TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

February 14, 1985

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority 50-391

Several telephone conference calls and meetings have recently been held between TVA and NRC representatives to discuss TVA's proposed changes to technical specification 4.6.4.3 regarding surveillance requirements for demonstrating operability of hydrogen ignitors.

TVA proposes to revise the existing surveillance requirements for demonstrating the operability of the hydrogen mitigation system to allow the use of a current measurement for verifying the minimum 1700°F. In addition, every nine months, in conjunction with ice weighing outages, 20 percent of the 68 ignitors will be measured using an optical pyrometer to verify the minimum 1700°F (see enclosed marked-up technical specification). This latter requirement will provide additional reassurance that the current measurement is an adequate method for verifying temperature.

Due to the locations of many of the hydrogen ignitors at the Watts Bar Nuclear Plant, the performance of a temperature measurement by optical pyrometer on every ignitor creates an occupational safety hazard at the Watts Bar Nuclear Plant. Many of the ignitors are in locations where it would be difficult to reach in order to perform an optical pyrometer measurement. For example, ignitors in the containment dome require the construction of a scaffold on top of the polar crane. Also, ignitors in the ice condenser require climbing a very long spiral staircase and making an entry into the ice condenser. Ignitors located at the top of the steam generator and pressurizer enclosures, both lower containment and upper containment, require climbing long ladders with a safety belt climbing apparatus. In addition, this testing also presents a hazard to other workers in the area of the ignitors. Personnel can be burned if they accidentally touch the ignitors during the temperature test. The temperature testing also increases overall radiation exposure because of the total time involved inside containment to gain access to all ignitors.

TVA believes adequate assurance that the ignitors reach the proper temperature can be obtained through current measurements. TVA has performed several tests on ignitors which show that if a current of 7.4 amperes is measured at the electrical distribution panel, the ignitors will be at a minimum of 1700°F (test report enclosed). A baseline current is obtained during initial testing

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1/1

(proper temperature is also verified). Future testing that verifies that baseline current is obtained ensures that the ignitor temperature is reached. The current measurement is also a measurement of the energy input to the ignitor. The ignitor must dissipate this energy or burn up. The containment conditions are essentially the same for each test. Consequently, the ignitor must reach the same temperture in order to dissipate the same amount of energy.

In lieu of revising technical specification 4.6.4.3 as discussed above, TVA has no objections to maintaining the technical specification (final draft version) as is and the staff approving TVA's proposed method of satisfying the subject surveillance requirement in the Watts Bar Safety Evaluation Report.

If you have any questions concerning this matter, please get in touch with D. B. Ellis at FTS 858-2681.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. W. Hufham, Manager
Licensing and Regulations

Sworn to and subscribed before me
this 14th day of Feb. 1985.

Paulette D. White
Notary Public

My Commission Expires 8-24-88

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

ENCLOSURE

FINAL DRAFT

DEC 1 1 1984

LIMITING CONDITION FOR OPERATION

3.6.4.3 Both trains of the Primary Containment Hydrogen Mitigation System shall be operable.

APPLICABILITY: MODES 1 and 2.

ACTION

With one train of the Hydrogen Mitigation System inoperable, restore the inoperable train to OPERABLE status within 7 days or increase the surveillance interval of Specification 4.6.4.3a. from 92 days to 7 days on the OPERABLE train until the inoperable train is returned to OPERABLE status.

SURVEILLANCE REQUIREMENTS

4.6.4.3 Each train of the Hydrogen Mitigation System shall be demonstrated OPERABLE:

a. At least once per 92 days by energizing the supply breakers and verifying that at least 33 of 34 ignitors in each train are energized,* and

b. At least once per ~~18 months~~ 92 days by verifying the temperature of each energized ignitor is a minimum of 1700°F. The temperature of the ignitors will be verified by measuring at least 7.4 amperes on each ignitor circuit with two energized ignitors, and at least 3.7 amperes on each ignitor circuit with one energized ignitor, taken at the distribution panel.

c. At least once per 9 months by verifying the temperature, by optical pyrometer measurement, of 20 % of the ignitors, with at least one ignitor from upper containment, lower containment, and the ice condenser is a minimum of 1700 °F.

*Inoperable ignitors must not be on corresponding redundant circuits which provide coverage for the same region.

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

TEST REPORT ON PERMANENT

HYDROGEN MITIGATION SYSTEM

TEMPERATURE vs CURRENT MEASUREMENTS OF HYDROGEN IGNITORS

TAYCO MODEL NO. 193-3442-4

PERFORMANCE DATES: ~~January 26-27, 1985~~

Performed by Don W. Willis
Don W. Willis by THS

Checked by H. M. De Souza
Hector M. DeSouza by THS

Submitted by C. E. Wood
C. E. Wood by THS

TEMPERATURE VERSUS CURRENT TESTING OF FOUR TAYCO MODEL 193-3442-4 HYDROGEN IGNITORS AT WATTS BAR NUCLEAR PLANT - JANUARY 26-27, 1985

1.0 SCOPE

Surveillance Requirement 4.6.4.3.b requires that once per 18 months the temperature of each hydrogen ignitor in the hydrogen mitigation system be verified to be a minimum of 1700°F. Because of the major industrial safety hazard to human life involved in reaching the hydrogen ignitors located in the reactor building dome to measure the temperature, this test was conducted to provide information to verify the assumption that the temperature of the hydrogen ignitors is directly related to the input current.

2.0 OBJECTIVE

To obtain sufficient temperature versus input current data for four typical hydrogen ignitors obtained from stock to verify that a linear relationship exists between the temperature of a hydrogen ignitor and the input current to the hydrogen ignitor.

3.0 SPECIAL TEST EQUIPMENT

3.1 Fluke Digital Multimeter, Model 8600A
3.2 Westinghouse In-Line Ammeter, Type PA-151, Style 717B054A09
3.3 Mikron Infrared Thermometer, Model M57PH, 120-inch Focal, 2% Accuracy
3.4 Variac, 125V ac, 10 Ampere

4.0 PREREQUISITES

Each hydrogen ignitor that was tested was subjected to a burn-in period of four hours at four amperes. This was done to stabilize the heater element.

5.0 TEST PERFORMANCE

Each hydrogen ignitor was subjected to the following tests. The test was performed four times on each ignitor to determine repeatability. The voltage was raised to 100V ac $\pm^{0}_{0}{}^{.25}$ and the current and temperature allowed to stabilize for five minutes before readings were taken. Following the data collection, the voltage was raised to 105V ac $\pm^{0}_{0}{}^{.25}$ and the current and temperature allowed to stablized for five minutes before readings were taken. The voltage was raised at 5-volt increments through 135V ac and the current and temperature allowed to stabilize for five minutes at each voltage level. Following the 135V ac readings, the voltage to the hydrogen ignitor was turned off and the hydrogen ignitor allowed to cool. The current versus temperature was plotted for each test on each hydrogen ignitor. The test setup, data, and graphs are attached.

