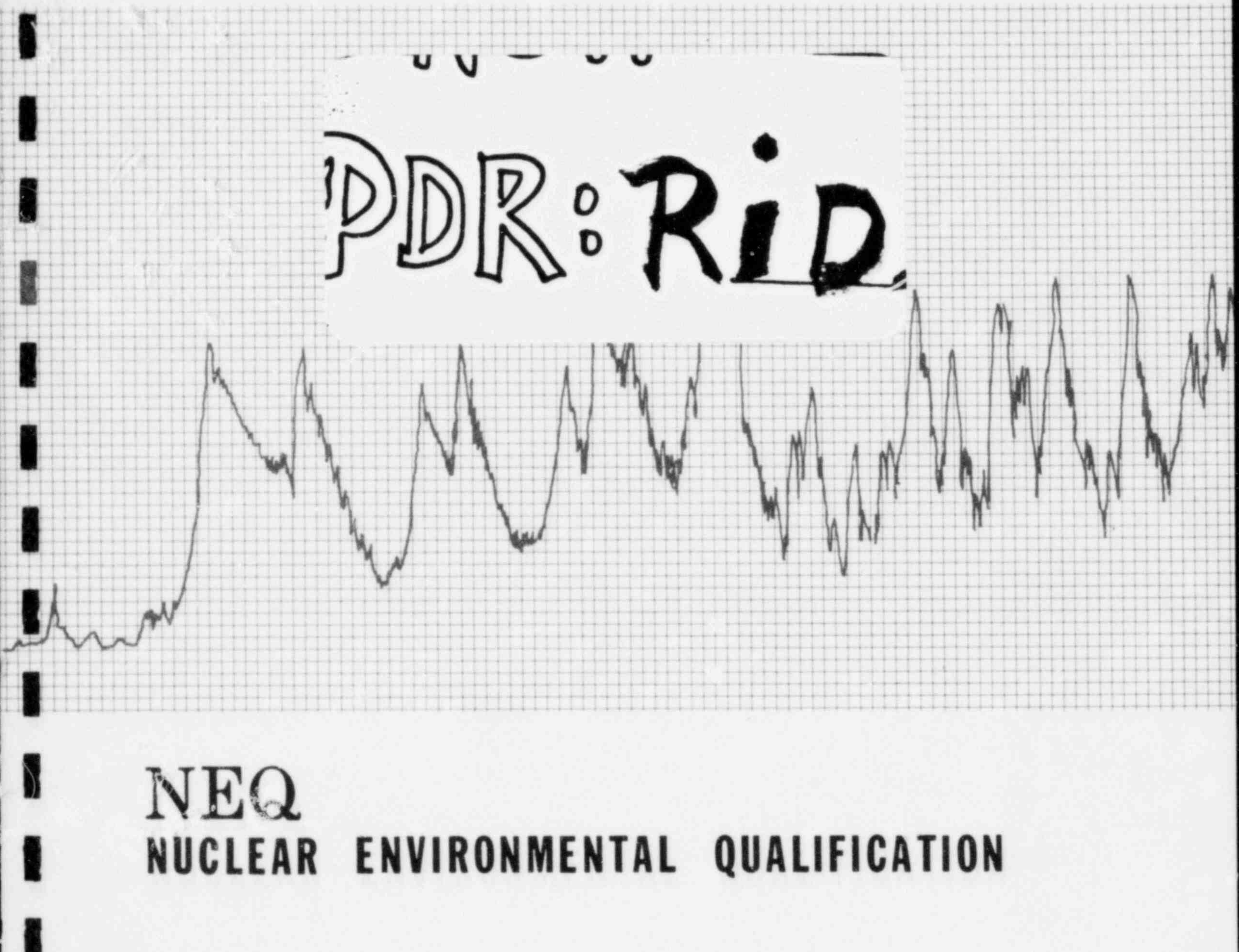
WYLE
LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP



PDR:RID

NEQ
NUCLEAR ENVIRONMENTAL QUALIFICATION

est REPORT

ENVIRONMENTAL QUALIFICATION TEST REPORT

ON

ELECTRICAL PENETRATION ASSEMBLY, TYPE B-M

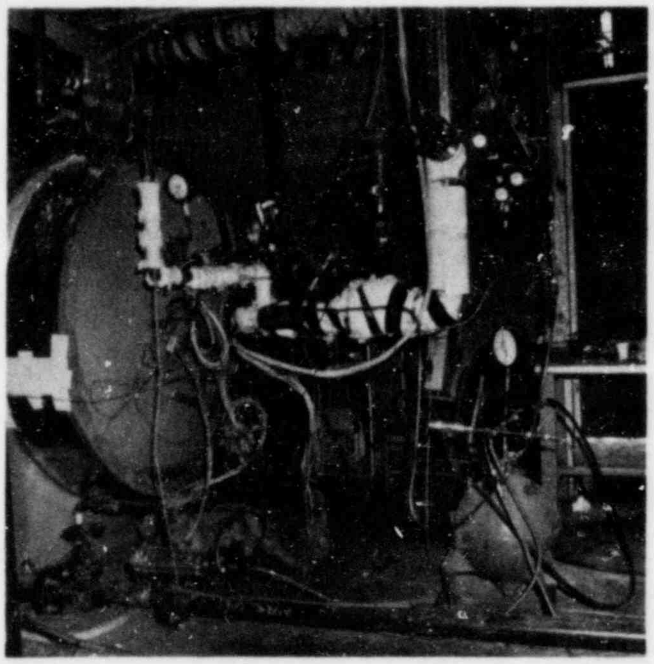
FOR

DUKE POWER COMPANY

VOLUME I

422 Church Street
Charlotte, NC 28242

VOLUME I



NEQ

Nuclear Environmental Qualification

Test Report

REPORT NO. 45869-1

WYLE JOB NO. 45869

CUSTOMER P. O. NO. 8828.05-3PM

PAGE i OF 322 PAGE REPORT

DATE July 21, 1982

SPECIFICATION (S) See References in Paragraph 5.0.

1.0 CUSTOMER Duke Power Company

ADDRESS 422 Church Street, Charlotte, NC 28242

2.0 TEST SPECIMEN Electrical Penetration Assembly, Type B-M, Twelve Electrical Plug Kits

3.0 MANUFACTURER D. G. O'Brien

4.0 SUMMARY

According to Duke Power Company, the purpose of this test was to verify the qualification of the D.G. O'Brien safety related Type "K" plug module due to the extrusion of the grommet material reported during Accident Testing conducted by Sandia Laboratories. Additional plugs were tested by Wyle Laboratories to verify the integrity of similar penetration plug types. Specifically, the safety related type "C" and "F" plugs were tested; in addition, non-safety related plug modules type "D", "E", and "L" were tested. All plug modules were assembled into a D. G. O'Brien Electrical Penetration Assembly, Type B-M, and subjected to a Nuclear Environmental Test Program. This test program consisted of thermal aging, radiation exposure, and a steam Accident Test.

STATE OF ALABAMA
COUNTY OF MADISON } ss. AL P.E. No. 8256

F. R. Johnson, being duly sworn, deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SEAL

SUBSCRIBED and sworn to before me this 23rd day of Sept., 1982

Patricia A. Phillips
Notary Public in and for the State of Alabama at large

My Commission expires Jan. 30, 1985

PREPARED BY H Smith
H. Smith, AL P.E. No. 5683

APPROVED BY
F. R. Johnson, AL P.E. #8256

WYLE Q. A.
T. Stinson

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
HUNTSVILLE, ALABAMA

4.0 SUMMARY (Continued)

The safety related type "K" plug module, as well as the "D" and "F" plug modules, performed satisfactorily during the Accident Test conducted from March 24 to March 31, 1982. However, erratic behavior (leakage current intermittently blowing 0.5 amp fuses) was observed on one conductor of Module C, two conductors of Module E, and two conductors of Module L. This erratic behavior ceased at the end of the Accident Test and post test electrical measurements could not demonstrate any difference between conductors. All conductors demonstrated high insulation resistance after the Accident Test.

Subsequently, Duke Power directed Wyle to conduct an additional seven-day Accident Test prior to disassembly of the penetration assembly and that an additional post test analysis (after first Accident Test) be conducted. The procedures and results of this second test program are reported in Volume II of this report.

This report contains the following sections:

VOLUME I

- Section I - Thermal Aging Test
- Section II - Assembly of Components
- Section III - Baseline Functional Test
- Section IV - Radiation Exposure
- Section V - Electrical Functional Test
- Section VI - Assembly of Cables/Penetration Unit
- Section VII - Accident Test
- Section VIII - Post Test Inspection
- Section IX - Wyle Laboratories' Qualification Procedures No. 543/6124-2/DK, Revision B, dated 3/17/82, and Revision C, dated 4/26/82.

VOLUME II

- Section I - Introduction
- Section II - Analysis of Module C, E, and L Cables and K Module Connector after the First Accident Test
- Section III - Extended Accident Test
- Section IV - Final Inspection

The Qualification Program was conducted in the order presented: Sections I thru VII, Volume I, and Sections I thru IV, Volume II.

Nine anomalies were noted during this program and are discussed briefly below, and in detail in the appropriate sections of this report.

4.0 SUMMARY (Continued)

NOTICES OF ANOMALY (NOA)

NOA No. 1

The thermal aging criteria for the face seals, penetration unit, plug kits, and three cables was 302°F for 504 hours. At one point during the aging, the oven temperature increased to 320°F for approximately 43 minutes. A malfunctioned temperature controller was replaced and the aging completed at 302°F.

NOA No. 2

The cables were received at the irradiation facility (Isomedix) with indication of mishandling during shipment and possible damage (shipping crate turned over and cables dumped to floor of truck).

The cables were visually inspected at Isomedix by H. Smith/B. Coleman of Wyle and R. Dover/J. Tannery of Duke Power. No damage was observed during the inspection. Wyle also conducted insulation resistance and electrical continuity tests per paragraphs 3.7.2 and 3.7.3 of Wyle Laboratories' Test Procedure 543/6124-2/DK. The electrical tests revealed no degradation. The cables were subsequently subjected to the irradiation process.

NOA No. 3

At the start of the initial steam ramp during the accident test, the chamber air temperature was approximately 200°F and not the specified 120°F. By extrapolating the ramp data back to 120°F, the ramp time from 120°F to 340°F was 8 seconds -- well below the required time of 10 seconds.

NOA No. 4

At approximately 120 minutes into the Accident Test, the chamber pressure decayed from the required 15 psig to zero. The internal chamber metal temperatures and specimen metal temperatures dropped a maximum of 5 degrees, indicating minimal thermal changes to the specimen during the 19-minute period.

NOA No. 5

Just prior to the start of the Accident Test, Conductor No. 4 of Module D had an insulation resistance of $2.7X10^7$ ohms, at 500 volts DC, which was below the Accident Test prestart value of 100 megohms. The condition was waived and the Accident Test conducted as planned.

4.0 SUMMARY (Continued)

NOA No. 6

Five conductors out of 50 exhibited leakage current in excess of 0.5 amps (blew 0.5 amp fuses) at various times during the Accident Test. Power was restored to some of these conductors periodically during the Accident Test.

NOA No. 7

During the second Accident Test, Conductors 9-10 of Module E exhibited leakage current in excess of 0.5 amps (blew 0.5 amp fuse). Power was restored to this conductor on the next day and the leakage current remained below 0.5 amps during the remainder of the test. At the end of the second Accident Test, conductors 11-12 of Module E exhibited leakage current in excess of 0.5 amps (blew 0.5 amp fuse). These conductors did not exhibit leakage currents in excess of 0.5 amps during the first Accident Test.

NOA No. 8 (Second Accident Test)

The data logger did not print during a portion of the fourth day of the Accident Test. Chamber steam temperature and chemical solution flow were monitored and recorded on the test surveillance sheet each hour during the period that the data logger was not printing. Leakage current was also monitored each hour (by inspecting 0.5 amp fuse). Since the chamber steam temperature and chemical solution flow rate were well within operating tolerances at each hour's check, and since there were no blown fuses during this time, it was assumed that no significant or abnormal events occurred and the test was continued.

NOA No. 9 (Second Accident Test)

The data logger did not print during a portion of the fifth day of the Accident Test. Chamber steam temperature and chemical solution flow rate were monitored and recorded on the test surveillance sheet each hour during the period that the data logger was not printing. Leakage current was also monitored each hour (by inspecting 0.5 amp fuse). Since the chamber steam temperature and chemical solution flow rate were well within operating tolerances at each hour's check, and since there were no blown fuses during this time, it was assumed that no significant or abnormal events occurred and the test was continued.

5.0 REFERENCES

5.1 Wyle Laboratories' Test Procedure No. 543/6124-2/DK, Revision B, dated 3/17/82 and Revision C, dated 4/28/82.

5.2 Duke Power Company Specification No. MCS-1393.01-00-0003, July 23, 1981, Revisions 1, 2, 3, 4, and 5.

4.0 SUMMARY (Continued)

5.3 IEEE 323-1971, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

5.4 IEEE 317-1972, "IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations."

5.5 ANSI N45-2.2-1972, "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants."

5.6 Duke Power Company MCM 1361.00-0016, "Low Voltage Penetration Instruction Manual."

5.7 Duke Power Company MCM 1361-00-0017, "Instrumentation Penetration Instruction Manual."

5.8 Duke Power Company CNM 1361.00-0010, "Low Voltage Penetration Instruction Manual."

5.9 Duke Power Company CNM 1361.00-0011, "Instrument Penetration Instruction Manual."

5.10 Duke Power Company IP-MCP-001, "Test Assembly Installation Sequence."

6.0 TEST SPECIMEN AND EQUIPMENT DESCRIPTION

6.1 Test Specimen Description

The test specimen consisted of one D.G. O'Brien Electrical Penetration Assembly, Type B-M; and twelve plug kits identified as:

Module	Plug Kit Inbd/Outbd	Mark No.	Description
C	C32P1002G07 C32P1002G08	3X2G2 3X2G2	3/C #2 AWG, FREP insulation interlocked armor, Anaconda
D	C32P1003G25 C32P1003G26	SP140X SP140X	4/C #8 AWG, 2/C #4 AWG, EP/Hypalon insulation, hypalon jacket, SS braid, Okonite
E	C32P1015G01 C32P1015G02	12X12G1 12X12G1	12/C #12 AWB, EP/Hypalon insulation, interlocked armor, Samuel Moore
F	C32P1004G07 C32P1004G08	3X10G2 3X10G2	3/C #10 AWG, FREP insulation, interlocked armor, Anaconda

6.0 TEST SPECIMEN AND EQUIPMENT DESCRIPTION (Continued)

6.1 Test Specimen Description (Continued)

Module	Inbd Plug Kit Outbd	Mark No.	Description
K	C32P1009G01 C32P1009G06	8X16G.6 8X16G.6	8/C #16 AWG, XLPE insulation, interlocked armor, Brand Rex (2 required per plug kit)
L	C32P1010G01 C32P1010G02	12X12G1 12X12G1	12/C #12 AWG, EP insulation, interlocked armor, Okonite

6.2 Test Equipment Description

The following equipment was used to conduct the test program:

a. Thermal Aging Ovens

1. Wyle Chamber No. 26 - Forced Air Resistant Heat.
2. Wyle Chamber No. 27 - Forced Air Resistant Heat - used for 250°F Aging.

b. Accident Chamber

The mechanical system arrangement for conducting the Accident Test consisted of an 118 ft^3 pressure vessel (Wyle Chamber No. 118) with associated valving and piping for supplying superheat and saturation steam. This system is shown schematically in Figure 1.

c. Instrumentation

A listing of the instrumentation used in measuring and recording data is shown in Table I thru XVI. All instrumentation used in the performance of this test program were calibrated in accordance with Wyle Laboratories' (Eastern Operations) Quality Assurance Policies and Procedures Manual, which conforms to the applicable portions of ANSI N45.2, 10 CFR 50, Appendix B, and Military Specification MIL-STD-45662. Standards used in performing all calibrations are traceable to the National Bureau of Standards.

7.0 RECEIVING INSPECTION

The test specimens, which consisted of a penetration unit, electrical plug kits, and associated cables arrived at Wyle Laboratories on November 3, 1981. Each component was visually inspected to verify model numbers, part numbers, and serial numbers; each component was visually inspected for damage. There were no anomalous conditions observed.

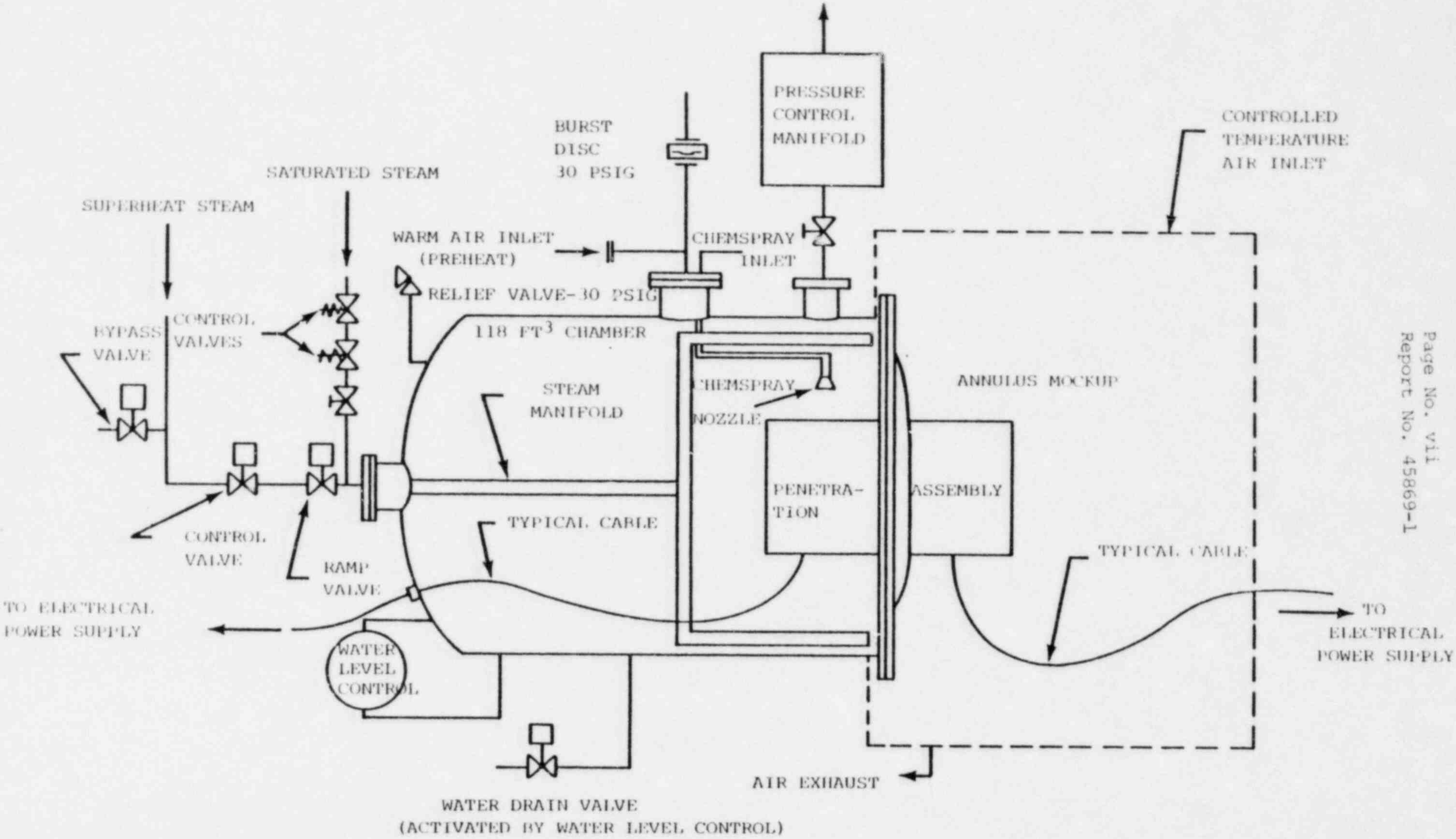


FIGURE 1. ACCIDENT TEST SCHEMATIC

TABLE I

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 11-4-81
Job No. 45869-01-7811
Test Area EV LAB
Technician M. LUTTRELL
Customer DUKE POWER
Type Test THERMAL AGING

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1.	CONTROLLER	Honeywell	N/A	N/A	3056	-125° +375	± .5%	8-13-81	2-13-82
2.	REDUNDANT	THERMOTRON	N/A	N/A	A3055	-125° +375	± .25%	8-13-81	2-13-82
3	RECORDER	Honeywell	45	N/A	94790	0 TO 400	± .5%	11-3-81	2-3-82
4.	TP 109	THERMOTRON	N/A	N/A	305X	N/A	N/A	N/A	N/A
5	CHAMBER #27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

WYLE 307

Instrument Test Engineer B. Gossett

WYLE 307

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WH-1029

TABLE II

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 12-10-81

Job No. 45869-03

Test Area GOOSE

Technician R Coleman

Customer DUKE

Type Test BASELINE FUNCTIONAL

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	DMM	Keithley	130	N/A	96753	MULTI	MFG	8-6-81	8-6-82
2	MEGOHMMETER	G/R	1864	N/A	11898	.5 MEGΩ -20x10^{3} MΩ	MFG	6-18-81	12-18-81

Instrument Test Engineer K Burkhart

Checked & Received By H Smith

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TABLE III

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 2-3-82
Job No. 45869-02-8119
Test Area ELECTRONICS
Technician G. DRAKE
Customer DUKE
Type Test Post Radiation Functional

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	MEGOHMMETER	GENERAL Radio	1864	N/A	11898	multi.	Mfg. Spec.	12-21-81	6-21-82
2	DIGITAL M.M.	KEITHLEY	179	N/A	0545	multi.	Mfg. Spec.	1-21-82	7-21-82
WYLE 307									

WYLE 30

Instrument Test Engineer

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TABLE IV

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 3-17-82

Job No. 45689-03

Test Area LOCA

Technician Robert ColemAN

Customer Duke

Type Test PRe-LOCA FUNCTIONAL

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	MEGOHmmeter	G/R	1864	N/A	11898	MULTI	MFG	12-21-81	6-21-82
2	DMM	KeitHLey	130	N/A	94977	MULTI	MFG	2-16-82	2-16-83
WYLE B07									

Instrument Test Engineer DMHooper

WYLE B07

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TABLE V

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 3-18-82

Job No. 45869-03

Test Area LOCA

Technician R. Coleman

Customer Duke

Type Test PRE-LOCA FUNCTIONAL

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Hi POT	ASS. Research	4030	N/A	96776	MULTI	MFG	1-27-82	4-27-82
WYLE 307									

Instrument Test Engineer

WYLE 307

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TABLE VI

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 3-19-82 Job No. 45869 Test Area LOCA

Technician LARRY SMITH Customer Duke Power Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	D.P.	Rosemount	NA	NA	546	0-150"H_2O	MFG	2-23-82	8-23-82
2	P.T.	STATHAM	NA	180	856	0-50PSI	±.25%	3-1-82	9-1-82
3	Power supply	Kepco	sm160-2	NA	97872	0-160VDC	±.1%	3-15-82	9-15-82
4	DATA Logger	Fluke	2240C	NA	202	multic	MFG	3-3-82	9-3-82
5	High speed Printer	T.I	810	NA	11777	MFG	MFG	9-10-81	9-10-82
6	materials Testing Gen	EXACT	340	NA	0542	multic	±.01%	11-19-81	5-19-82
7	T/C Linearizer	AGM	EA4002	NA	680	0-1000°F	±.1%	12-16-81	6-16-82
8	T/C Linearizer	AGM	EA4002	NA	681	0-1000°F	±.1%	12-16-81	6-16-82
9	T/C Linearizer	AGM	EA4002	NA	683	0-1000°F	±.1%	12-16-81	6-16-82
10	Power Supply	SPS	NA	NA	678	28VDC	±.1%	12-16-81	6-16-82
11	DMM	Keithly	NA	NA	100056	multic	MFG	12-16-81	12-16-82
12	Digital Thermometer	analog Devices	NA	NA	11520	0-1000°F	±2°F	11-30-81	5-30-82
13	P.H. Analyzer	Great Lakes inst	NA	NA	673	0-14PH	±.03PH	3-19-82	9-19-82
14	DATA Logger	Fluke	2240C	NA	343	multic	MFG	10-15-81	4-15-82
15	High speed Printer	TI	810	NA	3009	MFG	MFG	3-22-82	9-22-82
16	DMM	DATA Precision	NA	NA	92706	MFG	MFG	4-21-81	4-21-82
WYLE 307									

Instrument Test Engineer Wade Casey

WYLE 307

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TABLE VII

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 3-24-82 Job No. 45869-03 Test Area LOCA

Technician R. McClellan Customer DUKE Type Test FUNCTIONAL A+ T=0

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	AC HYPOT	ASSOCIATED RESEARCH	4030	N/A	96276	MULTI	MFG	1-27-82	4-27-82
2	MEGOHMMETER	GENERAL RADIO	1864	N/A	11894	0.5MΩ- 500000MΩ	MFG	12-21-82	6-21-82

WYLE 307

Instrument Test Engineer D M Hooper

WYLE 307

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TABLE VIII

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 3-24-82 Job No. 45869 Test Area LOCA

Technician R. McClellan Customer DUKE Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	AC HYPOT	ASSOCIATED RESEARCH	4030	N/A	96776	MULTI	MFG	1-27-82	4-27-82
2	SHUNT	WESTON	N/A	N/A	3089	1A/100mV	± .5%	1-19-82	7-19-82
3	SHUNT	WESTON	N/A	N/A	3228	10A/100mV 5A/50mV	± .5%	12-10-81	6-10-82
4	SHUNT	WESTON	N/A	N/A	3223	10A/100mV 5A/50mV	± .5%	12-9-81	6-9-82
5	SHUNT	WESTON	N/A	N/A	3226	10A/100mV 5A/50mV	± .5%	12-10-81	6-10-82
6	SHUNT	WESTON	N/A	N/A	3215	10A/100mV 5A/50mV	± .5%	12-9-81	12-82 ~~6-9-82~~ RTN.
7	SHUNT	WESTON	N/A	N/A	3224	10A/100mV 5A/50mV	± .5%	12-10-81	6-10-82
8	METER CURRENT	WESTON	433	N/A	96165	0-5A 0-10A	± .75%	2-22-82	5-22-82
9	TRANSFORMER CURRENT	WESTON	327	N/A	11740	1200A	± 1%	3-19-82	9-19-82
10	TRANSFORMER CURRENT	WESTON	461	N/A	97428	1000A	± .35%	11-23-81	5-23-82
11	TRANSFORMER CURRENT	BROWNELL	N/A	N/A	100020	100A	± 10%	3-2-82	9-2-82
12	TRANSFORMER CURRENT	BROWNELL	N/A	N/A	100021	100A	± 10%	3-2-82	9-2-82
13	TRANSFORMER CURRENT	BROWNELL	N/A	N/A	100022	100A	± 10%	3-2-82	9-2-82
14	TRANSFORMER CURRENT	BROWNELL	N/A	N/A	100024	100A	± 10%	3-2-82	9-2-82
15	TRANSFORMER CURRENT	BROWNELL	N/A	N/A	100025	100A	± 10%	3-2-82	9-2-82
16	CURRENT PROBE	FLUKE ~~BROWNELL~~	801-600	N/A	92675	2-600A	± 2%	1-22-82	7-22-82
17	MULTI METER	FLUKE	8012A	N/A	11703	MULTI	MFG	3-8-82	6-8-82
18	MULTI METER	KEITHLEY	130	N/A	94977	MULTI	MFG	2-16-82	2-16-83

Instrument Test Engineer

WYLE 307

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TABLE IX

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 4-30-82

Job No. 45869-07

Test Area LOCA

Technician R McClellan

Customer DUKE

Type Test POST SPLICE CHECK-OUT

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	AC HYPOT	ASC. RESEARCH	4030A	N/A	100165	0-4KVA	+2% DC -3% AC	3-5-82	9-5-82
2	MEGOHMMETER	GENERAL RADIO	1862-C	N/A	97892	$0.5M\Omega$- $5\times10^{6}M\Omega$	±3%	11-14-81	5-14-82

WYLE 307

Instrument Test Engineer DM Hooper

WYLE 307

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TABLE X

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 5-3-82
Job No. 45869-07
Test Area Elect. Lab.
Technician Perdue / McClellan
Customer Duke
Type Test Transformer Linearity Check

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Digital Multimeter	Keithley	179	N/A	0545	MULTI	MFG. Spec.	1-21-82	7-21-82
2	Digital Multimeter	Hewlett Packard	3465A	N/A	11184	MULTI	MFG. Spec.	12-14-81	6-14-82
3	Shunt	Weston	PR0005A	N/A	100514	5 Amp. 100 mV.	± .5%	4-28-82	10-28-82
4	Current Transformer	Weston	461	N/A	97427	5-25 Amp	± .35%	11-23-81	5-23-82
5	Current Transformer	Weston	461	N/A	3022	5-25 Amp	± 1%	12-1-81	6-1-82
6	Shunt	Weston	PR0005A	N/A	100515	5 Amp. 100 mV.	± .5%	4-28-82	10-28-82
7	Current Transformer	Weston	461	N/A	3023	5-25 Amp.	± .1%	12-1-81	6-1-82
8	Shunt	Weston	0042211	N/A	3207	10 Amp. 100 mV.	± .5%	12-10-81	6-10-82
WYLE 307									

Instrument Test Engineer K Burkhart

WYLE 307

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WH-1029

TABLE XI

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 5-7-82 Job No. 45869-06 Test Area LOCA

Technician McClellan/Pardue Customer Duke Power Type Test BASELINE/PRE-LOCA FUNCTIONAL

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	Megohmmeter	General Radio	1862	N/A	97892	0.5MΩ - 5.0×10^{5}MΩ	±3%	11-14-81	5-14-82
2	AC HIPOT	Associated Research	4030	416	96776	0-5000μA	MFG	4-30-82	7-30-82

WYLE 307

Instrument Test Engineer DMHooper WYLE 307 Checked & Received By

WH-1029

TABLE XII (Continued)

INSTRUMENTATION EQUIPMENT SHEET

Page 2 of 2

Date 5-10-82 Job No. 45869-06 Test Area LOCA

Technician McClellan Customer DUKE Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
19	MULTIMETER	KEITHLEY	179	N/A	92338	MULTI	±.04%	8-10-81	8-10-82
20	MULTIMETER	H-P	3465A	N/A	96293	MULTI	MFG	3-8-82	9-8-82
21	AC CURRENT CLAMP-ON	FLUKE	80i-600	N/A	3106	2-600A	MFG	1-14-82	7-14-82

WYLE 307

Page No. xx
Report No. 45869-1

Instrument Test Engineer Don Hooper WYLE 307 Checked & Received By

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TABLE XIII

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 5-10-82 Job No. 45869-06 Test Area LOCA

Technician McClellan/PERONE Customer DUKE Type Test LOCA TEST FUNCTIONALS

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration On	Calibration Due
1	Megohmmeter	General Radio	1862	N/A	97892	0.5MΩ - 5.0×10^5MΩ	±3%	11-14-81	5-14-82
2	AC HIPOT	Associated Research	4020	416	96776	0-5 kV	MFG	4-30-82	7-30-82

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Instrument Test Engineer DM Hooper WYLE 307 Checked & Received By H Smith

WH-1029

TABLE XIV

INSTRUMENTATION EQUIPMENT SHEET

Page 1 of 1

Date 5-13-82 Job No. 45869-06 Test Area LOCA

Technician Perdue/McClellan Customer Duke Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	Meghommeter	Gen. Radio	1862-C	2374	97892	MULTI	± 3%	5-12-82	11-12-82

WYLE 307

Instrument Test Engineer D M Hooper WYLE 307 Checked & Received By H Smith

WH-1029

TABLE XV

INSTRUMENTATION EQUIPMENT SHEET

Date 5/10/82 Job No. 45869-06 Test Area LOCA

Technician M. Edwards & S. Totherow Customer Duke Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	Controller	R/I	61011	N/A	94521	-125° +375°F	±.5%	5/7/82	11/7/82
2	Redundant	Thermotron	606723	N/A	3556	-125° +375°F	±2%	12/11/81	6/11/82
3	Pressure Gauge	USG	N/A	N/A	3188	30 in Hg. to 60 psig	±1%	5/6/82	8/6/82
4	Pressure Transducer	Statham	PA-418-503	N/A	0856	0 to 50 psia	±.25%	3/1/82	9/1/82
5	PH Analyzer	GLI	N/A	N/A	0673	0 to 14 Ph	±.03 Ph sb.	3/19/82	9/19/82
6	Data Logger	Fluke	2240B	N/A	0831	Multi	MFG.	2/12/82	8/12/82
7	Data Logger	Fluke	2240C	N/A	202	Multi	MFG.	3/3/82	9/3/82
8	Line Printer	TI	810RO	N/A	11777	Multi	MFG.	9/10/81	9/10/82
9	DC Power Supply	EM	N/A	N/A	80911	0 to 100 VDC	±1%	3/3/82	9/3/82
WYLE 307									

Instrument Test Engineer Wade Casey WYLE 307 Checked & Received By H Smith

WH-1029

TABLE XVI

INSTRUMENTATION EQUIPMENT SHEET

Date 5/10/82
Job No. 45869-06
Test Area LOCA
Technician M. Edwards & S. Tothmow
Customer Duke
Type Test LOCA

No.	Instrument	Manufacturer	Model No.	Serial No.	Wyle or Gov't No.	Range	Accuracy	Calibration	
								On	Due
1	Controller	R/I	61011	N/A	94521	-125° to 375°F	±.5%	5/7/82	11/7/82
2	Redundant	Thermotron	106723	N/A	3556	-125° to 375°F	±2%	12/11/81	6/11/82
3	Pressure Gauge	USG	N/A	N/A	3188	30 in Hg. to 60 psig	±1%	5/6/82	8/6/82
4	Pressure Transducer	Statham	PA 418-523	N/A	0856	0 to 50 psia	±.25%	3/1/82	9/1/82
5	PH Analyzer	GLI	N/A	N/A	0673	0 to 14 Ph	±.03 Phsb.	3/19/82	9/19/82
6	Data Logger	Fluke	2240B	N/A	0831	Multi	MFG.	2/12/82	8/12/82
7	Data Logger	Fluke	2240C	N/A	202	Multi	MFG.	3/3/82	9/3/82
8	Line Printer	TI	810RO	N/A	11777	Multi	MFG.	9/10/81	9/10/82
9	DC Power Supply	E M	N/A	N/A	80911	0 to 100 VDC	±1%	3/3/82	9/3/82
10	Diff. Transmitter	Rosemount	N/A	N/A	0546	0 to 150" H₂O	MFG	2/23/82	8/23/82

WYLE 307

Instrument Test Engineer Wade Creasy

WYLE 307

Checked & Received By H Smith

WH-1029

SECTION I

THERMAL AGING TEST

1.0 PROCEDURES

The penetration unit, cables, plug kits, and face seals were thermally aged in ovens as shown in Table I-1 (Appendix I-I). The plug kits were disassembled and placed loose in the oven. All other components were placed in the oven intact. See Photographs I-1 and I-2 (Appendix I-II). The activation energies were determined by Corporate Consulting and Development Company, Ltd., as shown in their report in Appendix I-III.

2.0 RESULTS

All components were visually inspected following completion of the thermal aging test, and there was no obvious visible damage. There was one anomaly that occurred during the thermal aging test. One of the ovens experienced a linear temperature increase over a 43-minute interval from the specification temperature of 302°F to a maximum of 320°F. This oven contained the penetration unit, plug kits, and cables 3X10G2, 8X16G.6, and 12X12G1. See Notice of Anomaly No. 1 (Appendix I-IV).

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APPENDIX I-I

TABLE

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TABLE I-1

THERMAL AGING CRITERIA

COMPONENT	QUANTITY	THERMAL AGING TEMPERATURE, °F/Time, Hrs.
Plug Kits		
(1) C32P1002G07	2 ea.	150°C/504 hours
(2) C32P1002G08	2	150°C/504 hours
(3) C32P1003G25	2	150°C/504 hours
(4) C32P1003G26	2	150°C/504 hours
(5) C32P1015G01	2	150°C/504 hours
(6) C32P1015G02	2	150°C/504 hours
(7) C32P1004G07	2	150°C/504 hours
(8) C32P1004G08	2	150°C/504 hours
(9) C32P1009G01	2	150°C/504 hours
(10) C32P1009G06	2	150°C/504 hours
(11) C32P1010G01	2	150°C/504 hours
(12) C32P1010G02	2	150°C/504 hours
Cable		
1 3X2G2 (Ana)	50 ft.	121°C/168 hours
2 SP140X (Oko)	60	121°C/168 hours
3 12XJ12G1 (SM)	50	121°C/168 hours
4 3X10G2 (Ana)	50	150°C/504 hours
5 8X10G.6 (BR)	100	150°C/168 hours
6 12X12G1 (Oko)	50	150°C/504 hours
Penetration	1	150°C/504 hours
Face Seals		
(1) C32C2060P03	3	150°C/504 hours
(2) C32C2060P04	3	150°C/504 hours
(3) C32C2060P05	3	150°C/504 hours
(4) C32C2060P06	3	150°C/504 hours
(5) C32C2060P07	3	150°C/504 hours
(6) C32C2060P08	3	150°C/504 hours
(7) C32C2060P09	3	150°C/504 hours
(8) C32C2060P10	3	150°C/504 hours
(9) C32C2060P19	3	150°C/504 hours
(10) C32C2060P20	3	150°C/504 hours
(11) C32C2060P17	3	150°C/504 hours
(12) C32C2060P18	3	150°C/504 hours

NOTES: All temperature/time valves above are for 40 year equivalent life.

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APPENDIX I-II

PHOTOGRAPHS

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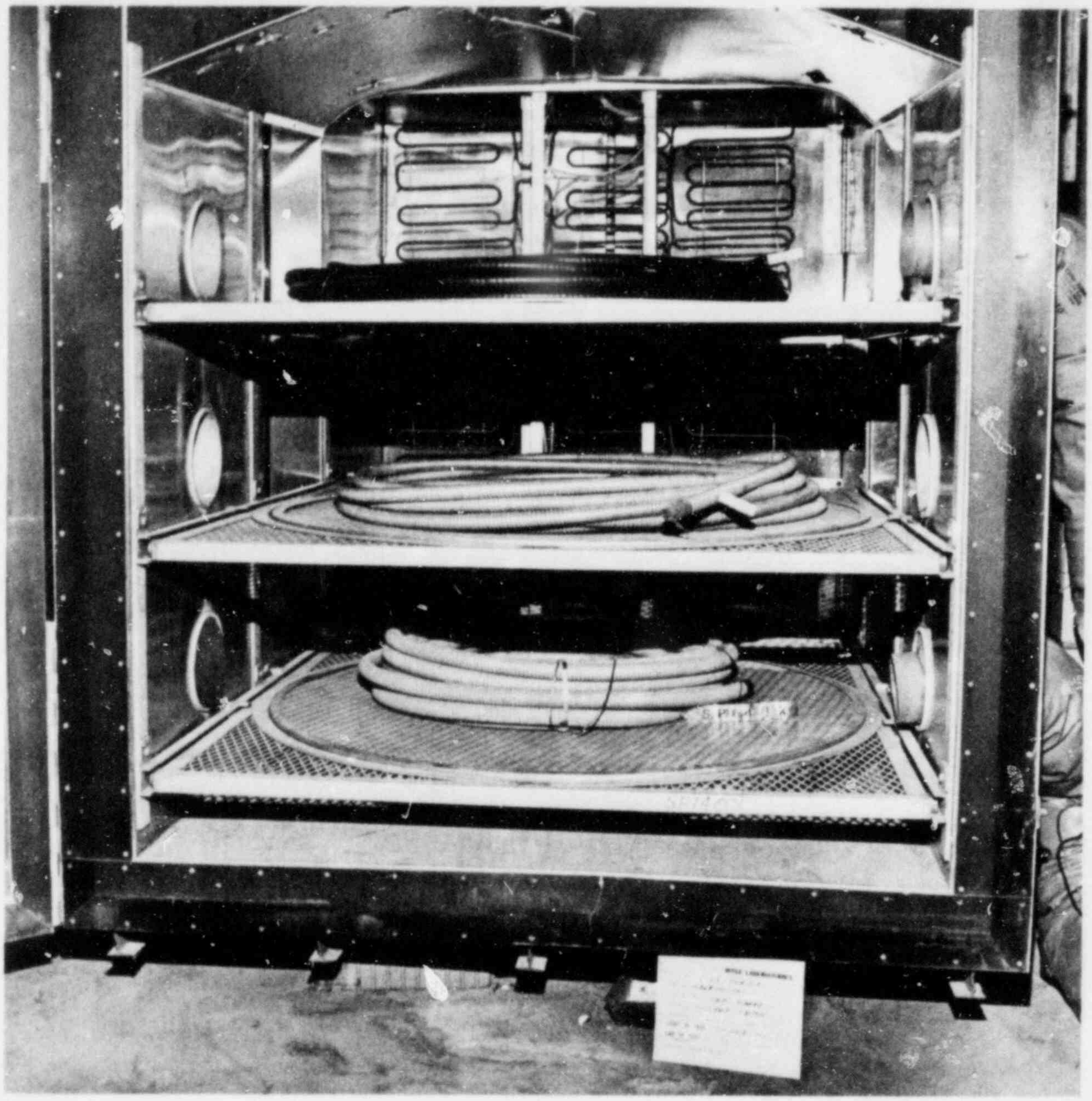
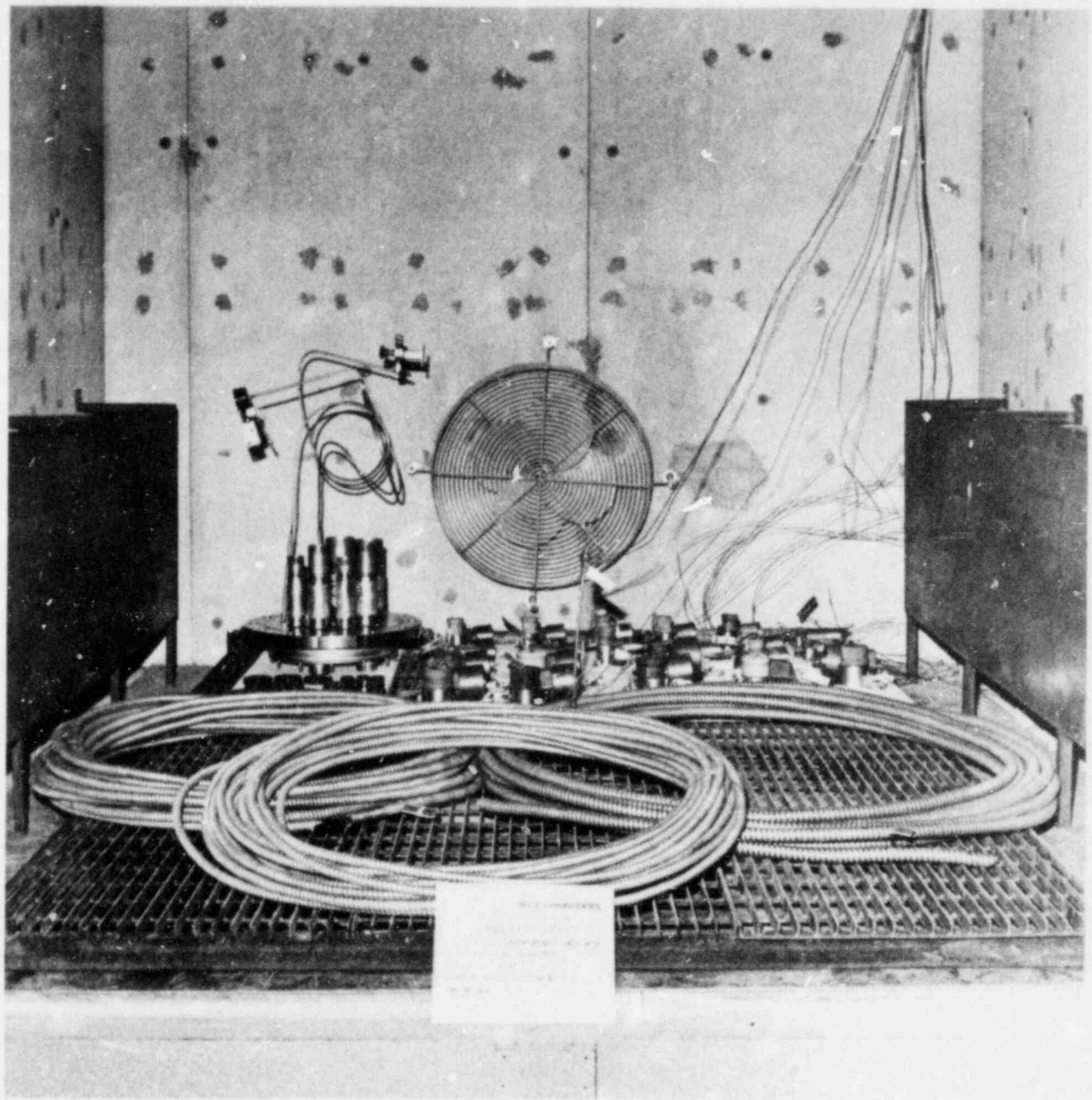


PHOTOGRAPH NO. I-1

CABLES IN THERMAL AGING OVEN



PHOTOGRAPH NO. I-2

CABLES AND PLUG KITS IN THERMAL AGING OVEN

APPENDIX I-III

MATERIAL ACTIVATION ENERGIES REPORT

BY

CORPORATE CONSULTING & DEVELOPMENT COMPANY, LTD.

August 20, 1981

Mr. C.J. Wylie
Chief Engineer
Duke Power Company
Electrical Division
P.O. Box 33189
Charlotte, NC 28242

ATTENTION: MR. P.M. McBRIDE
ENGINEERING SPECIALIST

SUBJECT: MATERIAL ACTIVATION ENERGIES
DYNAMIC THERMAL ANALYSIS
DUKE P.O. 8828.05-1 PMM
CCL PROJECT NUMBER 81-1601

Gentlemen:

This letter will document the work performed by Corporate Consulting and Development Company, Ltd. (CCL) on the subject project. The activation energies determined for the four materials analyzed are summarized as Attachment 1 to this letter. Copies of the Thermogravimetric Analysis data from which the activation energies were determined are also attached. Please note that all actual data is included. The calibration records of the DuPont 990 Thermal Analyzer are included as requested.

I trust that the enclosed information is self-explanatory. If you have any questions, please do not hesitate to call.

Very truly yours,

CORPORATE CONSULTING AND
DEVELOPMENT COMPANY, LTD.

Douglas D Greenwood

Douglas D. Greenwood, P.E.
Manager, Qualification Projects

DDG/ah/W

enclosure

cc: Mr. Ted Moleff (w/attach.)

CCL
Corporate Consulting & Development Company, Ltd.
Consultants Constructors
Koger Executive Center • 919-782-3441
P.O.Box 30096 • Raleigh N.C. 27622

ATTACHMENT 1

CCL SAMPLE NO.	DESCRIPTION	RUN NO. (HEATING RATE)	PEAK TEMPERATURE	ACTIVATION ENERGY
1601-001	Dow Corning Sylgard 170 RTV Grommet PN C32C2060P17	1450 (10°C/min)	362.5°C	3.61 ev
		1450-1 (5°C/min)	350°C	
		1455 (2°C/min)	345°C	
		1462 (1°C/min)	345°C	
1601-002	G10 Epoxy Glass Laminate Hard Insulator	1451 (10°C/min)	310°C	1.88 ev
		1451-1 (5°C/min)	300°C	
		1456 (2°C/min)	283.75°C	
		1463-2 (1°C/min)	280°C	
1601-003	Polysulfone Hard Insulator, PN C32C2128P01	1452 (10°C/min)	518.75°C	2.23 ev
		1452-1 (5°C/min)	503.75°C	
		1457 (2°C/min)	486.25°C	
		1464 (1°C/min)	468.75°C	
1601-004	Silicone Rubber O-Ring PN S604-70	1453 (10°C/min)	380°C	2.55 ev
		1453-1 (5°C/min)	366.25°C	
		1454 (2°C/min)	353.75°C	
		1461-1 (1°C/min)	352.75°C	

DATA SHEET

Corporate Consulting and Development Company, Ltd.

Customer DUKE POWER CO.

Specimen N/A

Part No. N/A

Spec. N/A

Para N/A

S/N N/A

GSI N/A

Amb. Temp. N/A

Photo N/A

Test Med. N/A

Specimen Temp. N/A

Job No. 1601

Report No.

Start Date 8-6-81

Test Title SEE BELOW

ATTENTION: DOUGLAS D. GREENWOOD

Subject: DUKE POWER DESIGN ENG P.O #8878.05-01 PMM
MATERIAL ACTIVIATION ENERGIES
THERMOGRAVIMETRIC ANALYSIS

INSTRUMENTATION and EQUIPMENT LIST

INSTRUMENTATION OR EQUIPMENT	CCL NO	CALIBRATION DUE DATE
THERMOGRAVIMETRIC ANALYZER (TGA)	5004	1-4-82
THERMAL ANALYZER RECORDER	5001	1-4-82

Specimen Failed

Specimen Passed /

NOD Written N/A

Tested By S.L. Griffin Date: 8-6-81

Witness Date: 8-6-81

Sheet No. 1 of 1

Approved 8/20/81

TF003

Du Pont Instruments

PART NO. 990527

RUN NO. M53 DATE 8-6 81

OPERATOR [illegible]

SAMPLE [illegible]

ATM [illegible]

FLOW RATE 50 ml/min

T-AXIS

PROG. RATE, °C/min 10

RANGE, °C/cm 25

HEAT ✓ COOL ISO

SHIFT, cm ±10

TIME, min/cm

DSC 200 µW/mV

DTA 50 mK/mV

RANGE, mV/cm

WEIGHT, mg

REFERENCE

MEASURED VARIABLE

TGA 50 µg/mV DTG 50 µg/(min mV)

SUPPRESSION, mg 8.08

RANGE, mV/cm 5

WEIGHT, mg 16.6

TIME CONST., sec 1

dY Lin @ Y=5

TMA 1 µm/mV DTM 0.1 µm/(min mV)

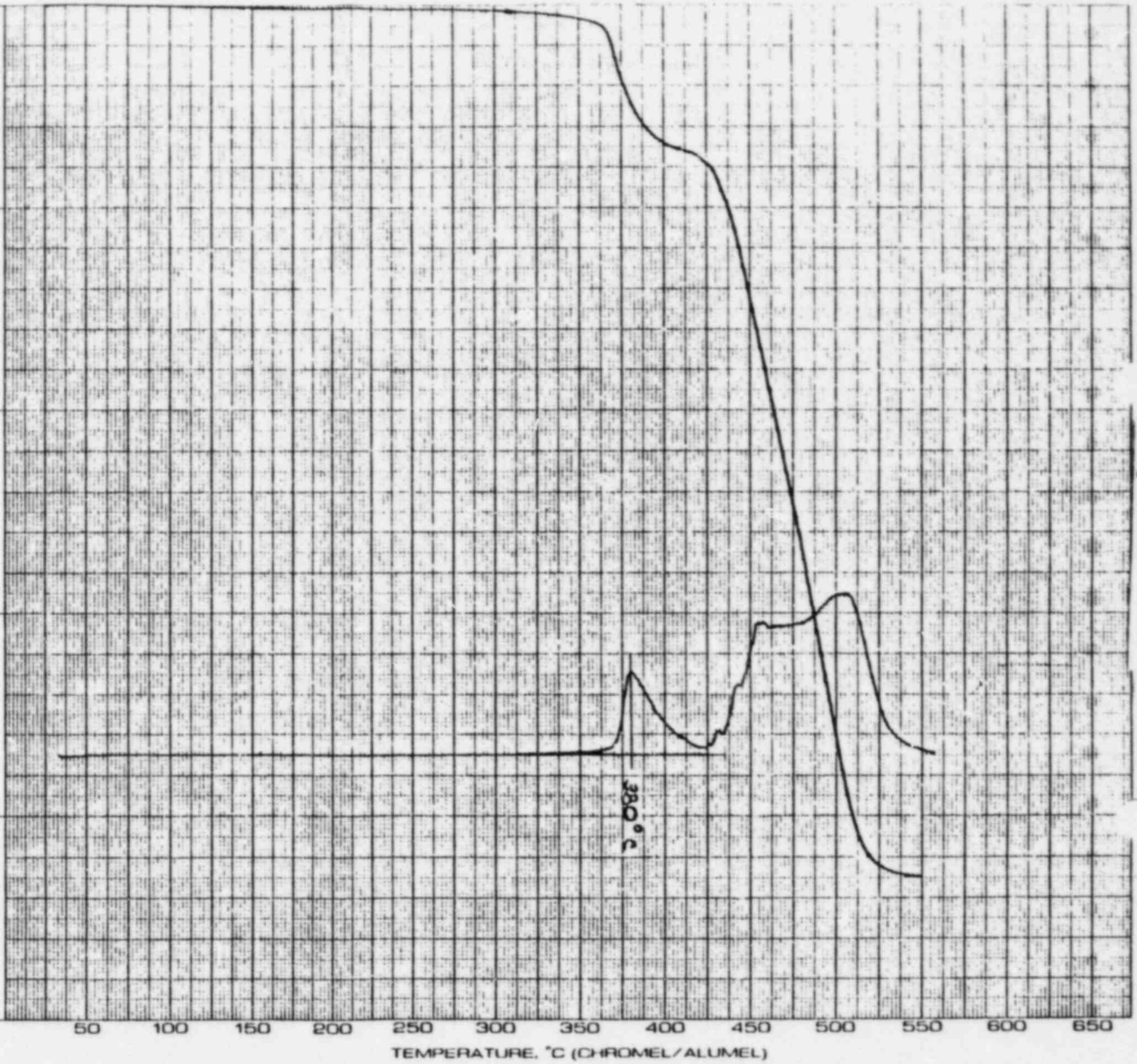
MODE

RANGE, mV/cm

SAMPLE SIZE

LOAD, g

dY



DuPont Instruments

PART NO. 990577

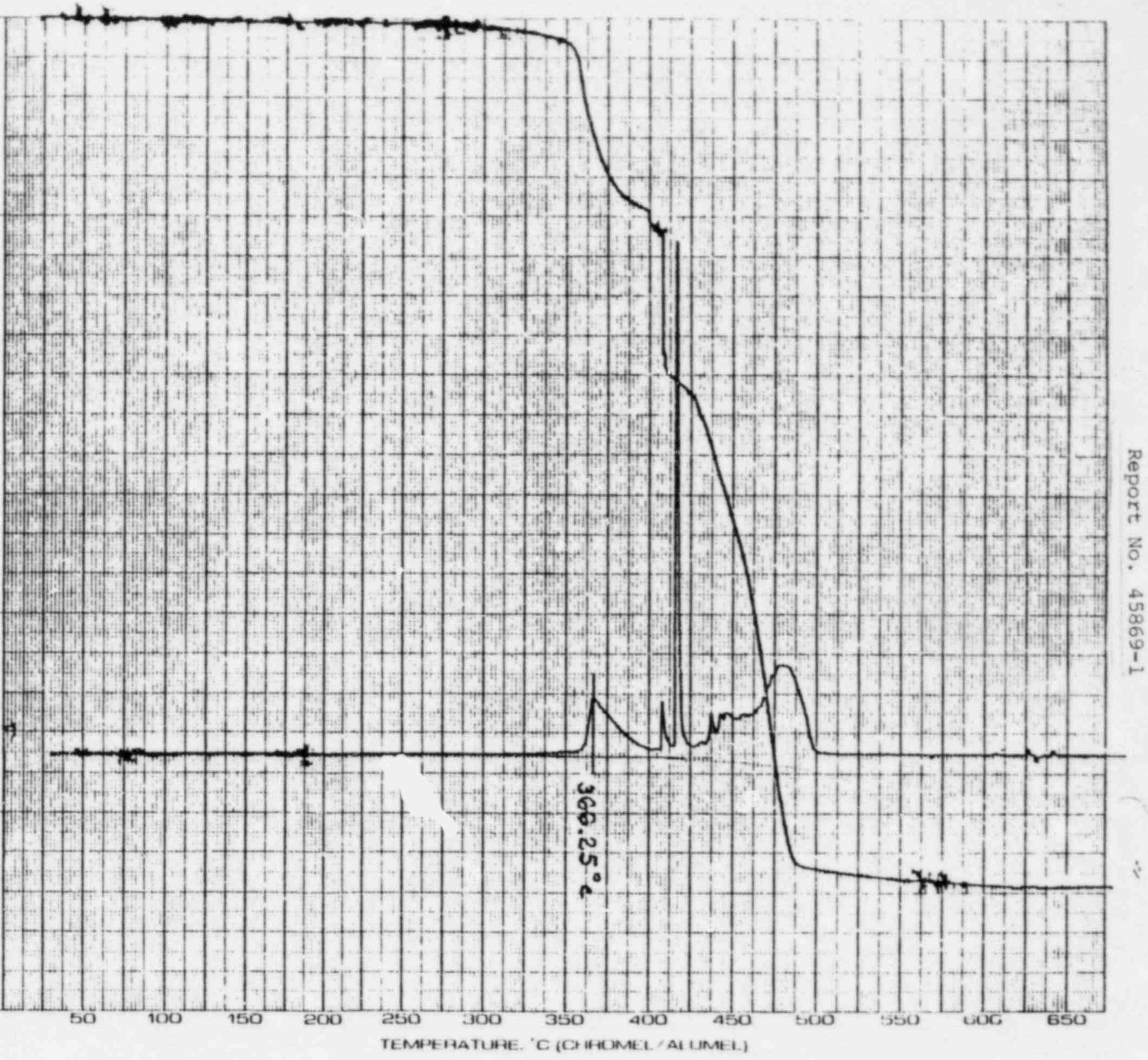
RUN NO. [illegible] DATE [illegible]
OPERATOR [illegible]
SAMPLE [illegible] ([illegible]) 1601-604
ATM [illegible]
FLOW RATE 50 ml/min

T-AXIS
PROG. RATE, °C/min 5
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm +10
TIME, min/cm

DSC 200 µW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 µg/mV DTG 50 µg/(min mV)
SUPPRESSION, mg 7.29
RANGE, mV/cm 5
WEIGHT, mg 14.58
TIME CONST., sec 1
dY [illegible]

TMA 1 µm/mV DTM 0.1 µm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY



DuPont Instruments

PART NO. 990527

RUN NO. [illegible] DATE 8 10 81
OPERATOR [illegible]
SAMPLE [illegible] (Silicone Rubber) 1601-004
ATM Air
FLOW RATE 50 ml/min

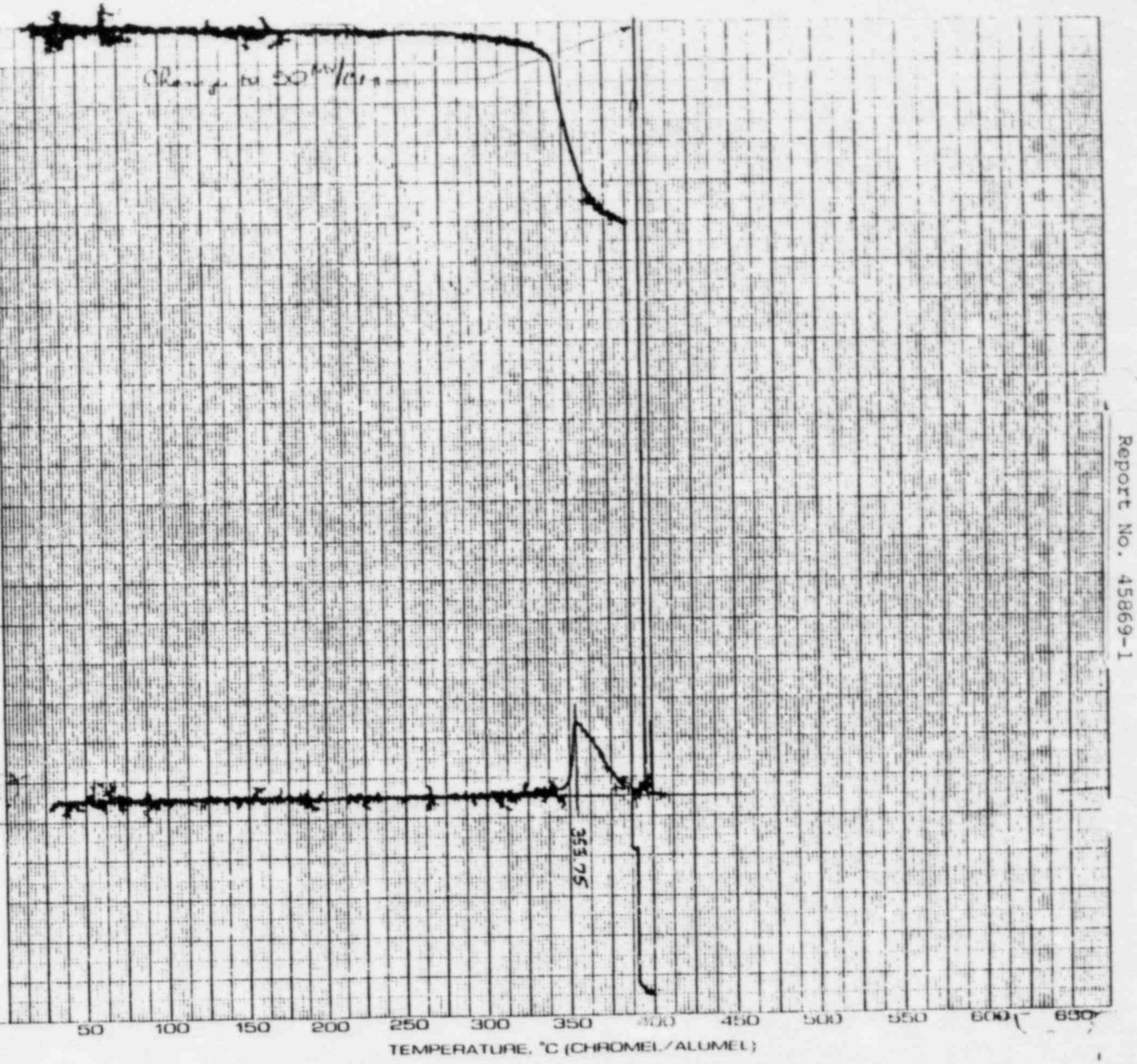
T-AXIS
PROG RATE, °C/min 2
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm ±10
TIME, min/cm

DSC 200 μW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)
SUPPRESSION, mg 7525
RANGE, mV/cm 2
WEIGHT, mg 19.25
TIME CONST., sec 1
dY Dr. [illegible] 2 mV/cm

TMA 1μm/mV DTM 0.1 μm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



DuPont Instruments

PART NO. 990527

RUN NO. 1461-1 DATE 8-14-8[illegible]

OPERATOR S.P. GRIFFIN

SAMPLE [illegible]

ATM O₂

FLOW RATE 50 ML/MIN

T-AXIS

PROG. RATE, °C/min 1

RANGE, °C/cm 25

HEAT ✓ COOL ISO

SHIFT, cm ±10

TIME, min/cm .25

DSC 200 μW/mV

DTA 50 mK/mV

RANGE, mV/cm

WEIGHT, mg

REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)

SUPPRESSION, mg 7.45

RANGE, mV/cm 5

WEIGHT, mg 14.90

TIME CONST., sec 1

dY [illegible] @ 4.2 MV/cm

TMA 1 μm/mV DTM 0.1 μm/(min mV)

MODE

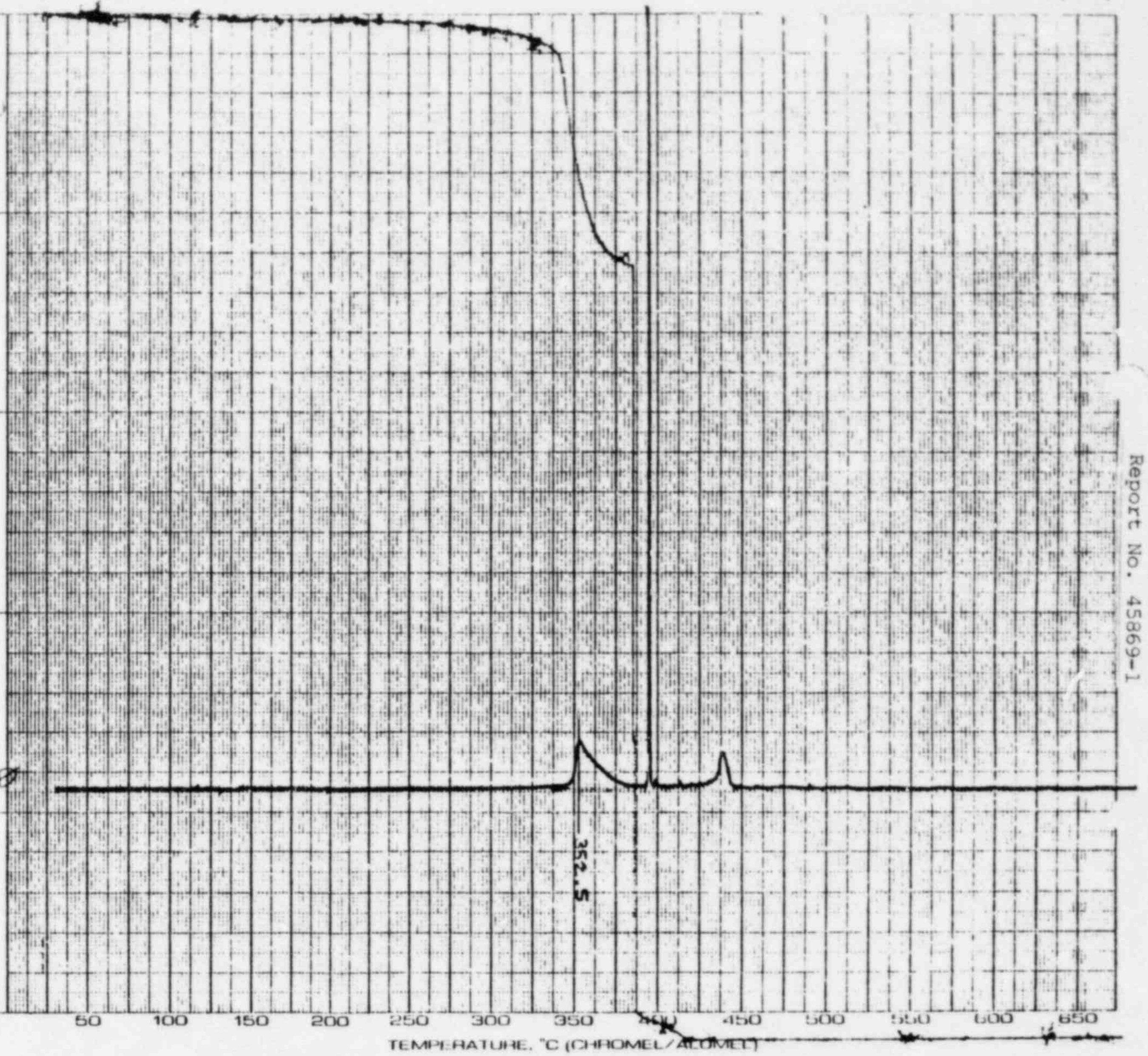
RANGE, mV/cm

SAMPLE SIZE

LOAD, g

dY

MEASURED VARIABLE



DuPont Instruments

PART NO. 990527

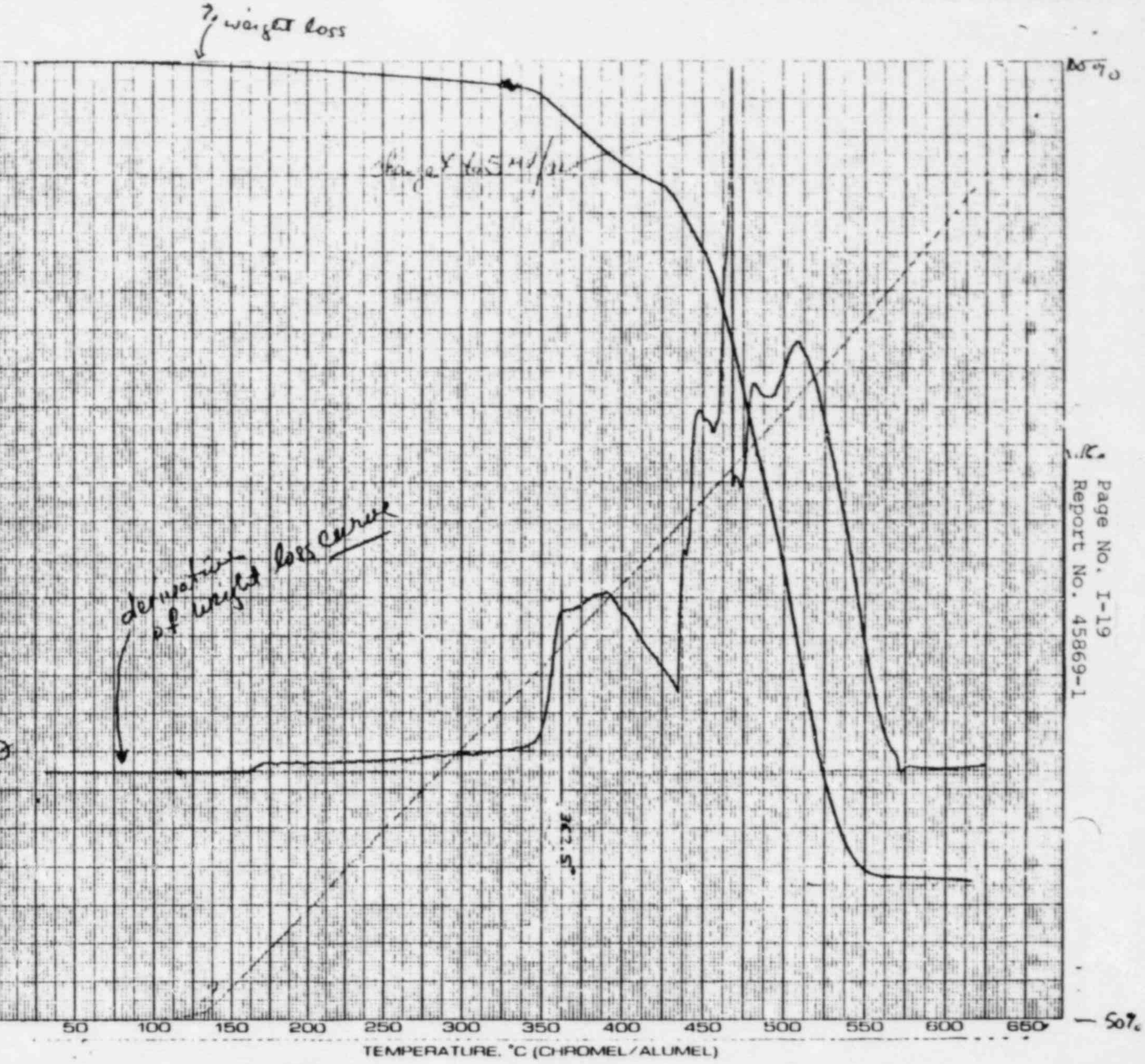
RUN NO [illegible] DATE [illegible]
OPERATOR [illegible]
SAMPLE [illegible]
ATM [illegible]
FLOW RATE [illegible]

