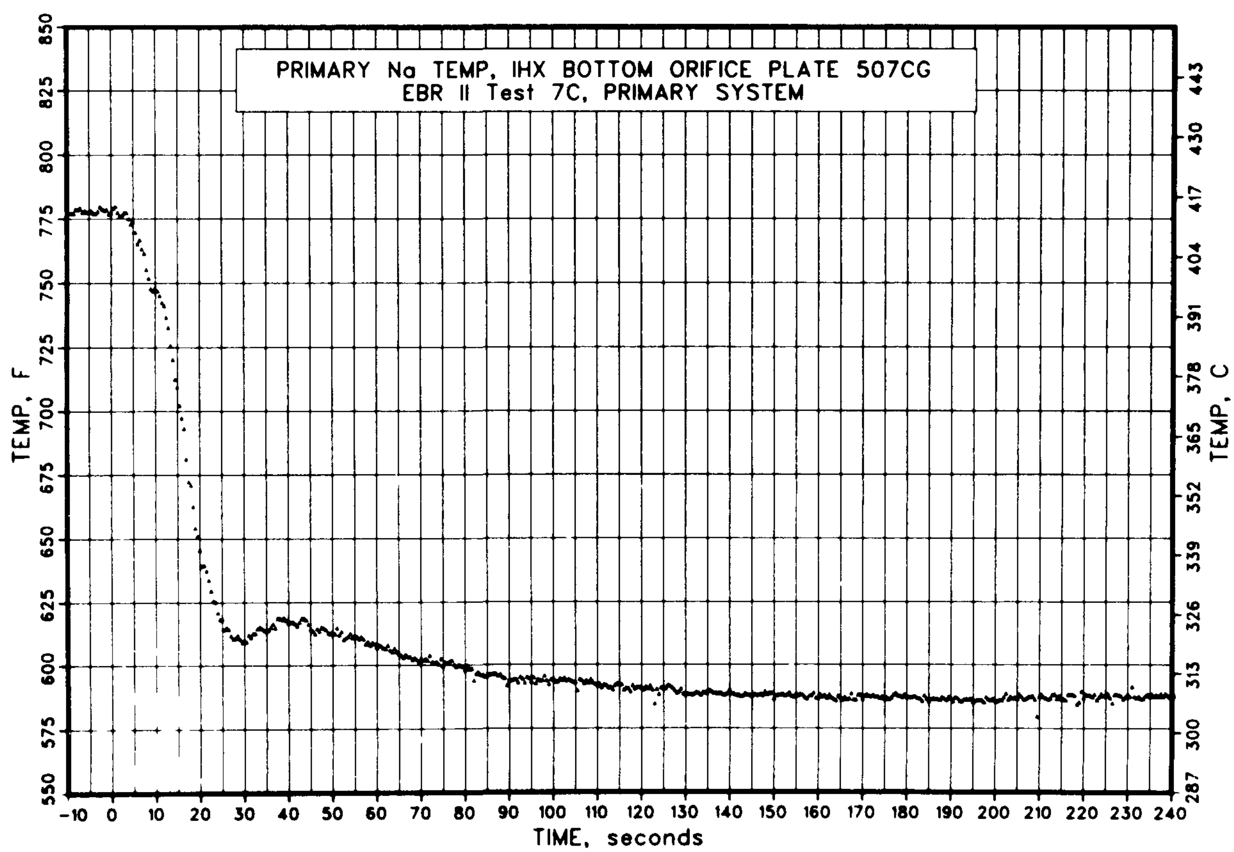

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EF
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds

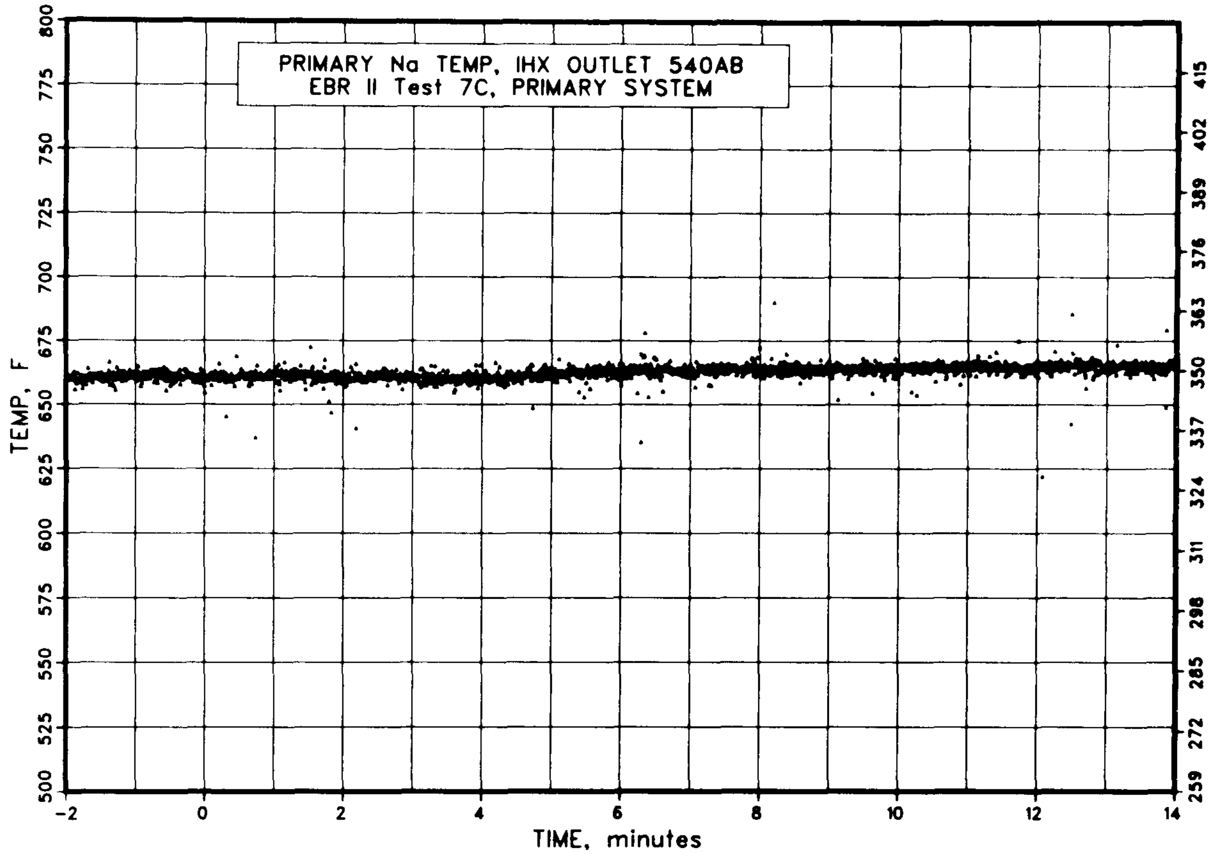

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507EG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CA
EBR II Test 7C, 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

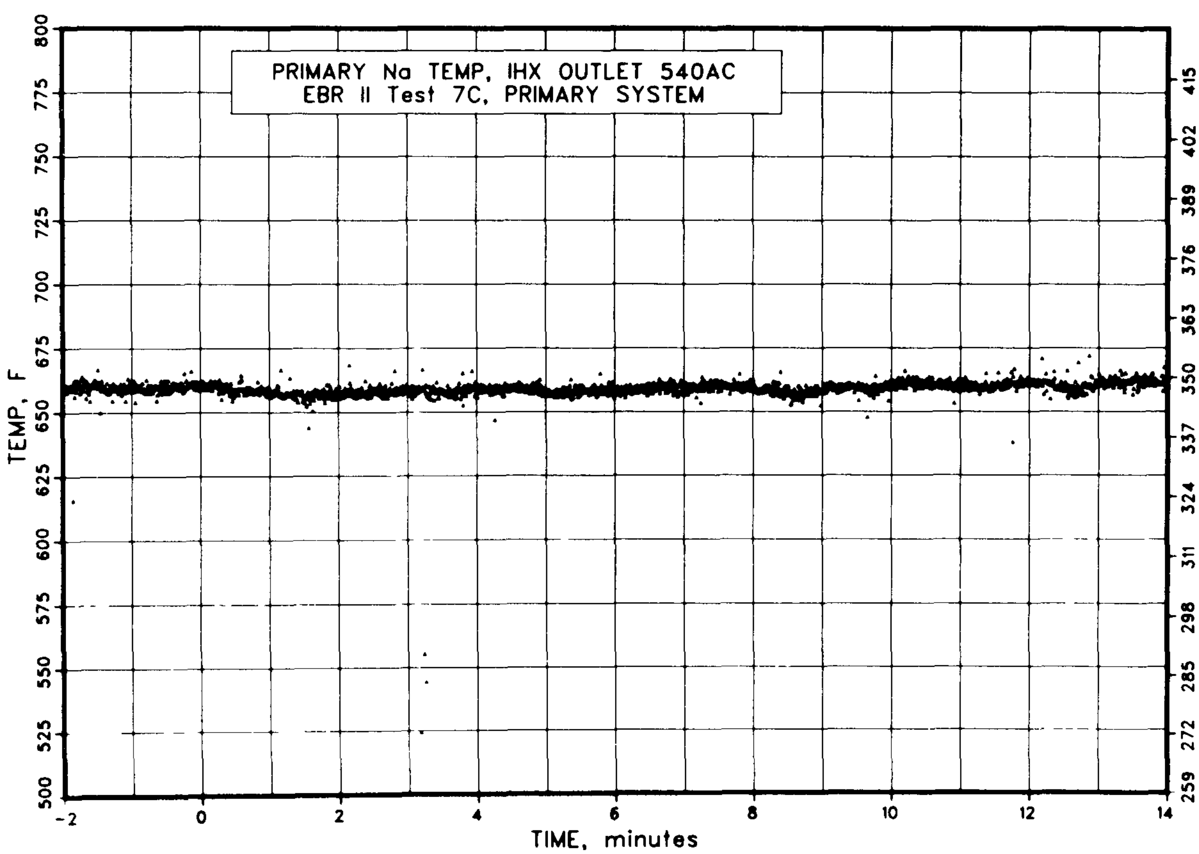

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-2
0
2
4
6
8
10
12
14


PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CA
EBR II Test 7C, 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 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

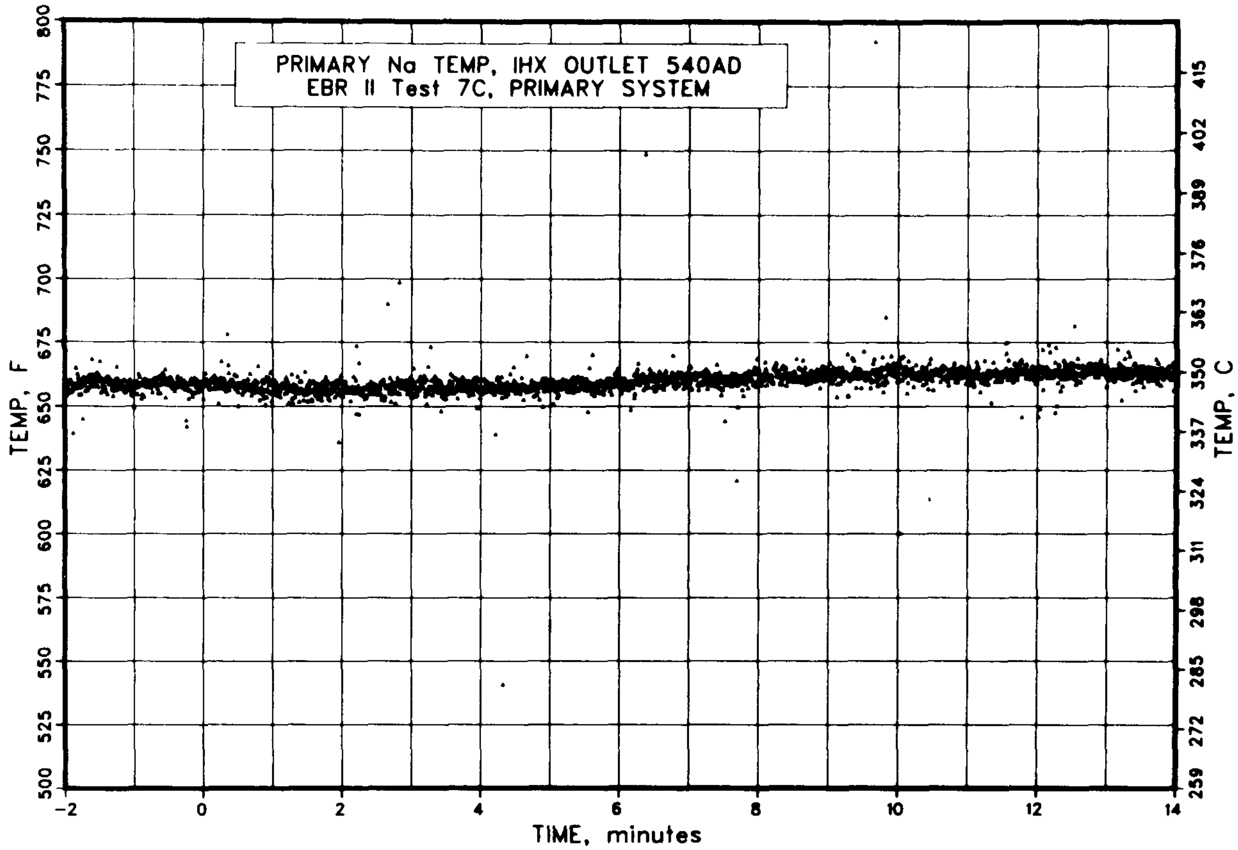

PRIMARY Na TEMP, IHX BOTTOM ORIFICE PLATE 507CG
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, seconds
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240

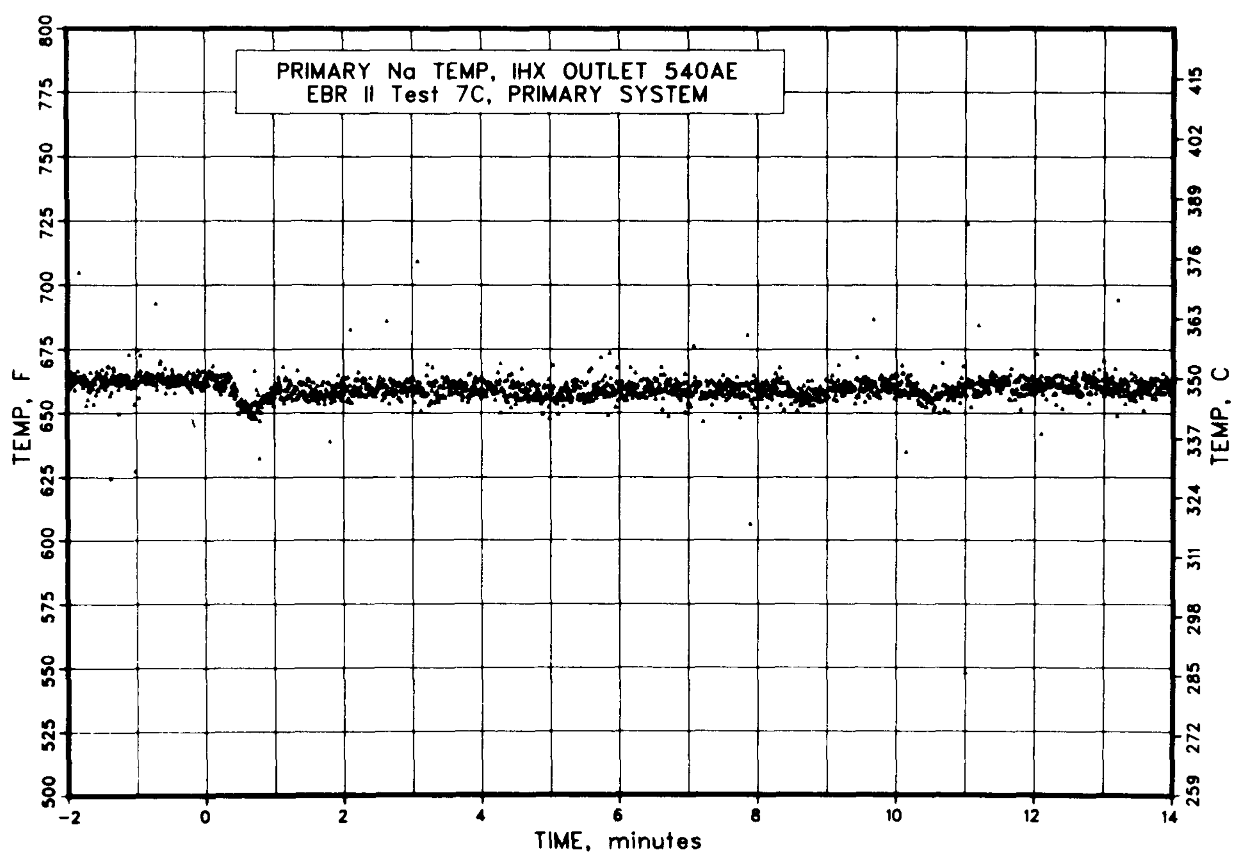


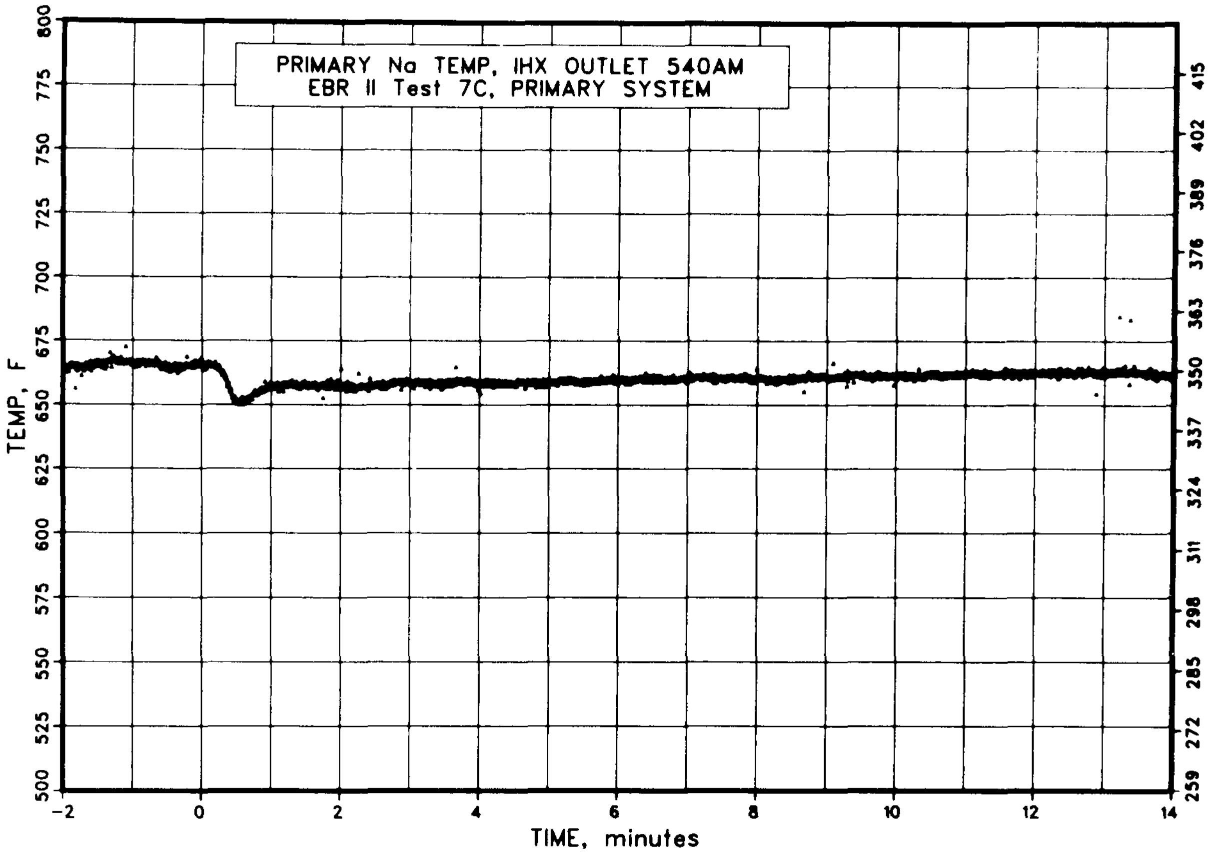
PRIMARY Na TEMP, IHX OUTLET 540AB
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14
TIME, minutes

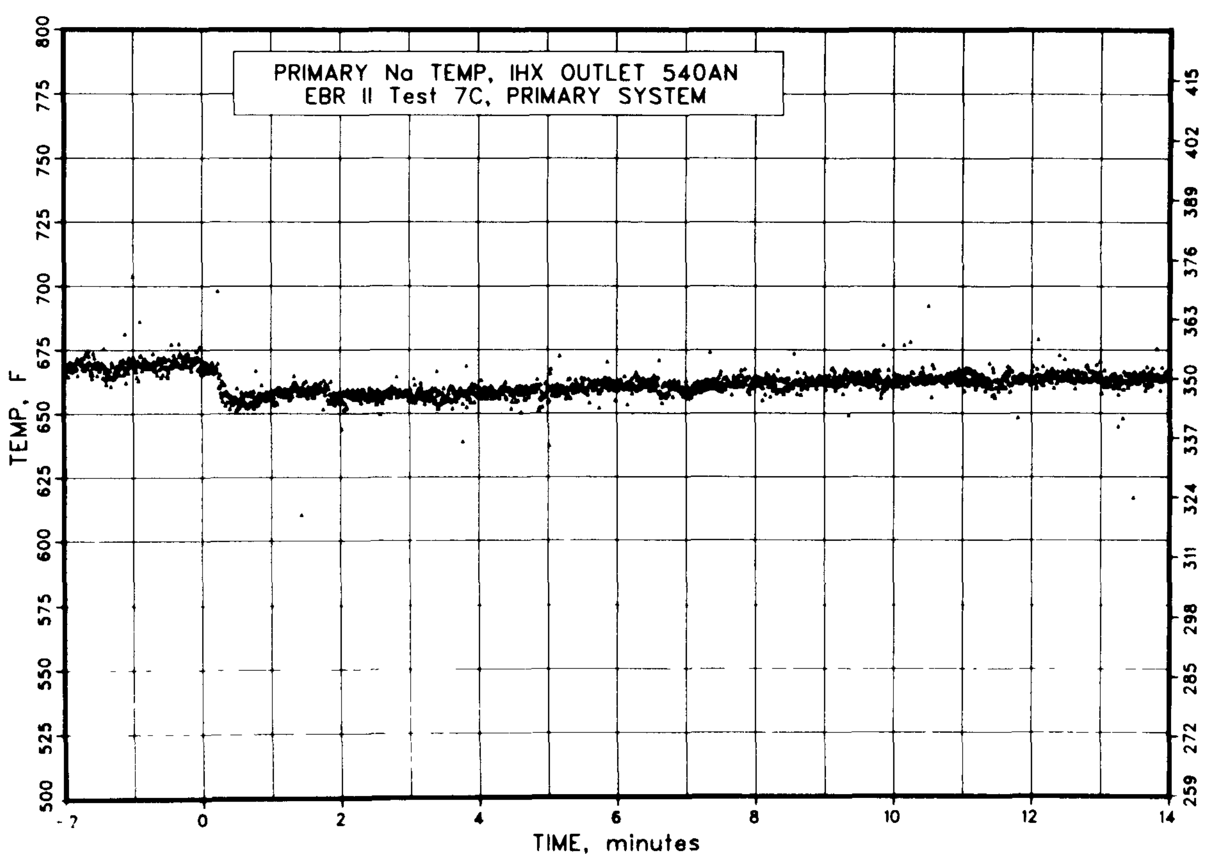


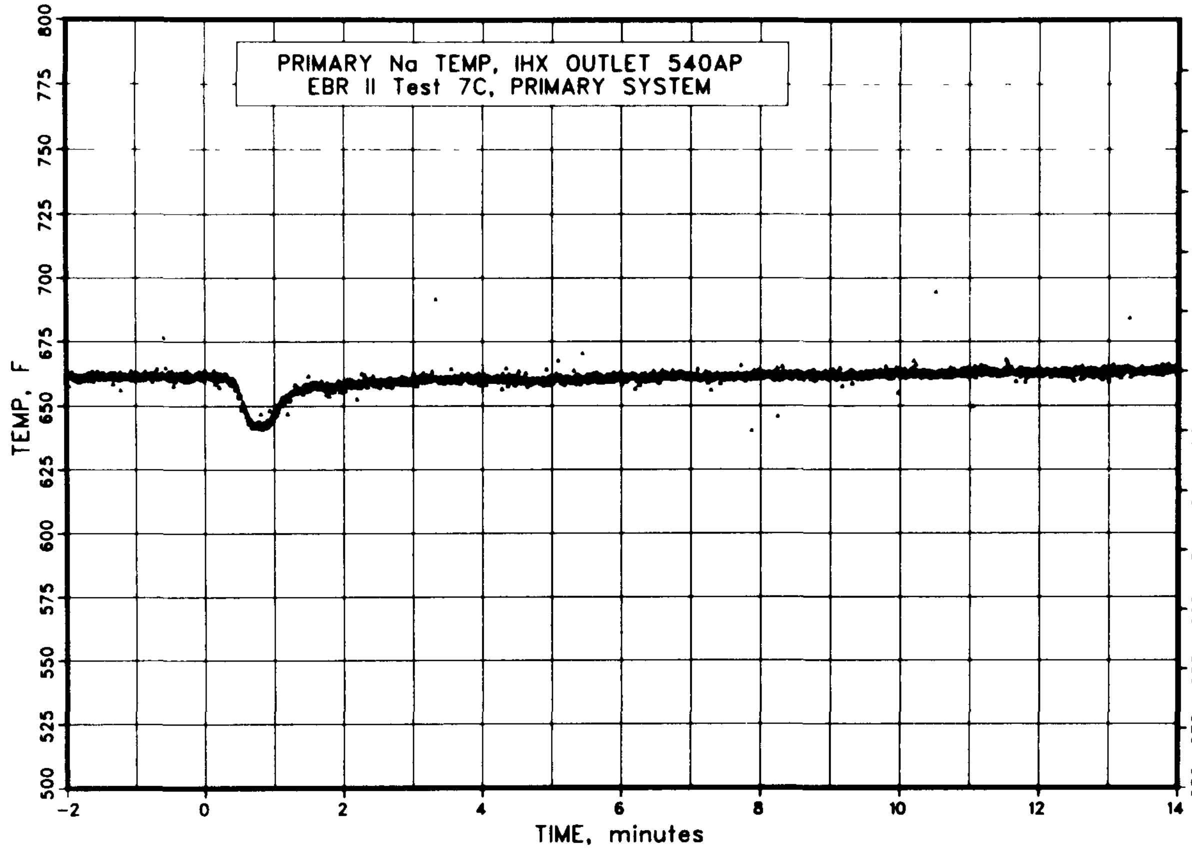
PRIMARY Na TEMP, IHX OUTLET 540AC
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14
TIME, minutes