6.0 CONCLUSIONS

The temperature versus current of the four hydrogen ignitors is linear. The scale on the infrared thermometer had to be changed from low to medium range when the temperature of the ignitor reached 1800°F. This is the reason for the differences seen on the graphs at approximately 4.05 amperes. The temperature readings following the scale change are linear also which concludes that the change in slope is a trait of the infrared gun and not of the hydrogen ignitor.

We determined that approximately 3.6 amperes input to the hydrogen ignitor is required to attain 1700°F. Our circuitry design has two hydrogen ignitors in parallel from each breaker in the permanent Hydrogen Mitigation Panels. Therefore, a minimum of 7.2 amperes will be required. We determined the longest cable run in the hydrogen mitigation system and calculated the maximum voltage drop which could be expected. The impedence of this cable is approximately 2.0653 ohms. The maximum calculated voltage drop is 14.2056 volts.

Our test data shows that the voltage required for 1700°F on the hydrogen ignitors is approximately 112V ac. Therefore, a minimum of 126.2056V ac is required on the hydrogen mitigation distribution panel. The transformer to the permanent Hydrogen Mitigation Distribution panel has a voltage regulator and the regulator has been adjusted to maintain 133V ac to the distribution panel. Therefore, the hydrogen ignitors will have adequate voltage.

Additionally similar test results were obtained on three different ignitors at our central laboratory. A copy of this test report is attached. (Report 85-4510.)

Based on our test data, we are confident that current measurements of at least 7.2 amps taken at the distribution panel on each circuit are adequate and will ensure a minimum of 1700°F on each ignitor in lieu of actual field temperature measurement.

Visual observation of the ignitors during the test performance revealed the following:

> At 1400°F, the visal appearance of the ignitor changed from metallic to a dark orange. Between 1400°F and 1500°F, the color changed to a glowing bright orange. Between 1600°F to 1700°F, there is not a significant change in color. Above 1700°F the color is a brilliant orange.

FIGURE 1: Test Setup

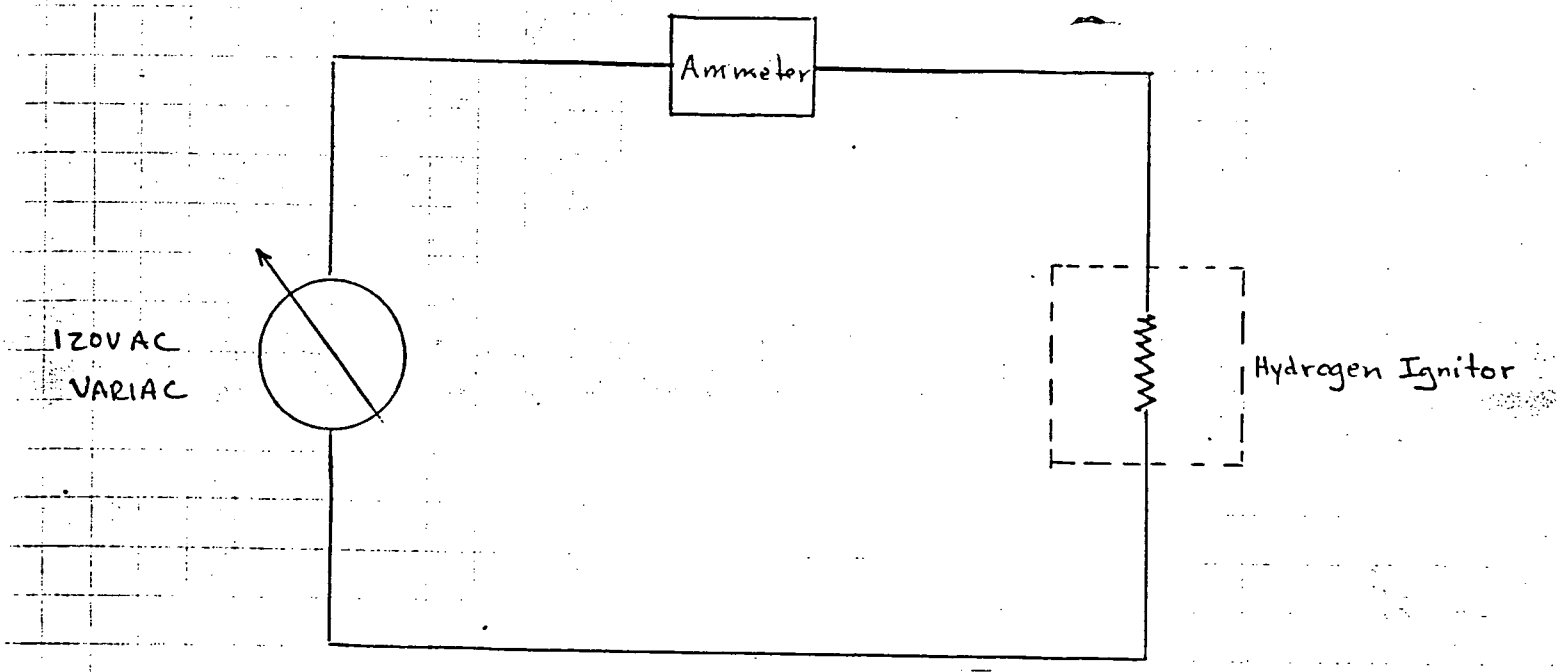
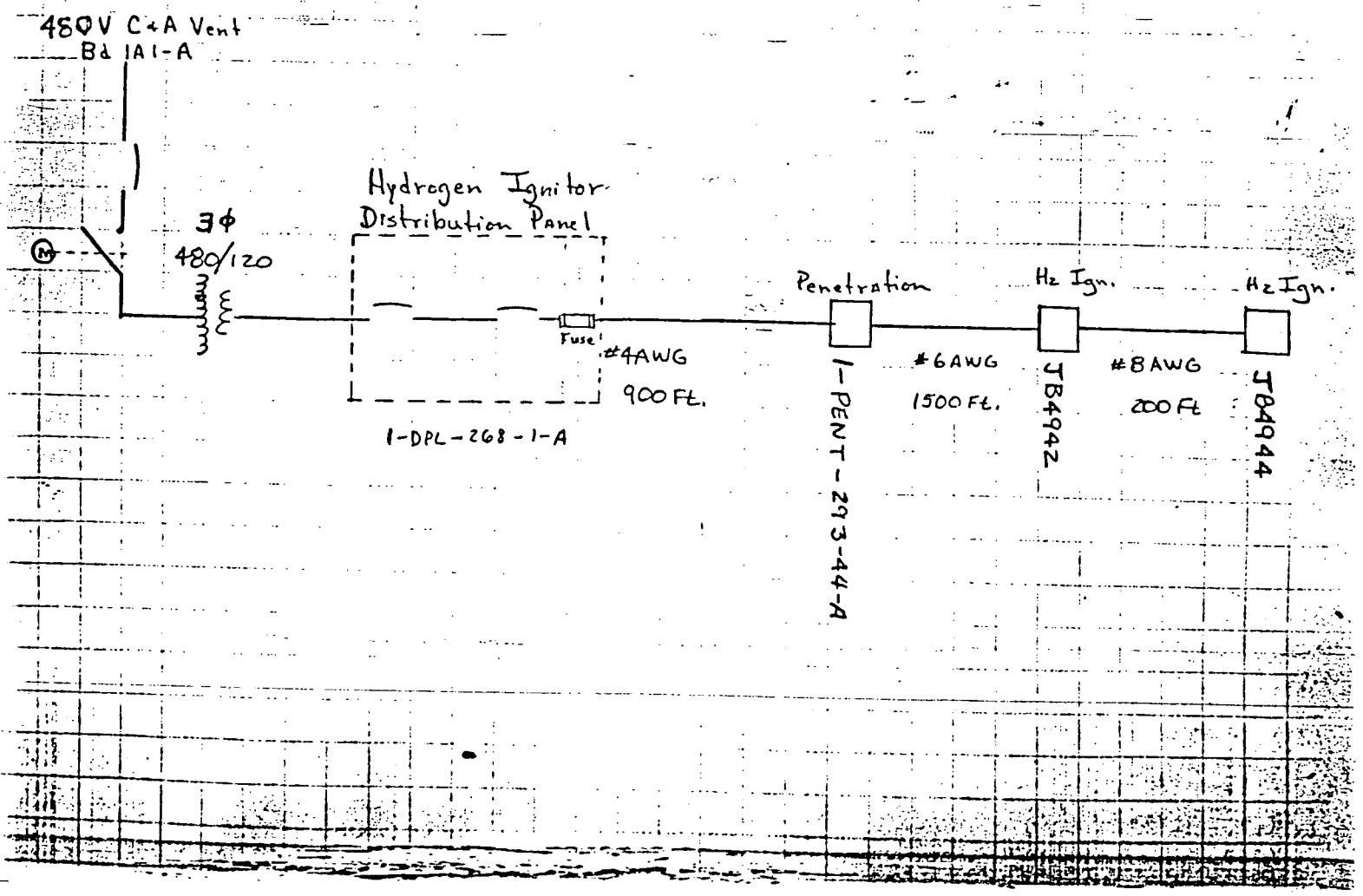