T-AXIS
PROG. RATE, °C/min 10
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm +10
TIME, min/cm

DSC 200 µW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 µg/mV DTG 50 µg/(min mV)
SUPPRESSION, mg 83.98
RANGE, mV/cm 10
WEIGHT, mg 111.96
TIME CONST., sec 1
dY [illegible] mV/cm

TMA 1 µm/mV DTM 0.1 µm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY



d wt loss

DuPont Instruments

PART NO. 990527

RUN NO. [illegible] DATE [illegible]
OPERATOR [illegible]
SAMPLE [illegible] (Dow [illegible])
ATM [illegible]
FLOW RATE [illegible]

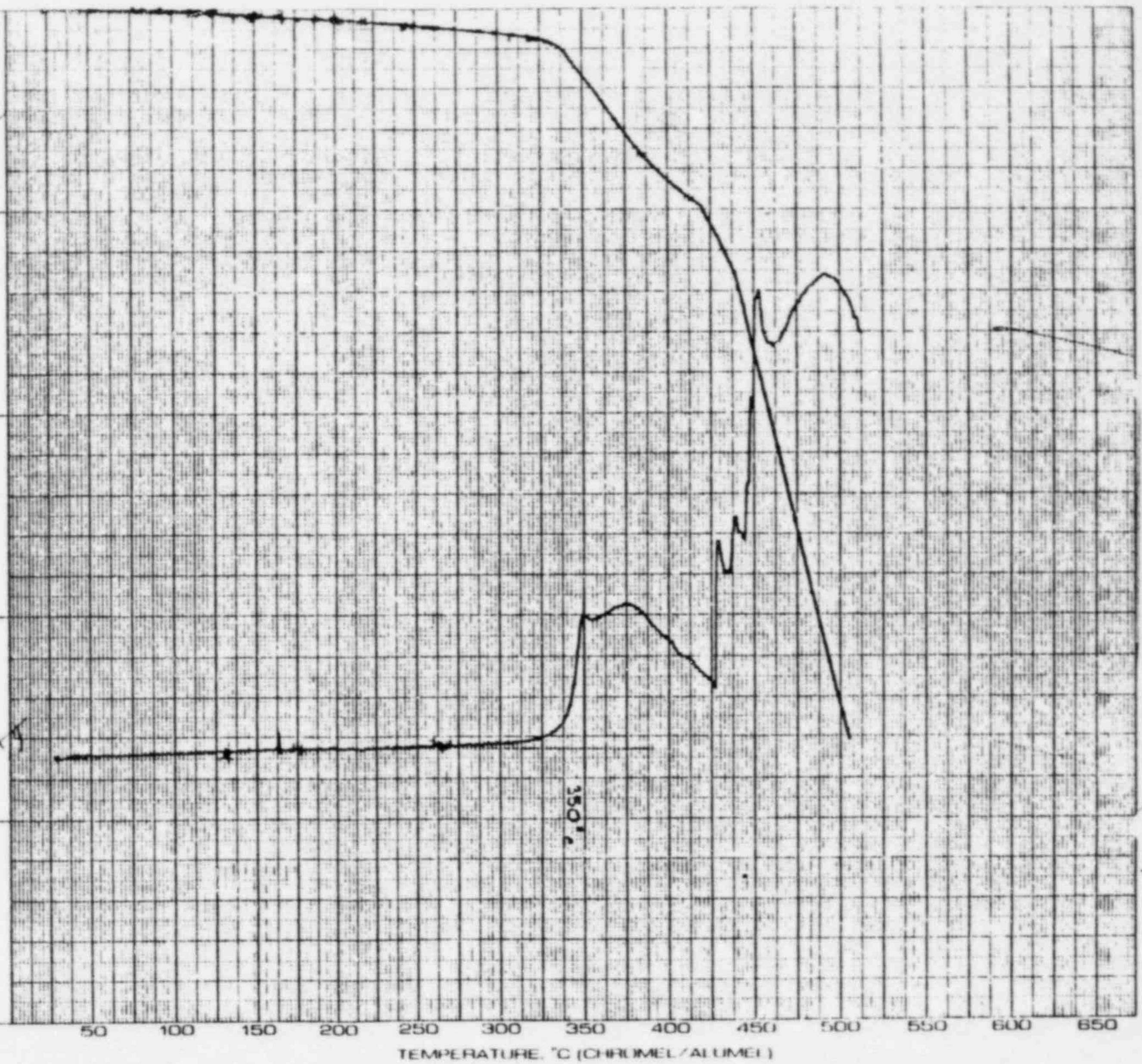
T-AXIS
PROG RATE, °C/min 5
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm ±10
TIME, min/cm

DSC 200 μW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)
SUPPRESSION, mg 25.5
RANGE, mV/cm 10
WEIGHT, mg [illegible]
TIME CONST., sec 1
dY [illegible]

TMA 1 μm/mV DTM 0.1 μm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



Du Pont Instruments

PART NO. 990527

RUN NO. [illegible] DATE 3-11-81
OPERATOR [illegible]
SAMPLE [illegible]
ATM [illegible]
FLOW RATE [illegible]

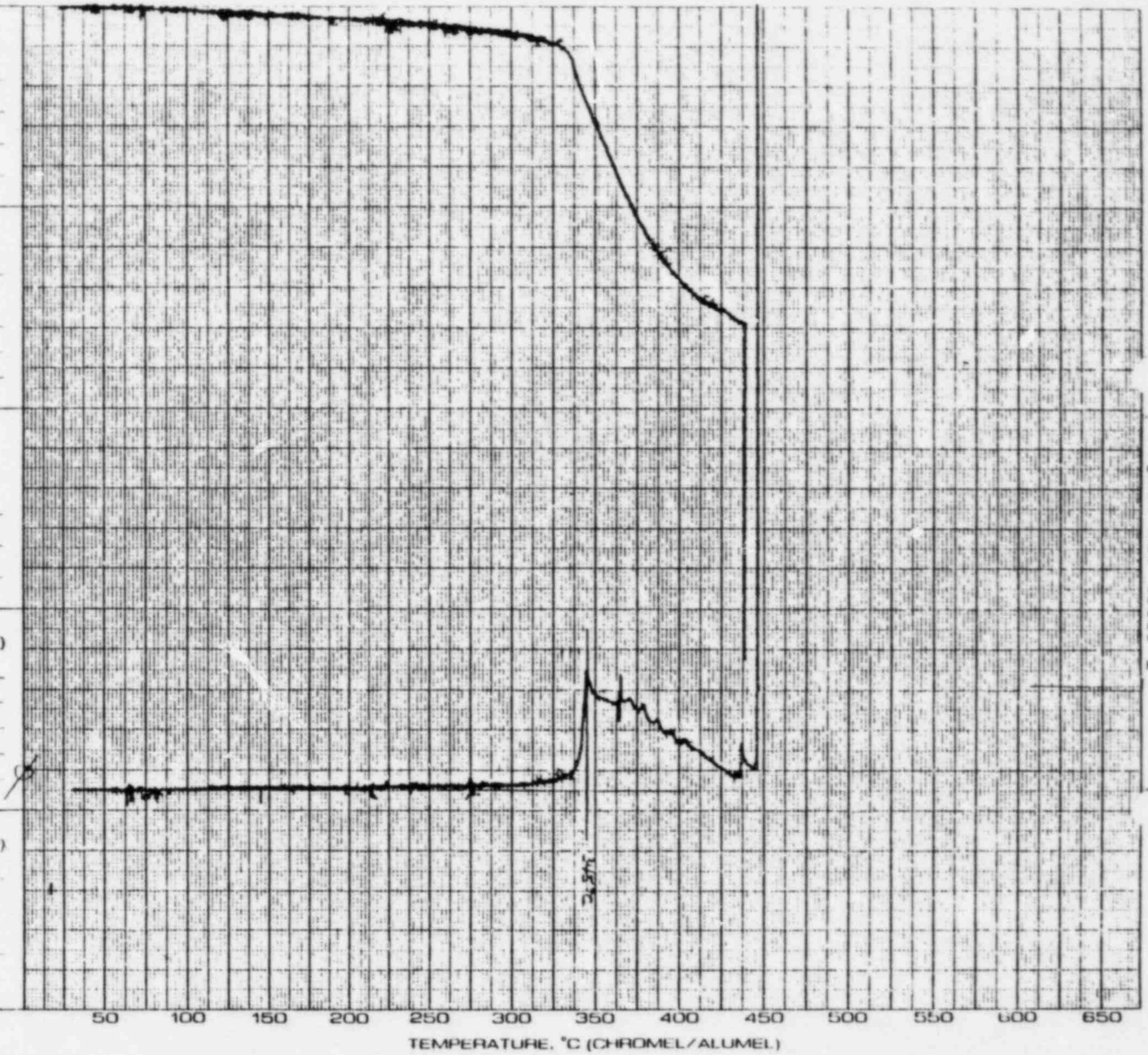
T-AXIS
PROG. RATE, °C/min 2
RANGE, °C/cm 25
HEAT COOL 150
SHIFT, cm +10
TIME, min/cm

DSC 200 μW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)
SUPPRESSION, mg 22.08
RANGE, mV/cm 10
WEIGHT, mg 44.17
TIME CONST., sec 1
dY [illegible]

TMA 1 μm/mV DTM 0.1 μm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



DuPont Instruments

PART NO. 990527

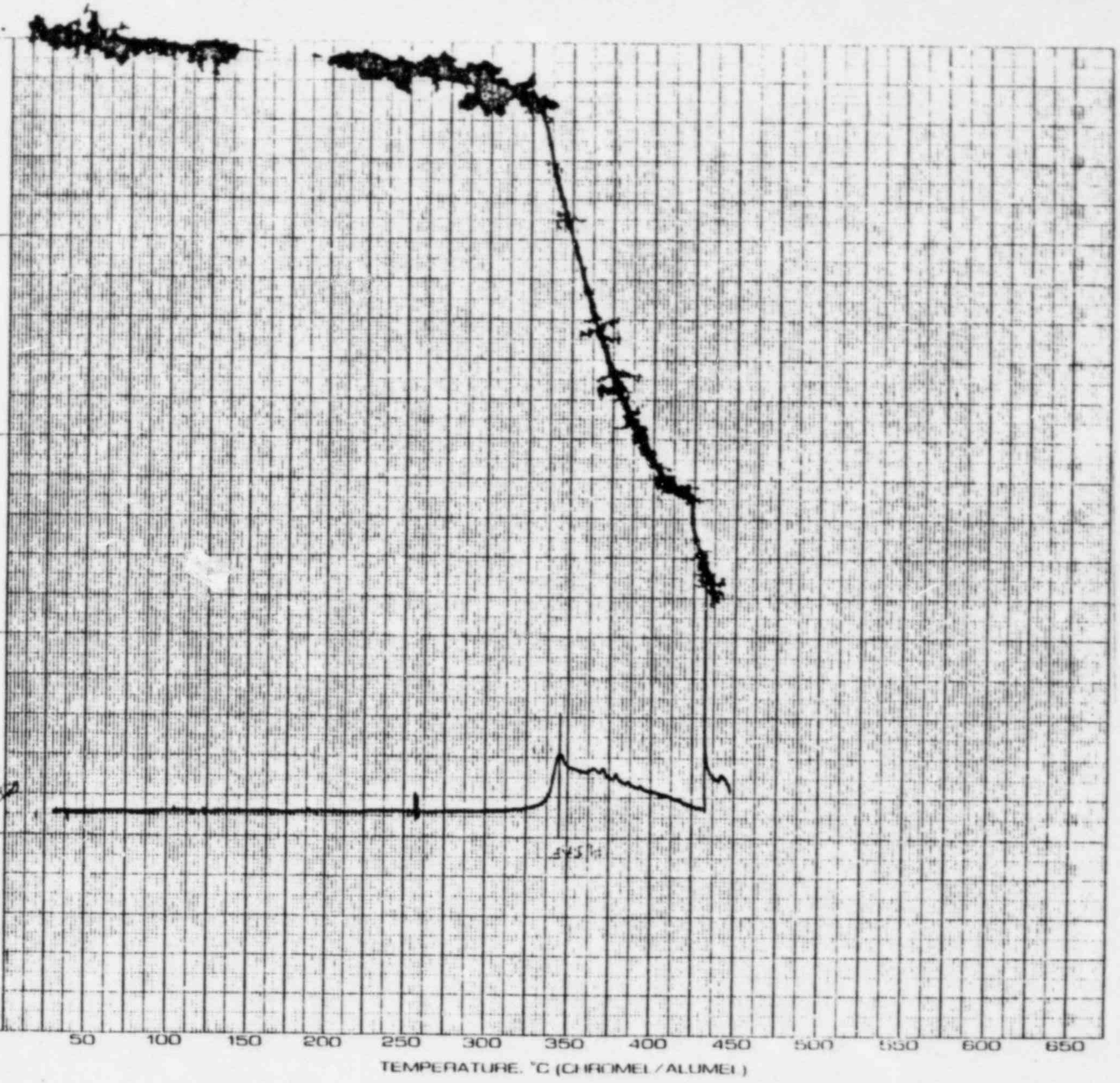
RUN NO. 1162 DATE 8-17-81
OPERATOR S. P. Griffin
SAMPLE GROWELL 1601-001
Dow [illegible]
ATM Air
FLOW RATE 50 ml/min

T-AXIS
PROG. RATE, °C/min 1
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm +10
TIME, min/cm .25

DSC 200 µW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 µg/mV DTG 50 µg/(min mV)
SUPPRESSION, mg 30.60
RANGE, mV/cm 10
WEIGHT, mg 41.20
TIME CONST., sec 1
dY ΔT @ 1.2

TMA 1 µm/mV DTM 0.1 µm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY



DuPont Instruments

PART NO. 990527

RUN NO [illegible] DATE [illegible]
OPERATOR [illegible]
SAMPLE [illegible]
ATM [illegible]
FLOW RATE [illegible]

T-AXIS

PROG. RATE, °C/min 10
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm ±10
TIME, min/cm

DSC 200 μW/mV
DTA 50 mK/mV

RANGE, mV/cm
WEIGHT, mg
REFERENCE

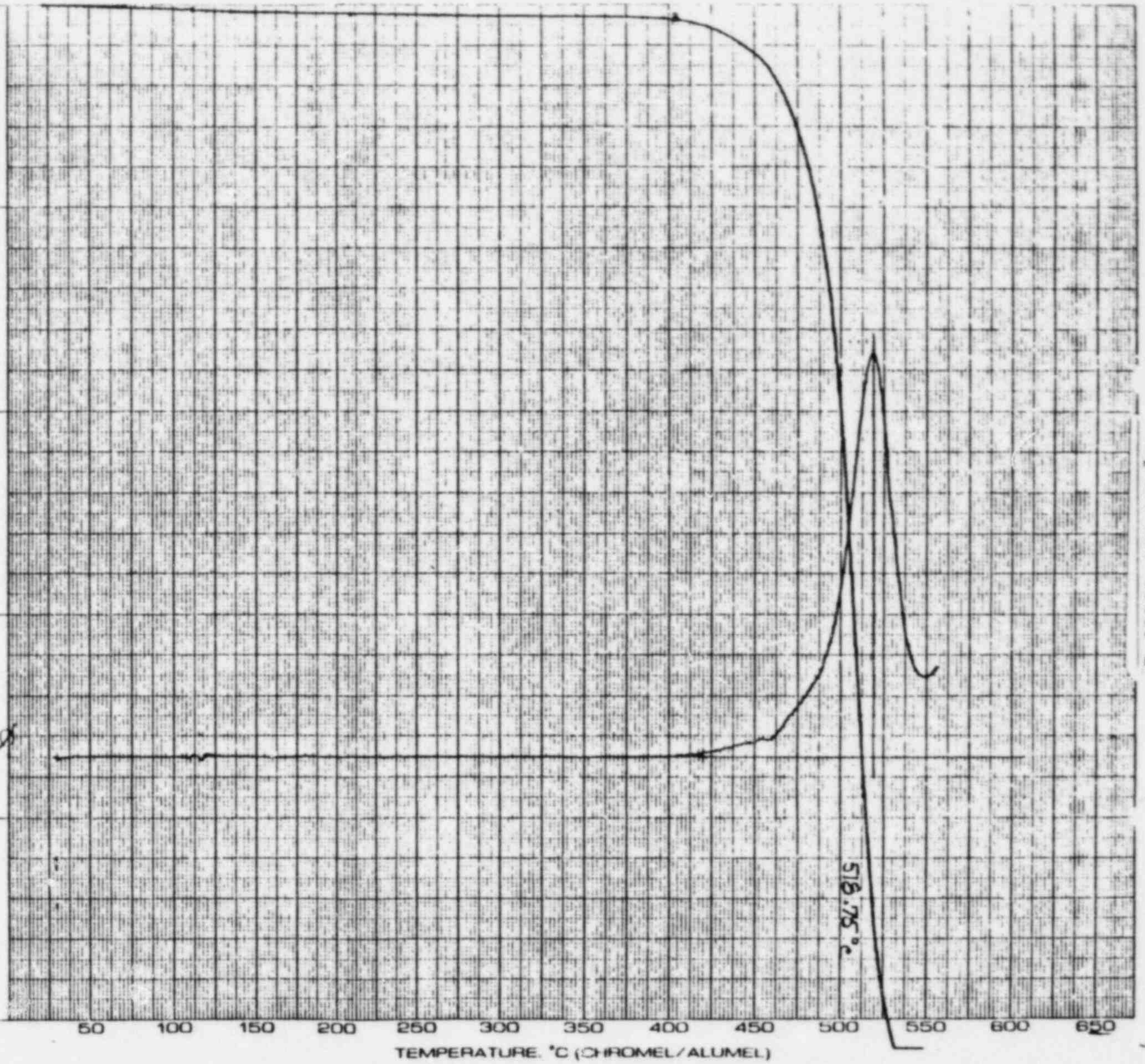
TGA 50 μg/mV DTG 50 μg/(min mV)

SUPPRESSION, mg 7.42
RANGE, mV/cm 5
WEIGHT, mg 14.84
TIME CONST., sec 1
dY [illegible]

TMA 1 μm/mV DTM 0.1 μm/(min mV)

MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



Du Pont Instruments

PART NO. 990527

RUN NO. [illegible] 1, DATE 8 4 81

OPERATOR [illegible]

SAMPLE [illegible] (POLYSULFIDE, #1601-004

ATM Air

FLOW RATE 50cc/min

T-AXIS

PROG. RATE, °C/min 5

RANGE, °C/cm 25

HEAT ✓ COOL ISO

SHIFT, cm +10

TIME, min/cm

DSC 200 µW/mV

DTA 50 mK/mV

RANGE, mV/cm

WEIGHT, mg

REFERENCE

TGA 50 µg/mV DTG 50 µg/(min mV)

SUPPRESSION, mg 8.65

RANGE, mV/cm

WEIGHT, mg 17.3

TIME CONST., sec 1

dY. [illegible] 2 mV/cm

TMA 1µm/mV DTM 0.1 µm/(min mV)

MODE

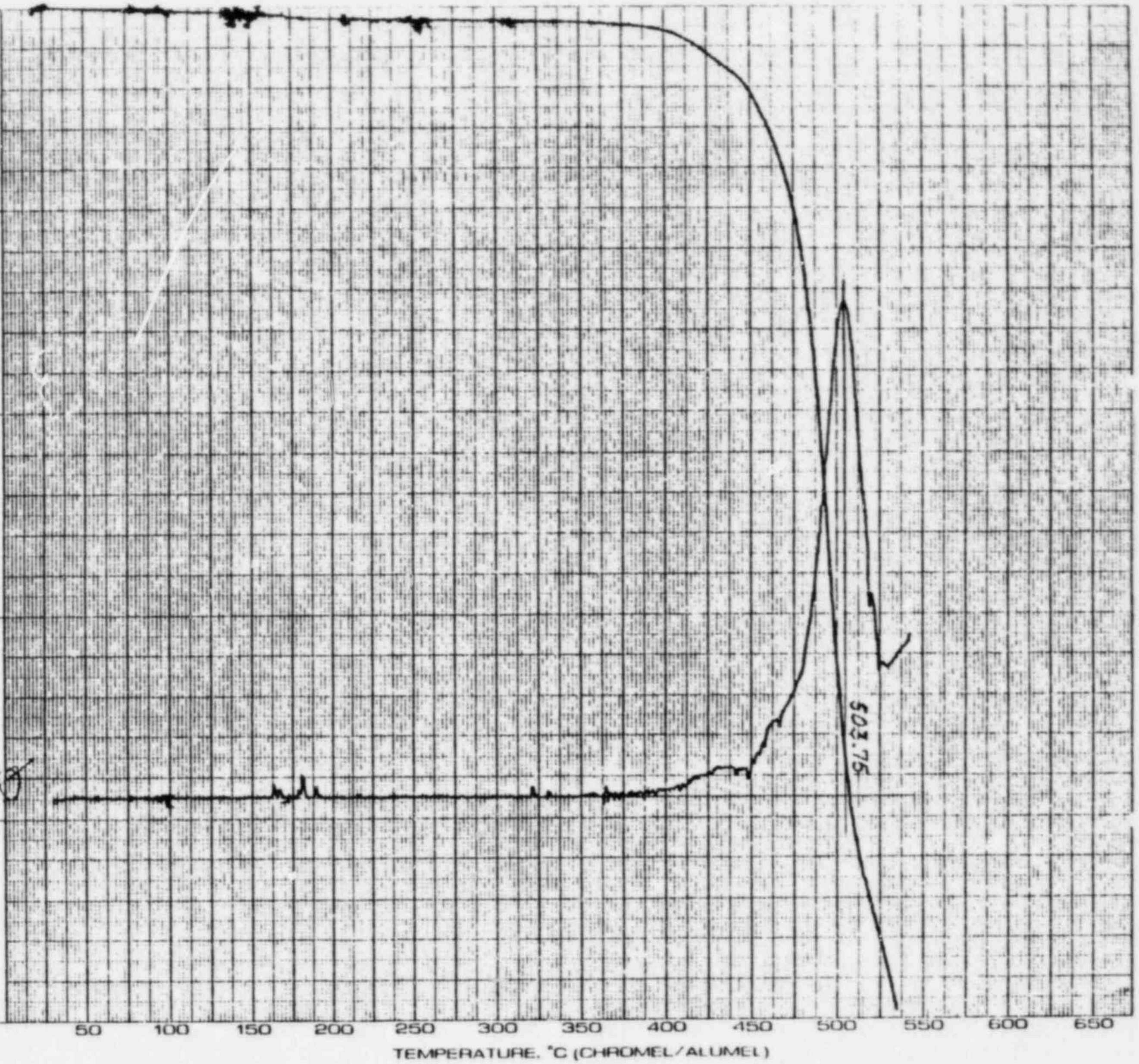
RANGE, mV/cm

SAMPLE SIZE

LOAD, g

dY

MEASURED VARIABLE



DuPont Instruments

PART NO. 990527

RUN NO. 1157 DATE [illegible]

OPERATOR [illegible]

SAMPLE [illegible]

ATM [illegible]

FLOW RATE [illegible] ml/min

T-AXIS

PROG. RATE, °C/min 2

RANGE, °C/cm 25

HEAT ✓ COOL ISO

SHIFT, cm ±10

TIME, min/cm

DSC 200 μW/mV

DTA 50 mK/mV

RANGE, mV/cm

WEIGHT, mg

REFERENCE

TGA 50 μg/mV **DTG** 50 μg/(min mV)

SUPPRESSION, mg 11.80

RANGE, mV/cm 5

WEIGHT, mg 2360

TIME CONST., sec 1

dY [illegible]

TMA 1 μm/mV **DTM** 0.1 μm/(min mV)

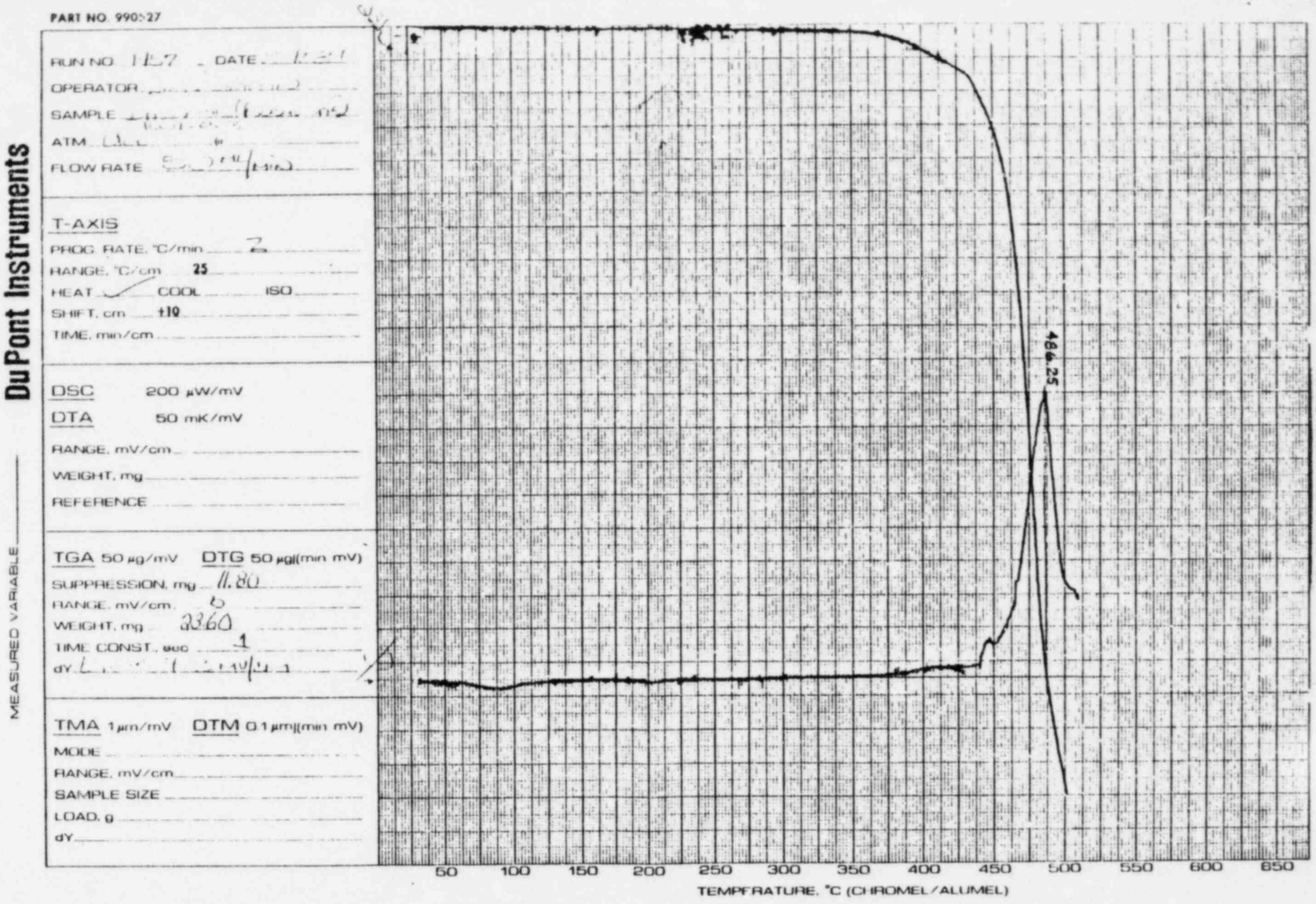
MODE

RANGE, mV/cm

SAMPLE SIZE

LOAD, g

dY



DuPont Instruments

PART NO. 990527

RUN NO 14-1 DATE 8 11 81

OPERATOR [illegible]

SAMPLE Insulation [illegible]
1601-001

ATM Air

FLOW RATE 50 ml/min

T-AXIS

PROG. RATE, °C/min 1

RANGE, °C/cm 25

HEAT ✓ COOL ISO

SHIFT, cm +10

TIME, min/cm

DSC 200 μW/mV

DTA 50 mK/mV

RANGE, mV/cm

WEIGHT, mg

REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)

SUPPRESSION, mg 24.225

RANGE, mV/cm 10

WEIGHT, mg 48.45

TIME CONST., sec 1

dY [illegible] = 2 mV/cm

TMA 1 μm/mV DTM 0.1 μm/(min mV)

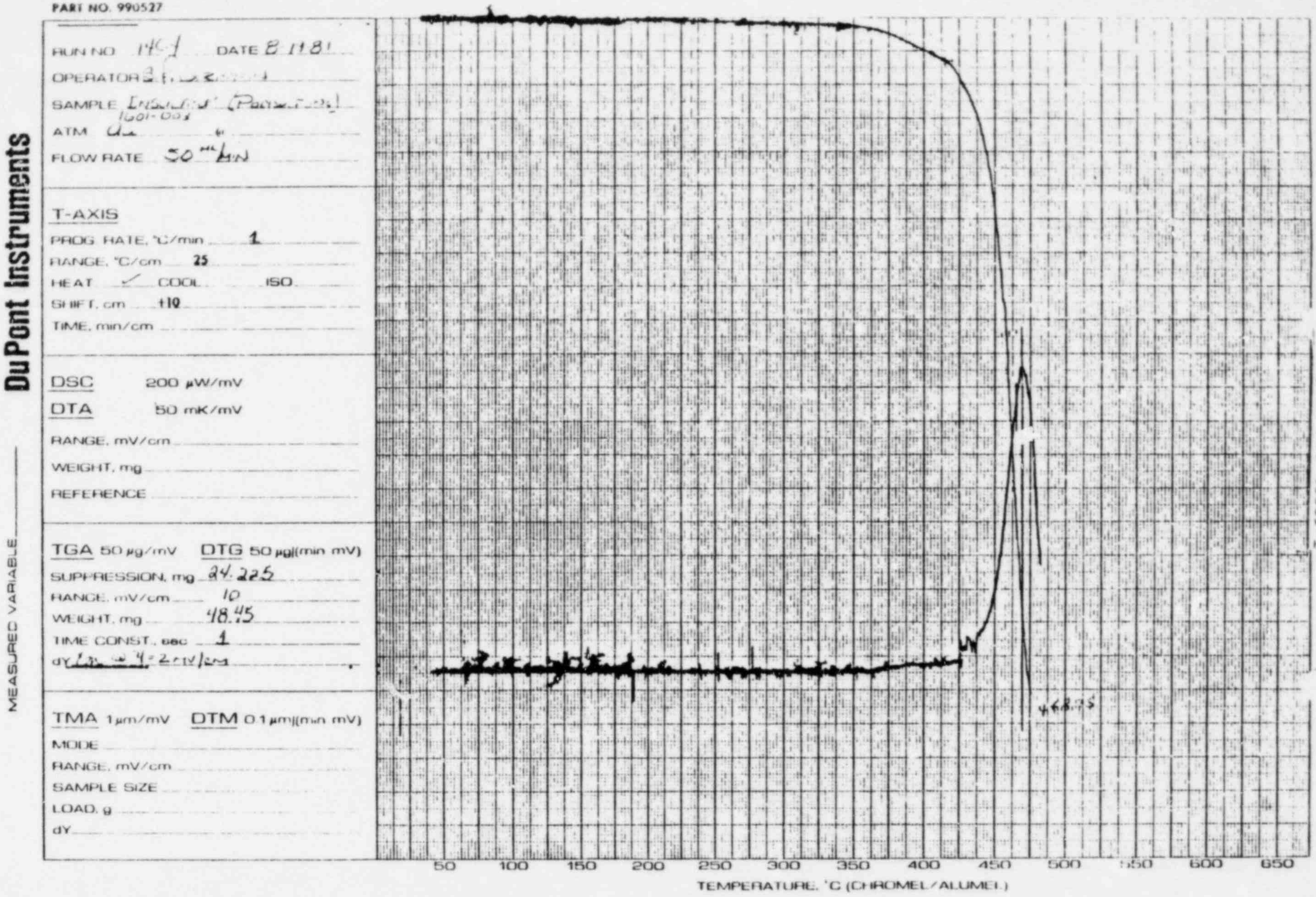
MODE

RANGE, mV/cm

SAMPLE SIZE

LOAD, g

dY



Du Pont Instruments

PART NO 990527

RUN NO [illegible] DATE [illegible]

OPERATOR [illegible]

SAMPLE [illegible]

ATM [illegible]

FLOW RATE 50 ml/min

T-AXIS

PROG. RATE, °C/min 10

RANGE, °C/cm 25

HEAT ✓ COOL ISO

SHIFT, cm ±10

TIME, min/cm

DSC 200 μW/mV

DTA 50 mK/mV

RANGE, mV/cm

WEIGHT, mg

REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)

SUPPRESSION, mg 8.17

RANGE, mV/cm 3

WEIGHT, mg 16.54

TIME CONST, sec 1

dY [illegible]

TMA 1 μm/mV DTM 0.1 μm/(min mV)

MODE

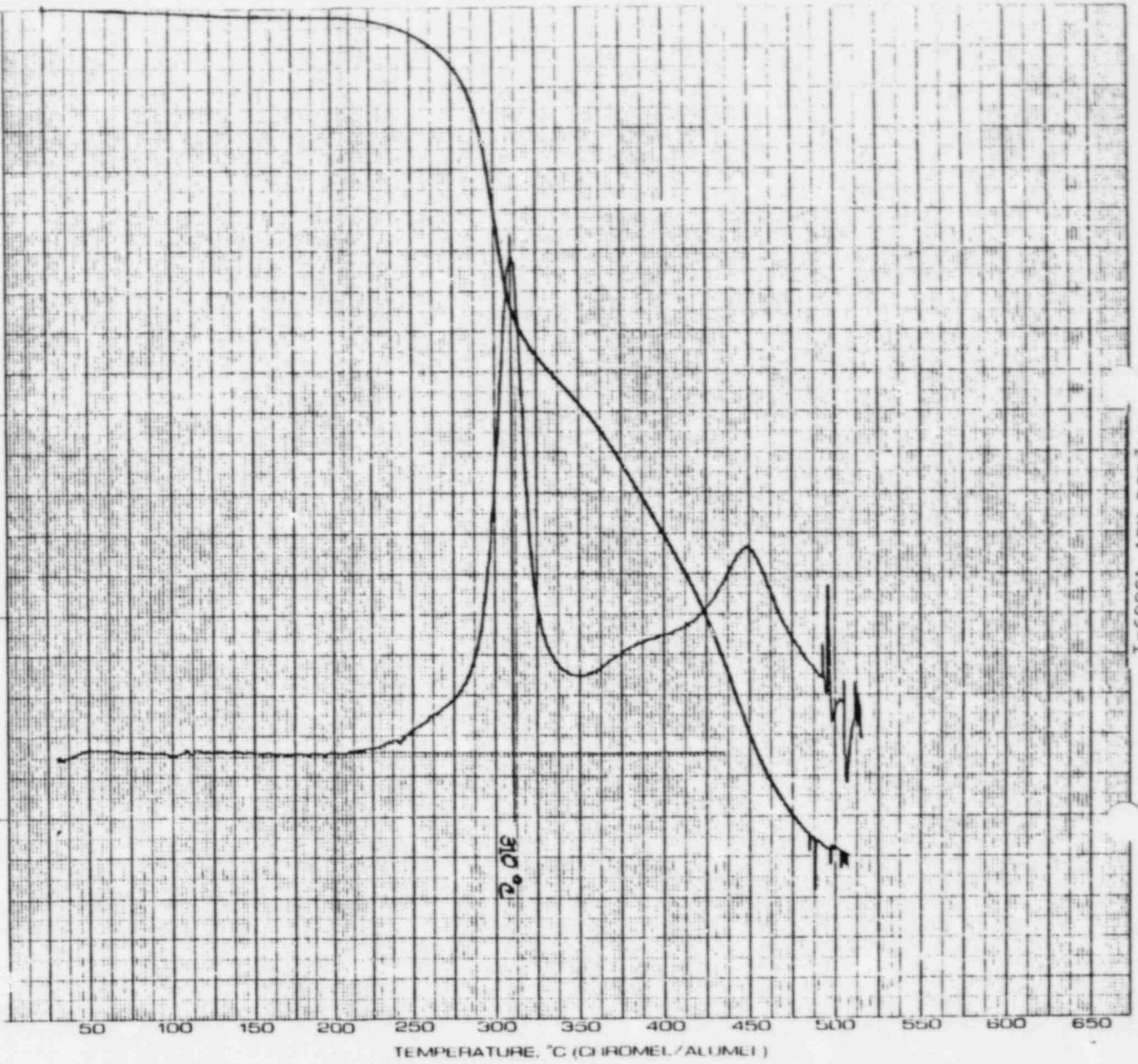
RANGE, mV/cm

SAMPLE SIZE

LOAD, g

dY

MEASURED VARIABLE



DuPont Instruments

PART NO. 990527

RUN NO. H-1 1 DATE 8781
OPERATOR [illegible]
SAMPLE [illegible] 1601-[illegible]
ATM [illegible]
FLOW RATE 50 ml/min

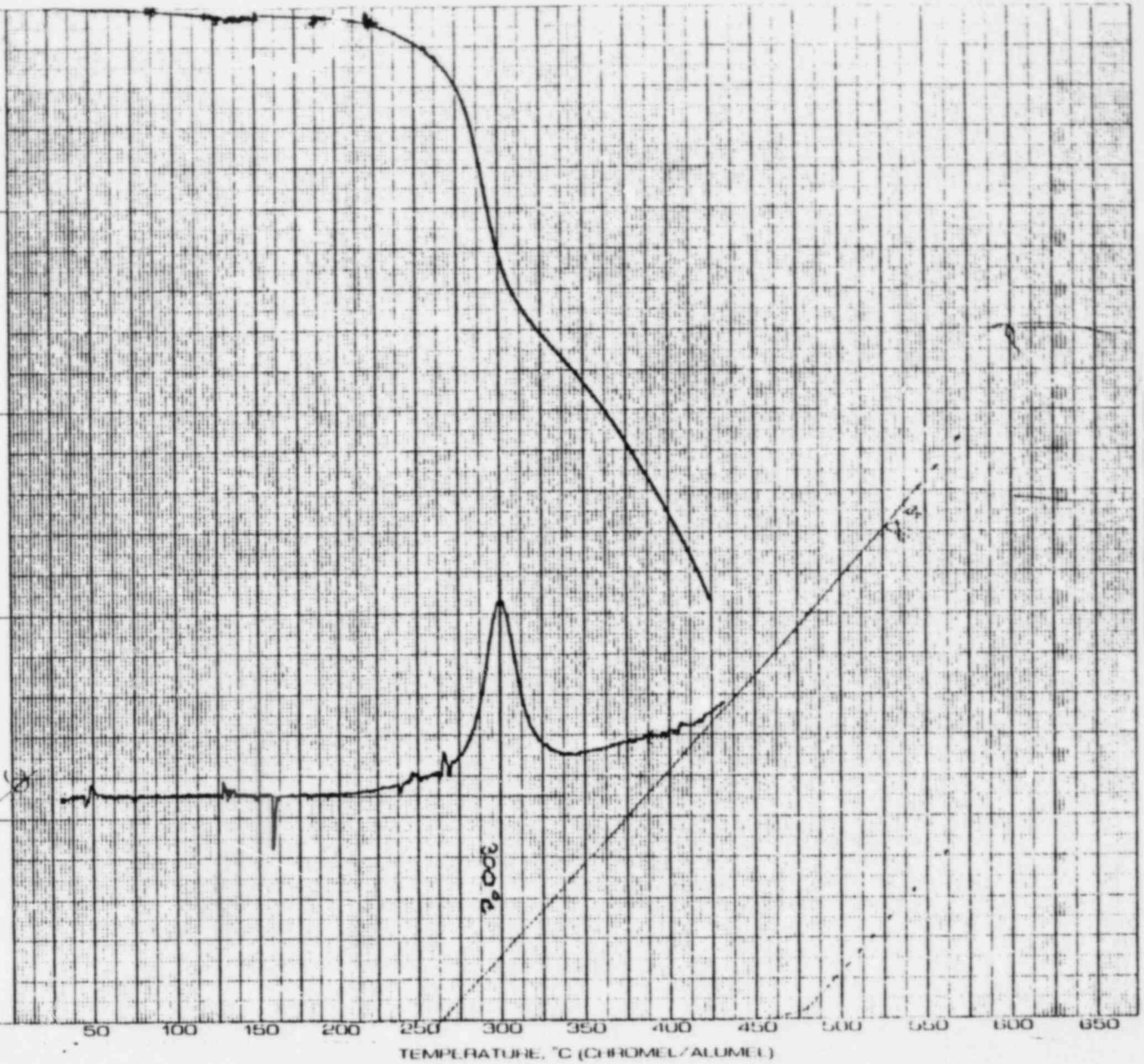
T-AXIS
PROG. RATE, °C/min 5
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm +10
TIME, min/cm

DSC 200 μW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 μg/mV DTG 50 μg/(min mV)
SUPPRESSION, mg 87
RANGE, mV/cm 5
WEIGHT, mg 17.8
TIME CONST., sec 1
dY [illegible] @ 4-5 [illegible]

TMA 1 μm/mV DTM 0.1 μm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



Du Pont Instruments

PART NO. 990527

RUN NO [illegible] DATE 5-11-81
OPERATOR [illegible]
SAMPLE [illegible]
ATM [illegible]
FLOW RATE [illegible]

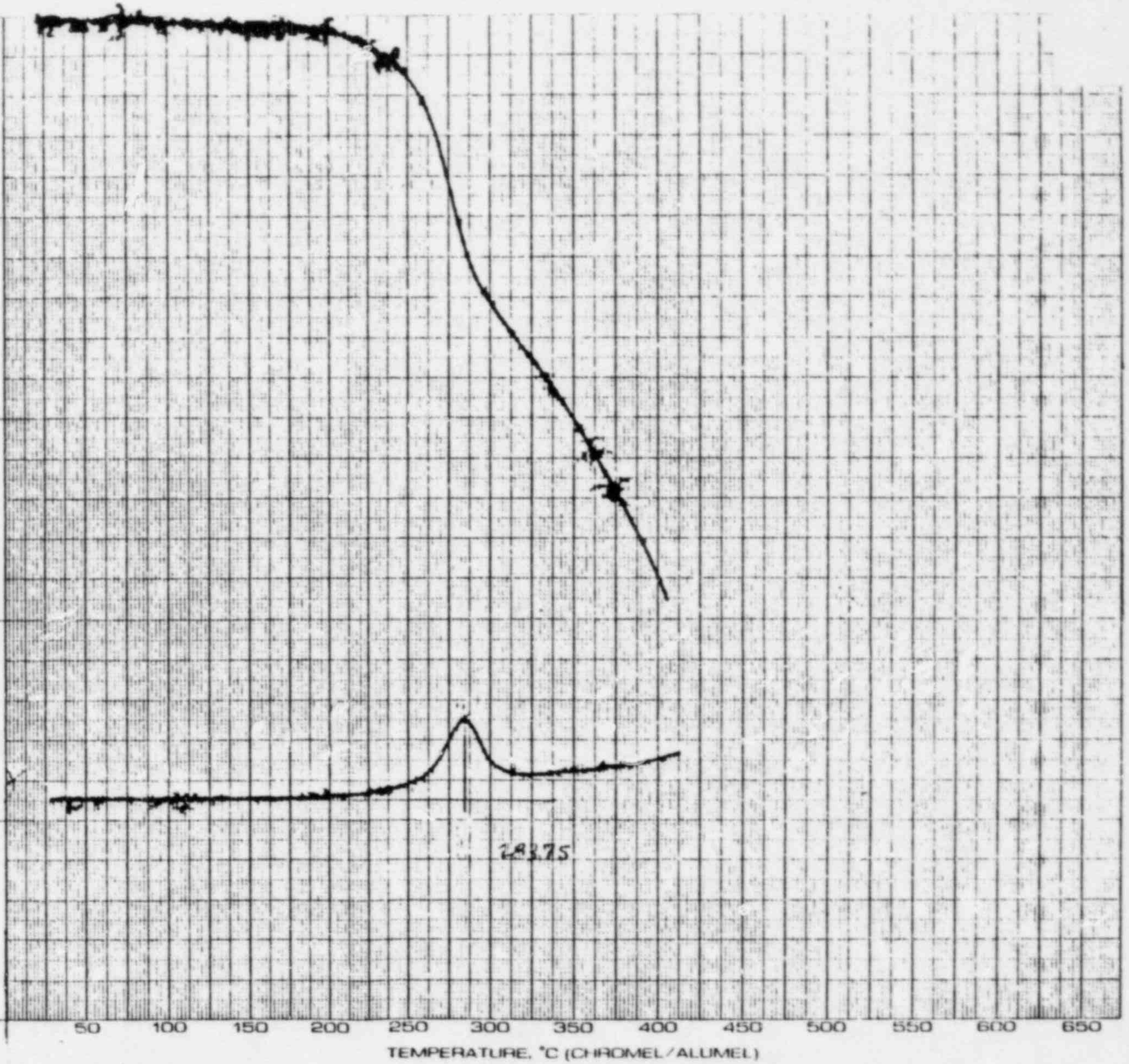
T-AXIS
PROG. RATE, °C/min [illegible]
RANGE, °C/cm 25
HEAT ✓ COOL ISO
SHIFT, cm ±10
TIME, min/cm

DSC 200 µW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 µg/mV DTG 50 µg/(min mV)
SUPPRESSION, mg 11.16
RANGE, mV/cm
WEIGHT, mg 23.52
TIME CONST., sec 1
dY [illegible]

TMA 1 µm/mV DTM 0.1 µm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



DuPont Instruments

PART NO. 990527

RUN NO. 1163 DATE 8 18 8[illegible]
OPERATOR SRG[illegible]
SAMPLE G-10 Epoxy [illegible] Laminate R
ATM Air
FLOW RATE 50 ml/min

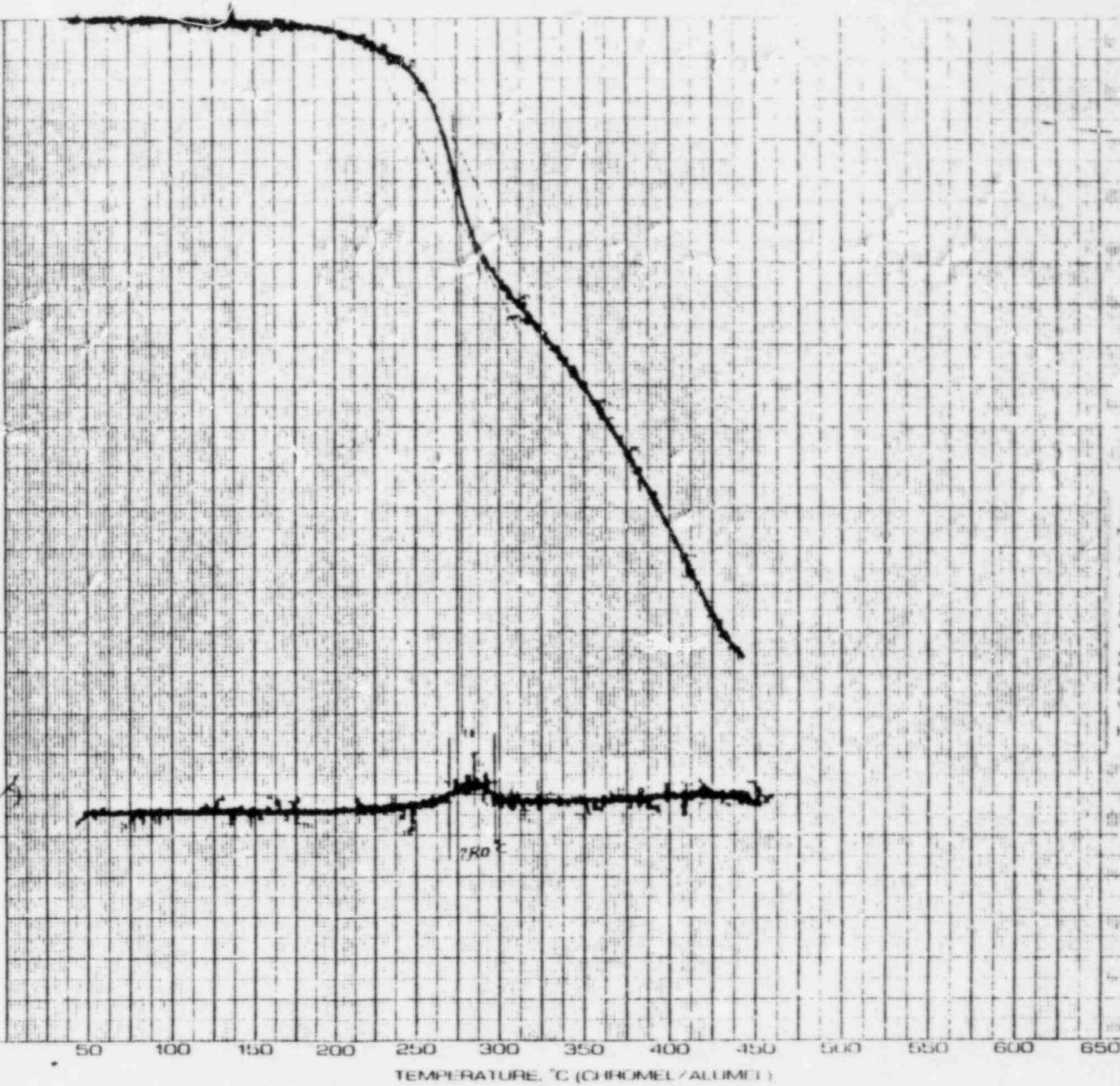
T-AXIS
PROG. RATE, °C/min 1
RANGE, °C/cm 25
HEAT ✓ COOL 150
SHIFT, cm ±10
TIME, min/cm .25

DSC 200 µW/mV
DTA 50 mK/mV
RANGE, mV/cm
WEIGHT, mg
REFERENCE

TGA 50 µg/mV DTG 50 µg/(min mV)
SUPPRESSION, mg 9.615
RANGE, mV/cm 5
WEIGHT, mg 19.23
TIME CONST., sec 1
dY [illegible] @ 4.2

TMA 1 µm/mV DTM 0.1 µm/(min mV)
MODE
RANGE, mV/cm
SAMPLE SIZE
LOAD, g
dY

MEASURED VARIABLE



APPENDIX I-IV

NOTICE OF ANOMALY

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WYLE LABORATORIES (Eastern Operations)

NOTICE OF ANOMALY

DATE: November 13, 1981

NOTICE NO: 1 P.O. NUMBER: 8828-05-3PM CONTRACT NO: N/A

CUSTOMER: Duke Power Company WYLE JOB NO: 45869

NOTIFICATION MADE TO: Paul McBride NOTIFICATION DATE: November 13, 1981

NOTIFICATION MADE BY: H. Smith VIA: Telecon

CATEGORY: ☐ SPECIMEN ☐ PROCEDURE ☒ TEST EQUIPMENT 26 DATE OF ANOMALY: November 12, 1981

PART NAME: Oven PART NO. ---

TEST: Thermal Aging I.D. NO. Wyle No. 26

SPECIFICATION: Wyle 543/6124-2/DK PARA. NO. Table 2

REQUIREMENTS:

Face seals, penetration unit, plug kits, and three cables shall be subjected to 302°F during thermal aging.

DESCRIPTION OF ANOMALY:

Oven temperature increased at a linear rate over approximately 43 minutes to a maximum level of 320°F before the redundant temperature controller activated.

DISPOSITION · COMMENTS · RECOMMENDATIONS:

The prime temperature controller experienced a relay failure. The controller was replaced and the thermal aging test continued. Customer concurred.

VERIFICATION:

TEST WITNESS:

REPRESENTING:

QUALITY ASSURANCE:

PROJECT ENGINEER: H Smith

PROJECT MANAGER: J Mosly

INTERDEPARTMENTAL COORDINATION:

WYLE Form WH 1066, Rev. Jan. 81

Page 1 of 1

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SECTION II

ASSEMBLY OF COMPONENTS

A representative of Duke Power Company assembled and labeled the plug kits/cables at the Wyle Facility following completion of the thermal aging test. The following is a summary of the assembly task:

1. The cables were terminated to the plug kits using the Duke Power Company Procedure No. IP-MCP-001.

2. Each cable/plug kit assembly was tagged with a metal I.D. tag which was numbered by module type, inboard or outboard end, and primary or backup cable.

   eg: C-in-1 = module C, inboard end, primary cable

   K-out-2 = module K, outboard end, secondary cable

   E-out-1 = module E, outboard end, primary cable

3. Cable/plug kit assembly E-in-2 was not made up due to the plug kit grommet being damaged due to handling during or after thermal aging. The plug kit and damaged grommet will go through radiation but will not be connected to the cable.

4. The #8AWG pins for D-out-2 were damaged during installation of the plugkit. The 2-#4AWG pins were terminated. The cable/plug kit assembly will go through radiation. New #4AWG pins will be terminated on the cable after radiation, <u>if necessary</u>.

5. A wrinkling of the 3/C#10 cable insulation was noted after thermal aging. The plug kits were terminated anyway. This may cause some problem during the steam test. All type F plugs are affected.

6. The face seals for the 'D' modules were for <u>seven</u> pin and not the specified six pin modules. This <u>may</u> create a problem in the steam test due to the void in the center of the face seal.

SECTION III

BASELINE FUNCTIONAL TEST

1.0 PROCEDURE

Following assembly of the plug kits/cables by Duke Power personnel, the assembled plugs/cables and penetration unit were subjected to an electrical functional test by Wyle personnel. This functional test was considered the baseline functional test and consisted of measuring the insulation resistance (I.R.) between each conductor and a check for electrical continuity. The insulation resistance was measured between each conductor and all other conductors tied to ground and applying a voltage of 500 VDC. All circuits were checked for electrical continuity using an ohmmeter. The required minimum I.R. of modules C, D, E, and F was 100 megohms and the required minimum I.R. of modules K and L was 10 megohms.

2.0 RESULTS

The I.R. of all conductors was greater than 100 megohms and all circuits exhibited continuity. See Appendix III-I for detailed data taken during the Baseline Functional Test.

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APPENDIX III-I

BASELINE FUNCTIONAL DATA

(Initial Test Following Assembly of Cables to Connectors)

DATA SHEET

Page No. III-4
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1003G25(2)
Spec. --
Para. --
S/N --
GSI No

Amb. Temp. 72°F
Photo No
Test Med. Air
Specimen Temp. Amb.

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title I.R. and Continuity - Baseline Functional

I.R. taken between each conductor and all other conductors tied to ground at 500 V.D.C.

Conductor	Resistance
A	4×10^{11} Ω
B	4.0×10^{11} Ω
C	3.5×10^{11} Ω
D	4.0×10^{11} Ω
E	4.0×10^{11} Ω
F	4.5×10^{11} Ω

Continuity was measured between wires and Pins A-F

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-11-81
Witness / Date:
Sheet No. of
Approved H Smith

DATA SHEET

Page No. III-5
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen Cable
Part No. C32P1003 Cat (1)
Spec. --
Para. --
S/N --
GSI No

Amb. Temp. 78°F
Photo No
Test Med. AiR
Specimen Temp. Amb.

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title I.R. AND Continuity -Baseline Functional

I.R. taken between each conductor and all other conductors tied to ground at 500 V.D.C.

Conductor	Resistance
A	3.5×10^{11} Ω
B	2.6×10^{11} Ω
C	2.6×10^{11} Ω
D	2.8×10^{11} Ω
E	3.2×10^{11} Ω
F	3.5×10^{11} Ω

Continuity was measured between Wires and Pins A-F.

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen PENTRATION UNIT
Part No. -.
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AiR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-12-81

Test Title IR READING BASELINE FUNCTIONAL

IR TAKEN PIN to GROUND At 500VDC

PIN	A	B	C	D	E	E
A	$1.7 \times 10^{12}\,\Omega$	$2.2 \times 10^{12}\,\Omega$	$1.1 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$	$2.6 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
B	$1.0 \times 10^{12}\,\Omega$	$2.4 \times 10^{12}\,\Omega$	$1.1 \times 10^{12}\,\Omega$	$2.0 \times 10^{13}\,\Omega$	$2.4 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
C	$10 \times 10^{12}\,\Omega$	$2.6 \times 10^{12}\,\Omega$	$1.2 \times 10^{12}\,\Omega$	$4.0 \times 10^{13}\,\Omega$	$3.0 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
D		$22 \times 10^{12}\,\Omega$		$>5.0 \times 10^{13}\,\Omega$	$2.6 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
E		$2.2 \times 10^{12}\,\Omega$		$>5.0 \times 10^{13}\,\Omega$	$3.0 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
F		$2.0 \times 10^{12}\,\Omega$		$>5.0 \times 10^{13}\,\Omega$	$2.8 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}$
G				$>5.0 \times 10^{13}\,\Omega$	$2.4 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}$
H				$>5.0 \times 10^{13}\,\Omega$	$3.0 \times 10^{12}\,\Omega$	$8.0 \times 10^{11}\,\Omega$
I				$>5.0 \times 10^{13}\,\Omega$	$2.6 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
J				$>5.0 \times 10^{13}\,\Omega$	$3.0 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
K				$2.0 \times 10^{13}\,\Omega$	$2.8 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
L				$2.6 \times 10^{13}\,\Omega$	$2.6 \times 10^{12}\,\Omega$	$>5.0 \times 10^{13}\,\Omega$
M						$>5.0 \times 10^{13}\,\Omega$
N						$>5.0 \times 10^{13}\,\Omega$

CONTINUITY WAS MEASURED PIN TO PIN

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

DATA SHEET

Page No. III-7
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1010601 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between EACH CONDUCTOR AND ALL OTHER CONDUCTORS tied to GROUND AT 500VDC.

CONDUCTORS	RESISTANCE
A	$5.2 \times 10^{11}\ \Omega$
B	$4.5 \times 10^{11}\ \Omega$
C	$5.0 \times 10^{11}\ \Omega$
D	$5.0 \times 10^{11}\ \Omega$
E	$5.0 \times 10^{11}\ \Omega$
F	$5.0 \times 10^{11}\ \Omega$
G	$5.0 \times 10^{11}\ \Omega$
H	$5.0 \times 10^{11}\ \Omega$
I	$5.4 \times 10^{11}\ \Omega$
J	$5.2 \times 10^{11}\ \Omega$
K	$5.0 \times 10^{11}\ \Omega$
L	$5.0 \times 10^{11}\ \Omega$

CONTINUITY WAS MEASURED between WIRES AND PINS A-L

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Calan Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

DATA SHEET

Page No. III-8
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power

Specimen Cable

Part No. C32 P1010 G02-(2)

Spec. --

Para. --

S/N --

GSI No

Amb. Temp. 78°F

Photo No

Test Med. Air

Specimen Temp. Amb.

Job No. 45869-03

Report No.

Start Date 12-11-81

Test Title I.R. and Continuity - Baseline Functional

I.R. taken between each conductor and all other conductors tied to Ground At 500 V.D.C.

Conductor	Resistance
A	5.8×10^{11} Ω
B	6.0×10^{11} Ω
C	5.8×10^{11} Ω
D	6.0×10^{11} Ω
E	6.4×10^{11} Ω
F	4.0×10^{11} Ω
G	5.6×10^{11} Ω
H	4.0×10^{11} Ω
I	6.1×10^{11} Ω
J	6.8×10^{11} Ω
K	5.2×10^{11} Ω
L	4.0×10^{11} Ω

Continuity was measured between wires and Pins A-L

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Coleman Date: 12-11-81

Witness Date:

Sheet No. of

Approved H Smith

WH-614A

DATA SHEET

Page No. III-9
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1010G02-1
Spec. --
Para. --
S/N --
GSI No

Amb. Temp. 72°F
Photo No
Test Med. Air
Specimen Temp. Ambient

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title I.R. and Continuity - Baseline Functional

I.R. taken between each conductor and all other conductors tied to ground at 500 V.D.C.

Conductor	Resistance
A	3.5×10^{11} Ω
B	3.0×10^{11} Ω
C	3.5×10^{11} Ω
D	3.5×10^{11} Ω
E	3.5×10^{11} Ω
F	3.5×10^{11} Ω
G	3.5×10^{11} Ω
H	3.5×10^{11} Ω
I	3.5×10^{11} Ω
J	3.5×10^{11} Ω
K	3.5×10^{11} Ω
L	3.5×10^{11} Ω

Continuity was measured between wires and Pins A - L

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-10
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C32P1009G06(1)
Amb. Temp. 72
Job No. 45869-03
Spec. --
Photo NO
Report No.
Para. --
Test Med. AIR
Start Date 12-12-81
S/N --
Specimen Temp. Amb
GSI NO
Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR taken between each Conductor AND ALL other CONDUCTORS tied to GROUND At 500VDC

CONDUCTORS	RESISTANCE
A	$5.4 \times 10^{11} \Omega$
B	$6.0 \times 10^{11} \Omega$
C	$5.0 \times 10^{11} \Omega$
D	$4.0 \times 10^{11} \Omega$
E	$4.0 \times 10^{11} \Omega$
F	$6.0 \times 10^{11} \Omega$
G	$5.0 \times 10^{11} \Omega$
H	$4.5 \times 10^{11} \Omega$
I	$5.0 \times 10^{11} \Omega$
J	$3.5 \times 10^{11} \Omega$
K	$5.4 \times 10^{11} \Omega$
L	$5.0 \times 10^{11} \Omega$
M	$35 \times 10^{11} \Omega$
N	$4.0 \times 10^{11} \Omega$

CONTINUITY WAS measured between WIRES AND PINS A-N

Specimen Failed
Tested By Robert R Colm Date: 12-12-81
Specimen Passed
Witness
Date:
NOA Written
Sheet No.
of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-11
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C 32 P1015 G01①
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between each conductor AND ALL other conductors tied to GROUND At 500VDC

CONDUCTORS	RESISTANCE
A	$6.6 \times 10^{11}\,\Omega$
B	$6.4 \times 10^{11}\,\Omega$
C	$6.4 \times 10^{11}\,\Omega$
D	$6.5 \times 10^{11}\,\Omega$
E	$6.8 \times 10^{11}\,\Omega$
F	$6.8 \times 10^{11}\,\Omega$
G	$7.0 \times 10^{11}\,\Omega$
H	$66 \times 10^{11}\,\Omega$
I	$6.5 \times 10^{11}\,\Omega$
J	$6.4 \times 10^{11}\,\Omega$
K	$6.6 \times 10^{11}\,\Omega$
L	$6.8 \times 10^{11}\,\Omega$

Continuity WAS measured between wires AND pins A-L

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert A R Coleman Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-12
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C32P1002 607 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AiR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title

IR taken between each conductor and all other conductors tied to GROUND At 500VDC

CONDUCTOR	RESISTANCE
A	$4.0 \times 10^{11} \Omega$
B	$3.5 \times 10^{11} \Omega$
C	$3.5 \times 10^{11} \Omega$

CONTINUITY WAS MEASURED between WIRES AND PINS A-C.

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-13
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen Cable
Part No. C32P1009G06 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869.03
Report No.
Start Date 12-10-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN BETWEEN EACH CONDUCTOR AND ALL OTHER CONDUCTORS TIED TO GROUND AT 500VDC

CONDUCTOR	RESISTANCE
A	$5.0 \times 10^{12}\,\Omega$
B	$4.5 \times 10^{12}\,\Omega$
C	$> 5.0 \times 10^{13}\,\Omega$
D	$4.0 \times 10^{12}\,\Omega$
E	$4.0 \times 10^{12}\,\Omega$
F	$4.5 \times 10^{12}\,\Omega$
G	$4.0 \times 10^{12}\,\Omega$
H	$4.0 \times 10^{12}\,\Omega$
I	$4.0 \times 10^{12}\,\Omega$
J	$4.5 \times 10^{12}\,\Omega$
K	$> 5.0 \times 10^{13}\,\Omega$
L	$4.5 \times 10^{12}\,\Omega$
M	$4.0 \times 10^{12}\,\Omega$
N	$4.5 \times 10^{12}\,\Omega$

CONTINUITY WAS MEASURED BETWEEN WIRES AND PINS A-N

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-10-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAble
Part No. C32P1009G01 (1)
Spec. - -
Para. - -
S/N - -
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title IR & Continuity BASELINE FUNCTIONAL

IR TAKEN between EACH conductor And ALL other conductors tied to GROUND AT 500VDC

Conductor	RESISTANCE
A	1.7 x10^{11}Ω
B	1.7 x10^{11}Ω
C	1.8 x10^{11}Ω
D	1.7 x10^{11}Ω
E	1.7x10^{11}Ω
F	1.6x10^{11}Ω
G	1.7X x 10^{11}Ω
H	1.7X 10^{11}Ω
I	1.7x 10^{11}Ω
J	1.6X10^{11}Ω
K	1.7X10^{11}Ω
L	1.7X10^{11}Ω
M	1.7X10^{11}Ω
N	1.7x10^{11}Ω

Continuity was measured between wires And pins A-N

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-15
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C32P1009601 (3)
Spec. --
Para. --
S/N --
GSI NO
Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb
Job No. 45869-03
Report No.
Start Date 12-10-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR taken between each conductor and all other conductors tied to Ground At 500VDC

Conductor	RESISTANCE
A	$1.7 \times 10^{13} \Omega$
B	$5.0 \times 10^{12} \Omega$
C	$> 5.0 \times 10^{13} \Omega$
D	$4.5 \times 10^{12} \Omega$
E	$4.0 \times 10^{12} \Omega$
F	$50 \times 10^{12} \Omega$
G	$40 \times 10^{12} \Omega$
H	$4.5 \times 10^{12} \Omega$
I	$40 \times 10^{12} \Omega$
J	$4.0 \times 10^{12} \Omega$
K	$> 50 \times 10^{13} \Omega$
L	$4.5 \times 10^{12} \Omega$
M	$4.0 \times 10^{12} \Omega$
N	$4.5 \times 10^{12} \Omega$

CONTINUITY WAS MEASURED between WIRES AND PINS A-N.

Specimen Failed
Specimen Passed
NOA Written
Tested By RafatRClu Date: 12-10-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-16
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1004G07(2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-12-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between EACH conductor AND ALL OTHER conductors tied to GROUND At 500vdc.

CONDUCTOR	RESISTANCE
A	$4.5 \times 10^{11}\,\Omega$
B	$4.0 \times 10^{11}\,\Omega$
C	$3.5 \times 10^{11}\,\Omega$

CONTINUITY WAS MEASURED between WIRES AND PINS A-C

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-17
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C 32P1004G07 (1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. AMb.

Job No. 45869.03
Report No.
Start Date 12-12-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between EACH conductor AND ALL other conductors tied to GROUND At 500vdc

CONDUctOR	RESIStANCE
A	$4.5 \times 10^{11}\,\Omega$
B	$5.0 \times 10^{11}\,\Omega$
C	$6.5 \times 10^{11}\,\Omega$

CONtINUitY WAS measured between WIRES And PINS A-C

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-18
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C32P1004G08(1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-12-81

Test Title IR AND CONtINUity BASELINE FUNCtIONAL

IR TAKEN between each conductor AND ALL other CONDUCTORS tied to GROUND At 500vdc

CONductor	REsistaNCE
A	$3.5 \times 10^{11}\,\Omega$
B	$3.5 \times 10^{11}\,\Omega$
C	$4.5 \times 10^{11}\,\Omega$

CONtINUity WAS measURED between WIRES AND PINS AC

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Calan Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

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DATA SHEET

Page No. III-19
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C-32P1004G08 (2)
Spec. --
Para. --
S/N --
GSI NO
Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb
Job No. 45869-03
Report No.
Start Date 12-12-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between EACH Conductor AND ALL other CONDUCTORS tied to GROUND At 500VDC

Conductor	RESISTANCE
A	$2.4 \times 10^{11} \Omega$
B	$2.0 \times 10^{11} \Omega$
C	$2.0 \times 10^{11} \Omega$

CONTINUITY WAS measured between wires AND PINS AC

Specimen Failed
Specimen Passed
NOA Written
Tested By Date:
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-20
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLE
Part No. C32P1002G08 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-12-81

Test Title IR AND CONtINUITY BASELINE FUNCTIONAL

IR TAKEN between EACH Conductor AND ALL other CONDuctoRS tied to GROUND At 500 VDC

CONDuctoRS	RESIStANCE
A	2.0 X 1.0^{11} Ω
B	2.2 X 10^{11} Ω
C	2.2 X 10^{11} Ω

CONtINUity WAS measURED between WIRES & PINS AC

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

WH-A14A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1002G07-1
Amb. Temp. 72
Job No. 45869-03
Spec. --
Photo NO
Report No.
Para. --
Test Med. AIR
Start Date 12-12-81
S/N --
Specimen Temp. Amb
GSI NO

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between EACH CONDUCTOR AND ALL other conductors tied to GROUND At 500VDC

CONDUCTORS	RESISTANCE
A	$1.9 \times 10^{11}\ \Omega$
B	$1.9 \times 10^{11}\ \Omega$
C	$1.9 \times 10^{11}\ \Omega$

CONTINUITY WAS measured between WIRES AND PINS A-C

Specimen Failed
Specimen Passed
NOA Written
Tested By Robert R Cole Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-22
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER

Specimen CAble

Part No. C32P1002G08 (1)

Amb. Temp. 72

Job No. 45869-03

Spec. --

Photo NO

Report No.

Para. --

Test Med. AIR

Start Date 12-12-81

S/N --

Specimen Temp. Amb

GSI NO

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR TAKEN between each conductor AND ALL other conductors tied to GROUND at 500vdc

CONDUCTOR	RESISTANCE
A	$1.3 \times 10^{11}\ \Omega$
B	$1.6 \times 10^{11}\ \Omega$
C	$1.3 \times 10^{11}\ \Omega$

CONTINUITY WAS measured between wires AND PINS A-C

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Colem Date: 12-12 81

Witness Date: -

Sheet No. of

Approved H Smith

DATA SHEET

Page No. III-23
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C 32P1003 G26 (1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR taken between each conductor and ALL other conductors tied to GROUND At 500VDC

CONDUCTOR	RESISTANCE
A	$1.8 \times 10^{11} \Omega$
B	$1.8 \times 10^{11} \Omega$
C	$1.8 \times 10^{11} \Omega$
D	$1.8 \times 10^{11} \Omega$
E	$1.8 \times 10^{11} \Omega$
F	$1.8 \times 10^{11} \Omega$

CONTINUITY WAS MEASURED between WIRES AND PINS A-E

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-24
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1015G02(1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title IR AND CONTINUITY BASELINE FUNCTIONAL

IR taken between each conductor and all other conductors tied to ground at 500VDC

CONDUCTORS	RESISTANCE:
A	8.6×10^{11} Ω
B	9.2×10^{11} Ω
C	8.4×10^{11} Ω
D	8.6×10^{11} Ω
E	8.6×10^{11} Ω
F	8.8×10^{11} Ω
G	8.0×10^{11} Ω
H	9.6×10^{11} Ω
I	1.2×10^{12} Ω
J	9.0×10^{11} Ω
K	1.1×10^{12} Ω
L	8.6×10^{11} Ω

Continuity was measured between wires and pins A-L

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-25
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32 P1015 G01 (2)
Spec. --
Para. --
S/N --
GSI No

Amb. Temp. 72°F
Photo No
Test Med. Air
Specimen Temp. Amb.

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title I.R. and Continuity - Baseline Functional

I.R. taken Between each conductor and all other conductors tied to ground. At 500 V.D.C.