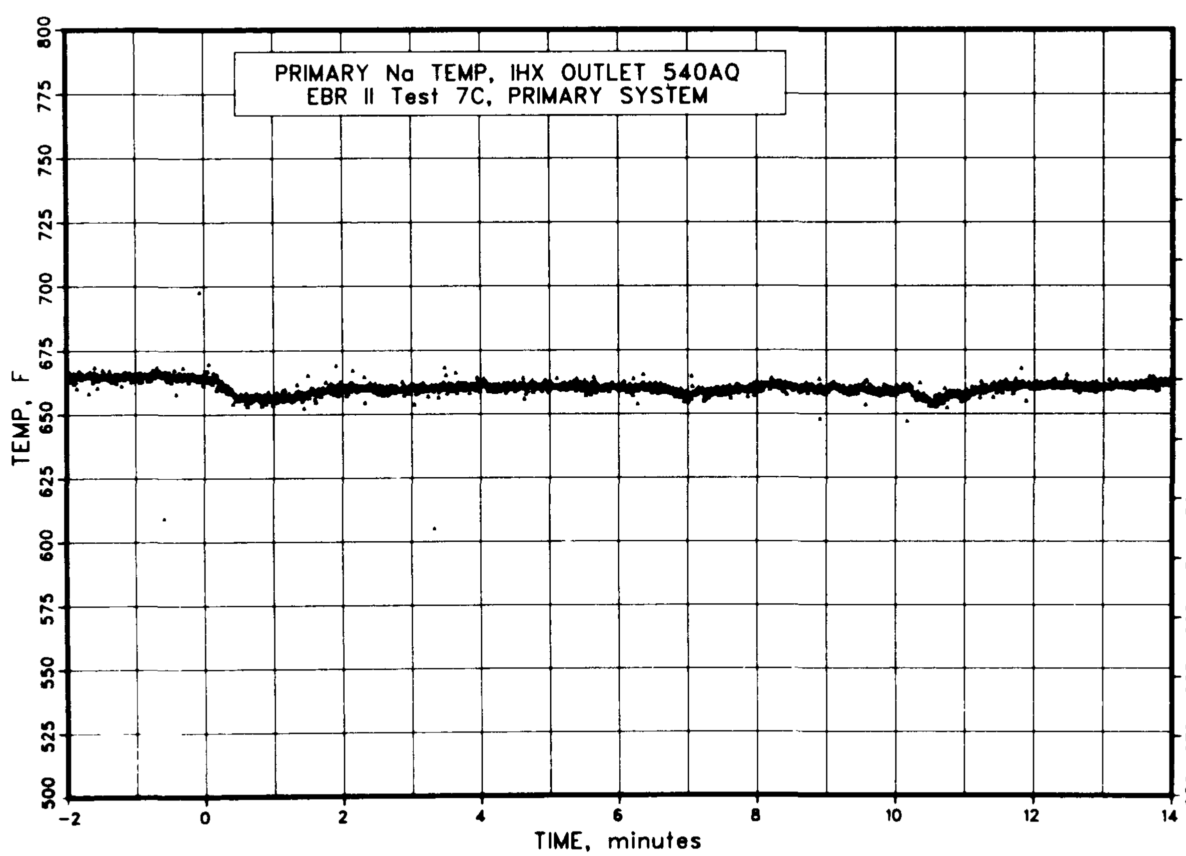

PRIMARY Na TEMP, IHX OUTLET 540AD
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
800
775
750
725
700
675
650
625
600
575
550
525
500
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14

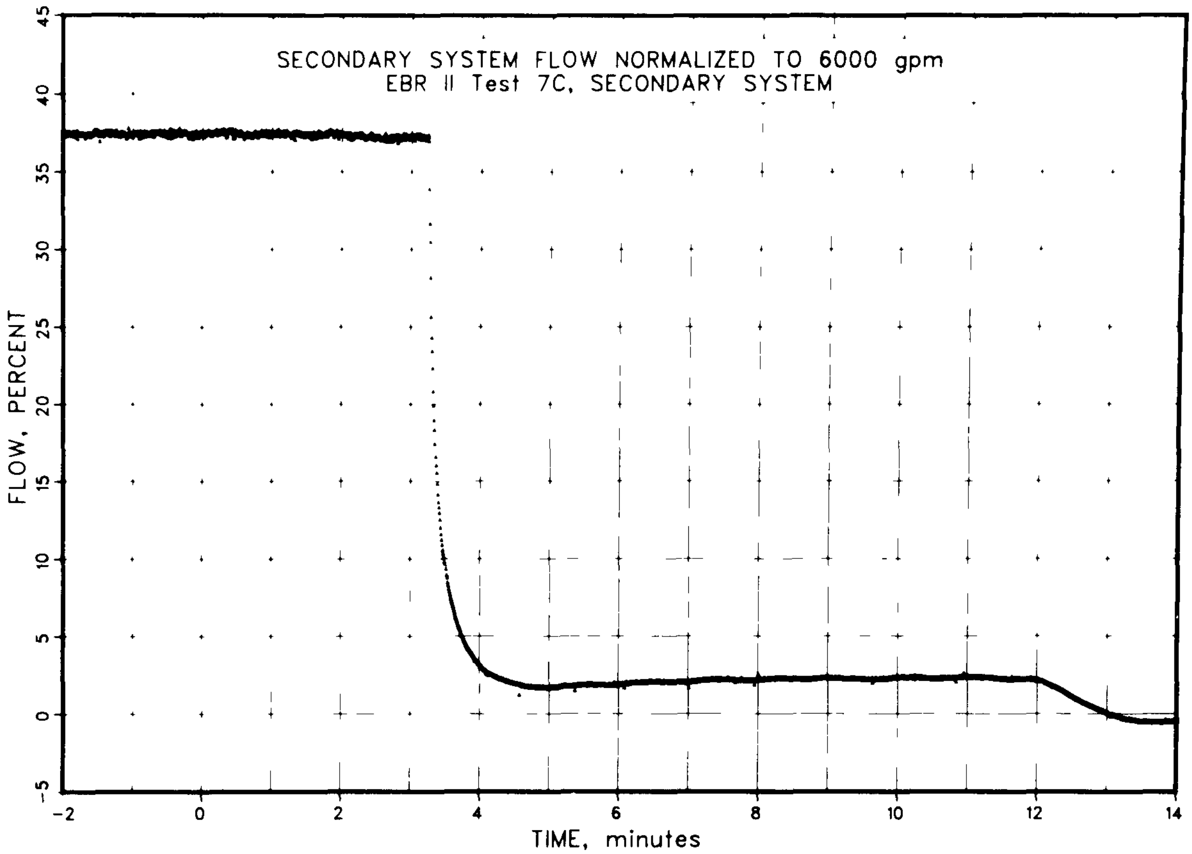

PRIMARY Na TEMP, IHX OUTLET 540AE
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
800
775
750
725
700
675
650
625
600
575
550
525
500
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14

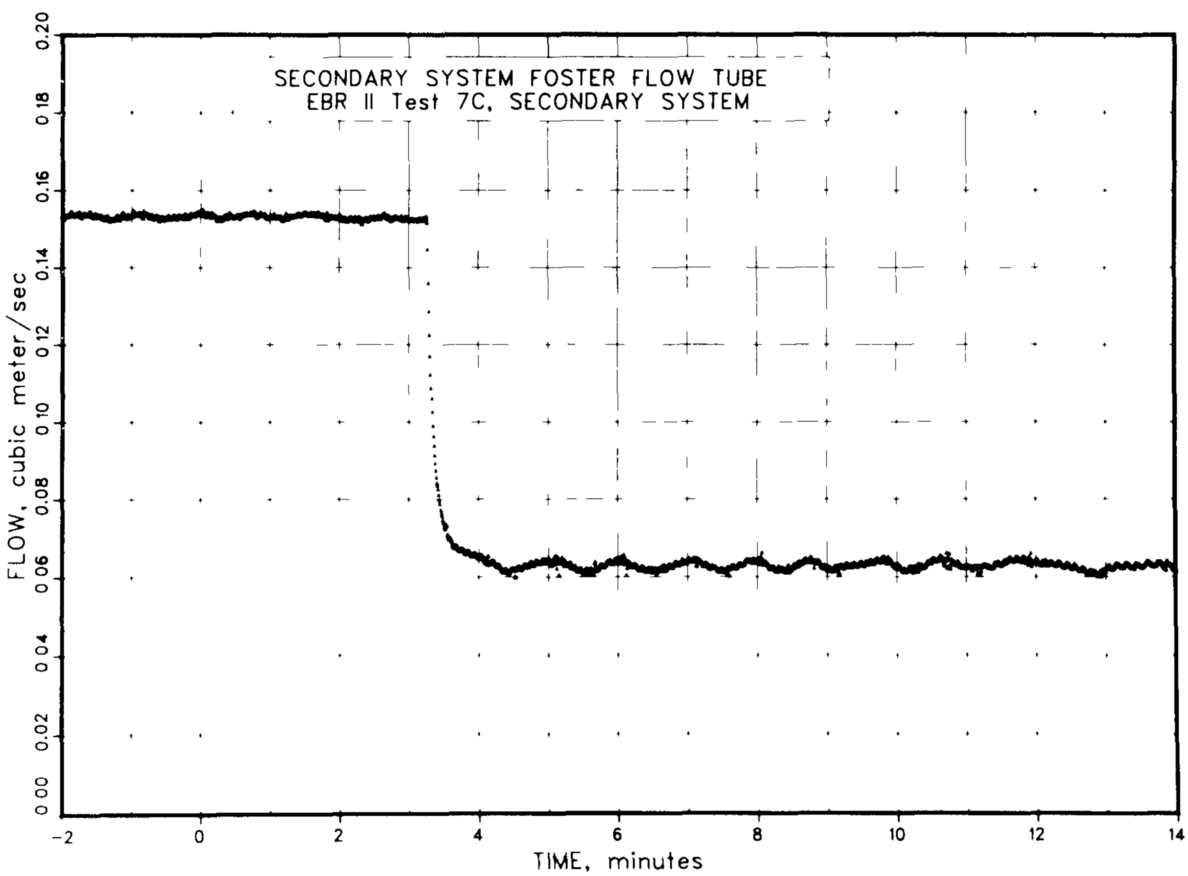

PRIMARY Na TEMP, IHX OUTLET 540AM
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
TIME, minutes
-2
0
2
4
6
8
10
12
14

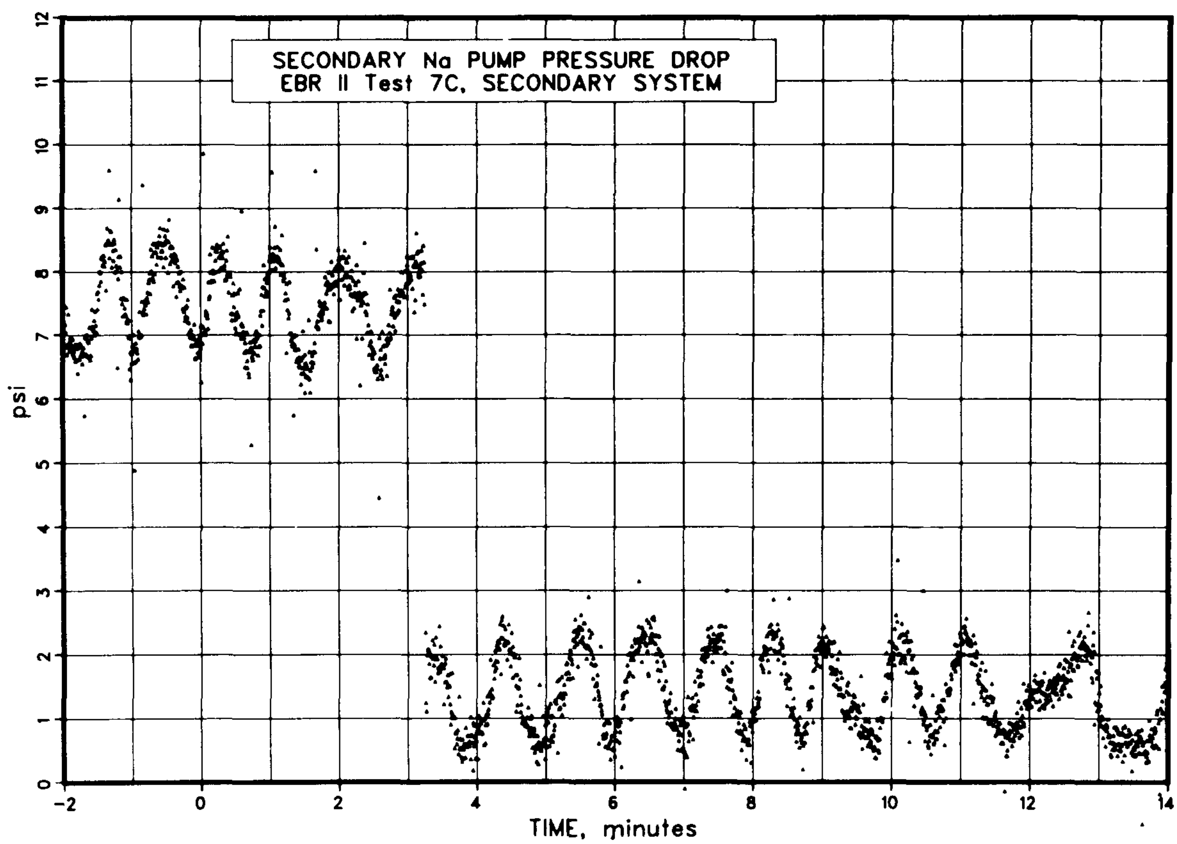

PRIMARY Na TEMP, IHX OUTLET 540AN
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
TIME, minutes
-2
0
2
4
6
8
10
12
14

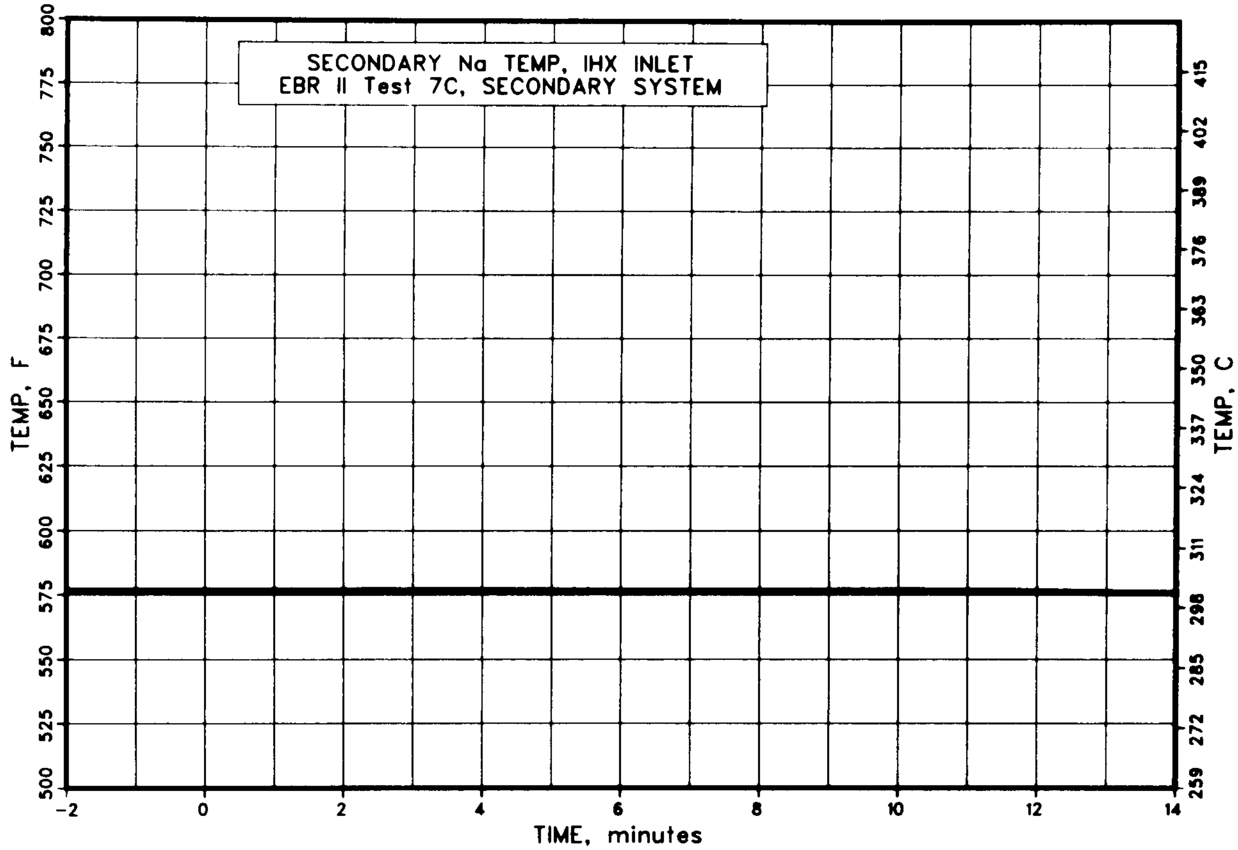

PRIMARY Na TEMP, IHX OUTLET 540AP
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
800
775
750
725
700
675
650
625
600
575
550
525
500
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14

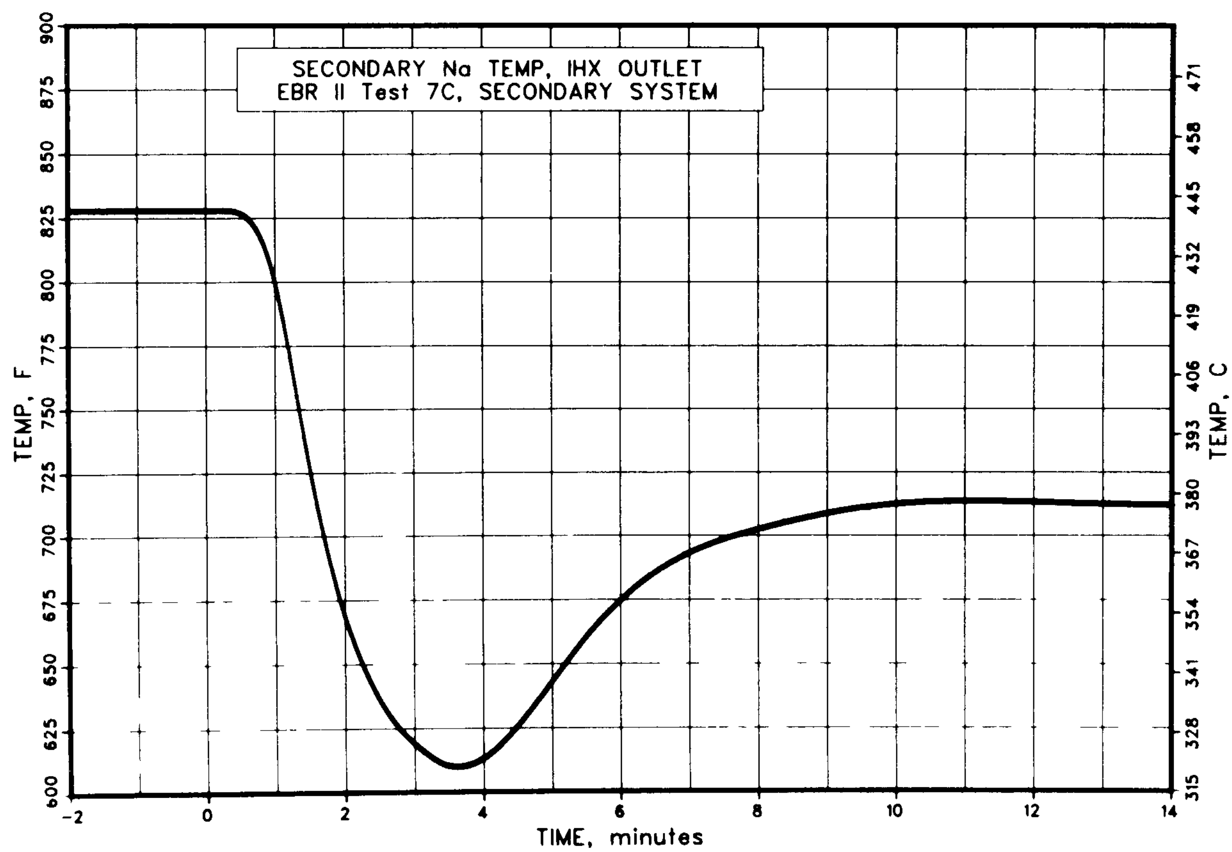

PRIMARY Na TEMP, IHX OUTLET 540AQ
EBR II Test 7C, PRIMARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
800
775
750
725
700
675
650
625
600
575
550
525
500
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14

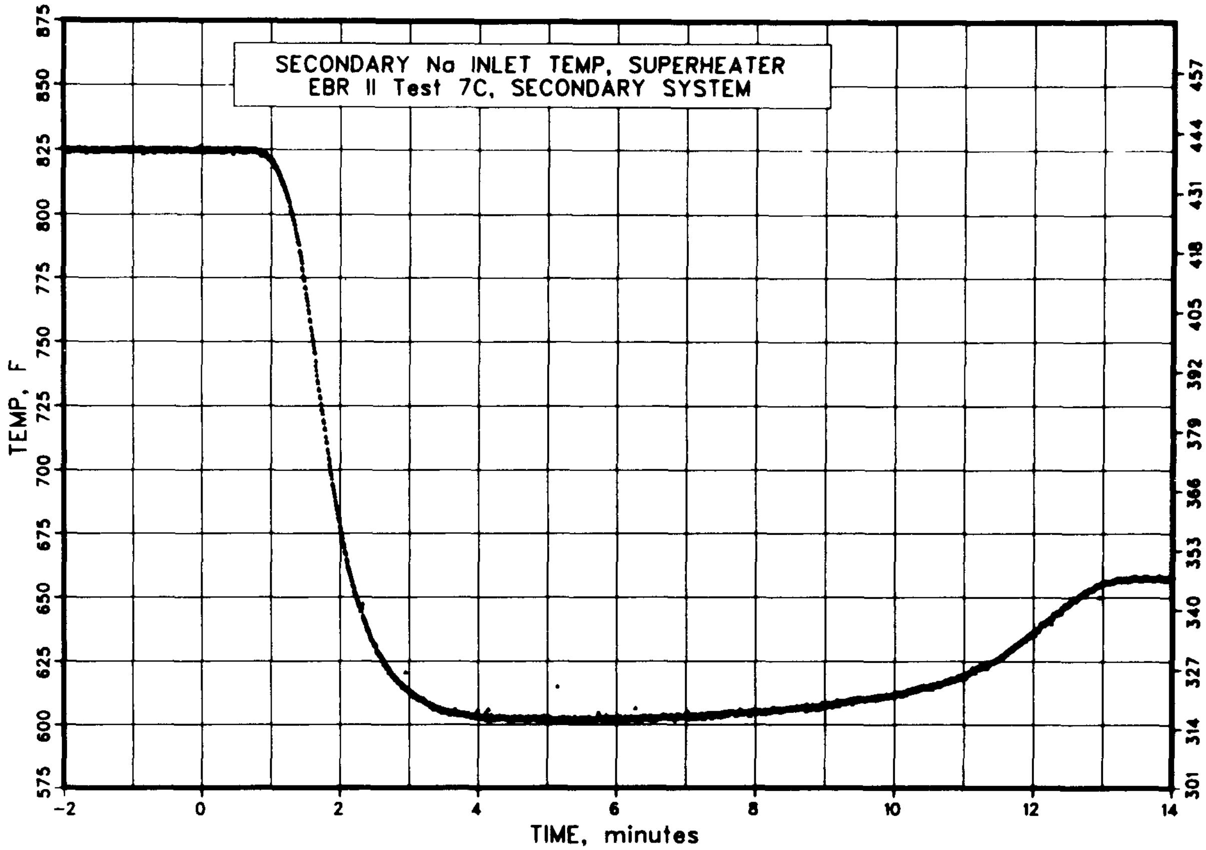

SECONDARY SYSTEM FLOW NORMALIZED TO 6000 gpm
EBR II Test 7C, SECONDARY SYSTEM
FLOW, PERCENT
TIME, minutes
-5
0
5
10
15
20
25
30
35
40
45
-2
0
2
4
6
8
10
12
14

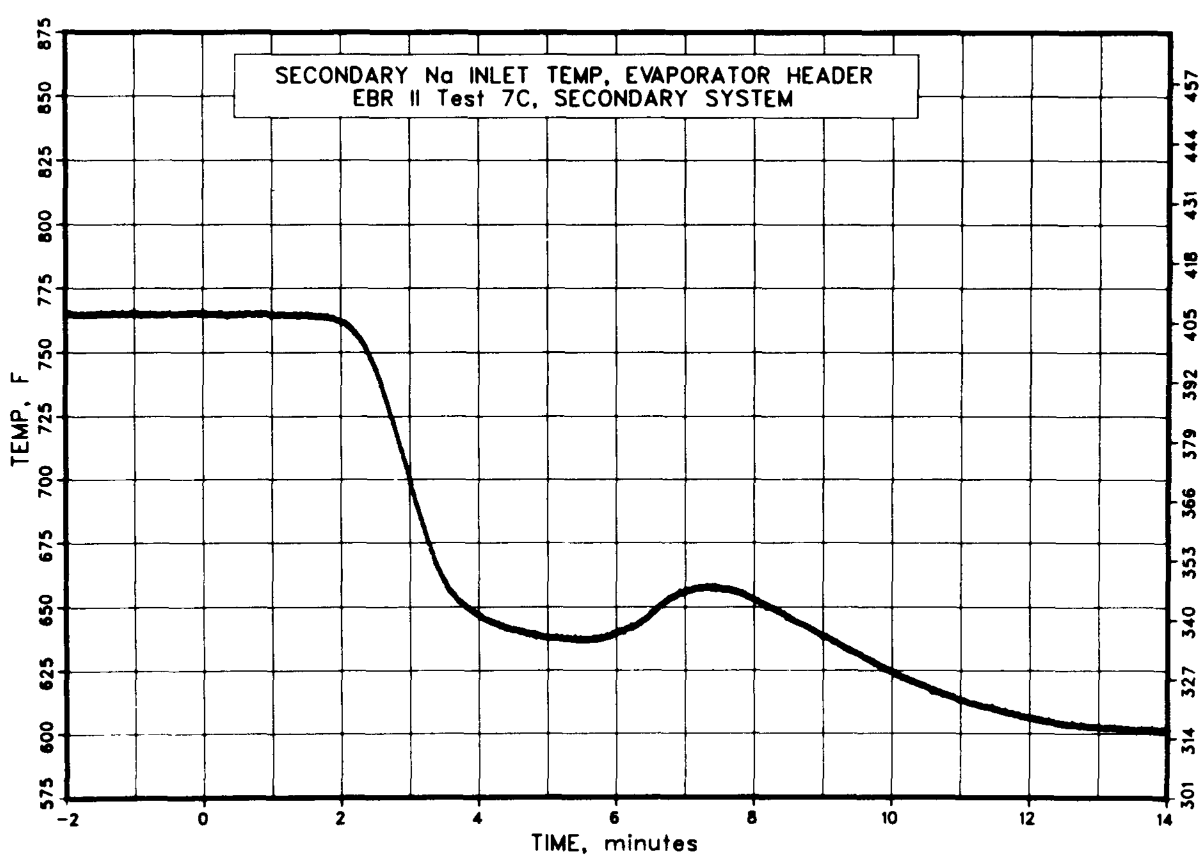

SECONDARY SYSTEM FOSTER FLOW TUBE
EBR II Test 7C, SECONDARY SYSTEM
FLOW, cubic meter/sec
TIME, minutes
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
-2
0
2
4
6
8
10
12
14