FIGURE 2: Typical Hydrogen Ignitor Circuit



Ignitor S/N 810 Model 193-3442-4 Burn Time 4 Hrs.

Ammeter S/N 320207 Cal Due Date 1/16/86 Ambient 75° F

Fluke S/N 497507 Cal Due Date 2/19/85

Variac S/N 116154 Cal Due Date 9/27/85

Mikron S/N 504681 Cal Due Date 9/17/85

TEST 1			TEST 2			TEST 3			TEST 4		
VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS.	TEMP.	VOLTS	AMPS	TE
100	3.3	1545	100	3.26	1560	100	3.26	1570	100	3.3	15
105	3.42	1614	105	3.42	1630	105	3.41	1635	105	3.42	16
110	3.57	1650	110	3.59	1695	110	3.57	1700	110	3.59	16
115	3.72	1715	115	3.7	1740	115	3.74	1748	115	3.75	17
120	3.82	1777 *Change Scale	120	3.81	1792 *Change Scale	120	3.87	1796 *Change Scale	120	3.91	17 *Ch Sc
125	4.05	1790	125	4.04	1788	125	4.05	1780	125	4.04	17
130	4.2	1810	130	4.2	1810	130	4.2	1810	130	4.2	18
135	4.29	1830	135	4.31	1830	135	4.34	1830	135	4.3	18

*The scale on the infrared gun had to be changed to accomodate the temperature. However, the temperature was read on the low end of the scale and is the reason for the temperature variations. The scale used to read 1700°F was the low scale and has good accuracy. The mid-range scale has less accuracy. This is the explanation of the offset on the graphs and in the data. The temperature versus current is linear on the medium scale.

Ignitor S/N 811

Ammeter S/N 320207

Fluke S/N 497507

Variac S/N 166154

Mikron S/N 504681

Model 193-3442-4

Cal Due Date 1/16/86

Cal Due Date 2/19/85

Cal Due Date 9/27/85

Cal Due Date 9/17/85

Burn Time 4 Hrs.

Ambient 72° F

TEST 1			TEST 2			TEST 3			TEST 4		
VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.
100	3.3	1580	100	3.31	1558	100	3.31	1570	100	3.30	1580
105	3.46	1642	105	3.44	1626	105	3.46	1629	105	3.47	1640
110	3.6	1702	110	3.58	1692	110	3.63	1695	110	3.65	1717
115	3.64	1749	115	3.76	1738	115	3.78	1732	115	3.74	1750
120	3.91	1810	120	3.92	1790	120	3.94	1780	120	3.93	1810
		*Change Scale			*Change Scale			*Change Scale			*Change Scale
125	4.06	1785	125	4.04	1798	125	4.07	1780	125	4.07	1795
130	4.2	1795	130	4.22	1812	130	4.18	1800	130	4.22	1820
135	4.36	1870	135	4.37	1834	135	4.4	1875	135	4.37	1860

Ignitor S/N 817

Model 193-3442-4

Burn Time 4 Hrs.

Ammeter S/N 320207

Cal Due Date 1/16/86

Ambient 71° F

Fluke S/N 497507

Cal Due Date 2/19/85

Variac S/N 166154

Cal Due Date 9/27/85

Mikron S/N 504681

Cal Due Date 9/17/85

TEST 1			TEST 2			TEST 3			TEST 4		
VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.
100	3.28	1582	100	3.31	1587	100	3.3	1580	100	3.31	1575
105	3.47	1648	105	3.45	1641	105	3.45	1642	105	3.45	1640
110	3.6	1701	110	3.61	1702	110	3.61	1700	110	3.6	1698
115	3.72	1760	115	3.76	1763	115	3.76	1755	115	3.76	1757
120	3.9	1805 X Change Scale	120	3.91	1811 X Change Scale	120	3.91	1803 X Change Scale	120	3.91	1811 X Chang Scale
125	4.06	1795	125	4.05	1795	125	4.05	1795	125	4.06	1790
130	4.23	1822	130	4.23	1820	130	4.22	1810	130	4.21	1820
135	4.36	1870	135	4.35	1875	135	4.37	1860	135	4.35	1875

Ignitor S/N 819 | Model 193-3442-4 | Burn Time 4 Hrs.