Conductors	Resistance
A	$7.0 \times 10^{11}\,\Omega$
B	$7.2 \times 10^{11}\,\Omega$
C	$6.6 \times 10^{11}\,\Omega$
D	$6.4 \times 10^{11}\,\Omega$
E	$7.4 \times 10^{11}\,\Omega$
F	$6.6 \times 10^{11}\,\Omega$
G	$7.8 \times 10^{11}\,\Omega$
H	$7.6 \times 10^{11}\,\Omega$
I	$7.8 \times 10^{11}\,\Omega$
J	$7.0 \times 10^{11}\,\Omega$
K	$8.6 \times 10^{11}\,\Omega$
L	$8.4 \times 10^{11}\,\Omega$

Continuity was measured Between Wires And Pins A L

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Colem Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. III-26
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cables
Part No. C32P1010G01 (1)
Spec. --
Para. --
S/N --
GSI No

Amb. Temp. 72°F
Photo No
Test Med. Air
Specimen Temp. Amb.

Job No. 45869-03
Report No.
Start Date 12-11-81

Test Title I.R. and Continuity - Baseline Functional

I.R. taken between each conductor and all other conductors tied to ground at 500 V.D.C.

Conductors	Resistance
A	$1.8\times10^{11}\,\Omega$
B	$1.8\times10^{11}\,\Omega$
C	$2.0\times10^{11}\,\Omega$
D	$2.0\times10^{11}\,\Omega$
E	$2.0\times10^{11}\,\Omega$
F	$2.0\times10^{11}\,\Omega$
G	$2.0\times10^{11}\,\Omega$
H	$2.0\times10^{11}\,\Omega$
I	$2.0\times10^{11}\,\Omega$
J	$2.0\times10^{11}\,\Omega$
K	$2.0\times10^{11}\,\Omega$
L	$2.0\times10^{11}\,\Omega$

Continuity was measured between wires and Pin A-L

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-11-81
Witness Date:
Sheet No. of
Approved H Smith

DATA SHEET

Page No. III-27
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLe
Part No. C32P1003G26(2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AiR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-12-81

Test Title IR AND CONtiNuity BASELINE Function

IR TAKEN between each conductor AND ALL other conductors tied to GROUND At 500VDC

CONDUCTOR	RESISTANCE
A	5.0×10^{11} Ω
B	5.0×10^{11} Ω
C	1.2×10^{13} Ω
D	30×10^{11} Ω
E	5.0×10^{11} Ω
F	30×10^{11} Ω

CONtiNuity WAS measured wire to PIN A-F

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Colm Date: 12-12-81
Witness Date:
Sheet No. of
Approved H Smith

SECTION IV

RADIATION EXPOSURE

1.0 PROCEDURE

All test specimen components were shipped to the Isomedix Company in New Jersey for radiation exposure. The components were exposed to a total integrated dose of 2.0 X 10^8 rads gamma, air equivalent, using a Cobalt 60 source, at a dose rate that did not exceed 1.0 X 10^6 rads per hour.

2.0 RESULTS

The cables, face seals, and plug kits arrived at Isomedix with an indication of mishandling during shipment (shipping crate turned over and cables dumped to floor of truck). The components were visually inspected at Isomedix by engineering representatives from Wyle Laboratories and Duke Power, and the Wyle representatives conducted electrical functional tests on the cable assemblies. No damage was observed during the visual inspection and the electrical tests (insulation resistance continuity) revealed no degradation. See Notice of Anomaly No. 2 and Electrical Test Data (Appendices IV-I and IV-II, respectively).

All components were subjected to the prescribed radiation exposure. See Isomedix Report (Appendix IV-III). At completion of the radiation exposure, all components were inspected by Wyle personnel for damage. No anomalous conditions were observed.

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APPENDIX IV-I

NOTICE OF ANOMALY

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WYLE LABORATORIES (Eastern Operations)

NOTICE OF ANOMALY

DATE: 1-11-82

NOTICE NO: 2 P.O. NUMBER: 8828-05-3PM CONTRACT NO: N/A

CUSTOMER: Duke Power Company WYLE JOB NO: 45869

NOTIFICATION MADE TO: R.Dover/J. Tannery NOTIFICATION DATE: 12-23-81

NOTIFICATION MADE BY: H. Smith VIA: Telecon

CATEGORY: ☒ SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE OF ANOMALY: 12-22-81

PART NAME: Cables PART NO. ---

TEST: --- I.D. NO. ---

SPECIFICATION: WLTP 543/6124-2/DK PARA. NO. ---

REQUIREMENTS:

N/A

DESCRIPTION OF ANOMALY:

The Cables were received at the irradiation facility (Isomedix) with indication of mishandling during shipment and possible damage (shipping crate turned over and cables dumped to floor of truck).

DISPOSITION · COMMENTS · RECOMMENDATIONS:

The Cables were visually inspected at Isomedix by H. Smith/B. Coleman of Wyle and R. Dover/J. Tannery of Duke Power. No damage was observed during the inspection. Wyle also conducted insulation resistance and electrical continuity tests per Paragraphs 3.7.2 and 3.7.3 of WLTP 543/6124-2/DK. The electrical tests revealed no degradation. With Duke Power Company's concurrence, the Cables were subjected to the irradiation process.

VERIFICATION:

PROJECT ENGINEER: H Smith

TEST WITNESS: PROJECT MANAGER: Herschel Jordan

REPRESENTING: INTERDEPARTMENTAL COORDINATION:

QUALITY ASSURANCE B.N. Hollingsworth

WYLE Form WH 1066, Rev. Jan. 81

Page 1 of 1

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APPENDIX IV-II

BASELINE ELECTRICAL TEST AT ISOMEDIX

DATA SHEET

AT ISOMEDIX

Page No. IV-8
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1002608 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$40 \times 10^{12}\ \Omega$	OK
B	$4.0 \times 10^{12}\ \Omega$	OK
C	$3.5 \times 10^{12}\ \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER

Specimen CABLE

Part No. C32P1003G25 (1)

Spec. --

Para. --

S/N --

GSI NO

Amb. Temp. 72

Photo NO

Test Med. AIR

Specimen Temp. Amb

Job No. 45869-03

Report No.

Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between EACH CONDUCTOR AND CONDUCTORS tied to ground At 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$1.5 \times 10^{12} \Omega$	OK
B	$1.0 \times 10^{12} \Omega$	OK
C	$1.1 \times 10^{12} \Omega$	OK
D	$1.1 \times 10^{12} \Omega$	OK
E	$1.2 \times 10^{12} \Omega$	OK
F	$1.0 \times 10^{12} \Omega$	OK

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Colan Date: 12-28-81

Witness Date:

Sheet No. of

Approved H Smith

WH-614A

DATA SHEET

Page No. IV-10
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1002G08(1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$4.0 \times 10^{12}\,\Omega$	OK
B	$4.5 \times 10^{12}\,\Omega$	OK
C	$50 \times 10^{12}\,\Omega$.	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-11
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1003G26 (1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR taken between each conductor AND conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$1.2 \times 10^{12} \Omega$	OK
B	$1.2 \times 10^{12} \Omega$	OK
C	$1.2 \times 10^{12} \Omega$	OK
D	$1.0 \times 10^{12} \Omega$	OK
E	$1.1 \times 10^{12} \Omega$	OK
F	$1.2 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-12
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1002G07 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$1.1 \times 10^{11} \Omega$	OK
B	$1.1 \times 10^{11} \Omega$	OK
C	$1.0 \times 10^{11} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By H Smith Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-13
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C 32 P1003G25 (2)
Amb. Temp. 72
Spec. --
Photo NO
Para. --
Test Med. AIR
S/N --
Specimen Temp. Amb
GSI NO

Job No. 45869
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND ALL other conductors tied to ground at 500VDC

CONDUCTOR	RESISTANCE	CONTINUITY
A	$1.2 \times 10^{11} \Omega$	OK
B	$1.0 \times 10^{11} \Omega$	OK
C	$1.3 \times 10^{11} \Omega$	OK
D	$1.4 \times 10^{11} \Omega$	OK
E	$1.2 \times 10^{11} \Omega$	OK
F	$1.2 \times 10^{11} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Cl Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-14
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1009G06 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONductoR	RESISTANCE	CONTINUITY
A	$> 5.0 \times 10^{13}\ \Omega$	OK
B	$5.0 \times 10^{12}\ \Omega$	OK
C	$> 5.0 \times 10^{13}\ \Omega$	OK
D	~~1.2~~ 4.0 $\times 10^{12}\ \Omega$	OK
E	$4.5 \times 10^{12}\ \Omega$	OK
F	$4.5 \times 10^{12}\ \Omega$	OK
G	$4.5 \times 10^{12}\ \Omega$	OK
H	$4.0 \times 10^{12}\ \Omega$	OK
I	$4.0 \times 10^{12}\ \Omega$	OK
J	$40 \times 10^{12}\ \Omega$	OK
K	$> 5.0 \times 10^{13}\ \Omega$	OK
L	$5.0 \times 10^{12}\ \Omega$	OK
M	$5.0 \times 10^{12}\ \Omega$	OK
N	$3.0 \times 10^{12}\ \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-28-81
Witness Date:
Sheet No. of
Approved

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1010G01 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$>5.0 \times 10^{13}\ \Omega$	OK
B	$>5.0 \times 10^{13}\ \Omega$	OK
C	$>5.0 \times 10^{13}\ \Omega$	OK
D	$>5.0 \times 10^{13}\ \Omega$	OK
E	$>5.0 \times 10^{13}\ \Omega$	OK
F	$>5.0 \times 10^{13}\ \Omega$	OK
G	$>5.0 \times 10^{13}\ \Omega$	OK
H	$>5.0 \times 10^{13}\ \Omega$	OK
I	$>5.0 \times 10^{13}\ \Omega$	OK
J	$>5.0 \times 10^{13}\ \Omega$	OK
K	$>5.0 \times 10^{13}\ \Omega$	OK
L	$>5.0 \times 10^{13}\ \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER

Specimen CABLE

Part No. C32P1015G02(1)

Spec. --

Para. --

S/N --

GSI NO

Amb. Temp. 72

Photo NO

Test Med. AIR

Specimen Temp. Amb

Job No. 45869-03

Report No.

Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$>5.0 \times 10^{13} \Omega$	OK
B	$4.5 \times 10^{13} \Omega$	OK
C	$8.0 \times 10^{12} \Omega$	OK
D	$4.5 \times 10^{12} \Omega$	OK
E	$>5.0 \times 10^{13} \Omega$	OK
F	$7.0 \times 10^{12} \Omega$	OK
G	$9.2 \times 10^{12} \Omega$	OK
H	$1.0 \times 10^{13} \Omega$	OK
I	$8.5 \times 10^{12} \Omega$	OK
J	$1.3 \times 10^{13} \Omega$	OK
K	$1.3 \times 10^{13} \Omega$	OK
L	$1.0 \times 10^{13} \Omega$	OK

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Coleman Date: 12-28-81

Witness Date:

Sheet No. of

Approved H Smith

WH-614A

DATA SHEET

Page No. IV-17
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAbLE
Part No. C32P1010G02-(2)
Spec. --
Para. --
S/N --
GSI NO
Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb
Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONductoR	RESISTANCE	CONTINUITY
A	$> 5.0 \times 10^{13}\,\Omega$	OK
B	$> 5.0 \times 10^{13}\,\Omega$	OK
C	$> 5.0 \times 10^{13}\,\Omega$	OK
D	$> 5.0 \times 10^{13}\,\Omega$	OK
E	$> 5.0 \times 10^{13}\,\Omega$	OK
F	$> 5.0 \times 10^{13}\,\Omega$	OK
G	$> 5.0 \times 10^{13}\,\Omega$	OK
H	$> 5.0 \times 10^{13}\,\Omega$	OK
I	$> 50 \times 10^{13}\,\Omega$	OK
J	$> 5.0 \times 10^{13}\,\Omega$	OK
K	$> 5.0 \times 10^{13}\,\Omega$	OK
L	$> 5.0 \times 10^{13}\,\Omega$	OK

Specimen Failed
Specimen Passed
NOA Written
Tested By Robert A Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1003G26 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo ~~AIR~~ NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$1.0 \times 10^{12} \Omega$	OK
B	$1.4 \times 10^{12} \Omega$	OK
C	$9.0 \times 10^{11} \Omega$	OK
D	$60 \times 10^{11} \Omega$	OK
E	$1.0 \times 10^{12} \Omega$	OK
F	$4.0 \times 10^{11} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-28-81
Witness Date:
Sheet No. of
Approved

WH-614A

DATA SHEET

Page No. IV-19
Report No. 45869-1

Customer DUKE POWER
Specimen CABLE
Part No. C32P1015G01 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

WYLE LABORATORIES

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR taken between each conductor and conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$>5.0 \times 10^{13}\,\Omega$	OK
B	$>5.0 \times 10^{13}\,\Omega$	OK
C	$>50 \times 10^{13}\,\Omega$	OK
D	$>5.0 \times 10^{13}\,\Omega$	OK
E	$>5.0 \times 10^{13}\,\Omega$	OK
F	$>50 \times 10^{13}\,\Omega$	OK
G	$>50 \times 10^{13}\,\Omega$	OK
H	$>50 \times 10^{13}\,\Omega$	OK
I	$>5.0 \times 10^{13}\,\Omega$	O.K
J	$>50 \times 10^{13}\,\Omega$	OK
K	$>5.0 \times 10^{13}\,\Omega$	OK.
L	$>5.0 \times 10^{13}\,\Omega$	O.K

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-20
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1002608 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$4.0 \times 10^{12}\,\Omega$	OK
B	$4.0 \times 10^{12}\,\Omega$	OK
C	$3.5 \times 10^{12}\,\Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved

WH-614A

DATA SHEET

Page No. IV-21
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1003625(1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$1.5 \times 10^{12} \Omega$	OK
B	$1.0 \times 10^{12} \Omega$	OK
C	$1.1 \times 10^{12} \Omega$	OK
D	$1.1 \times 10^{12} \Omega$	OK
E	$1.2 \times 10^{12} \Omega$	OK
F	$1.0 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Colan Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER

Specimen CABLE

Part No. C32P1002G08(1)

Spec. --

Para. --

S/N --

GSI NO

Amb. Temp. 72

Photo NO

Test Med. AIR

Specimen Temp. Amb

Job No. 45869-03

Report No.

Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$4.0 \times 10^{12} \Omega$	OK
B	$4.5 \times 10^{12} \Omega$	OK
C	$5.0 \times 10^{12} \Omega$	OK

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Coleman Date: 12-28-81

Witness Date:

Sheet No. of

Approved H Smith

WH-614A

DATA SHEET

Page No. IV-23
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1003G26 (1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONductor	RESISTANCE	CONTINUITY
A	$1.2 \times 10^{12} \Omega$	OK
B	$1.2 \times 10^{12} \Omega$	OK
C	$1.2 \times 10^{12} \Omega$	OK
D	$1.0 \times 10^{12} \Omega$	OK
E	$1.1 \times 10^{12} \Omega$	OK
F	$1.2 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By R McARColeman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1002G07 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR taken between each conductor AND conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$1.1 \times 10^{11}\,\Omega$	ok
B	$1.1 \times 10^{11}\,\Omega$	ok
C	$1.0 \times 10^{11}\,\Omega$	ok

Specimen Failed
Specimen Passed
NOA Written

Tested By
Date: 12-28-81
Witness
Date:
Sheet No. of
Approved

WH-614A

DATA SHEET

Page No. IV-25
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C 32 P1003 G25 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND ALL other conductors tied to ground at 500VDC

CONDUCTOR	RESISTANCE	CONTINUITY
A	$1.2 \times 10^{11}\,\Omega$	OK
B	$1.0 \times 10^{11}\,\Omega$	OK
C	$1.3 \times 10^{11}\,\Omega$	OK
D	$1.4 \times 10^{11}\,\Omega$	OK
E	$1.2 \times 10^{11}\,\Omega$	OK
F	$1.2 \times 10^{11}\,\Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R [illegible] Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-26
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1009G06 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$>5.0 \times 10^{13}$ Ω	OK
B	5.0×10^{12} Ω	OK
C	$>5.0 \times 10^{13}$ Ω	OK
D	~~1.2~~ 4.0 $\times 10^{12}$ Ω	OK
E	4.5×10^{12} Ω	OK
F	4.5×10^{12} Ω	OK
G	4.5×10^{12} Ω	OK
H	4.0×10^{12} Ω	OK
I	4.0×10^{12} Ω	OK
J	40×10^{12} Ω	OK
K	$>5.0 \times 10^{13}$ Ω	OK
L	5.0×10^{12} Ω	OK
M	5.0×10^{12} Ω	OK
N	3.0×10^{12} Ω	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Customer DUKE POWER
Specimen CABLE
Part No. C32P1010G01 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

WYLE LABORATORIES

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR taken between each conductor and conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$>5.0 \times 10^{13}\ \Omega$	OK
B	$>5.0 \times 10^{13}\ \Omega$	OK
C	$>5.0 \times 10^{13}\ \Omega$	OK
D	$>5.0 \times 10^{13}\ \Omega$	OK
E	$>5.0 \times 10^{13}\ \Omega$	OK
F	$>5.0 \times 10^{13}\ \Omega$	ok
G	$>5.0 \times 10^{13}\ \Omega$	OK
H	$>5.0 \times 10^{13}\ \Omega$	OK
I	$>5.0 \times 10^{13}\ \Omega$	O K
J	$>5.0 \times 10^{13}\ \Omega$	OK
K	$>5.0 \times 10^{13}\ \Omega$	OK
L	$>5.0 \times 10^{13}\ \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-28
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1015G02(1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between EACH CONDUCTOR AND CONDUCTORS tied to ground At 500VDC.

CONDUCTOR	RESISTANCE	CONTINUITY
A	$>5.0 \times 10^{13} \Omega$	OK
B	$4.5 \times 10^{13} \Omega$	OK
C	$8.0 \times 10^{12} \Omega$	OK
D	$4.5 \times 10^{12} \Omega$	OK
E	$>5.0 \times 10^{13} \Omega$	OK
F	$7.0 \times 10^{12} \Omega$	OK
G	$9.2 \times 10^{12} \Omega$	OK
H	$1.0 \times 10^{13} \Omega$	OK
I	$8.5 \times 10^{12} \Omega$	OK
J	$1.3 \times 10^{13} \Omega$	OK
K	$1.3 \times 10^{13} \Omega$	OK
L	$1.0 \times 10^{13} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Colman Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

Page No. IV-29
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1010G02-(2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR taken between each conductor AND conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$> 5.0 \times 10^{13}\ \Omega$	OK
B	$> 5.0 \times 10^{13}\ \Omega$	OK
C	$> 5.0 \times 10^{13}\ \Omega$	OK
D	$> 5.0 \times 10^{13}\ \Omega$	OK
E	$> 5.0 \times 10^{13}\ \Omega$	OK
F	$> 5.0 \times 10^{13}\ \Omega$	OK
G	$> 5.0 \times 10^{13}\ \Omega$	OK
H	$> 5.0 \times 10^{13}\ \Omega$	OK
I	$> 50 \times 10^{13}\ \Omega$	OK
J	$> 5.0 \times 10^{13}\ \Omega$	OK
K	$> 5.0 \times 10^{13}\ \Omega$	OK
L	$> 5.0 \times 10^{13}\ \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-28-81
Witness Date:
Sheet No. of
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1003G26 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo ~~AIR~~ NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 12-28-81

Test Title IR AND CONTINUITY - BASELINE FUNCTIONAL

IR TAKEN between each conductor AND conductors tied to ground at 500VDC.

Conductor	Resistance	Continuity
A	$1.0 \times 10^{12}\ \Omega$	ok
B	$1.4 \times 10^{12}\ \Omega$	OK
C	$9.0 \times 10^{11}\ \Omega$	OK
D	$60 \times 10^{11}\ \Omega$	OK
E	$1.0 \times 10^{12}\ \Omega$	OK
F	$4.0 \times 10^{11}\ \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By Date: 12-28-81
Witness Date:
Sheet No. of
Approved

WH-614A

APPENDIX IV-III

ISOMEDIX RADIATION EXPOSURE REPORT

ISOMEDIX

February 5, 1982

Mr. Jim Marconnet
Wyle Labs
7800 Governors Drive West
Huntsville, Ala. 35800

Dear Mr. Marconnet:

This will summarize parameters pertinent to the irradiation of your test specimens, as per your Purchase Order #4-3257-S. This is your Job #45869-02. Specimen description and groupings are on the attached sheet.

Group 1 was exposed to a cobalt 60 gamma source for a period of 379 hours at a nominal dose rate of 0.55 megarade per hour. The calculated dose based on dosimetry was 208 megarads. Halfway through the exposure, the specimen was rotated 180 degrees to give a more uniform dose distribution.

Group II was exposed to a cobalt 60 gamma source for a period of 271 hours at a nominal dose rate of 0.77 megarade per hour. The calculated dose based on dosimetry was 208 megarades. Halfway through the exposure, the specimens were rotated 180 degrees to give a more uniform dose distribution.

Dosimetry was performed using Harwell Red 4034 Perspex dosimeters, utilizing a Bausch and Lomb Model 710 spectrophotometer as the readout instrument. This system is calibrated directly with NBS, with the last readout calibration being September 08,1981. A copy of the dosimetry correlation report is available upon request.

Irradiation was conducted in air at ambient temperature and pressure. Radiant heat from the source heated the specimens somewhat, but the temperature did not exceed 120 degrees F, as indicated by previous measurements on an oil solution in the same relative position.

Isomedix Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 • (201) 887-2666

Irradiation for Group 1 was initiated on December 31, 1981, and was completed on January 21, 1982.

Irradiation for Group II was initiated on December 31, 1981, and was completed on January 15, 1982.

Very truly yours,

ISOMEDIX, INC.

David P Constantine

David P. Constantine
Production Manager

DC/mjb

Enclosure

WYLE LABORATORIES
7800 Governors Drive West
Huntsville, Alabama
A. C. 205 — 837-4411

Test Specimens Nº 4- 10267

SHIPPING MEMORANDUM

ISOMEDIX
80 South Jefferson Road
Whippany, New Jersey 07981

DATE December 14, 1981
JOB NO. 45869-02
YOUR P. O. NO. N/A
AUTHORIZED BY H. Smith
ATTENTION OF George Dietz

ROUTING: FC ☐ SD ☐ PP ☐ UPS ☐ RAIL ☐ AIR ☐ EXP. ☐ FRT. ☐ OT ☐ OTHER ____

INSURANCE: $50.00 ☐ $100.00 ☐ $200.00 ☐ $500.00 ☐ OTHER ____ MARKING: FRAGILE ☐ THIS SIDE UP ☐

OTHER SHIPPING INSTRUCTIONS Wyle Truck PREPAID ☒ COLLECT ☐

ITEM	QUANTITY	DESCRIPTION		
		Test Specimens for Irradiation		
1	1	Penetration Unit		
2	23	Cables		
		C32P1009G06 (1) C32P1010G01 (1) C32P1010G01 (2) C32P1010G02 (2) C32P1010G02 (1) C32P1009G06 (2) C32P1009G01 (1) C32P1009G01 (2) C32P1004G07 (2) C32P1004G07 (1) C32P1004G08 (1) C32P1004G08 (2) C32P1002G08 (2) C32P1002G08 (1) C32P1002G07 (1) C32P1002G07 (2) C32P1003G26 (1) C32P1003G25 (1) C32P1003G25 (2) C32P1015G02 (1) C32P1015G01 (2) C32P1015G01 (1) C32P1003G26 (2)		
3	1	Box containing 20 Grommets and one connector		
		THIS IS AN ACKNOWLEDGMENT COPY PLEASE SIGN AND RETURN. REC'D BY ____ DATE ____		

ACKNOWLEDGMENT

SECTION V

ELECTRICAL FUNCTIONAL TEST (AFTER RADIATION EXPOSURE)

1.0 PROCEDURE

This Electrical Functional Test was conducted per the same procedure as the Baseline Functional Test of Section III, but was conducted after radiation exposure and before final assembly of the components by Duke Power Company personnel.

2.0 RESULTS

The insulation resistance of all conductors was greater than 100 megohms and all circuits exhibited continuity. See Appendix V-I for detailed data taken during the Functional Test.

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APPENDIX V-I

POST IRRADIATION BASELINE TEST

DATA SHEET

Page No. V-4
Report No. 45869-1

WYLE LABORATORIES

Customer: DUKE POWER
Specimen: PENETRATION.
Part No.: —
Spec.: —
Para.: —
S/N: —
GSI: NO

Amb. Temp.: 74°
Photo: NO
Test Med.: A.R
Specimen Temp.: Amb

Job No.: 45869-02-8119
Report No.:
Start Date: 2-4-82

Test Title: Post Radiation Functional

I.R. TAKEN between Conductor AND All other Conductors to Ground @ 500 VDC

	A	B	C	D	E	F
A	$40 \times 10^9 \Omega$	$10 \times 10^9 \Omega$	$0.6 \times 10^9 \Omega$	$60 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$60 \times 10^9 \Omega$
B	$8 \times 10^9 \Omega$	$6 \times 10^9 \Omega$	$1.0 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$80 \times 10^9 \Omega$
C	$20 \times 10^9 \Omega$	$14 \times 10^9 \Omega$	$1.0 \times 10^9 \Omega$	$65 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$10 \times 10^9 \Omega$
D		$13 \times 10^9 \Omega$		$90 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$50 \times 10^9 \Omega$
E		$7 \times 10^9 \Omega$		$50 \times 10^9 \Omega$	$60 \times 10^9 \Omega$	$50 \times 10^9 \Omega$
F		$7 \times 10^9 \Omega$		$70 \times 10^9 \Omega$	$70 \times 10^9 \Omega$	$70 \times 10^9 \Omega$
G				$50 \times 10^9 \Omega$	$70 \times 10^9 \Omega$	$15 \times 10^9 \Omega$
H				$70 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$60 \times 10^9 \Omega$
I				$50 \times 10^9 \Omega$	$60 \times 10^9 \Omega$	$60 \times 10^9 \Omega$
J				$90 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$70 \times 10^9 \Omega$
K				$90 \times 10^9 \Omega$	$60 \times 10^9 \Omega$	$50 \times 10^9 \Omega$
L				$80 \times 10^9 \Omega$	$50 \times 10^9 \Omega$	$60 \times 10^9 \Omega$
M						$60 \times 10^9 \Omega$
N						$60 \times 10^9 \Omega$

Specimen Failed
Specimen Passed
NOA Written

Tested By: G. DRAKE Date: 2-4-82
Witness: Date:
Sheet No.: of 25
Approved:

WH-614A

DATA SHEET

Page No. V-5
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Pentration
Part No. –
Spec. –
Para. –
S/N –
GSI NO

Amb. Temp. 74°F
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-07
Report No.
Start Date 2-3-8

Test Title Post Radiation Functional Continuity

Pin	A	B	C	D	E
A	ok	ok	ok	ok	ok
B	ok	ok	ok	ok	ok
C	ok	ok	ok	ok	ok
D		ok		ok	ok
E		ok		ok	ok
F		ok		ok	ok
G				ok	ok
H				ok	ok
I				ok	ok
J				ok	ok
k				ok	ok
L				ok	ok
M					
N					

Specimen Failed
Specimen Passed
NOA Written

Tested By C Oulene Date: 2-3
Witness Date:
Sheet No. 2 of 25
Approved H Smith

WH-614A

DATA SHEET

Page No. V-6
Report No. 45869-1

WYLE LABORATORIE

Customer Duke Power
Specimen Cable
Part No. C32P1010G01-2
Spec. -
Para. -
S/N -
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-0
Report No.
Start Date 2-3-8

Test Title Post Radiation Functional

I.R. taken between each conductor and all other conductors to ground @ 500VDC

Conductor	I.R.	Continui
A	$1.4 \times 10^{12} \Omega$	Ok
B	$1.5 \times 10^{12} \Omega$	Ok
C	$2.0 \times 10^{12} \Omega$	Ok
D	$1.2 \times 10^{12} \Omega$	Ok
E	$1.0 \times 10^{12} \Omega$	Ok
F	$1.0 \times 10^{12} \Omega$	Ok
G	$0.9 \times 10^{12} \Omega$	Ok
H	$1.0 \times 10^{12} \Omega$	Ok
I	$1.0 \times 10^{12} \Omega$	Ok
J	$1.0 \times 10^{12} \Omega$	Ok
K	$1.0 \times 10^{12} \Omega$	Ok
L	$1.0 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-4
Witness Date:
Sheet No. 3 of 2
Approved

WH-614A

DATA SHEET

Page No. V-7
Report No. 45869-1

WYLE LABORATORI

Customer DUKE POWER
Specimen CAbLes
Part No. C32P1004G06-2
Spec. - -
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-
Report No.
Start Date 2-3-82

Test Title POST RAdiAtION FUNCtIONAL

IR tAKEN between conductor AND ALL othE
conductor tied to GROUND At 500VDC

CONductoR	IR	CONtINUIty
A	$0.1 \times 10^{12} \Omega$	OK
B	$0.12 \times 10^{12} \Omega$	OK
C	$0.1 \times 10^{12} \Omega$	OK
D	$0.1 \times 10^{12} \Omega$	OK
E	$0.1 \times 10^{12} \Omega$	OK
F	$0.1 \times 10^{12} \Omega$	OK
G	$0.1 \times 10^{12} \Omega$	OK
H	$0.1 \times 10^{12} \Omega$	OK
I	$0.1 \times 10^{12} \Omega$	OK
J	$0.1 \times 10^{12} \Omega$	OK
K	$0.1 \times 10^{12} \Omega$	OK
L	$0.1 \times 10^{12} \Omega$	OK
M	$0.1 \times 10^{12} \Omega$	OK
N	$0.1 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2-
Witness Date:
Sheet No. 4(of 2
Approved H Smith

WH-614A

DATA SHEET

Page No. V-8
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1010G02 (1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72°F
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-0
Report No.
Start Date 2-3-82

Test Title POST RADIATION FUNCTIONAL

IR TAKEN between CONDUCTORS AND ALL OTHER CONDUCTORS tied to GROUND AT 500VDC.

CONDUCTOR	IR	CONTINUIT
A	$0.8 \times 10^{12} \Omega$	OK
B	$0.6 \times 10^{12} \Omega$	OK
C	$0.5 \times 10^{12} \Omega$	OK
D	$0.5 \times 10^{12} \Omega$	OK
E	$0.6 \times 10^{12} \Omega$	OK
F	$0.6 \times 10^{12} \Omega$	OK
G	$0.6 \times 10^{12} \Omega$	OK
H	$0.4 \times 10^{12} \Omega$	OK
I	$0.7 \times 10^{12} \Omega$	OK
J	$0.4 \times 10^{12} \Omega$	OK
K	$0.5 \times 10^{12} \Omega$	OK
L	$0.5 \times 10^{12} \Omega$	OK
		OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2-3
Witness Date:
Sheet No. 5 of 23
Approved H Smith

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DATA SHEET

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1004G08-1
Spec. –
Para. –
S/N –
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-82

Test Title Post Radiation Functional

I.R. taken between each conductor and all other conductors to ground @ 500 VDC

Conductor	I.R.	Continuity
A.	$3.0 \times 10^{12}\ \Omega$	Ok
B.	$2.8 \times 10^{12}\ \Omega$	Ok
C.	$2.8 \times 10^{12}\ \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-4
Witness Date:
Sheet No. 6 of 25
Approved H Smith

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DATA SHEET

Page No. V-10
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1003G26-2
Amb. Temp. 74°
Spec. —
Photo
Para. —
Test Med. Air
S/N —
Specimen Temp. Amb
GSI NO
Job No. 45869-02-2
Report No.
Start Date 2-3-82

Test Title Post Radiation Functional

I.R. taken between each conductor and all other conductors to ground @ 500 VDC

Conductor	I.R.	Continuity
A	$0.8 \times 10^{12} \Omega$	OK
B	$0.9 \times 10^{12} \Omega$	OK
C	$0.3 \times 10^{12} \Omega$	OK
D	$0.3 \times 10^{12} \Omega$	OK
E	$0.5 \times 10^{12} \Omega$	OK
F	$0.3 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-
Witness Date:
Sheet No. 7 of 25
Approved H Smith

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DATA SHEET

Page No. V-11
Report No. 45869-1

WYLE LABORATORIES

Customer Duke power
Specimen Cable
Part No. C32P1003G26-1
Spec. -
Para. -
S/N -
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-82

Test Title Post Radiation Functional

I.R. taken between Each Conductor and all other Conductors to Ground @ 500VDC

Conductor	IR	Continuity
A	$0.3 \times 10^{12} \Omega$	Ok
B	$0.3 \times 10^{12} \Omega$	Ok
C	$0.2 \times 10^{12} \Omega$	Ok
D	$0.3 \times 10^{12} \Omega$	Ok
E	$0.4 \times 10^{12} \Omega$	Ok
F	$0.5 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-8
Witness Date:
Sheet No. 8 of 25
Approved H Smith

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DATA SHEET

Page No. V-12
Report No. 45869-1

WYLE LABORATORIES

Customer DukE PowER
Specimen CAblE
Part No. C321009G06 (2)
Spec. –
Para. –
S/N –
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-02-8
Report No.
Start Date 2-3-82

Test Title Post Radiation Functional

I.R. taken between each Conductor and all other Conductors to Ground @ 500VDC

Conductor	I.R.	Continuit
A	$450 \times 10^9 \Omega$	OK
B	$406 \times 10^9 \Omega$	OK
C	$450 \times 10^9 \Omega$	OK
D	$300 \times 10^9 \Omega$	OK
E	$300 \times 10^9 \Omega$	OK
F	$300 \times 10^9 \Omega$	OK
G	$300 \times 10^9 \Omega$	OK
H	200 ~~30~~ $\times 10^9 \Omega$ HOD	OK
I	$200 \times 10^9 \Omega$	OK
J	$150 \times 10^9 \Omega$	OK
K	$200 \times 10^9 \Omega$	OK
L	$150 \times 10^9 \Omega$	OK
M	$150 \times 10^9 \Omega$	OK
N	$150 \times 10^9 \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Deake Date: 2-3-
Witness Date:
Sheet No. 9 of 25
Approved H Smith

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DATA SHEET

Page No. V-13
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1010G01-1
Amb. Temp. 74°
Job No. 45869-02
Spec. -
Photo
Report No.
Para. -
Test Med. Air
Start Date 2-3-82
S/N -
Specimen Temp. Amb
GSI NO

Test Title Post Radiation Functional

I.R. taken between each conductor and all other conductors to ground @ 500 VDC

Conductor	I.R.	Continuity
A	$0.3 \times 10^{12} \Omega$	Ok
B	$0.4 \times 10^{12} \Omega$	Ok
C	$0.3 \times 10^{12} \Omega$	Ok
D	$0.2 \times 10^{12} \Omega$	Ok
E	$0.2 \times 10^{12} \Omega$	Ok
F	$0.2 \times 10^{12} \Omega$	Ok
G	$0.2 \times 10^{12} \Omega$	Ok
H	$0.3 \times 10^{12} \Omega$	Ok
I	$0.4 \times 10^{12} \Omega$	Ok
J	$0.3 \times 10^{12} \Omega$	Ok
K	$0.4 \times 10^{12} \Omega$	Ok
L	$0.3 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-
Witness Date:
Sheet No. 10 of 25
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATOR

Customer Duke Power
Specimen Cable
Part No. C32P1003G25-1
Spec. –
Para. –
S/N –
GSI NA

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-C
Report No.
Start Date 2-3-

Test Title Post Radiation Functional

I.R. taken between each Conductor and other Conductors to Ground @ 500VDC

Conductor	I R	Contin
A	$0.8 \times 10^{12} \Omega$	O
B	$0.8 \times 10^{12} \Omega$	Ok
C	$0.6 \times 10^{12} \Omega$	Ok
D	$0.3 \times 10^{12} \Omega$	Ok
E	$0.4 \times 10^{12} \Omega$	Ok
F	$0.3 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date:
Witness Date:
Sheet No. 11 of
Approved H Smith

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DATA SHEET

Page No. V-15
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1002G08-2
Spec. –
Para. –
S/N –
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-8:

Test Title Post Radiation Functional

I.R. taken between Each Conductor and other Conductor to Ground @ 500VDC

Conductor	I.R.	Continuity
A.	$2.0 \times 10^{12} \Omega$	ok
B.	$2.0 \times 10^{12} \Omega$	ok
C.	$2.0 \times 10^{12} \Omega$	ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-
Witness Date:
Sheet No. 10 of 25
Approved H Smith

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DATA SHEET

Page No. V-16
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1004G08-2
Amb. Temp. 74°
Job No. 45869-02-8
Spec. –
Photo
Report No.
Para. –
Test Med. Air
Start Date 2-3-82
S/N –
Specimen Temp. Amb
GSI NO

Test Title Post Radiation Functional

I.R. taken between each conductor and all other conductors to ground @ 500VDC

Conductor	IR	Continuity
A.	$0.3 \times 10^{12} \Omega$	Ok
B.	$0.4 \times 10^{12} \Omega$	ok
C.	$0.4 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written
Tested By G. Drake Date: 2-3-8
Witness Date:
Sheet No. 13 of 25
Approved H Smith

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DATA SHEET

Page No. V-17
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power

Specimen CAble

Part No. C32P1002G08-1

Amb. Temp. 74°

Job No. 45869-02-

Spec. —

Photo

Report No.

Para. —

Test Med. AiR

Start Date 2-3-82

S/N —

Specimen Temp. Amb

GSI No

Test Title POST RADIATION FUNCTIONAL

I.R. taken between Each Conductor And All other Conductors to Ground @500VDC

CONductor	I.R.	CONTINUIT
A.	$1.5 \times 10^{12}\Omega$	OK
B.	$1.5 \times 10^{12}\Omega$	OK
C.	$1.5 \times 10^{12}\Omega$	OK

Specimen Failed

Specimen Passed

NOA Written

Tested By G. DRAKE Date: 2-3-

Witness Date:

Sheet No. 14 of 25

Approved

DATA SHEET

Page No. V-18
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1002607-1
Spec. -
Para. -
S/N -
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. amb

Job No. 45869-0
Report No.
Start Date 2-3-82

Test Title Post Radiation Functional

I.R. taken between each conductor and all other conductors to ground @ 500VDC

Conductor	IR	Continuity
A	$0.3 \times 10^{12} \Omega$	ok
B	$0.4 \times 10^{12} \Omega$	ok
C	$0.4 \times 10^{12} \Omega$	ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3
Witness Date:
Sheet No. 15 of 25
Approved H Smith

WH-614A

DATA SHEET

C

Page No. V-19
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1004G07-2
Spec. -
Para. -
S/N -
GSI NO

Amb. Temp. 74°
Photo
Test Med. Air
Specimen Temp. Amb

Job No. 45869.02-8119
Report No.
Start Date 2-3-82

Test Title Post Radiation Functional

I.R. Taken between Each Conductor And All other Conductors To Ground @ 500VDC

Conductor	I.R.	Continuity
A.	$0.3 \times 10^{12} \Omega$	Ok
B.	$0.3 \times 10^{12} \Omega$	Ok
C.	$0.3 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-82
Witness Date:
Sheet No. 16c of 25
Approved H Smith

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C

DATA SHEET

Page No. V-20
Report No. 45869-1

WYLE LABORATORIES

Customer Duke Power
Specimen Cable
Part No. C32P1004G07-1
Spec. –
Para. –
S/N –
GSI NO

Amb. Temp. 74°
Photo
Test Med. AiR
Specimen Temp. Amb

Job No. 45869-02-811
Report No.
Start Date 2-3-82

Test Title POST Radiation Functional

I.R. taken between Each Conductor And All other Conductors to Ground @ 500VDC

Conductor	I.R.	Continuity
A.	$0.3 \times 10^{12} \Omega$	Ok
B.	$0.4 \times 10^{12} \Omega$	Ok
C.	$0.3 \times 10^{12} \Omega$	Ok

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-82
Witness Date:
Sheet No. 17 of 25
Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIE

Customer DUKE POWER

Specimen CAble

Part No. C32P1009G06 (1)

Amb. Temp. 72

Job No. 45869-0

Spec. --

Photo NO

Report No.

Para. --

Test Med. AIR

Start Date 2-3-82

S/N --

Specimen Temp. Amb

GSI NO

Test Title Post RAdiAtion FUNCtional

IR takEN between conductor AND ALL otHER CoNductors tied to GROUNd At 500VDC

Conductor	IR	CONtINUity
A	$0.13 \times 10^{12} \Omega$	OK
B	$0.2 \times 10^{12} \Omega$	OK
C	$0.24 \times 10^{12} \Omega$	OK
D	$0.2 \times 10^{12} \Omega$	OK
E	$0.2 \times 10^{12} \Omega$	OK
F	$0.2 \times 10^{12} \Omega$	OK
G	$0.24 \times 10^{12} \Omega$	OK
H	$0.2 \times 10^{12} \Omega$	OK
I	$0.2 \times 10^{12} \Omega$	OK
J	$0.2 \times 10^{12} \Omega$	OK
K	$0.2 \times 10^{12} \Omega$	OK
L	$0.1 \times 10^{12} \Omega$	OK
M	$0.1 \times 10^{12} \Omega$	OK
N	$0.15 \times 10^{12} \Omega$	OK

Specimen Failed

Specimen Passed

NOA Written

Tested By G. DRAKE Date: 2-3

Witness Date:

Sheet No. 18 of 25

Approved H Smith

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAble
Part No. C32P1010G02 (2)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AiR
Specimen Temp. Amb

Job No. 45869.02
Report No.
Start Date 2-3-82

Test Title Post RAdiAtion Functional

IR taken between conductor And ALL other conductors tied to GROUND At 500VDC

CONDUCTOR	IR	CONTINUITY
A	$0.15 \times 10^{12} \Omega$	OK
B	$0.3 \times 10^{12} \Omega$	OK
C	$0.3 \times 10^{12} \Omega$	OK
D	$0.35 \times 10^{12} \Omega$	OK
E	$0.3 \times 10^{12} \Omega$	OK
F	$0.3 \times 10^{12} \Omega$	OK
G	$0.3 \times 10^{12} \Omega$	OK
H	$0.3 \times 10^{12} \Omega$	OK
I	$0.3 \times 10^{12} \Omega$	OK
J	$0.3 \times 10^{12} \Omega$	OK
K	$0.2 \times 10^{12} \Omega$	OK
L	$0.3 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2-3
Witness Date:
Sheet No. 19 of 25
Approved

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DATA SHEET

Page No. V-23
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAble
Part No. C32P1009G01 (1)
Spec. - -
Para. - -
S/N - -
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-82

Test Title POST RAdiAtion Functional

IR taken between Conductor And All other Conductors tied to Ground at 500VDC.

Conductor	IR	Continuity
A	$0.2 \times 10^{12} \Omega$	OK
B	$0.15 \times 10^{12} \Omega$	OK
C	$0.2 \times 10^{12} \Omega$	OK
D	$0.2 \times 10^{12} \Omega$	OK
E	$0.2 \times 10^{12} \Omega$	OK
F	$0.15 \times 10^{12} \Omega$	OK
G	$0.2 \times 10^{12} \Omega$	OK
H	$0.17 \times 10^{12} \Omega$	OK
I	$0.2 \times 10^{12} \Omega$	OK
J	$0.15 \times 10^{12} \Omega$	OK
K	$0.15 \times 10^{12} \Omega$	OK
L	$0.15 \times 10^{12} \Omega$	OK
M	$0.15 \times 10^{12} \Omega$	OK
N	$0.2 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-
Witness Date:
Sheet No. 20 of 25
Approved H Smith

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DATA SHEET

Page No. V-24
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAble
Part No. C321003G25 Z)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-82

Test Title POST RAdiation FUNctional

IR taken between conductor AND ALL other conductors tied to GROUND At 500VDC.

Conductor	IR	Continuity
A	$0.7 \times 10^{12} \Omega$	OK
B	$0,8 \times 10^{12} \Omega$	OK
C	$0.5 \times 10^{12} \Omega$	OK
D	$0,3 \times 10^{12} \Omega$	OK
E	$0.6 \times 10^{12} \Omega$	OK
F	$0.6 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2-3-82
Witness Date:
Sheet No. 24 of 25
Approved H. Smith

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DATA SHEET

Page No. V-75
Report No. 45869-1

WYLE LABORATORIE

Customer DUKE POWER
Specimen CAbLe
Part No. C32P1002G07(Q)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AiR
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-82

Test Title Post RAdiAtion FUNCtionAL

IR taken between conductor And ALL other conductors tied to GROUND At 500VDC

Conductor	IR	Continuity
1	$1.4 \times 10^{12} \Omega$	OK
2	$1.4 \times 10^{12} \Omega$	OK
3	$1.3 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2·3
Witness Date:
Sheet No. 226 of 7
Approved H Smith

WH-614A

C

DATA SHEET

Page No. V-26
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAble
Part No. C32P1015G01 (1)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-02
Report No.
Start Date 2-3-82

Test Title Post RAdiAtion Functional

IR taken between each conductor and all other conductors tied to GROUND at 500VDC

Conductor	IR	Continuity
A	$1.4 \times 10^{12} \Omega$	OK
B	$1.2 \times 10^{12} \Omega$	OK
C	$1.2 \times 10^{12} \Omega$	OK
D	$0.7 \times 10^{12} \Omega$	OK
E	$1.0 \times 10^{12} \Omega$	OK
F	$1.4 \times 10^{12} \Omega$	OK
G	$1.6 \times 10^{12} \Omega$	OK
H	$1.0 \times 10^{12} \Omega$	OK
I	$1.0 \times 10^{12} \Omega$	OK
J	$1.2 \times 10^{12} \Omega$	OK
K	$1.5 \times 10^{12} \Omega$	OK
L	$1.2 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. Drake Date: 2-3-8
Witness Date:
Sheet No. 23 of 25
Approved H Smith

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DATA SHEET

C

Page No. V-27
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE POWER
Specimen CABLE
Part No. C32P1015G02 (Z)
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-02-8115
Report No.
Start Date 2-3-81

Test Title BASELINE FUNCTIONAL POST RADIATION

IR taken between conductor and ALL other conductors tied to GROUND at 500VDC

CONDUCTOR	IR	CONTINUITY
A	$0.6 \times 10^{12} \Omega$	OK
B	$1.5 \times 10^{12} \Omega$	OK
C	$1.4 \times 10^{12} \Omega$	OK
D	$1.2 \times 10^{12} \Omega$	OK
E	$1.5 \times 10^{12} \Omega$	OK
F	$1.2 \times 10^{12} \Omega$	OK
G	$1.4 \times 10^{12} \Omega$	OK
H	$1.2 \times 10^{12} \Omega$	OK
I	$1.2 \times 10^{12} \Omega$	OK
J	$0.8 \times 10^{12} \Omega$	OK
K	$1.3 \times 10^{12} \Omega$	OK
L	$0.9 \times 10^{12} \Omega$	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2-3-82
Witness Date:
Sheet No. 24 of 25
Approved H Smith

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DATA SHEET

Page No. V-28
Report No. 45869-1

C

WYLE LABORATORIES

Customer DUKE POWER
Specimen CAble
Part No. -32P1615602 (1)
Spec. --
Para. --
S/N -
GSI NO

Amb. Temp. 72
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-02-8119
Report No.
Start Date 2-3-82

Test Title POST RAdiAtion Functional

IR TAKEN between each conductor And ALL other Conductors tied to Ground at 500VDC

Conductor	IR	Continuity
A	1.5 x 10^12 Ω	OK
B	1.5 x 10^12 Ω	OK
C	1.2 x 10^12 Ω	OK
D	1.3 x 10^12 Ω	OK
E	1.4 x 10^12 Ω	OK
F	1.4 x 10^12 Ω	OK
G	1.2 x 10^12 Ω	OK
H	1.2 x 10^12 Ω	OK
I	0.6 x 10^12 Ω	OK
J	1.1 x 10^12 Ω	OK
K	1.0 x 10^12 Ω	OK
L	1.3 x 10^12 Ω	OK

Specimen Failed
Specimen Passed
NOA Written

Tested By G. DRAKE Date: 2-3-82
Witness Date:
Sheet No. 25 of 25
Approved H Smith

SECTION VI

ASSEMBLY OF CABLES/PENETRATION UNIT

1.0 PROCEDURE

Following radiation exposure, the penetration unit was installed into the test chamber dome (containment wall mockup) and the cables connected to both sides of the penetration unit. The assembly work was conducted by Duke Power personnel. A Baseline Electrical Functional Test was conducted on the assembled modules.

2.0 RESULTS

The insulation resistance of all conductors was greater than 100 megohms and all circuits exhibited continuity. See Appendix VI-I for complete data taken during the Functional Test.

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APPENDIX VI-I

BASELINE TEST AFTER ASSEMBLY OF CABLES TO PENETRATION UNIT

DATA SHEET

WYLE LABORATORIES

Customer DUKE POWER

Specimen CAble

Part No. module C&F

Spec. --

Para. --

S/N --

GSI NO

Amb. Temp. 74

Photo NO

Test Med. AIR

Specimen Temp. Amb

Job No. 43869.03

Report No.

Start Date 3-18-82

Test Title PRE-LOCA HIGH POTENtIAL TEST

1000VAC Applied between each conductor AND GROUND FOR 1 minute

WIRE	LEAKAGE module C	LEAKAGE module F
A	420 uAmps	335 uAmps
B	420 uAmps	335 uAmps
C	420 uAmps	345 uAmps

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Calen Date: 3-18-82

Witness Date:

Sheet No. of

Approved

WH-614A

DATA SHEET

Page No. VI-5
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE
Specimen CAbLe
Part No. module L
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 74
Photo NO
Test Med. AiR
Specimen Temp. Amb.

Job No. 45869-03
Report No.
Start Date 3-18-82

Test Title PRE-LOCA FUNCtIONAL

CONtINUity AND IR. IR WAS tAKEN between wire AND ALL OtHER wires tied to GROUND At 500VDC.

WIRE	CONtINUity	IR
A	OK	$2.0 \times 10^{8} \Omega$
B	OK	$5.0 \times 10^{8} \Omega$
C	OK	$1.2 \times 10^{10} \Omega$
D	OK	$1.1 \times 10^{11} \Omega$
E	OK	$3.0 \times 10^{8} \Omega$
F	OK	$7.0 \times 10^{8} \Omega$
G	OK	$1.6 \times 10^{11} \Omega$
H	OK	$9.0 \times 10^{10} \Omega$
I	OK	$3.5 \times 10^{10} \Omega$
J	OK	$1.0 \times 10^{11} \Omega$
K	OK	$1.5 \times 10^{9} \Omega$
L	OK	$7.4 \times 10^{10} \Omega$

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 3-18-82
Witness Date:
Sheet No. of
Approved

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE

Specimen CAbLe

Part No. Module K

Spec. --

Para. --

S/N --

GSI NO

Amb. Temp. 74

Photo NO

Test Med. AIR

Specimen Temp. Amb

Job No. 45869-03

Report No.

Start Date 3-18-82

Test Title PRE-LOCA FUNCTIONAL

CONTINUITY AND IR. IR WAS TAKEN between WIRE AND ALL OTHER WIRES tied to GROUND AT 500VDC

WIRE	CONTINUITY	IR
A	OK	$8.6 \times 10^{9}\,\Omega$
B	OK	$9.0 \times 10^{9}\,\Omega$
C	OK	$5.0 \times 10^{10}\,\Omega$
D	OK	$8.0 \times 10^{10}\,\Omega$
E	OK	$7.6 \times 10^{9}\,\Omega$
F	OK	$1.2 \times 10^{8}\,\Omega$
G	OK	$7.2 \times 10^{10}\,\Omega$
H	OK	$6.0 \times 10^{10}\,\Omega$
I	OK	$5.2 \times 10^{10}\,\Omega$
J	OK	$6.8 \times 10^{10}\,\Omega$
K	OK	$6.2 \times 10^{10}\,\Omega$
L	OK	$5.0 \times 10^{10}\,\Omega$
M	OK	$6.2 \times 10^{10}\,\Omega$
N	OK	$4.0 \times 10^{9}\,\Omega$

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert Coleman Date: 3-18-82

Witness Date:

Sheet No. of

Approved H Smith

WH-614A

DATA SHEET

Page No. VI-7
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE
Specimen CABLE
Part No. module F
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 74
Photo NO
Test Med. AiR
Specimen Temp. Amb.

Job No. 45869-03
Report No.
Start Date 3-17-82

Test Title PRE-LOCA FUNCTIONAL

CONTINUITY AND IR IR WAS TAKEN between WIRE AND ALL OTHER WIRES tied to GROUND At 500VDC.

WIRE	CONTINUITY	IR
A	OK	$1.0 \times 10^9 \Omega$
B	OK	$1.4 \times 10^8 \Omega$
C	OK	$2.0 \times 10^9 \Omega$

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 3-17-82
Witness Date:
Sheet No. of
Approved H Small

WH-614A

DATA SHEET

Page No. VI-8
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE
Specimen CAbLes
Part No. module c
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 74
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 3-17-82

Test Title PRE-LOCA FUNCTIONAL

CONTINUITY AND IR. IR taken between wire and all other wires tied to GROUND at 500VDC.

WIRE	CONTINUITY	IR
A	OK	$2.2 \times 10^{10} \Omega$
B	OK	$2.5 \times 10^{10} \Omega$
C	OK	$1.6 \times 10^{10} \Omega$

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Colan Date: 3-17-82
Witness Date:
Sheet No. of
Approved H Smeld

WH-614A

DATA SHEET

WYLE LABORATORIES

Customer DUKE

Specimen CAbles

Part No. module D

Spec. - -

Para. - -

S/N - -

GSI NO

Amb. Temp. 74

Photo NO

Test Med. AIR

Specimen Temp. Amb

Job No. 45869

Report No.

Start Date 3-17-82

Test Title PRE-LOCA Functional

CONTINUITY AND IR: IR WAS taken between wire AND ALL OTHER wires tied to GROUND At 500VDC

WIRE	CONTINUITY	IR
A	OK	$1.1 \times 10^{10}\,\Omega$
B	OK	$2.0 \times 10^{10}\,\Omega$
C	OK	$2.4 \times 10^{10}\,\Omega$
D	OK	$6.0 \times 10^{9}\,\Omega$
E	OK	$2.8 \times 10^{10}\,\Omega$
F	OK	$1.5 \times 10^{10}\,\Omega$

Specimen Failed

Specimen Passed

NOA Written

Tested By Robert R Colem Date: 3-17-82

Witness Date:

Sheet No. of

Approved

WH-614A

DATA SHEET

Page No. VI-10
Report No. 45869-1

WYLE LABORATORIES

Customer DUKE
Specimen CAble
Part No. module E
Spec. --
Para. --
S/N --
GSI NO

Amb. Temp. 74
Photo NO
Test Med. AIR
Specimen Temp. Amb

Job No. 45869-03
Report No.
Start Date 3-17-82

Test Title PRE-LOCA FUNCTIONAL

CONTINUITY AND IR. IR WAS TAKEN between WIRE AND ALL OTHER WIRES tied to GROUND at 500VDC

WIRE	CONTINUITY	IR
A	OK	$1.5 \times 10^{10} \Omega$
B	OK	$4.0 \times 10^{10} \Omega$
C	OK	$1.7 \times 10^{10} \Omega$
D	OK	$1.3 \times 10^{10} \Omega$
E	OK	$1.3 \times 10^{10} \Omega$
F	OK	$2.0 \times 10^{10} \Omega$
G	OK	$1.8 \times 10^{10} \Omega$
H	OK	$1.8 \times 10^{10} \Omega$
I	OK	$2.8 \times 10^{10} \Omega$
J	OK	$1.8 \times 10^{10} \Omega$
K	OK	$1.3 \times 10^{10} \Omega$
L	OK	$3.5 \times 10^{10} \Omega$

Specimen Failed
Specimen Passed
NOA Written

Tested By Robert R Coleman Date: 3-17-82
Witness Date:
Sheet No. of
Approved

WH-614A

SECTION VII

ACCIDENT TEST

1.0 PROCEDURE

1.1 Test Arrangement

Steam Chamber

A steam chamber as shown in Figure VII-1 of Appendix VII-I was used for the Accident Test. The wall mockup was bolted to the chamber. Penetrations for six (6) cables and twenty-five (25) thermocouple wires were provided at the opposite end of the chamber from the wall mockup. Superheated steam and/or saturated steam, as required, was introduced into the chamber from the end of the chamber opposite the wall mockup. A manifold distributed steam evenly across the end of the chamber. Chemical spray was provided along the top of the chamber and a chamber drain was provided at the bottom of the chamber.

Annulus Mockup

An environmental chamber was erected around the penetration mounting and wall mockup. This chamber was supplied with heating and/or cooling, as required, to maintain the specified annulus temperature. Cables supplied by Duke Power Company were routed from the electric penetration test specimen through the environmental chamber wall to a junction panel located outside of the environmental chamber.

Instrumentation

Forty-five (45) temperature measurements were made using Type K thermocouples and were located as shown in Table VII-I of Appendix VII-I. Chamber pressure and thermocouple measurements No. 2, 6, 10, 18, 19, and 20 were recorded at the following sample rates:

1 sample/second for the first 5 minutes.
1 sample/minute from T = 5 minutes to T = 150 minutes.
1 sample/15 minutes from T = 150 minutes to T = 60 hours.
1 sample/hour from T = 60 hours until T = 7 days.

The voltage and current at modules C, D, E, F, and L; the leakage current at module K; and the remaining 39 thermocouples, as shown in Table VII-I of Appendix VII-I were recorded at the following sample rates:

1 sample/minute for the first 150 minutes.
1 sample/15 minutes from T = 150 minutes until T = 60 hours.
1 sample/hour from T = 60 hours until T = 7 days.

1.0 PROCEDURE (Continued)

1.1 Test Arrangement

Chemical Spray Composition

The chemical spray solution for the first 30 minutes of the Accident Test was made from potable water by adding sufficient quantities of Boric Acid to provide 210C ppm of Boron. The chemical spray solution for the rest of the Accident Test was made from potable water with 1922 ppm of Boron as Boric Acid and NaOH were added as required to maintain the pH between 6.0 and 10.0. New batches of the chemical spray solution were made up at least once every 4 days and replaced the old chemical spray solutions.

Test Specimen Electrical Power

The conductors of Modules C, D, E, F, and L were wired in series to form six (6) current loops. Each loop was independently energized to the voltage and current specified in Table VII-I of Appendix VII-I, using the polarization voltage method as shown in Figure VII-2. The conductors of Module K were energized at 120 volts and zero amps.

1.2 Accident Test Sequence and Procedure

The accident test was conducted in the following sequence and manner:

1. A Baseline Electrical Test was conducted just before admitting steam to the chamber.

2. The chamber was heated internally to 120°F with a forced air heater.

3. Electrical power was applied to Modules C, D, E, F, L, and K as shown in Figure VII-2 of Appendix VII-I. The electrical power was applied throughout the 7-day Accident Test, except during the brief periods when insulation resistance readings were taken.

4. Steam was introduced into the chamber to maintain the temperature-pressure-time profile shown in Figure VII-3, Appendix VII-II. The annulus mockup temperature was maintained as shown in Figure VII-4, Appendix VII-II.

5. At 10 seconds after initiation of the steam ramp, chemical spray solution flow was initiated and the flow maintained throughout the Accident Test. The flow was directed vertically downward at a flow rate of 0.15 gallon/minute/ft.^{2} of specimen area or specifically 0.75 gallon/minute.

1.0 PROCEDURE (Continued)

1.2 Accident Test Sequence and Procedure (Continued)

6. Insulation resistance, as described in paragraph 1.1 of Section III, and a high potential test of Modules C and F conductors at 1000 VAC were conducted when the chamber temperature was stabilized at 300°F, at 250°F, and at 8 hours after start of the steam ramp; at 16 hours, at 24 hours, and when the temperature was stabilized at 228°F. Subsequently, insulation resistance and high potential tests were conducted on a daily basis during the 7-day Accident Test.

7. The electrical tests of paragraph 6 were repeated at the end of the 7-day test, after the modules had cooled to room temperature, but prior to their removal from the chamber.

1.3 Results

1.3.1 Summary

The required electrical power was maintained throughout the 7-day Accident Test except for periods when leakage current exceeded 0.5 amps and blew 0.5 amp fuses on Modules C, E, and L, involving a total of 5 conductors out of a total of 50.

The required Accident Test steam pressure-temperature profile was maintained within tolerance throughout the 7-day Accident Test with the exception of excursions occurring at time zero and at 2 hours after start of the initial steam ramp.

1.3.2 Electrical Results

The Functional Test results of the insulation resistance measurements are summarized in Tables VII-I through VII-VI of Appendix VII-III. The required applied voltage and current per Table VII-I, Appendix VII-I, was maintained throughout the 7-day Accident Test with the following exceptions:

Module C

Leakage current exceeded 0.5 amps (blew 0.5 amp fuse) at approximately 142 hours after start of the Accident Test. The problem was isolated to Conductor No. 3, which was removed from the circuit and power re-established to the remaining conductors of Module C. Conductor No. 3 was placed back in the circuit on the seventh day, but the 0.5 amp fuse blew in approximately 23 minutes. On the seventh day, water droplets were observed forming at the cable splice of Module C, which indicated steam was being

1.0 PROCEDURE (Continued)

1.3.2 Electrical Results (Continued)

Module C (Continued)

forced through the cable (along the wire, between insulation and conductor). This indicated a strong possibility of a break in the cable insulation somewhere inside the accident chamber. As these cables had been subjected to accelerated thermal aging and radiation, the necessary handling and flexing during installation could have produced a crack in the insulation.

Module D

Just prior to start of the steam ramp, at time zero, Conductor No. 4 had an insulation resistance of $2.2X10^7$ ohms at 500 volts DC. See Notice of Anomaly No. 5, Appendix VII-II.

Module E

Leakage current exceeded 0.5 amps (blew 0.5 amp fuse) at approximately 84 hours (4th day). The problem was isolated to Conductor No. 1, which was removed from the circuit and power re-established to the remaining conductors. At approximately 144 hours, Conductor No. 1 was replaced in the circuit and power re-established until the end of test.

Water was observed at Conductor No. 6 splice at approximately 96 hours (4th day). See water discussion, Module C. Leakage current exceeded 0.5 amps (blew fuse) at approximately 168 hours (7th day). The problem was isolated to Conductor No. 6 which was removed from the circuit for the remaining few hours of the test.

Module L

Leakage current exceeded 0.5 amps (blew 0.5 amp fuse) at approximately 25.5 hours. The problem was isolated to Conductor No. 9, which was removed from the circuit and power re-established to the remaining conductors of the module. At approximately 34 hours, the fuse blew again and the problem was isolated to Conductor No. 8, which was removed and power re-established to the remaining conductors. No attempt was made to re-establish power to Conductors 8 and 9 until at 144 hours. At this time, Conductors 8 and 9 were placed back in the circuit and power was maintained until end of test.

See Notice of Anomaly No. 6, Appendix VII-II, for more information on electrical problems. The times shown in Notice of Anomaly No. 6 are not as precise as those shown in the above discussion, which reflects a more detailed inspection of the data.

1.0 PROCEDURE (Continued)

1.3.2 Electrical Results (Continued)

Module L (Continued)

No problems were encountered with Modules D, F, and K.

1.3.3 Environmental Results

Chemical Spray

Chemical spray solution flowrate and pH were monitored daily. The flowrate was maintained at 0.75 gallon/minute and the pH maintained between 6 and 10.

Steam

The required Accident Test steam pressure-temperature profile, Figure VII-3 of Appendix VII-I, was maintained within tolerance throughout the 7-day Accident Test with the exception of excursions occurring at time zero and at 2 hours after start of the initial steam ramp. These excursions are discussed in more detail in Notice of Anomaly Nos. 3 and 4, Appendix VII-II.

Chamber pressure and all temperature measurements are shown in plotted format in Appendix VII-III.

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APPENDIX VII-I

ACCIDENT TEST SCHEMATIC AND TEST SET-UP PHOTOGRAPHS

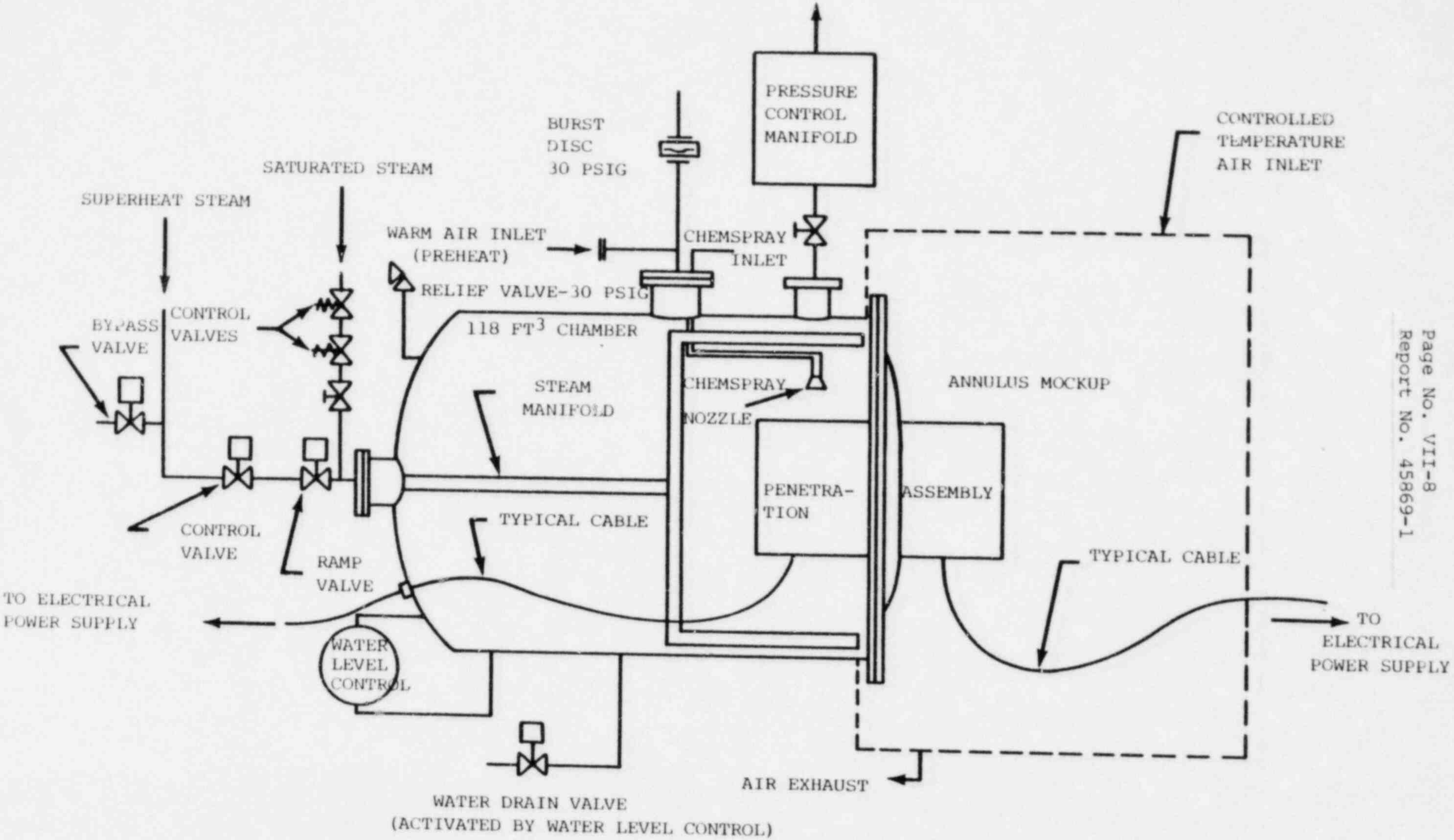


FIGURE VII-1. ACCIDENT TEST SCHEMATIC

The method utilized for the application of polarization voltage and high current to the test items is described in the following paragraphs.

- The required test currents are produced by current transformers, isolated to produce loop current through the test items.
- The required polarization voltages are produced by high-voltage transformers, isolated to produce polarization voltages between the test items and the ground plane.
- Polarization voltage is applied with the source polarization power supply. in the event leakage current exceeds a specified amount, the line fuse is blown, indicating that test item degradation has occurred.
- The required current loads are monitored electrically for indications of test item discontinuities.
- All test items requiring the same current and voltage will be connected in series with terminations exterior to the test chamber.