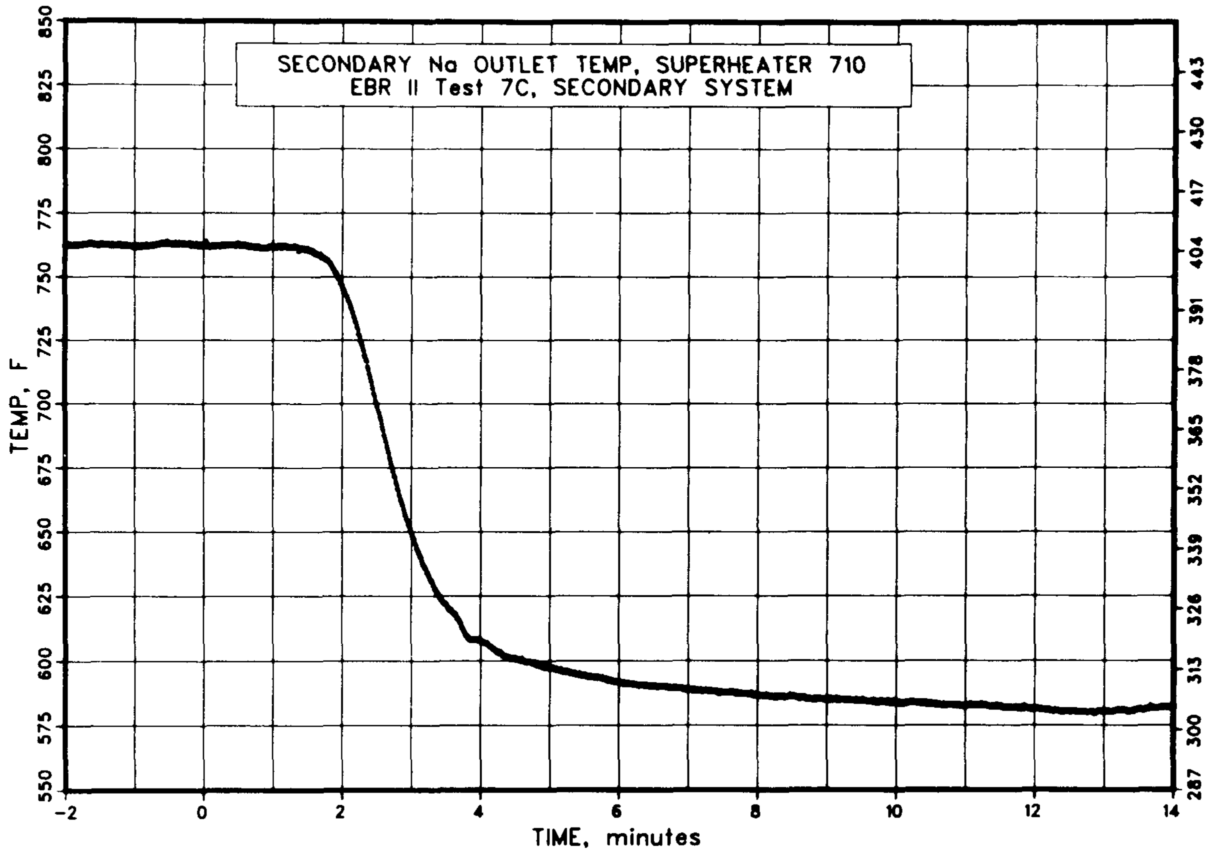

SECONDARY Na PUMP PRESSURE DROP
EBR II Test 7C, SECONDARY SYSTEM
psi
TIME, minutes
0
1
2
3
4
5
6
7
8
9
10
11
12
-2
0
2
4
6
8
10
12
14

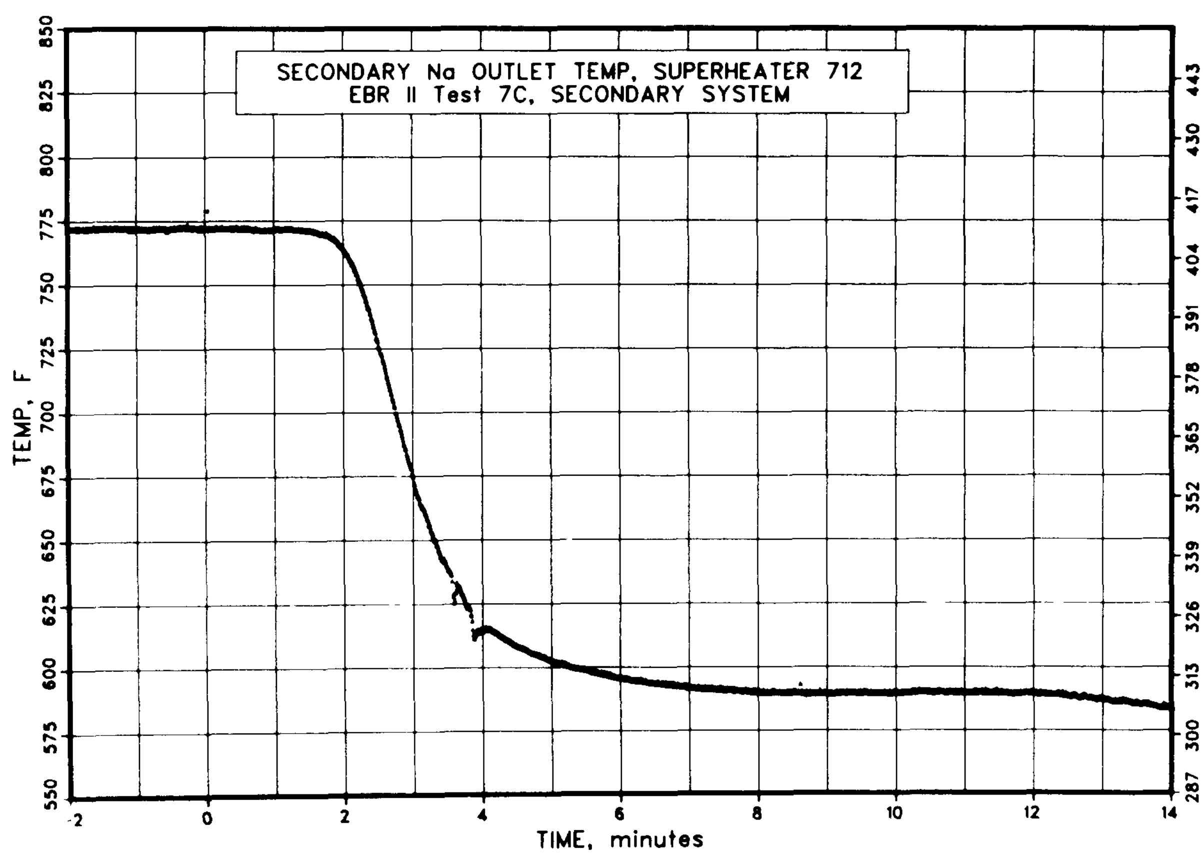

SECONDARY Na TEMP, IHX INLET
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

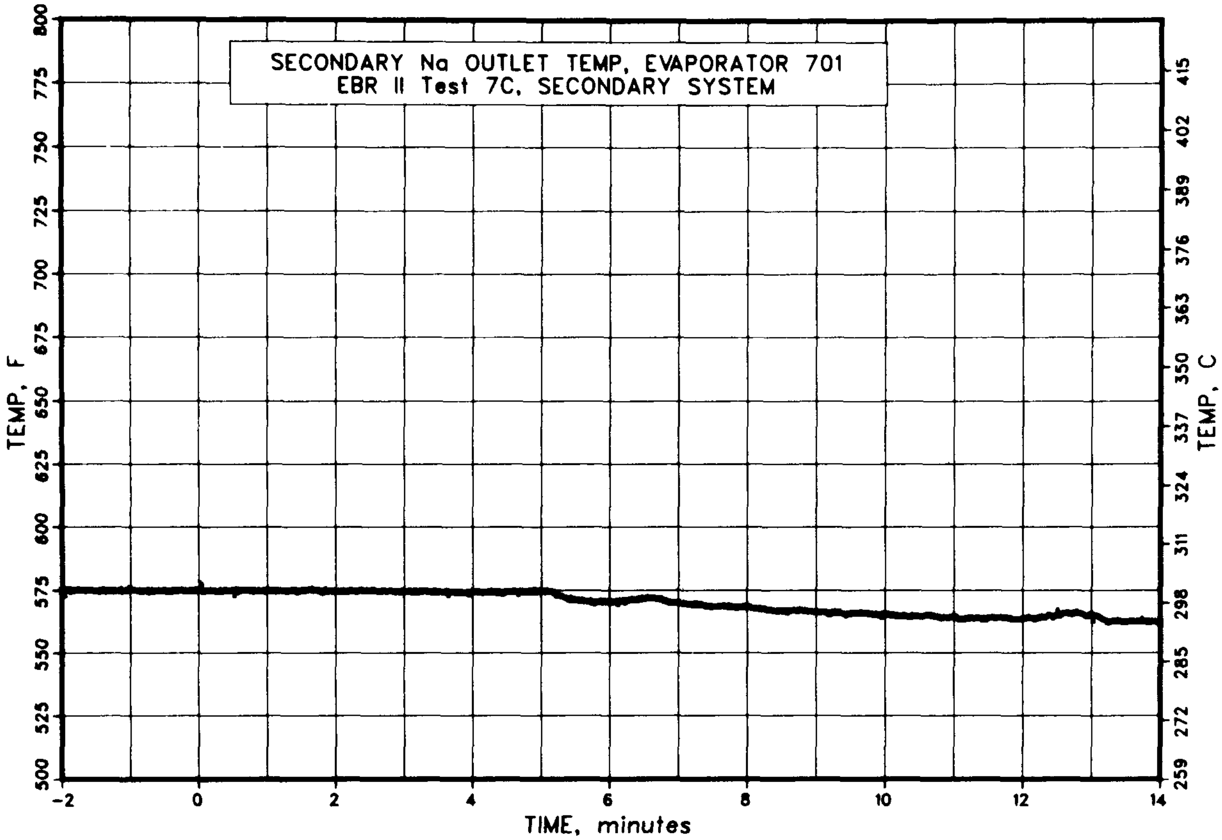

SECONDARY Na TEMP, IHX OUTLET
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

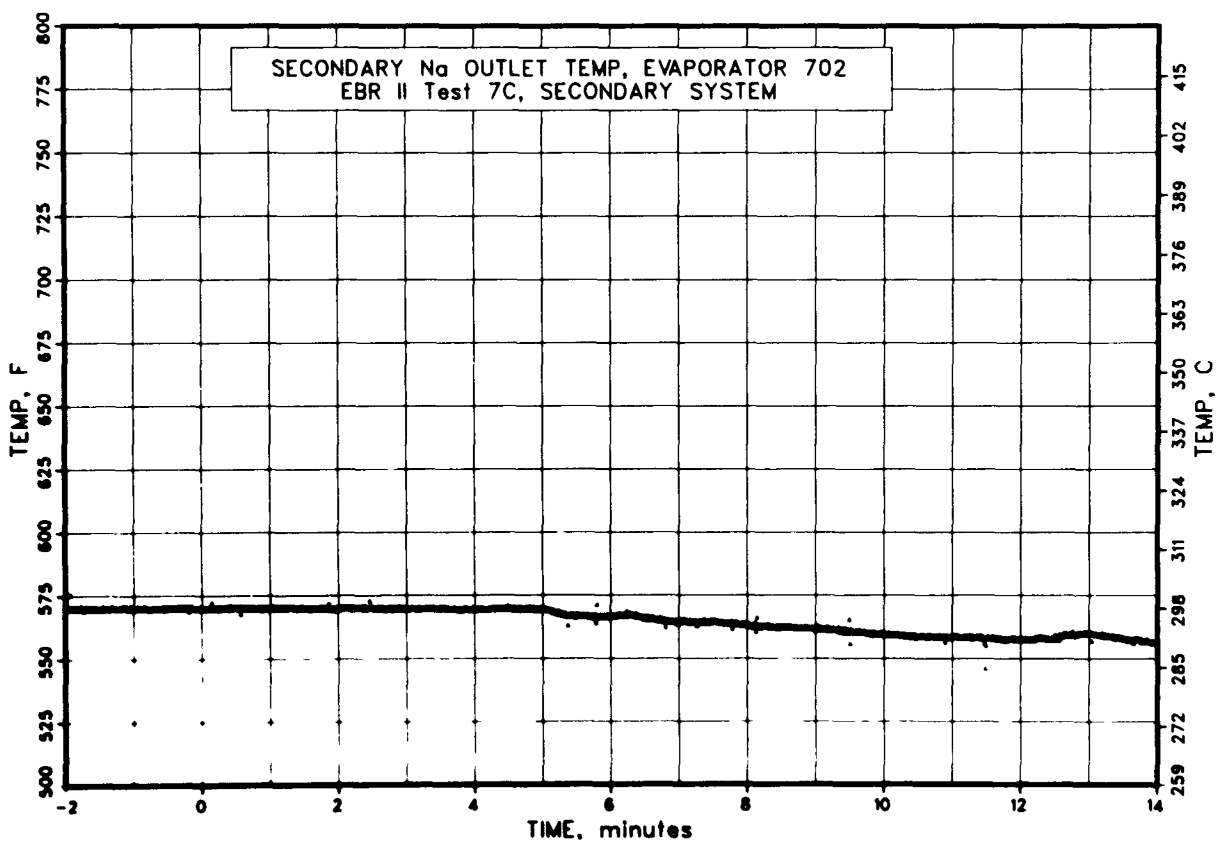

SECONDARY Na INLET TEMP, SUPERHEATER
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
875
850
825
800
775
750
725
700
675
650
625
600
575
457
444
431
418
405
392
379
366
353
340
327
314
301
-2
0
2
4
6
8
10
12
14

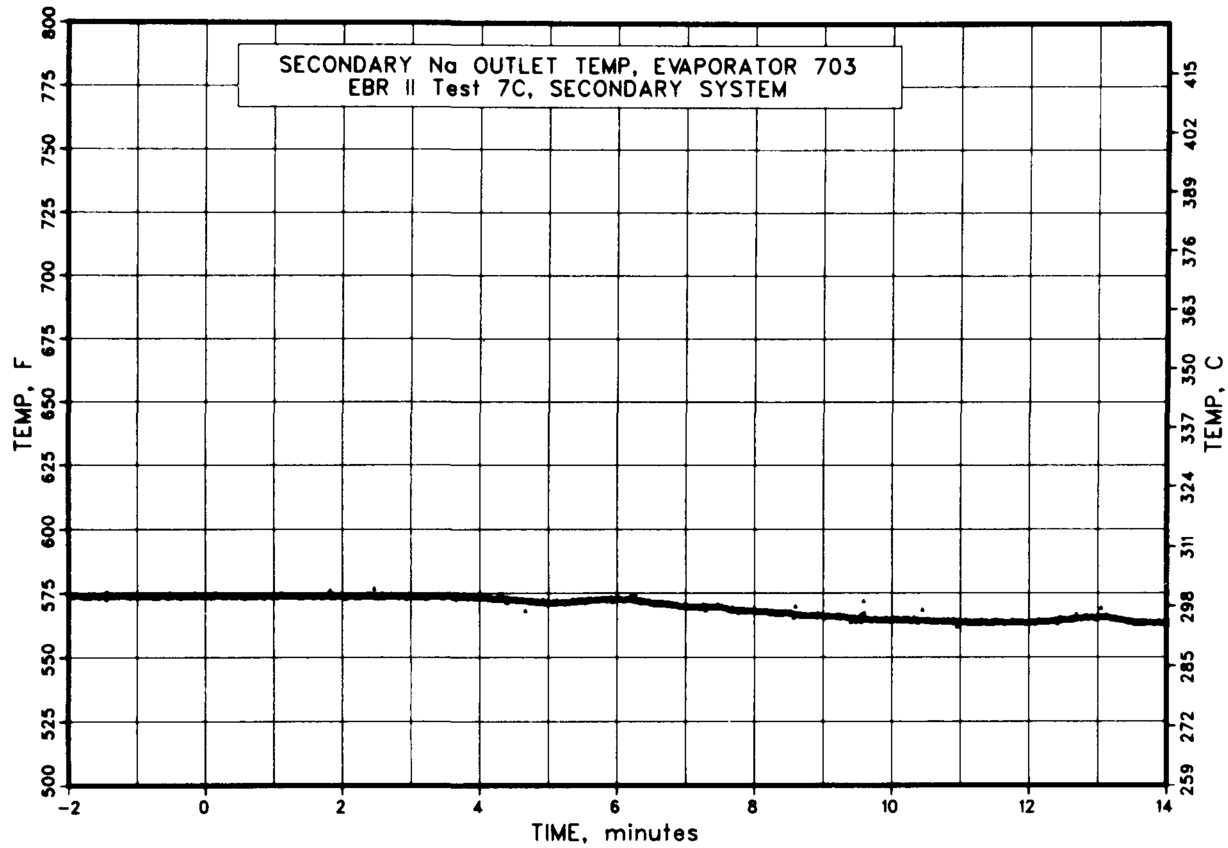

SECONDARY Na INLET TEMP, EVAPORATOR HEADER
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
875
850
825
800
775
750
725
700
675
650
625
600
575
457
444
431
418
405
392
379
366
353
340
327
314
301
-2
0
2
4
6
8
10
12
14

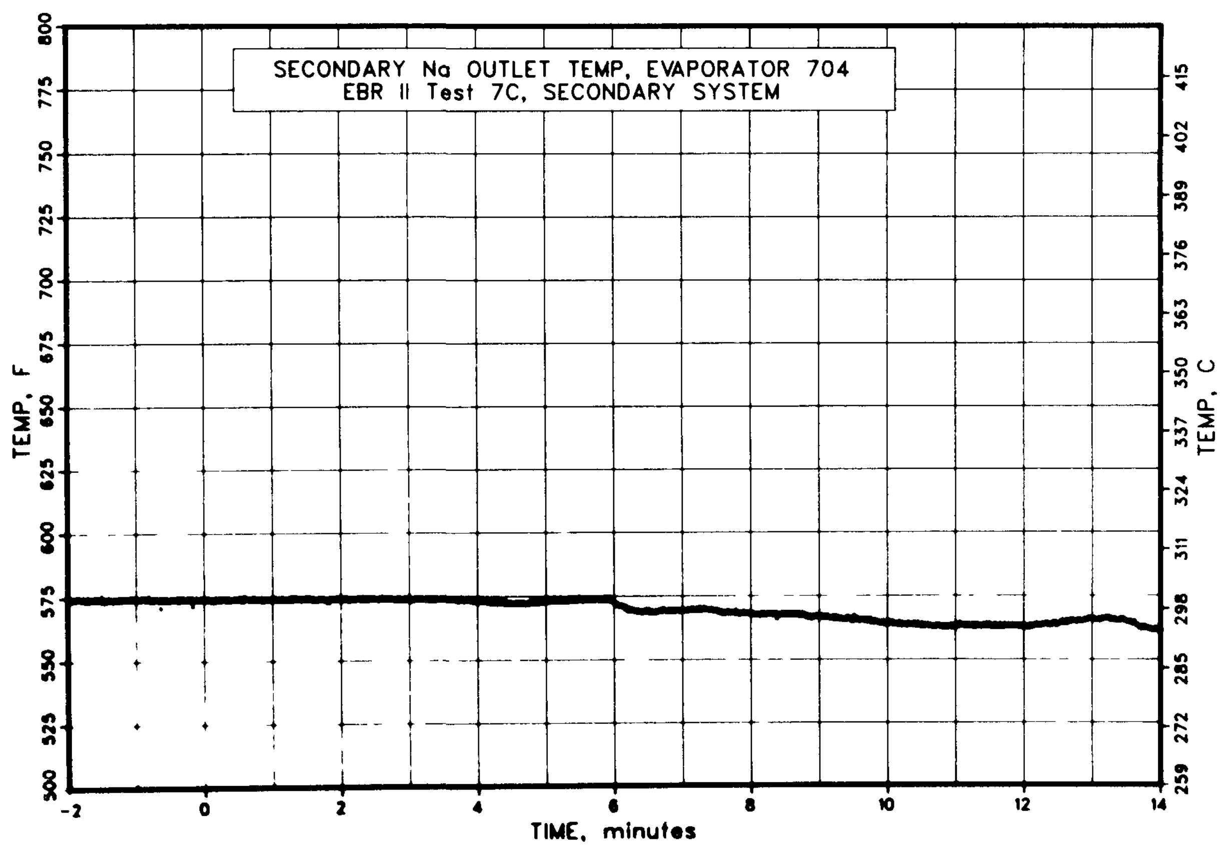

SECONDARY Na OUTLET TEMP, SUPERHEATER 710
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
850
825
800
775
750
725
700
675
650
625
600
575
550
TEMP, C
443
430
417
404
391
378
365
352
339
326
313
300
287
-2
0
2
4
6
8
10
12
14
TIME, minutes

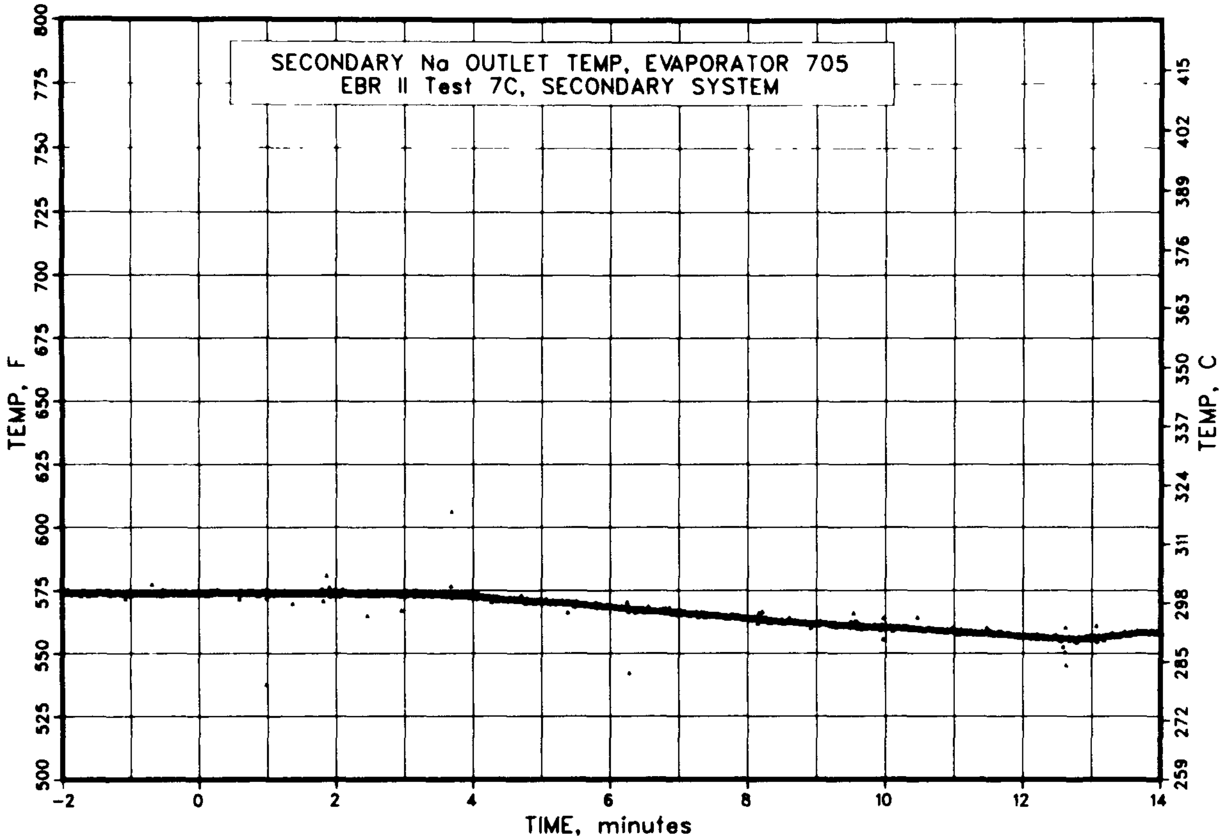

SECONDARY Na OUTLET TEMP, SUPERHEATER 712
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
850
825
800
775
750
725
700
675
650
625
600
575
550
TEMP, C
443
430
417
404
391
378
365
352
339
326
313
300
287
-2
0
2
4
6
8
10
12
14
TIME, minutes

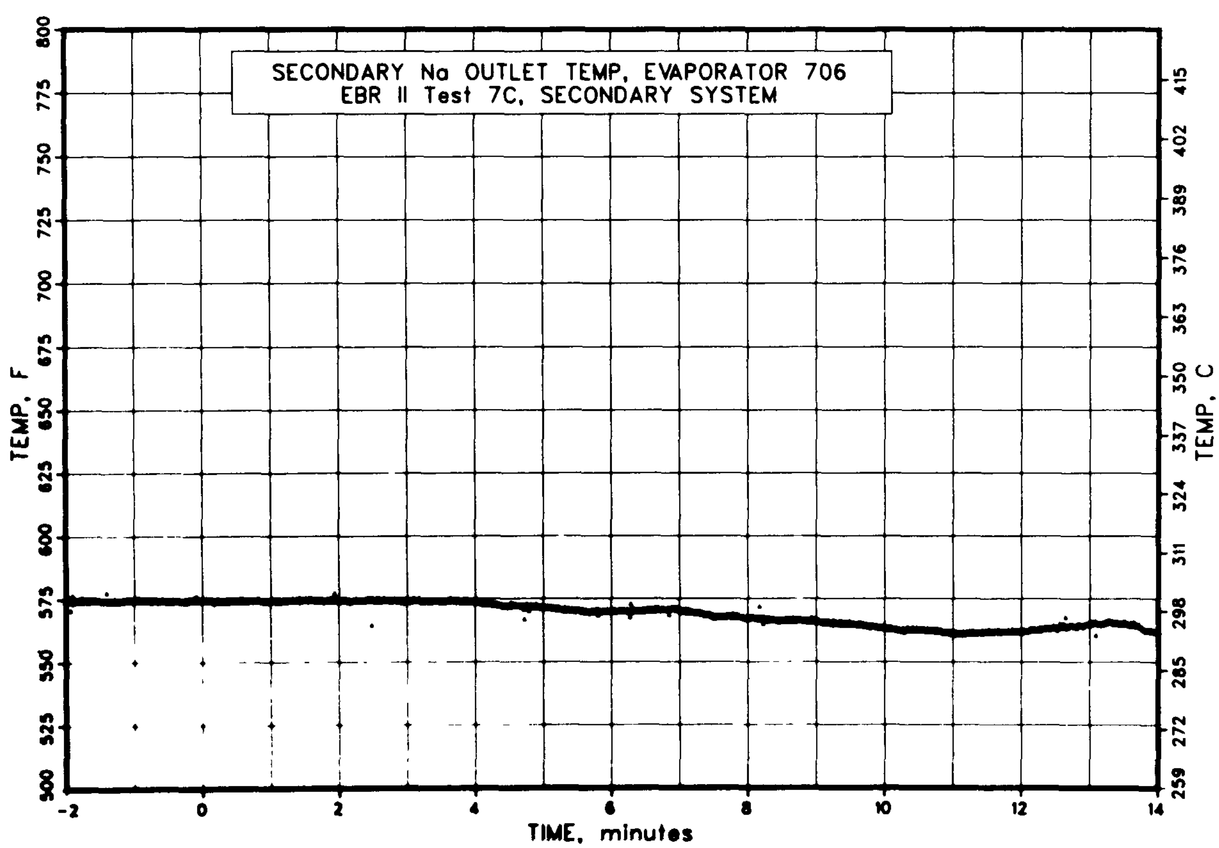

SECONDARY Na OUTLET TEMP, EVAPORATOR 701
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