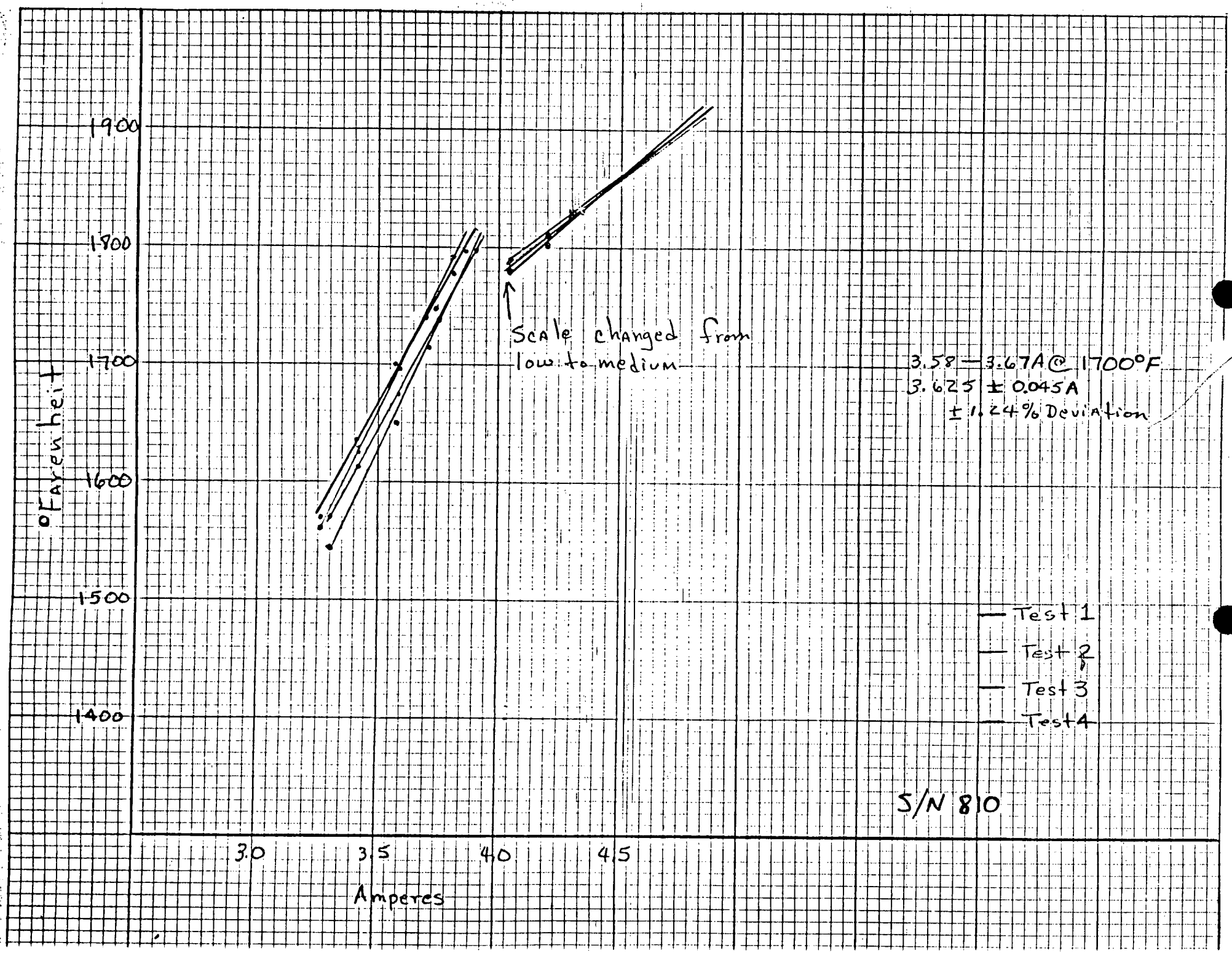
Ammeter S/N 320207 | Cal Due Date 1/16/86 | Ambient 71° F