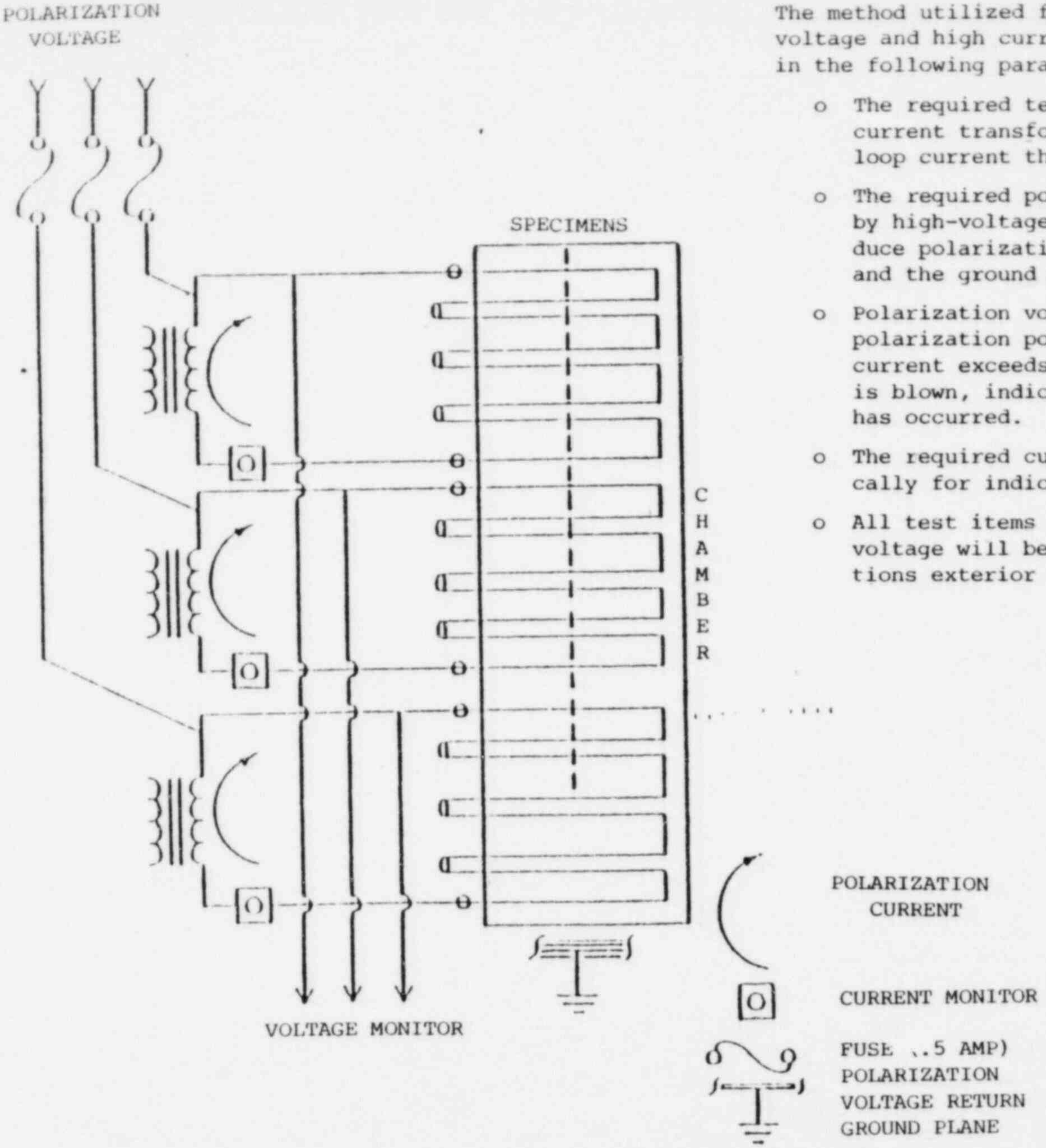
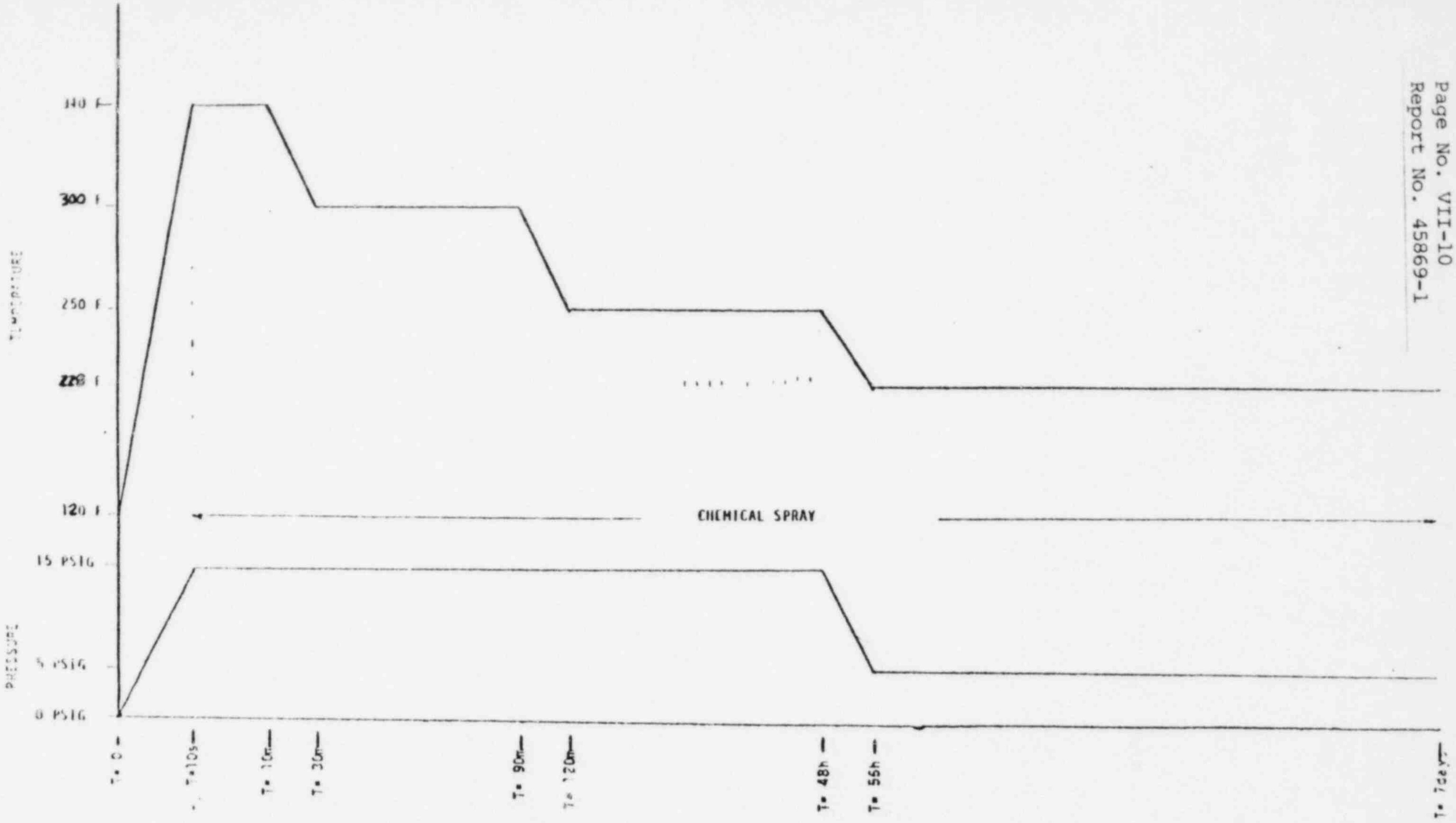
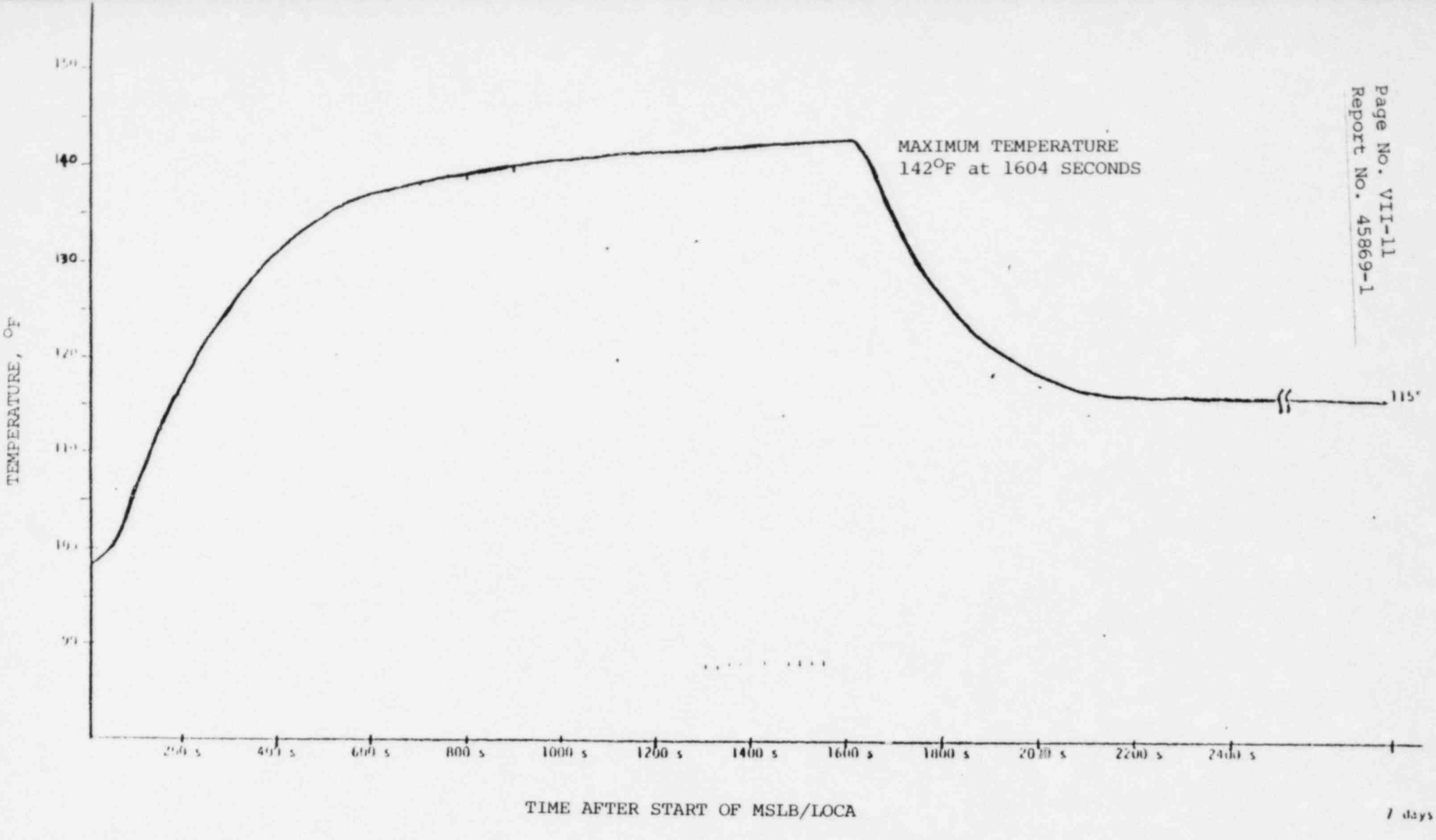


FIGURE VII-2. SPECIMEN ELECTRICAL CONVERTERS



NOTE:
1) All steady state temperatures shall be as shown, +10°, -0°F.
2) Peak pressure shall not exceed 25 psig.
3) Steady state pressure for superheat regions shall be as shown +8°, -0°F.
4) For 250°F and below, the pressure shall follow the saturation curve for the temperature.
5) It is permissible for the initial 10-second ramp to extend out to 30 seconds.

FIGURE VII-3. ENVIRONMENTAL TEST PROFILE INSIDE CONTAINMENT



MAXIMUM TEMPERATURE
142°F at 1604 SECONDS

NOTE: 1) The test temperature profile shall be as close to the above profile as practical during the transient.
2) After 2400 seconds, the test temperature shall be within +15°F, -0°F.

FIGURE VII-4. ANNULUS TEMPERATURE PROFILE COMBINED MSLB/LOCA

TABLE VII-I

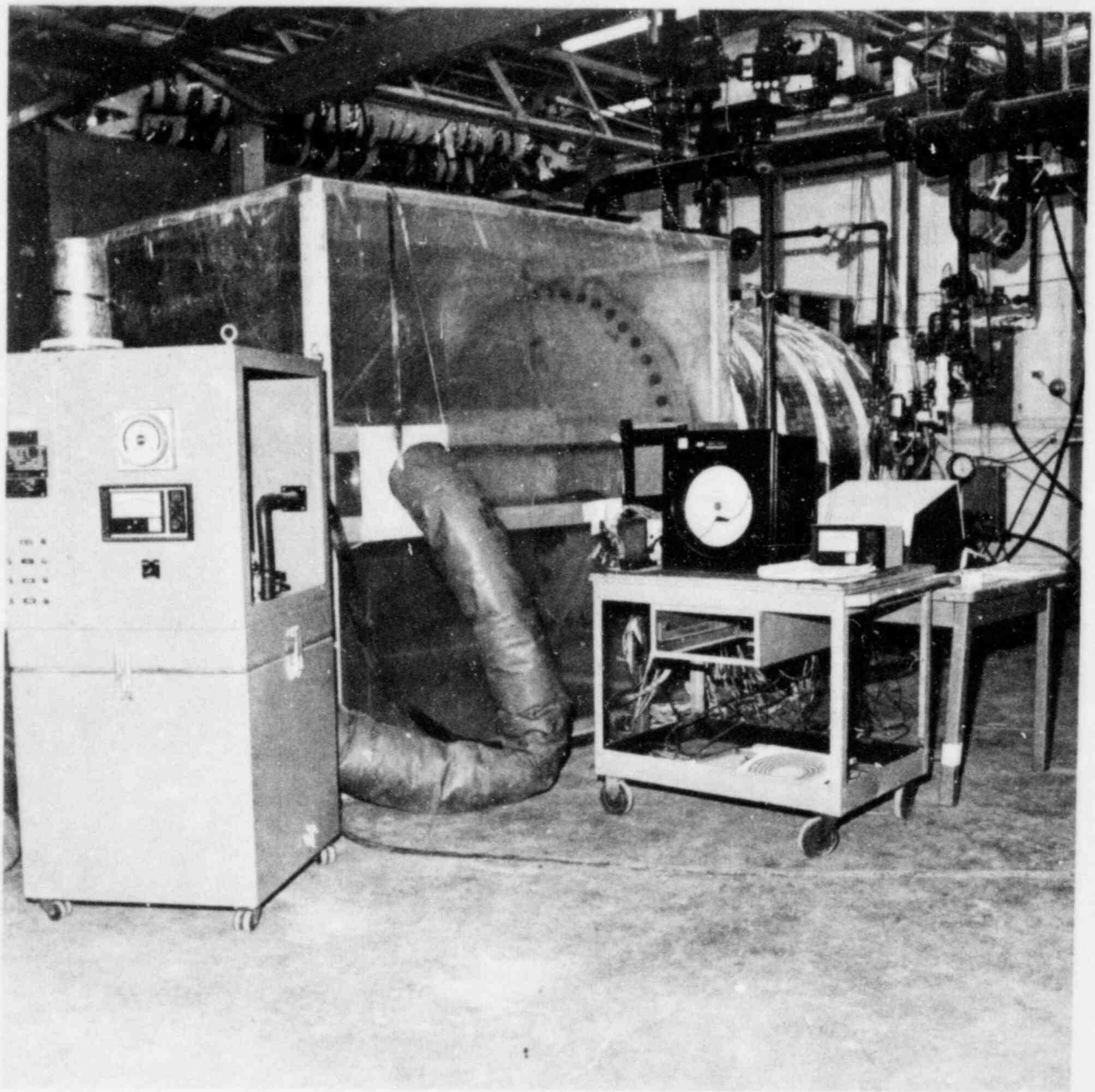
MODULE ELECTRICAL REQUIREMENTS

MODULE	CONDUCTOR	VOLTAGE	CURRENT
C	1	600 VAC	150 Amps (± 10 amps)
	2	600 VAC	0 Amps
	3	600 VAC	150 Amps
D	1	600 VAC	25 Amps (± 2 amps)
	2	600 VAC	25 Amps
	3	600 VAC	50 Amps (± 3 amps)
	4	600 VAC	50 Amps
	5	600 VAC	25 Amps
	6	600 VAC	25 Amps
E	1	600 VAC	15 Amps (± 2 amps)
	2	600 VAC	15 Amps
	3	600 VAC	15 Amps
	4	600 VAC	15 Amps
	5	600 VAC	15 Amps
	6	600 VAC	15 Amps
	7	600 VAC	15 Amps
	8	600 VAC	15 Amps
	9	600 VAC	15 Amps
	10	600 VAC	15 Amps
	11	600 VAC	15 Amps
	12	600 VAC	15 Amps
F	1	600 VAC	30 Amps (± 3 amps)
	2	600 VAC	0 Amps
	3	600 VAC	30 Amps
K	1	120 VAC	0
	2	120 VAC	0
	3	120 VAC	0

TABLE VII-I (CONTINUED)

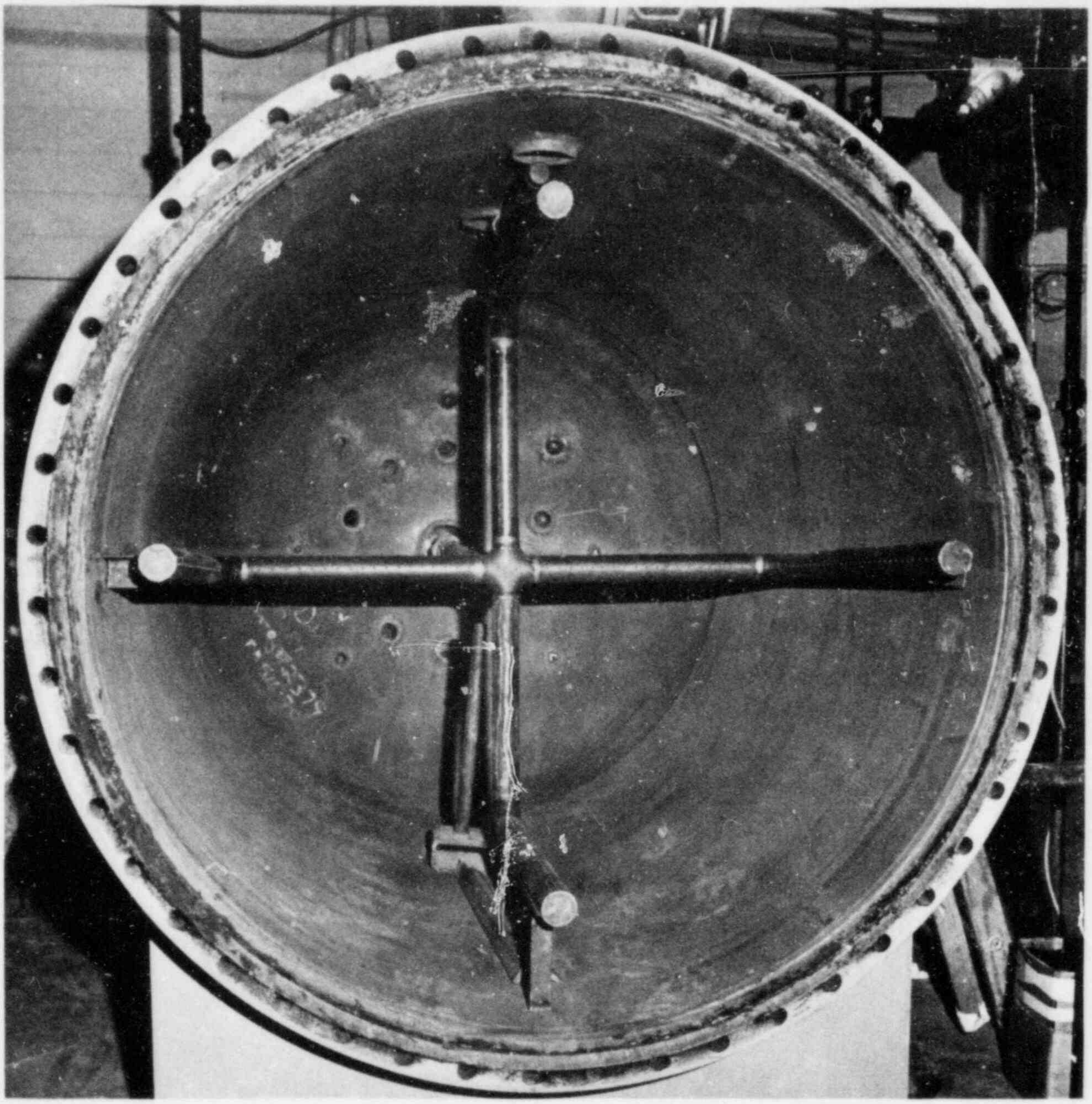
MODULE	CONDUCTOR	VOLTAGE	CURRENT
K	4	120 VAC	0
	5	120 VAC	0
	6	120 VAC	0
	7	120 VAC	0
	8	120 VAC	0
	9	120 VAC	0
	10	120 VAC	0
	11	120 VAC	0
	12	120 VAC	0
	13	120 VAC	0
	14	120 VAC	0
L	1	600 VAC	5 Amps (± 1 amp)
	2	600 VAC	5 Amps
	3	600 VAC	5 Amps
	4	600 VAC	5 Amps
	5	600 VAC	5 Amps
	6	600 VAC	5 Amps
	7	600 VAC	5 Amps
	8	600 VAC	5 Amps
	9	600 VAC	5 Amps
	10	600 VAC	5 Amps
	11	600 VAC	5 Amps
	12	600 VAC	5 Amps

NOTE: Tolerance on 600 VAC is ± 10V, and on 120 VAC ± 5 VAC Tolerances on currents are noted above and applied to each conductor requiring that ampacity.



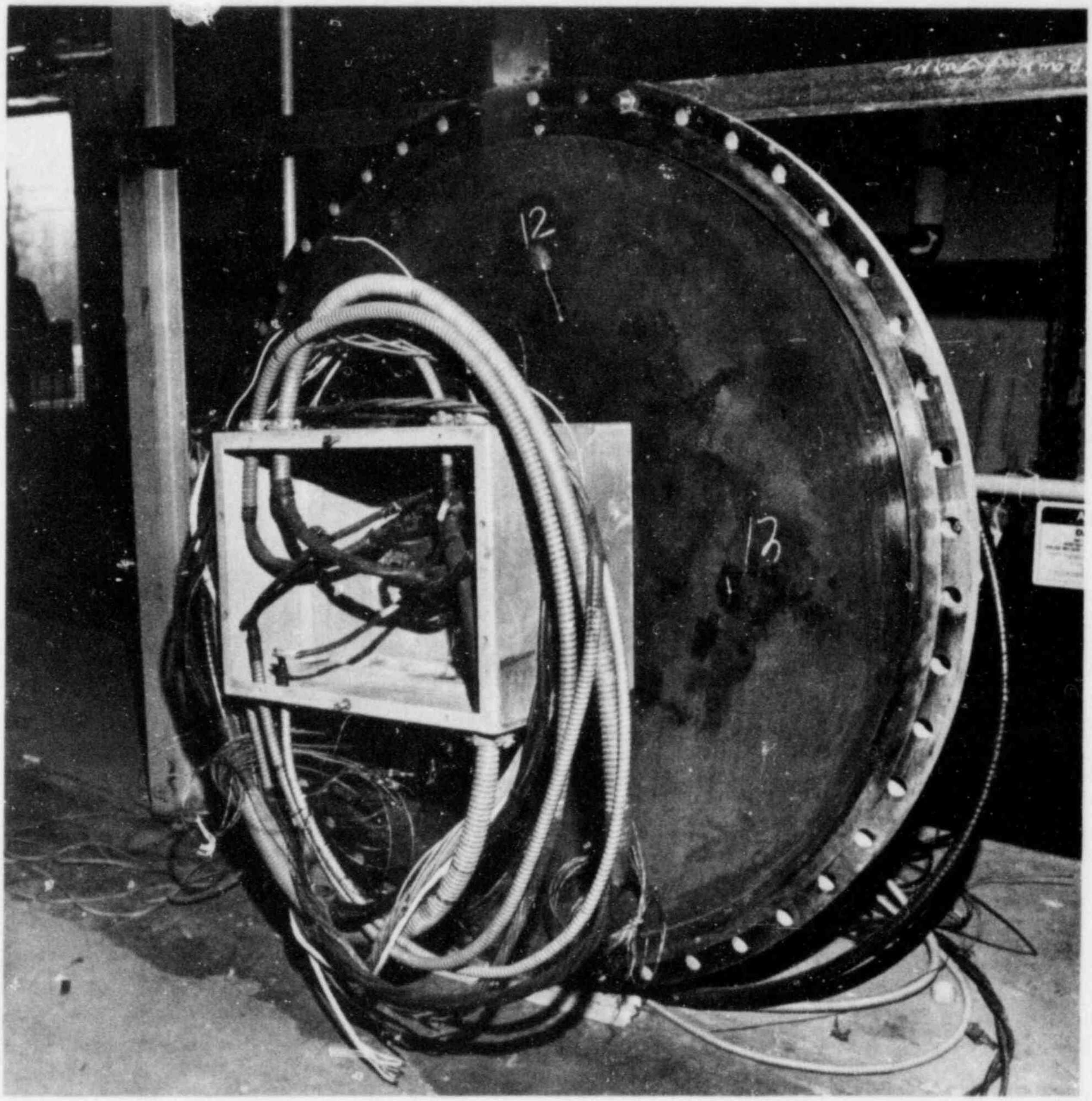
PHOTOGRAPH VII-1

TEST SETUP SHOWING ANNULUS MOCKUP



PHOTOGRAPH VII-2

STEAM MANIFOLD

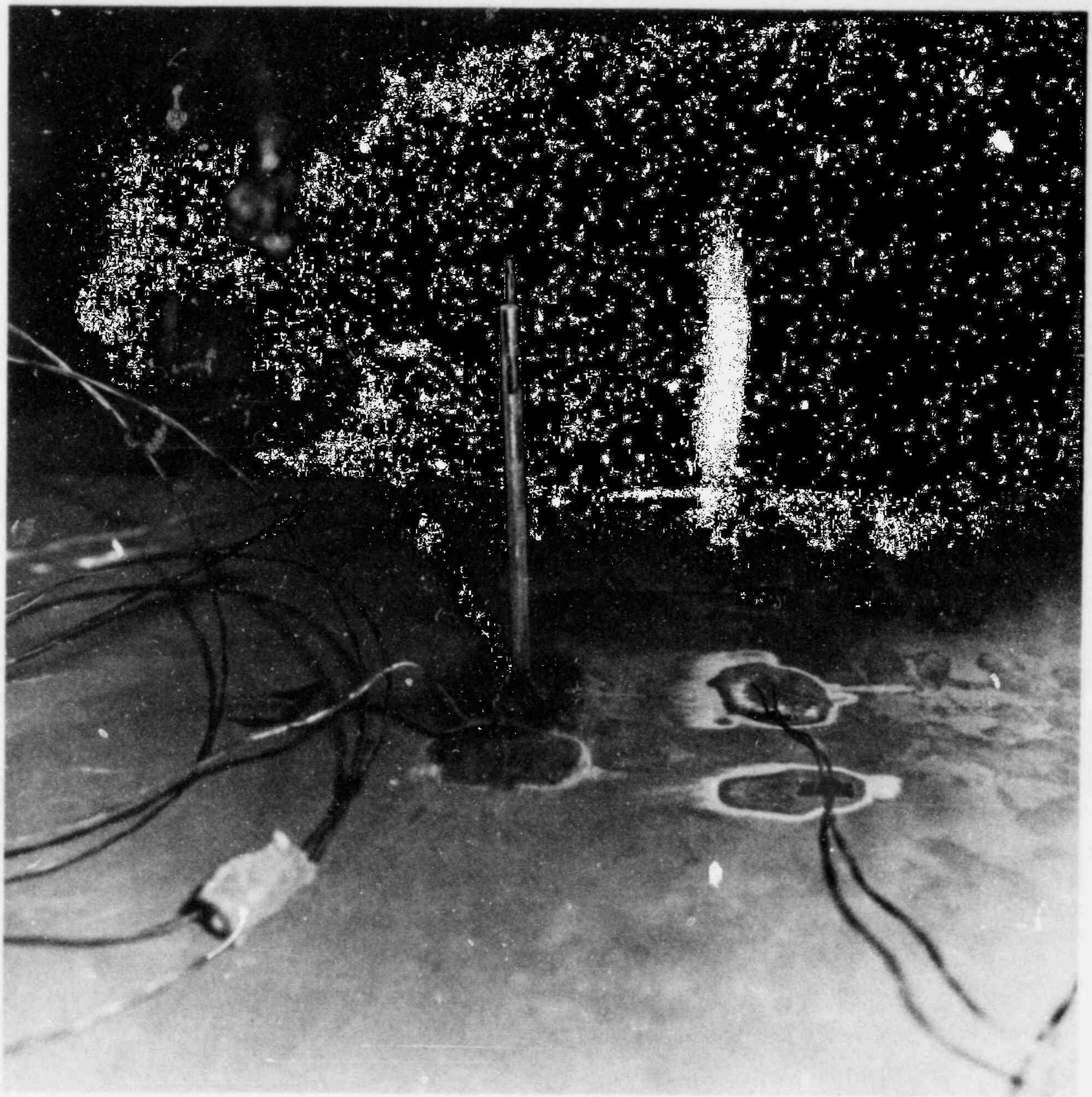


PHOTOGRAPH VII-3

INBOARD SIDE OF PENETRATION UNIT AND
THERMOCOUPLES NO. 12 AND 13

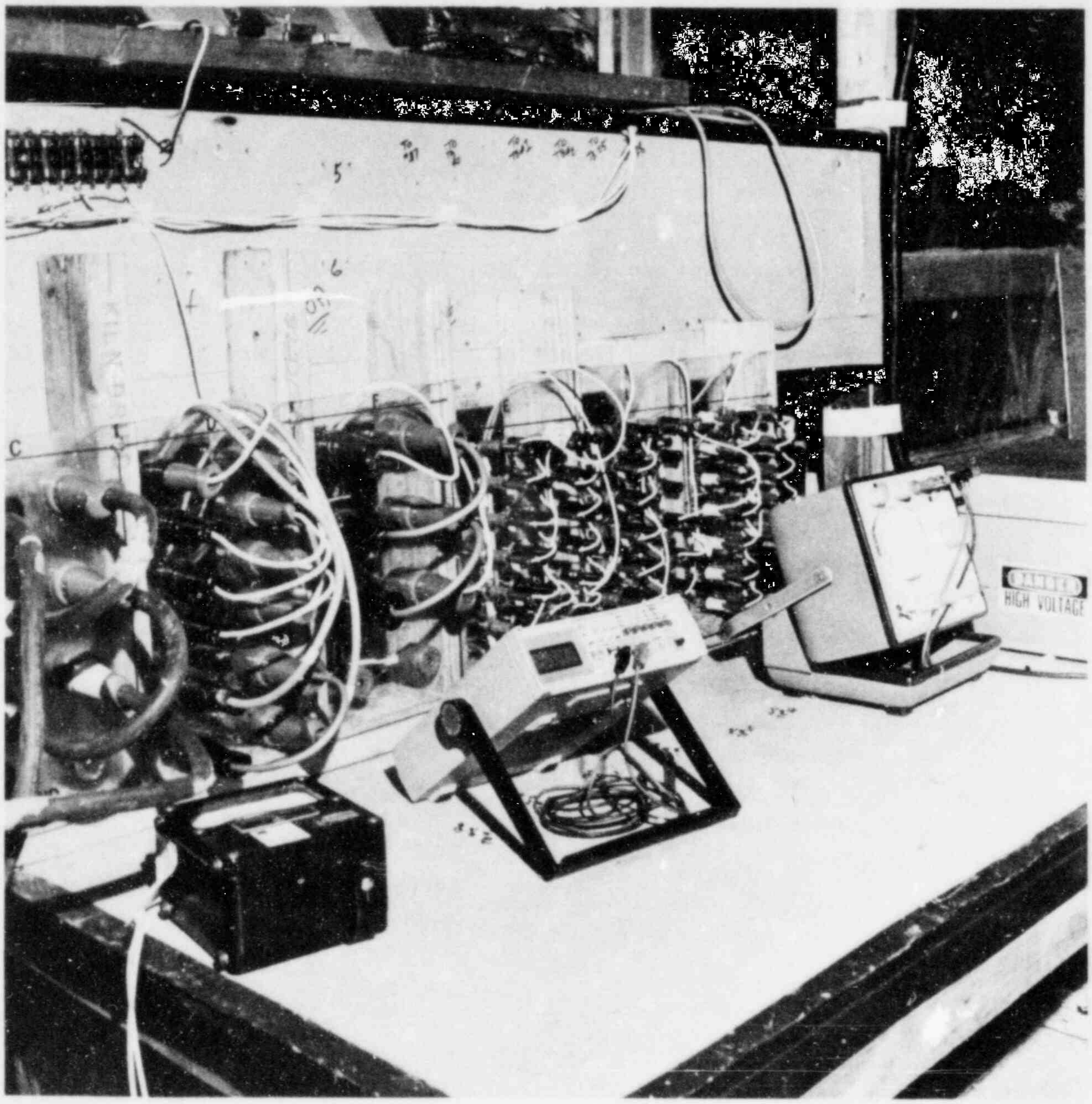
PHOTOGRAPH VII-4

DETAIL OF THERMOCOUPLE NO. 12 INSTALLATION



PHOTOGRAPH VII-5

DETAIL OF THERMOCOUPLE NO. 18 INSTALLATION
(TYPICAL OF THERMOCOUPLES NO. 19 AND 20)



PHOTOGRAPH VII-6

ELECTRICAL MONITORING TABLE

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APPENDIX VII-II

NOTICES OF ANOMALY

WYLE LABORATORIES (Eastern Operations)

NOTICE OF ANOMALY

DATE: 3-29-82

NOTICE NO: 3 P.O. NUMBER: 8828.05-3PM CONTRACT NO: N/A

CUSTOMER: Duke Power Company WYLE JOB NO: 45869

NOTIFICATION MADE TO: Paul McBride NOTIFICATION DATE: 3-24-82

NOTIFICATION MADE BY: H. Smith VIA: Verbal

CATEGORY: ☐ SPECIMEN ☐ PROCEDURE ☒ TEST EQUIPMENT DATE OF ANOMALY: 3-24-82

PART NAME: LOCA System PART NO. N/A

TEST: LOCA I.D. NO. N/A

SPECIFICATION: WLTP 543/6124-2/DK, Rev. B PARA. NO. 3.8.4.1, 3.8.11

REQUIREMENTS:

The environment chamber shall be initially heated to 120°F using heated forced air. The first steam transient shall be from 120°F to 340°F in 10 seconds.

DESCRIPTION OF ANOMALY:

The chamber air temperature was approximately 200°F just prior to initiation of the first temperature transient (340° in 10 seconds) and not 120°F.

DISPOSITION · COMMENTS · RECOMMENDATIONS:

The higher than specified temperature was due to slight leakage into the chamber through the exhaust system valves which were apparently subjected to a back pressure from the superheat bypass flow connected to common exhaust piping. Consequently, the 340°F ramp was initiated at 200°F and not 120°F. By extrapolating the ramp data back to 120°F, the ramp time from 120°F to 340°F was 8 seconds, well below the required time of 10 seconds.

VERIFICATION:

TEST WITNESS: —

REPRESENTING: —

QUALITY ASSURANCE: B. N. Hollingsworth

PROJECT ENGINEER: H. Smith

PROJECT MANAGER: Herschel Jordan

INTERDEPARTMENTAL COORDINATION:

WYLE Form WH 1065, Rev. Jan. 81

Page 1 of 1

WYLE LABORATORIES (Eastern Operations)

NOTICE OF ANOMALY

DATE: 3-29-82

NOTICE NO: 4 P.O. NUMBER: 8828.05-3PM CONTRACT NO: N/A

CUSTOMER: Duke Power Company WYLE JOB NO: 45869

NOTIFICATION MADE TO: Paul McBride NOTIFICATION DATE: 3-24-82

NOTIFICATION MADE BY: H. Smith VIA: Verbal

CATEGORY: ☐ SPECIMEN ☐ PROCEDURE ☒ TEST EQUIPMENT DATE OF ANOMALY: 3-24-82

PART NAME: LOCA System PART NO. N/A

TEST: LOCA I.D. NO. N/A

SPECIFICATION: WLTP 543/6124-2/DK, Rev. B PARA. NO. 3.8.11

REQUIREMENTS:

The chamber shall be maintained at a saturation condition of 250°F and 15 psig beginning at 120 minutes into the LOCA Test.

DESCRIPTION OF ANOMALY:

At approximately 120 minutes into the LOCA Test, the chamber pressure decayed from 15 psig to zero over a 19-minute period and chamber air temperature decayed to 210°F.

DISPOSITION · COMMENTS · RECOMMENDATIONS:

The problem was due to improper wiring of the saturation system inlet solenoid valves. The wiring error was corrected, steam flow initiated, and chamber conditions brought within specification. The internal chamber metal temperatures and specimen metal temperatures dropped a maximum of 5 degrees, indicating minimal thermal changes to the specimen during the 19-minute period.

The test was continued with Customer concurrence.

VERIFICATION:

PROJECT ENGINEER: H Smith

TEST WITNESS: —

PROJECT MANAGER: Herschel Jordan

REPRESENTING: —

INTERDEPARTMENTAL COORDINATION:

QUALITY ASSURANCE:

WYLE LABORATORIES (Eastern Operations)

NOTICE OF ANOMALY

DATE: 4-12-82

NOTICE NO: 5 P.O. NUMBER: 8828.05-3PM CONTRACT NO: N/A

CUSTOMER: Duke Power Company WYLE JOB NO: 45869

NOTIFICATION MADE TO: J. Tannery NOTIFICATION DATE: 3-24-82

NOTIFICATION MADE BY: H. Smith VIA: Verbal

CATEGORY: ☒ SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE OF ANOMALY: 3-24-82

PART NAME: Module D PART NO. ---

TEST: Insulation Resistance I.D. NO. ---

SPECIFICATION: WLTP 543/6124-2/DK, Rev. B PARA. NO. 3.7.2

REQUIREMENTS:

The insulation resistance (I.R.) of each conductor and all other conductors tied to ground shall be 100 megohms or greater at an applied voltage of 500 VDC.

DESCRIPTION OF ANOMALY:

Just prior to the start of the LOCA test, Conductor No. 4 of Module D had an I.R. of $2.2x10^7$ ohms at 500 volts DC.

DISPOSITION · COMMENTS · RECOMMENDATIONS:

Per Customer direction, no changes were made and the LOCA test was initiated.

VERIFICATION:

TEST WITNESS: —

REPRESENTING: —

QUALITY ASSURANCE: B.N. Hollingsworth

PROJECT ENGINEER: H Smith

PROJECT MANAGER: Herschel Jordan

INTERDEPARTMENTAL COORDINATION: MJ Lee

WYLE LABORATORIES (Eastern Operations)

NOTICE OF ANOMALY

DATE: 4-13-82

NOTICE NO.: 6 P.O. NUMBER: 8828.05-3PM CONTRACT NO: N/A

CUSTOMER: Duke Power Company WYLE JOB NO: 45869

NOTIFICATION MADE TO: J. Tannery NOTIFICATION DATE: See Below

NOTIFICATION MADE BY: H. Smith VIA: Verbal and Telecon

CATEGORY: ☒ SPECIMEN ☐ PROCEDURE ☐ TEST EQUIPMENT DATE OF ANOMALY: See Below

PART NAME: Modules C, E, L PART NO. ---

TEST: Electrical Functional during LOCA I.D. NO. ---

SPECIFICATION: WLTP 543/6124-2/DK PARA. NO. 2.4.2

REQUIREMENTS:

Electrical circuit integrity shall be maintained during and after the LOCA test. Leakage current shall be monitored with a 0.5 amp fuse.

DESCRIPTION OF ANOMALY:

The following conductors exhibited leakage current in excess of 0.5 amp (blew 0.5 amp fuse) during the LOCA test:

Module	Conductor	Time, after start of LOCA, Hours	Date of Anomaly	Date of Notification
L	9	27	3-25-82	3-25-82
L	8	45	3-26-82	3-26-82
E	1	94	3-28-82	3-28-82
C	3	142	3-30-82	3-30-82
E	6	167	3-31-82	3-31-82

DISPOSITION · COMMENTS · RECOMMENDATIONS:

All of the above conductors were jumpered out of the circuits when the fuses were found blown and power was then reapplied to the remaining conductors of the affected modules. At the completion of LOCA testing and after the LOCA chamber had cooled to ambient conditions, the leakage current was less than 0.5 amp. A post-test circuit investigation was inconclusive in precisely locating the current leakage. It is not presently known if the current leakage was located in the penetration unit, which is the test specimen, or in the cabling used to complete the circuit in the LOCA chamber. Power was restored to some of the above circuits periodically during the test.

Further analysis and tests are planned to determine if the current leakage was in the penetration unit or the cables, or both.

VERIFICATION:

TEST WITNESS: —

REPRESENTING: —

QUALITY ASSURANCE: B.M. Hollingsworth

PROJECT ENGINEER: H Smith

PROJECT MANAGER: Herschel Jordan

INTERDEPARTMENTAL COORDINATION: NJ

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APPENDIX VII-III

TABULATED ELECTRICAL DATA AND TEST DATA PLOTS

TABLE VII-I. MODULE C ELECTRICAL DATA DURING ACCIDENT TEST

INSULATION RESISTANCE, OHMS

CONDUCTOR	TIME, FROM START OF STEAM RAMP													
	ZERO 3-24	40 MIN. 300°F 3-24	2 HOURS 250°F 3-24	8 HOURS 250°F 3-24	16 HOURS 250°F 3-25	24 HOURS 250°F 3-25	48 HOURS 250°F 3-26	58 HOURS 228°F 3-26	72 HOURS 228°F 3-27	96 HOURS 228°F 3-28	120 HOURS 228°F 3-29	144 HOURS 228°F 3-30	168 HOURS 228°F 3-31	192 HOURS 70°F 4-1
1	$7.0X10^{9}$	$5.0X10^{8}$	$9.0X10^{7}$	$1.4X10^{8}$	$1.3X10^{8}$	$1.2X10^{8}$	$4.5X10^{7}$	$4.5X10^{7}$	$1.2X10^{8}$	$2.0X10^{7}$	$1.8X10^{7}$	$1.7X10^{7}$	$1.8X10^{7}$	$4.5X10^{7}$
2	$8.6X10^{8}$	$1.3X10^{8}$	$1.0X10^{8}$	$1.3X10^{8}$	$1.0X10^{8}$	$7.5X10^{7}$	$3.0X10^{7}$	$2.6X10^{7}$	$3.0X10^{7}$	$1.8X10^{7}$	$1.5X10^{7}$	$1.5X10^{7}$	$8.6X10^{6}$	$3.5X10^{7}$
3	$1.0X10^{9}$	$2.0X10^{8}$	$1.5X10^{8}$	$1.6X10^{8}$	$4.0X10^{7}$	$2.0X10^{7}$	$4.0X10^{7}$	$3.5X10^{7}$	$1.8X10^{7}$	$1.6X10^{7}$	$1.5X10^{7}$	$1.9X10^{7}$ (1)	$3.0X10^{6}$ (2)	$9.8X10^{7}$ (3)
	HIGH POTENTIAL TEST, MICROAMPS													
1	485	490	675	2300	700	700	700	700	700	700	700	5000	750	430
2	600	510	700	750	700	700	700	700	700	700	700	5000	725	450
3	600	510	675	800	680	700	700	700	700	1200	700	5000	5000	435

(1) Blew .5 amp fuse at approximately 142 hours. Removed Conductor No. 3 from circuit.

(2) Blew .5 amp fuse when Conductor 3 was placed back in circuit. Replaced fuse; blew 23 minutes later. Removed conductor from circuit.

(3) Splice on Wire No. 3 (located between test table and inboard side of chamber) had water dripping at splice.

TABLE VII-II. MODULE D ELECTRICAL DATA DURING LOCA TEST

INSULATION RESISTANCE, OHMS

CONDUCTOR	TIME, FROM START OF STEAM RAMP													
	ZERO 3-24	40 MIN. 300°F 3-24	2 HOURS 250°F 3-24	8 HOURS 250°F 3-24	16 HOURS 250°F 3-25	24 HOURS 250°F 3-25	48 HOURS 250°F 3-26	58 HOURS 228°F 3-26	72 HOURS 228°F 3-27	96 HOURS 228°F 3-28	120 HOURS 228°F 3-29	144 HOURS 228°F 3-30	168 HOURS 228°F 3-31	192 HOURS 70°F 4-1
1	$2.2X10^{9}$	$9.3X10^{7}$	$9.4X10^{7}$	$8.0X10^{7}$	$3.8X10^{7}$	$1.8X10^{7}$	$3.5X10^{7}$	$4.0X10^{6}$	$3.5X10^{6}$	$2.4X10^{6}$	$1.8X10^{6}$	$2.2X10^{6}$	$1.1X10^{6}$	$5.0X10^{7}$
2	$1.5X10^{8}$	$9.6X10^{7}$	$1.0X10^{8}$	$8.6X10^{7}$	$4.6X10^{7}$	$1.4X10^{7}$	$5.0X10^{5}$	$5.6X10^{5}$	$5.6X10^{5}$	$1.2X10^{6}$	$8.6X10^{5}$	$1.0X10^{6}$	$7.0X10^{5}$	$5.0X10^{7}$
3	$5.0X10^{8}$	$8.0X10^{7}$	$8.0X10^{7}$	$4.0X10^{7}$	$3.5X10^{7}$	$2.0X10^{7}$	$3.0X10^{6}$	$1.3X10^{7}$	$1.1X10^{7}$	$6.8X10^{6}$	$6.6X10^{6}$	$7.2X10^{6}$	$5.2X10^{6}$	$5.4X10^{8}$
4	$2.2X10^{7}$	$6.8X10^{7}$	$9.0X10^{7}$	$6.8X10^{7}$	$6.0X10^{7}$	$9.8X10^{6}$	$7.6X10^{6}$	$6.8X10^{6}$	$4.5X10^{6}$	$4.5X10^{6}$	$4.5X10^{6}$	$5.2X10^{6}$	$5.0X10^{6}$	$5.0X10^{7}$
5	$6.6X10^{8}$	$1.4X10^{8}$	$1.5X10^{8}$	$7.0X10^{7}$	$6.3X10^{7}$	$1.9X10^{7}$	$4.5X10^{7}$	$4.5X10^{7}$	$7.6X10^{6}$	$4.5X10^{7}$	$3.5X10^{7}$	$2.3X10^{7}$	$1.2X10^{6}$	$2.6X10^{7}$
6	$7.4X10^{8}$	$1.0X10^{8}$	$1.0X10^{8}$	$6.2X10^{7}$	$6.5X10^{7}$	$2.2X10^{7}$	$1.6X10^{7}$	$8.4X10^{6}$	$7.8X10^{6}$	$7.2X10^{6}$	$1.0X10^{7}$	$7.4X10^{6}$	$6.6X10^{6}$	$1.6X10^{8}$

TABLE VII-III. MODULE E ELECTRICAL DATA DURING ACCIDENT TEST

INSULATION RESISTANCE, OHMS

CONDUCTOR	TIME, FROM START OF STEAM RAMP													
	ZERO 3-24	40 MIN. 300°F 3-24	2 HOURS 250°F 3-24	8 HOURS 250°F 3-24	16 HOURS 250°F 3-25	24 HOURS 250°F 3-25	48 HOURS 250°F 3-26	58 HOURS 228°F 3-26	72 HOURS 228°F 3-27	96 HOURS 228°F 3-28	120 HOURS 228°F 3-29	144 HOURS 228°F 3-30	168 HOURS 228°F 3-31	192 HOURS 70°F 4-1
1	$2.5X10^9$	$2.4X10^8$	$1.3X10^8$	$1.0X10^8$	$2.8X10^7$	$1.3X10^7$	$4.0X10^6$	$8.0X10^6$	$1.0X10^7$	(1,3) $9.0X10^4$	----	$6.8X10^6$ (4)	$5.2X10^6$	$5.2X10^8$
2	$6.0X10^9$	$5.0X10^8$	$2.0X10^8$	$1.3X10^8$	$5.4X10^7$	$1.5X10^7$	$4.0X10^6$	$7.6X10^6$	$1.2X10^7$	$3.5X10^6$	$8.0X10^6$	$4.5X10^6$	$4.5X10^6$	$6.6X10^7$
3	$5.0X10^9$	$5.8X10^8$	$3.0X10^8$	$2.2X10^8$	$1.0X10^8$	$1.5X10^8$	$8.4X10^7$	$8.6X10^7$	$7.6X10^7$	$3.0X10^7$	$7.0X10^7$	$2.4X10^7$	$1.3X10^7$	$5.0X10^7$
4	$3.0X10^9$	$5.0X10^8$	$2.6X10^8$	$4.0X10^8$	$1.4X10^8$	$1.0X10^8$	$3.0X10^7$	$2.2X10^7$	$2.8X10^7$	$1.6X10^7$	$1.3X10^7$	$1.2X10^7$	$6.8X10^6$	$3.5X10^7$
5	$1.8X10^9$	$5.0X10^8$	$2.7X10^8$	$2.4X10^8$	$1.2X10^8$	$6.5X10^7$	$1.4X10^7$	$1.6X10^7$	$1.3X10^7$	$7.8X10^6$	$7.0X10^6$	$6.8X10^6$	$5.4X10^6$	$5.0X10^7$
6	$3.0X10^9$	$4.0X10^8$	$2.4X10^8$	$1.8X10^8$	$7.8X10^7$	$2.5X10^7$	$6.3X10^6$	$1.0X10^7$	$1.1X10^7$	$3.5X10^6$ (2)	$3.5X10^6$	$4.0X10^6$	$2.8X10^6$ (5)	$6.4X10^5$
7	$3.4X10^9$	$5.0X10^8$	$1.9X10^8$	$1.6X10^8$	$8.4X10^7$	$6.2X10^7$	$2.0X10^7$	$2.4X10^7$	$1.6X10^7$	$2.2X10^7$	$2.6X10^7$	$2.2X10^7$	$1.3X10^7$	$1.8X10^7$
8	$4.0X10^9$	$4.0X10^8$	$1.8X10^8$	$2.2X10^8$	$1.1X10^8$	$7.4X10^7$	$3.0X10^7$	$4.5X10^7$	$2.8X10^7$	$6.6X10^6$	$9.0X10^6$	$1.1X10^7$	$1.0X10^7$	$5.6X10^8$
9	$1.25X10^9$	$5.2X10^8$	$2.6X10^8$	$2.0X10^8$	$1.5X10^8$	$8.4X10^7$	$2.4X10^6$	$3.5X10^6$	$3.5X10^6$	$1.8X10^6$	$2.0X10^6$	$3.5X10^6$	$3.5X10^6$	$6.2X10^7$
10	$3.0X10^9$	$5.4X10^8$	$3.5X10^8$	$2.4X10^3$	$5.0X10^7$	$1.8X10^7$	$4.5X10^6$	$9.4X10^6$	$1.5X10^7$	$2.4X10^6$	$6.2X10^6$	$4.5X10^6$	$4.5X10^6$	$5.8X10^7$
11	$3.0X10^9$	$7.2X10^8$	$3.5X10^8$	$4.0X10^8$	$2.8X10^8$	$1.2X10^8$	$2.6X10^7$	$2.6X10^7$	$4.0X10^7$	$1.2X10^7$	$2.0X10^7$	$2.8X10^6$	$1.7X10^7$	$8.2X10^7$
12	$3.0X10^9$	$4.5X10^8$	$1.8X10^8$	$1.3X10^8$	$1.0X10^8$	$9.0X10^6$	$3.0X10^6$	$2.4X10^6$	$3.5X10^7$	$2.0X10^6$	$1.0X10^6$	$2.6X10^6$	$3.5X10^6$	$1.1X10^8$

NOTES:

(1) At 100 volts DC.
(2) Water observed dripping from wire (between conductor and insulation) at splice outside LOCA chamber.
(3) Blew .5 amp fuse at approximately 84 hours, removed conductor from circuit.
(4) Low resistance cleared; replaced conductor back into circuit.
(5) Blew .5 amp fuse at approximately 168 hours, removed conductor from circuit.

TABLE VII-IV. MODULE F ELECTRICAL DATA DURING LOCA TEST

INSULATION RESISTANCE, OHMS

CONDUCTOR	TIME, FROM START OF STEAM RAMP													
	ZERO 3-24	40 MIN. $300^{O}F$ 3-24	2 HOURS $250^{O}F$ 3-24	8 HOURS $250^{O}F$ 3-24	16 HOURS $250^{O}F$ 3-25	24 HOURS $250^{O}F$ 3-25	48 HOURS $250^{O}F$ 3-26	58 HOURS $228^{O}F$ 3-26	72 HOURS $228^{O}F$ 3-27	96 HOURS $228^{O}F$ 3-28	120 HOURS $228^{O}F$ 3-29	144 HOURS $228^{O}F$ 3-30	168 HOURS $228^{O}F$ 3-31	192 HOURS $70^{O}F$ 4-1
1	$1.8X10^{9}$	$1.3X10^{8}$	$1.2X10^{8}$	$1.3X10^{8}$	$7.4X10^{7}$	$2.0X10^{7}$	$6.4X10^{6}$	$1.2X10^{7}$	$1.2X10^{7}$	$2.4X10^{6}$	$4.5X10^{6}$	$5.0X10^{6}$	$1.4X10^{6}$	$5.0X10^{7}$
2	$5.0X10^{9}$	$5.8X10^{7}$	$6.7X10^{7}$	$5.0X10^{7}$	$5.0X10^{7}$	$1.8X10^{7}$	$3.0X10^{6}$	$1.7X10^{7}$	$1.8X10^{6}$	$1.0X10^{6}$	$1.6X10^{6}$	$3.0X10^{6}$	$1.0X10^{6}$	$4.0X10^{7}$
3	$2.0X10^{9}$	$1.5X10^{8}$	$1.2X10^{8}$	$5.2X10^{7}$	$5.8X10^{7}$	$9.0X10^{6}$	$1.1X10^{7}$	$1.4X10^{7}$	$8.4X10^{6}$	$7.6X10^{6}$	$6.6X10^{6}$	$8.6X10^{6}$	$6.2X10^{6}$	$2.4X10^{7}$
	HIGH POTENTIAL, MICROAMPS													
1	350	365	370	390	370	420	460	650	650	900	900	1100	1400	390
2	370	385	400	420	410	600	800	1000	950	1200	5000	950	1800	650
3	370	385	400	420	410	500	460	700	850	700	700	600	600	360

TABLE VII-V. MODULE K ELECTRICAL DATA DURING LOCA TEST

INSULATION RESISTANCE, OHMS @ 500 VDC

CONDUCTOR	TIME, FROM START OF STEAM RAMP													
	ZERO 3-24	40 MIN. 300°F 3-24	2 HOURS 250°F 3-24	8 HOURS 250°F 3-24	16 HOURS 250°F 3-25	24 HOURS 250°F 3-25	48 HOURS 250°F 3-26	58 HOURS 228°F 3-26	72 HOURS 228°F 3-27	96 HOURS 228°F 3-28	120 HOURS 228°F 3-29	144 HOURS 228°F 3-30	168 HOURS 228°F 3-31	192 HOURS 70°F 4-1
1	$3.0X10^{9}$	$5.4X10^{7}$	$2.6X10^{7}$	$1.2X10^{7}$	$3.5X10^{6}$	$1.9X10^{6}$	$3.0X10^{5*}$	$2.5X10^{5*}$	$2.4X10^{5*}$	$1.4X10^{5*}$	$1.6X10^{5*}$	$1.2X10^{5*}$	$1.6X10^{5*}$	$5.8X10^{6}$
2	$4.5X10^{9}$	$6.0X10^{7}$	$4.0X10^{7}$	$2.6X10^{7}$	$1.5X10^{7}$	$8.0X10^{6}$	$2.6X10^{6}$	$1.2X10^{6}$	$1.1X10^{6}$	$2.0X10^{5*}$	$3.0X10^{5*}$	$2.2X10^{5*}$	$2.0X10^{5*}$	$6.6X10^{6}$
3	$2.8X10^{9}$	$6.2X10^{7}$	$4.5X10^{7}$	$2.7X10^{7}$	$1.8X10^{7}$	$<.5X10^{6}$	$<5.0X10^{4}$	$2.1X10^{6}$	$2.6X10^{5*}$	$1.8X10^{5*}$	$1.4X10^{5*}$	$2.2X10^{5*}$	$1.8X10^{5*}$	$8.8X10^{6}$
4	$4.0X10^{9}$	$6.0X10^{7}$	$2.8X10^{7}$	$1.5X10^{7}$	$2.1X10^{7}$	$<.5X10^{6}$	$1.8X10^{5*}$	$4.5X10^{5*}$	$2.2X10^{5*}$	$2.4X10^{5*}$	$2.2X10^{5*}$	$1.9x10^{5*}$	$2.2X10^{5*}$	$5.4X10^{6}$
5	$4.0X10^{9}$	$5.8X10^{7}$	$4.0X10^{7}$	$4.0X10^{7}$	$2.3X10^{7}$	$2.0X10^{7}$	$1.0X10^{7}$	$1.0X10^{7}$	$1.1X10^{7}$	$2.6X10^{6}$	$2.0X10^{6}$	$1.3X10^{6}$	$6.0X10^{5}$	$2.4X10^{7}$
6	$4.0X10^{9}$	$1.0X10^{8}$	$5.0X10^{7}$	$3.5X10^{7}$	$2.0X10^{7}$	$<.5X10^{6}$	$<5.0X10^{*4}$	$6.8X10^{6}$	$1.1X10^{7}$	$7.4X10^{6}$	$3.5X10^{6}$	$1.8X10^{6}$	$1.2X10^{6}$	$3.5X10^{7}$
7	$4.0X10^{9}$	$1.1X10^{8}$	$5.0X10^{7}$	$4.5X10^{7}$	$2.4X10^{7}$	$<.5X10^{6}$	$3.0X10^{5*}$	$1.4X10^{5*}$	$5.6X10^{4*}$	$1.0X10^{6}$	$8.2X10^{5*}$	$4.0X10^{5*}$	$<.0X10^{5*}$	$1.1X10^{7}$
8	$4.2X10^{9}$	$6.0X10^{7}$	$4.0X10^{7}$	$2.0X10^{7}$	$1.8X10^{7}$	$8.0X10^{6}$	$5.6X10^{6}$	$4.0X10^{6}$	$1.0X10^{6}$	$4.0X10^{5*}$	$3.5X10^{5*}$	$2.6X10^{5*}$	$2.8X10^{5*}$	$6.2X10^{6}$
9	$4.0X10^{9}$	$8.0X10^{7}$	$4.0X10^{7}$	$4.0X10^{7}$	$2.0X10^{7}$	$1.9X10^{7}$	$1.4X10^{7}$	$1.1X10^{7}$	$1.0X10^{7}$	$2.4X10^{6}$	$5.0X10^{6}$	$2.8X10^{6}$	$1.7X10^{6}$	$2.8X10^{7}$
10	$3.5X10^{9}$	$1.2X10^{8}$	$1.0X10^{8}$	$7.0X10^{7}$	$3.5X10^{7}$	$2.4X10^{7}$	$1.5X10^{7}$	$3.0X10^{7}$	$1.8X10^{7}$	$3.5X10^{6}$	$1.0X10^{7}$	$1.1X10^{7}$	$2.6X10^{6}$	$4.0X10^{7}$
11	$2.6X10^{9}$	$5.6X10^{7}$	$4.0X10^{7}$	$4.0X10^{7}$	$3.6X10^{7}$	$2.1X10^{7}$	$1.0X10^{7}$	$7.6X10^{6}$	$8.2X10^{6}$	$4.0X10^{6}$	$2.0X10^{6}$	$7.4X10^{5}$	$4.5X10^{5*}$	$1.2X10^{7}$
12	$3.0X10^{9}$	$5.0X10^{7}$	$2.6X10^{7}$	$1.4X10^{7}$	$1.0X10^{7}$	$4.5X10^{6}$	$2.4X10^{6}$	$1.4X10^{6}$	$4.0X10^{5*}$	$6.8X10^{5}$	$7.0X10^{5*}$	$2.6X10^{5*}$	$3.5X10^{5*}$	$5.6X10^{6}$
13	$3.0X10^{9}$	$5.4X10^{7}$	$4.0X10^{7}$	$2.4X10^{7}$	$1.8X10^{7}$	$1.5X10^{7}$	$8.2X10^{6}$	$8.6X10^{6}$	$4.5X10^{6}$	$1.8X10^{6}$	$2.0X10^{6}$	$4.5X10^{5*}$	$4.0X10^{5*}$	$1.0X10^{7}$
14	$3.0X10^{9}$	$5.0X10^{7}$	$2.5X10^{7}$	$2.0X10^{7}$	$2.1X10^{7}$	$5.6X10^{6}$	$3.5X10^{6}$	$1.2X10^{6}$	$2.2X10^{6}$	$8.6X10^{5}$	$1.0X10^{6}$	$3.5X10^{5*}$	$4.5X10^{5*}$	$4.5X10^{6}$

*At 100 VDC.

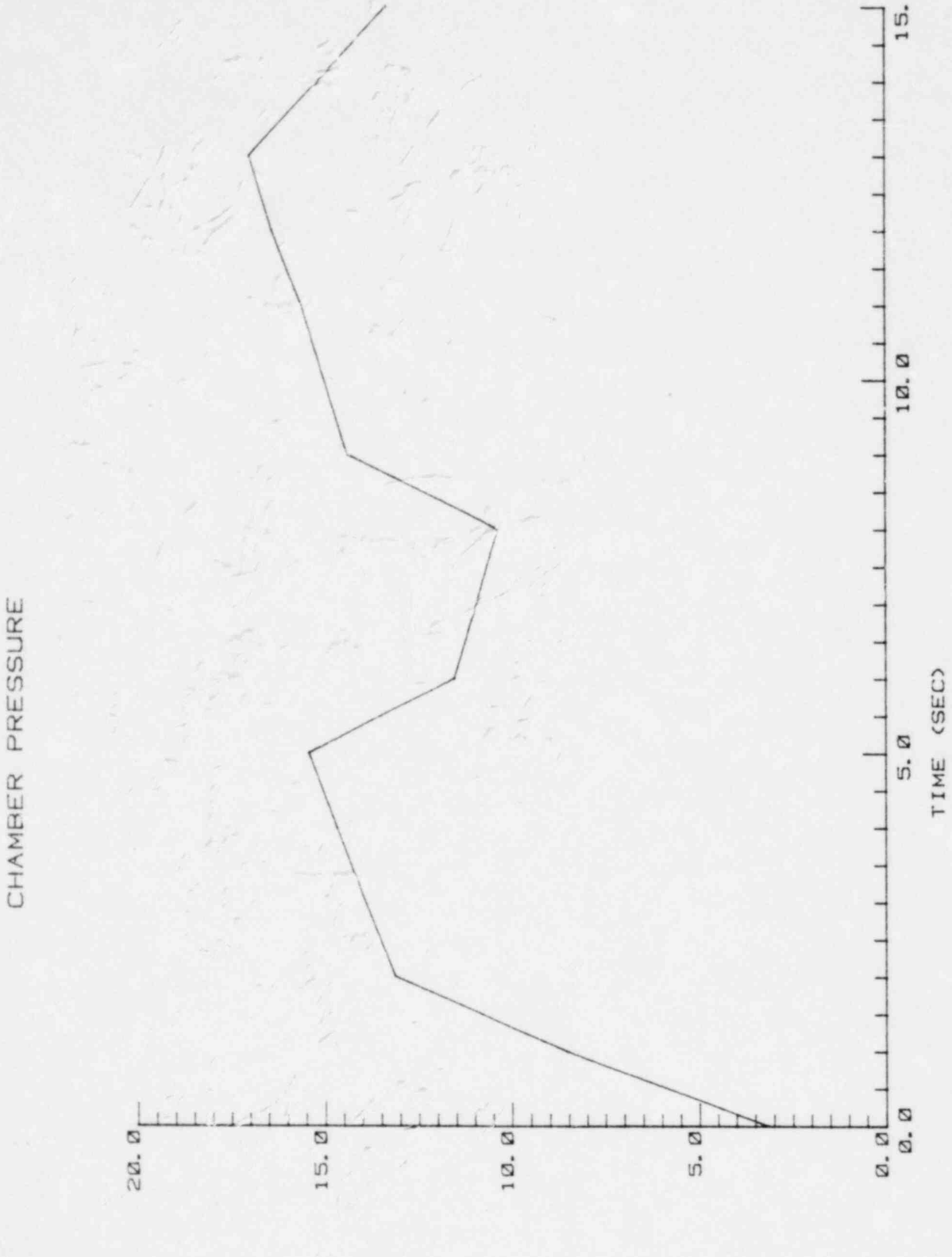
TABLE VII-VI. MODULE L ELECTRICAL DATA DURING LOCA TEST

INSULATION RESISTANCE, OHMS @ 500 VDC

CONDUCTOR	TIME, FROM START OF STEAM RAMP													
	ZERO 3-24	40 MIN. 300°F 3-24	2 HOURS 250°F 3-24	8 HOURS 250°F 3-24	16 HOURS 250°F 3-25	24 HOURS 250°F 3-25	48 HOURS 250°F 3-26	58 HOURS 228°F 3-26	72 HOURS 228°F 3-27	96 HOURS 228°F 3-28	120 HOURS 228°F 3-29	144 HOURS 228°F 3-30	168 HOURS 228°F 3-31	192 HOURS 70°F 4-1
1	$3.9X10^8$	$5.0X10^7$	$1.0X10^8$	$9.2X10^7$	$9.0X10^7$	$8.6X10^7$	$7.8X10^7$	$4.0X10^7$	$4.0X10^7$	$4.0X10^7$	$5.0X10^7$	$5.0X10^7$	$4.0X10^7$	$3.0X10^{10}$
2	$3.0X10^8$	$5.0X10^7$	$1.3X10^8$	$2.0X10^8$	$1.8X10^8$	$1.7X10^8$	$1.5X10^8$	$7.8X10^7$	$6.0X10^7$	$4.5X10^7$	$7.6X10^7$	$6.8X10^7$	$8.6X10^7$	$1.0X10^{10}$
3	$4.0X10^9$	$5.0X10^7$	$8.0X10^6$	$2.8X10^8$	$1.6X10^8$	$1.3X10^6$	$1.0X10^8$	$5.4X10^7$	$2.8X10^7$	$2.6X10^7$	$4.0X10^7$	$5.0X10^7$	$3.5X10^7$	$3.5X10^{10}$
4	$6.3X10^9$	$5.0X10^7$	$1.1X10^8$	$1.7X10^8$	$1.5X10^8$	$1.1X10^8$	$9.0X10^7$	$5.8X10^7$	$4.5X10^7$	$4.5X10^7$	$6.0X10^7$	$5.6X10^7$	$6.2X10^7$	$8.2X10^{10}$
5	$4.0X10^8$	$3.5X10^7$	$5.0X10^7$	$1.3X10^8$	$5.0X10^7$	$4.5X10^7$	$1.8X10^7$	$1.9X10^7$	$1.6X10^7$	$1.4X10^7$	$1.6X10^7$	$2.4X10^7$	$2.2X10^7$	$1.1X10^{10}$
6	$3.0X10^8$	$4.5X10^7$	$1.2X10^8$	$1.0X10^8$	$1.3X10^8$	$9.8X10^7$	$6.0X10^7$	$2.2X10^7$	$2.4X10^7$	$2.0X10^7$	$4.0X10^7$	$2.4X10^7$	$2.4X10^7$	$1.0X10^{10}$
7	$9.2X10^{10}$	$5.0X10^7$	$1.3X10^8$	$1.6X10^8$	$1.4X10^8$	$1.1X10^8$	$6.8X10^7$	$3.0X10^7$	$3.0X10^7$	$2.8X10^7$	$3.5X10^7$	$4.5X10^7$	$4.5X10^7$	$8.6X10^9$
8	$1.8X10^{10}$	$1.5X10^6$	$5.0X10^6$	$1.4X10^8$	$2.0X10^6$	$1.1X10^6$	$5X10^4$(2,3)	---	---	---	---	$1.0X10^6$(4)	$6.8X10^4$(2)	$<5.0X10^4$(2)
9	$2.0X10^{10}$	$6.4X10^6$	$1.8X10^7$	$1.1X10^8$	$7.8X10^6$	$1.5X10^6$(1)	---	---	---	---	---	$1.0X10^5$(2,4)	$5.8X10^4$(2)	$<5.0X10^4$(2)
10	$1.0X10^{10}$	$3.5X10^7$	$8.2X10^7$	$3.0X10^8$	$7.4X10^7$	$5.5X10^7$	$3.5X10^7$	$1.6X10^7$	$1.4X10^7$	$1.2X10^7$	$1.7X10^7$	$1.3X10^7$	$1.4X10^7$	$1.5X10^{10}$
11	$2.2X10^9$	$3.5X10^7$	$7.0X10^7$	$3.1X10^8$	$4.5X10^7$	$4.5X10^7$	$2.6X10^7$	$1.4X10^7$	$1.7X10^7$	$1.1X10^7$	$1.5X10^7$	$2.2X10^7$	$1.6X10^7$	$5.4X10^9$
12	$10X10^{10}$	$3.0X10^7$	$7.0X10^7$	$9.6X10^7$	$1.6X10^7$	$2.2X10^7$	$1.8X10^7$	$1.2X10^7$	$9.2X10^6$	$7.8X10^6$	$1.0X10^7$	$8.6X10^6$	$8.8X10^6$	$2.6X10^{10}$

NOTES:

(1) Blew .5 amp fuse at approximately 25.5 hours, removed from circuit.
(2) IR measured at 100 volts, DC.
(3) Blew .5 amp fuse at approximately 34 hours, removed from circuit.
(4) Replaced conductor back in circuit.