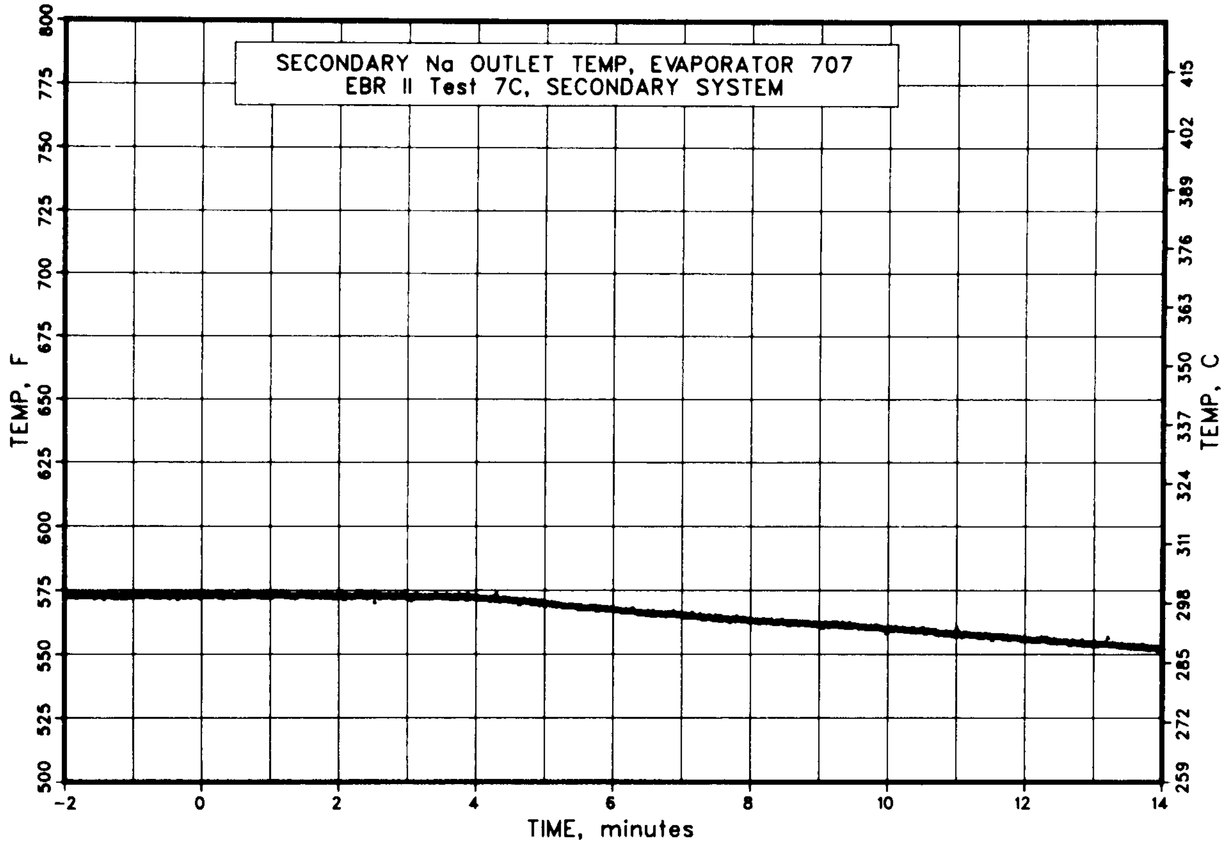

SECONDARY Na OUTLET TEMP, EVAPORATOR 702
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes

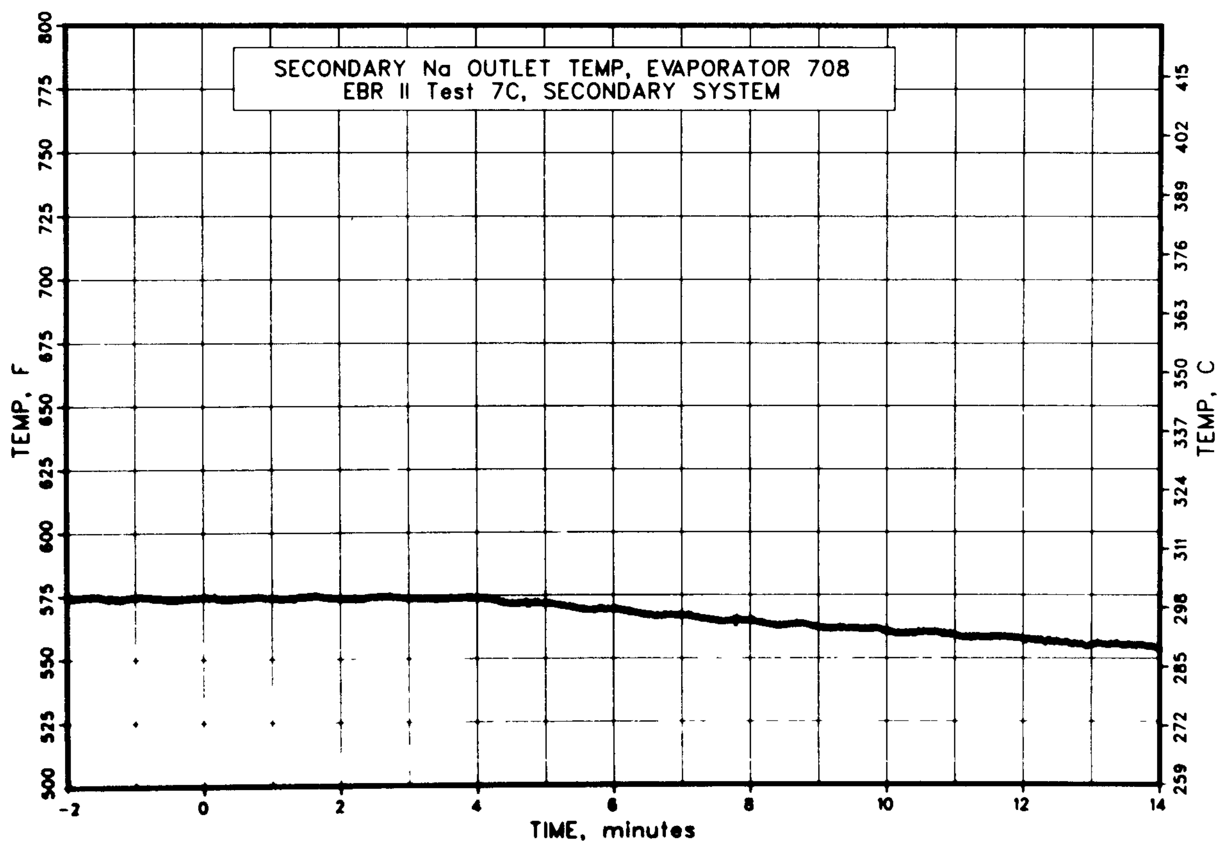

SECONDARY Na OUTLET TEMP, EVAPORATOR 703
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14
TIME, minutes

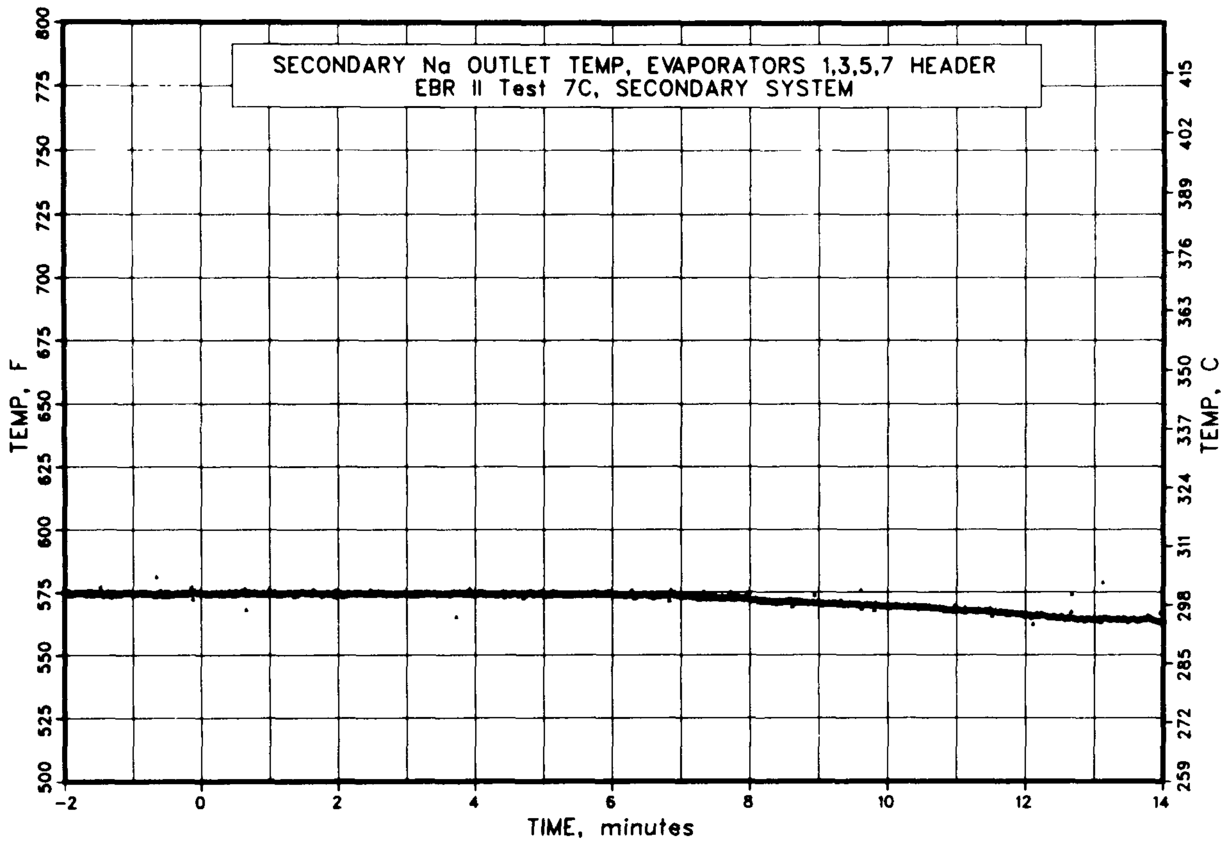

SECONDARY Na OUTLET TEMP, EVAPORATOR 704
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14
TIME, minutes


SECONDARY Na OUTLET TEMP, EVAPORATOR 705
EBR II Test 7C, 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
TIME, minutes

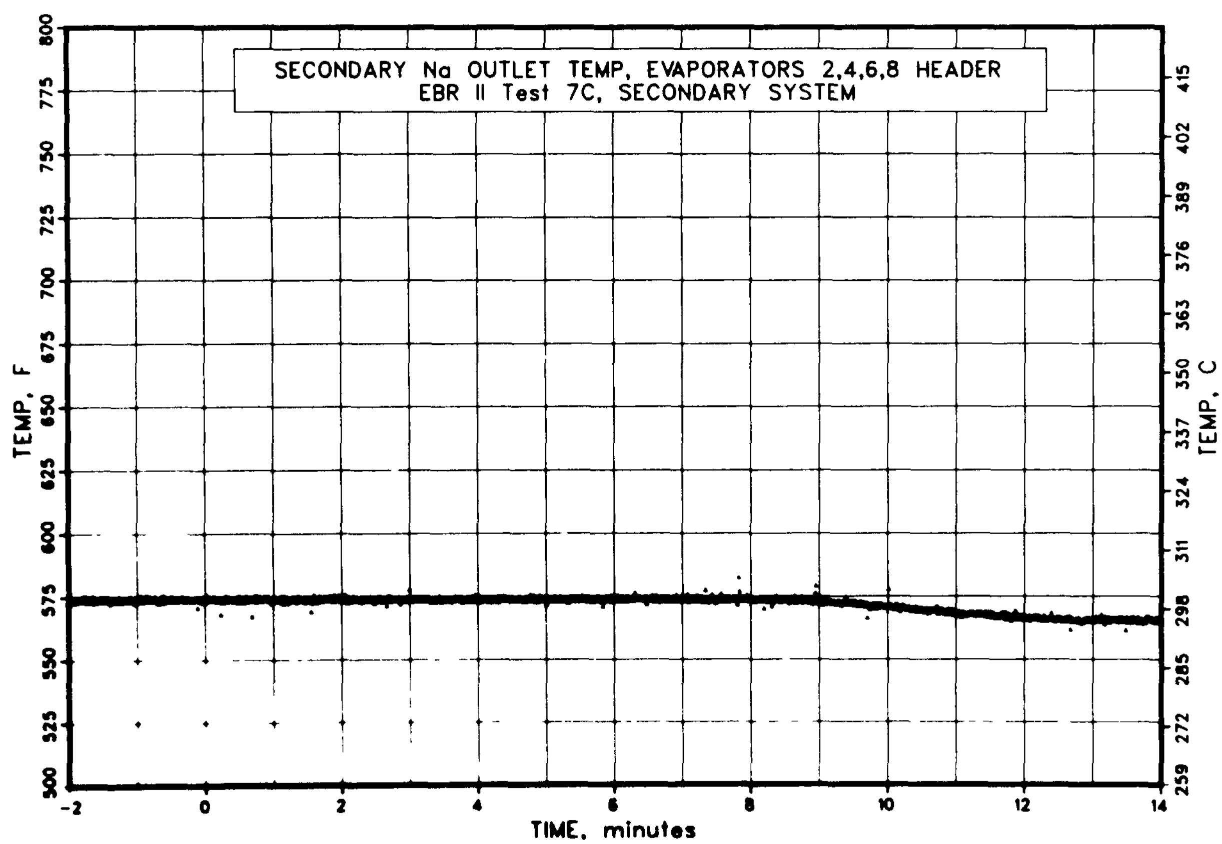

SECONDARY Na OUTLET TEMP, EVAPORATOR 706
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
800
775
750
725
700
675
650
625
600
575
550
525
500
TEMP, C
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14
TIME, minutes


SECONDARY Na OUTLET TEMP, EVAPORATOR 707
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
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
-2
0
2
4
6
8
10
12
14

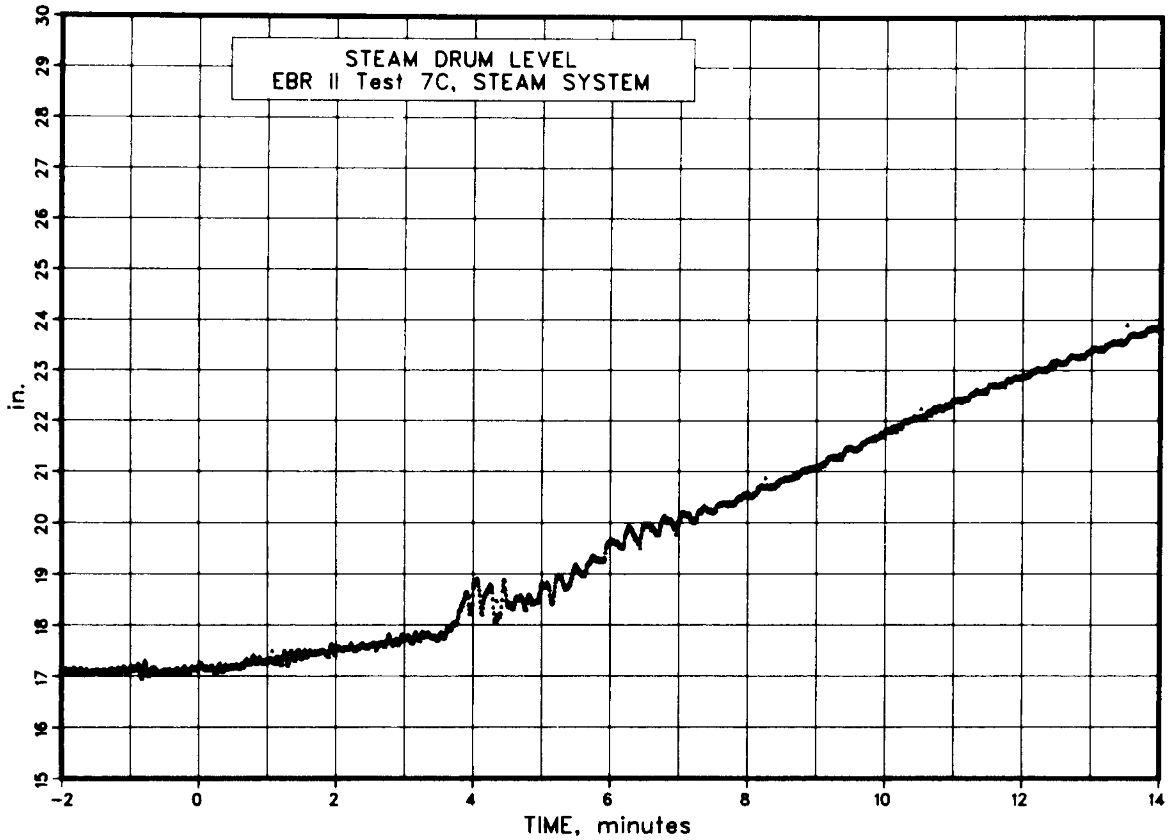

SECONDARY Na OUTLET TEMP, EVAPORATOR 708
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes
800
775
750
725
700
675
650
625
600
575
550
525
500
415
402
389
376
363
350
337
324
311
298
285
272
259
-2
0
2
4
6
8
10
12
14



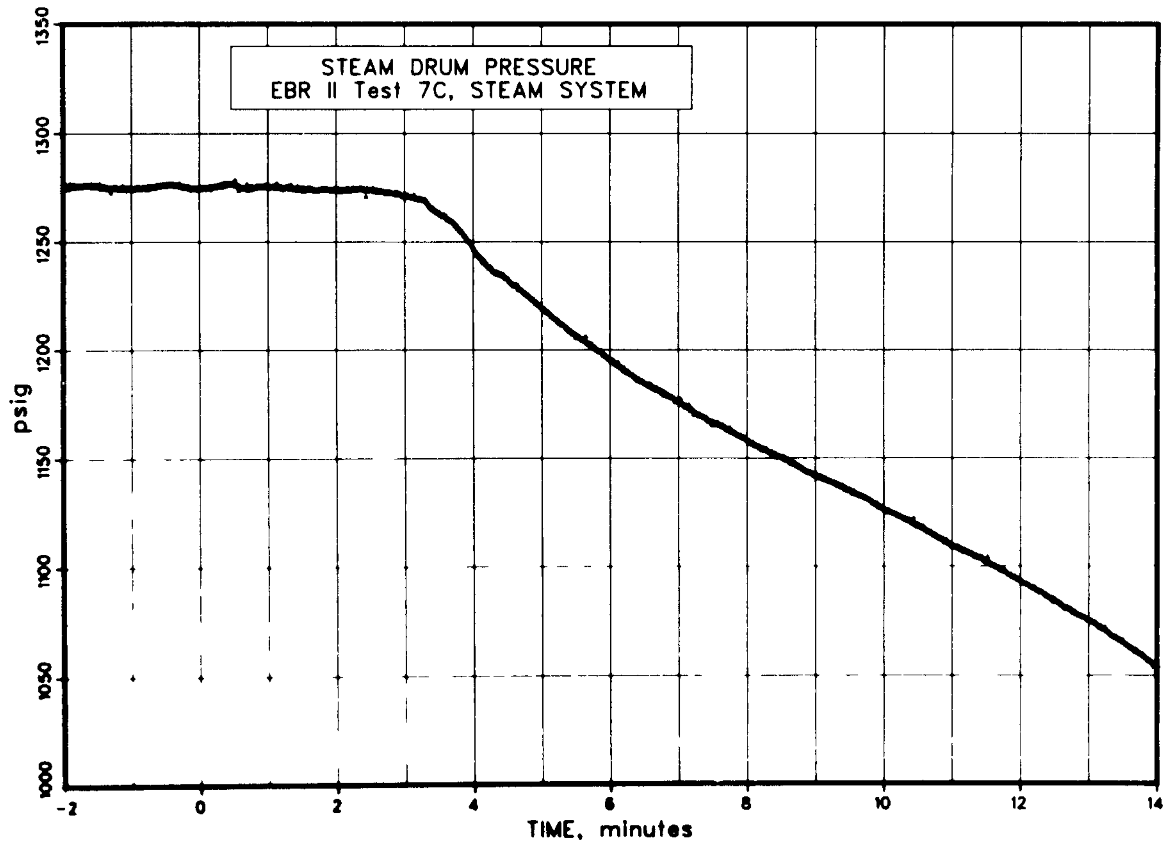
SECONDARY Na OUTLET TEMP, EVAPORATORS 1,3,5,7 HEADER
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes



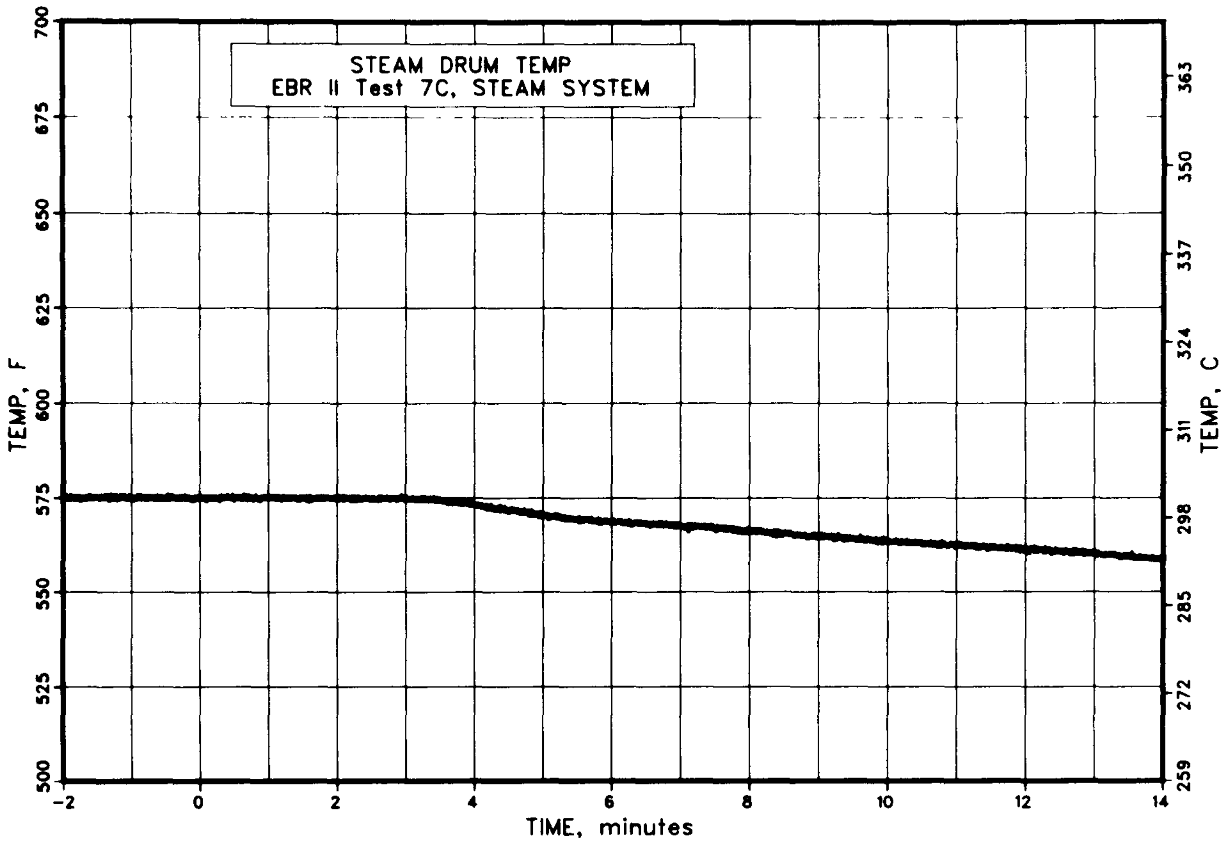
SECONDARY Na OUTLET TEMP, EVAPORATORS 2,4,6,8 HEADER
EBR II Test 7C, SECONDARY SYSTEM
TEMP, F
TEMP, C
TIME, minutes



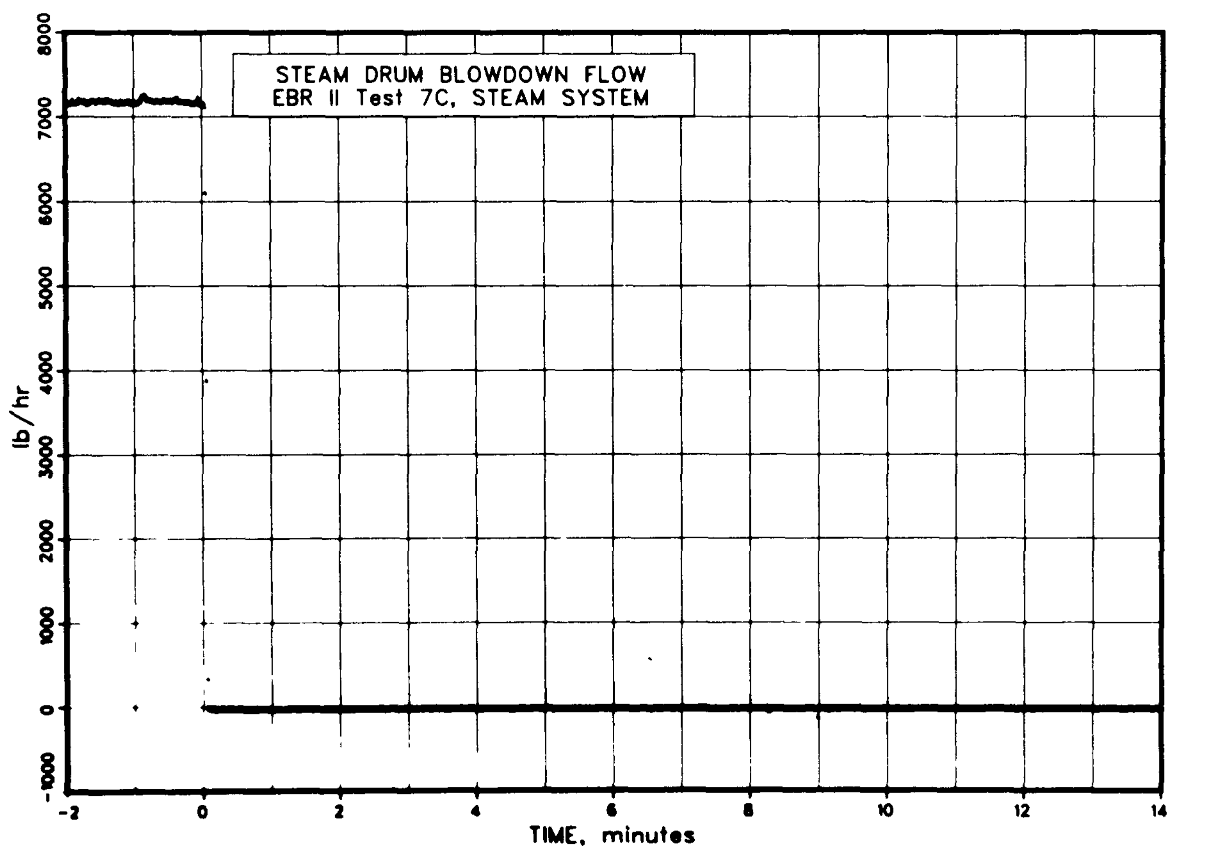
STEAM DRUM LEVEL
EBR II Test 7C, STEAM SYSTEM
in.
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
-2
0
2
4
6
8
10
12
14
TIME, minutes