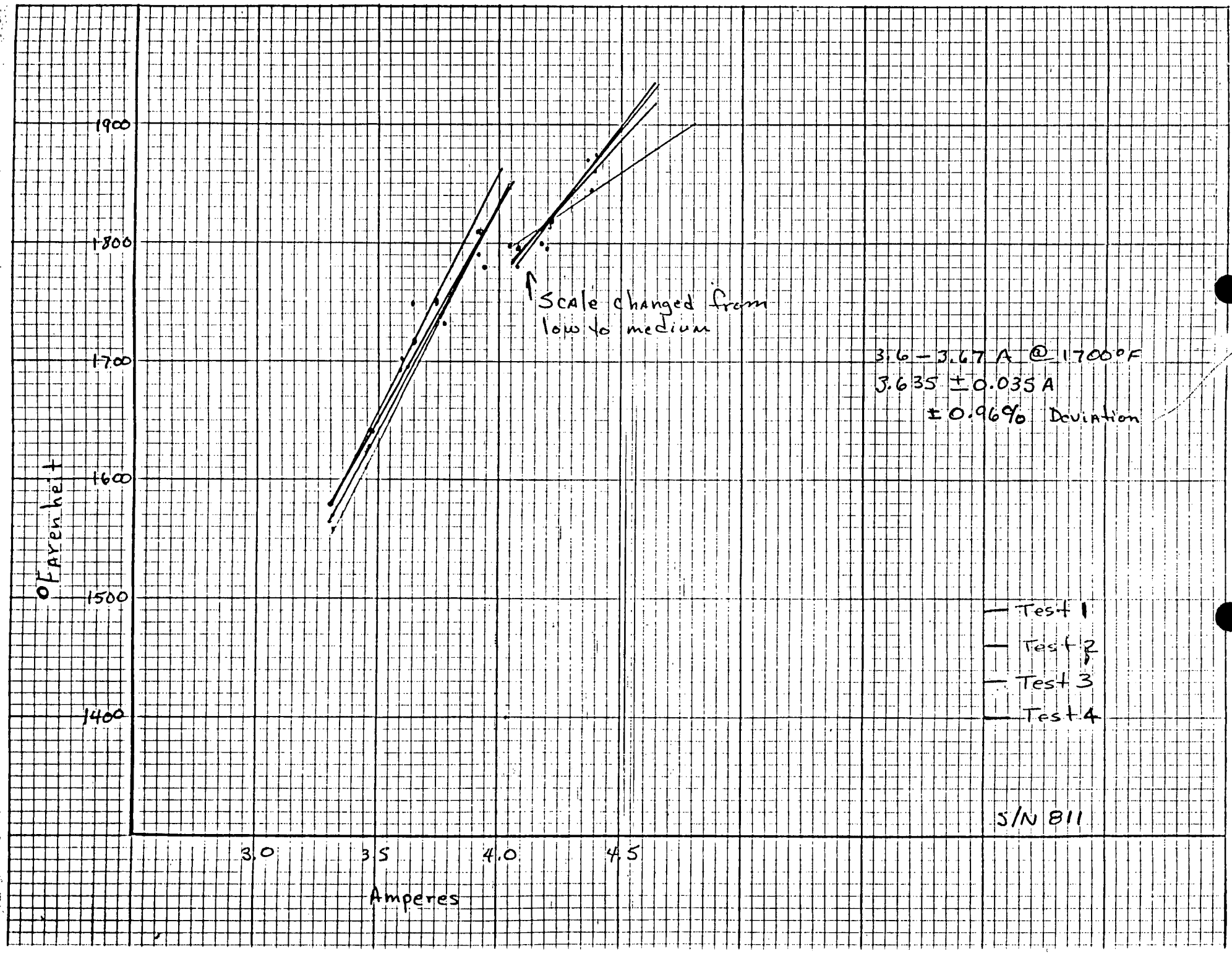
Fluke S/N 497507 | Cal Due Date 2/19/85

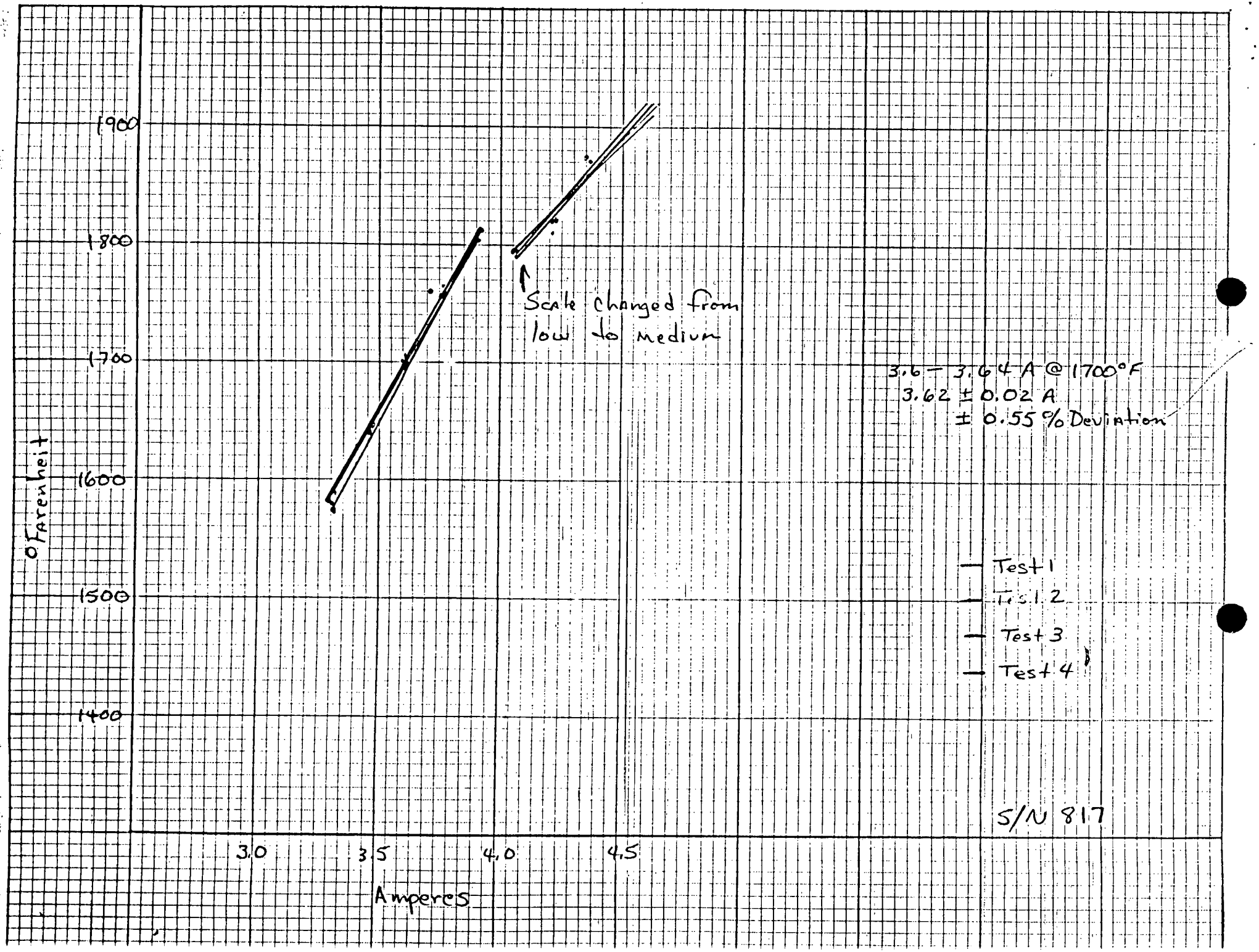
Variac S/N 166154 | Cal Due Date 9/27/85