CHAMBER PRESSURE
TIME (SEC)
0.0
5.0
10.0
15.0
RESSURE (P.S.I.G.)
0.0
5.0
10.0
15.0
20.0

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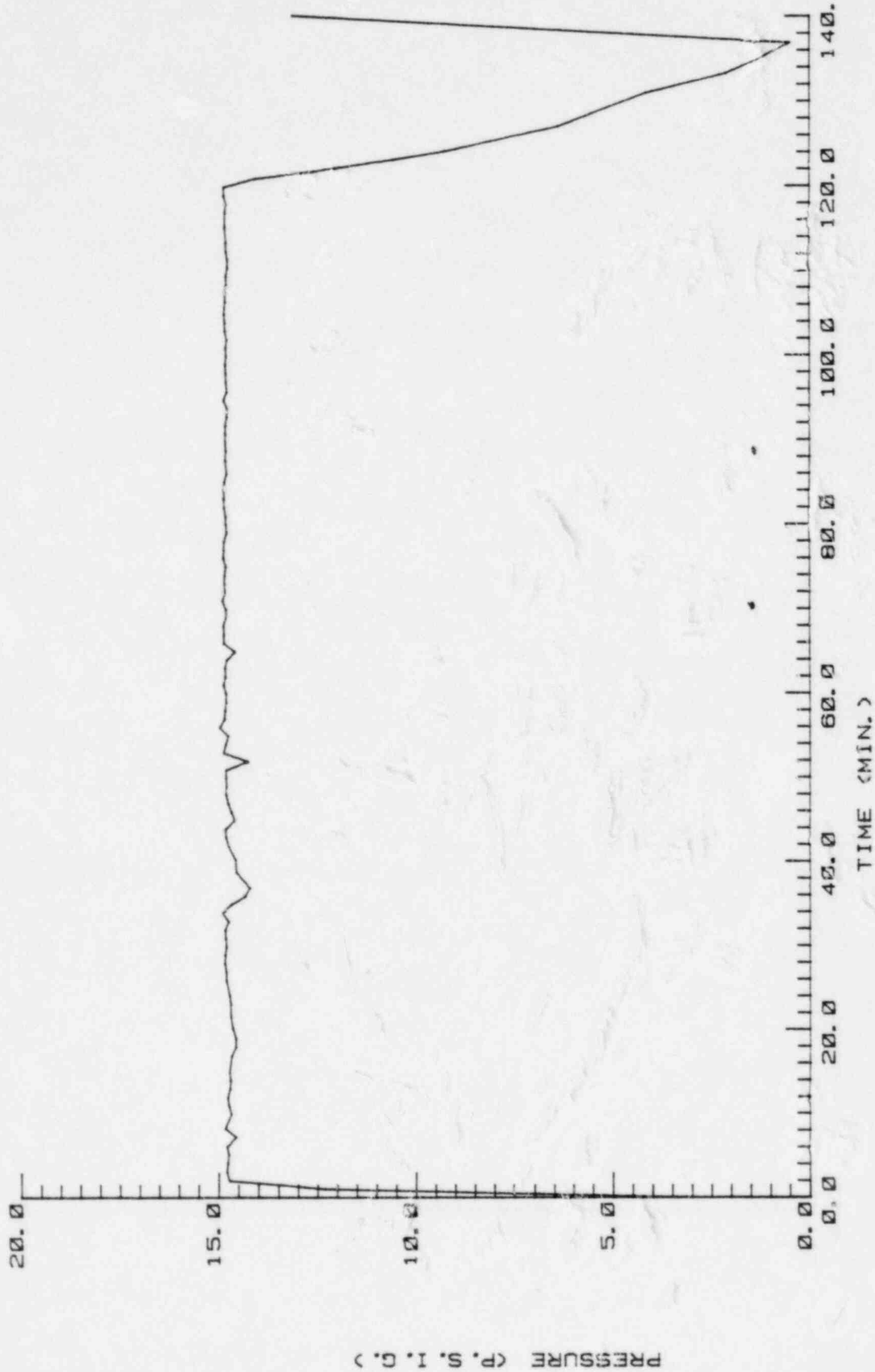
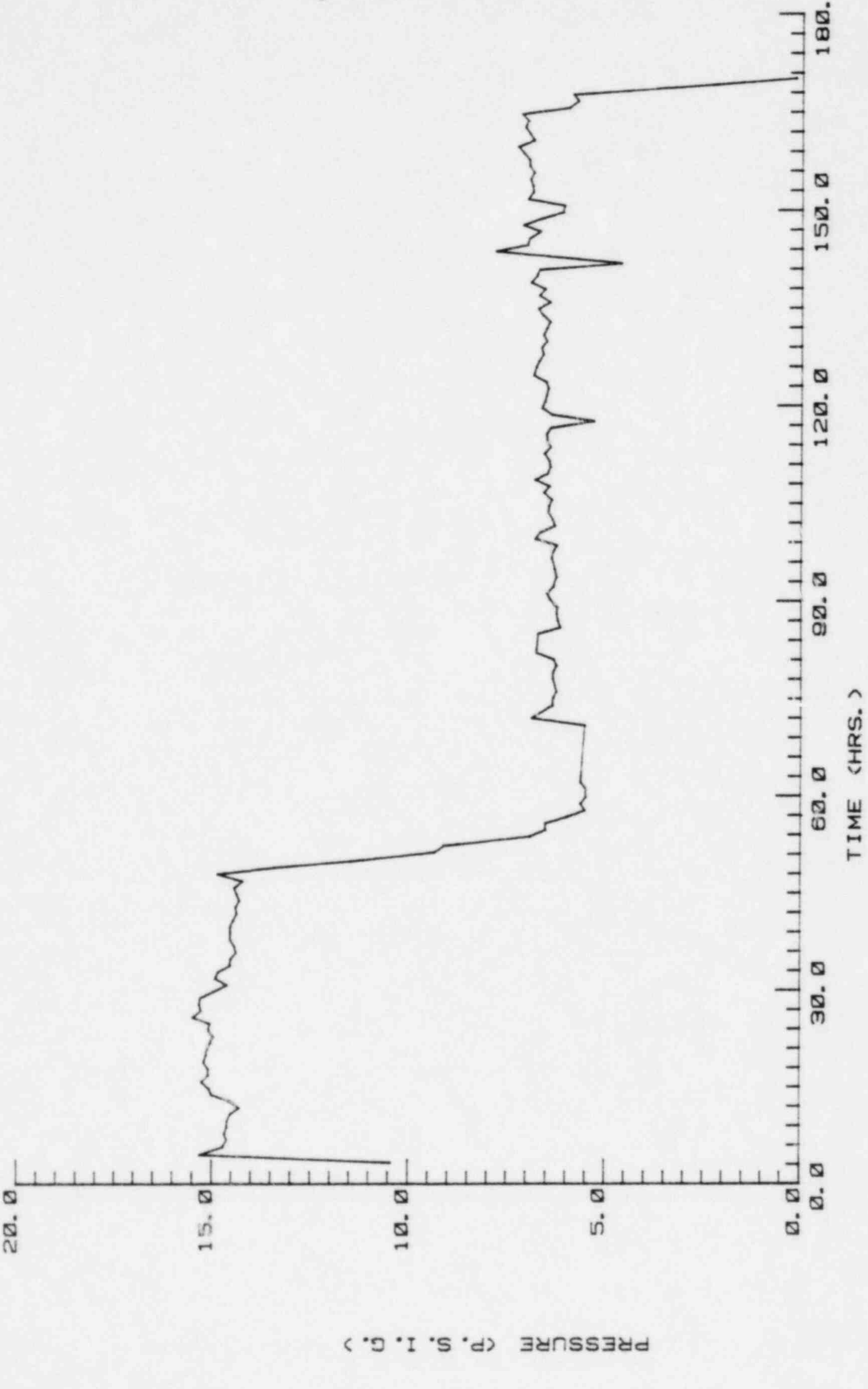
CHAMBER PRESSURE

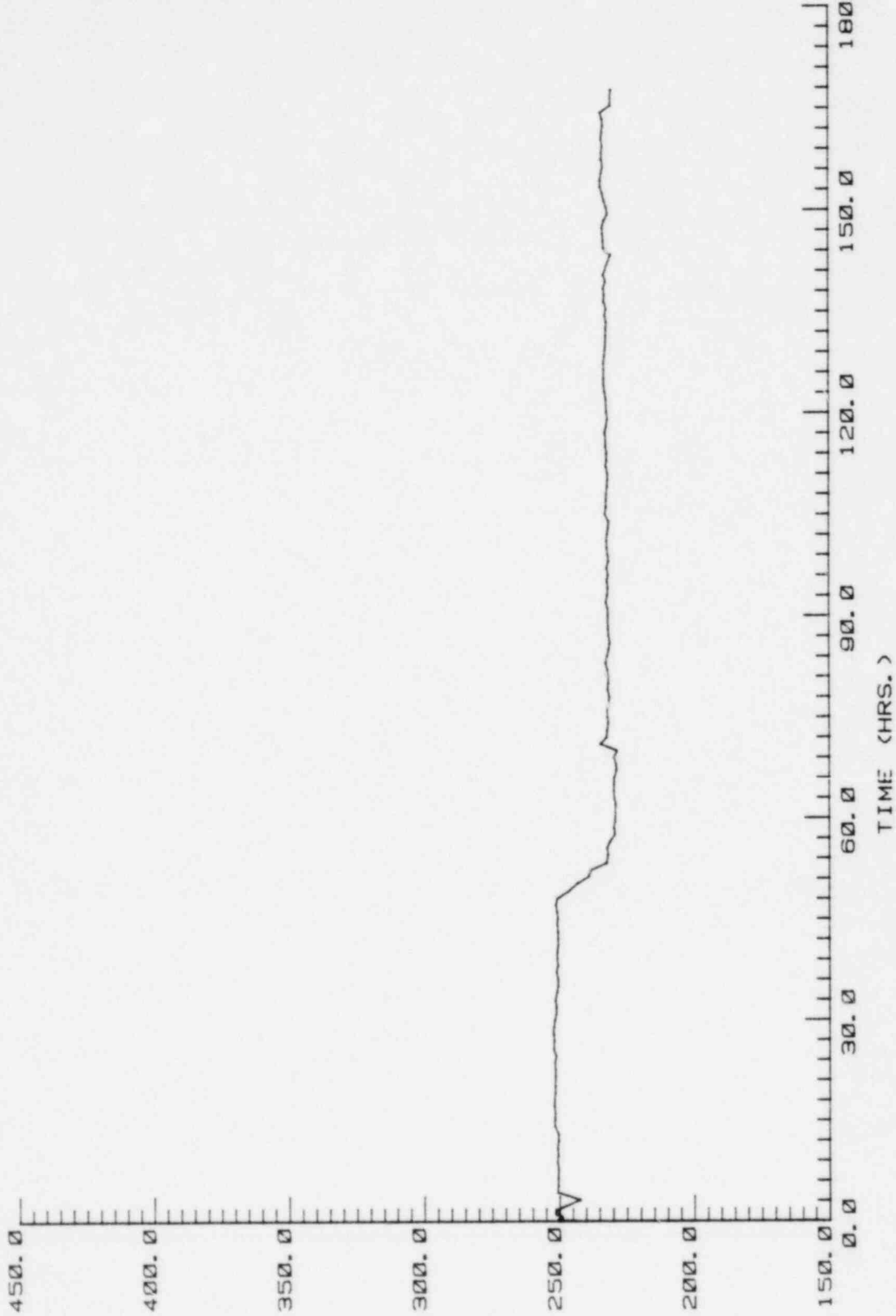


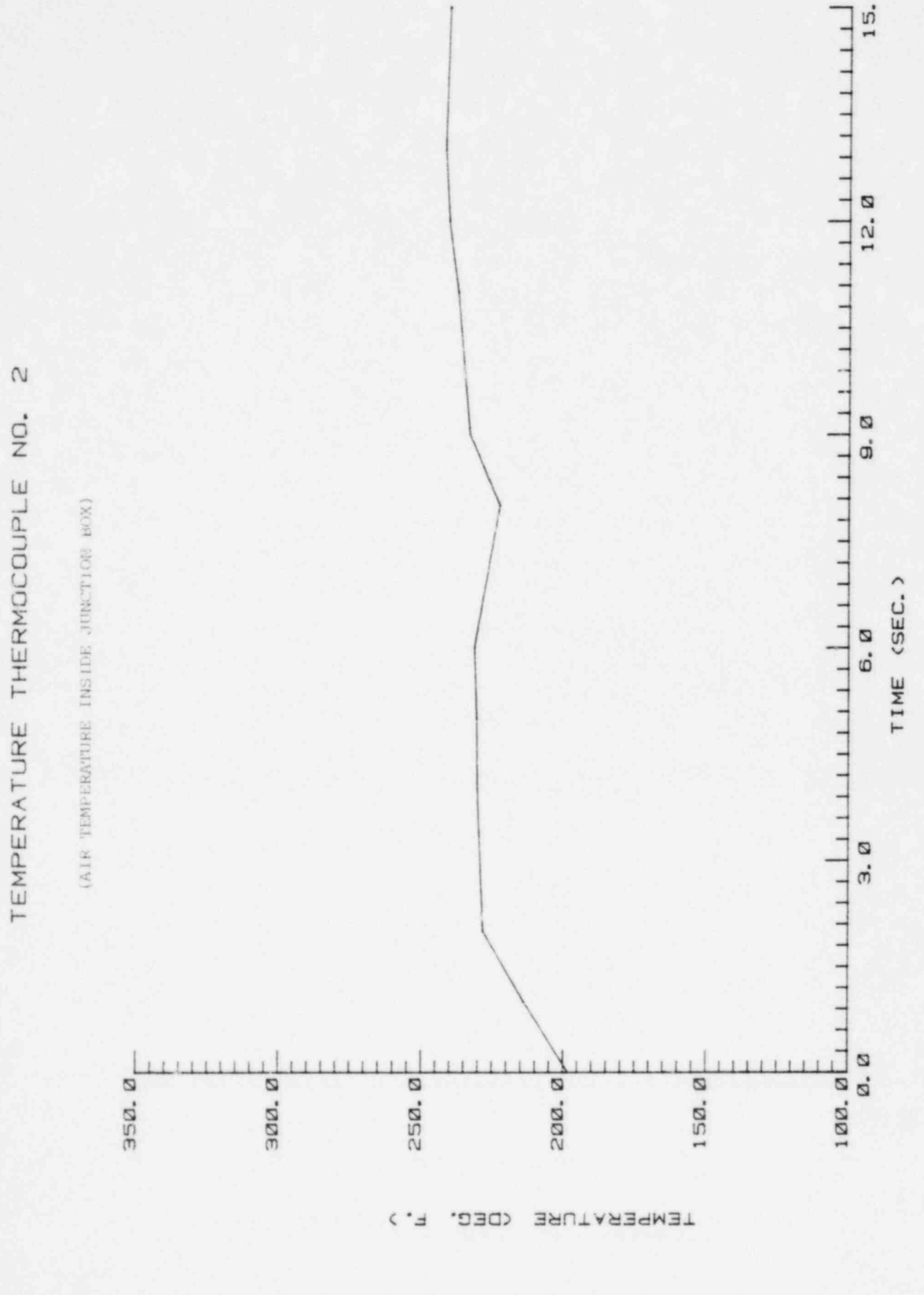
CHAMBER PRESSURE

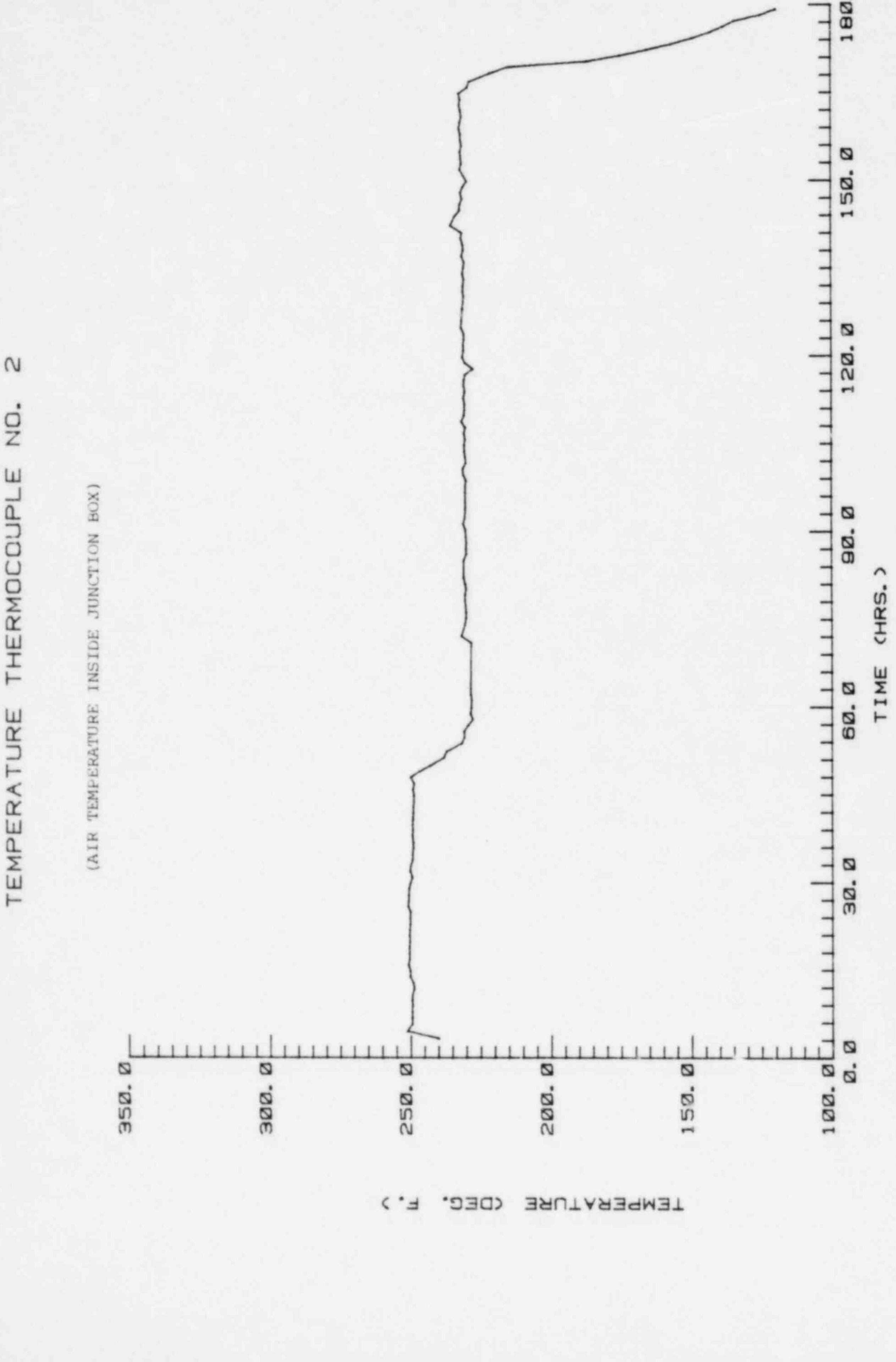


TEMPERATURE THERMOCOUPLE NO. 1

(ON EXTERIOR FACE OF JUNCTION BOX COVER)




TEMPERATURE THERMOCOUPLE NO. 2
(AIR TEMPERATURE INSIDE JUNCTION BOX)
TEMPERATURE (DEG. F.)
350.0
300.0
250.0
200.0
150.0
100.0
0.0
3.0
6.0
9.0
12.0
15.0
TIME (SEC.)

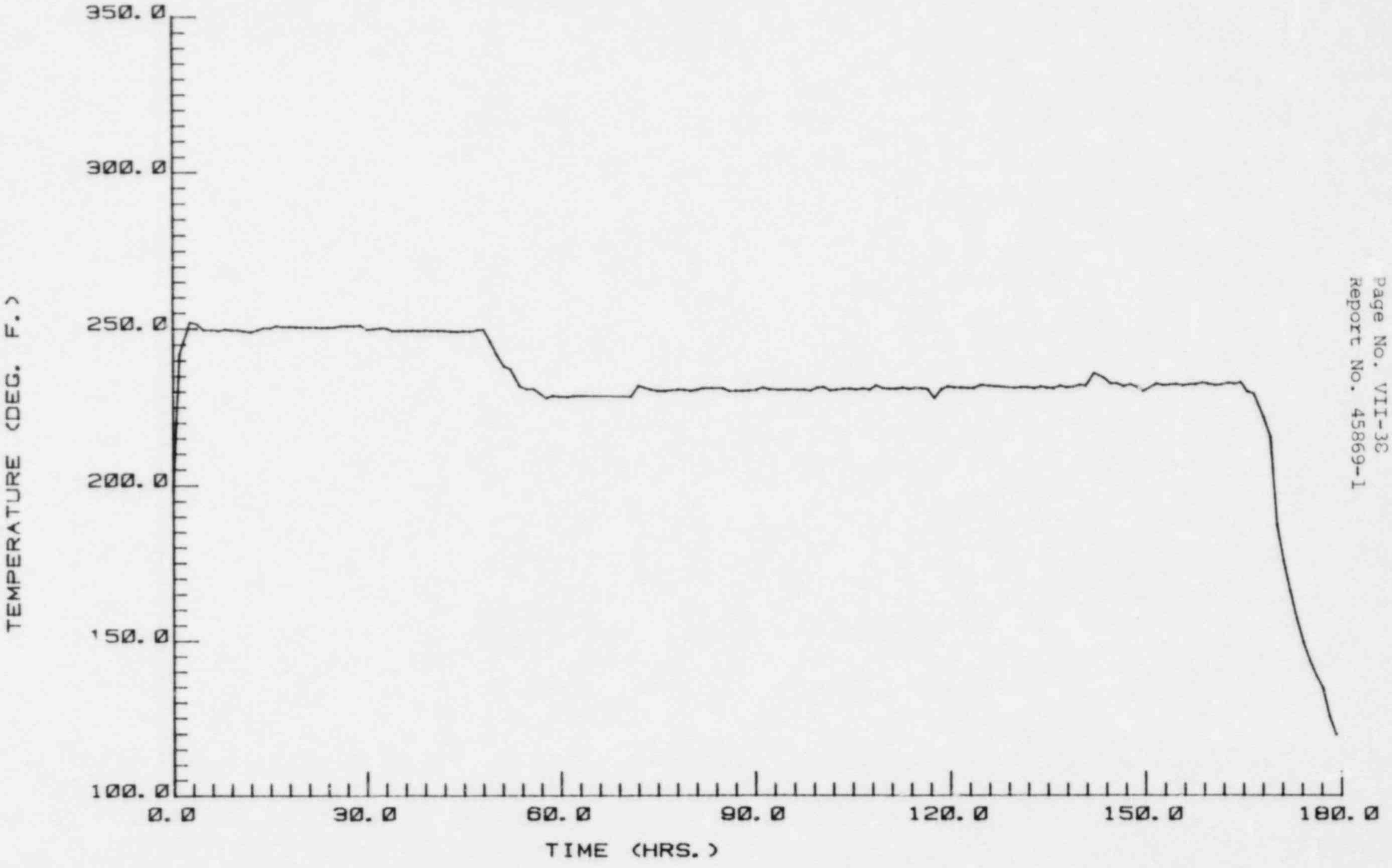


TEMPERATURE THERMOCOUPLE NO. 2

(AIR TEMPERATURE INSIDE JUNCTION BOX)

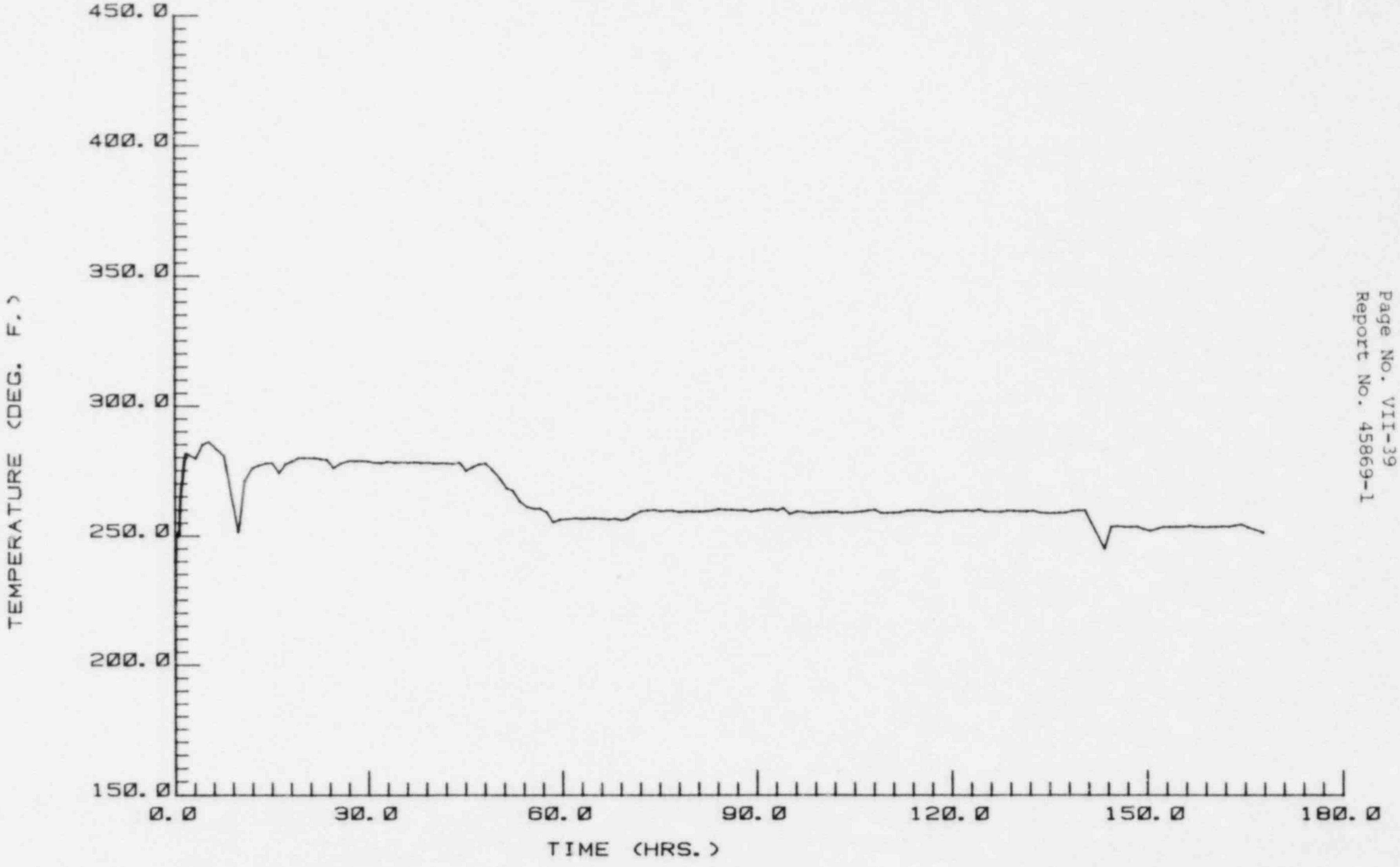
TEMPERATURE THERMOCOUPLE NO. 2

(AIR TEMPERATURE INSIDE JUNCTION BOX)



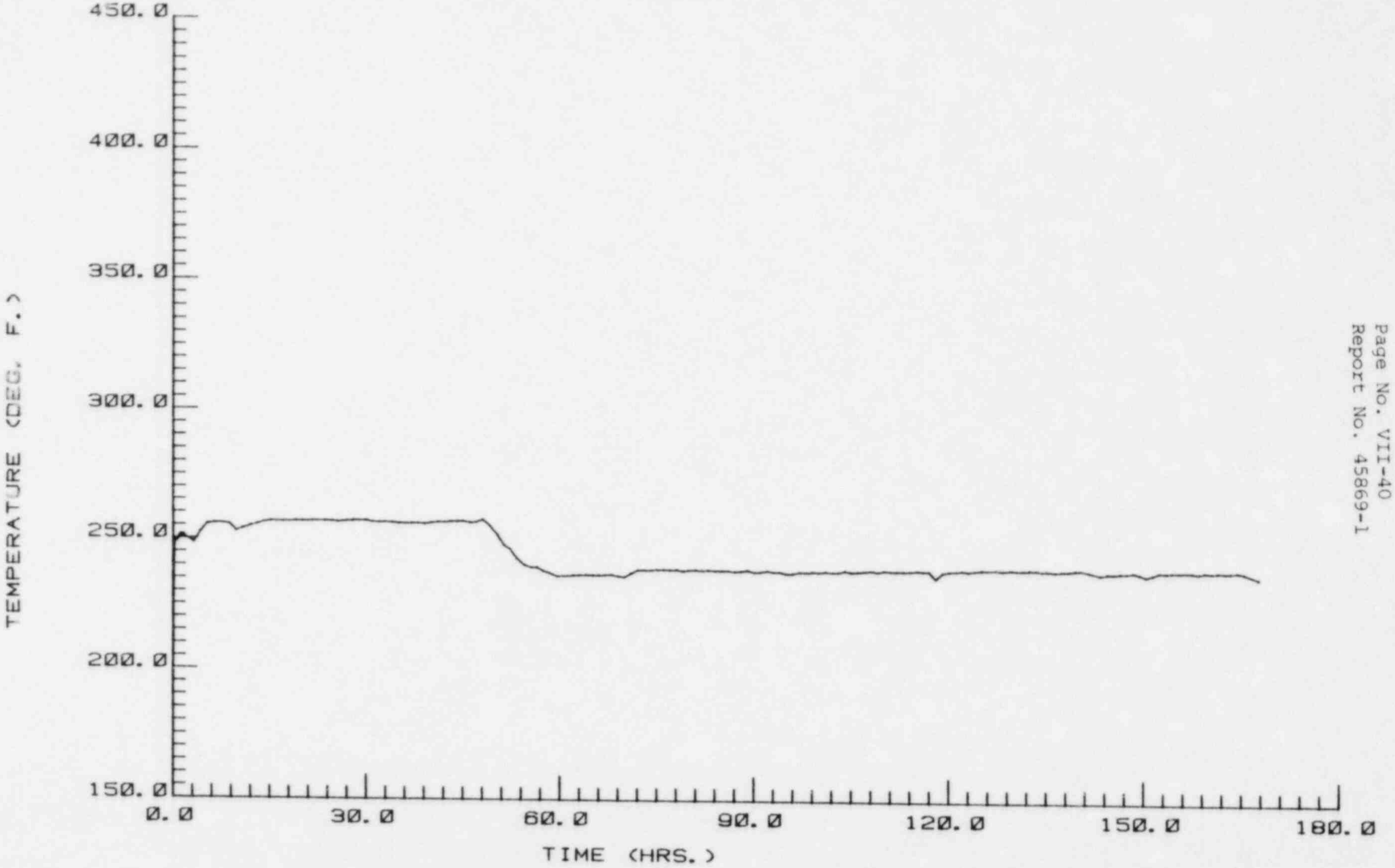
TEMPERATURE THERMOCOUPLE NO. 3

(IN BACKSHELL OF MODULE C)



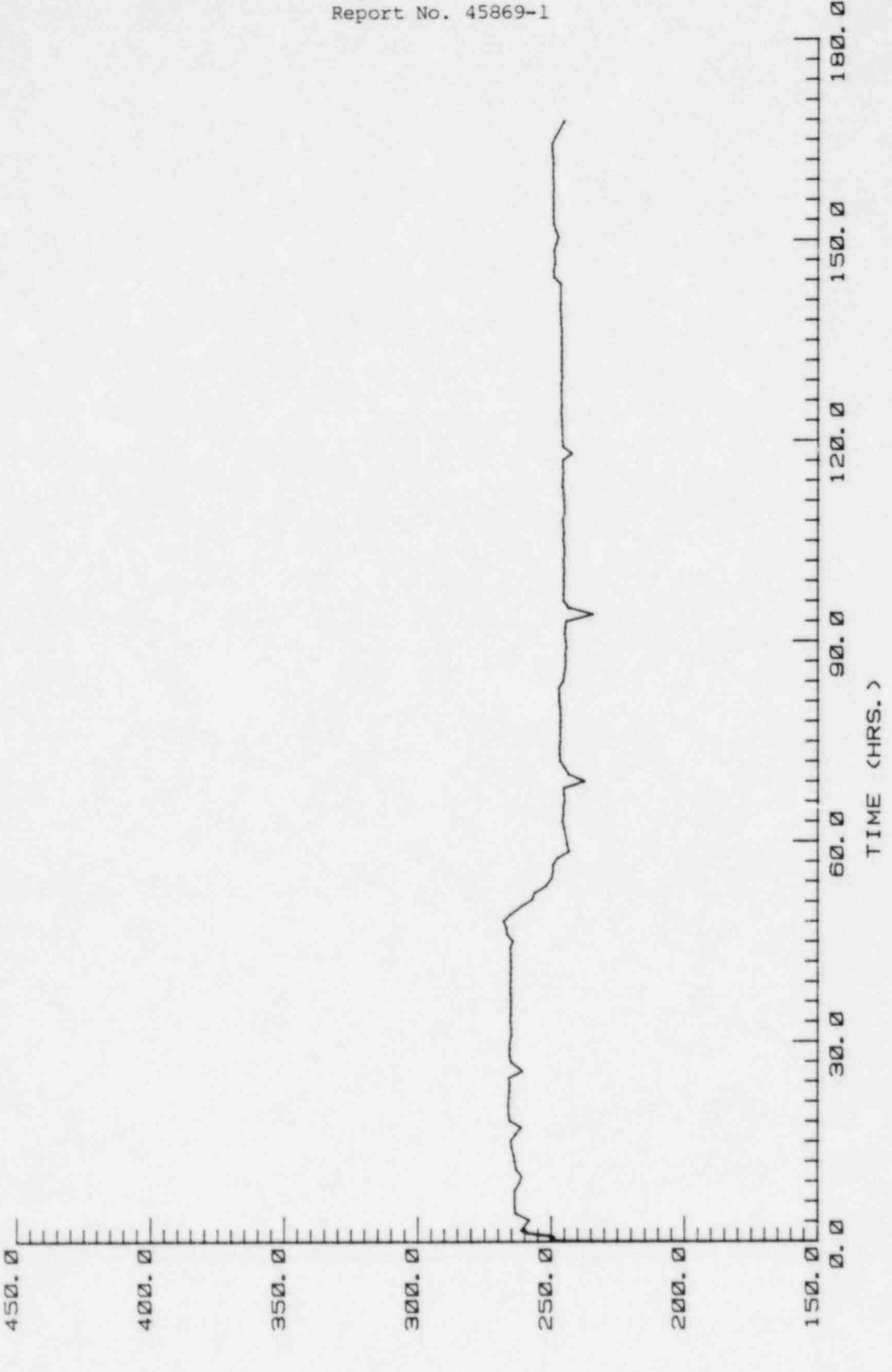
TEMPERATURE THERMOCOUPLE NO. 4

(IN BACKSHELL OF MODULE D)



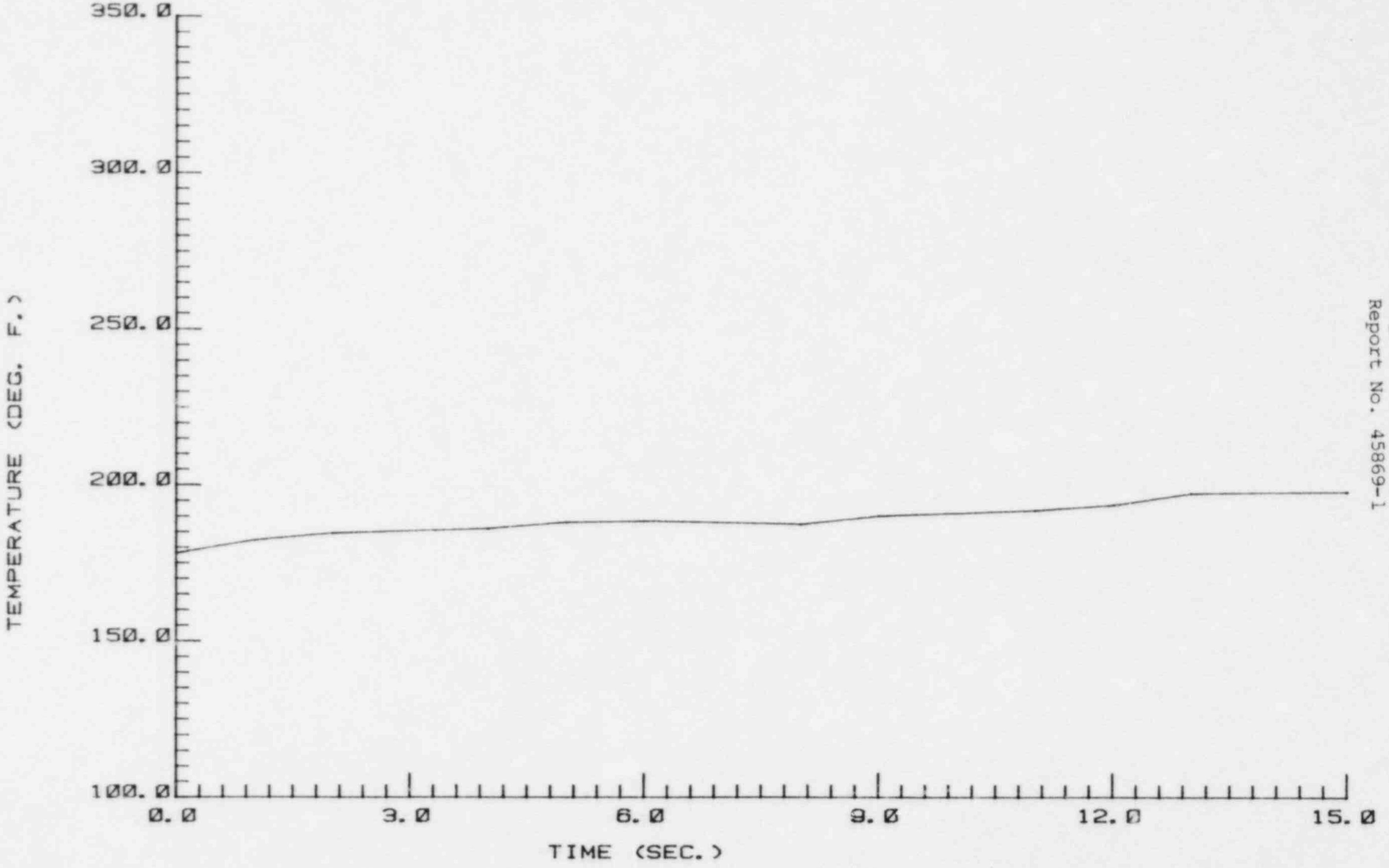
TEMPERATURE THERMOCOUPLE NO. 5

(IN BACKSHELL OF MODULE E)



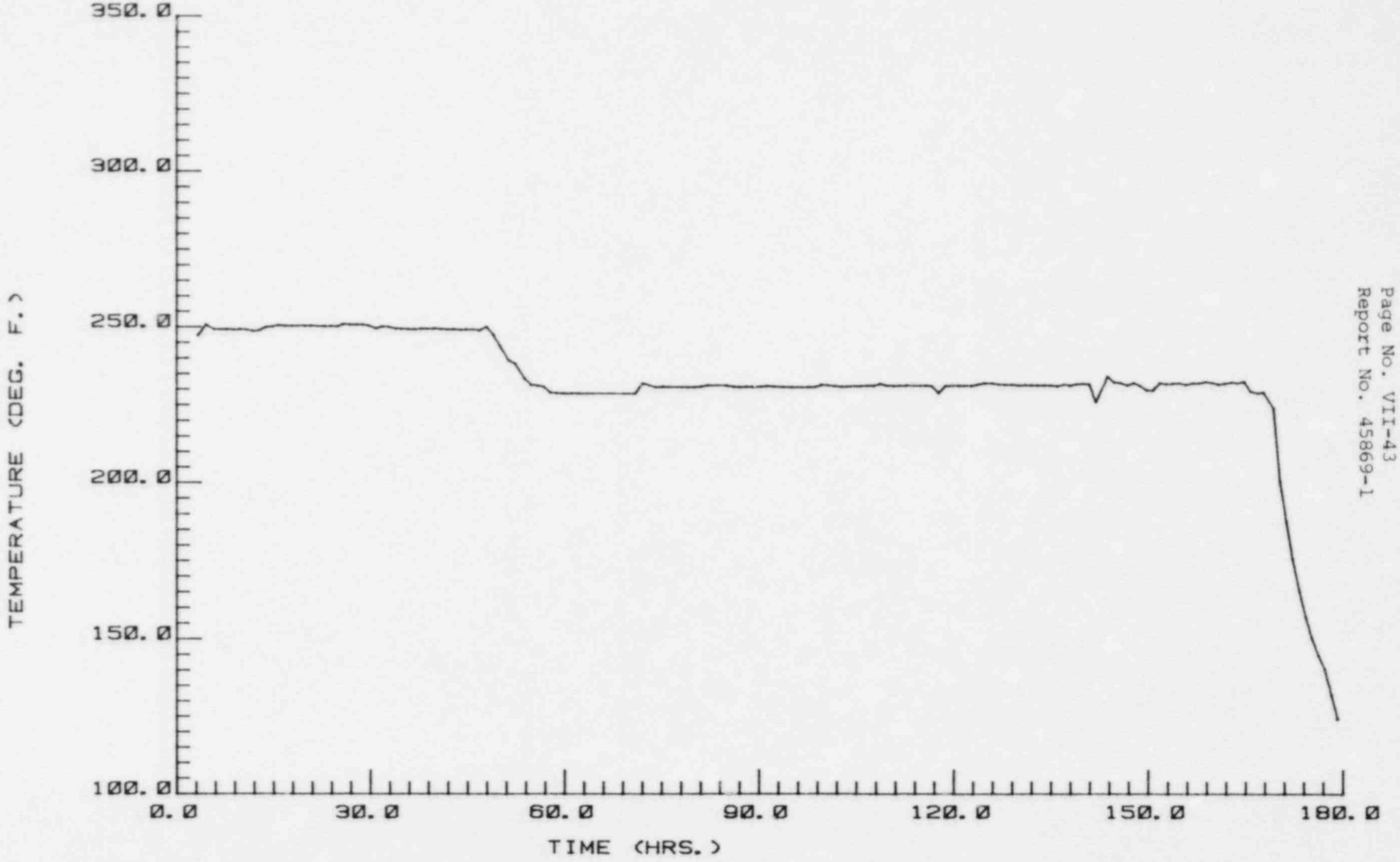
TEMPERATURE THERMOCOUPLE NO. 6

(IN BACKSHELL OF MODULE F)



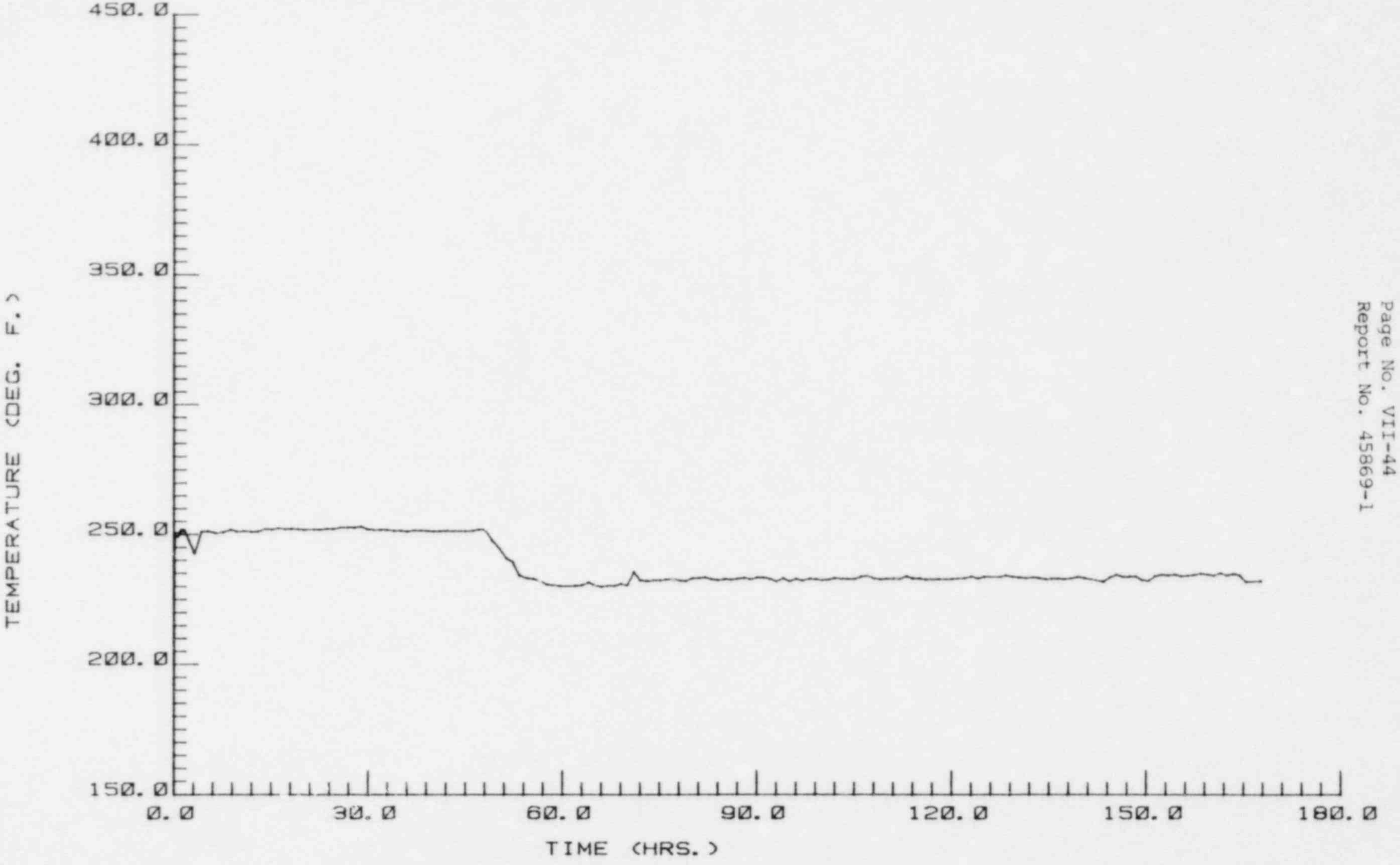
TEMPERATURE THERMOCOUPLE NO. 6

(IN BACKSHELL OF MODULE F)



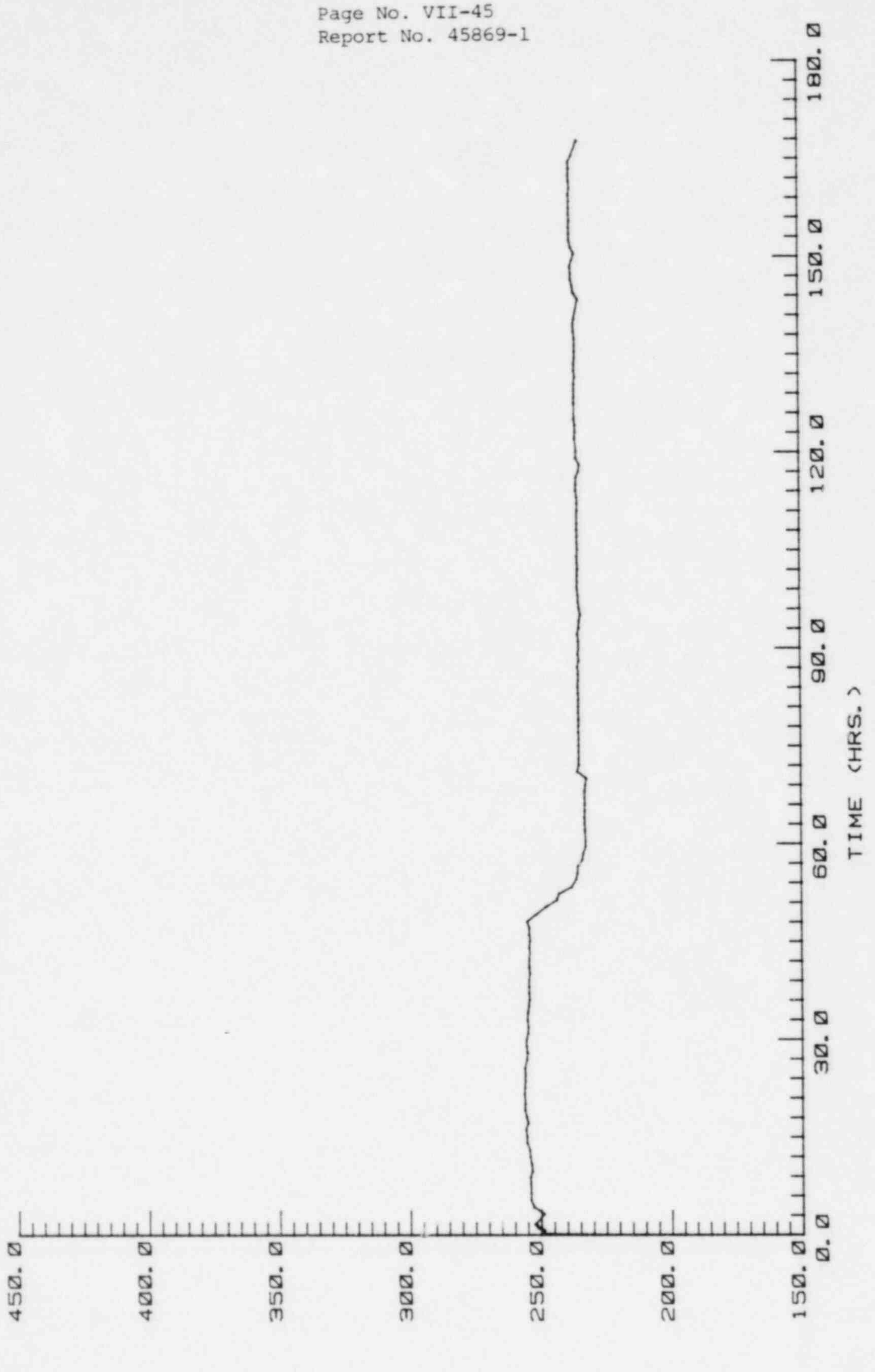
TEMPERATURE THERMOCOUPLE NO. 7

(IN BACKSHELL OF MODULE K)



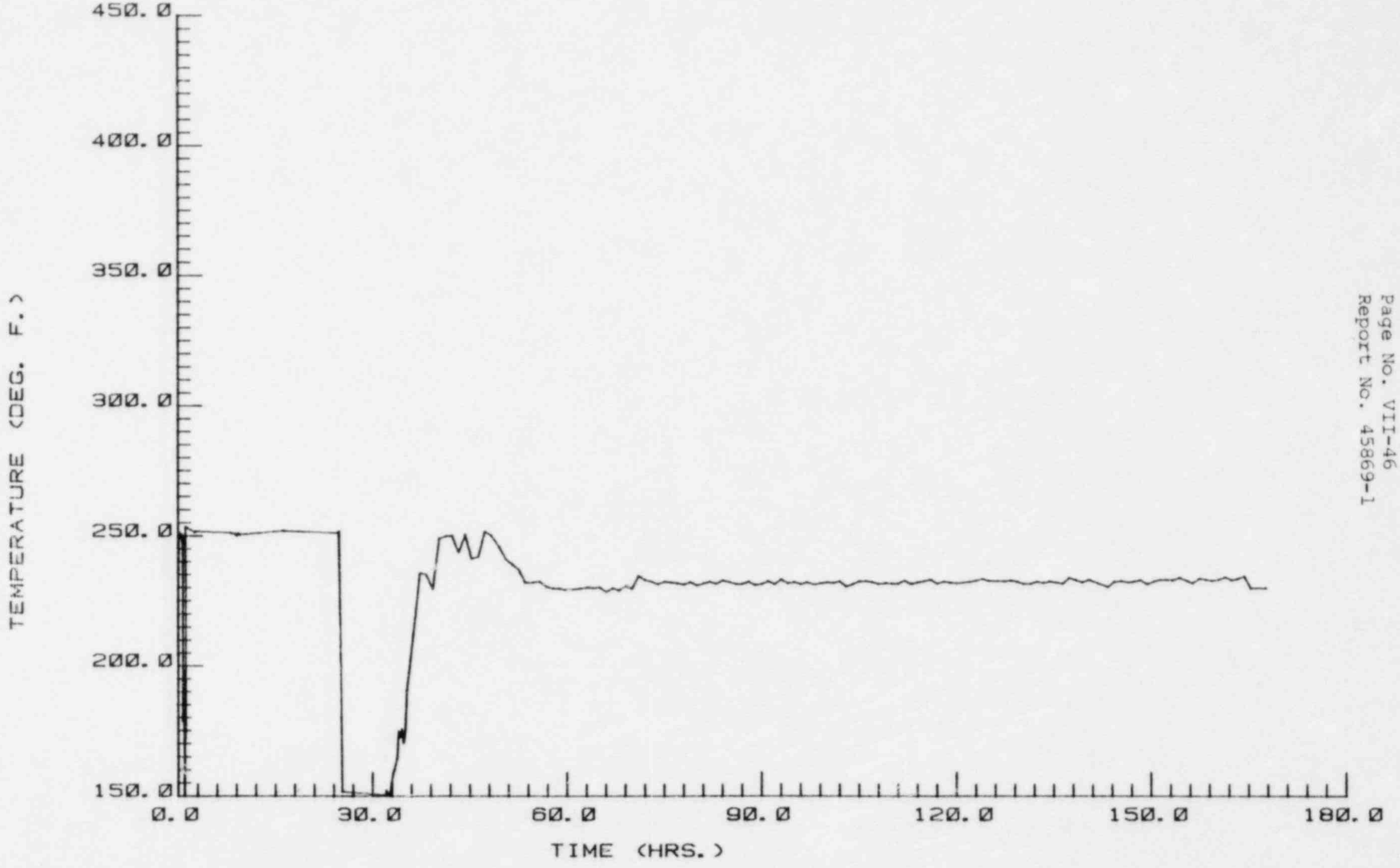
TEMPERATURE THERMOCOUPLE NO. 8

(IN BACKSHELL OF MODULE L)



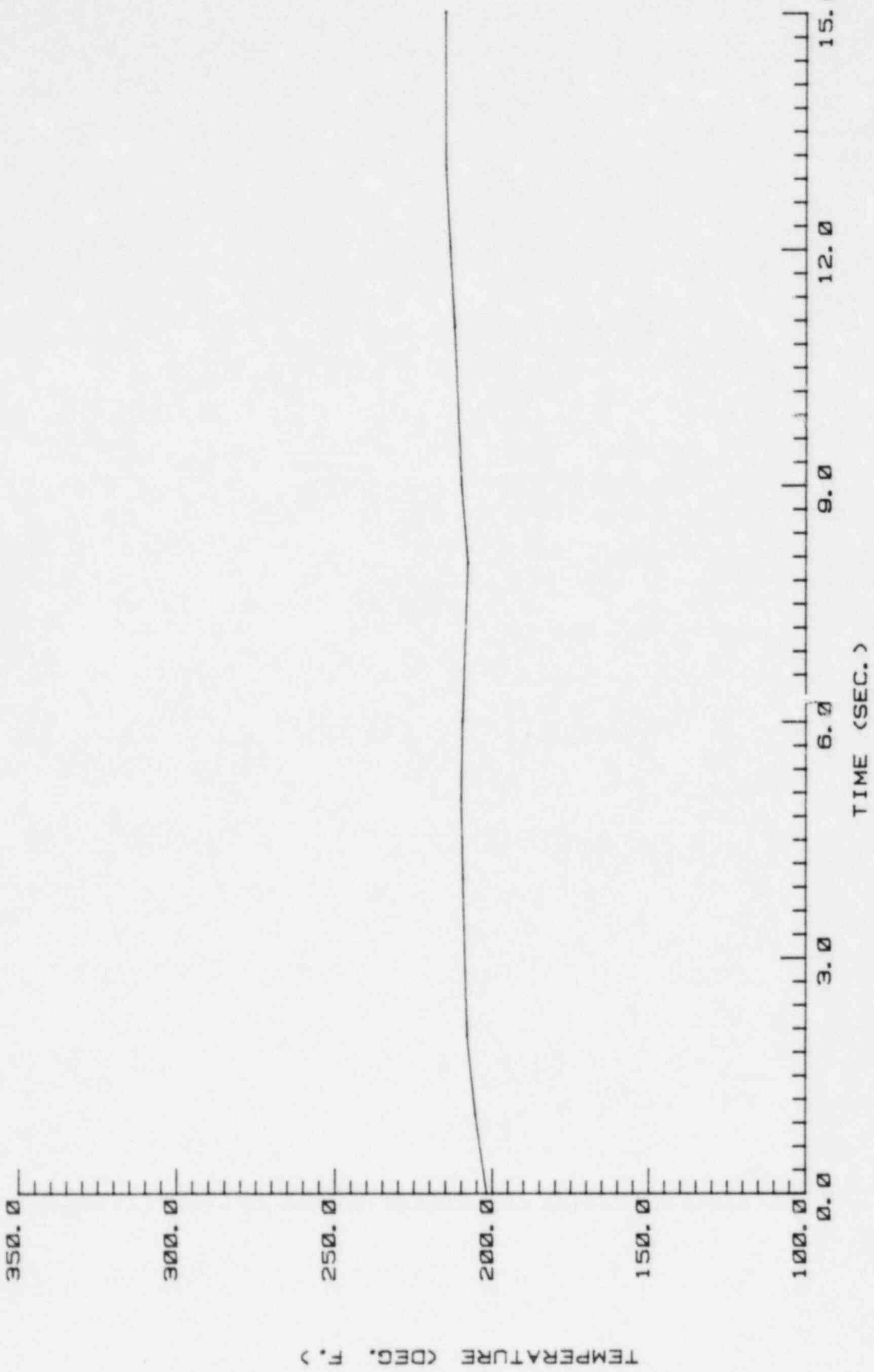
TEMPERATURE THERMOCOUPLE NO. 9

(ON OUTSIDE OF JUNCTION BOX MTG RING - 360°)



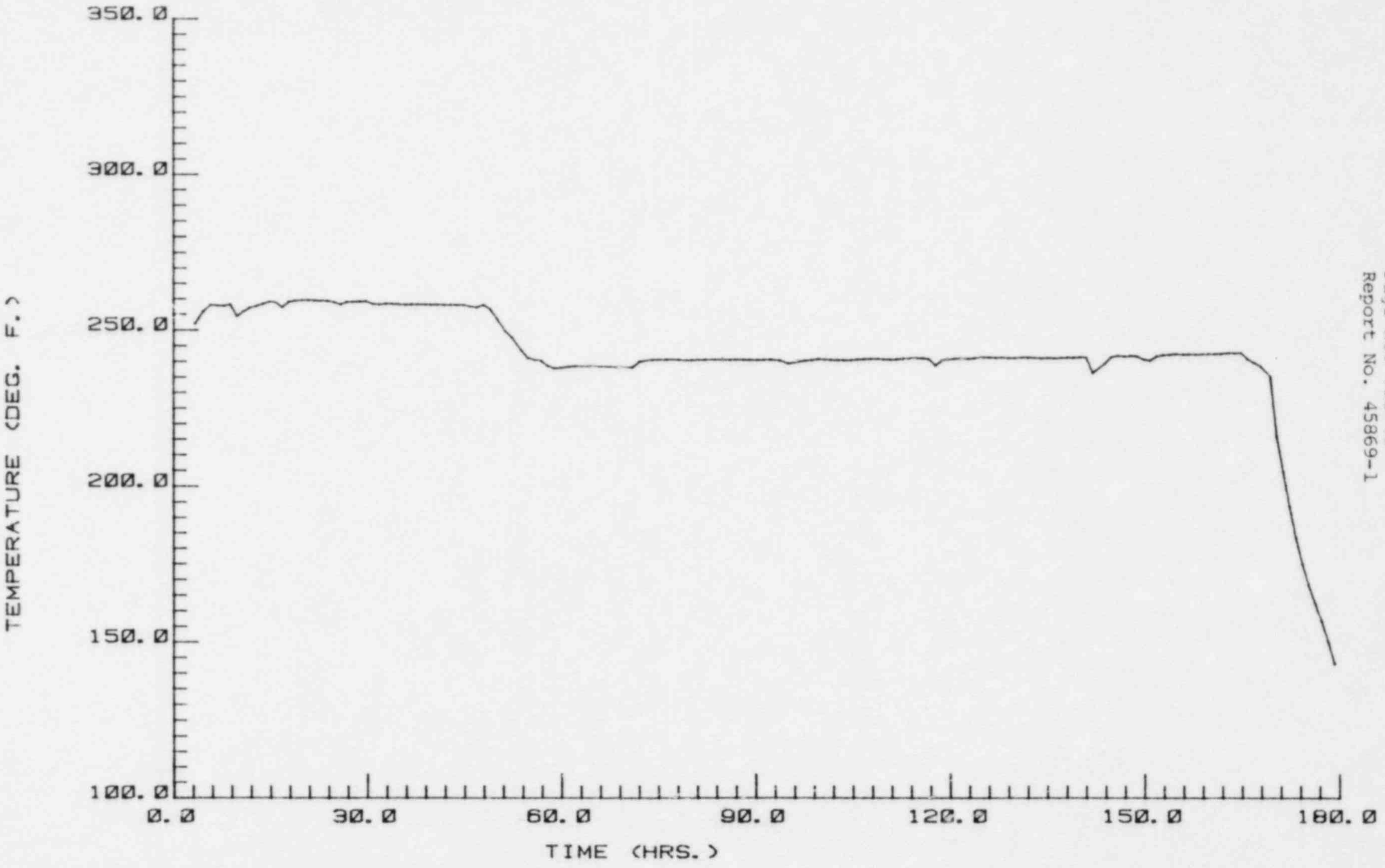
TEMPERATURE THERMOCOUPLE NO. 10

(ON FACE OF FLANGE NEAR MODULE C)



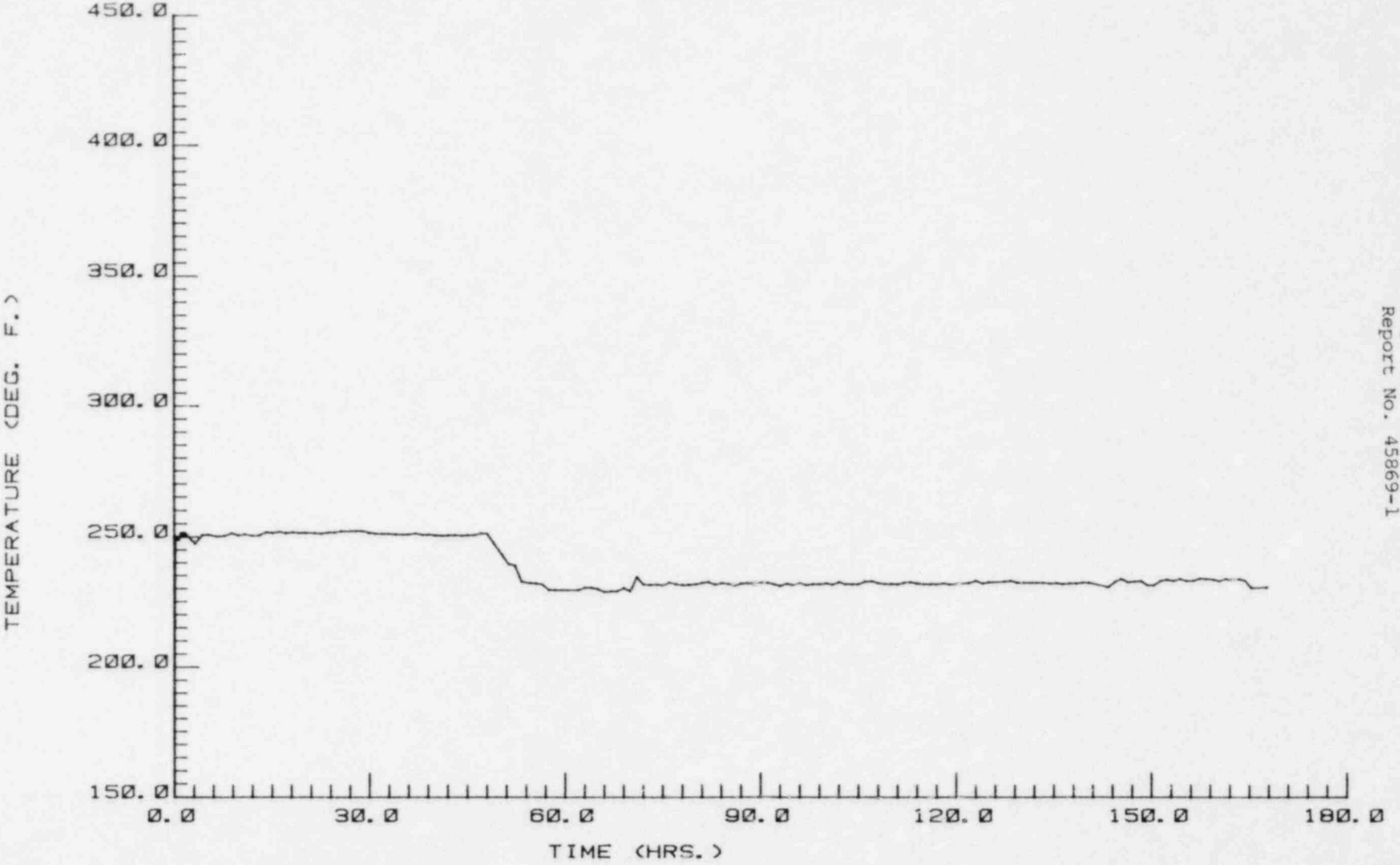
TEMPERATURE THERMOCOUPLE NO. 10

(ON FACE OF FLANGE NEAR MODULE C)



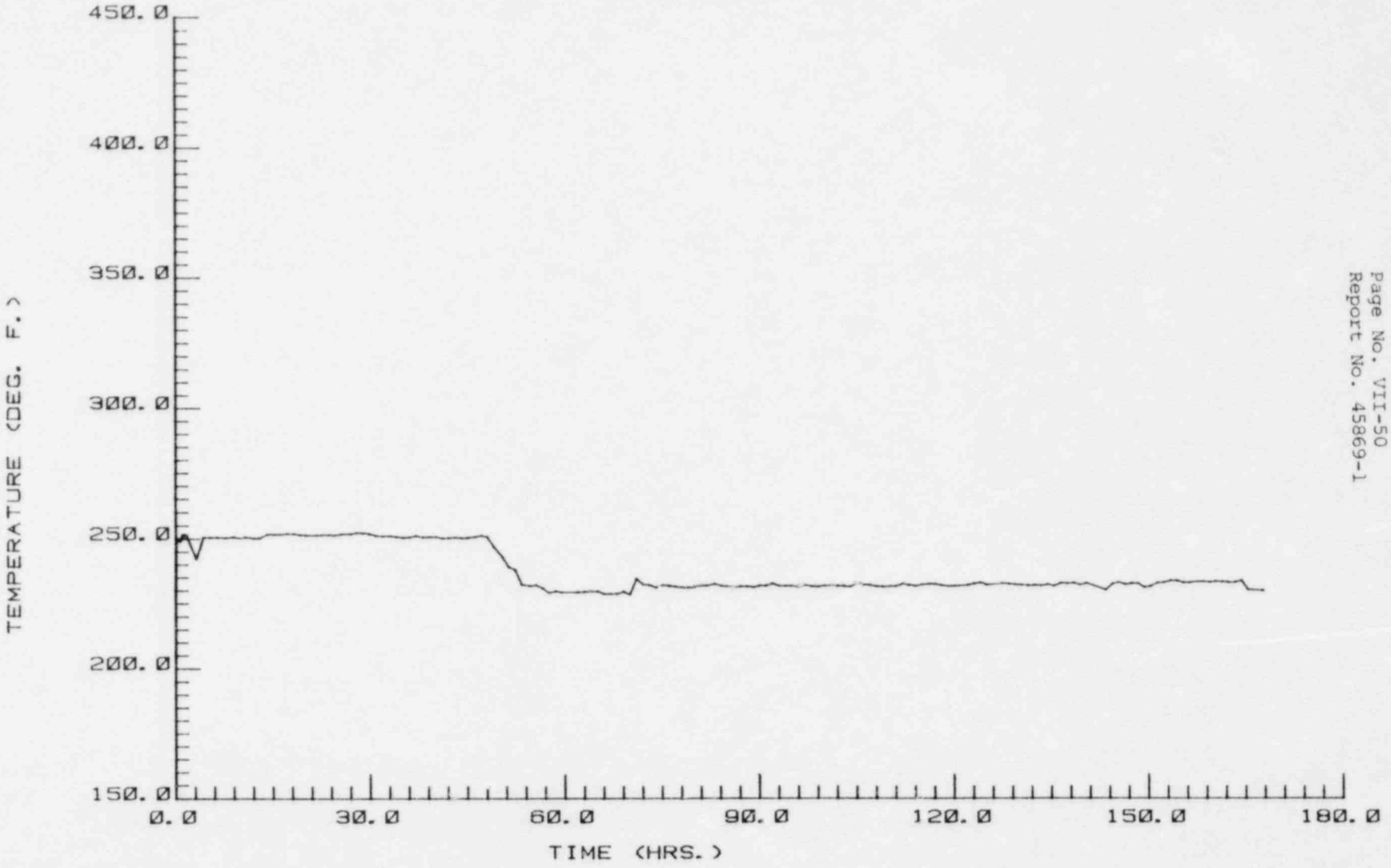
TEMPERATURE THERMOCOUPLE NO. 11

(ON FACE OF FLANGE NEAR MODULE K OR L)



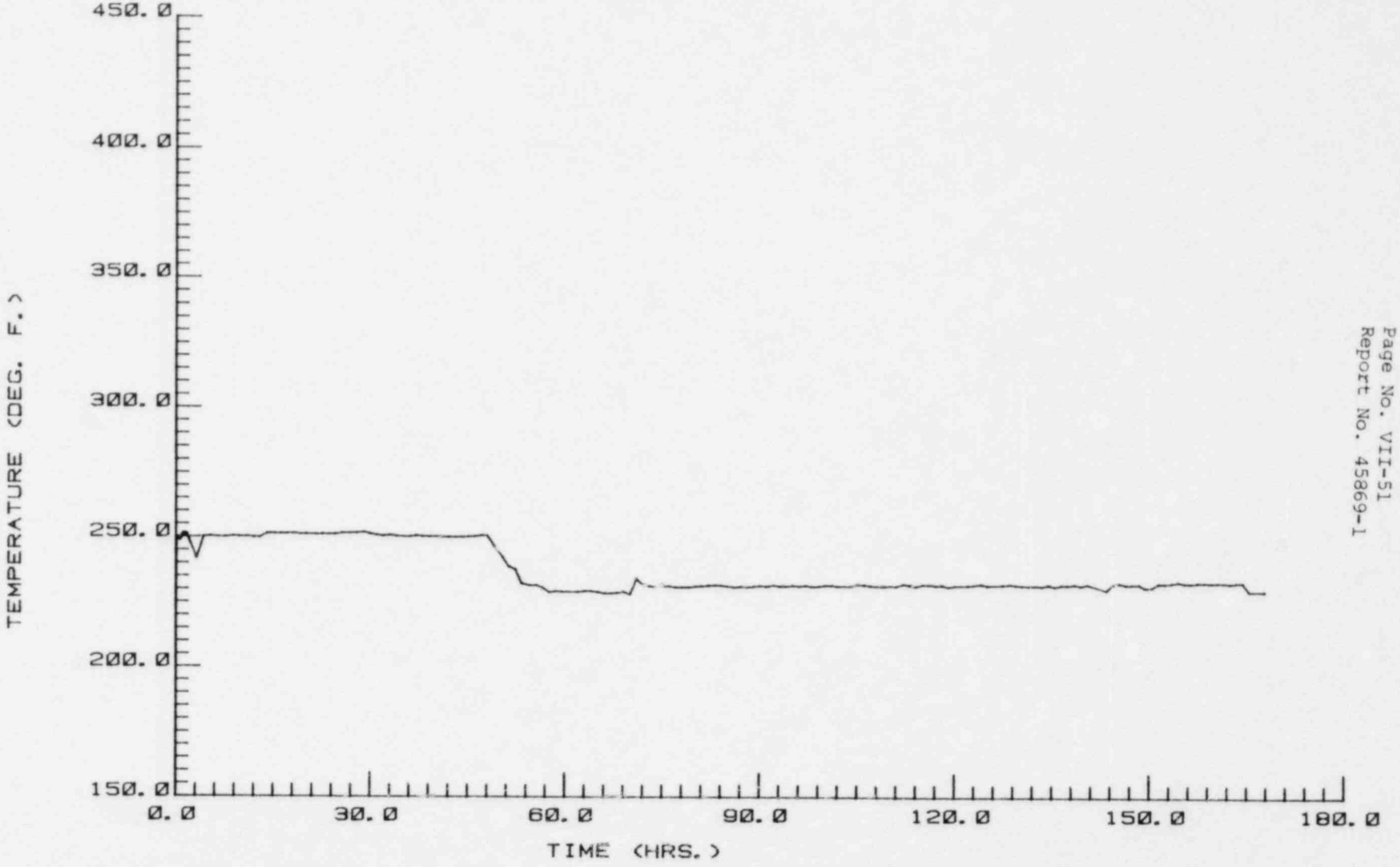
TEMPERATURE THERMOCOUPLE NO. 12

(ON 3/4-INCH CHAMBER FLANGE PLATE AT 360°)