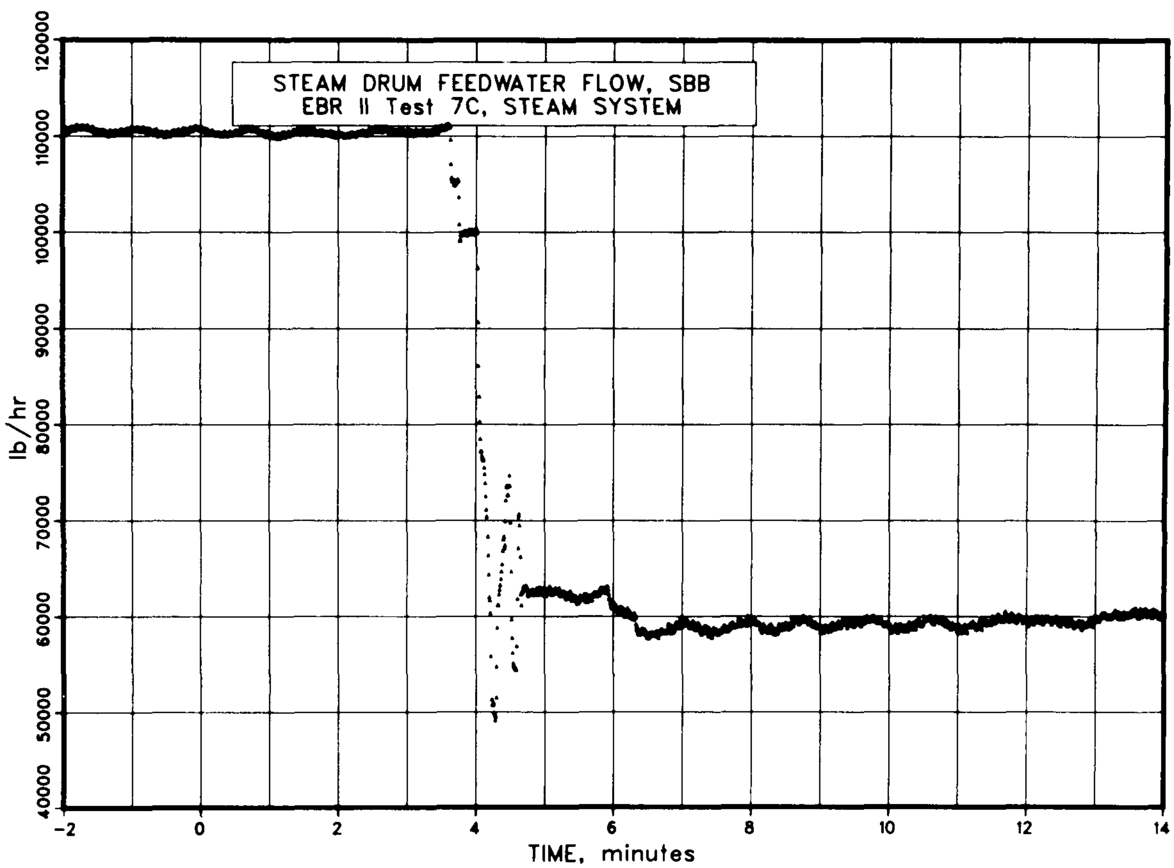
STEAM DRUM PRESSURE
EBR II Test 7C, STEAM SYSTEM
psig
1000
1050
1100
1150
1200
1250
1300
1350
-2
0
2
4
6
8
10
12
14
TIME, minutes

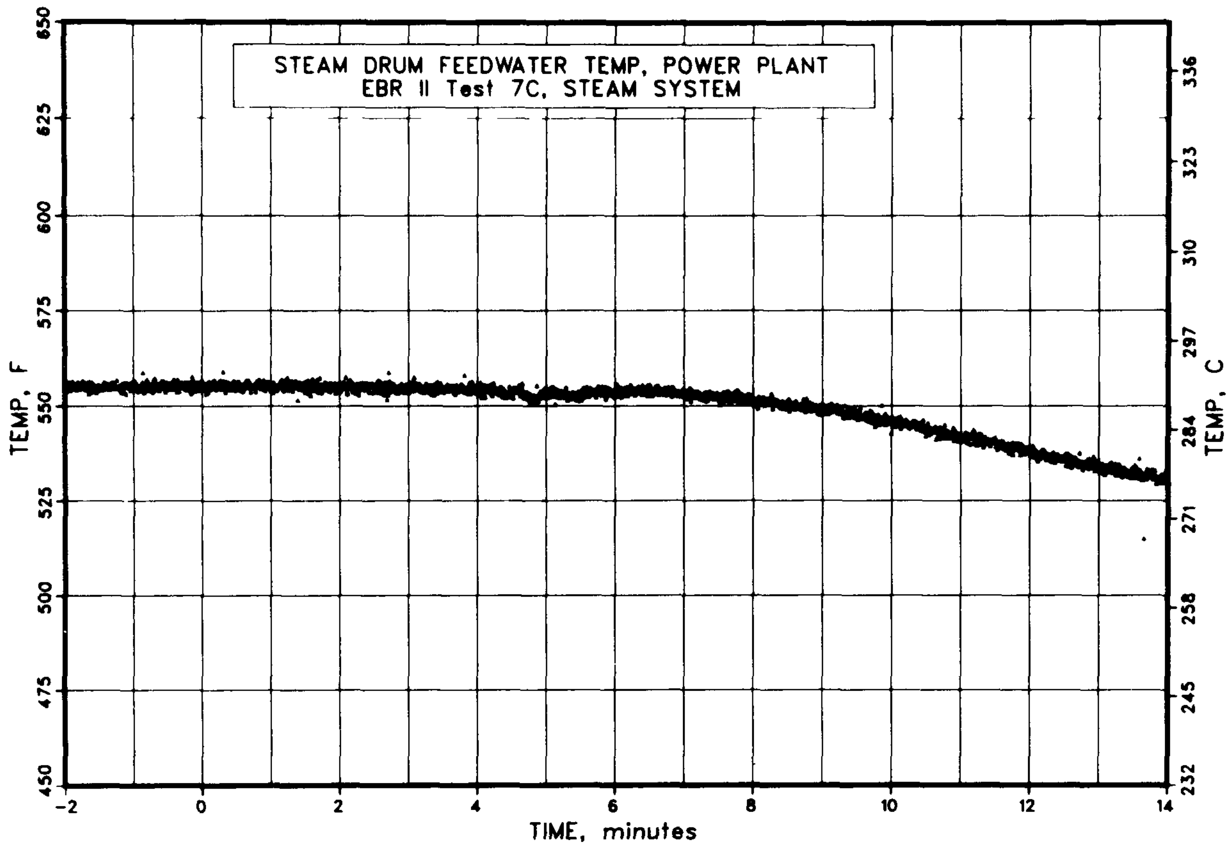


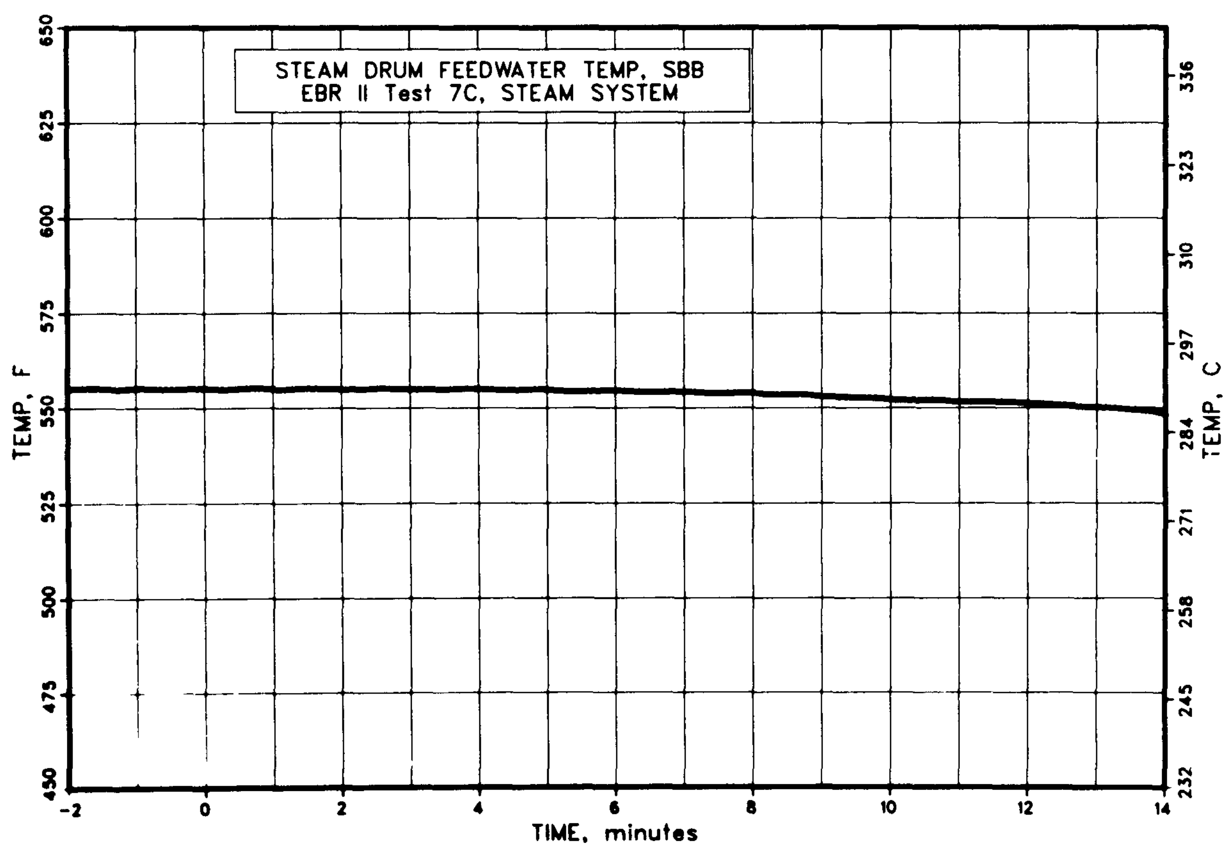
STEAM DRUM TEMP
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes

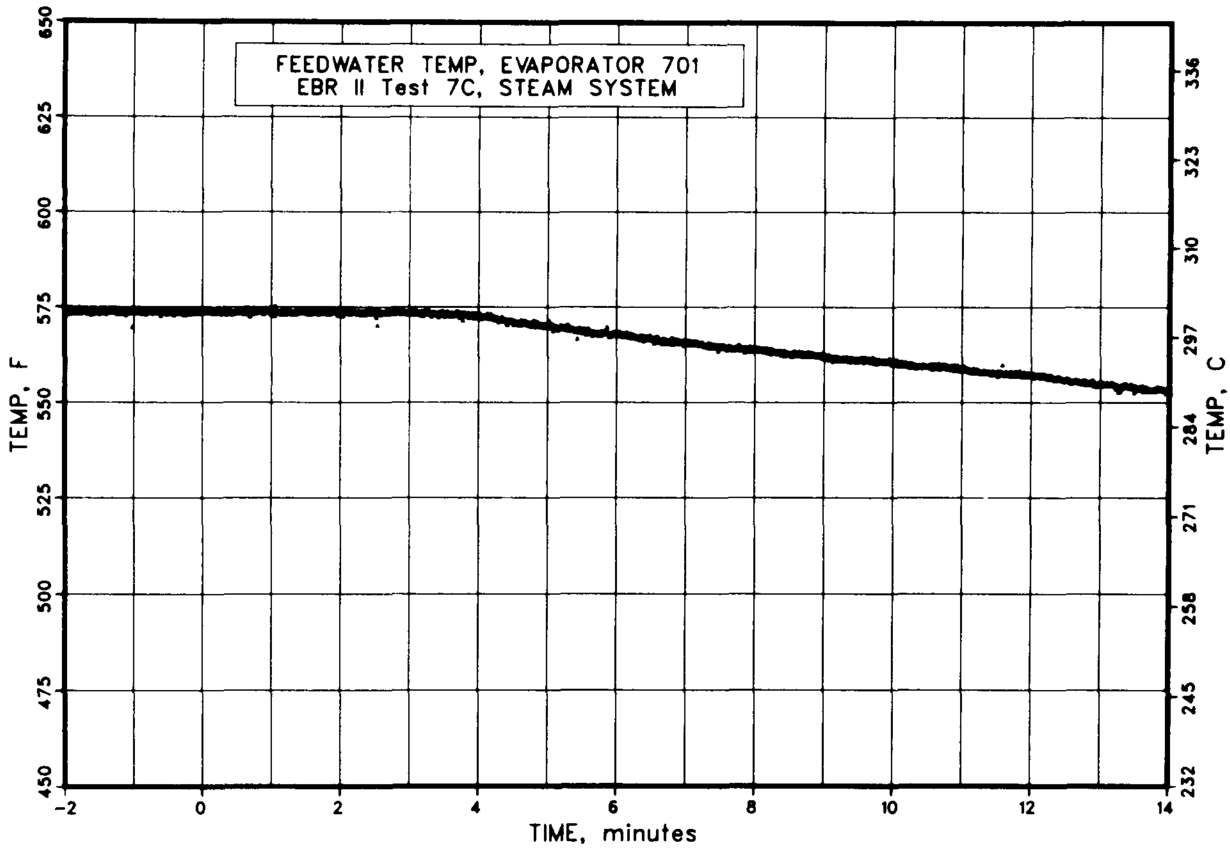


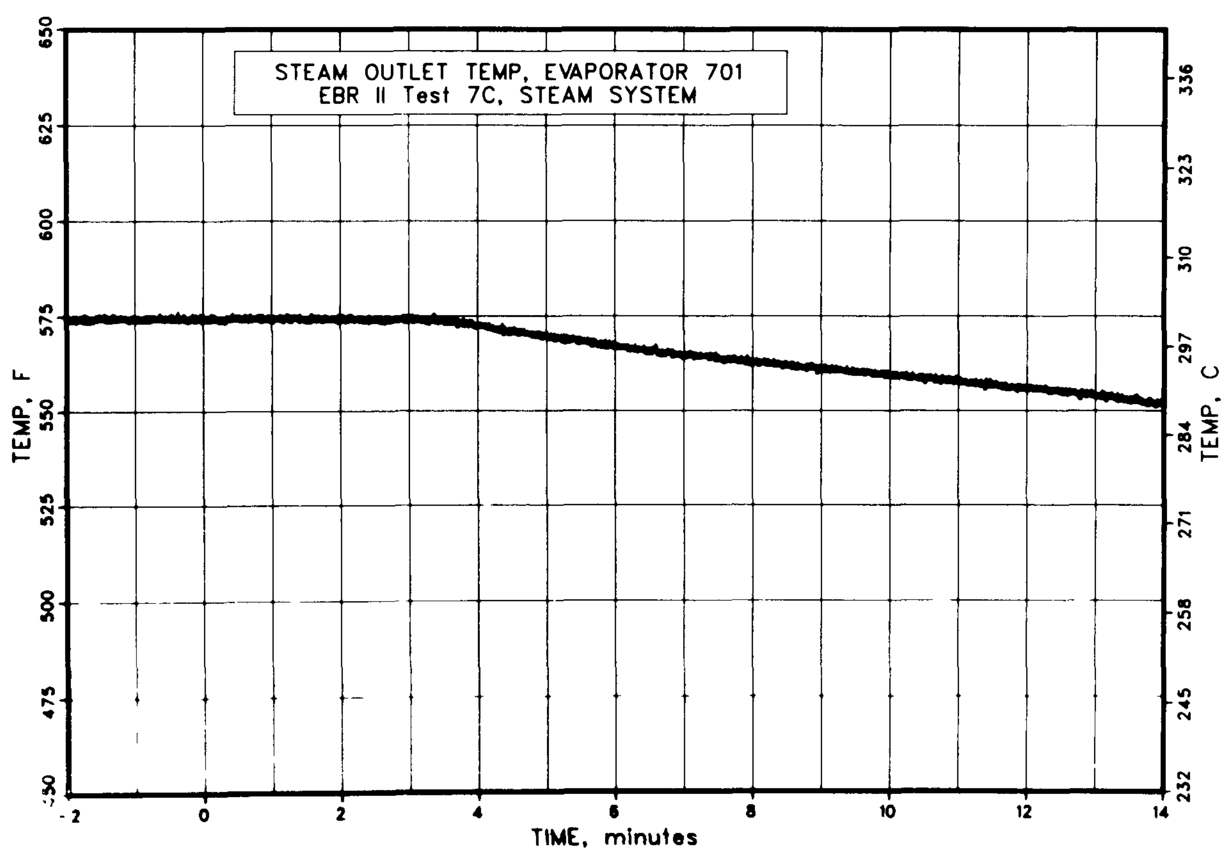
STEAM DRUM BLOWDOWN FLOW
EBR II Test 7C, STEAM SYSTEM
lb/hr
TIME, minutes

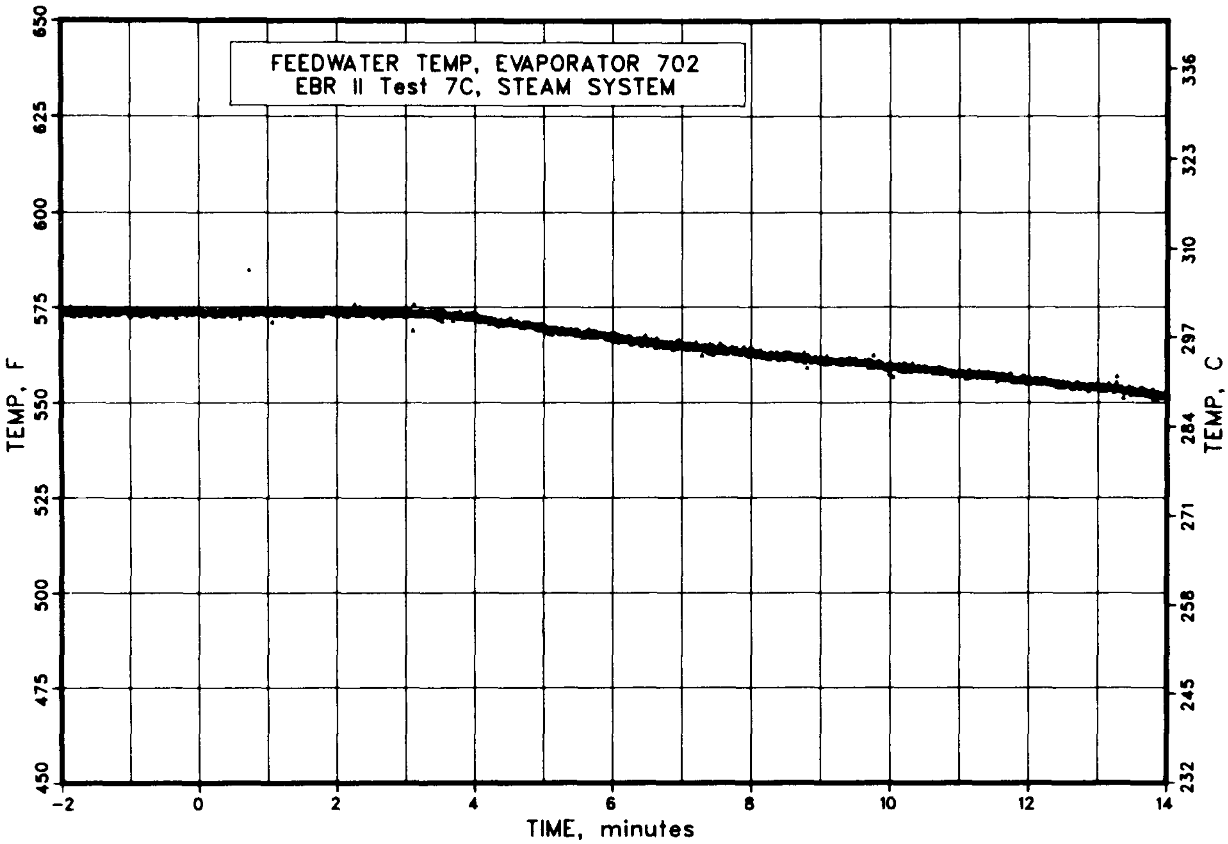

STEAM DRUM FEEDWATER FLOW, SBB
EBR II Test 7C, STEAM SYSTEM
lb/hr
120000
110000
100000
90000
80000
70000
60000
50000
40000
-2
0
2
4
6
8
10
12
14
TIME, minutes

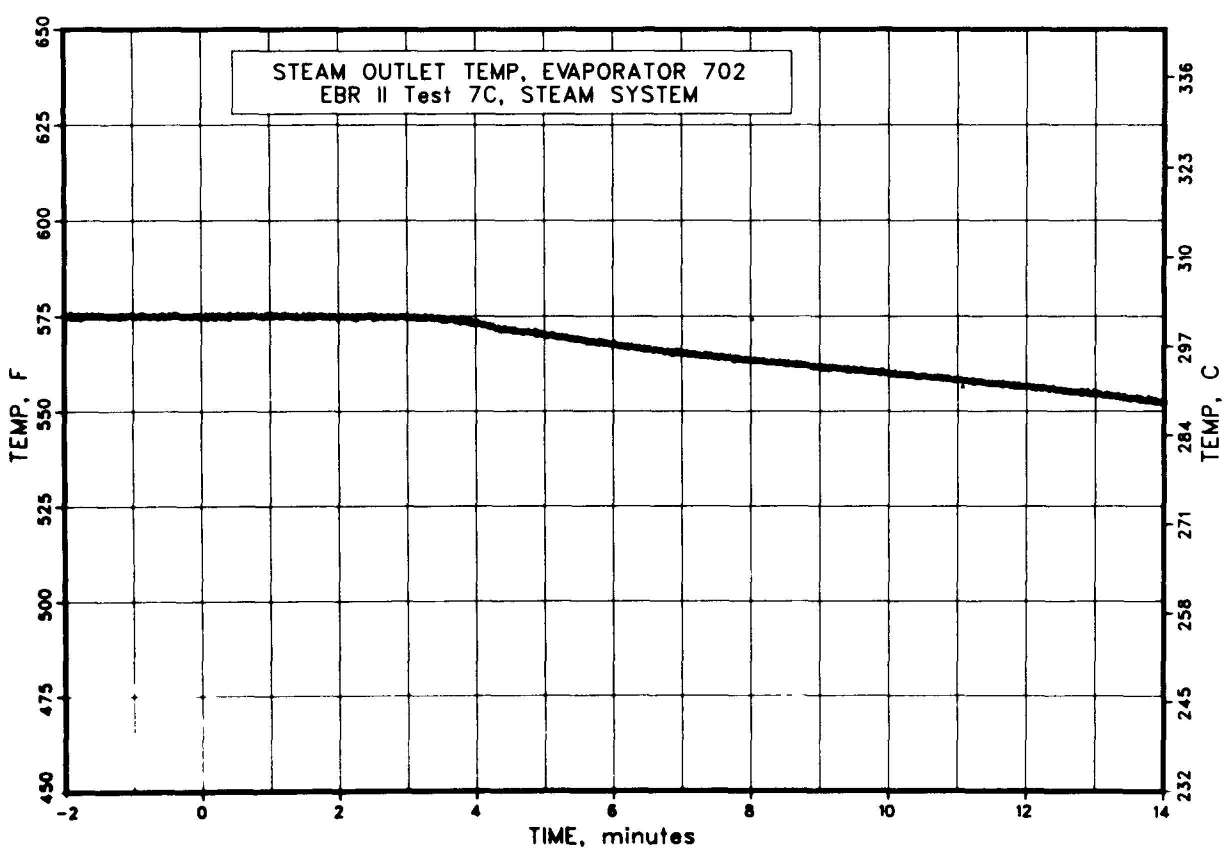

STEAM DRUM FEEDWATER TEMP, POWER PLANT
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

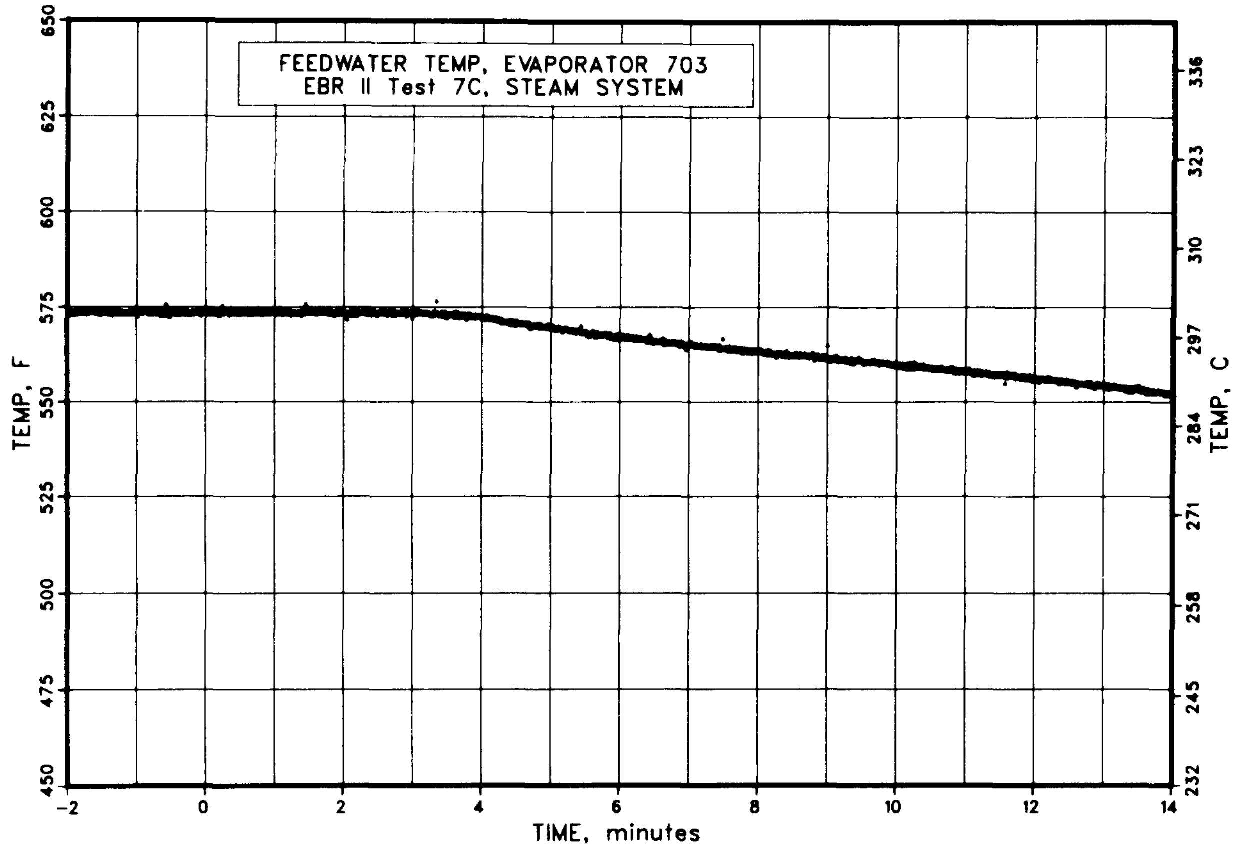

STEAM DRUM FEEDWATER TEMP, SBB
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