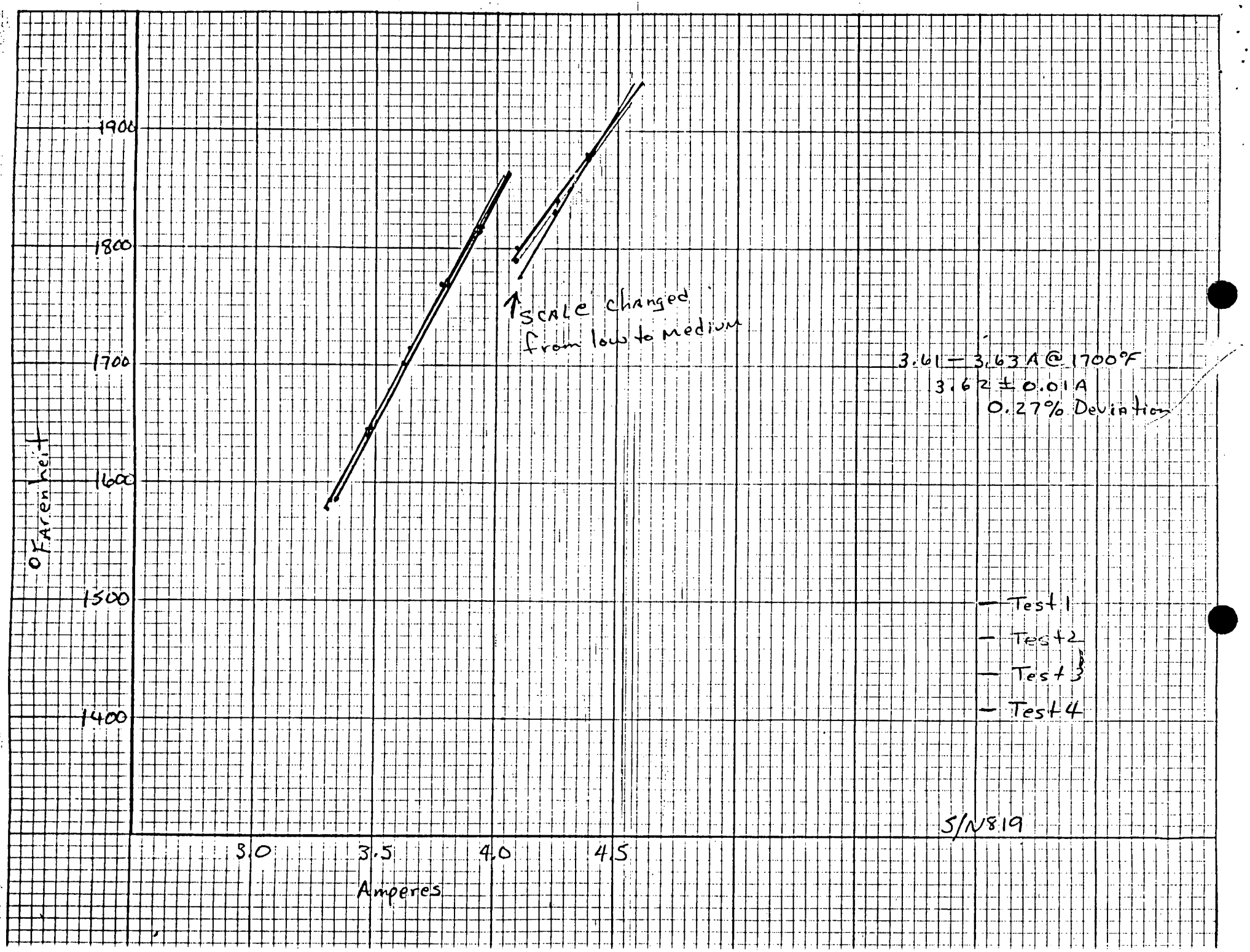
Mikron S/N 504681 | Cal Due Date 9/19/85

TEST 1			TEST 2			TEST 3			TEST 4		
VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.	VOLTS	AMPS	TEMP.
100	3.32	1585	100	3.32	1585	100	3.30	1578	100	3.34	1585
105	3.46	1645	105	3.46	1642	105	3.46	1640	105	3.47	1647
110	3.64	1713	110	3.63	1702	110	3.61	1701	110	3.61	1700
115	3.77	1769	115	3.77	1769	115	3.80	1767	115	3.79	1771
120	3.93	1817	120	3.94	1818	120	3.93	1812	120	3.92	1812
125	4.08	*Change Scale 1800	125	4.07	*Change Scale 1790	125	4.08	*Change Scale 1790	125	4.1	*Change Scale 1775
130	4.25	1840	130	4.24	1830	130	4.25	1840	130	4.24	1830
135	4.37	1880	135	4.37	1880	135	4.38	1875	135	4.38	1875


1900
1800
1700
1600
1500
1400
°Fahrenheit
3.0
3.5
4.0
4.5
Amperes
Scale changed from low to medium
3.58 – 3.67A @ 1700°F
3.625 ± 0.045A
± 1.24% Deviation
Test 1
Test 2
Test 3
Test 4
S/N 810


1900
1800
1700
1600
1500
1400
°Farenheit
3.0
3.5
4.0
4.5
Amperes
Scale changed from low to medium
3.6 – 3.67 A @ 1700°F
3.635 ± 0.035 A
± 0.96% Deviation
Test 1
Test 2
Test 3
Test 4
S/N 811


1900
1800
1700
1600
1500
1400
°Farenheit
3.0
3.5
4.0
4.5
Amperes
Scale changed from low to medium
3.6 – 3.64 A @ 1700°F
3.62 ± 0.02 A
± 0.55% Deviation
Test 1
Test 2
Test 3
Test 4
S/N 817


1900
1800
1700
1600
1500
1400
°Farenheit
3.0
3.5
4.0
4.5
Amperes
↑ SCALE changed from low to medium
3.61 – 3.63 A @ 1700°F
3.62 ± 0.01 A
0.27% Deviation
– Test 1
– Test 2
– Test 3
– Test 4
S/N 819

E13 841221 001

8412280140 9

TECHNICAL REPORT

REPORT NO.: 85-4510

SHEET NO.: 1 of 1 SHEETS

LOCATION: Central Laboratories Services

DATE OF WORK: 12/19/84

SUBJECT: VERIFICATION OF HYDROGEN IGNITORS, MODEL 193-3442-4

DATE OF REPORT: 12/20/84

COPIES SENT TO: Chuck Brewton, Sequoyah NUC PR; ARMS; LMR

PREPARED BY: B. Z. Loyd CHECKED BY: G. A. Erickson APPROVED BY: H. A. Taff

Hydrogen ignitors were tested at five points ranging from 110 volts ac to 130 volts ac in 5-volt increments.

The voltage and current were monitored with a Yokagawa 2503 ac power meter (±12% of reading + .06% of range), and a type S thermocouple (±4° F). Each standard is part of the laboratory quality assurance program and has documented traceability.

Each ignitor was run three times because it was observed that the initial test indicated substantially higher temperatures than the second or third run. Plotted graph values depict the third run.

The ignitors appear to have linear temperature increase as a function of current and are repeatable after initial burn-in.

Attached are graphs for each ignitor as well as the recorded data for each test.

GAE:BZL:AKC
Attachments

TEST RECORD -- GENERAL

REPORT No.: BS - 4510
SHEET No.: 1 OF 1 SHEETS
DATE OF TEST: 12-20-84
DATE OF REPORT: 12-28-84

LOCATION: CENTRAL LABORATORIES
SUBJECT: HYDROGEN IGNITORS MODEL 193-3442-4
GENERAL DATA:

COPIES SENT TO:

TESTED BY:	CHECKED BY:	APPROVED BY:
B. Z. Loyd		

1ST RUN NEW IGNITOR (INITIAL TEST)
3RD RUN USED FOR GRAPH.