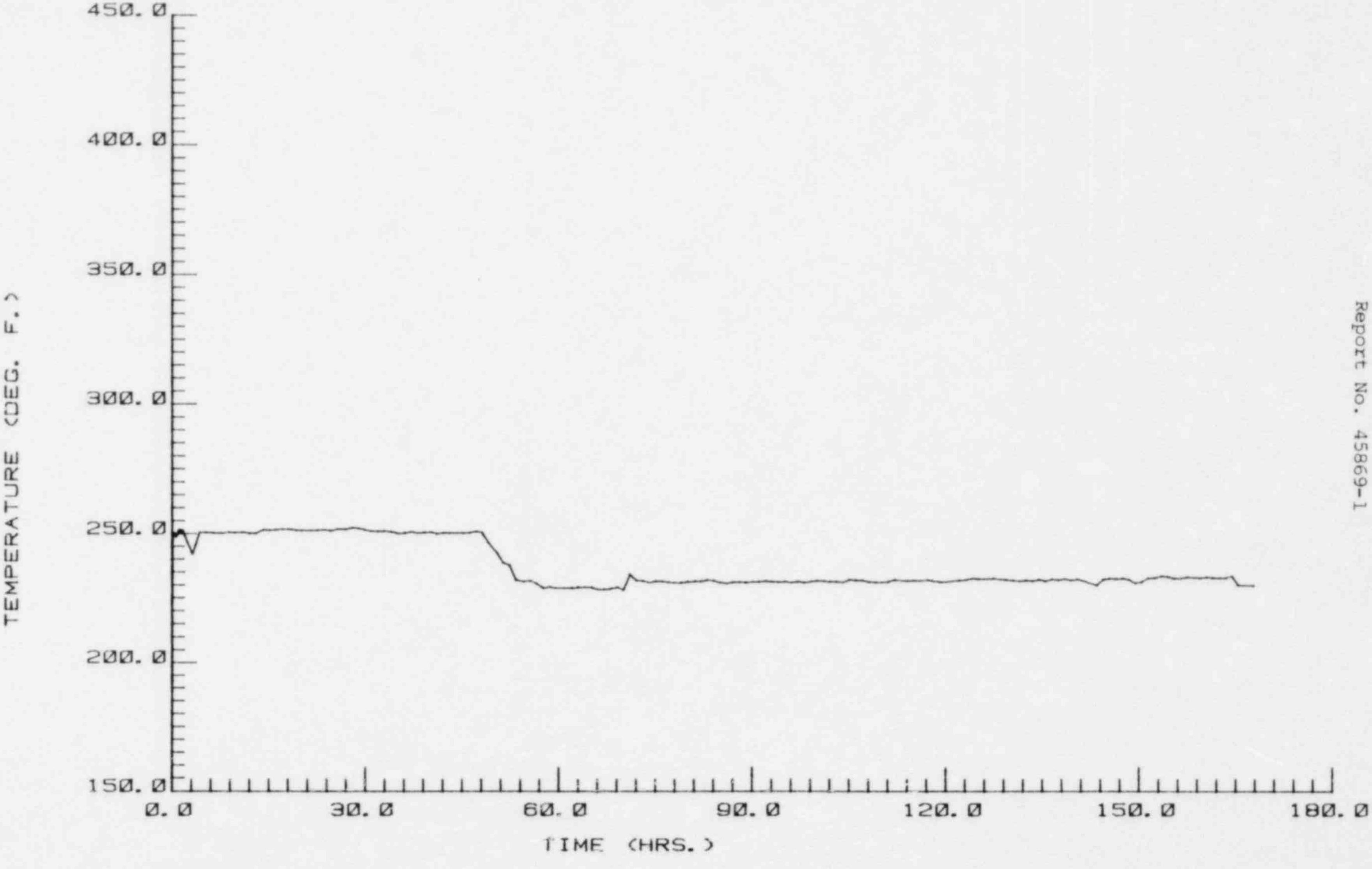
TEMPERATURE THERMOCOUPLE NO. 13

(ON 3/4-INCH CHAMBER FLANGE PLATE AT 90°)



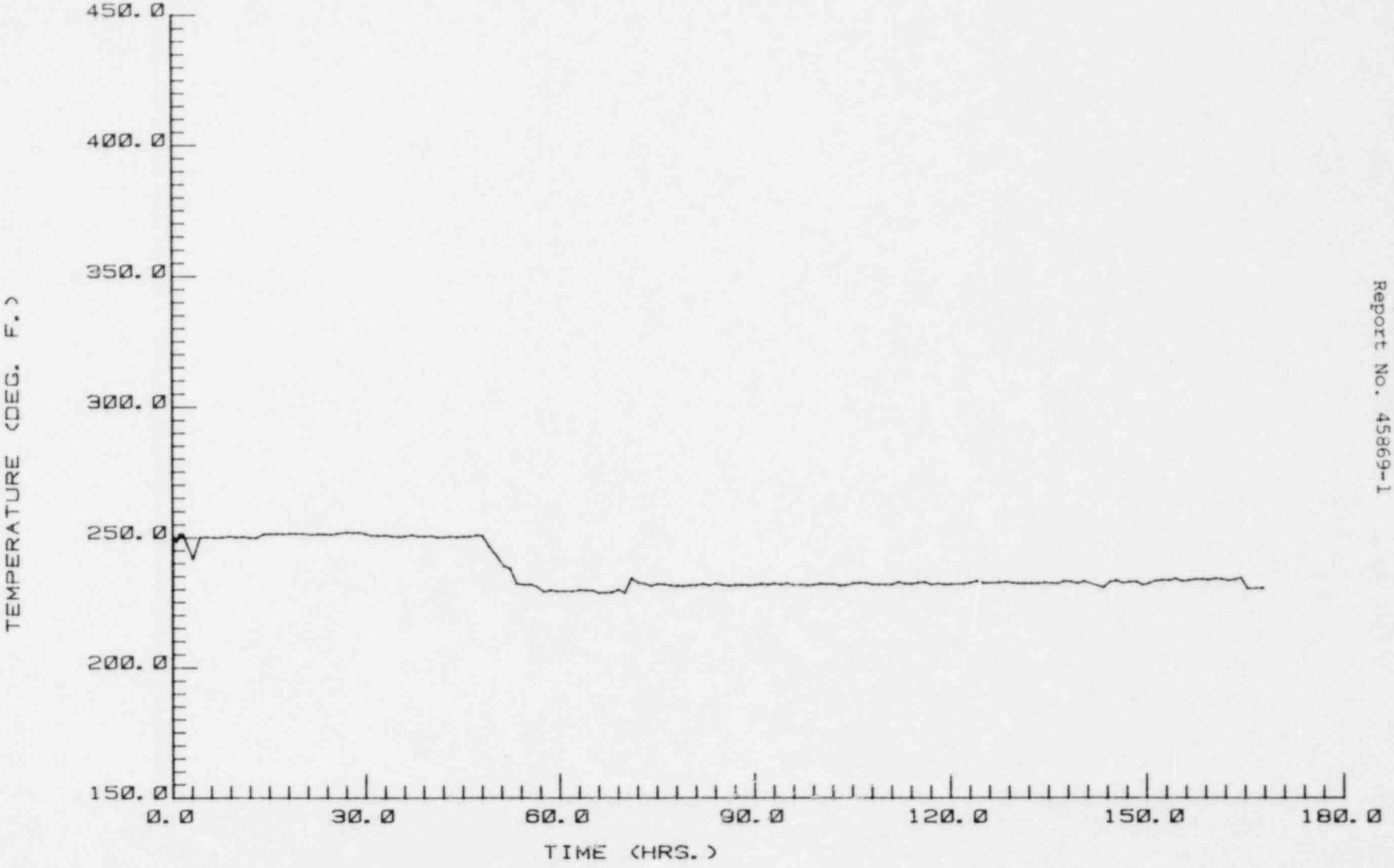
TEMPERATURE THERMOCOUPLE NO. 14

(ON 3/5-INCH CHAMBER FLANGE PLATE AT 180°)



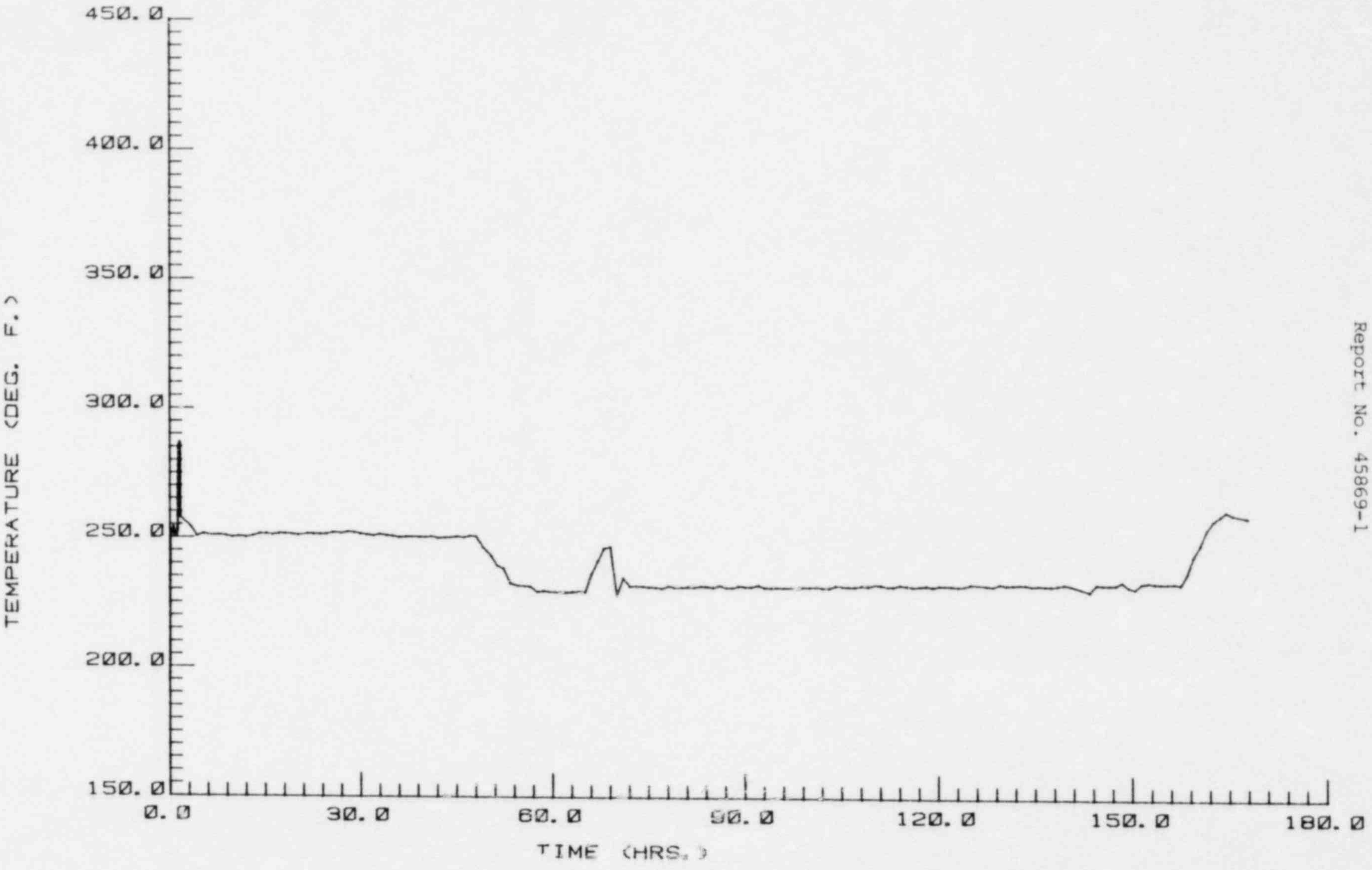
TEMPERATURE THERMOCOUPLE NO. 15

(ON 3/4-INCH CHAMBER FLANGE PLATE AT 270°)



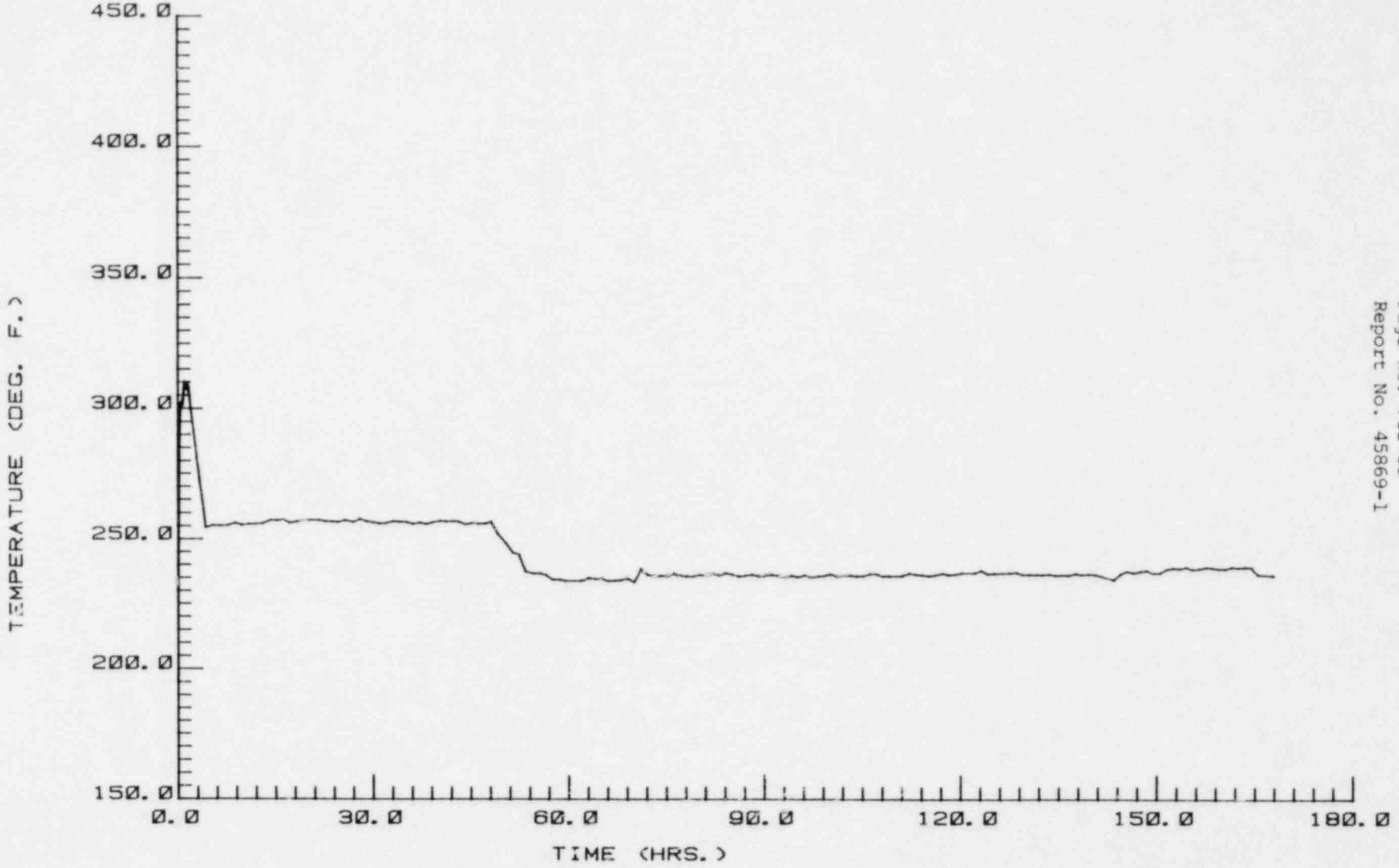
TEMPERATURE THERMOCOUPLE NO. 16

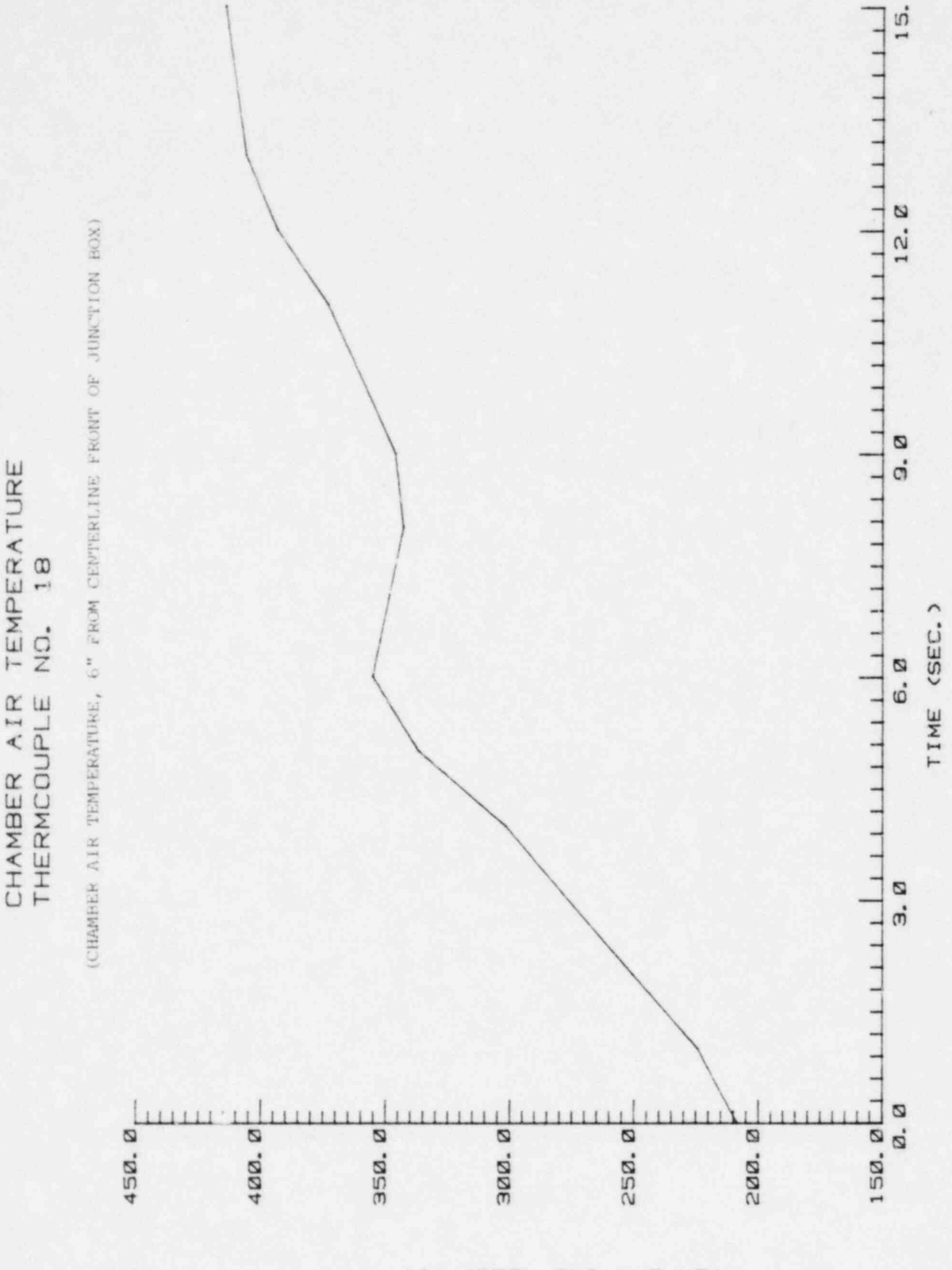
(UNDER ARMOR ON 3X10G2 CABLE FROM MODULE F)



TEMPERATURE THERMOCOUPLE NO. 17

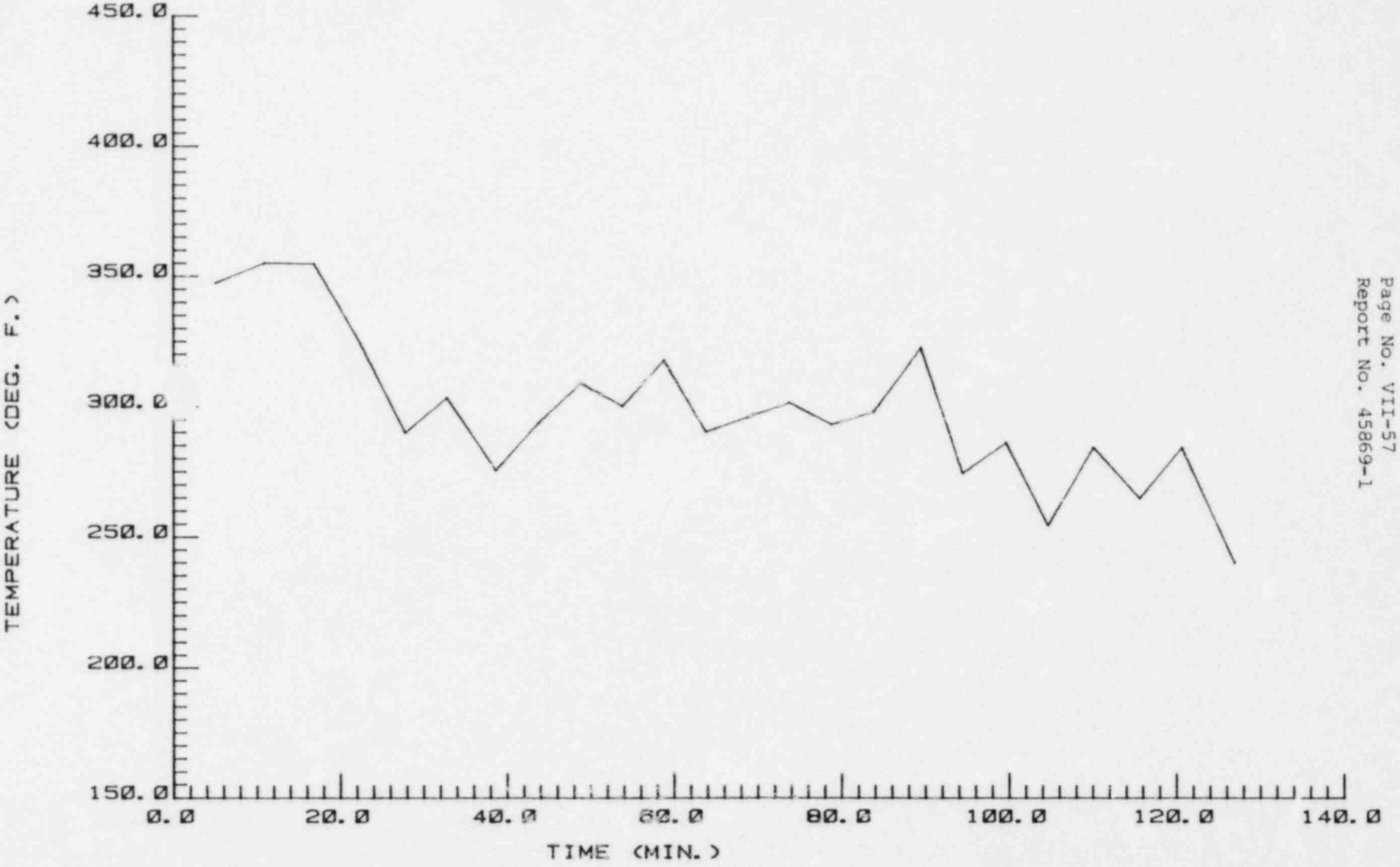
(UNDER ARMOR ON 12X12G1 FROM MODULE L)




CHAMBER AIR TEMPERATURE
THERMOCOUPLE NO. 18
(CHAMBER AIR TEMPERATURE, 6" FROM CENTERLINE FRONT OF JUNCTION BOX)
TEMPERATURE (DEG. F.)
450.0
400.0
350.0
300.0
250.0
200.0
150.0
0.0
3.0
6.0
9.0
12.0
15.0
TIME (SEC.)

CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 18

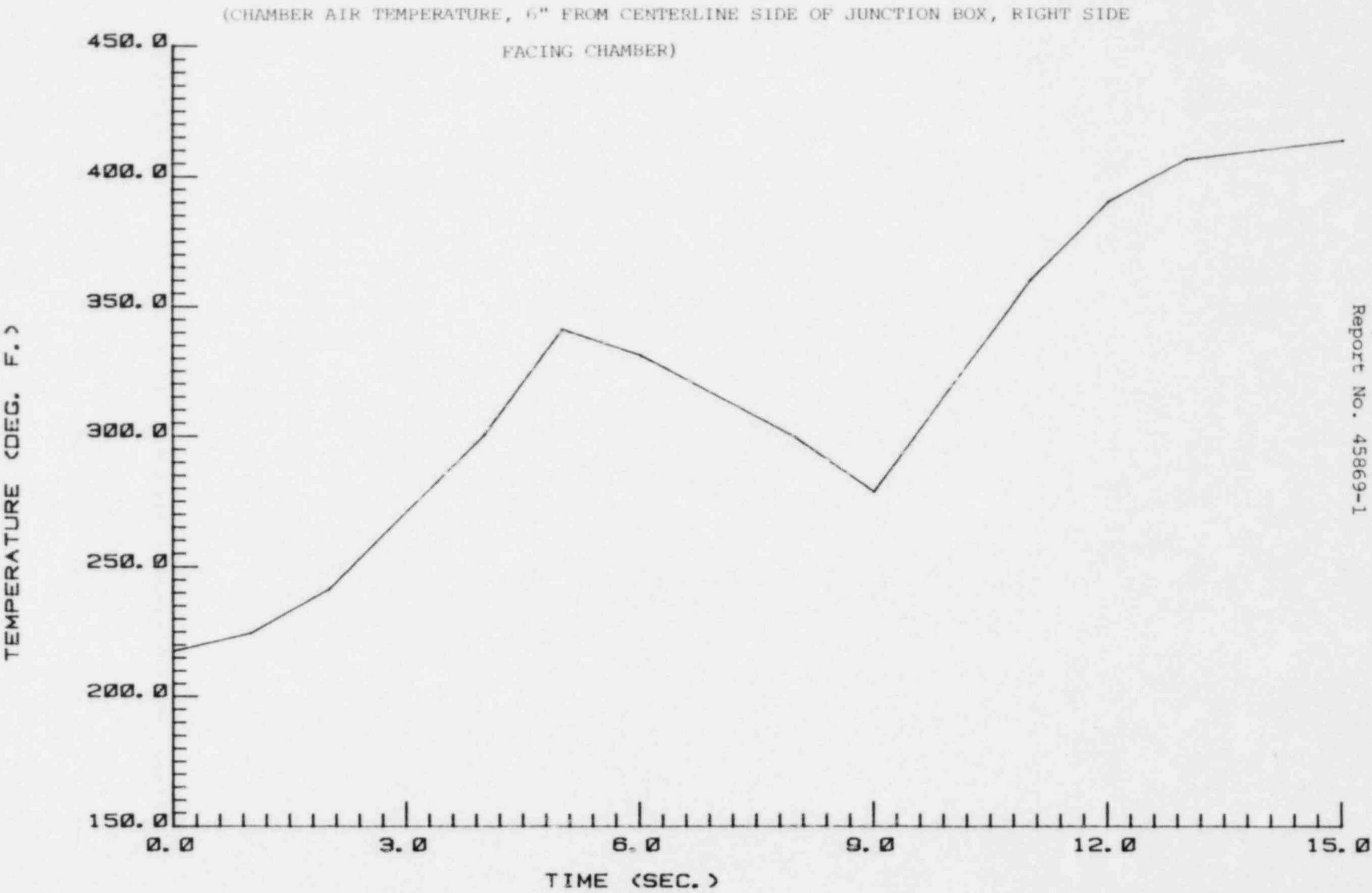
(CHAMBER AIR TEMPERATURE, 6" FROM CENTERLINE FRONT OF JUNCTION BOX)



CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 18

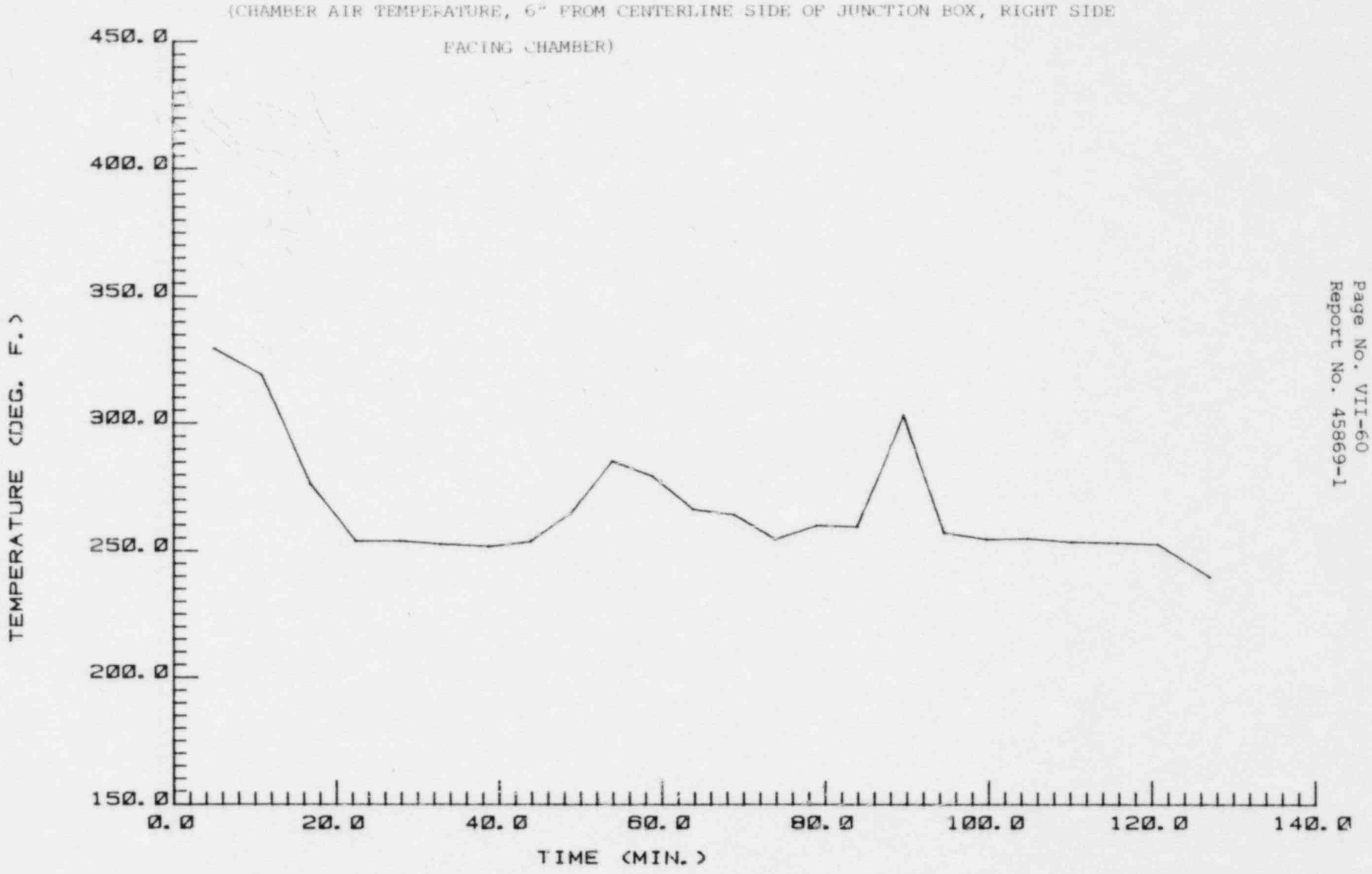
(CHAMBER AIR TEMPERATURE, 6" FROM CENTERLINE FRONT OF JUNCTION BOX)

CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 19



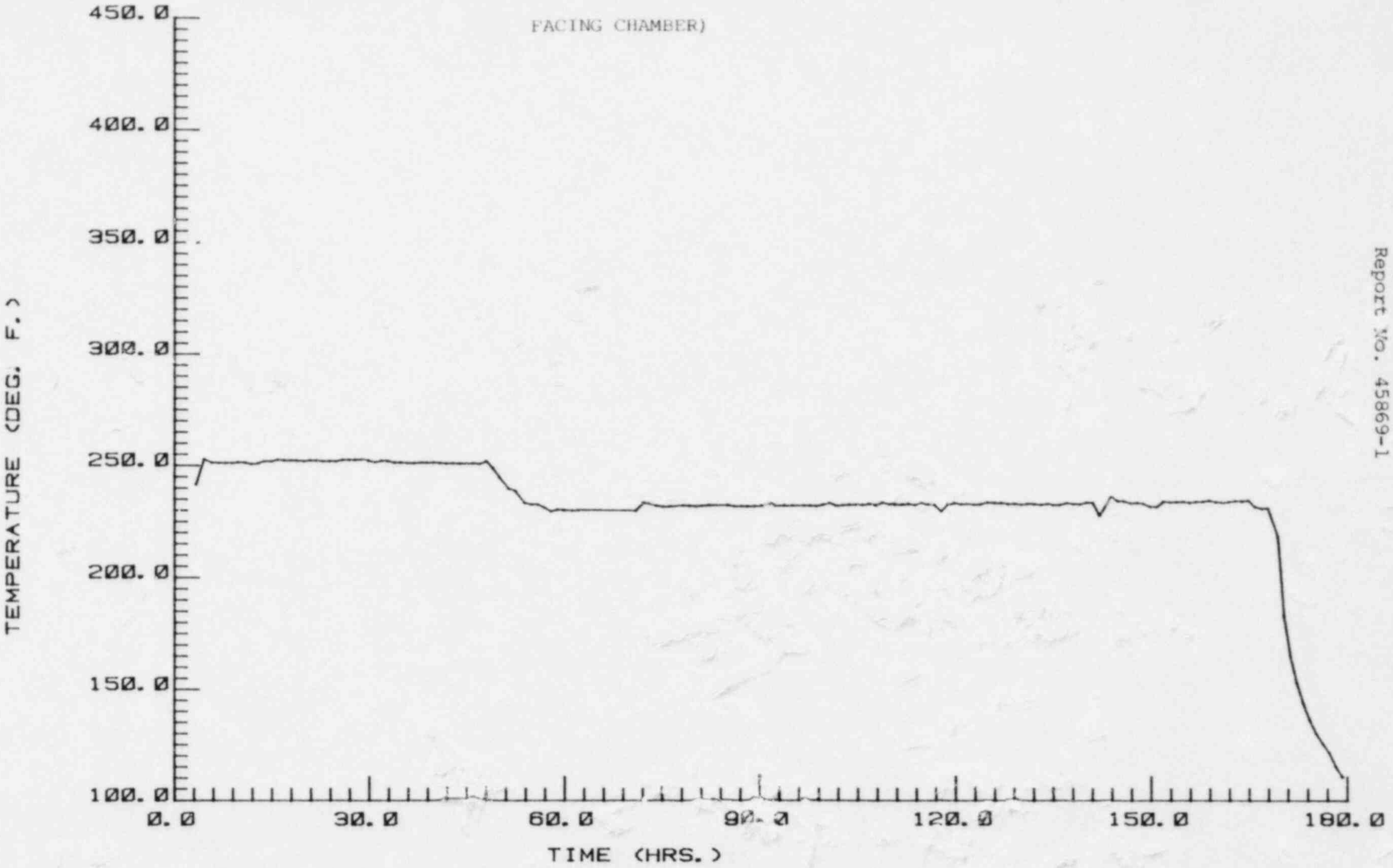
(CHAMBER AIR TEMPERATURE, 6" FROM CENTERLINE SIDE OF JUNCTION BOX, RIGHT SIDE FACING CHAMBER)

CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 19



(CHAMBER AIR TEMPERATURE, 6" FROM CENTERLINE SIDE OF JUNCTION BOX, RIGHT SIDE FACING CHAMBER)

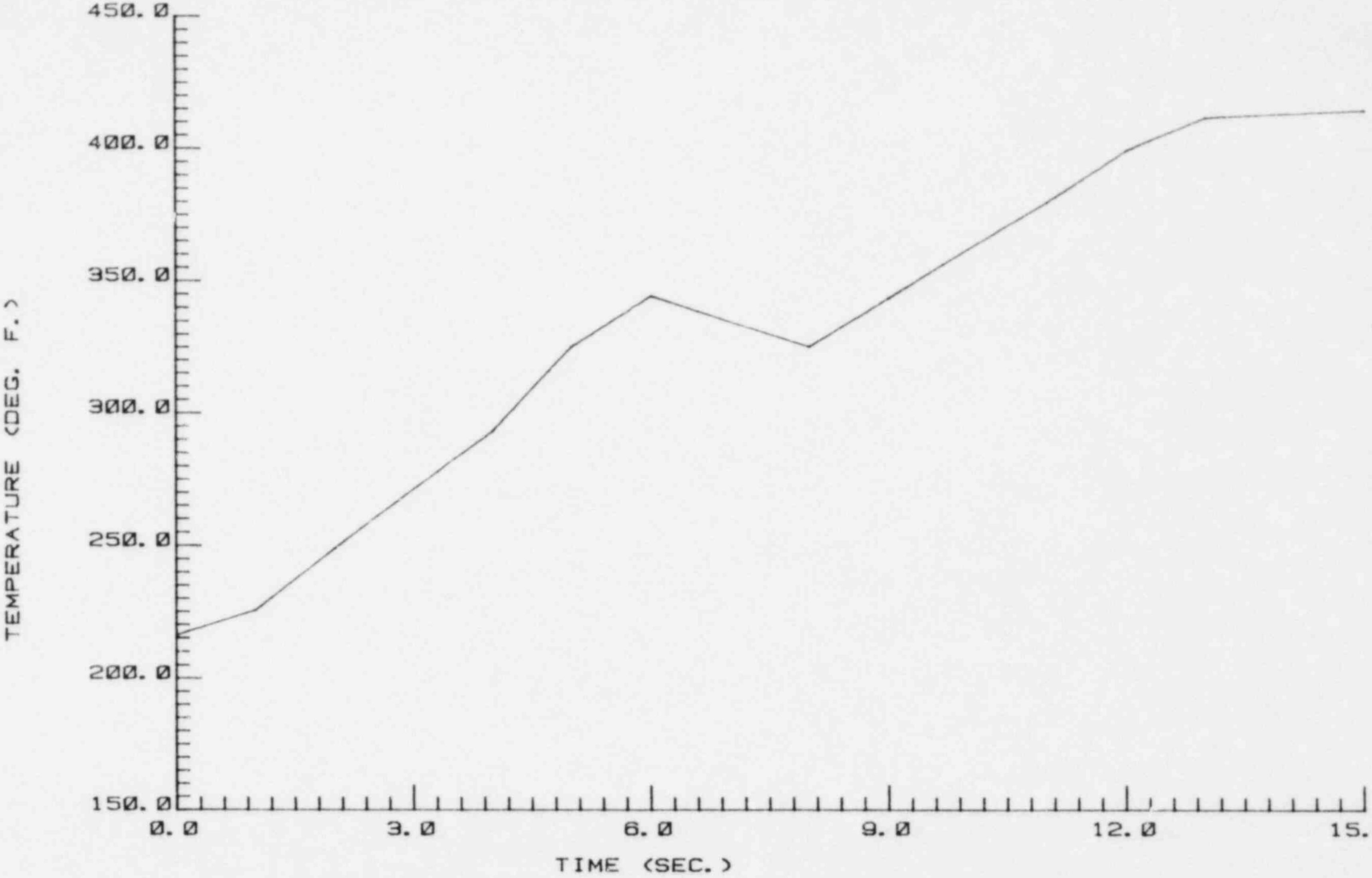
CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 19



(CHAMBER AIR TEMPERATURE, 6" FROM CENTERLINE SIDE OF JUNCTION BOX, RIGHT SIDE FACING CHAMBER)

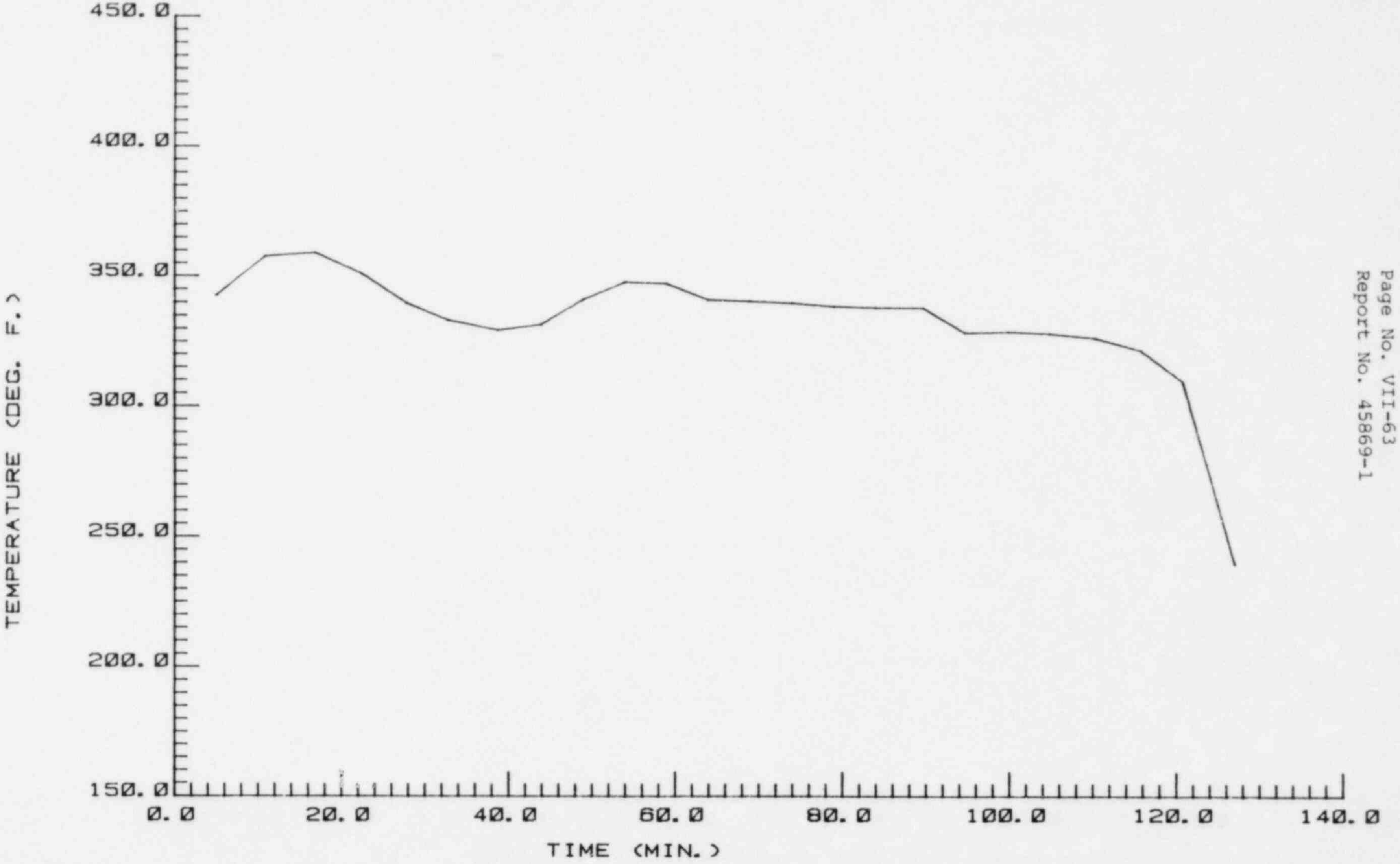
CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 20

(CHAMBER AIR TEMPERATURE, 6" FROM BOTTOM, CENTERLINE OR JUNCTION BOX)

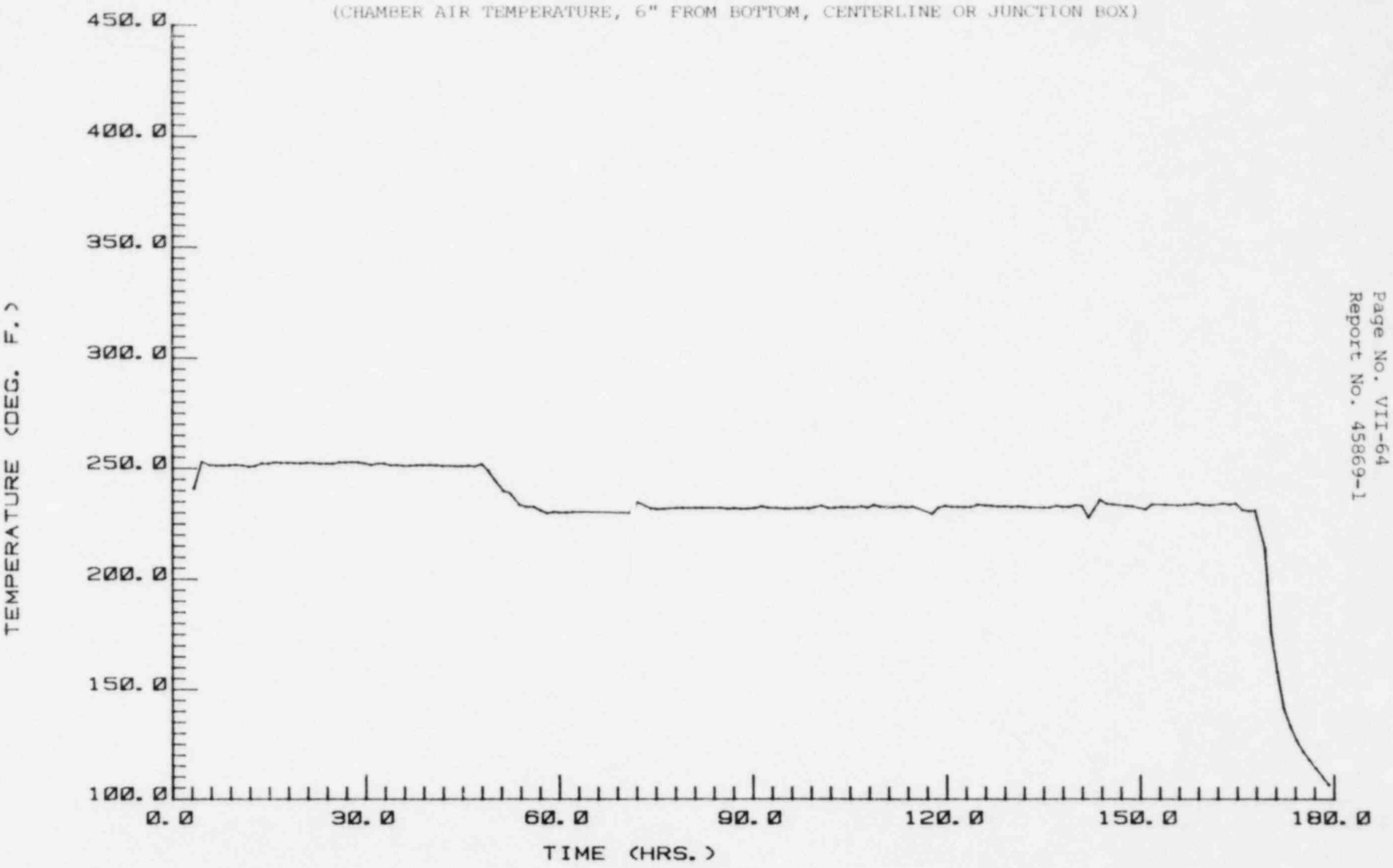


CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 20

(CHAMBER AIR TEMPERATURE 6" FROM BOTTOM, CENTERLINE OR JUNCTION BOX)

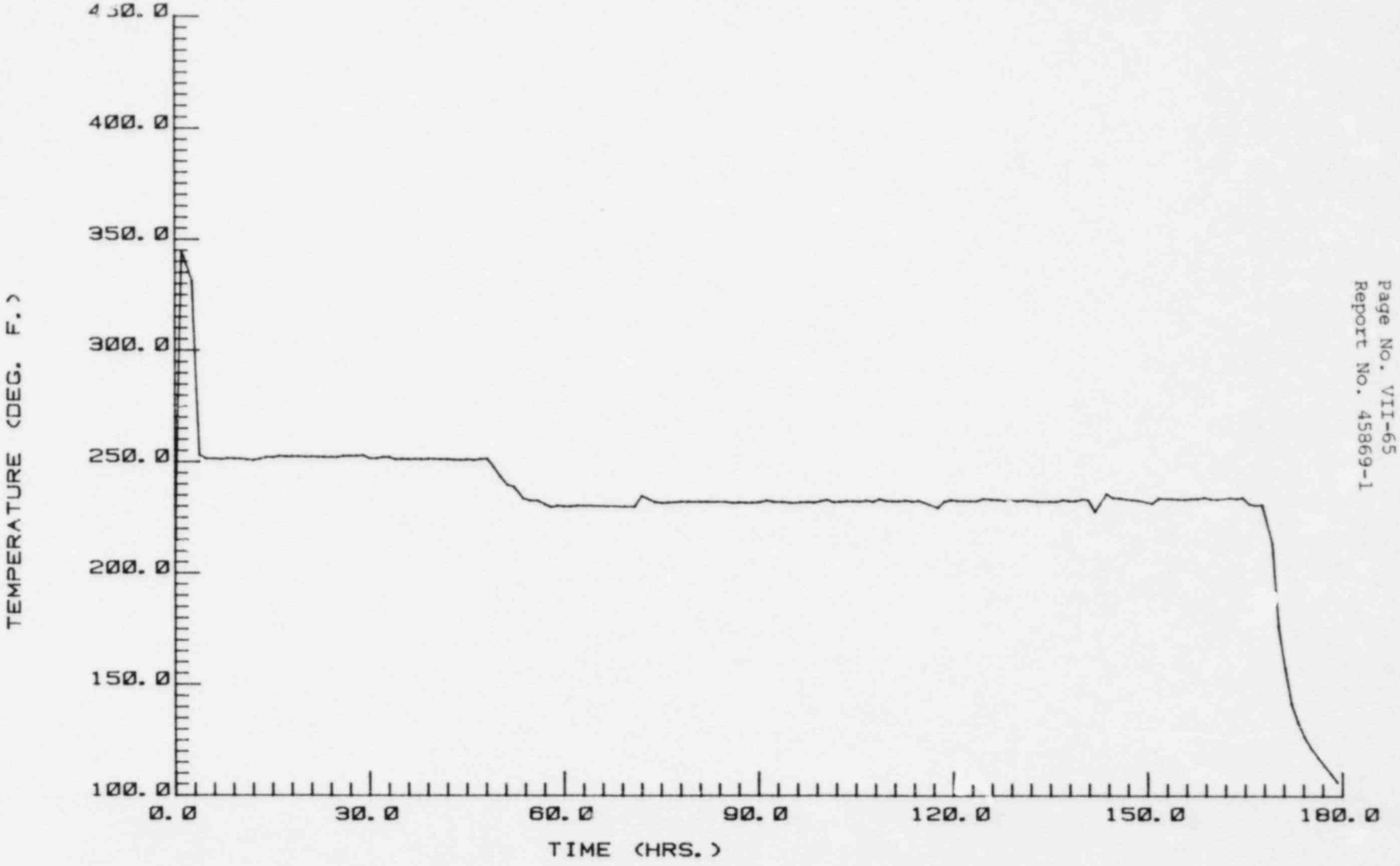


CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 20



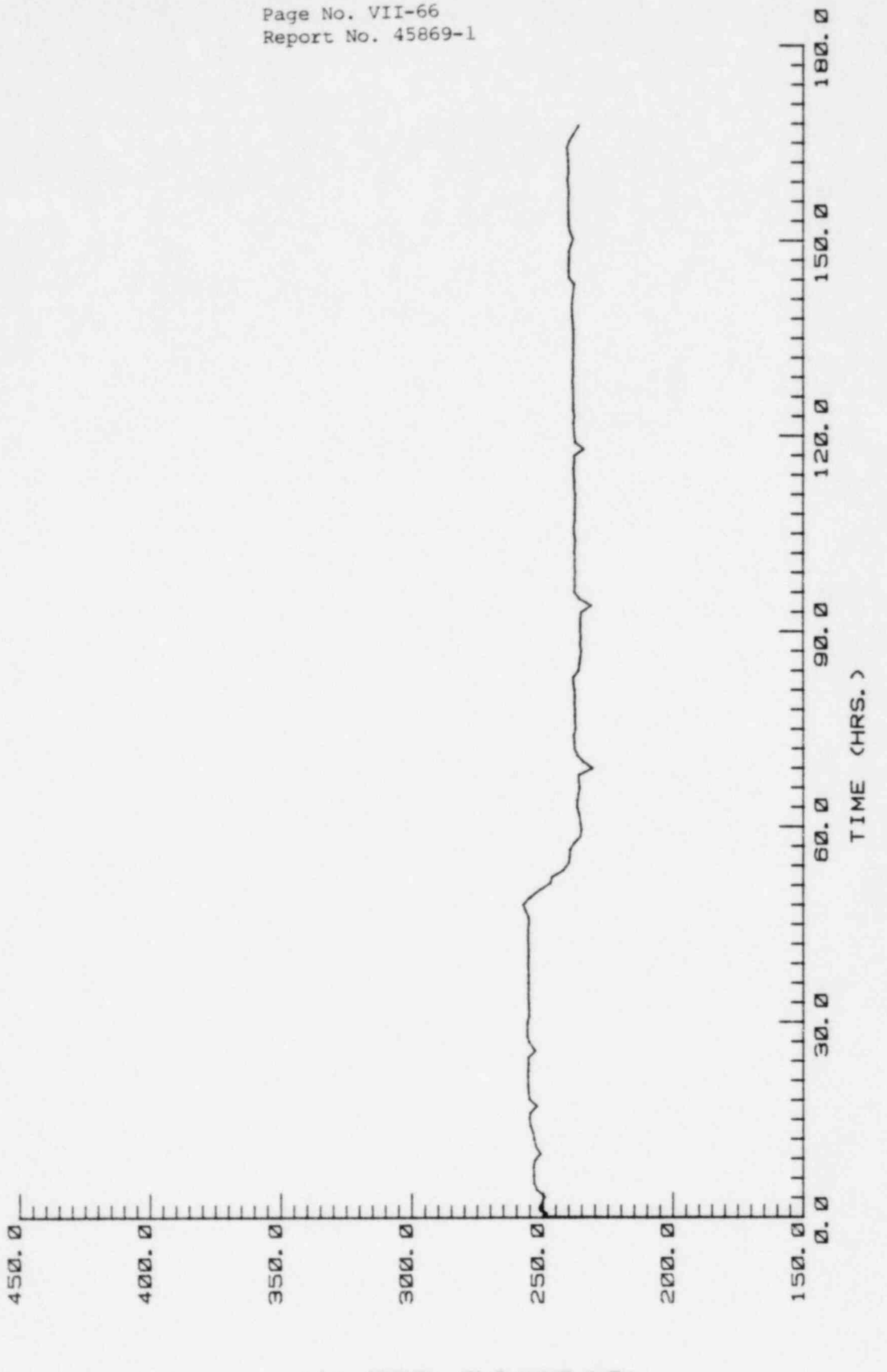
CHAMBER AIR TEMPERATURE
THERMCOUPLE NO. 20

(CHAMBER AIR TEMPERATURE, 6" FROM BOTTOM, CENTERLINE OR JUNCTION BOX)



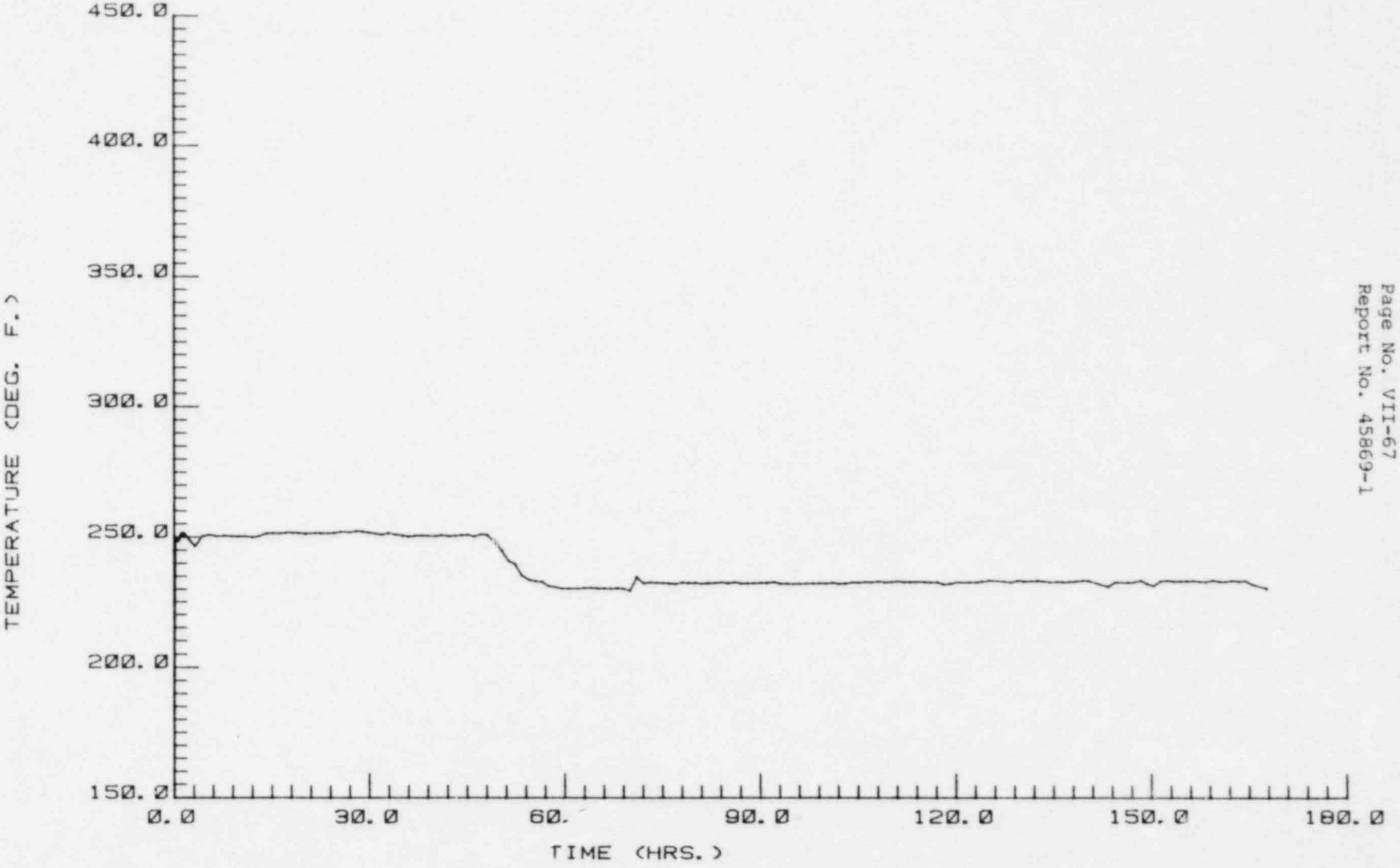
TEMPERATURE THERMOCOUPLE NO. 21

(ON RECEPTACLE OF MODULE E)



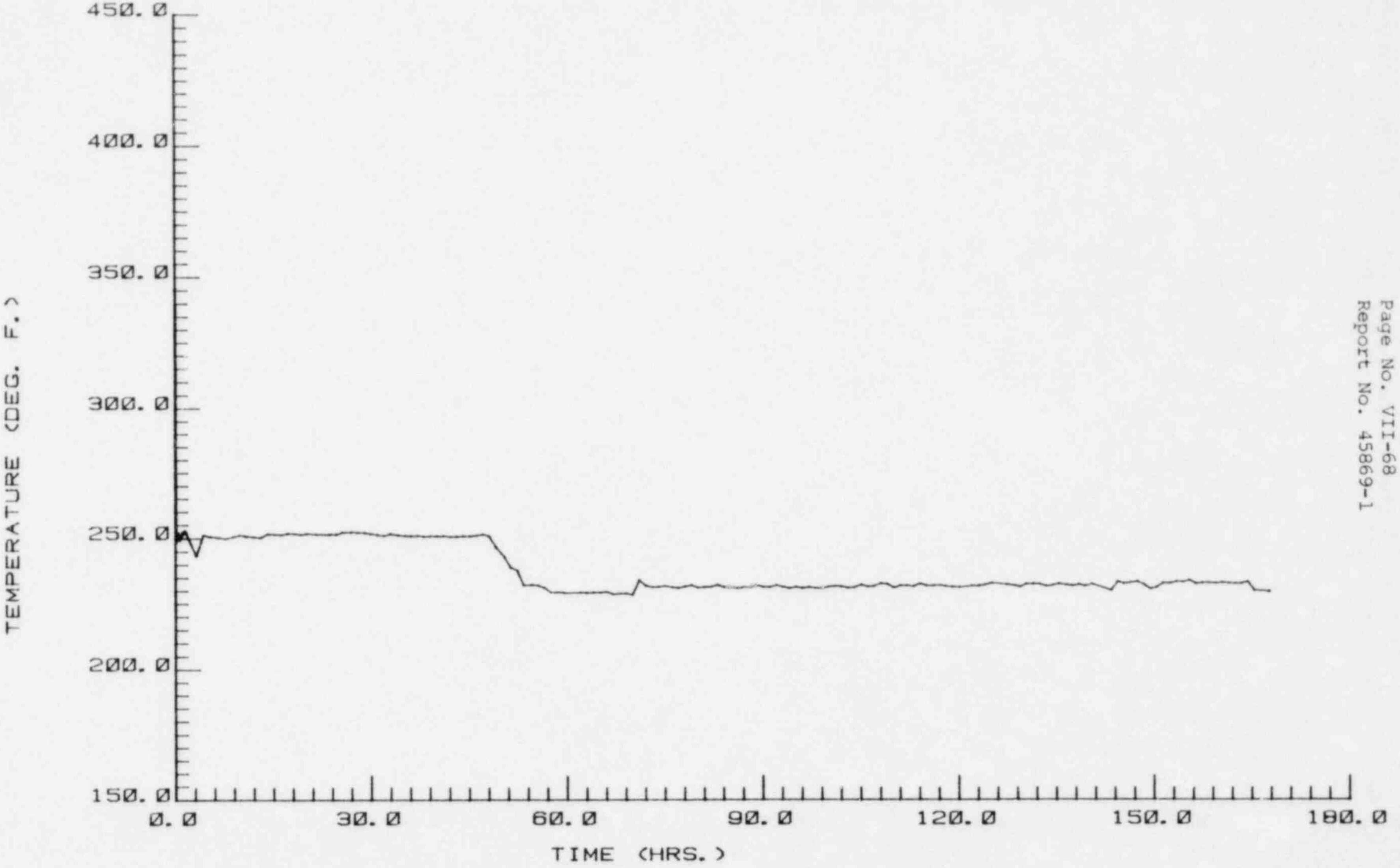
TEMPERATURE THERMOCOUPLE NO. 22

(ON RECEPTACLE OF MODULE D)



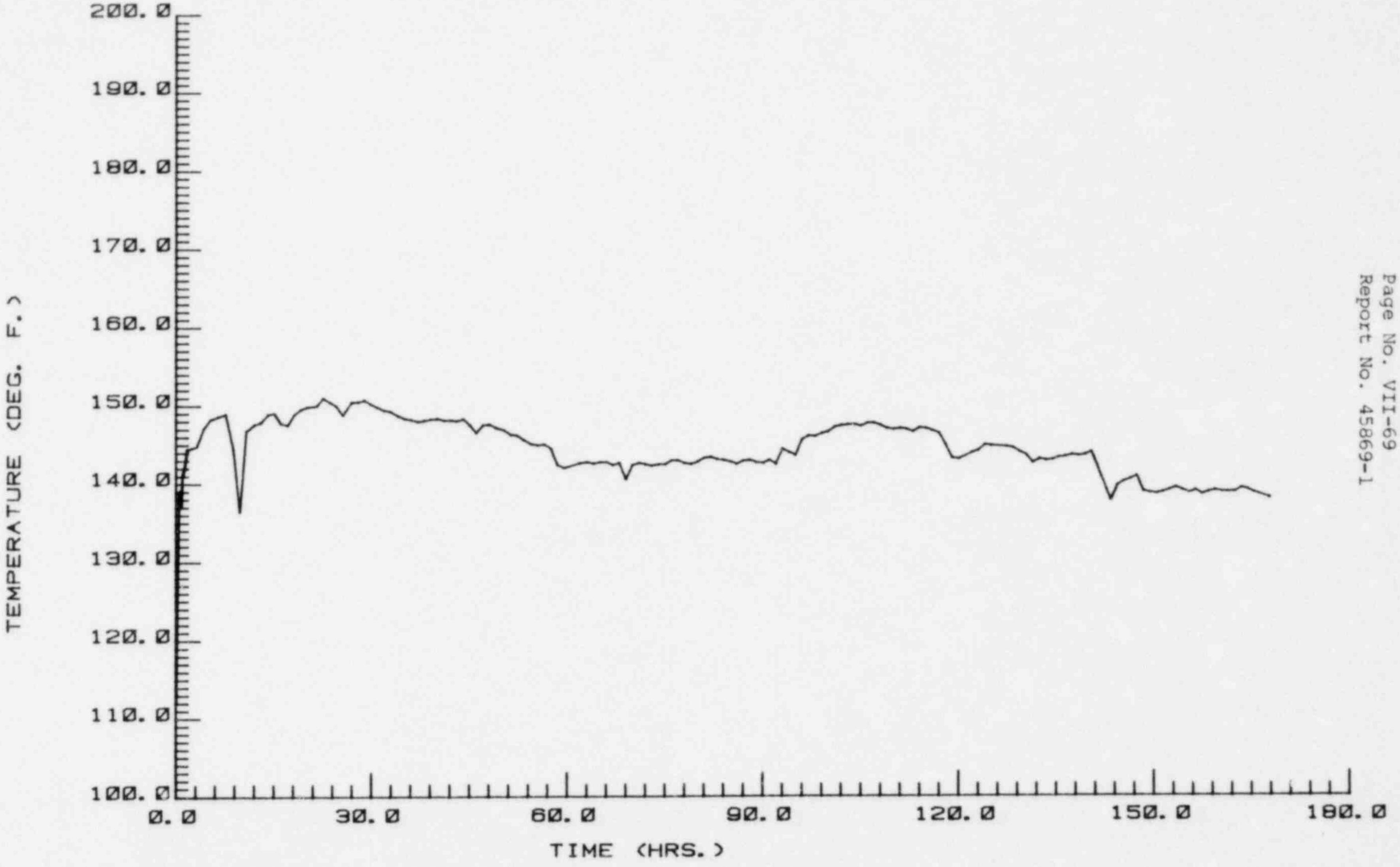
TEMPERATURE THERMOCOUPLE NO. 23

(CHAMBER AIR TEMPERATURE (6" ABOVE CENTERLINE JUNCTION BOX)



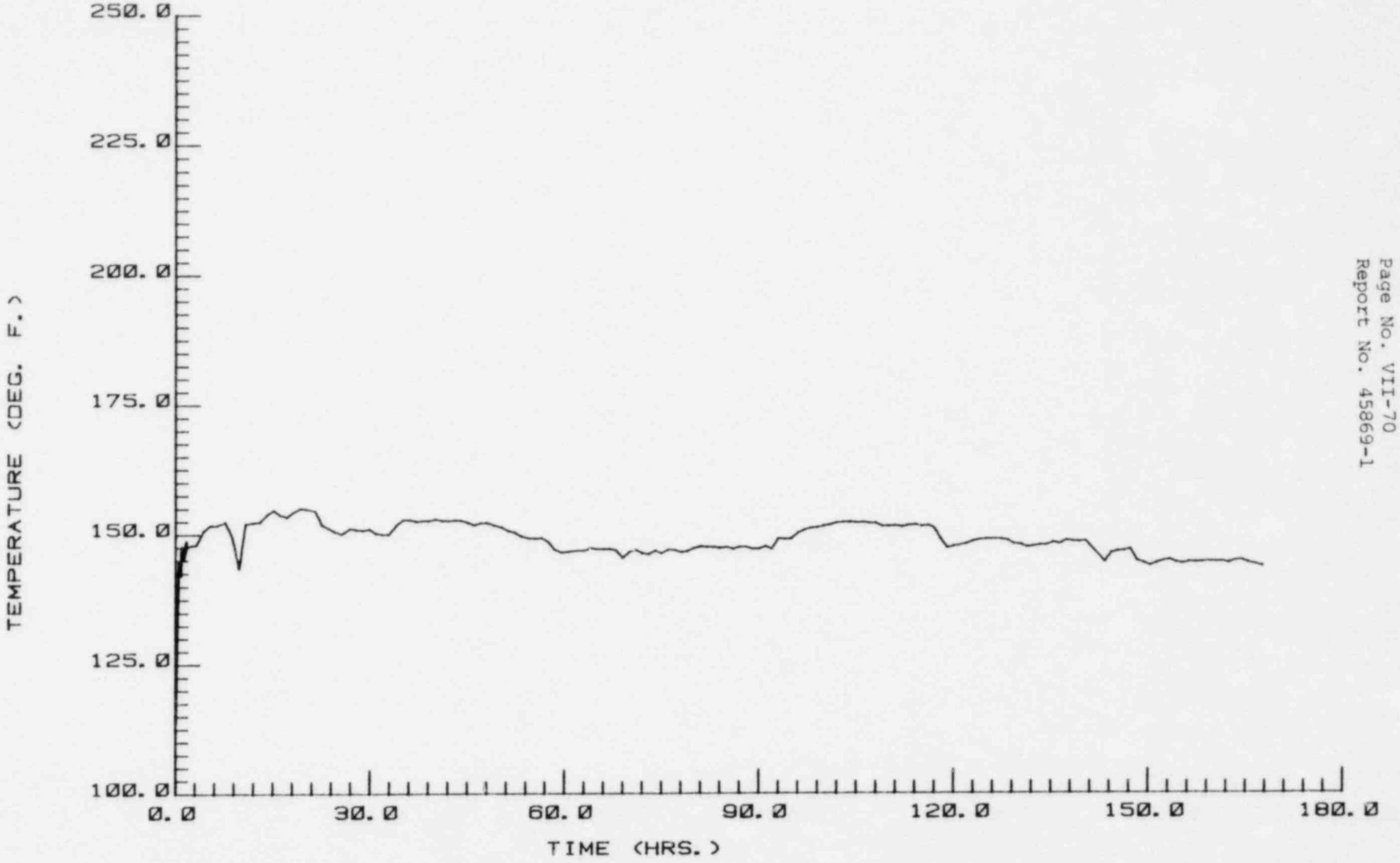
TEMPERATURE THERMOCOUPLE NO. 26

(ON EXTERIOR FACE OF JUNCTION BOX COVER)



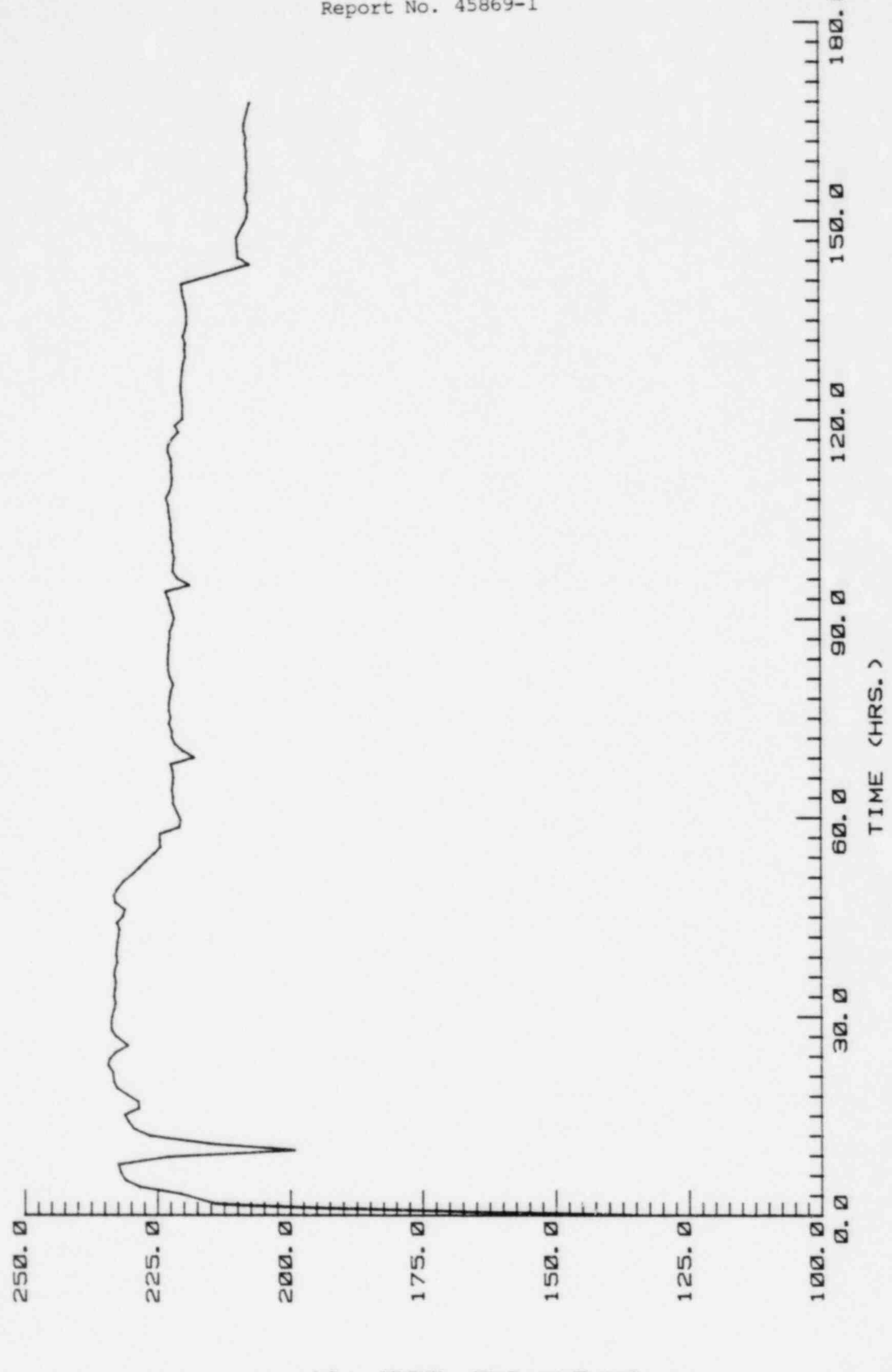
TEMPERATURE THERMOCOUPLE NO. 27

(AIR TEMPERATURE INSIDE JUNCTION BOX)