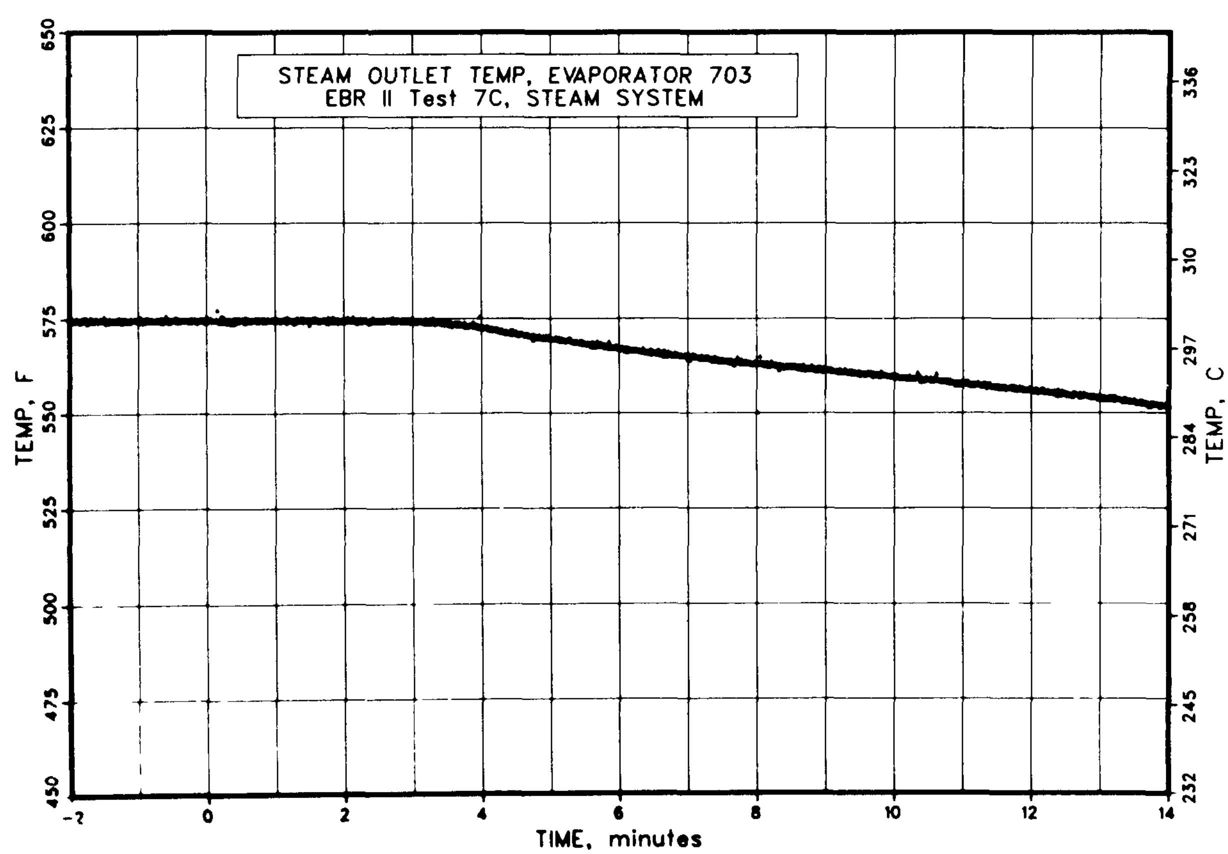

FEEDWATER TEMP, EVAPORATOR 701
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

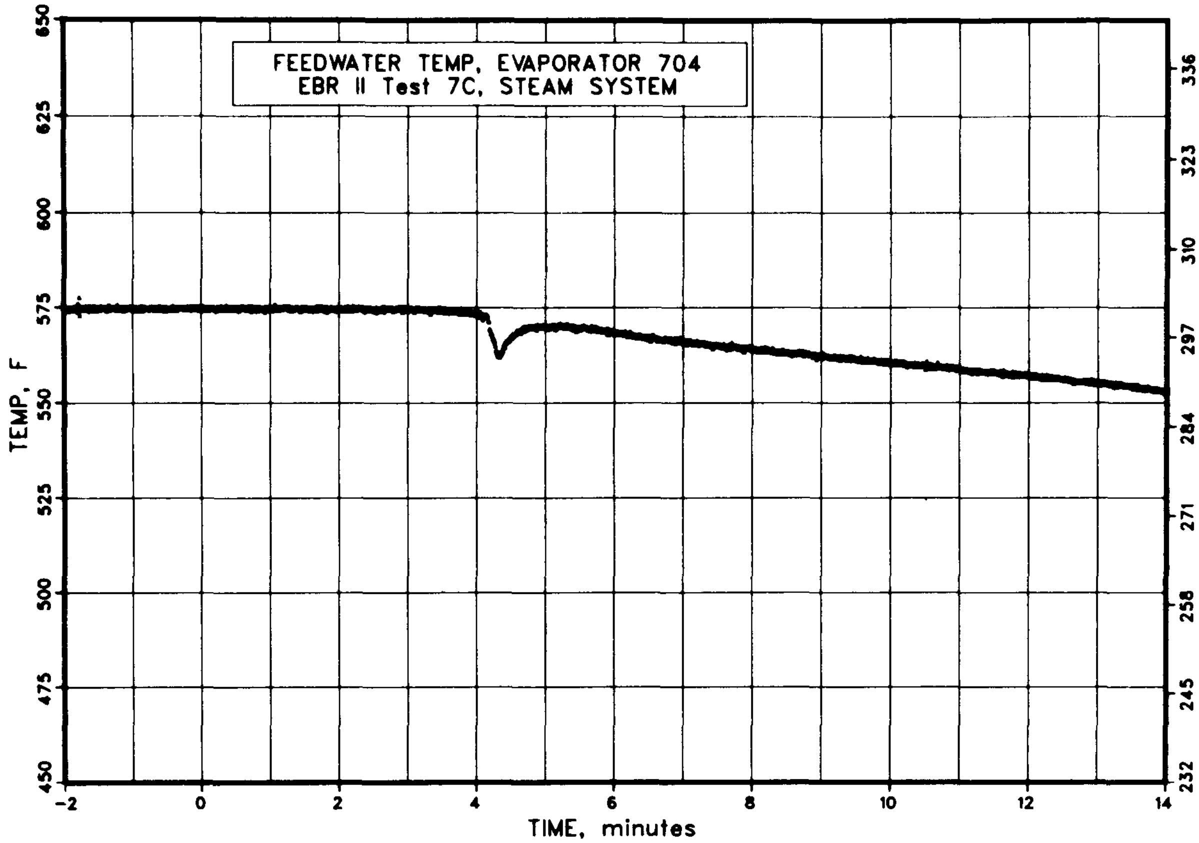

STEAM OUTLET TEMP, EVAPORATOR 701
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

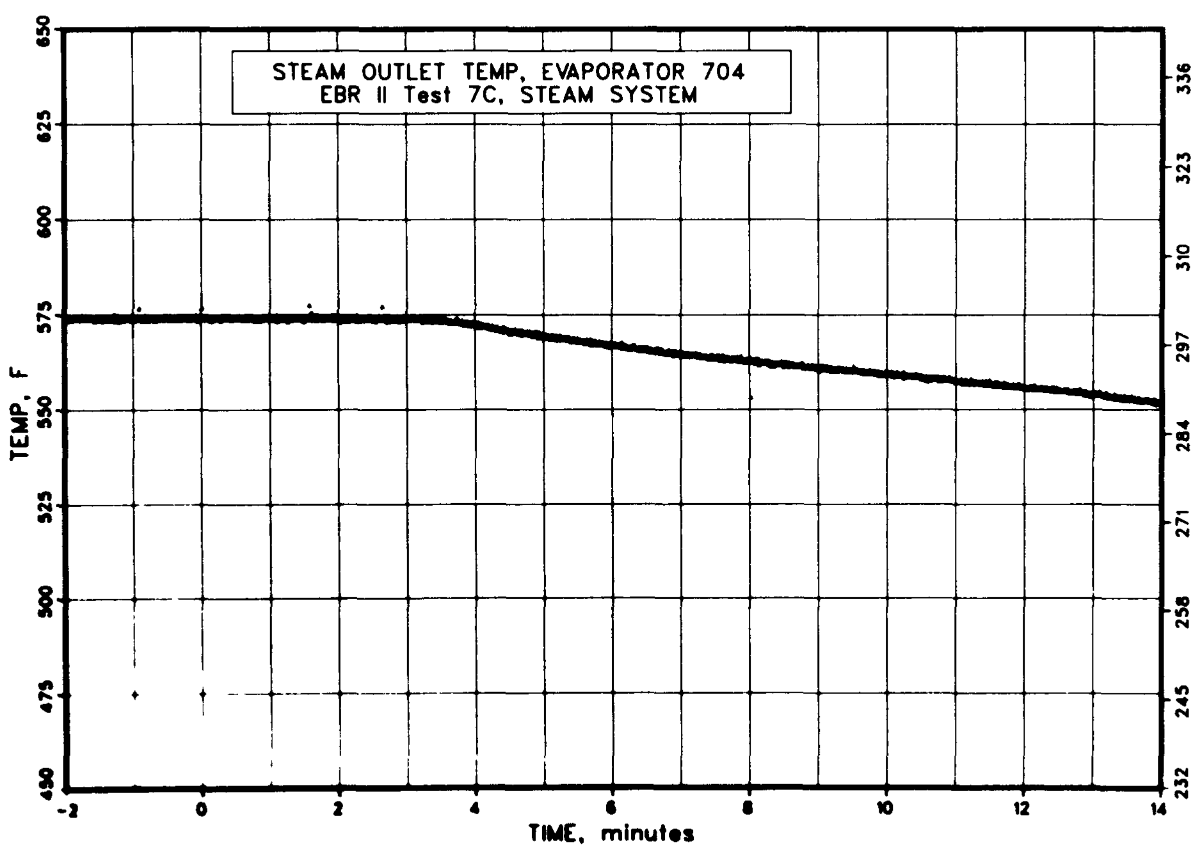

FEEDWATER TEMP, EVAPORATOR 702
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

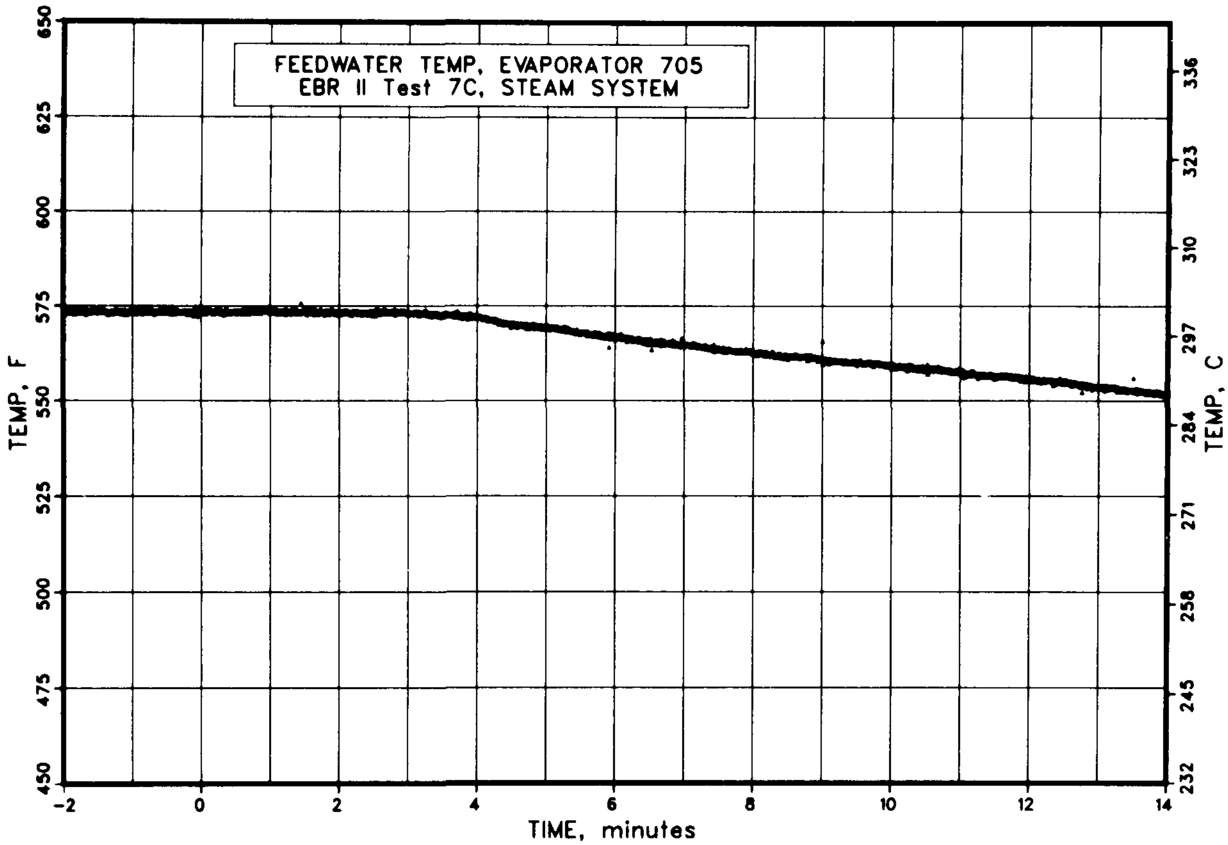

STEAM OUTLET TEMP, EVAPORATOR 702
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

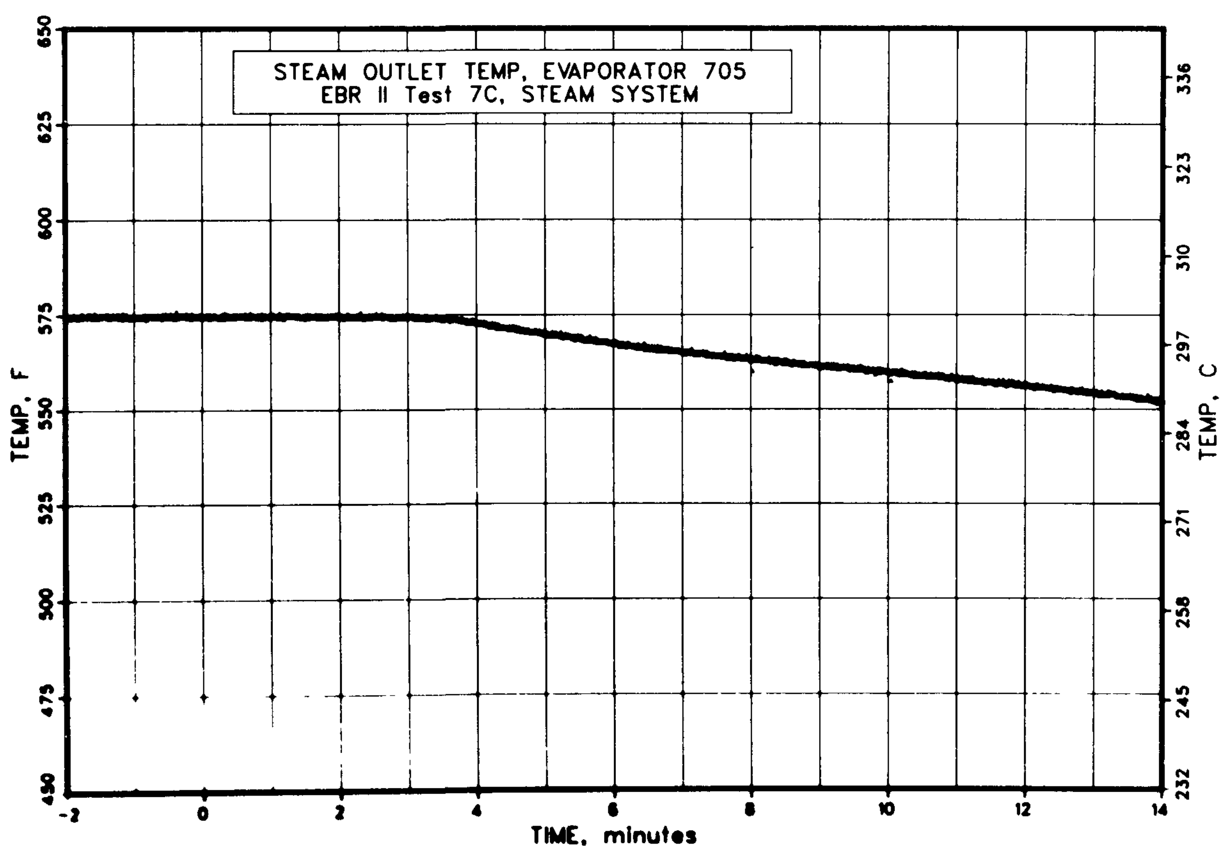

FEEDWATER TEMP, EVAPORATOR 703
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

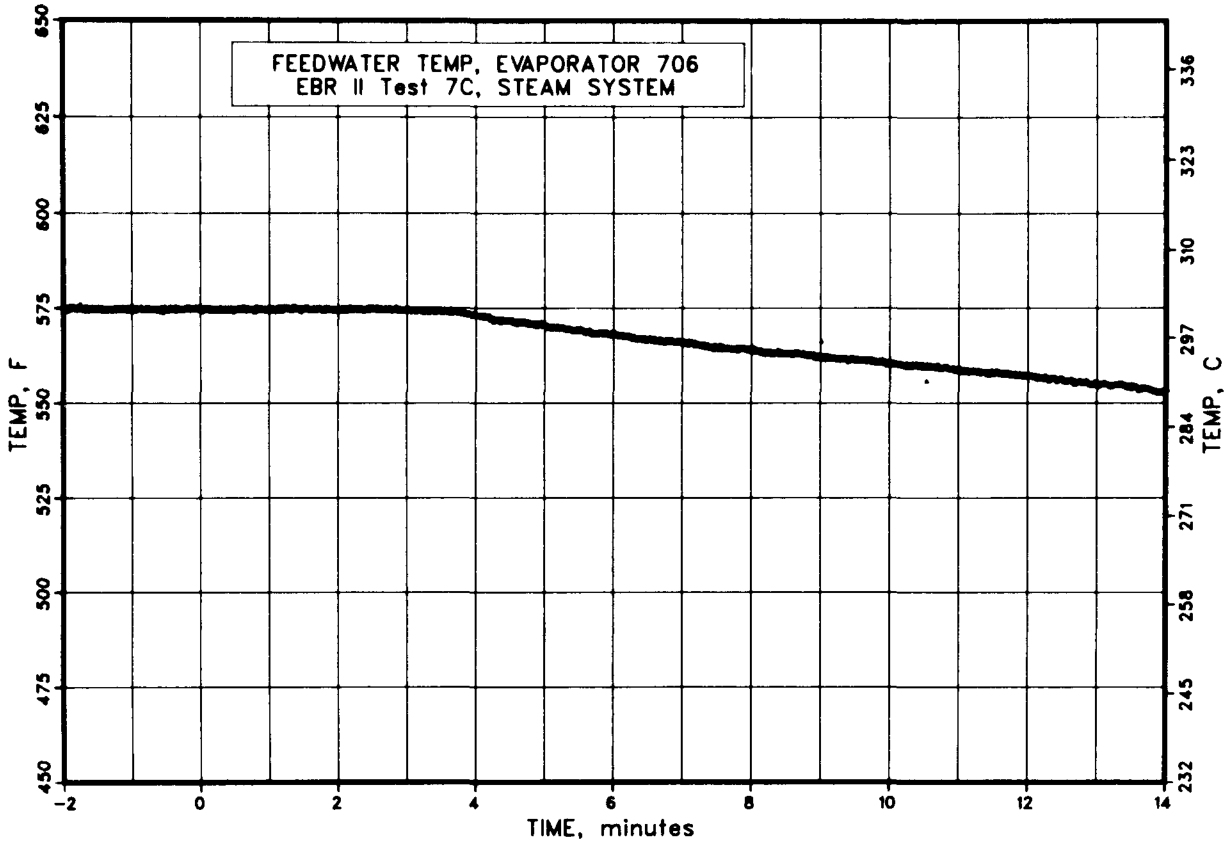

STEAM OUTLET TEMP, EVAPORATOR 703
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

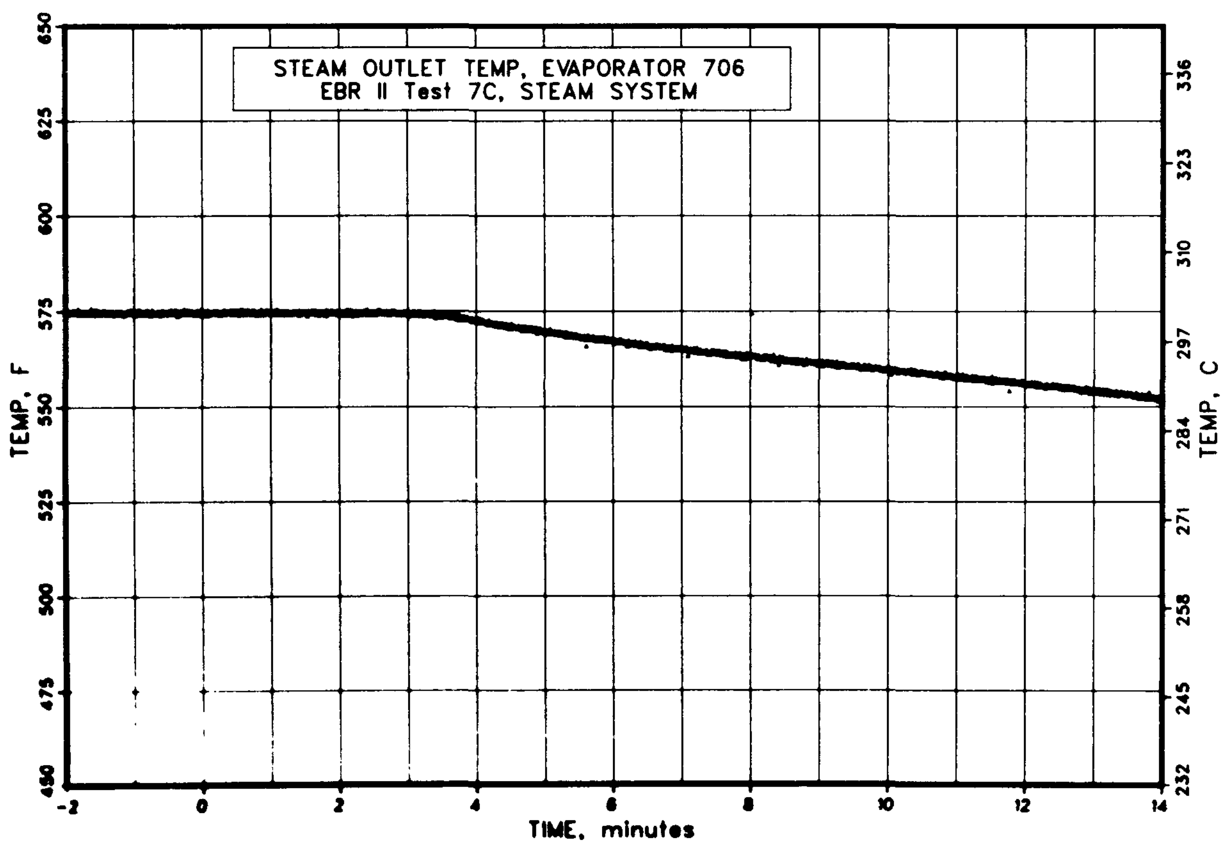

FEEDWATER TEMP, EVAPORATOR 704
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

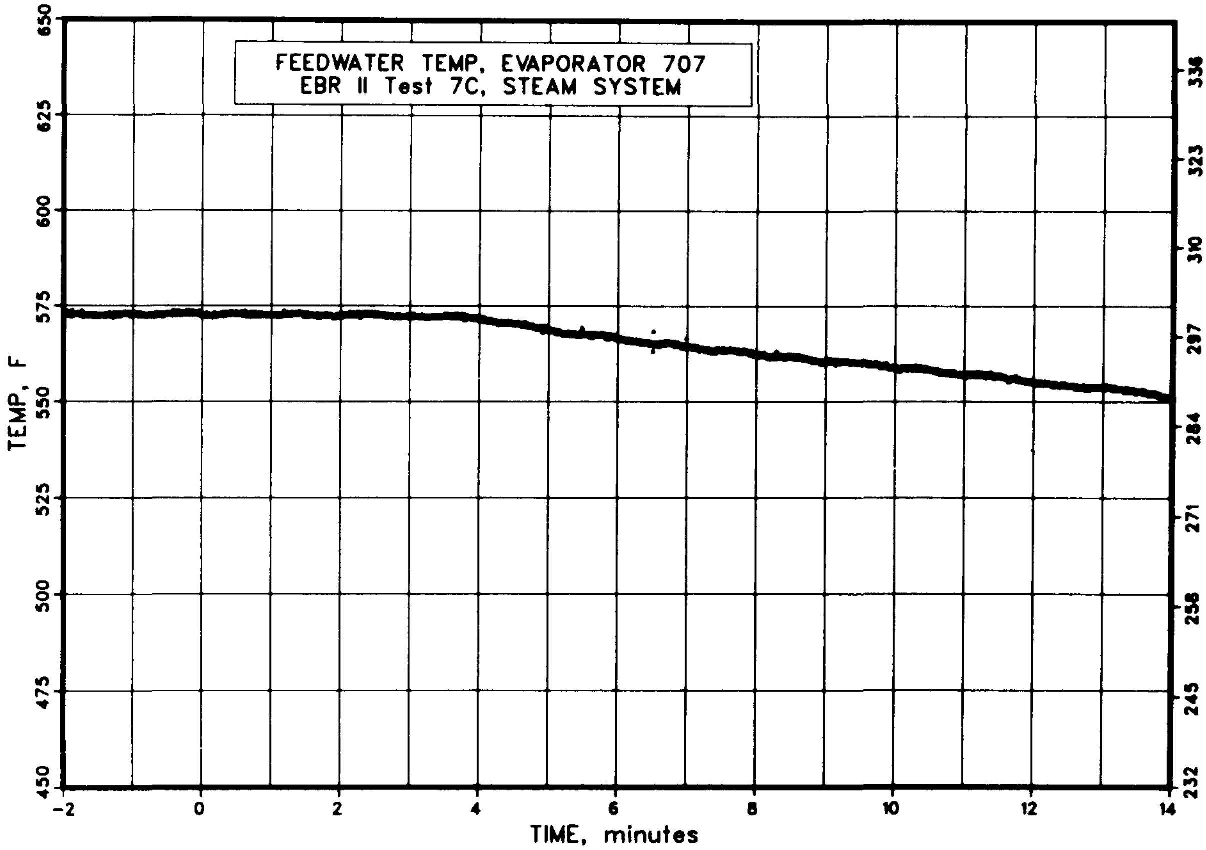

STEAM OUTLET TEMP, EVAPORATOR 704
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