IGNITOR S/N 688

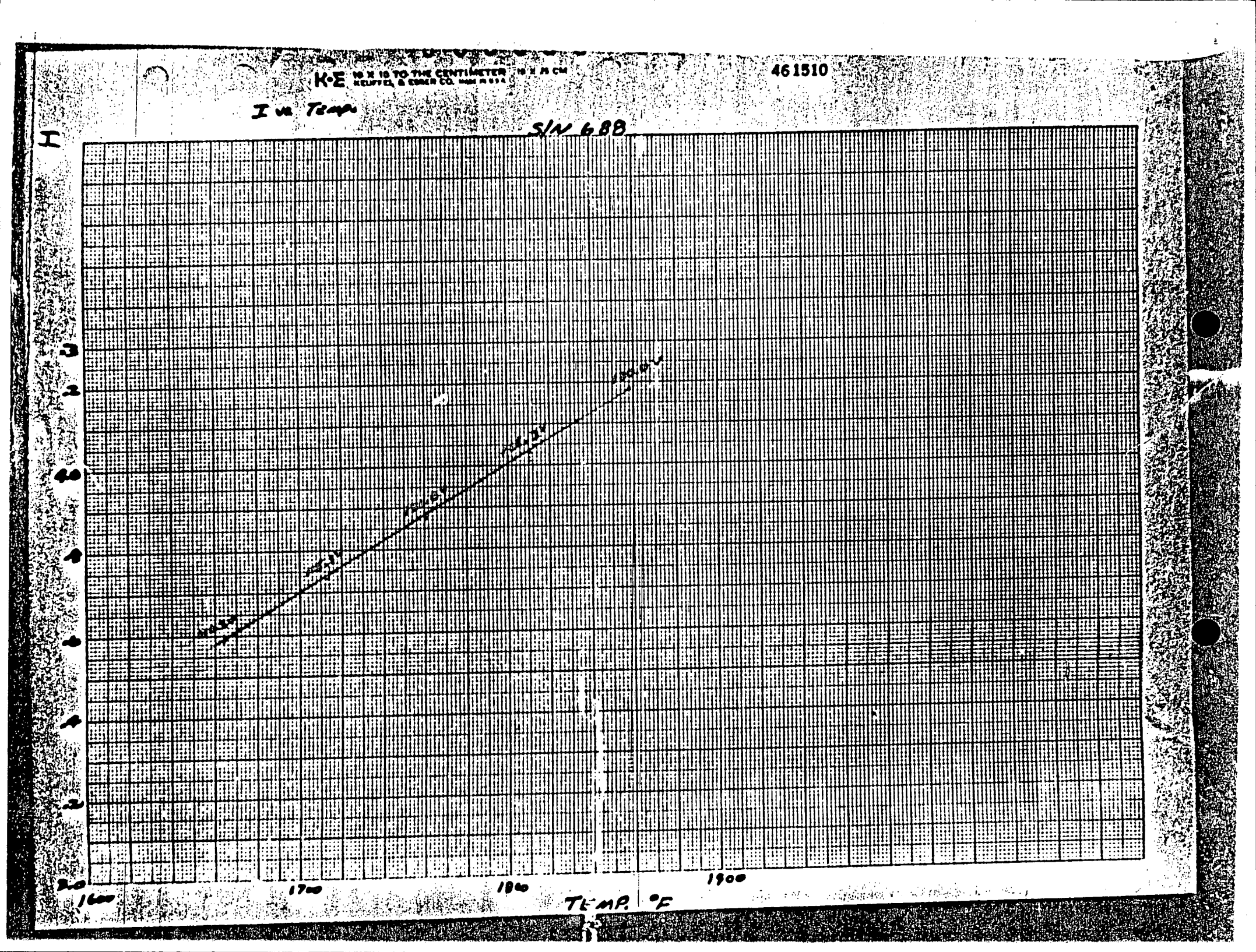
1ST RUN			2ND RUN			3RD RUN		
VAC	AMPS	TEMP °F	VAC	AMPS	TEMP °F	VAC	AMPS	TEMP °F
109.7	3.565	1698	110.4	3.588	1675	110.3	3.584	1664
115.3	3.730	1751	115.1	3.734	1721	115.1	3.737	1713
120.3	3.885	1807	120.0	3.881	1764	120.0	3.876	1761
125.2	4.036	1848	125.3	4.040	1815	125.3	4.039	1811
129.8	4.172	1884	130.0	4.185	1861	130.0	4.183	1858

IGNITOR S/N 695

110.3	3.606	1673	110.5	3.604	1652	110.1	3.592	1648
115.3	3.769	1728	115.2	3.748	1694	115.3	3.757	1659
120.0	3.891	1772	120.1	3.896	1748	120.1	3.894	1744
125.0	4.049	1814	125.2	4.045	1799	125.4	4.041	1795
130.2	4.195	1849	129.9	4.191	1941	130.1	4.200	1839