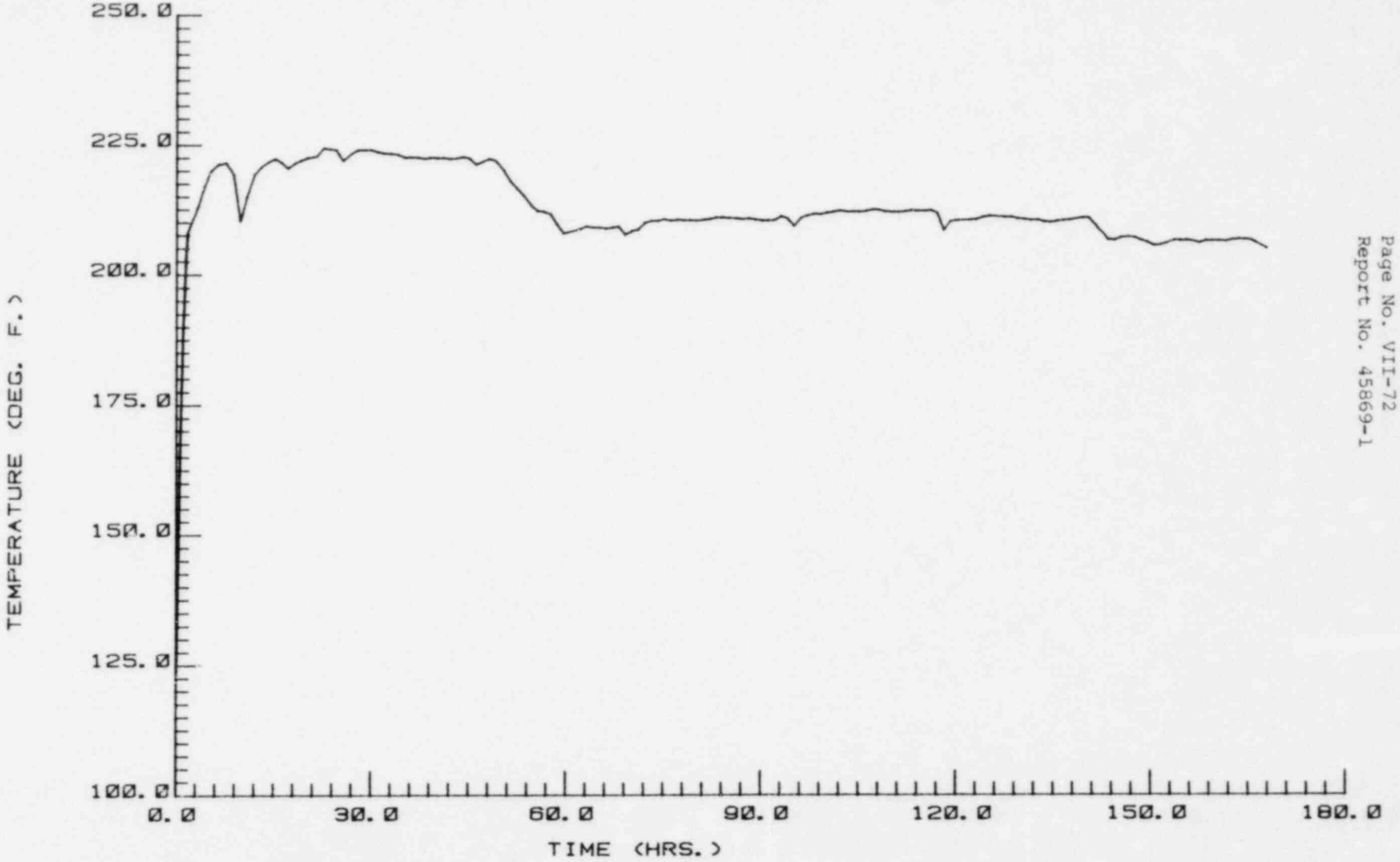
TEMPERATURE THERMOCOUPLE NO. 28

(IN BACKSHELL OF MODULE C)



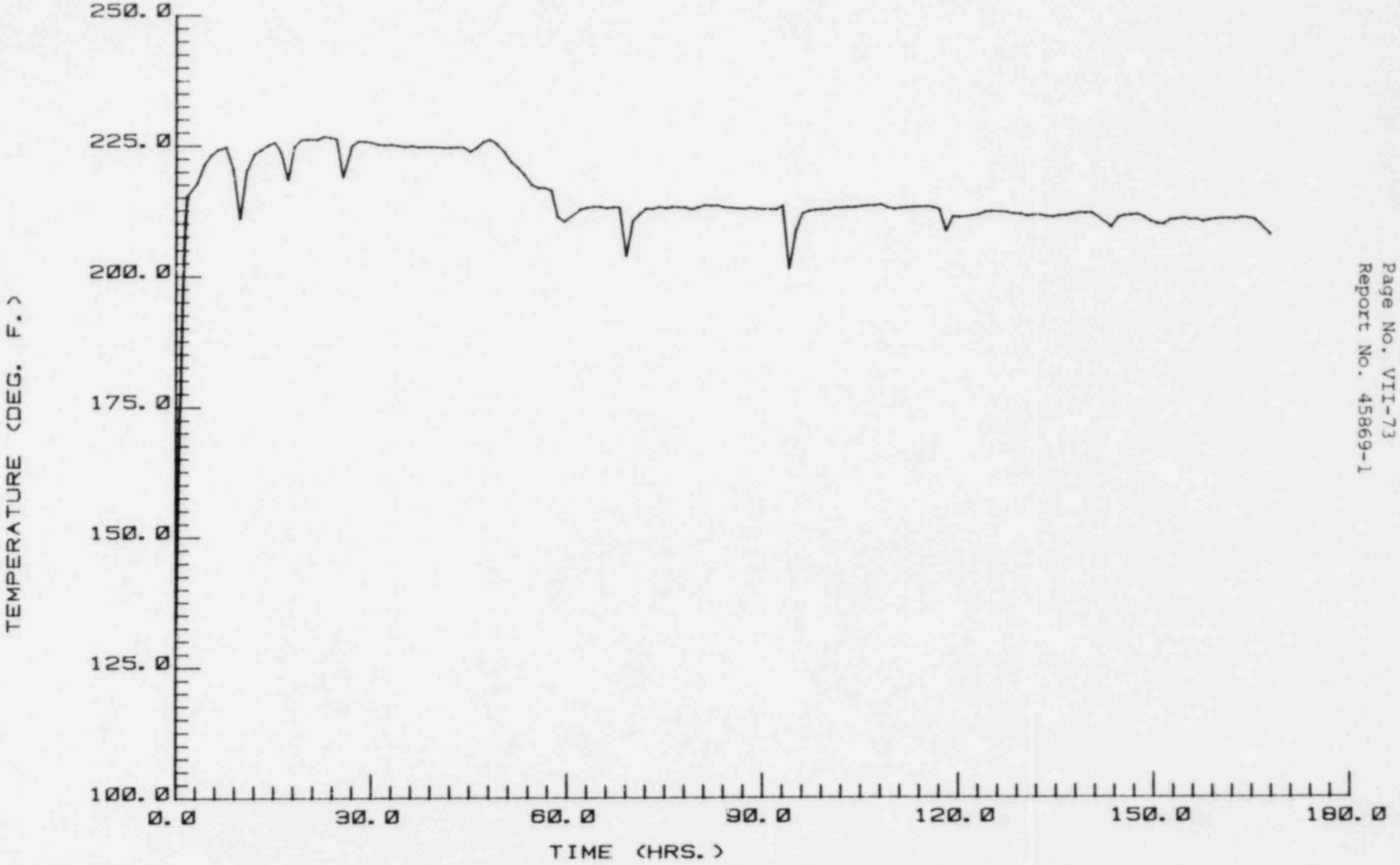
TEMPERATURE THERMOCOUPLE NO. 29

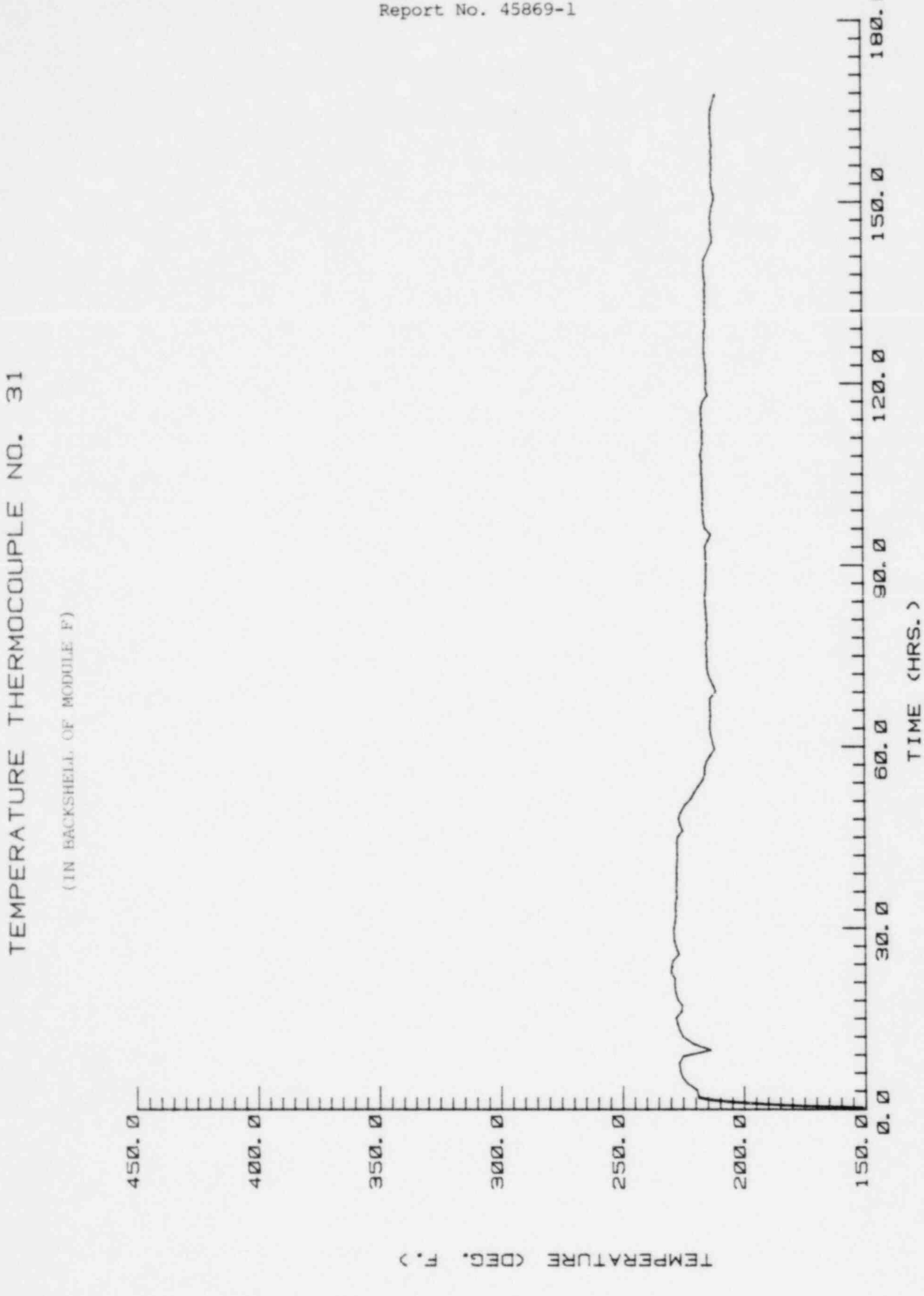
(IN BACKSHELL OF MODULE D)



TEMPERATURE THERMOCOUPLE NO. 30

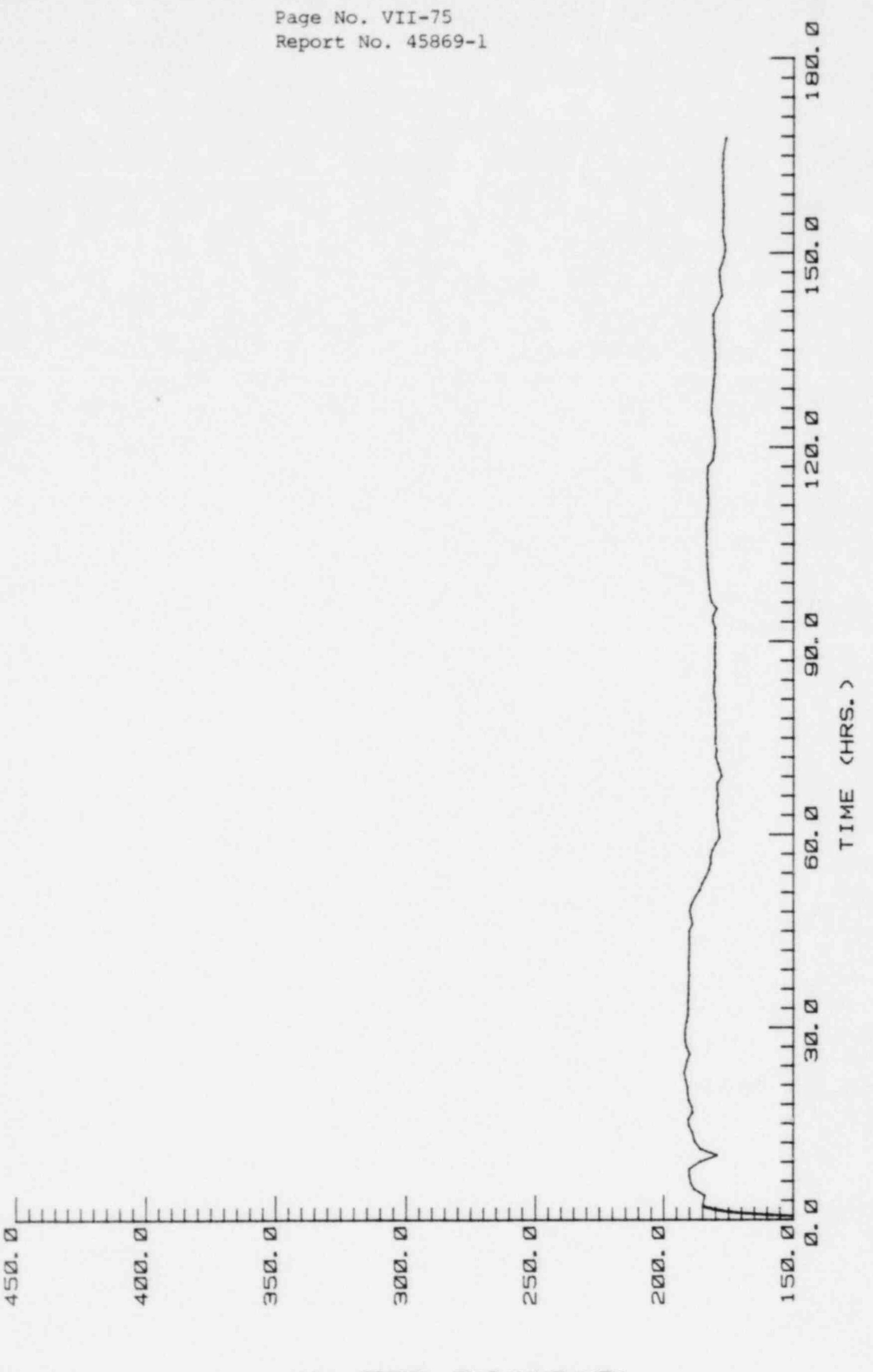
(IN BACKSHELL OF MODULE E)





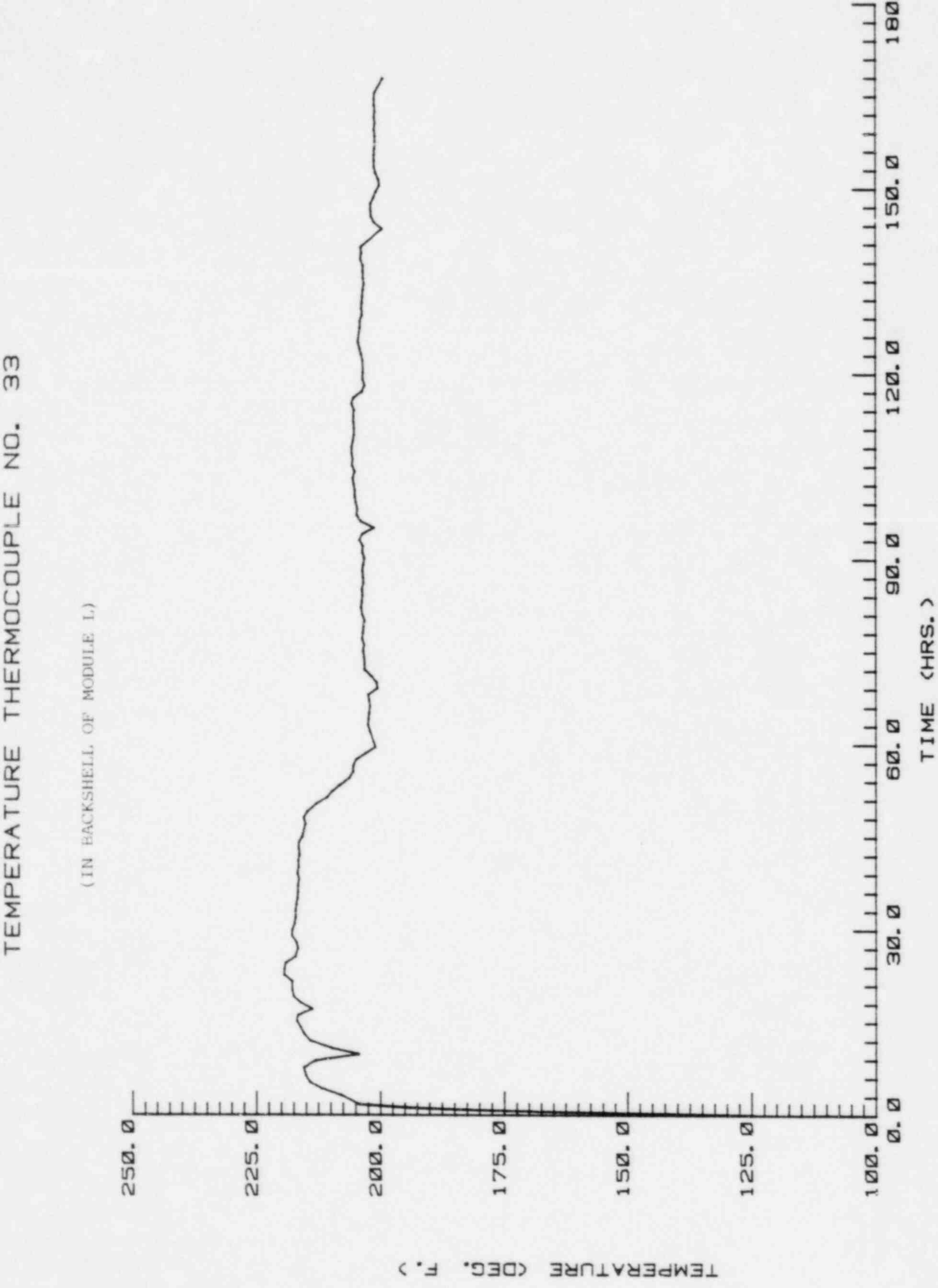
TEMPERATURE THERMOCOUPLE NO. 31

(IN BACKSHELL OF MODULE F)



TEMPERATURE THERMOCOUPLE NO. 32

(IN BACKSHELL OF MODULE K)

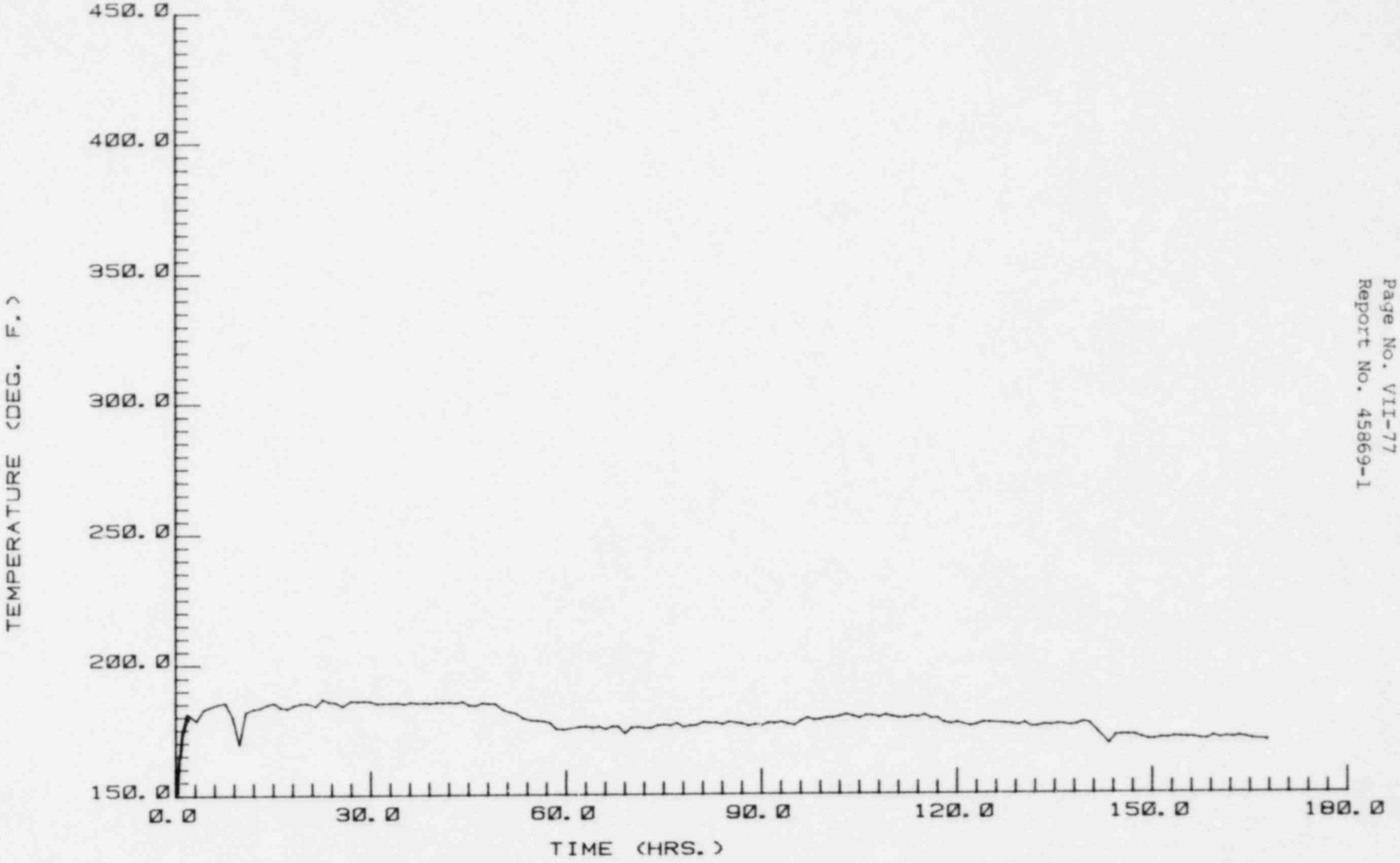


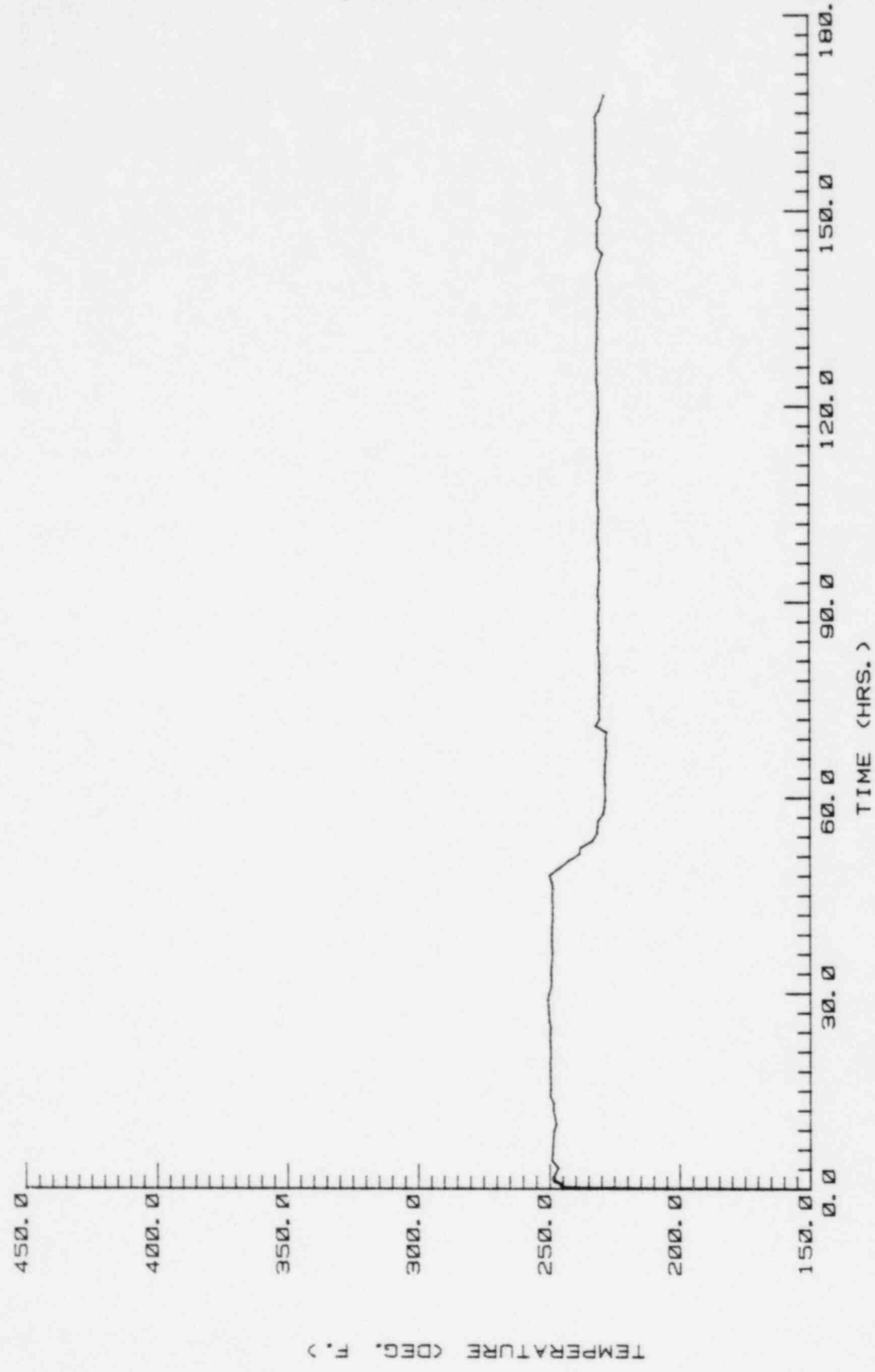
TEMPERATURE THERMOCOUPLE NO. 33

(IN BACKSHELL OF MODULE 1)

TEMPERATURE THERMOCOUPLE NO. 34

(INSIDE NOZZLE AIR TEMPERATURE)



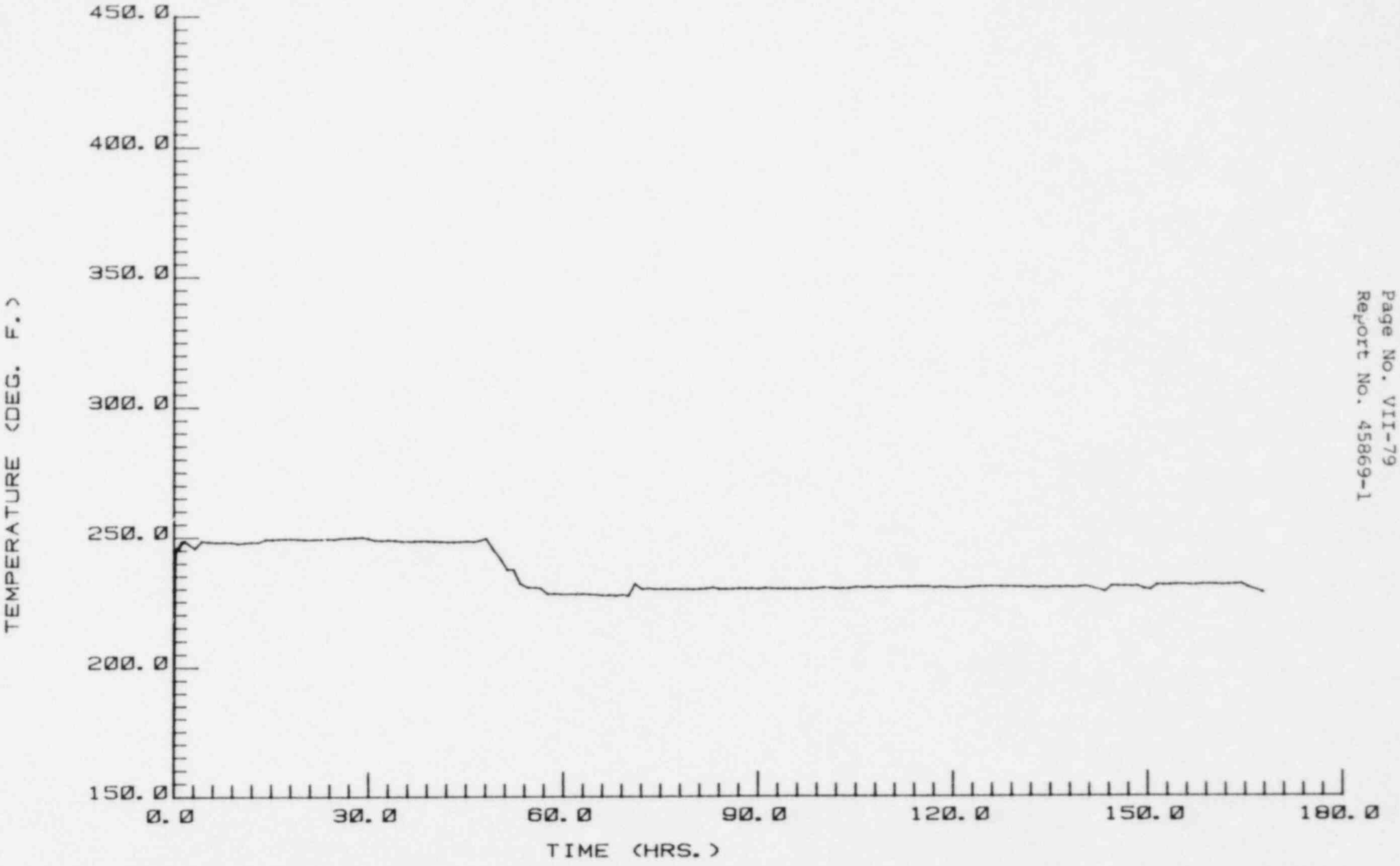


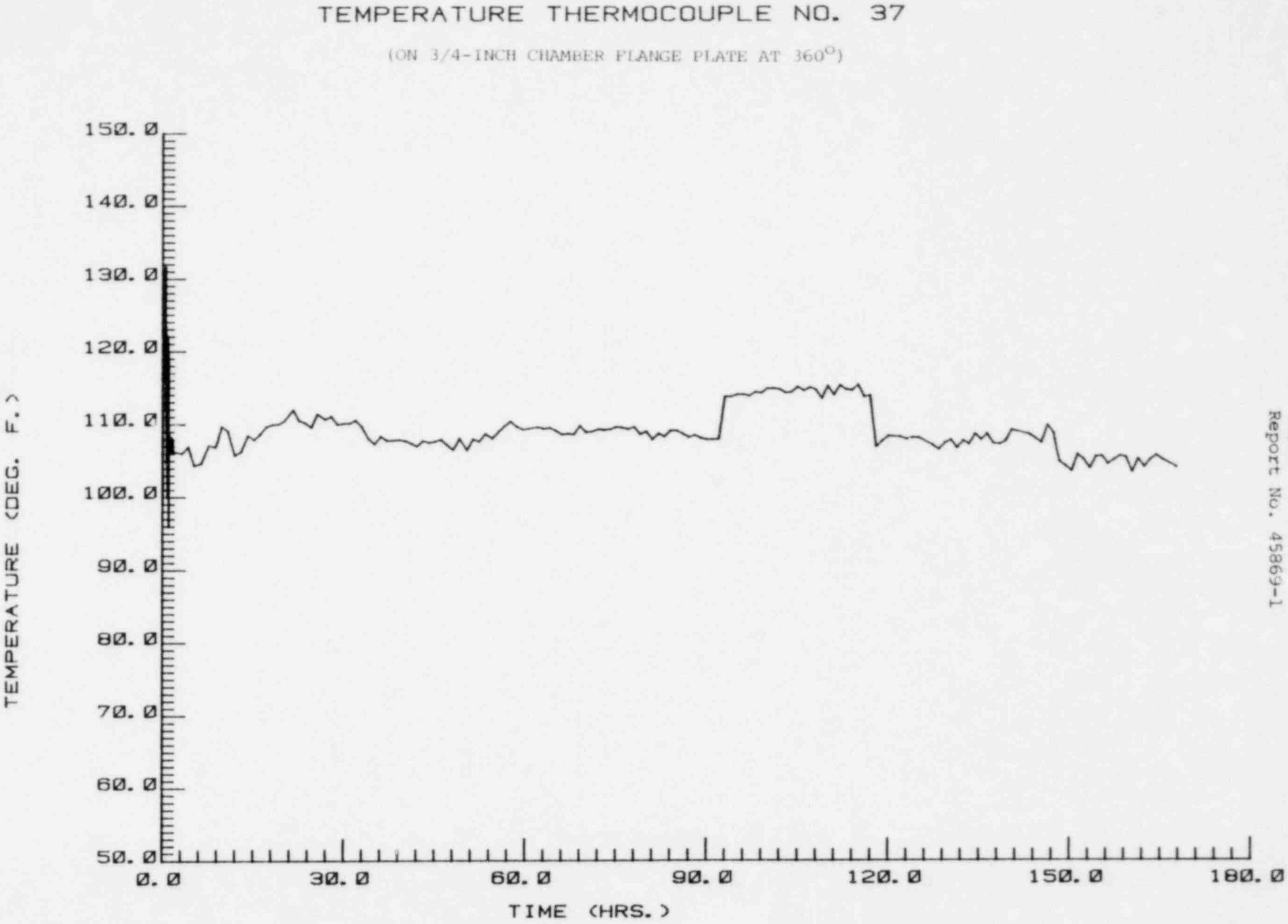
TEMPERATURE THERMOCOUPLE NO. 35

(ON FACE OF FLANGE NEAR MODULE C)

TEMPERATURE THERMOCOUPLE NO. 36

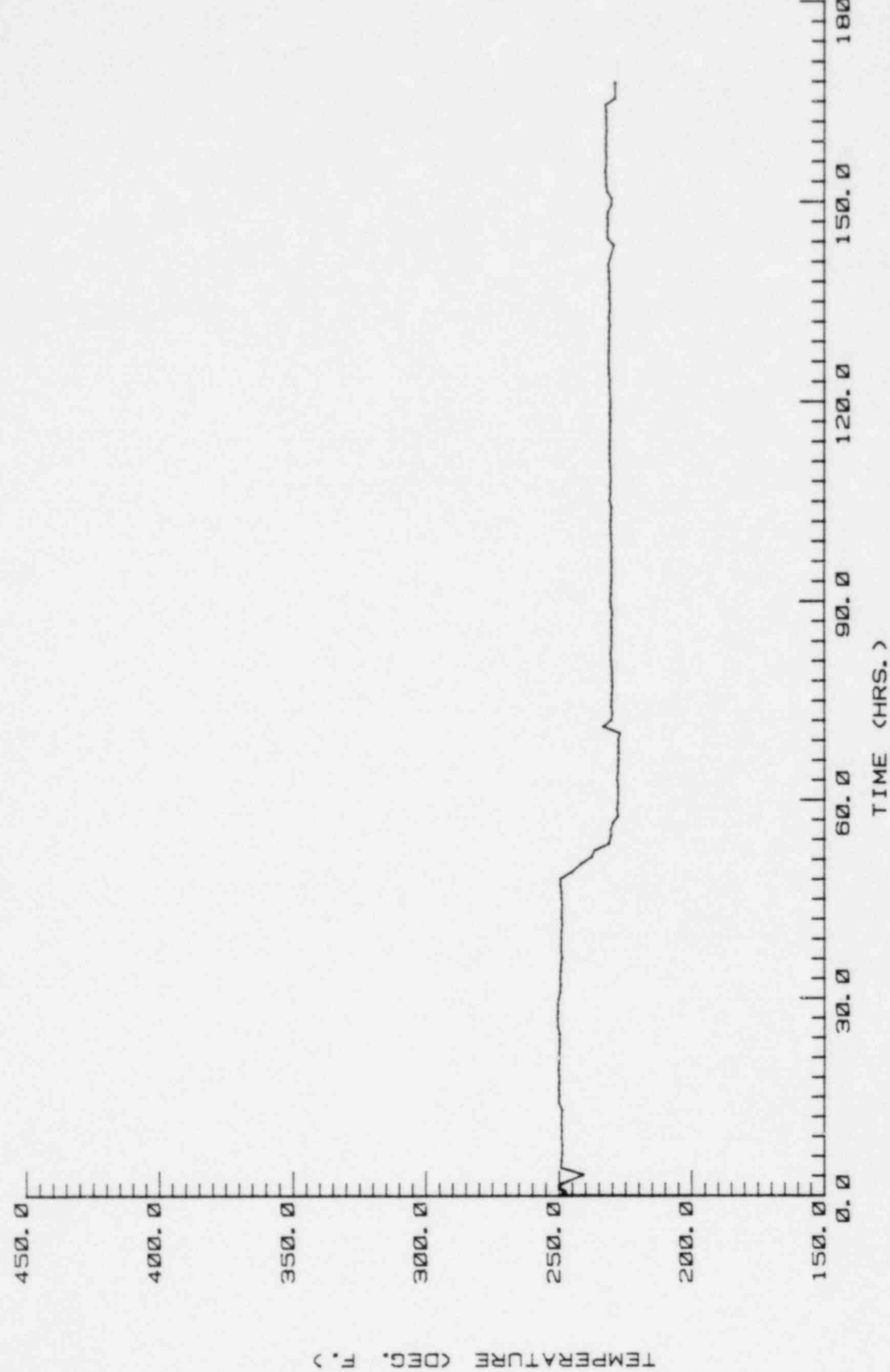
(ON FACE OF FLANGE NEAR MODULE K OR L)




TEMPERATURE THERMOCOUPLE NO. 37
(ON 3/4-INCH CHAMBER FLANGE PLATE AT 360°)
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
0.0
30.0
60.0
90.0
120.0
150.0
180.0
TEMPERATURE (DEG. F.)
TIME (HRS.)

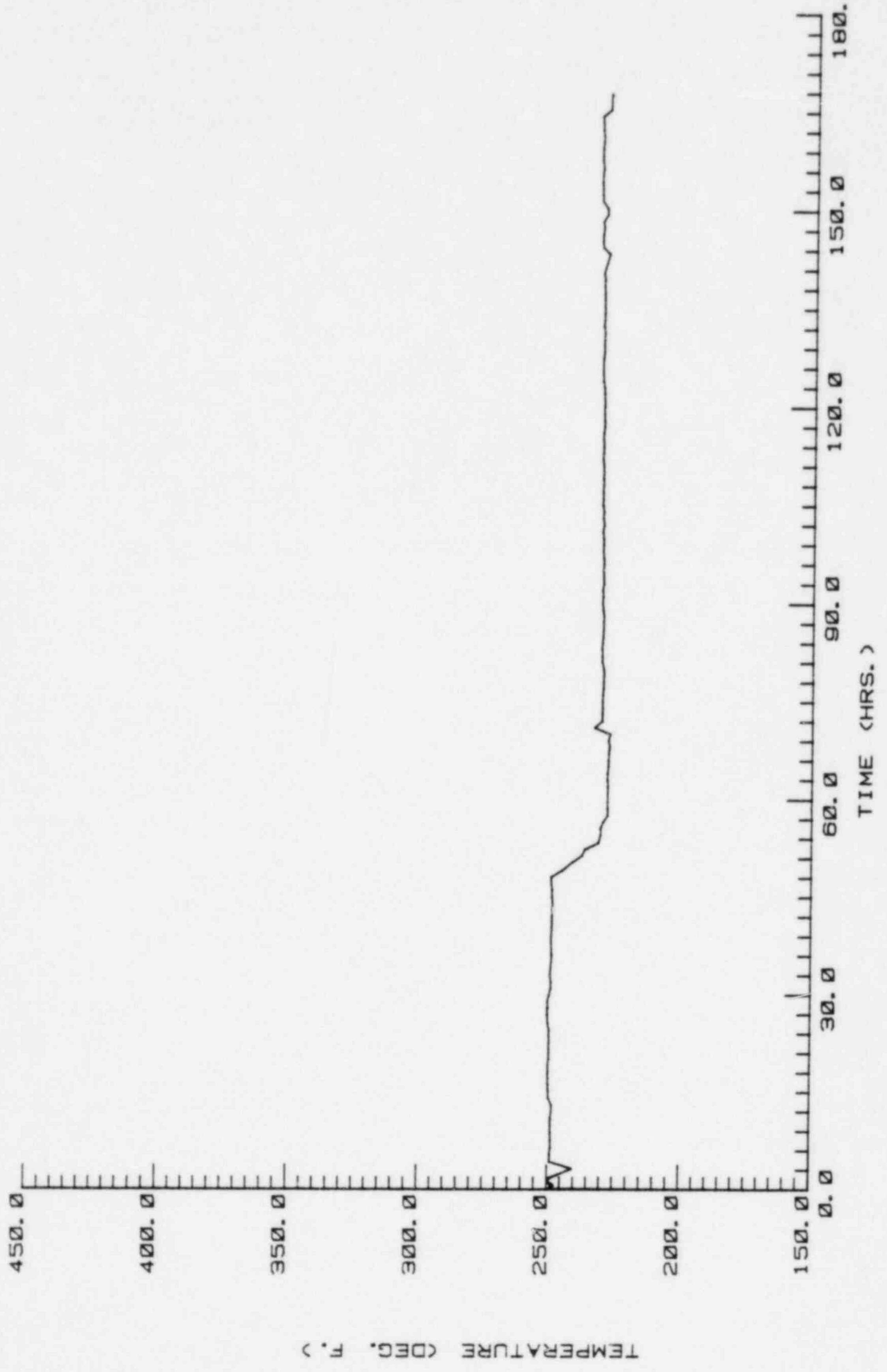
TEMPERATURE THERMOCOUPLE NO. 38

(ON 3/4-INCH CHAMBER FLANGE PLATE AT 90°)



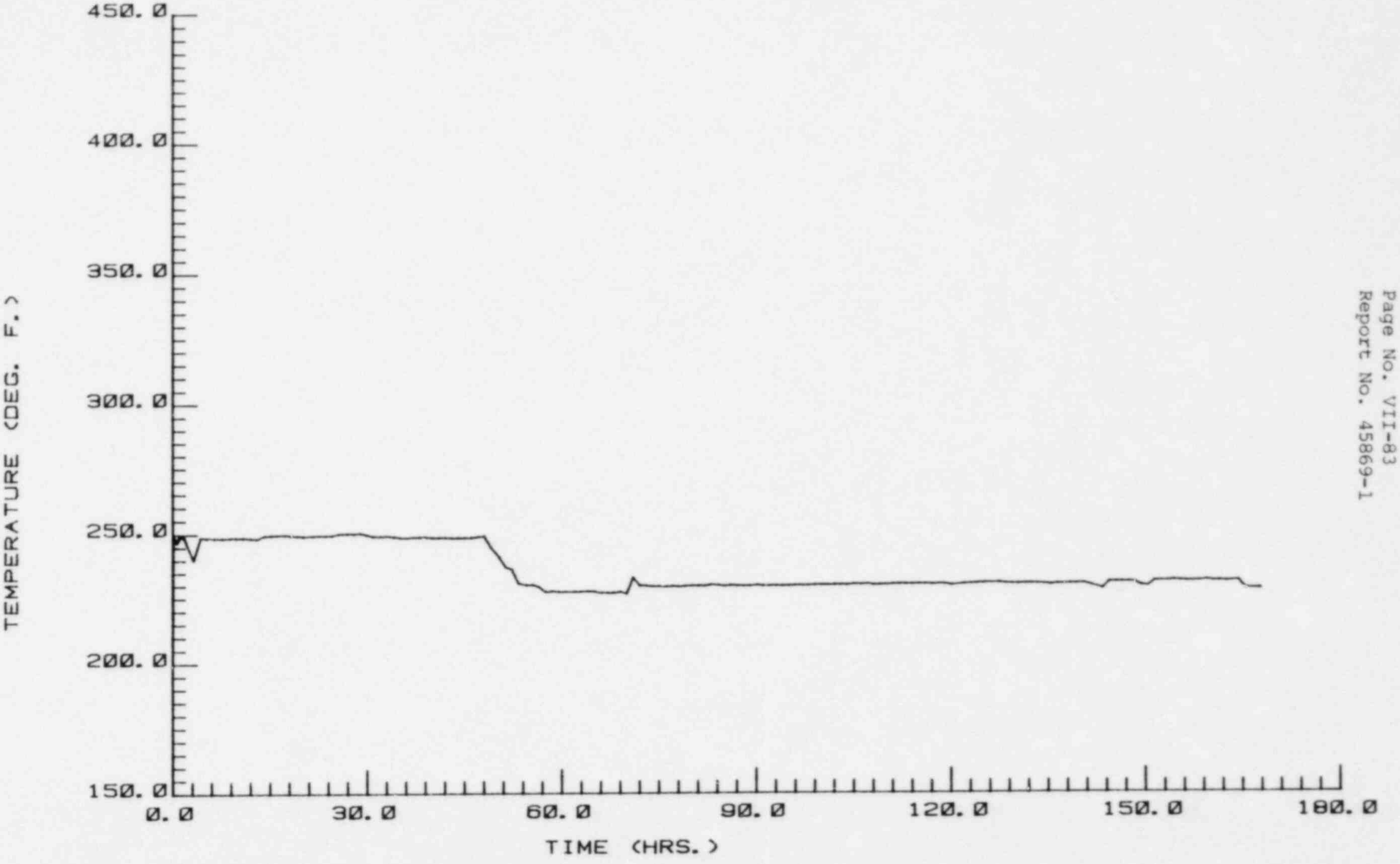
TEMPERATURE THERMOCOUPLE NO. 39

(ON 3/4-INCH CHAMBER FLANGE PLATE AT 180°)



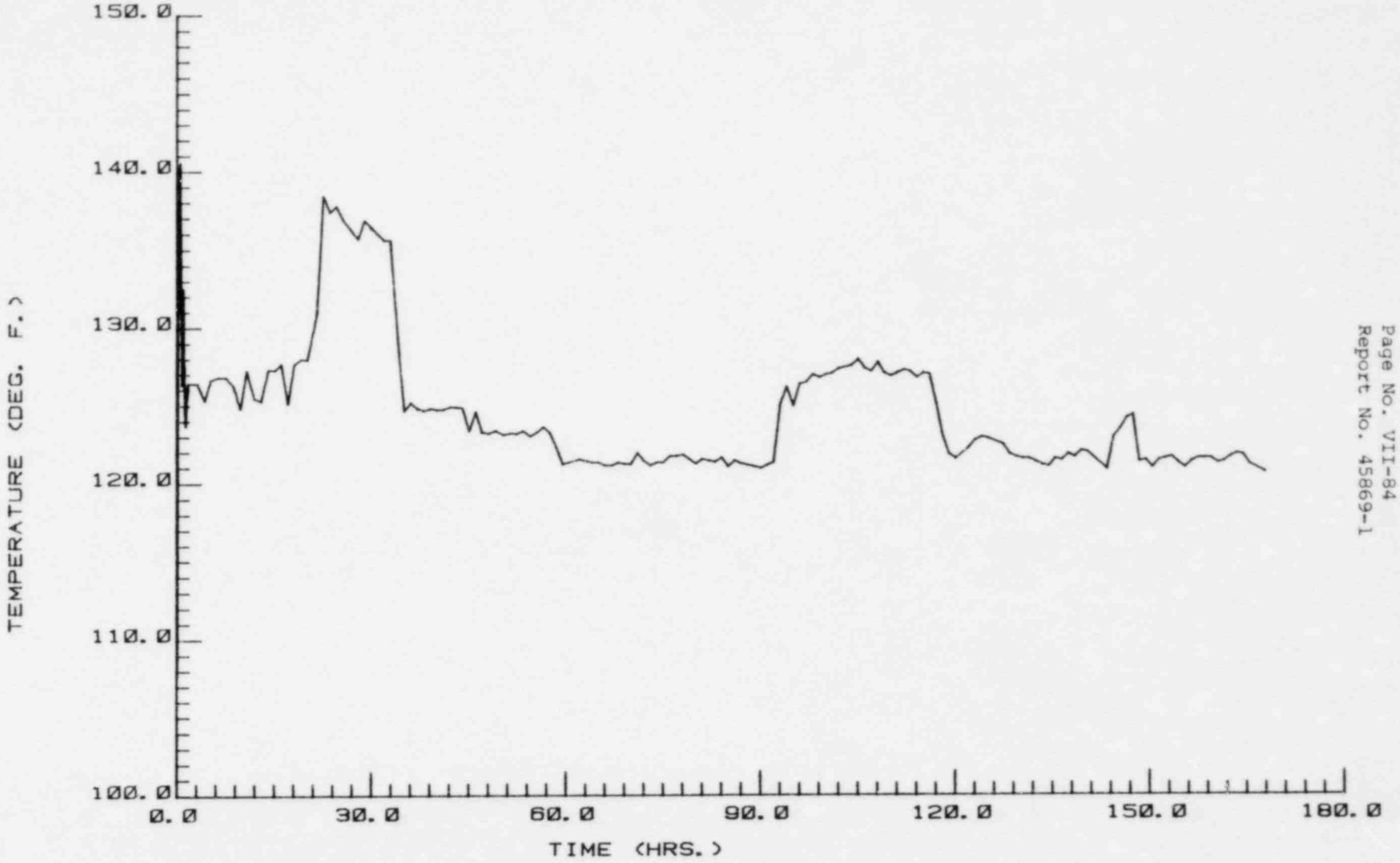
TEMPERATURE THERMOCOUPLE NO. 40

(ON 3/4-INCH CHAMBER FLANGE PLATE AT 270°)



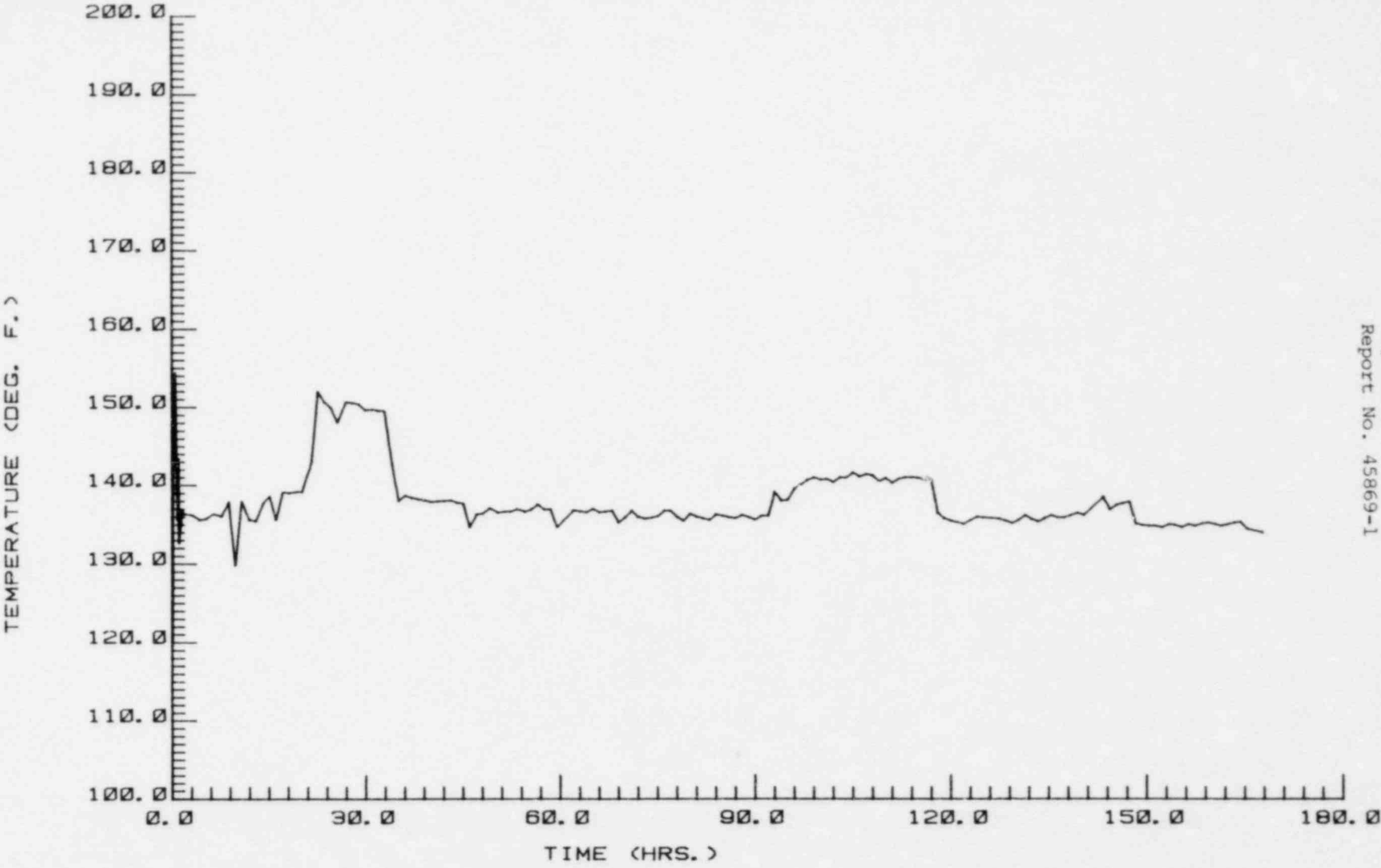
TEMPERATURE THERMOCOUPLE NO. 41

(UNDER ARMOR ON 3X10G2 FROM MODULE F)



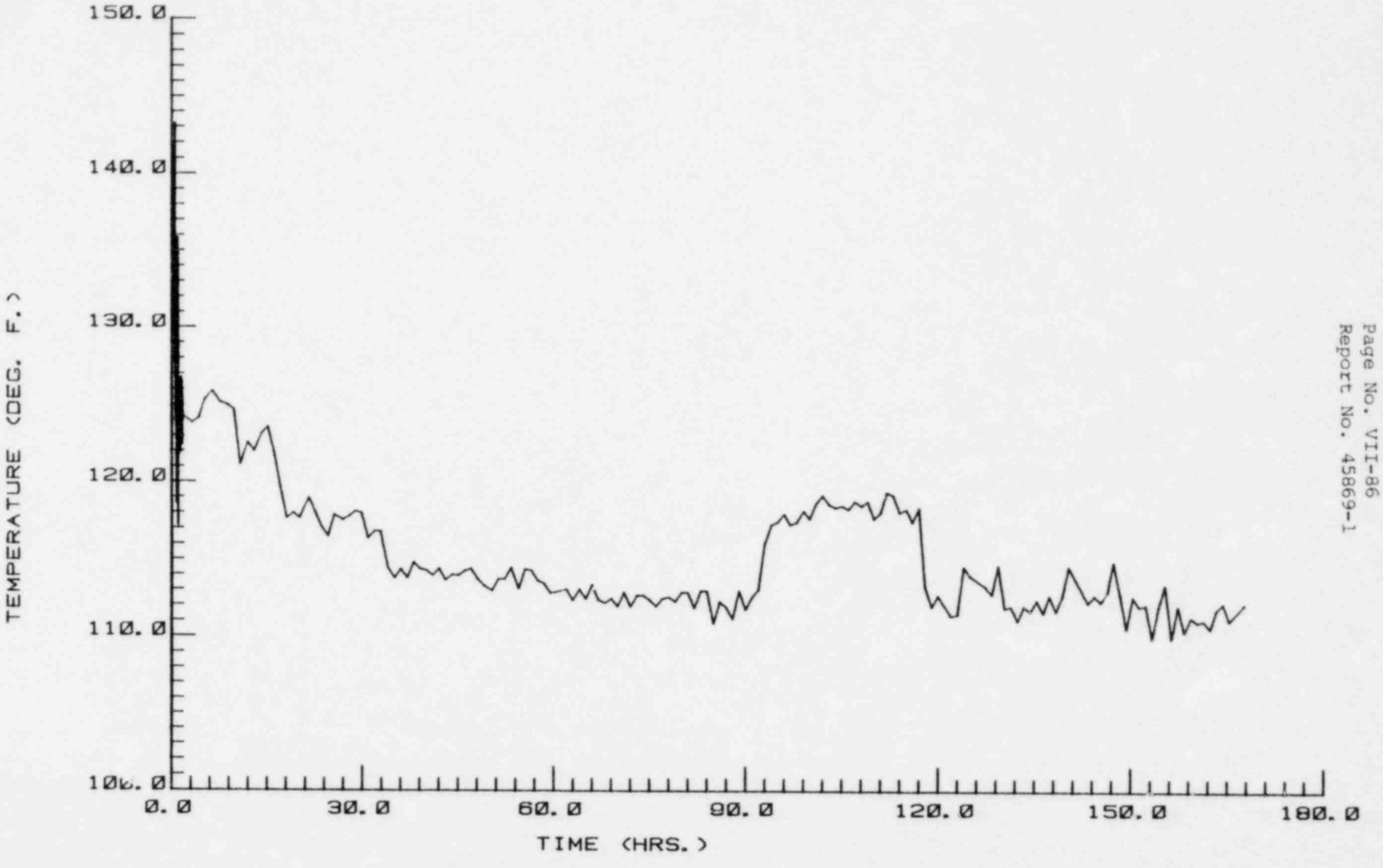
TEMPERATURE THERMOCOUPLE NO. 42

(UNDER ARMOR ON 12X12G1 FROM MODULE L)



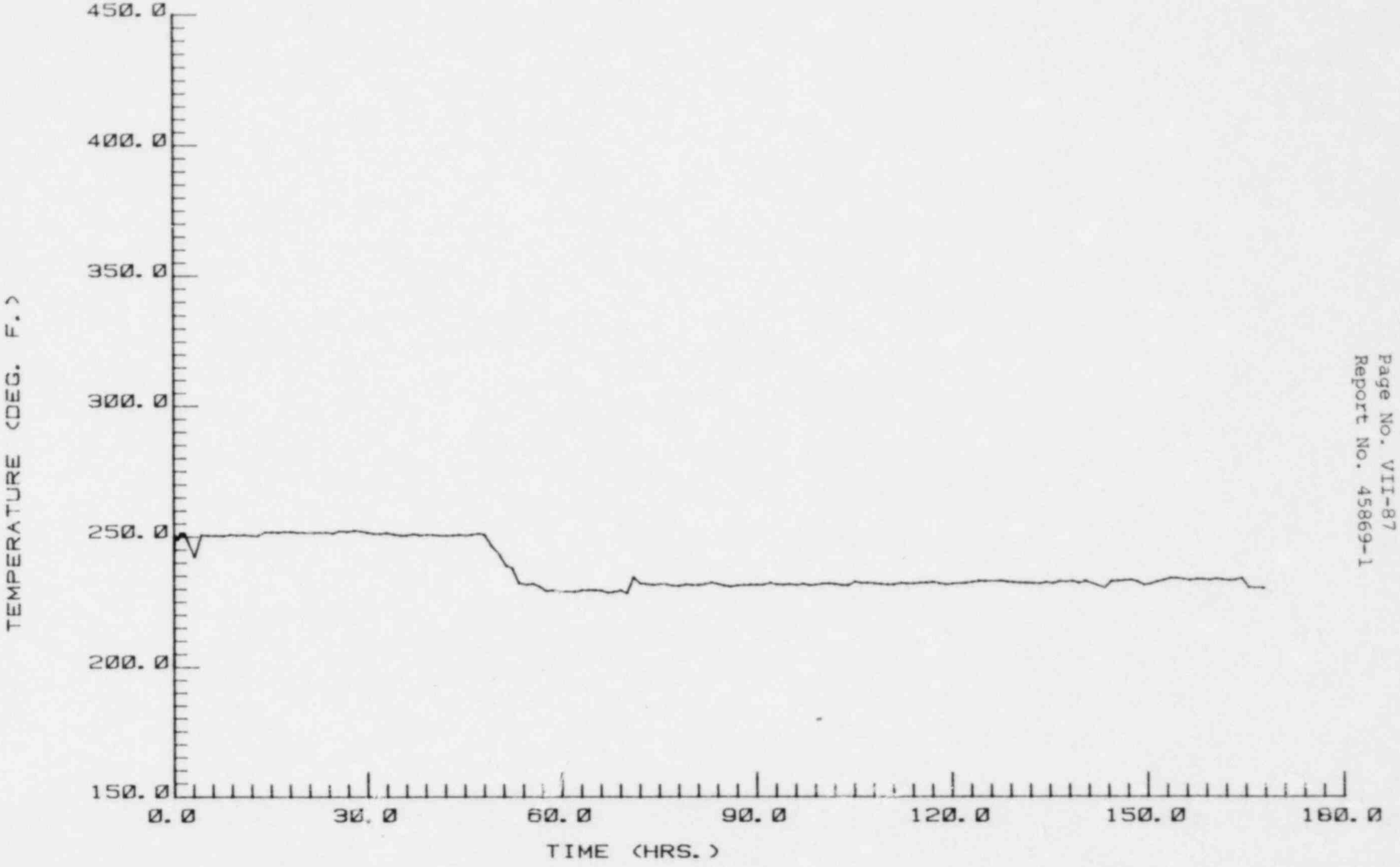
TEMPERATURE THERMOCOUPLE NO. 43

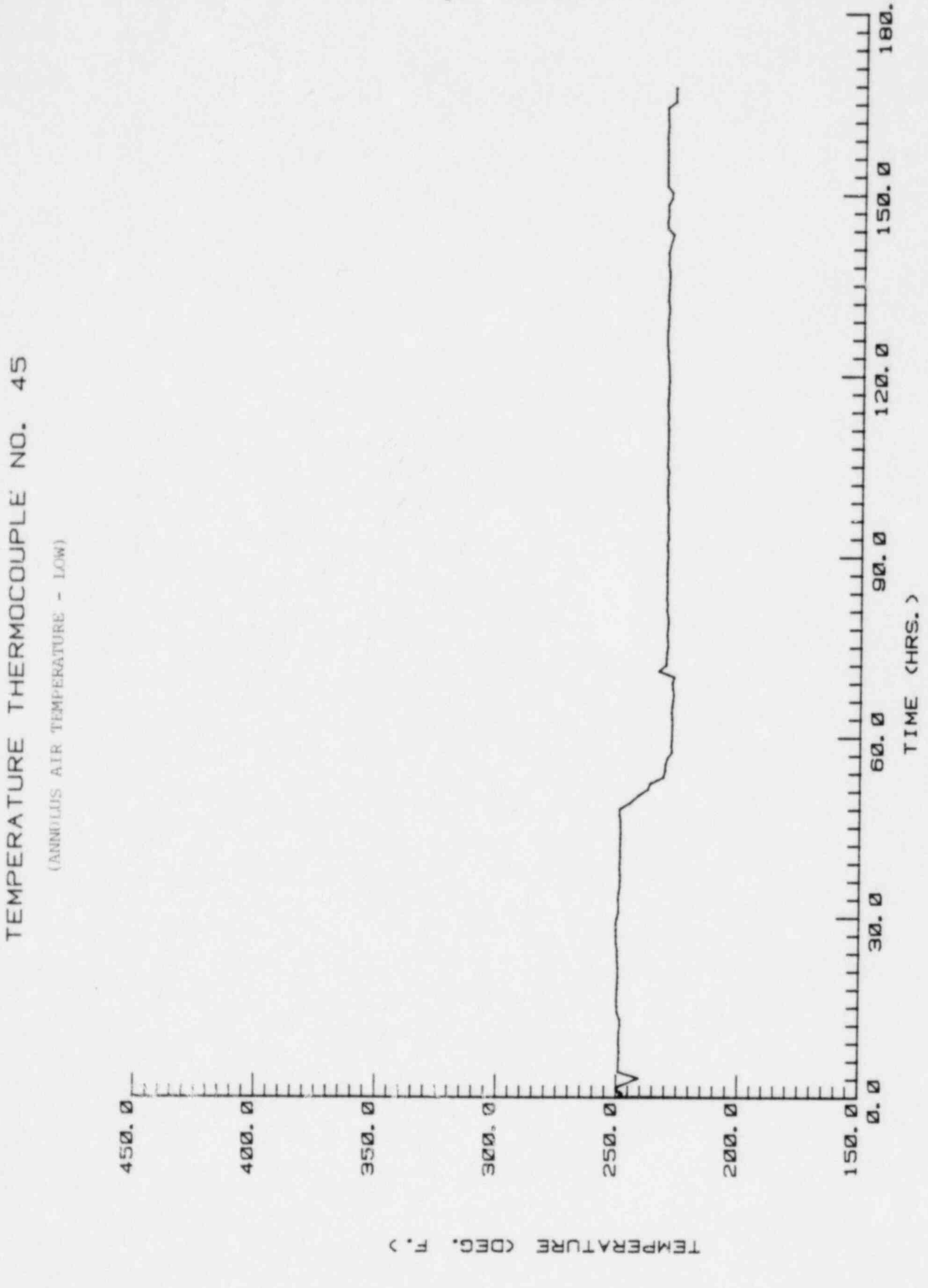
(ANNULUS AIR TEMPERATURE - HIGH)



TEMPERATURE THERMOCOUPLE NO. 44

(ANNULUS AIR TEMPERATURE - CENTER, CONTROL)



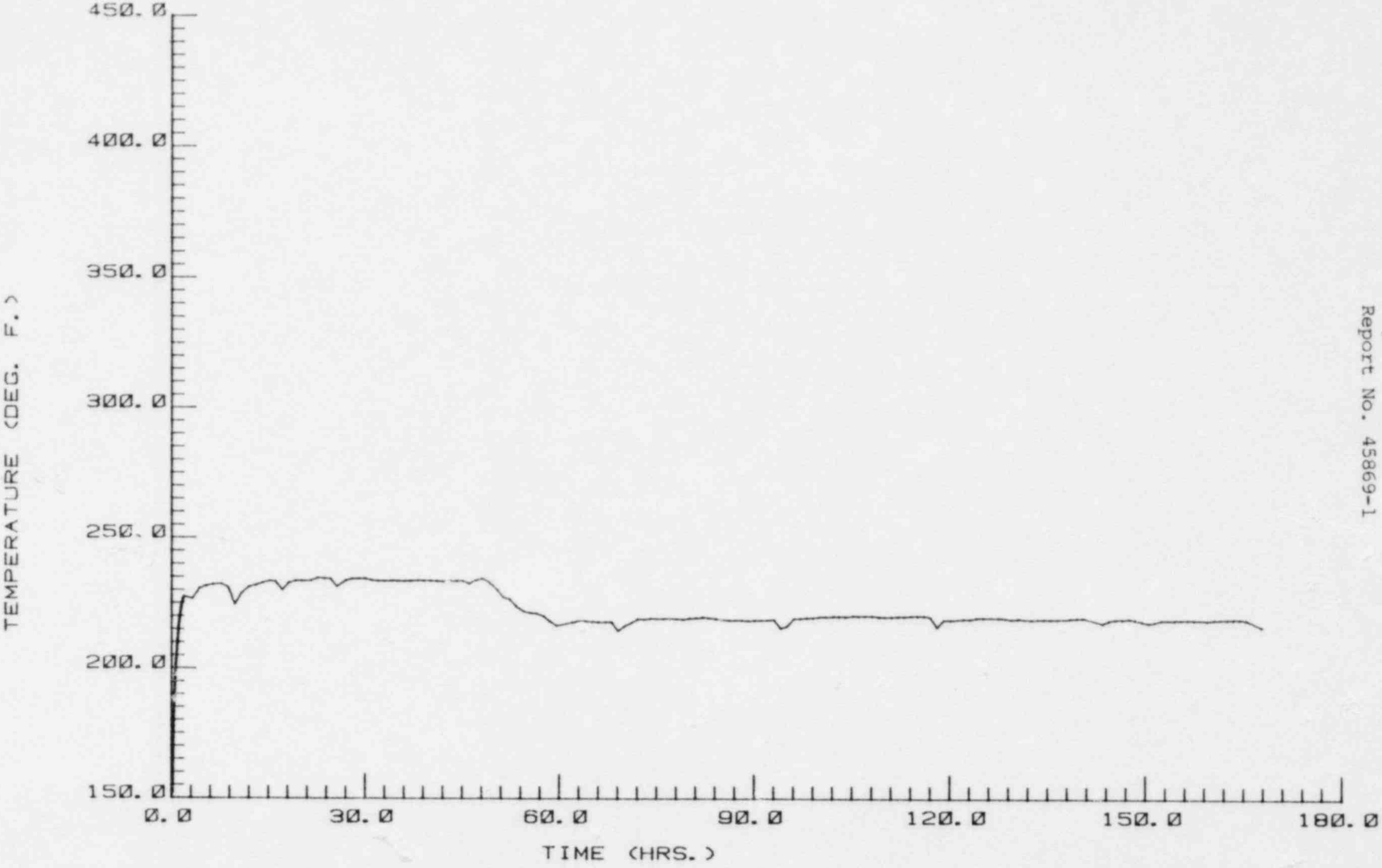


TEMPERATURE THERMOCOUPLE NO. 45

(ANNULUS AIR TEMPERATURE - LOW)

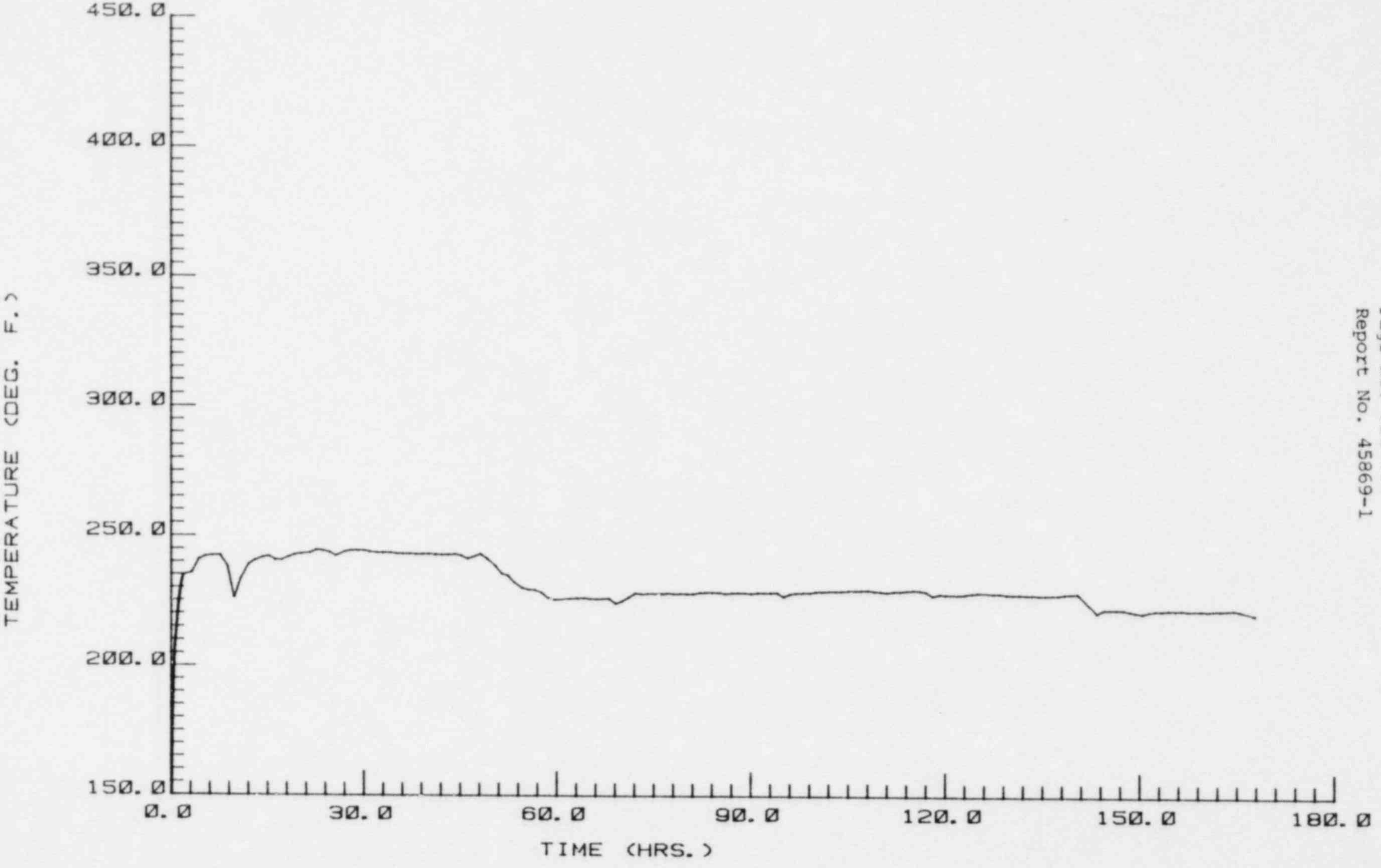
TEMPERATURE THERMOCOUPLE NO. 46

(ON RECEPTABLE OF MODULE E)



TEMPERATURE THERMOCOUPLE NO. 47

(ON RECEPTACLE OF MODULE D)



SECTION VIII

POST-TEST INSPECTION

Most of the planned post-test inspection was not conducted at the end of the 7-day Accident Test. Due to some of the conductors exhibiting leakage current in excess of 0.5 amps during the 7-day test, Duke Power directed that the modules be subjected to another 7-day Accident Test before disconnecting the couplings and making a detailed inspection. Post-test inspection results are reported in Volume II.