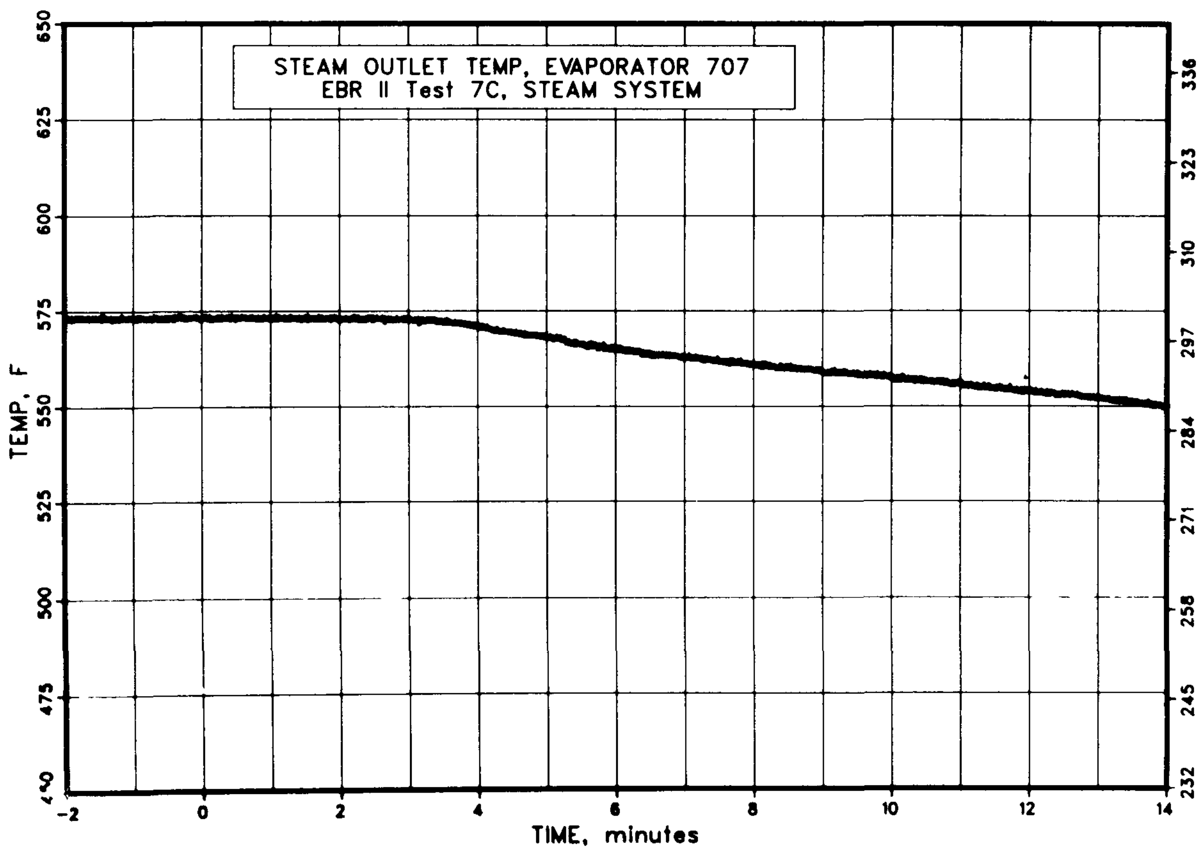

FEEDWATER TEMP, EVAPORATOR 705
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

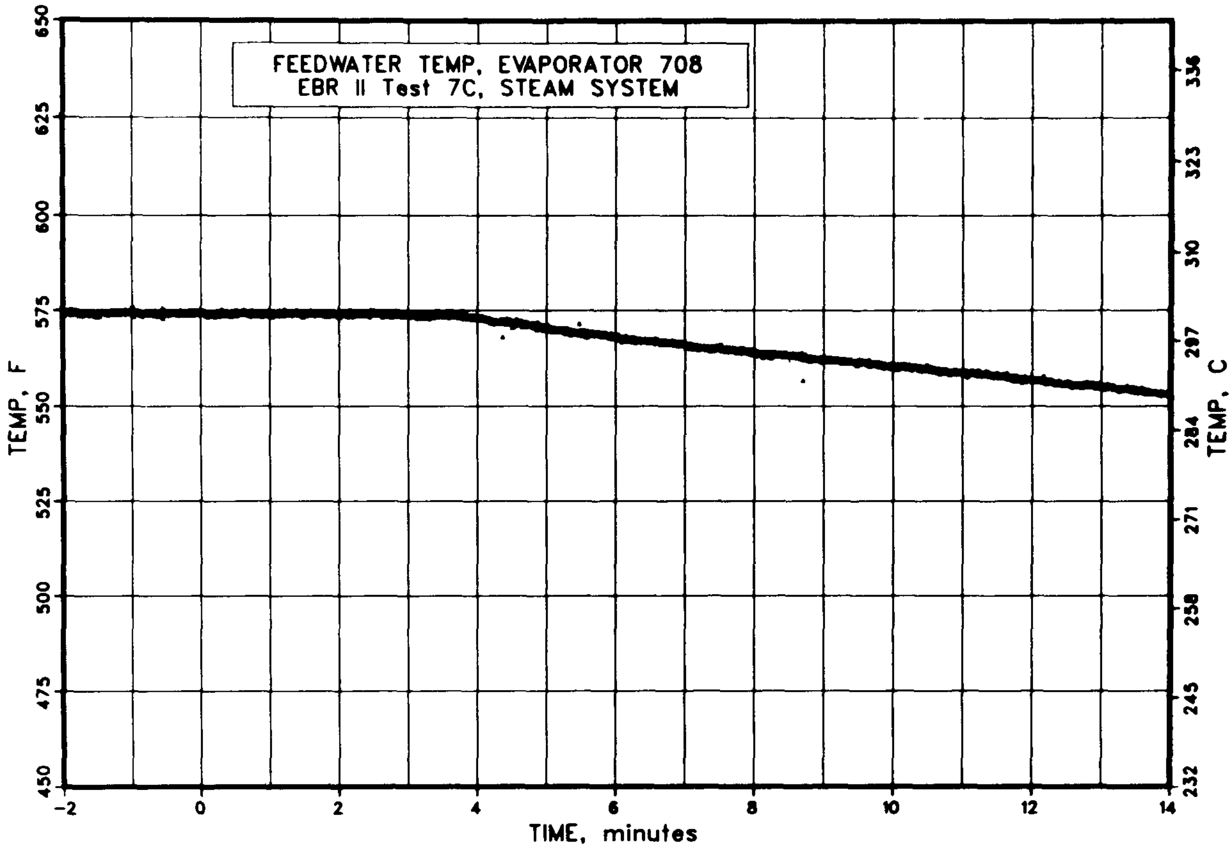

STEAM OUTLET TEMP, EVAPORATOR 705
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

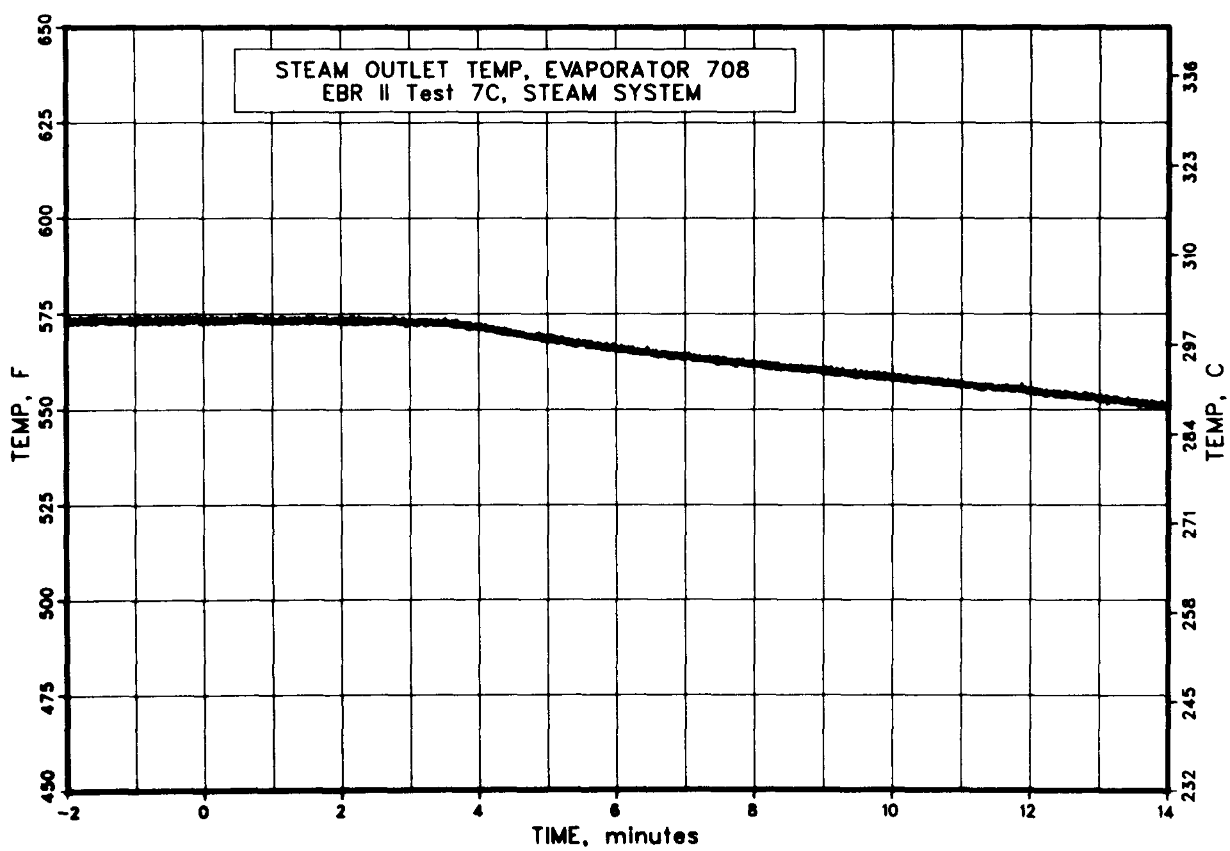

FEEDWATER TEMP, EVAPORATOR 706
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

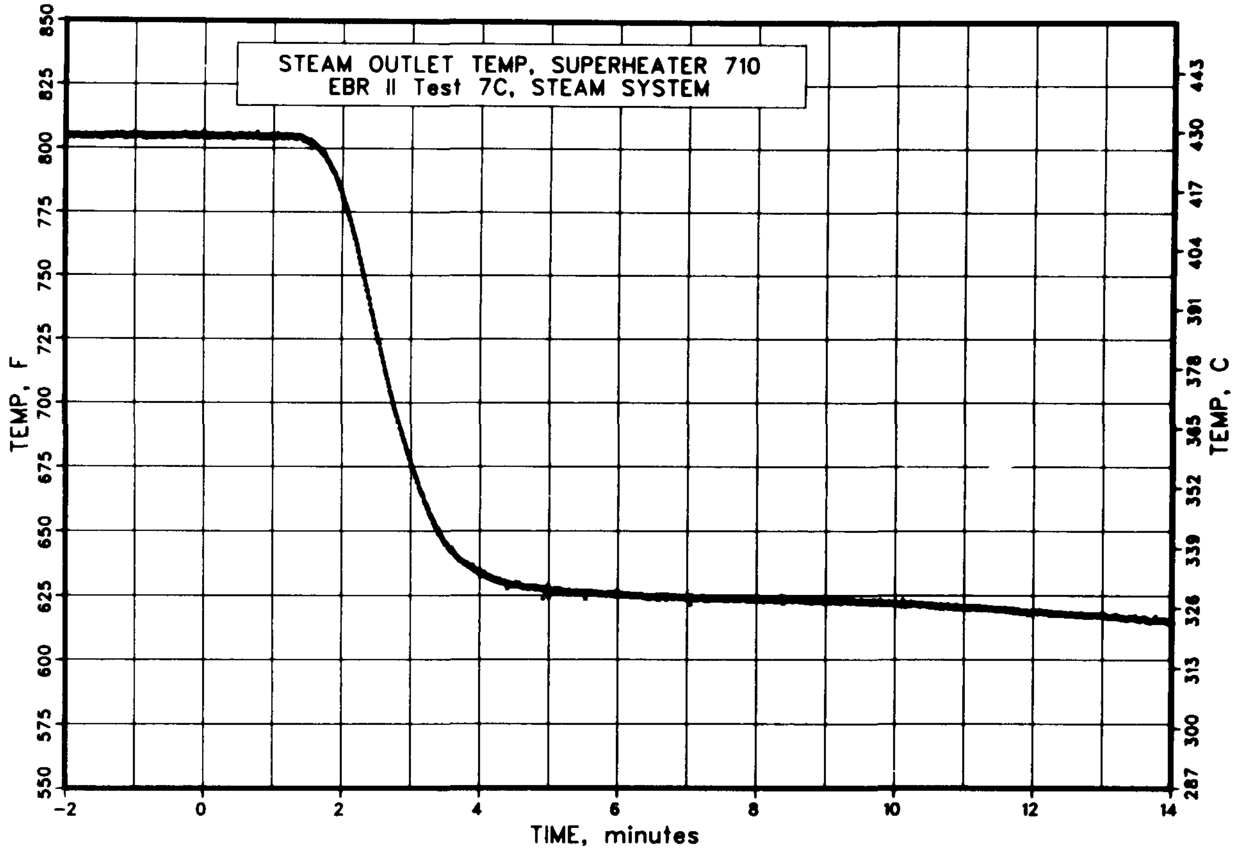

STEAM OUTLET TEMP, EVAPORATOR 706
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

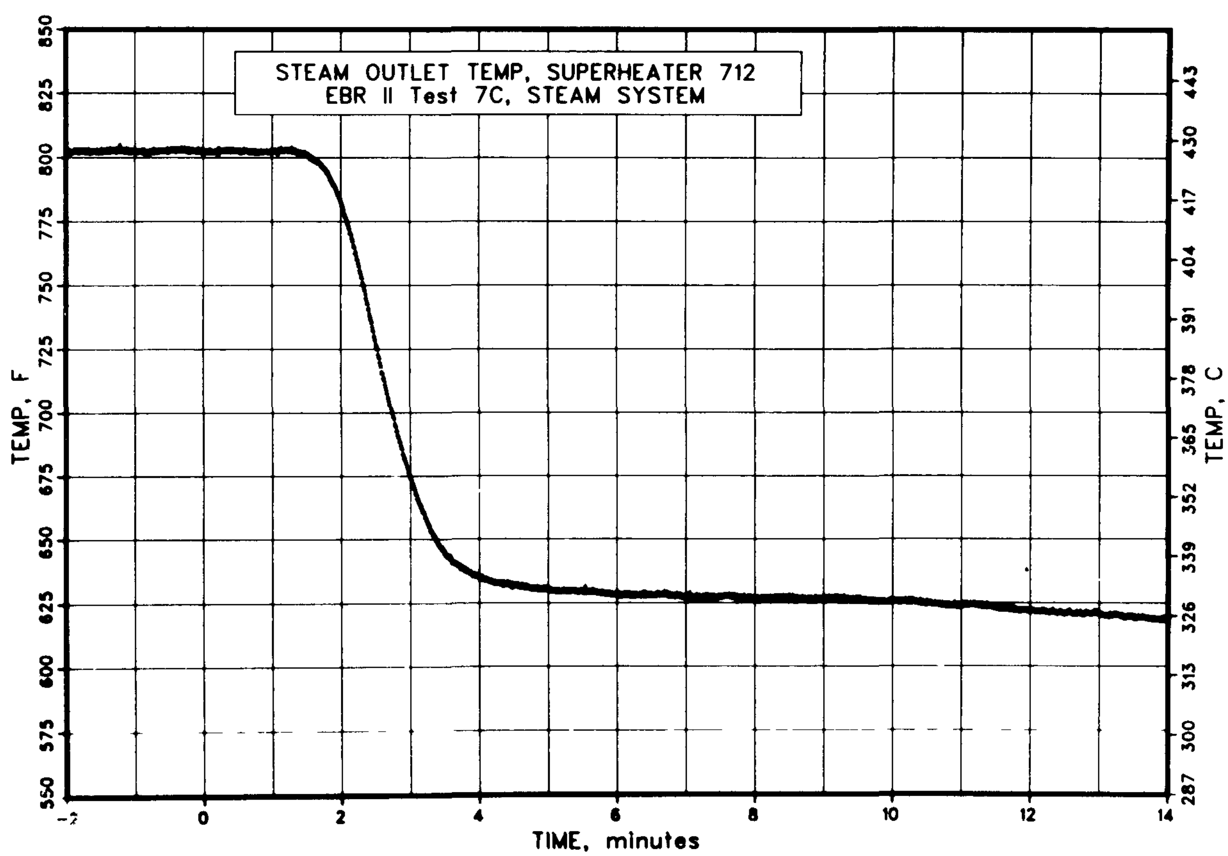

FEEDWATER TEMP, EVAPORATOR 707
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
450
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

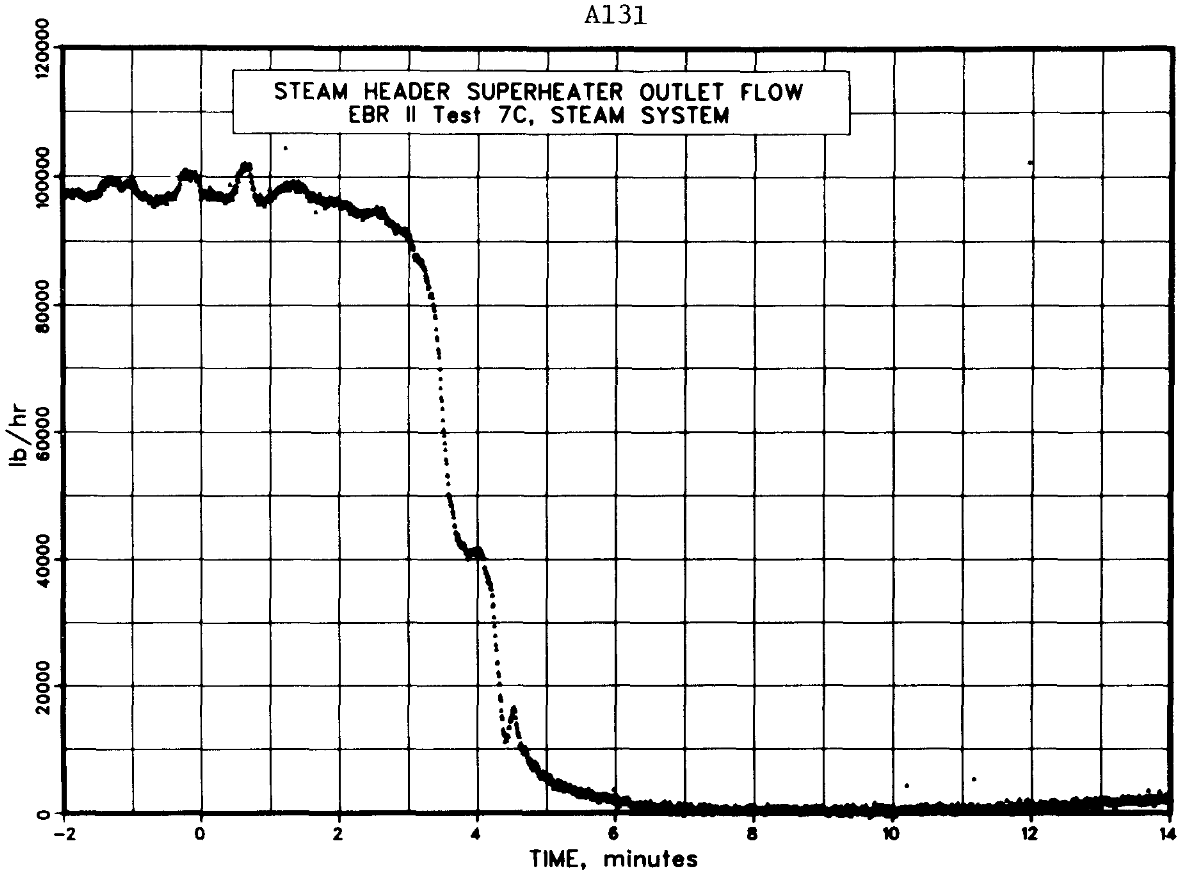

STEAM OUTLET TEMP, EVAPORATOR 707
EBR II Test 7C, STEAM SYSTEM
TEMP, F
650
625
600
575
550
525
500
475
TEMP, C
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14
TIME, minutes

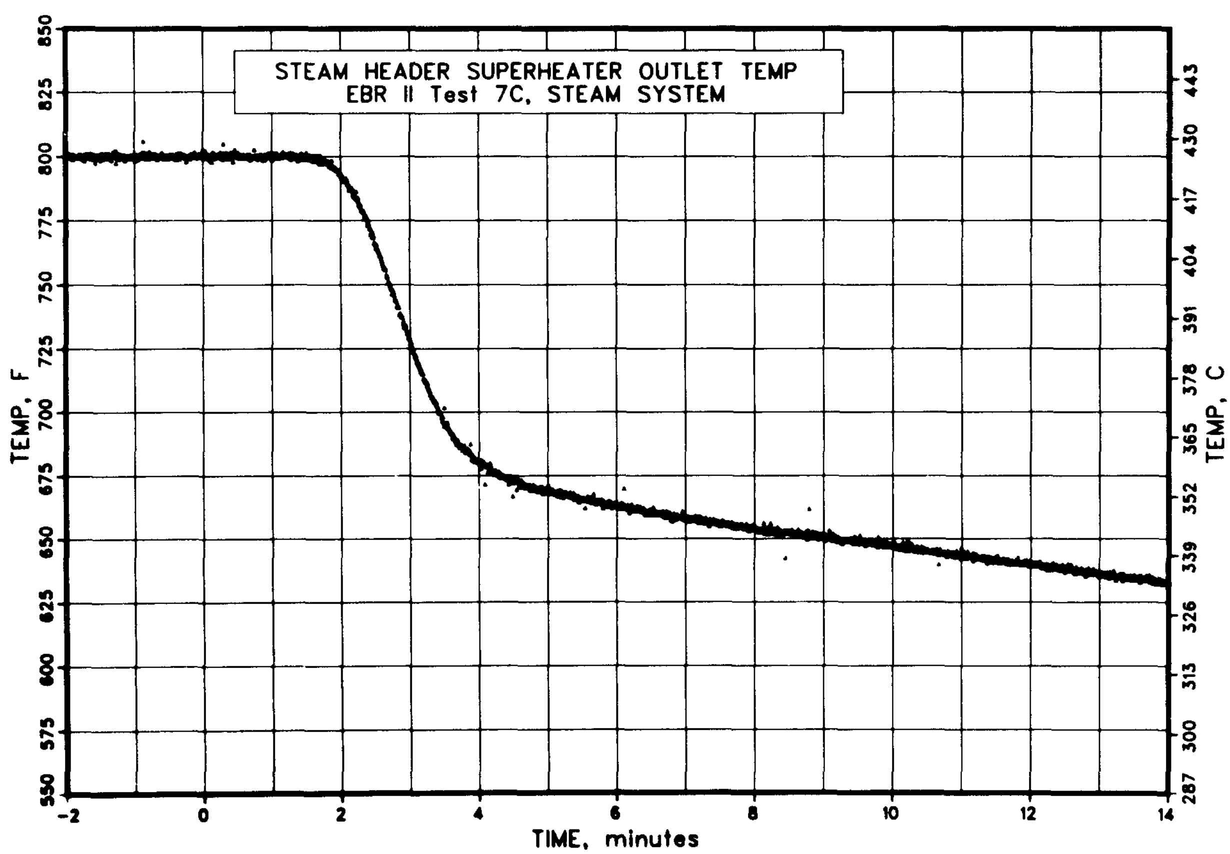

FEEDWATER TEMP, EVAPORATOR 708
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

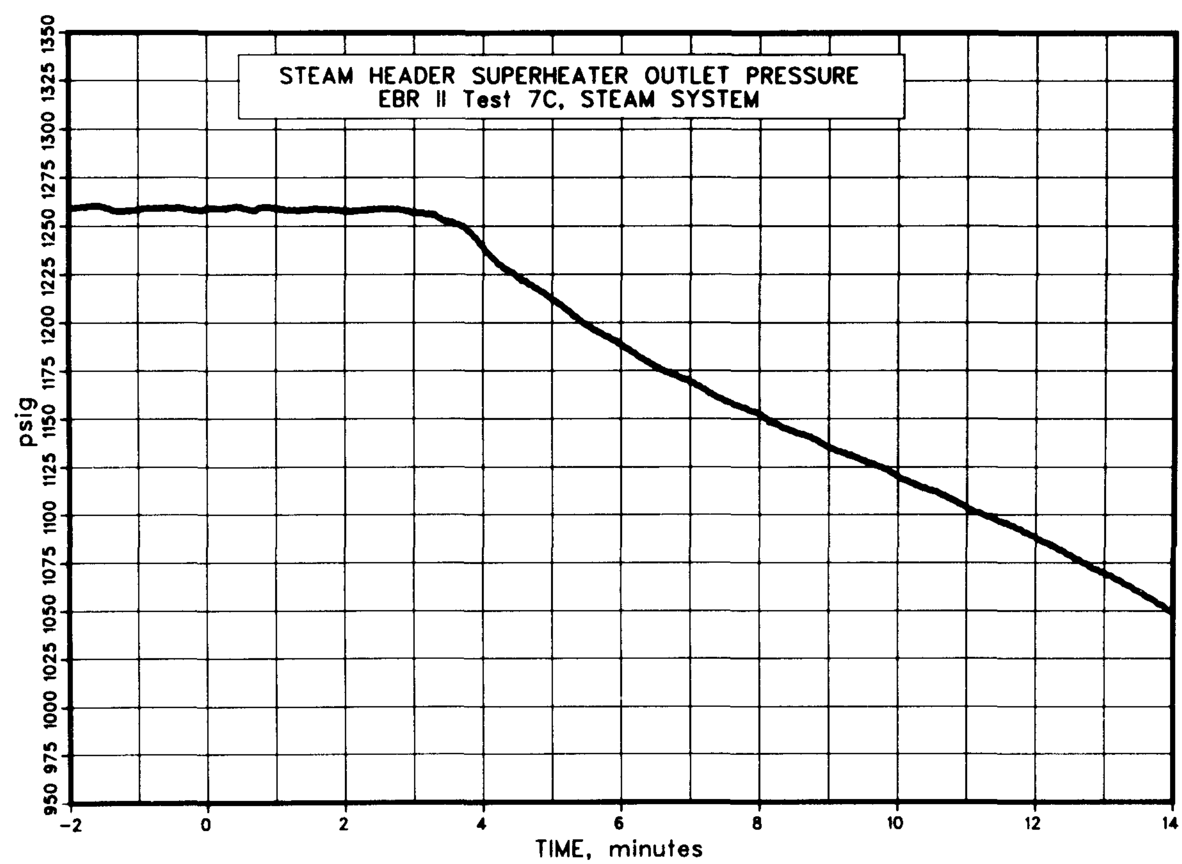

STEAM OUTLET TEMP, EVAPORATOR 708
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
650
625
600
575
550
525
500
475
450
336
323
310
297
284
271
258
245
232
-2
0
2
4
6
8
10
12
14