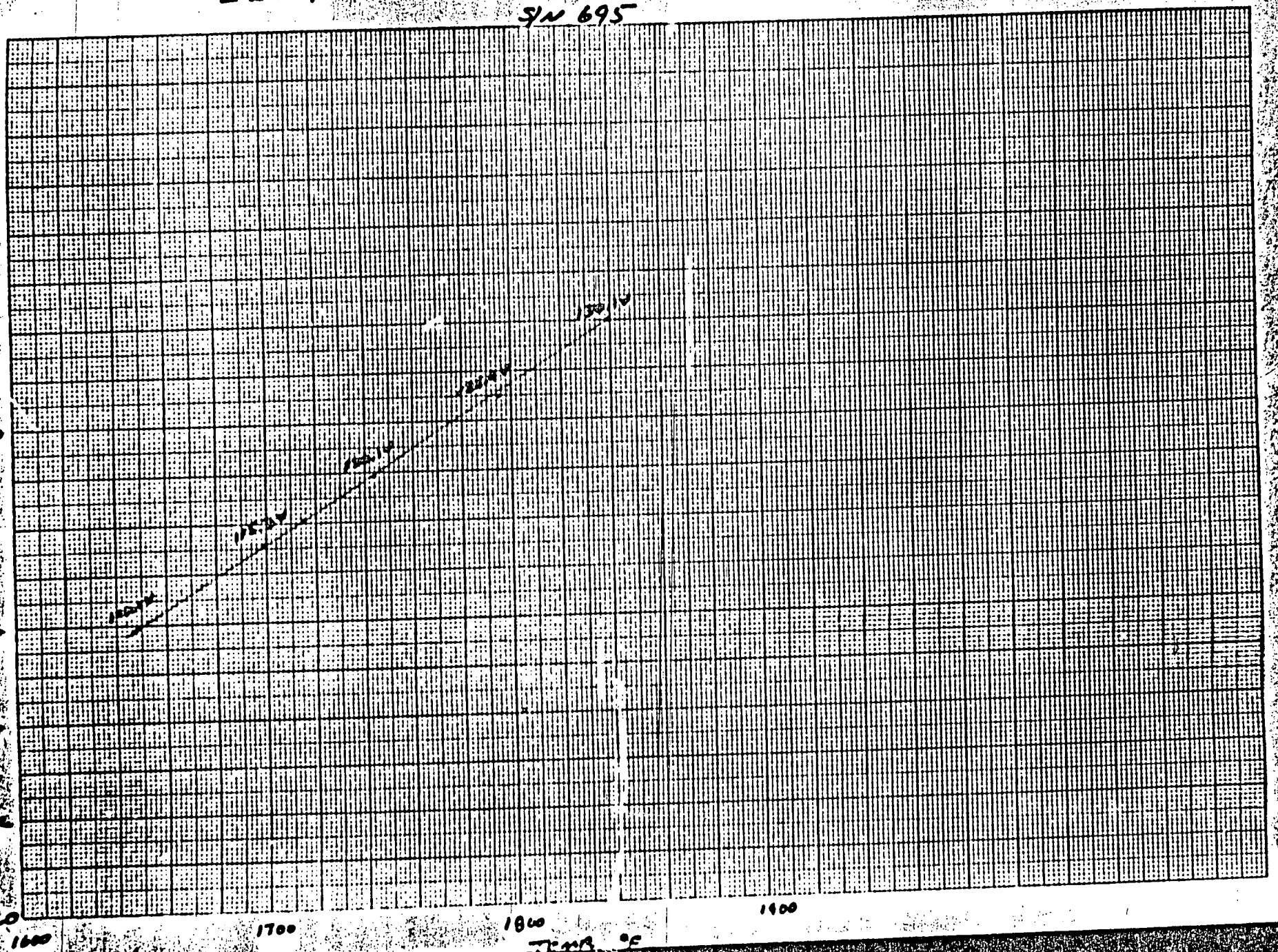
IGNITOR S/N 697

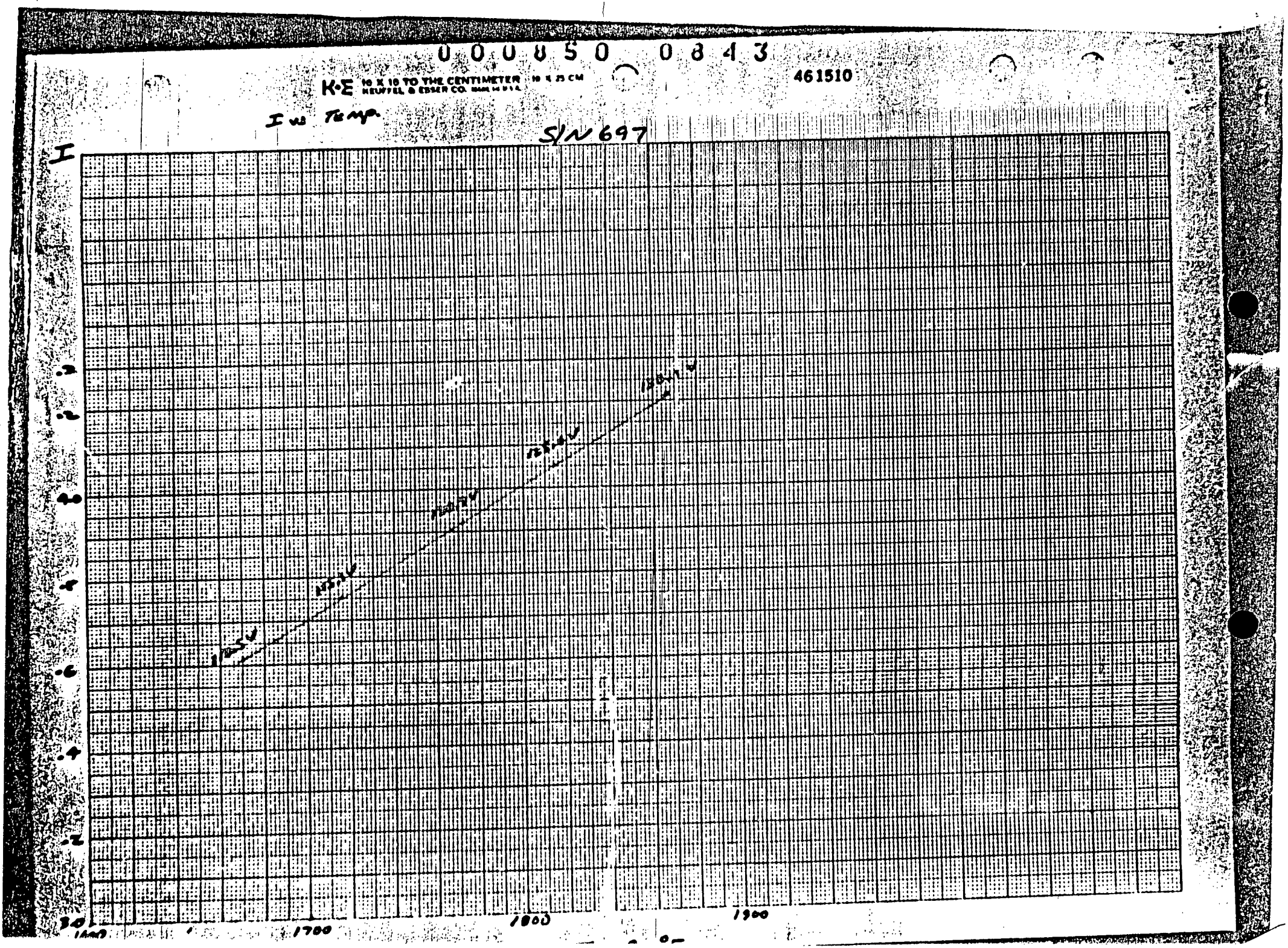
110.0	3.593	1702	110.4	3.606	1671	110.5	3.613	1670
115.4	3.755	1752	115.1	3.751	1719	115.1	3.752	1716
120.0	3.892	1790	120.8	3.921	1778	120.7	3.926	1772
124.8	4.040	1832	125.0	4.052	1820	125.0	4.052	1815
129.8	4.203	1870	129.6	4.194	1865	130.1	4.214	1866


K·E 10 X 10 TO THE CENTIMETER 10 X 25 CM
KEUFFEL & ESSER CO. MADE IN U.S.A.
461510
I vs Temp
S/N 688
I
3
2
40
4
4
2
20
1600
1700
1800
1900
TEMP. °F

I vs Temp

S/N 695




0 0 0 0 8 5 0 0 8 4 3
K·E 10 X 10 TO THE CENTIMETER
KEUFFEL & ESSER CO.
461510
I vs Temp
SN 697
I
1700
1800
1900