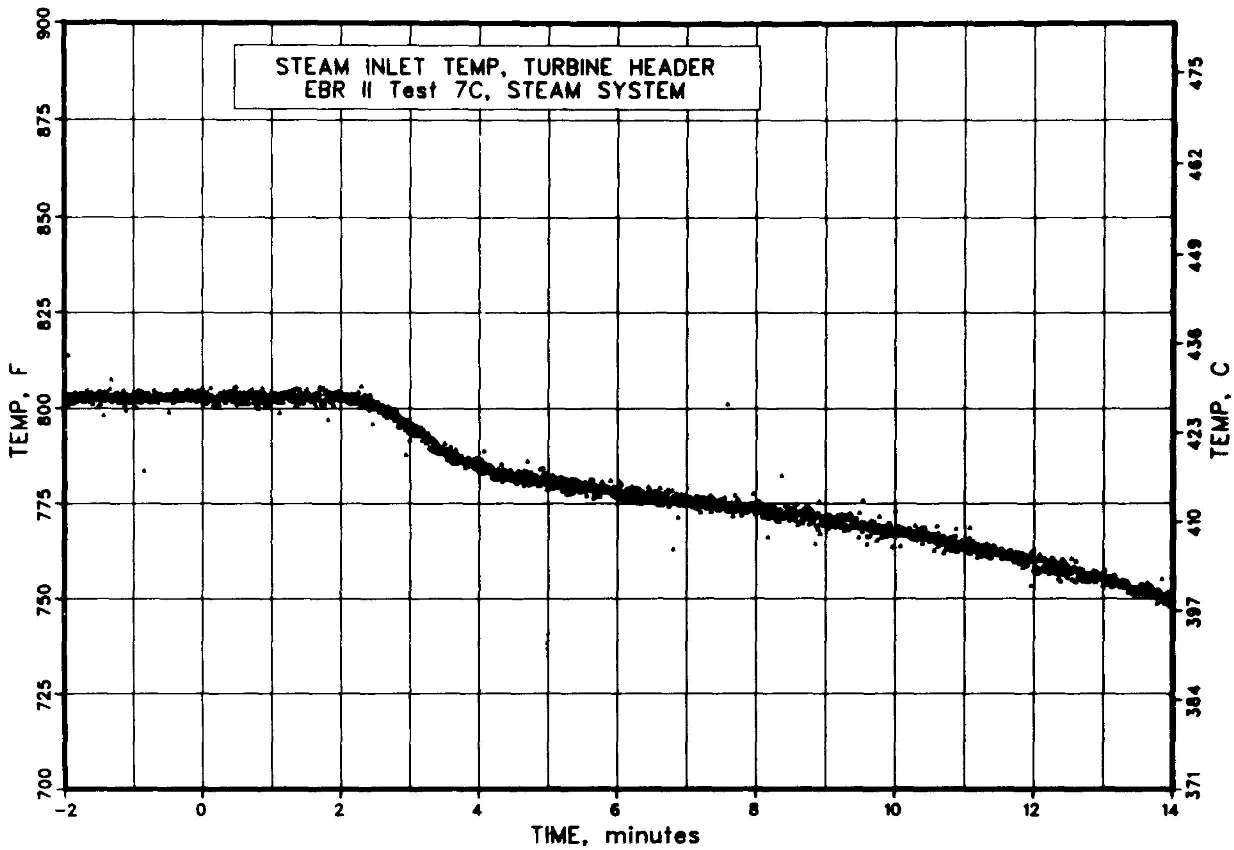

STEAM OUTLET TEMP, SUPERHEATER 710
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
-2
0
2
4
6
8
10
12
14

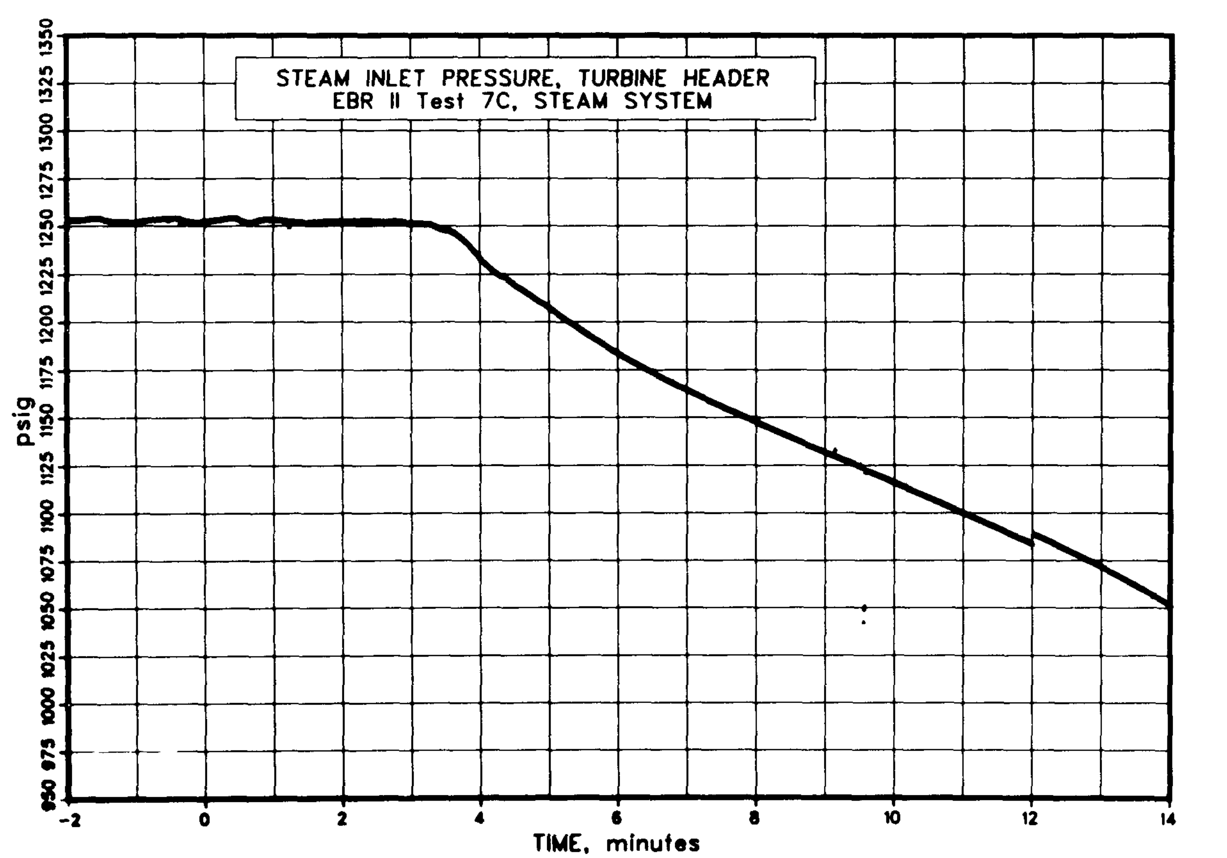

STEAM OUTLET TEMP, SUPERHEATER 712
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
850
825
800
775
750
725
700
675
650
625
600
575
550
443
430
417
404
391
378
365
352
339
326
313
300
287
0
2
4
6
8
10
12
14

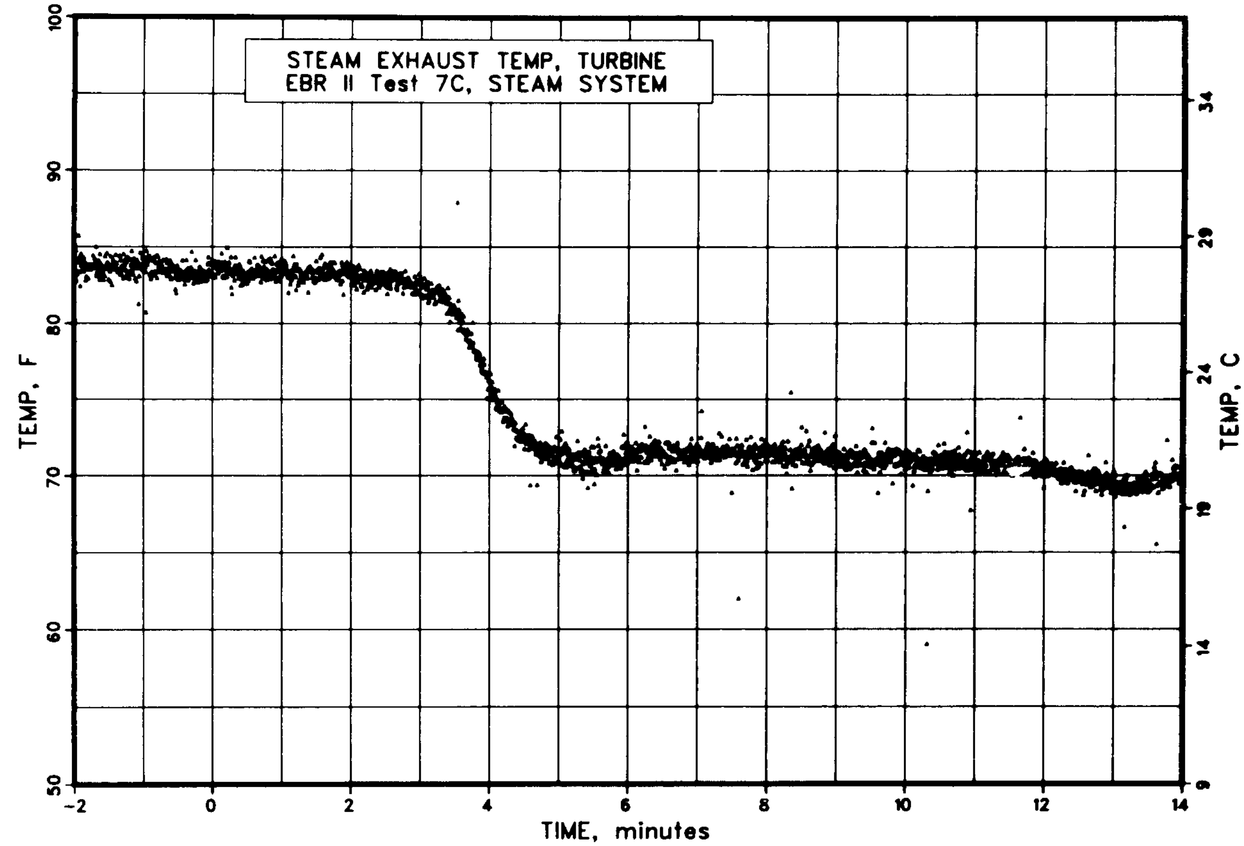

STEAM HEADER SUPERHEATER OUTLET FLOW
EBR II Test 7C, STEAM SYSTEM
lb/hr
0
20000
40000
60000
80000
100000
120000
-2
0
2
4
6
8
10
12
14
TIME, minutes

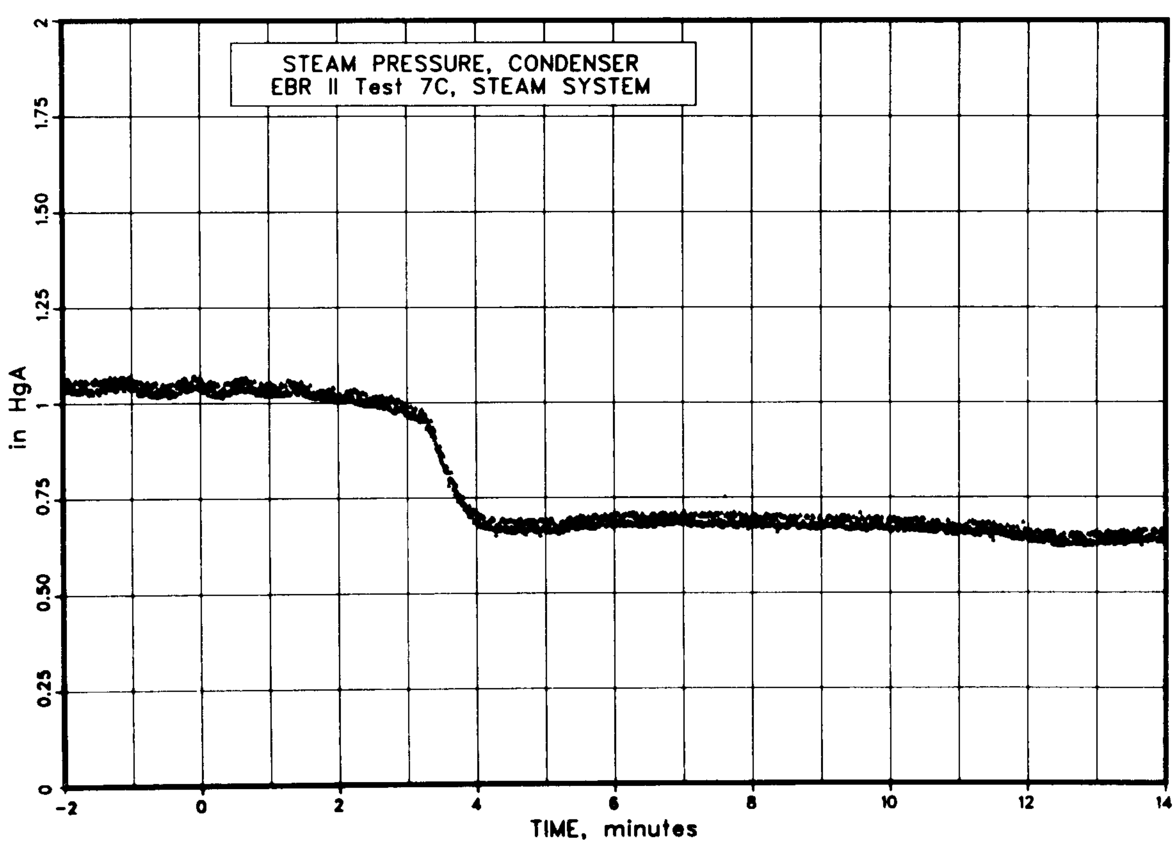

STEAM HEADER SUPERHEATER OUTLET TEMP
EBR II Test 7C, STEAM SYSTEM
TEMP, F
550
575
600
625
650
675
700
725
750
775
800
825
850
TEMP, C
287
300
313
326
339
352
365
378
391
404
417
430
443
-2
0
2
4
6
8
10
12
14
TIME, minutes

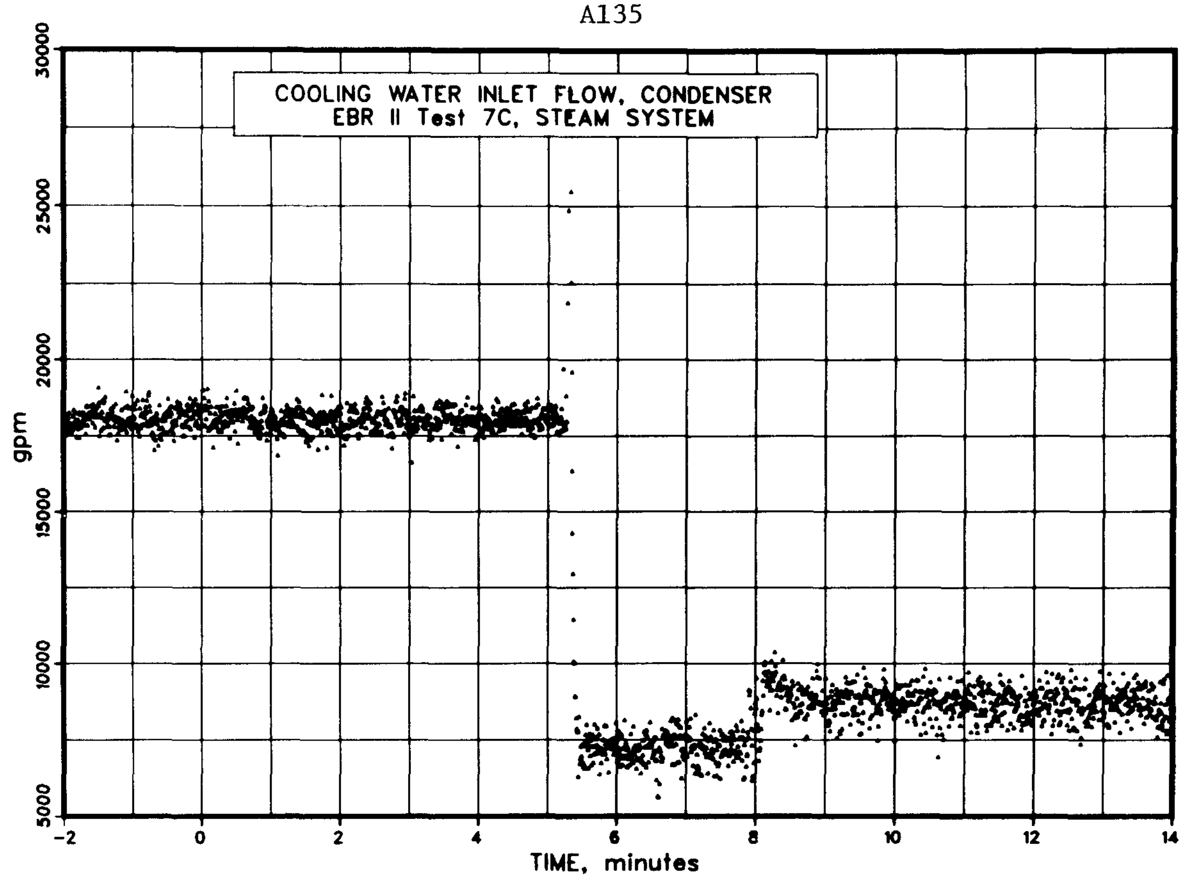

STEAM HEADER SUPERHEATER OUTLET PRESSURE
EBR II Test 7C, STEAM SYSTEM
psig
950
975
1000
1025
1050
1075
1100
1125
1150
1175
1200
1225
1250
1275
1300
1325
1350
-2
0
2
4
6
8
10
12
14
TIME, minutes


STEAM INLET TEMP, TURBINE HEADER
EBR II Test 7C, 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

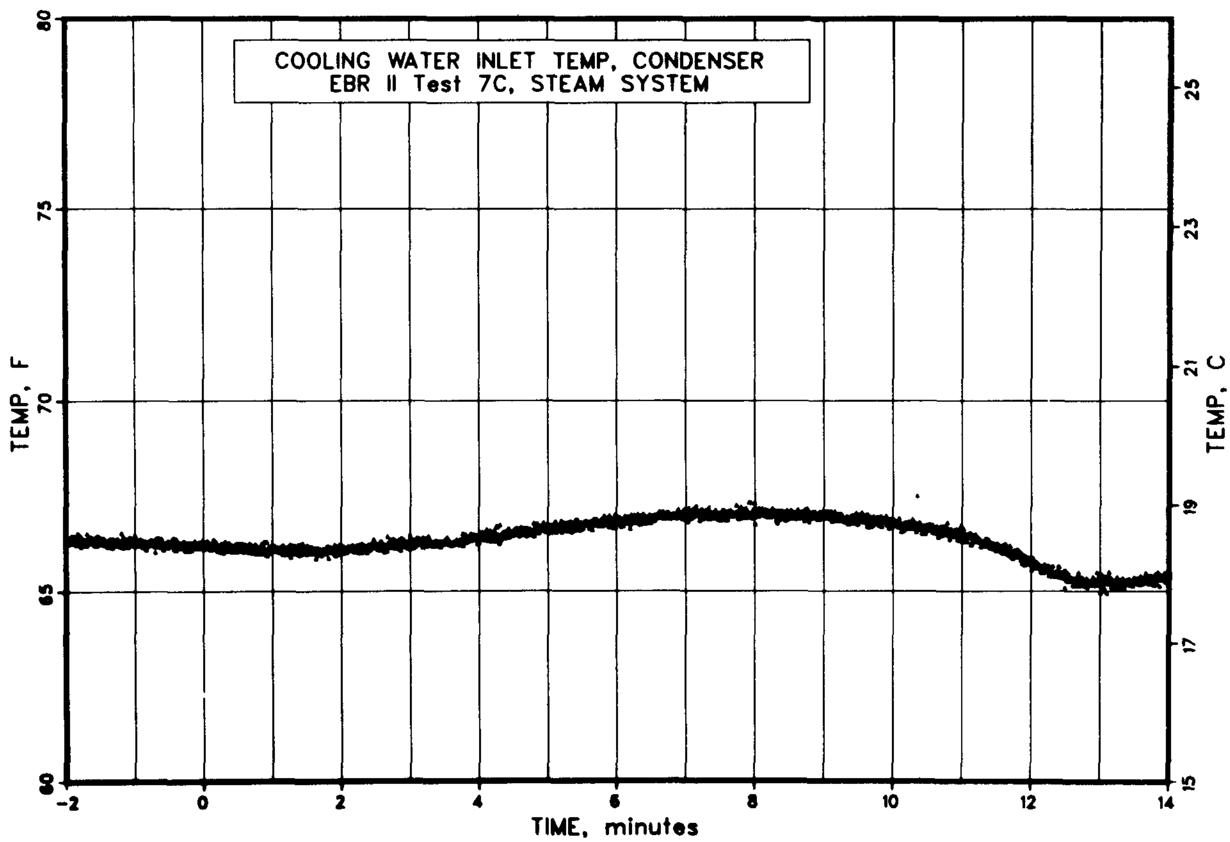

STEAM INLET PRESSURE, TURBINE HEADER
EBR II Test 7C, STEAM SYSTEM
psig
TIME, minutes
1350
1325
1300
1275
1250
1225
1200
1175
1150
1125
1100
1075
1050
1025
1000
975
950
-2
0
2
4
6
8
10
12
14


STEAM EXHAUST TEMP, TURBINE
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
100
90
80
70
60
50
34
29
24
19
14
9
-2
0
2
4
6
8
10
12
14

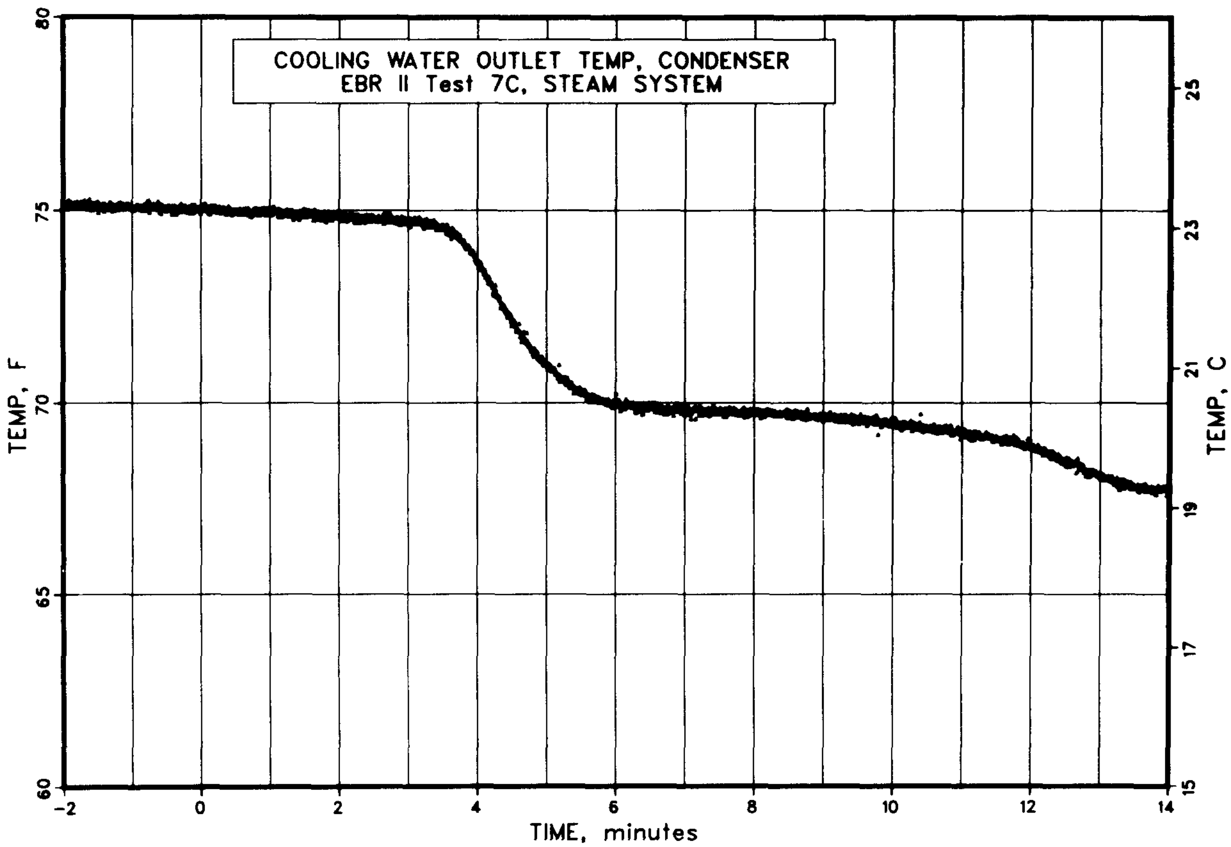

STEAM PRESSURE, CONDENSER
EBR II Test 7C, STEAM SYSTEM
in HgA
TIME, minutes
2
1.75
1.50
1.25
1
0.75
0.50
0.25
0
-2
0
2
4
6
8
10
12
14



COOLING WATER INLET FLOW, CONDENSER
EBR II Test 7C, STEAM SYSTEM
gpm
30000
25000
20000
15000
10000
5000
-2
0
2
4
6
8
10
12
14
TIME, minutes



COOLING WATER INLET TEMP, CONDENSER
EBR II Test 7C, STEAM SYSTEM
TEMP, F
80
75
70
65
60
TEMP, C
25
23
21
19
17
15
-2
0
2
4
6
8
10
12
14
TIME, minutes


COOLING WATER OUTLET TEMP, CONDENSER
EBR II Test 7C, STEAM SYSTEM
TEMP, F
TEMP, C
TIME, minutes
80
75
70
65
60
25
23
21
19
17
15
-2
0
2
4
6
8
10
12
14