SECTION IX

WYLE LABORATORIES' QUALIFICATION PROCEDURES NO. 543/6124-2/DK, REVISION B, DATED 3/17/82, AND REVISION C, DATED 4/26/82

The Wyle Test Procedures used to conduct this program are presented in Appendices IX-I and IX-II. The Revision B procedure was used to conduct all programs as shown in Volume I and the Revision C procedure was used to conduct all the programs shown in Volume II, which was the Extended Accident Test and Extensive Post-Test Analysis Program.

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APPENDIX IX-I

WYLE LABORATORIES' TEST PROCEDURE NO. 543/6124-2/DK, REVISION B

TEST PROCEDURE

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
P. O. BOX 1008 • HUNTSVILLE, ALABAMA 35807
TWX (810) 726-2225 • TELEPHONE (205) 837-4411

TEST PROCEDURE NO. 543/6124-2/DK

DATE: September 23, 1981
Rev. B: 3/17/82

J/N 45869

NUCLEAR ENVIRONMENTAL QUALIFICATION
TEST PROCEDURE

FOR

ELECTRIC PENETRATIONS TYPES B-M

FOR

DUKE POWER COMPANY

FOR USE IN

McGUIRE NUCLEAR POWER GENERATING STATION
UNITS 1 AND 2

APPROVED BY: ______
FOR: ______

APPROVED BY: ______
FOR: ______

APPROVED BY: ______
FOR: ______

APPROVED BY PROJECT MANAGER: Herschel D. Jordan
Herschel D. Jordan

APPROVED BY QUALITY ENGINEER: Murvin J. Kimball

PREPARED BY PROJECT ENGINEER: James E. Marconnet
James E. Marconnet

REVISIONS

FORM 1054-1 Rev. 4/74

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L	DESCRIPTION OF CHANGES
A	10/12/81	2	LM	JEM MK	1.2.1 - Changed to Revision 1. Changed 1.2.9 to 1.2.10, added 1.2.9.
A	10/12/81	3	LM	JEM MK	Revised 1.4, rewrote 2.0.
A	10/12/81	6	LM	JEM MK	3.3 - Added second paragraph. 3.5 - Changed title, added 4th sen-
					tence. 3.6 - changed 1.2.8 to 1.2.9.
A	10/12/81	8	LM	JEM MK	3.8.4.1 - Changed 2 inches to 6 inches
A	10/12/81	9	LM	JEM MK	3.8.8.1 - Corrected typographical err
A	10/12/81	11	LM	JEM MK	3.8.10 - Changed "No Chemical" to "Water"
A	10/12/81	13 & 14	LM	JEM MK	Added notes to Figure 1 and Figure 2.
A	10/12/81	18 & 19	LM	JEM MK	Corrected plug kit numbers.
B	3/17/82	7	HS		Revised Para. 3.8.2
B	3/17/82	8	HS		Revised Para. 3.8.4.1

REVISIONS

Page No. IX-5
Report No. 45869-1

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP

REVISION. B
543/6124-2/DK
TEST PROCEDURE NO.
DATE: September 23, 1981
Rev. B 3/17/82

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L.	DESCRIPTION OF CHANGES
B	3/17/82	9	HS HS		Revised Para. 3.8.6 and 3.8.7
B	3/17/82	10	HS HS		Revised Para. 3.8.9.2
B	3/17/82	13	HS HS		Added Note No. 5
B	3/17/82	17	HS HS		Added Fuse size
B	3/17/82	19	HS HS		Changed numbers of Cable No. 3
					and face seals 7 and 8.
B	3/17/82	20, 21	HS HS		Changed module K voltage to 120 volts
B	3/17/82	22	HS HS		Added notes to TC's 17. 18, 19, 20,
					and 23. Deleted TC's 28 through 33
					changed "on" to "in"
B	3/17/82	23	HS		Added note to TC 44. Deleted TC's
					48, 49, and 50.

1.0 SCOPE

This document has been prepared by Wyle Laboratories for the Duke Power Company and encompasses specific equipment, electric penetrations, manufactured by D. G. O'Brien, Inc., for use in McGuire Nuclear Power Generating Station.

1.1 Objectives

The purpose of this procedure is to present the requirements, procedures, and sequence to test the electric penetrations for use in the McGuire Nuclear Power Generating Station.

1.2 Applicable Qualification Standards, Specifications, and Documents

1.2.1 Duke Power Company Specification No. MCS-1393.01-00-0003, July 23, 1981, Revision 1. Ⓐ

1.2.2 IEEE 323-1971, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

1.2.3 IEEE 317-1972, "IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations."

1.2.4 ANSI N45.2.2-1972, "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants."

1.2.5 Duke Power Co. MCM 1361.00-0016, "Low Voltage Penetration Instruction Manual."

1.2.6 Duke Power Co. MCM 1361.00-0017, "Instrumentation Penetration Instruction Manual."

1.2.7 Duke Power Co. CNM 1361.00-0010, "Low Voltage Penetration Instruction Manual."

1.2.8 Duke Power Co. CNM 1361.00-0011, "Instrument Penetration Instruction Manual."

1.2.9 Duke Power Co. IP-MCP-001, "Test Assembly Installation Sequence." Ⓐ

1.2.10 Wyle Laboratories Quotation No. 543/6124-2/DK.

1.3 Equipment Description

The test specimens to be supplied by Duke Power Company shall consist of the six (6) modules listed in Table 1, plus the plugs and cables connected to each end of the modules. Duke Power Company shall also provide the penetration mounting, the wall mockup, and all dummy mountings and modules for the Chamber Calibration Test and Accident Test.

1.0 SCOPE (Continued)

1.4 Qualification Sequence

Qualification shall be performed in the following sequence:

- Receiving Inspection
- Thermal Aging
- Assemble Plug Kits onto Cables; Perform Baseline Test Ⓐ
- Radiation Exposure
- Functional Tests Ⓐ
- Assembly of Remaining Components by Duke Power at Wyle Laboratories Ⓐ
- Baseline Functional Tests
- Accident Test
- Functional Tests
- Post-Test Inspection

2.0 QUALIFICATION REQUIREMENTS

The test specification includes any required margins. Ⓐ

2.1 Normal Service Conditions

The following design environmental conditions inside containment for normal operation are as specified by Duke Power Company.

- Temperature: 120°F
- Pressure: 0 to 3 psig
- Humidity: 65-80%
- Radiation: 2 x 10^4 rads (40-year integrated exposure)

The following design environmental conditions in the annulus between the steel containment vessel and the concrete Reactor Building are as specified by Duke Power Company.

- Temperature: 98°F
- Pressure: Atmospheric
- Humidity: 65-80%
- Radiation: 2 x 10^4 rads (40-year integrated exposure)

2.0 QUALIFICATION REQUIREMENTS (Continued)

2.2 Accident and Post-Accident Service Conditions

The following design environmental conditions inside containment during and after the postulated Design Basis Event (Loss of Coolant Accident or Main Steam Line Break) are as specified by Duke Power Company.

- Temperature: 340°F (Peak)
- Pressure: 15 psig (Peak)
- Humidity: 100%
- Radiation: 2×10^8 rads (1-year integrated exposure)
- Chemical Spray:

First 30 Min:	Boron	- 2,100 ppm
	NaOH	- 0
	pH	- ≅5
Thereafter:	Boron	- 1,922 ppm
	NaOH	- As required for pH
	pH	- 6-10

Figure 1 shows the temperature/pressure/time profile inside containment as specified by Duke Power Company.

The following design environmental conditions in the annulus between the steel containment vessel and the concrete Reactor Building are as specified by Duke Power Company.

- Temperature: 142°F (Peak)
- Pressure: Minus 0.5 inches H_2O to plus 0.5 inches H_2O
- Humidity: 65-80%
- Radiation: 1.5×10^8 rads (1-year integrated exposure)

Figure 2 shows the temperature/pressure/time profile in the annulus as specified by Duke Power Company.

2.3 Other Service Conditions

Table 3 shows the 60-hertz voltage and current requirements for the conductors of the six (6) modules as specified by Duke Power Company.

2.0 QUALIFICATION REQUIREMENTS (Continued)

2.4 Safety-Related Functions

The safety classification of this equipment is Class 1E. The subject equipment provides essential services in support of emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or is otherwise essential in providing support to prevent significant release of radioactive material to the environment. The safety-related functions are described in the following paragraphs.

2.4.1 Description

The electrical penetration assemblies specified will be used to perform various electrical functions inside the reactor containment structure.

2.4.2 Acceptance Criteria

The test specimens shall be considered to have met the criteria of this test specification if they complete the test sequence and still maintain circuit integrity. Circuit integrity shall be indicated by the test specimen being capable of maintaining the required voltage and/or current specified in Table 3.

2.5 Safety-Related Components

All components in the subject equipment are assumed to be safety related.

3.0 QUALIFICATION TEST PROGRAM

3.1 Receiving Inspection

An inspection shall be performed upon receipt of the test specimen components at the test facility. This inspection shall assure that the equipment received is as described in Paragraph 1.3. Applicable series, model, part, and/or serial numbers shall be verfied. Specimens shall be labeled, as deemed necessary by the Project Engineer, to facilitate identification of the specimens during all phases of the qualification program. The results of the inspection (specimen identification, quantities, configurations, etc.) shall be recorded. Photographs shall be taken of the test specimen components.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.2 Thermal Aging

The desired life of the subject equipment is 40 years. The test specimen components shall be thermally aged in two (2) thermal chambers for the times and temperatures in Table 2 as specified by Duke Power Company. The thermal aging temperature shall be recorded continuously. The relative humidity shall be uncontrolled and shall not be monitored. The thermal aging chambers shall be opened briefly as required to remove test specimens after their respective thermal aging times. Photographs shall be taken of the thermal aging test setup before and after thermal aging.

3.3 Visual Inspection

The test specimen components shall be visually inspected. This inspection shall assure that the components have no obvious visible damage. Photographs shall be taken of the test specimen components.

Duke Power Company personnel shall then assemble the plug kits, and perform the Baseline Tests (3.7.2 and 3.7.3) on the plug kits, cables and penetration. All other components shall be visually inspected. (Reference 1.2.5 through 1.2.9.) Ⓐ

3.4 Radiation Exposure

The test specimen components shall be exposed to a total integrated dose of 2.0×10^8 rads gamma, air equivalent, minimum, using a Cobalt 60 source, at a dose rate not to exceed 1.0×10^6 rads per hour as specified by Duke Power Company. This is the combined normal and accident dose.

3.5 Functional Tests Ⓐ

The test specimen components shall be visually inspected. This inspection shall assure that the components have no obvious visible damage. Photographs shall be taken of the test specimen components. The plug kits, cables and penetrations shall be checked for baseline data (3.7.2 and 3.7.3). Ⓐ

3.6 Assembly of Components

Duke Power Company shall assemble and label the remaining components at Wyle Laboratories, using the procedures of references 1.2.5 through 1.2.9 as appropriate. Ⓐ

3.7 Baseline Functional Test

The following Baseline Functional Tests shall be performed on the assembled modules before they are installed in the penetration mounting and wall mockup.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.7.1 Visual Inspection

The modules shall be visually inspected. This inspection shall assure that the modules have no obvious visible damage and are labeled properly. A photograph shall be taken of the assembled modules.

3.7.2 Insulation Resistance

Insulation resistance shall be measured between each conductor and all other conductors tied to ground at 500 VDC as indicated on Figure 4. If the I.R. is less than the minimum scale reading at 500 VDC, then the I.R. shall be measured at 100 VDC. The I.R. of modules C, D, E, and F shall be 100 megohms or greater. The I.R. of modules K and L shall be 10 megohms or greater. Duke Power Company shall be notified of any I.R. readings below these values.

3.7.3 Continuity

All circuits shall be checked for electrical continuity using an ohmmeter or equivalent.

3.8 Accident Test

3.8.1 Mounting

The test specimen modules shall be installed in the penetration mounting installed in the wall mockup at Wyle Laboratories by Duke Power Company. Photographs shall be taken of the assembly.

3.8.2 Thermocouple Installation B

Thermocouples shall be attached to the test specimen assembly per Table 4 or as specified by Duke Power Company. These thermocouples shall be commercially available probes or shall be field-fabricated and shall be welded or strapped in place.

3.8.3 Wall Mockup Installation

The wall mockup shall be attached to an environmental chamber similar to that shown in Figure 3, and the test specimen armored cables and thermocouple leads shall be run through chamber penetrations and sealed per Wyle Laboratories' standard practice.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.4 Steam Environmental Chamber

An environmental chamber similar to the steam environment chamber shown in Figure 3 shall be used for the Accident Test. The wall mockup shall bolt to this environmental chamber and shall seal the chamber. Penetrations for six (6) cables and twenty-five (25) thermocouple wires shall be provided at the opposite end of the chamber from the wall mockup. Superheated steam and/or saturated steam, as required, shall be introduced into the chamber from the end of the chamber opposite the wall mockup. A manifold shall distribute this steam evenly across the end of the chamber. Chemical spray nozzles shall be provided along the top of the chamber. A chamber drain shall be provided at the bottom of the chamber.

3.8.4.1 Chamber Temperature Control

The chamber temperature, for control purposes, shall be the average
of three (3) thermocouples located within 6 inches of the surface Ⓐ
of the test specimen. These shall be thermocouples 18, 19, and B
20 per Table 4.

The environment chamber shall be initially heated to 120°F, using
heated forced air. Superheated steam shall be used during the B
first temperature transient (120°F to 340°F). Saturated steam
shall be used thereafter to maintain the chamber temperature.
Chamber temperature reductions shall be at the chamber thermal
recovery rate or slower (by the addition of saturated steam).

3.8.4.2 Chamber Pressure Control

The chamber pressure shall be monitored with a pressure gauge and a pressure transducer. Filtered, regulated house air shall be provided to maintain the chamber pressure, as required, after the initial temperature/pressure transient.

3.8.5 Annulus Mockup

An environmental chamber shall be erected to surround the penetration mounting and wall mockup. This chamber shall be equipped with heating and/or cooling, as required, to maintain the annulus temperatures specified in Figure 2. Cables supplied by Duke Power Company shall run from the electric penetration test specimen through the environmental chamber wall to a junction panel located outside of the environmental chamber.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.6 Test Specimen Energization

The conductors of modules C, D, E, F, and L shall be wired in series as required to form six (6) current loops. Each loop shall be independently energized to the voltage and current specified in Table 3, using the polarization voltage method as shown in Figure 5. The conductors of module K shall be connected together and energized to 120 VAC. B

3.8.7 Test Specimen Instrumentation B

The chamber pressure and the thermocouples designated in Table 4 as numbers 2, 6, 10, 18, 19, and 20 shall be recorded on a datalogger at the following sample rates:

1 sample/second for the first 5 min.
1 sample/minute from T = 5 min. to T = 150 min.
1 sample/15 minutes from T = 150 min. to T = 60 hrs.
1 sample/hour from T = 60 hrs. until T = 7 days

The voltage and current at modules C, D, E, F, and L; the leakage current at module K; and the remaining 39 thermocouples as shown in Table 4 shall be recorded on a datalogger at the following sample rates:

1 sample/minute for the first 150 min.
1 sample/15 minutes from T = 150 min. until T = 60 hrs.
1 sample/hour from T - 60 hrs until T = 7 days

3.8.8 Chemical Spray

3.8.8.1 Chemical Spray Composition

The chemical spray solution for the first 30 minutes of the Accident Test shall be made from potable water with 2100 ppm of Boron as Boric Acid added. The pH is expected to be approximately 5.0. The chemical spray solution for the rest of the Accident Test shall be made from potable water with 1922 ppm of Boron as Boric Acid and NaOH added as required to maintain the pH between 6.0 and 10.0. New batches of the chemical spray solution shall be made up at least once every 4 days and shall replace the old chemical spray solutions. Ⓐ

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.8.2 Chemical Spray Rate

The chemical spray solution shall be sprayed continuously vertically downward in the steam chamber from 10 seconds into the Accident Test to the end of the test. The minimum spray rate shall be 0.15 (gal/min)/ft^2 of area of the test chamber projected onto a horizontal plane. The spray rate shall be recorded daily by measuring the pressure drop across the spray nozzles or by other means. The chemical spray solution shall be recirculated. The pH of the chemical spray solution shall be recorded at least daily. The chemical spray solution temperature shall not be monitored or controlled.

3.8.9 Functional Tests

3.8.9.1 Pre-Accident Test Functional Tests

3.8.9.1.1 Insulation Resistance

The Functional Tests of Paragraph 3.7.2 shall be repeated.

3.8.9.1.2 Continuity

The Functional Tests of Paragraph 3.7.3 shall be repeated.

3.8.9.1.3 High Potential Test

Module C and F conductors shall be high potential tested at 1000 VAC for 1 minute, using a Hy-Pot or equivalent between each conductor and ground. The leakage current shall be recorded.

3.8.9.2 Accident Test Functional Tests

The Functional Tests of Paragraphs 3.7.2 and 3.8.9.1.3 shall be
repeated on a daily basis during the Accident Test. In addition,
these tests shall be performed commencing before T_o, when the B
temperature is stabilized at 300°F; when the temperature is stabi-
lized at 250°F, at 8 hours, at 16 hours, at 24 hours; and when the
temperature is stabilized at 228°F. The measurements required at B
the 300°F plateau may extend beyond the 300°F plateau. The measure-
ments at the 300°F point shall be taken in the following order: C,
E, K, F, D, and L.

3.8.10 Chamber Calibration

A trial run shall be performed prior to the Accident Test to determine the actual temperature and pressure ramps of which the chambers are capable. A dummy penetration mounting and dummy modules designed to simulate the test specimens (volume and mass) or plugs shall be installed in the chambers to simulate the actual test configuration.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.10 Chamber Calibration (Continued)

These dummy modules or plugs shall be provided by Duke Power Company. Photographs shall be taken of the chamber calibration test setup. A maximum of fifteen (15) thermocouples shall be installed for the trial run and shall be monitored by the oscillographs and datalogger with high speed printer. Water spray shall be used during the trial run. No energization shall be required. No Functional Tests shall be performed. Ⓐ

Environmental test data from this test run shall be submitted to Duke Power Company for review prior to the installation of the test specimens in the penetration mounting.

3.8.11 Accident Test Exposure

The test specimens shall be installed in the wall mockup and shall be subjected to the environmental conditions specified in Figures 1 and 2 simultaneously within the limitations of the environmental chambers, as determined during the chamber test run.

3.9 Final Functional Test

The Functional Tests of Paragraph 3.8.9.1 shall be repeated at room ambient temperature before the test specimens are removed from the environmental chambers.

3.10 Post-Test Inspection

Upon completion of the test program, the equipment shall be visually inspected. The equipment shall be disassembled to the extent necessary to perform the inspection. The condition of the equipment shall be recorded. Photographs shall be taken of the test specimens before and after they are removed from the wall mockup.

3.11 In-Process Inspection

The records shall be checked for quality of performance after each test.

The test items shall be examined for possible damage following all tests. All important test effects shall be logged. Black and white photographs shall be taken of any noticeable physical damage that may occur.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.12 Quality Assurance

The test program shall be performed in accordance with Wyle Laboratories' (Eastern Operations) Quality Assurance Policies and Procedures Manual, which conforms to the applicable portions of ANSI N-45.2, 10 CFR/50, Appendix B, and Military Specification MIL-C-45662A.

All instrumentation used in the performance of this test program shall be calibrated in accordance with this manual. Standards used in performing all calibrations are traceable to the National Bureau of Standards.

Duke Power Company Forms 930.1C and 301.4 shall be submitted to Duke Power Company at the completion of the test program.

3.13 Report

Ten (10) copies of the test report shall be issued, describing the test requirements, procedures, and results. The report shall be prepared in accordance with the format requirements of IEEE 323-1974, where applicable. Representative black and white photographs of the test specimens and test setups shall be reproduced in the report. The Accident Test specimen instrumentation data shall be provided to Duke Power in computer printout form but will not be included in the test report.

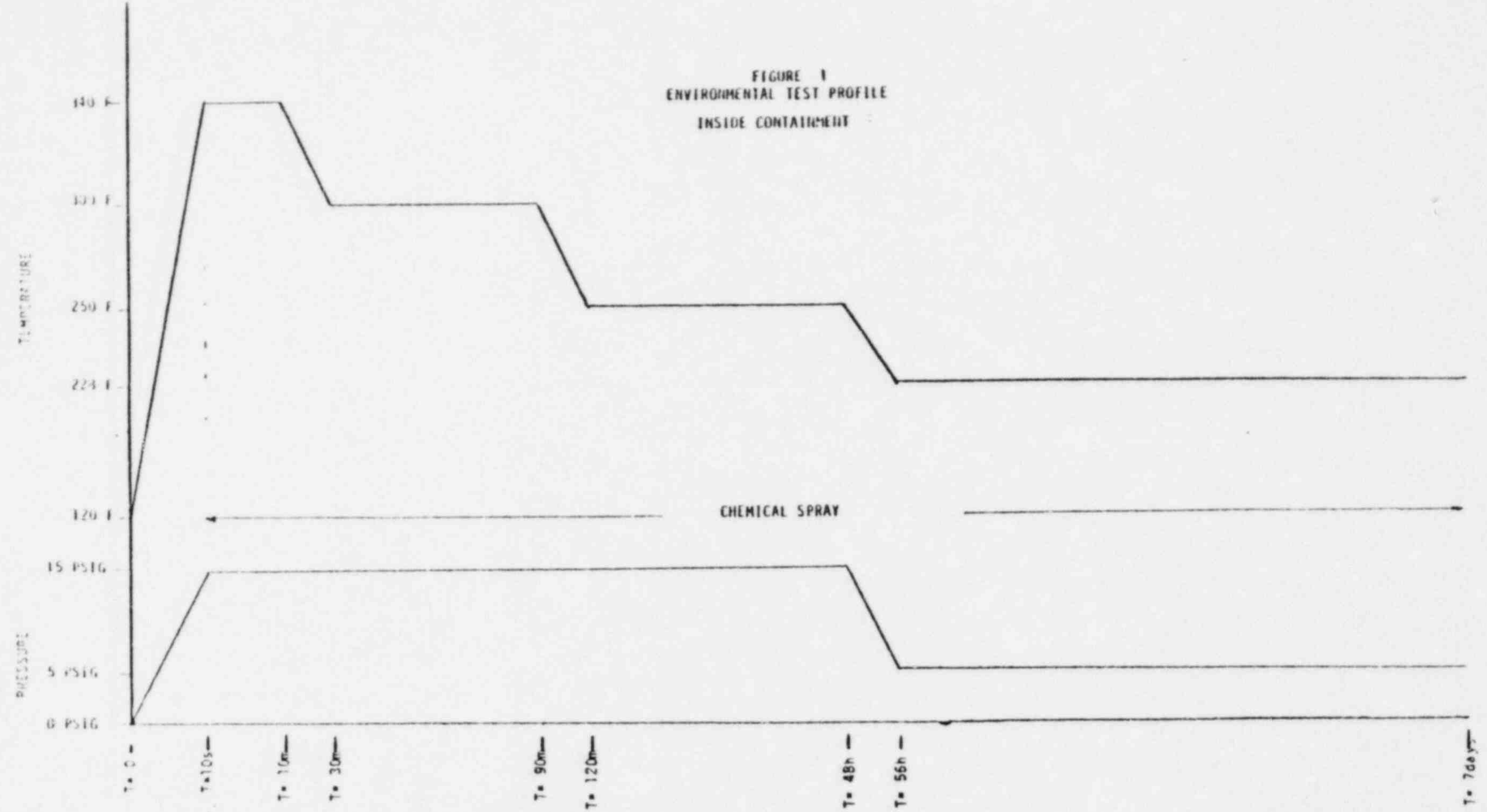


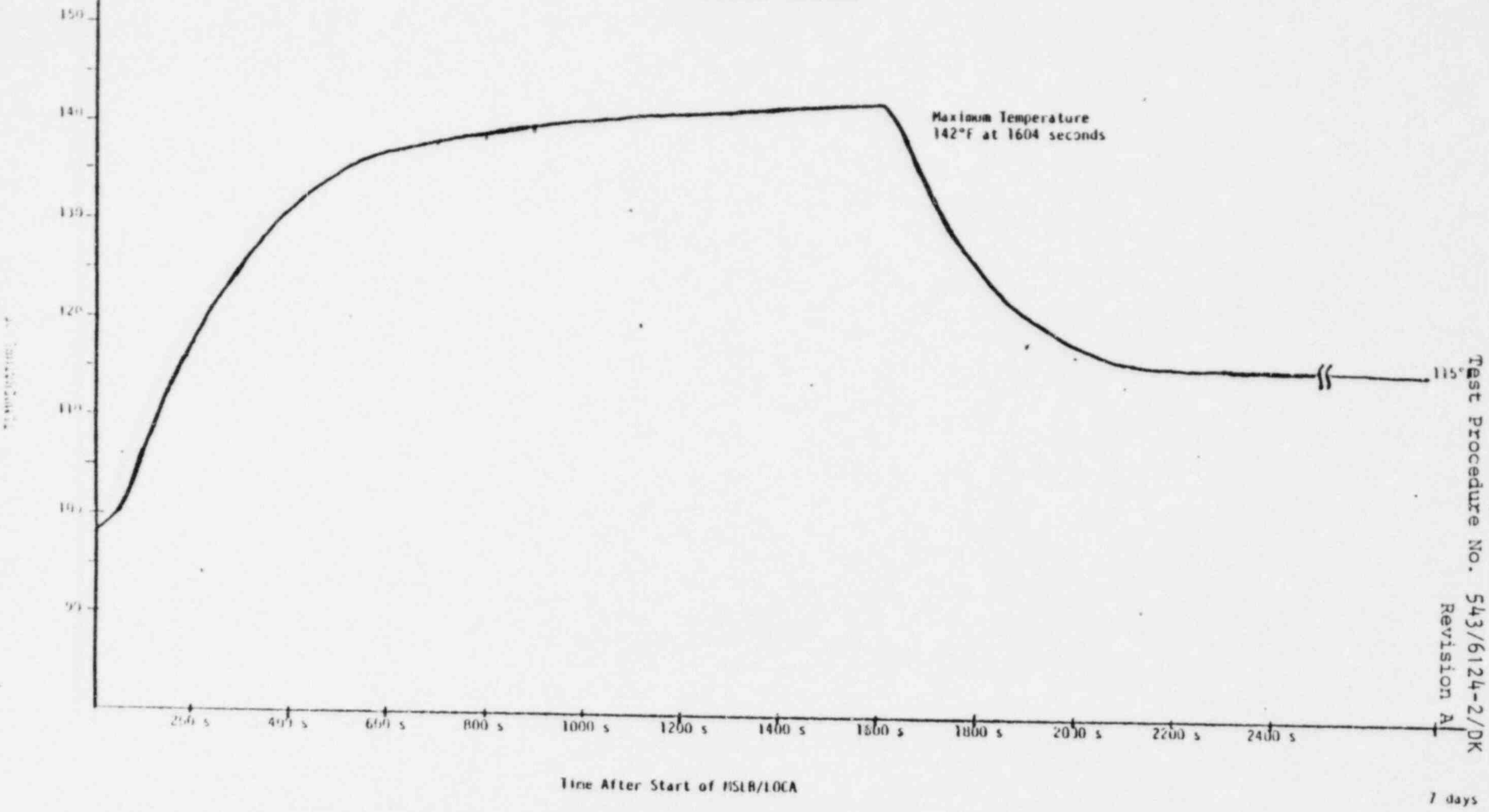
FIGURE 1
ENVIRONMENTAL TEST PROFILE
INSIDE CONTAINMENT

NOTE: 1) All steady state temperatures shall be as shown, +10°, -0°F.
2) Peak pressure shall not exceed 25 psig.
3) Steady state pressure for superheat regions shall be as shown +8°, -0°F.
4) For 250°F and below, the pressure shall follow the saturation curve for the temperature.
5) It is permissible for the initial 10-second ramp to extend out to 30 seconds.

Ⓐ

B

Figure 2
Annulus Temperature Profile
Combined MSLB/LOCA



Ⓐ

NOTE: 1) The test temperature profile shall be as close to the above profile as practical during the transient.

2) After 2400 seconds, the test temperature shall be within +15°F, -0°F.

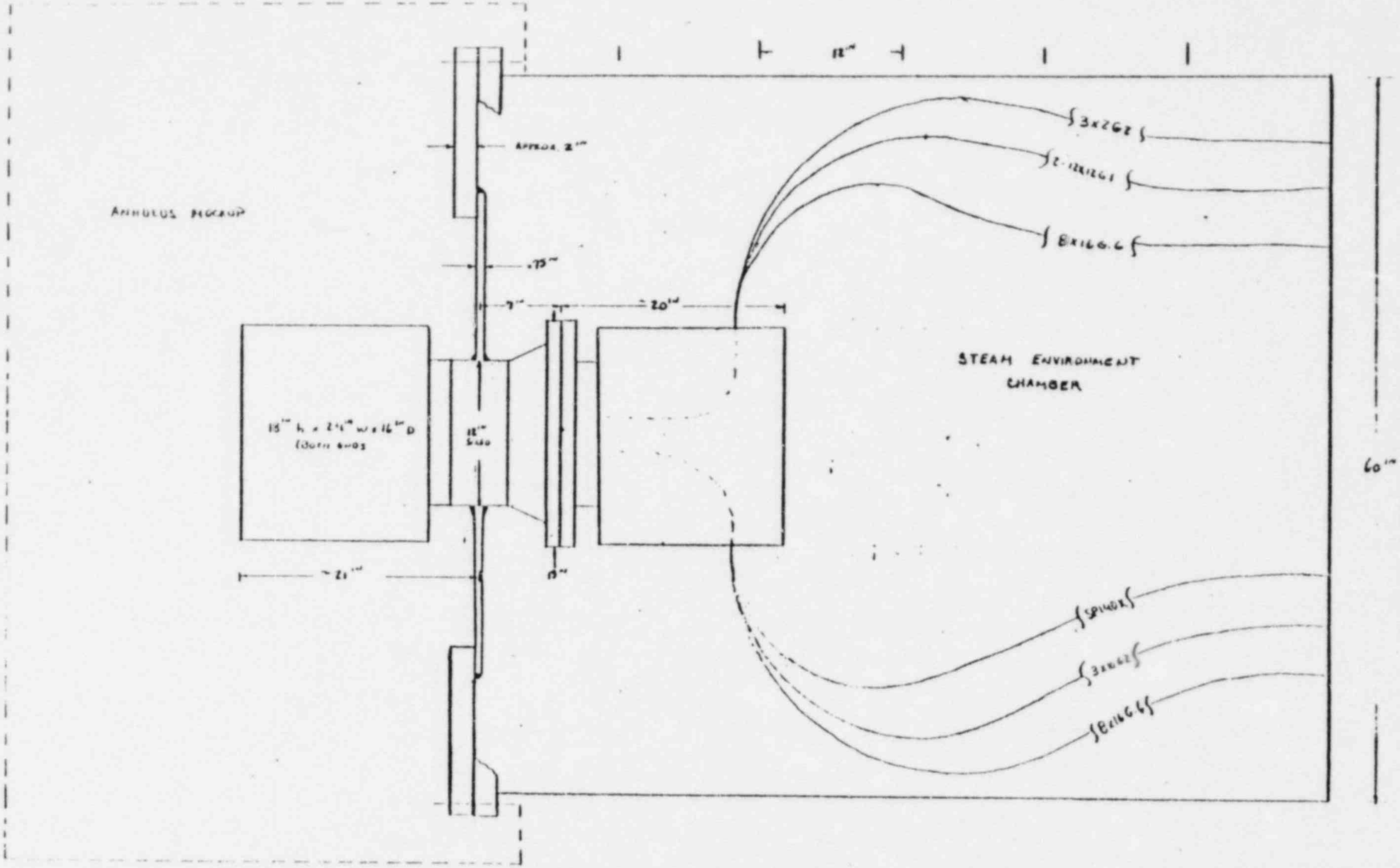
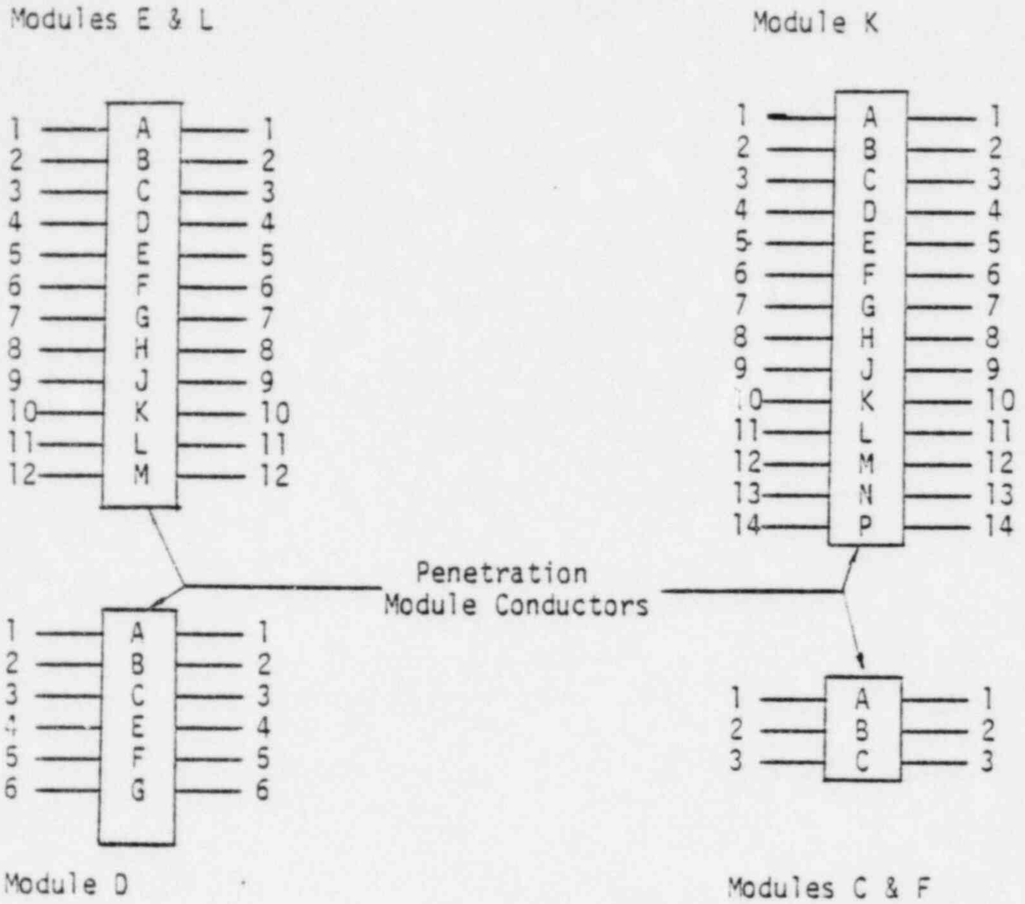


FIGURE 3

MOUNTING CONFIGURATION

FIGURE 4

WIRING DIAGRAM AND INSULATION RESISTANCE



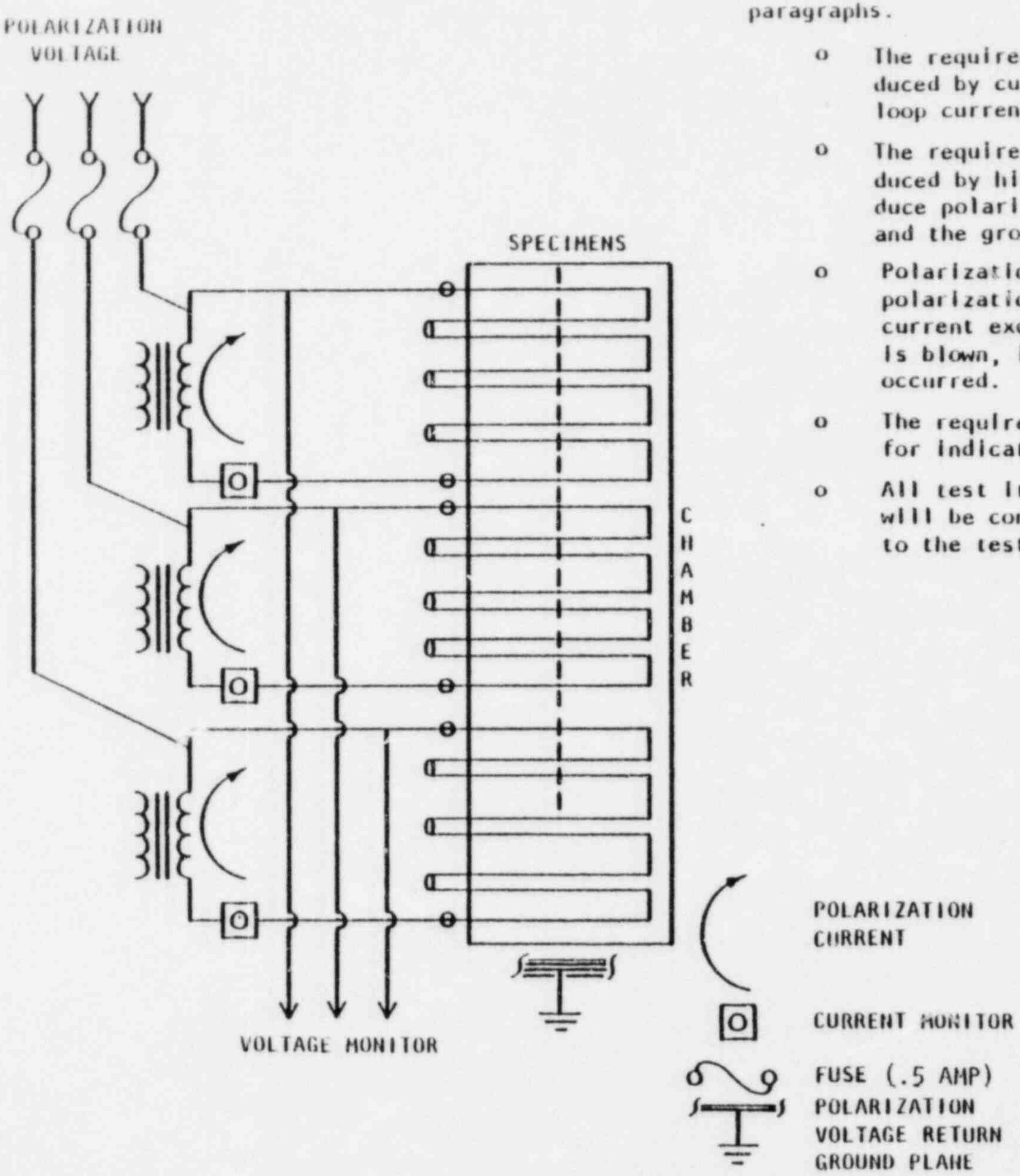
NOTE: 1- On module D Pins C & E are 4 AWG and Pins A,B,F & G are 8 AWG

2. Insulation resistance (IR) shall be measured between each conductor and all other conductors tied to ground.

3. Insulation Resistance shall be greater than 100 megohms for modules C, D, E, and F and 10 megohms for modules K and L prior to start of testing. Readings below these values after the start of testing shall be flagged. Functional capability of the circuits is determined by the ability of the circuits to maintain the prescribed voltage.

The method utilized for the application of polarization voltage and high current to the test items is described in the following paragraphs.

- o The required test currents (TBD amperes) are produced by current transformers, isolated to produce loop current through the test items.
- o The required polarization voltages (TBD VAC) are produced by high-voltage transformers, isolated to produce polarization voltages between the test items and the ground plane.
- o Polarization voltage is applied with the source polarization power supply. In the event leakage current exceeds a specified amount, the line fuse is blown, indicating that test item degradation has occurred.
- o The required current loads are monitored electrically for indications of test item discontinuities.
- o All test items requiring the same current and voltage will be connected in series with terminations external to the test chamber.



B

FIGURE 5. CONFIGURATION FOR APPLICATION OF POLARIZATION VOLTAGE AND HIGH CURRENT

TABLE 1
LIST OF SPECIMENS

Module	Plug Kit Inbd/Outbd	Mark No.	Cable Description
C (M02)	C32P1002G07 C32P1002G08	3X2G2 3X2G2	3/C #2 AWG, EP/Hypalon insulation interlocked armor, Anaconda
D (M03-1)	C32P1003G25 C32P1003G26	SP140X SP140X	4/C #8 AWG, 2/C #4 AWG, EP/Hypalon insulation, hypalon jacket, SS braid, Okonite Ⓐ
E (M 13)	C32P1015G01 C32P1015G02	12X12G1 12X12G1	12/C #12 AWG, EP/Hypalon insulation, interlocked armor, Samuel Moore
F (M 12)	C32P1004G07 C32P1004G08	3X10G2 3X10G2	3/C #10 AWG, EP insulation, interlocked armor, Anaconda
K (M10)	C32P1009G01 C32P1009G06	8X16G.6 8X16G.6	8/C #16 AWG, XLPE insulation, interlocked armor, Brand Re (2 required per plug kit) Note 1
L (M09)	C32P1010G01 C32P1010G02	12X12G1 12X12G1	12/C #12 AWG, EP insulation, interlocked armor, Okonite

NOTE: 1: only 14 of the 16 conductors will terminate in the plug
2: Interfacial seals and cable listed on Table 2

TABLE 2
THERMAL AGING CRITERIA

Components	Quantity	Thermal Aging Temperature/Time	Comments	
Plug Kits				
(1) C32P1002G07	2 ea	150°C/504 hours	Entire plug kit requires thermal aging	
(2) C32P1002G08	2	" "	" " " " " "	
(3) C32P1003G25	2	" "	" " " " " "	
(4) C32P1003G26	2	" "	" " " " " "	Ⓐ
(5) C32P1015G01	2	" "	" " " " " "	
(6) C32P1015G02	2	" "	" " " " " "	
(7) C32P1004G07	2	" "	" " " " " "	
(8) C32P1004G08	2	" "	" " " " " "	
(9) C32P1009G01	2	" "	" " " " " "	
(10) C32P1009G06	2	" "	" " " " " "	
(11) C32P1010G01	2	" "	" " " " " "	
(12) C32P1010G02	2	150°C/504 hours	" " " " " "	
Cable				
1 3X2G2 (Ana)	50 ft	121°C/168 hours		
2 SP140X (Oko)	50	121°C/168 hours		
3 12XJ12G1 (SM)	50	121°C/168 hours		
4 3X10G2 (Ana)	50	150°C/504 hours		B
5 8X16G.6 (BR)	100	150°C/168 hours		
6 12X12G1 (Oko)	50	150°C/504 hours		
Penetration	1	150°C/504 hours	Unit is 19 inch O.D. x 20 inch long	
Face Seals				
(1) C32C2060P03	3	150°C/504 hours	Module C inside end	
(2) C32C2060P04	3	" " hours	Module C outside end	
(3) C32C2060P05	3	" " hours	Module D inside end	
(4) C32C2060P06	3	" " hours	Module D outside end	
(5) C32C2060P07	3	" " hours	Module E inside end	
(6) C32C2060P08	3	" "	Module E outside end	
(7) C32C2060P09	3	" "	Module F inside end	
(8) C32C2060P10	3	" "	Module F outside end	B
(9) C32C2060P19	3	" "	Module K inside end	B
(10) C32C2060P20	3	" "	Module K outside end	
(11) C32C2060P17	3	" "	Module L inside end	
(12) C32C2060P18	3	" "	Module L outside end	

NOTES: All temperature/time values above are for 40 year equivalent life

TABLE 3 Revision B

MODULE ELECTRICAL REQUIREMENTS

Module	Conductor	Voltage	Current
C	1	600 VAC	150 Amps (± 10 amps)
	2	600 VAC	150 Amps
	3	600 VAC	150 Amps
D	1	600 VAC	25 Amps (± 2 amps)
	2	600 VAC	25 Amps
	3	600 VAC	50 Amps (± 3 amps)
	4	600 VAC	50 Amps
	5	600 VAC	25 Amps
	6	600 VAC	25 Amps
E	1	600 VAC	15 Amps (± 2 amps)
	2	600 VAC	15 Amps
	3	600 VAC	15 Amps
	4	600 VAC	15 Amps
	5	600 VAC	15 Amps
	6	600 VAC	15 Amps
	7	600 VAC	15 Amps
	8	600 VAC	15 Amps
	9	600 VAC	15 Amps
	10	600 VAC	15 Amps
	11	600 VAC	15 Amps
	12	600 VAC	15 Amps
F	1	600 VAC	30 Amps (± 3 amps)
	2	600 VAC	30 Amps
	3	600 VAC	30 Amps
K	1	120 VAC	0
	2	120 VAC	0
	3	120 VAC	0
	4	120 VAC	0
	5	120 VAC	0
	6	120 VAC	0
	7	120 VAC	0

B

TABLE 3

Module	Conductor	Voltage	Current	
K	8	120 VAC	0	B
	9	120 VAC	0	
	10	120 VAC	0	
	11	120 VAC	0	
	12	120 VAC	0	
	13	120 VAC	0	
	14	120 VAC	0	
L	1	600 VAC	5 Amps (± 1 amp)	
	2	600 VAC	5 Amps	
	3	600 VAC	5 Amps	
	4	600 VAC	5 Amps	
	5	600 VAC	5 Amps	
	6	600 VAC	5 Amps	
	7	600 VAC	5 Amps	
	8	600 VAC	5 Amps	
	9	600 VAC	5 Amps	
	10	600 VAC	5 Amps	
	11	600 VAC	5 Amps	
	12	600 VAC	5 Amps	

NOTE: All voltages ± volts AC
Tolerances on currents are noted above and applies to each conductor requiring that ampacity.

TABLE 4

Thermocouple Locations

Inside Steam Chamber

1 On exterior face of junction box cover
2 Air temp inside junction box
3 In backshell of module C
4 " " " " D
5 " " " " E
6 " " " " F
7 " " " " K
8 " " " " L
9 On outside of junction box mtg ring (360°)
10 On face of flange near module C
11 On face of flange near module K or L
12 On 3/4 inch chamber flange plate at 360°
13 " " " " " 90°
14 " " " " " 180°
15 " " " " " 270°
16 Under armor on 3X10G2 cable from module F
17 Under armor on 12X12G1 from module L
18 Chamber air temperature, 6" from centerline front of junction box B
19 Chamber air temperature, 6" from centerline side of junction box, righ side facing chamber B
20 Chamber air temperature, 6" from bottom, centerline or junction box B
21 On receptacle of module E
22 On receptacle of module D
23 Chamber air temperature (6" above centerline junction box) B
B

Outside Steam Chamber

26 On exterior face of junction box cover
27 Air temperature inside junction box
28 In backshell of module C B
29 In backshell of module D B
30 " " " E
31 " " " F
32 " " " K
33 " " " L

TABLE 4

Thermocouple Locations

34	Inside nozzle air temperature	
35	On face of flange near module C	
36	On face of flange near module K or L	
37	On 3/4 inch chamber flange plate at 360°	
38	" " " " " 90°	
39	" " " " " 180°	
40	" " " " " 270°	
41	Under armor on 3X10G2 from module F	
42	" " " 12X12G1 from module L	
43	Annulus air temp (high)	
44	Annulus air temp (center), control	B
45	Annulus air temp (low)	
46	On receptable of module E	
47	On receptacle of module D	

B

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APPENDIX IX-II

WYLE LABORATORIES' TEST PROCEDURE NO. 543/6124-2/DK, REVISION C

TEST PROCEDURE

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP
P. O. BOX 1008 • HUNTSVILLE, ALABAMA 35807
TWX (810) 726-2225 • TELEPHONE (205) 837-4411

TEST PROCEDURE NO. 543/6124-2/DK

DATE: September 23, 1981
Revision C: 4/26/82

J/N 45869

NUCLEAR ENVIRONMENTAL QUALIFICATION
TEST PROCEDURE

FOR

ELECTRIC PENETRATIONS TYPES B-M

FOR

DUKE POWER COMPANY

FOR USE IN

McGUIRE NUCLEAR POWER GENERATING STATION
UNITS 1 AND 2

APPROVED BY: ______
FOR: ______
APPROVED BY: ______
FOR: ______
APPROVED BY: ______
FOR: ______

APPROVED BY PROJECT MANAGER: Herschel D. Jordan
Herschel D. Jordan
APPROVED BY QUALITY ENGINEER: Marvin J Kimball
PREPARED BY PROJECT ENGINEER: James E. Marconnet
James E. Marconnet

REVISIONS

FORM 1054-1 Rev. 4/74

REV. NO.	DATE	PAGES AFFECTED	BY	APPR.	DESCRIPTION OF CHANGES
A	10/12/81	2	LM	JEM MK	1.2.1 - Changed to Revision I. Changed 1.2.9 to 1.2.10, added 1.2.9.
A	10/12/81	3	LM	JEM MK	Revised 1.4, rewrote 2.0.
A	10/12/81	6	LM	JEM MK	3.3 - Added second paragraph. 3.5 - Changed title, added 4th sen-
					tence. 3.6 - changed 1.2.8 to 1.2.9.
A	10/12/81	8	LM	JEM MK	3.8.4.1 - Changed 2 inches to 6 inches.
A	10/12/81	9	LM	JEM MK	3.8.8.1 - Corrected typographical error
A	10/12/81	11	LM	JEM MK	3.8.10 - Changed "No Chemical" to "Water"
A	10/12/81	13 & 14	LM	JEM MK	Added notes to Figure 1 and Figure 2.
A	10/12/81	18 & 19	LM	JEM MK	Corrected plug kit numbers.
B	3/17/82	7	HS		Revised Para. 3.8.2
[illegible]	3/17/82	8	HS		Revised Para. 3.8.4.1

1.0 SCOPE

This document has been prepared by Wyle Laboratories for the Duke Power Company and encompasses specific equipment, electric penetrations, manufactured by D. G. O'Brien, Inc., for use in McGuire Nuclear Power Generating Station.

1.1 Objectives

The purpose of this procedure is to present the requirements, procedures, and sequence to test the electric penetrations for use in the McGuire Nuclear Power Generating Station.

1.2 Applicable Qualification Standards, Specifications, and Documents

1.2.1 Duke Power Company Specification No. MCS-1393.01-00-0003, July 23, 1981, Revision 1. Ⓐ

1.2.2 IEEE 323-1971, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

1.2.3 IEEE 317-1972, "IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations."

1.2.4 ANSI N45.2.2-1972, "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants."

1.2.5 Duke Power Co. MCM 1361.00-0016, "Low Voltage Penetration Instruction Manual."

1.2.6 Duke Power Co. MCM 1361.00-0017, "Instrumentation Penetration Instruction Manual."

1.2.7 Duke Power Co. CNM 1361.00-0010, "Low Voltage Penetration Instruction Manual."

1.2.8 Duke Power Co. CNM 1361.00-0011, "Instrument Penetration Instruction Manual."

1.2.9 Duke Power Co. IP-MCP-001, "Test Assembly Installation Sequence." Ⓐ

1.2.10 Wyle Laboratories Quotation No. 543/6124-2/DK.

1.3 Equipment Description

The test specimens to be supplied by Duke Power Company shall consist of the six (6) modules listed in Table 1, plus the plugs and cables connected to each end of the modules. Duke Power Company shall also provide the penetration mounting, the wall mockup, and all dummy mountings and modules for the Chamber Calibration Test and Accident Test.

REVISIONS

Page No. IX-31
Report No. 45869-1

WYLE LABORATORIES
SCIENTIFIC SERVICES AND SYSTEMS GROUP

REVISION C
TEST PROCEDURE NO. 543/6124-2/DK
DATE: April 26, 1982

REV. NO.	DATE	PAGES AFFECTED	BY	APP'L.	DESCRIPTION OF CHANGES
B	3/17/82	9	HS HS		Revised Para. 3.8.6 and 3.8.7
B	3/17/82	10	HS HS		Revised Para. 3.8.9.2
B	3/17/82	13	HS HS		Added Note No. 5
B	3/17/82	17	HS HS		Added Fuse size
B	3/17/82	19	HS HS		Changed numbers of Cable No. 3
					and face seals 7 and 8.
B	3/17/82	20, 21	HS HS		Changed module K voltage to 120 volts
B	3/17/82	22	HS HS		Added notes to TC's 17, 18, 19, 20,
					and 23. Deleted TC's 28 through 33
					changed "on" to "in"
B	3/17/82	23	HS HS		Added note to TC 44. Deleted TC's
					48, 49, and 50.
C	4/22/82	24 - 44	HS HS		Added Addendum No. 1 for Extended
					Accident Test and Post Test Analysis
					of Penetration Unit & Associated
					Cables.

1.0 SCOPE (Continued)

1.4 Qualification Sequence

Qualification shall be performed in the following sequence:

- Receiving Inspection
- Thermal Aging
- Assemble Plug Kits onto Cables; Perform Baseline Test Ⓐ
- Radiation Exposure
- Functional Tests Ⓐ
- Assembly of Remaining Components by Duke Power at Wyle Laboratories Ⓐ
- Baseline Functional Tests
- Accident Test
- Functional Tests
- Post-Test Inspection

2.0 QUALIFICATION REQUIREMENTS

The test specification includes any required margins. Ⓐ

2.1 Normal Service Conditions

The following design environmental conditions inside containment for normal operation are as specified by Duke Power Company.

- Temperature: 120°F
- Pressure: 0 to 3 psig
- Humidity: 65-80%
- Radiation: 2×10^4 rads (40-year integrated exposure)

The following design environmental conditions in the annulus between the steel containment vessel and the concrete Reactor Building are as specified by Duke Power Company.

- Temperature: 98°F
- Pressure: Atmospheric
- Humidity: 65-80%
- Radiation: 2×10^4 rads (40-year integrated exposure)

2.0 QUALIFICATION REQUIREMENTS (Continued)

2.2 Accident and Post-Accident Service Conditions

The following design environmental conditions inside containment during and after the postulated Design Basis Event (Loss of Coolant Accident or Main Steam Line Break) are as specified by Duke Power Company.

- Temperature: 340°F (Peak)
- Pressure: 15 psig (Peak)
- Humidity: 100%
- Radiation: 2×10^8 rads (1-year integrated exposure)
- Chemical Spray:
  - First 30 Min: Boron - 2,100 ppm
    NaOH - 0
    pH - ≅5
  - Thereafter: Boron - 1,922 ppm
    NaOH - As required for pH
    pH - 6-10

Figure 1 shows the temperature/pressure/time profile inside containment as specified by Duke Power Company.

The following design environmental conditions in the annulus between the steel containment vessel and the concrete Reactor Building are as specified by Duke Power Company.

- Temperature: 142°F (Peak)
- Pressure: Minus 0.5 inches H_2O to plus 0.5 inches H_2O
- Humidity: 65-80%
- Radiation: 1.5×10^8 rads (1-year integrated exposure)

Figure 2 shows the temperature/pressure/time profile in the annulus as specified by Duke Power Company.

2.3 Other Service Conditions

Table 3 shows the 60-hertz voltage and current requirements for the conductors of the six (6) modules as specified by Duke Power Company.

2.0 QUALIFICATION REQUIREMENTS (Continued)

2.4 Safety-Related Functions

The safety classification of this equipment is Class 1E. The subject equipment provides essential services in support of emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or is otherwise essential in providing support to prevent significant release of radioactive material to the environment. The safety-related functions are described in the following paragraphs.

2.4.1 Description

The electrical penetration assemblies specified will be used to perform various electrical functions inside the reactor containment structure.

2.4.2 Acceptance Criteria

The test specimens shall be considered to have met the criteria of this test specification if they complete the test sequence and still maintain circuit integrity. Circuit integrity shall be indicated by the test specimen being capable of maintaining the required voltage and/or current specified in Table 3.

2.5 Safety-Related Components

All components in the subject equipment are assumed to be safety related.

3.0 QUALIFICATION TEST PROGRAM

3.1 Receiving Inspection

An inspection shall be performed upon receipt of the test specimen components at the test facility. This inspection shall assure that the equipment received is as described in Paragraph 1.3. Applicable series, model, part, and/or serial numbers shall be verfied. Specimens shall be labeled, as deemed necessary by the Project Engineer, to facilitate identification of the specimens during all phases of the qualification program. The results of the inspection (specimen identification, quantities, configurations, etc.) shall be recorded. Photographs shall be taken of the test specimen components.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.2 Thermal Aging

The desired life of the subject equipment is 40 years. The test specimen components shall be thermally aged in two (2) thermal chambers for the times and temperatures in Table 2 as specified by Duke Power Company. The thermal aging temperature shall be recorded continuously. The relative humidity shall be uncontrolled and shall not be monitored. The thermal aging chambers shall be opened briefly as required to remove test specimens after their respective thermal aging times. Photographs shall be taken of the thermal aging test setup before and after thermal aging.

3.3 Visual Inspection

The test specimen components shall be visually inspected. This inspection shall assure that the components have no obvious visible damage. Photographs shall be taken of the test specimen components.

Duke Power Company personnel shall then assemble the plug kits, and perform the Baseline Tests (3.7.2 and 3.7.3) on the plug kits, cables and penetration. All other components shall be visually inspected. (Reference 1.2.5 through 1.2.9.) Ⓐ

3.4 Radiation Exposure

The test specimen components shall be exposed to a total integrated dose of 2.0×10^8 rads gamma, air equivalent, minimum, using a Cobalt 60 source, at a dose rate not to exceed 1.0×10^6 rads per hour as specified by Duke Power Company. This is the combined normal and accident dose.

3.5 Functional Tests Ⓐ

The test specimen components shall be visually inspected. This inspection shall assure that the components have no obvious visible damage. Photographs shall be taken of the test specimen components. The plug kits, cables and penetrations shall be checked for baseline data (3.7.2 and 3.7.3). Ⓐ

3.6 Assembly of Components

Duke Power Company shall assemble and label the remaining components at Wyle Laboratories, using the procedures of references 1.2.5 through 1.2.9 as appropriate. Ⓐ

3.7 Baseline Functional Test

The following Baseline Functional Tests shall be performed on the assembled modules before they are installed in the penetration mounting and wall mockup.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.7.1 Visual Inspection

The modules shall be visually inspected. This inspection shall assure that the modules have no obvious visible damage and are labeled properly. A photograph shall be taken of the assembled modules.

3.7.2 Insulation Resistance

Insulation resistance shall be measured between each conductor and all other conductors tied to ground at 500 VDC as indicated on Figure 4. If the I.R. is less than the minimum scale reading at 500 VDC, then the I.R. shall be measured at 100 VDC. The I.R. of modules C, D, E, and F shall be 100 megohms or greater. The I.R. of modules K and L shall be 10 megohms or greater. Duke Power Company shall be notified of any I.R. readings below these values.

3.7.3 Continuity

All circuits shall be checked for electrical continuity using an ohmmeter or equivalent.

3.8 Accident Test

3.8.1 Mounting

The test specimen modules shall be installed in the penetration mounting installed in the wall mockup at Wyle Laboratories by Duke Power Company. Photographs shall be taken of the assembly.

3.8.2 Thermocouple Installation

Thermocouples shall be attached to the test specimen assembly per Table 4 or as specified by Duke Power Company. These thermocouples shall be commercially available probes or shall be field-fabricated and shall be welded or strapped in place. B

3.8.3 Wall Mockup Installation

The wall mockup shall be attached to an environmental chamber similar to that shown in Figure 3, and the test specimen armored cables and thermocouple leads shall be run through chamber penetrations and sealed per Wyle Laboratories' standard practice.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.4 Steam Environmental Chamber

An environmental chamber similar to the steam environment chamber shown in Figure 3 shall be used for the Accident Test. The wall mockup shall bolt to this environmental chamber and shall seal the chamber. Penetrations for six (6) cables and twenty-five (25) thermocouple wires shall be provided at the opposite end of the chamber from the wall mockup. Superheated steam and/or saturated steam, as required, shall be introduced into the chamber from the end of the chamber opposite the wall mockup. A manifold shall distribute this steam evenly across the end of the chamber. Chemical spray nozzles shall be provided along the top of the chamber. A chamber drain shall be provided at the bottom of the chamber.

3.8.4.1 Chamber Temperature Control

The chamber temperature, for control purposes, shall be the average of three (3) thermocouples located within 6 inches of the surface of the test specimen. These shall be thermocouples 18, 19, and 20 per Table 4. Ⓐ B

The environment chamber shall be initially heated to 120°F, using heated forced air. Superheated steam shall be used during the first temperature transient (120°F to 340°F). Saturated steam shall be used thereafter to maintain the chamber temperature. Chamber temperature reductions shall be at the chamber thermal recovery rate or slower (by the addition of saturated steam). B

3.8.4.2 Chamber Pressure Control

The chamber pressure shall be monitored with a pressure gauge and a pressure transducer. Filtered, regulated house air shall be provided to maintain the chamber pressure, as required, after the initial temperature/pressure transient.

3.8.5 Annulus Mockup

An environmental chamber shall be erected to surround the penetration mounting and wall mockup. This chamber shall be equipped with heating and/or cooling, as required, to maintain the annulus temperatures specified in Figure 2. Cables supplied by Duke Power Company shall run from the electric penetration test specimen through the environmental chamber wall to a junction panel located outside of the environmental chamber.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.6 Test Specimen Energization

The conductors of modules C, D, E, F, and L shall be wired in series as required to form six (6) current loops. Each loop shall be independently energized to the voltage and current specified in Table 3, using the polarization voltage method as shown in Figure 5. The conductors of module K shall be connected together and energized to 120 VAC. B

3.8.7 Test Specimen Instrumentation B

The chamber pressure and the thermocouples designated in Table 4 as numbers 2, 6, 10, 18, 19, and 20 shall be recorded on a datalogger at the following sample rates:

1 sample/second for the first 5 min.
1 sample/minute from T = 5 min. to T = 150 min.
1 sample/15 minutes from T = 150 min. to T = 60 hrs.
1 sample/hour from T = 60 hrs. until T = 7 days

The voltage and current at modules C, D, E, F, and L; the leakage current at module K; and the remaining 39 thermocouples as shown in Table 4 shall be recorded on a datalogger at the following sample rates:

1 sample/minute for the first 150 min.
1 sample/15 minutes from T = 150 min. until T = 60 hrs.
1 sample/hour from T - 60 hrs until T = 7 days

3.8.8 Chemical Spray

3.8.8.1 Chemical Spray Composition

The chemical spray solution for the first 30 minutes of the Accident Test shall be made from potable water with 2100 ppm of Boron as Boric Acid added. The pH is expected to be approximately 5.0. The chemical spray solution for the rest of the Accident Test shall be made from potable water with 1922 ppm of Boron as Boric Acid and NaOH added as required to maintain the pH between 6.0 and 10.0. New batches of the chemical spray solution shall be made up at least once every 4 days and shall replace the old chemical spray solutions. Ⓐ

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.8.2 Chemical Spray Rate

The chemical spray solution shall be sprayed continuously vertically downward in the steam chamber from 10 seconds into the Accident Test to the end of the test. The minimum spray rate shall be 0.15 (gal/min)/ft^2 of area of the test chamber projected onto a horizontal plane. The spray rate shall be recorded daily by measuring the pressure drop across the spray nozzles or by other means. The chemical spray solution shall be recirculated. The pH of the chemical spray solution shall be recorded at least daily. The chemical spray solution temperature shall not be monitored or controlled.

3.8.9 Functional Tests

3.8.9.1 Pre-Accident Test Functional Tests

3.8.9.1.1 Insulation Resistance

The Functional Tests of Paragraph 3.7.2 shall be repeated.

3.8.9.1.2 Continuity

The Functional Tests of Paragraph 3.7.3 shall be repeated.

3.8.9.1.3 High Potential Test

Module C and F conductors shall be high potential tested at 1000 VAC for 1 minute, using a Hy-Pot or equivalent between each conductor and ground. The leakage current shall be recorded.

3.8.9.2 Accident Test Functional Tests

The Functional Tests of Paragraphs 3.7.2 and 3.8.9.1.3 shall be repeated on a daily basis during the Accident Test. In addition, these tests shall be performed commencing before T_o, when the temperature is stabilized at 300°F; when the temperature is stabilized at 250°F, at 8 hours, at 16 hours, at 24 hours; and when the temperature is stabilized at 228°F. The measurements required at the 300°F plateau may extend beyond the 300°F plateau. The measurements at the 300°F point shall be taken in the following order: C, E, K, F, D, and L. B B

3.8.10 Chamber Calibration

A trial run shall be performed prior to the Accident Test to determine the actual temperature and pressure ramps of which the chambers are capable. A dummy penetration mounting and dummy modules designed to simulate the test specimens (volume and mass) or plugs shall be installed in the chambers to simulate the actual test configuration.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.8.10 Chamber Calibration (Continued)

These dummy modules or plugs shall be provided by Duke Power Company. Photographs shall be taken of the chamber calibration test setup. A maximum of fifteen (15) thermocouples shall be installed for the trial run and shall be monitored by the oscillographs and datalogger with high speed printer. Water spray shall be used during the trial run. No energization shall be required. No Functional Tests shall be performed. Ⓐ

Environmental test data from this test run shall be submitted to Duke Power Company for review prior to the installation of the test specimens in the penetration mounting.

3.8.11 Accident Test Exposure

The test specimens shall be installed in the wall mockup and shall be subjected to the environmental conditions specified in Figures 1 and 2 simultaneously within the limitations of the environmental chambers, as determined during the chamber test run.

3.9 Final Functional Test

The Functional Tests of Paragraph 3.8.9.1 shall be repeated at room ambient temperature before the test specimens are removed from the environmental chambers.

3.10 Post-Test Inspection

Upon completion of the test program, the equipment shall be visually inspected. The equipment shall be disassembled to the extent necessary to perform the inspection. The condition of the equipment shall be recorded. Photographs shall be taken of the test specimens before and after they are removed from the wall mockup.

3.11 In-Process Inspection

The records shall be checked for quality of performance after each test.

The test items shall be examined for possible damage following all tests. All important test effects shall be logged. Black and white photographs shall be taken of any noticeable physical damage that may occur.

3.0 QUALIFICATION TEST PROGRAM (Continued)

3.12 Quality Assurance

The test program shall be performed in accordance with Wyle Laboratories' (Eastern Operations) Quality Assurance Policies and Procedures Manual, which conforms to the applicable portions of ANSI N-45.2, 10 CFR/50, Appendix B, and Military Specification MIL-C-45662A.

All instrumentation used in the performance of this test program shall be calibrated in accordance with this manual. Standards used in performing all calibrations are traceable to the National Bureau of Standards.

Duke Power Company Forms 930.1C and 301.4 shall be submitted to Duke Power Company at the completion of the test program.

3.13 Report

Ten (10) copies of the test report shall be issued, describing the test requirements, procedures, and results. The report shall be prepared in accordance with the format requirements of IEEE 323-1974, where applicable. Representative black and white photographs of the test specimens and test setups shall be reproduced in the report. The Accident Test specimen instrumentation data shall be provided to Duke Power in computer printout form but will not be included in the test report.

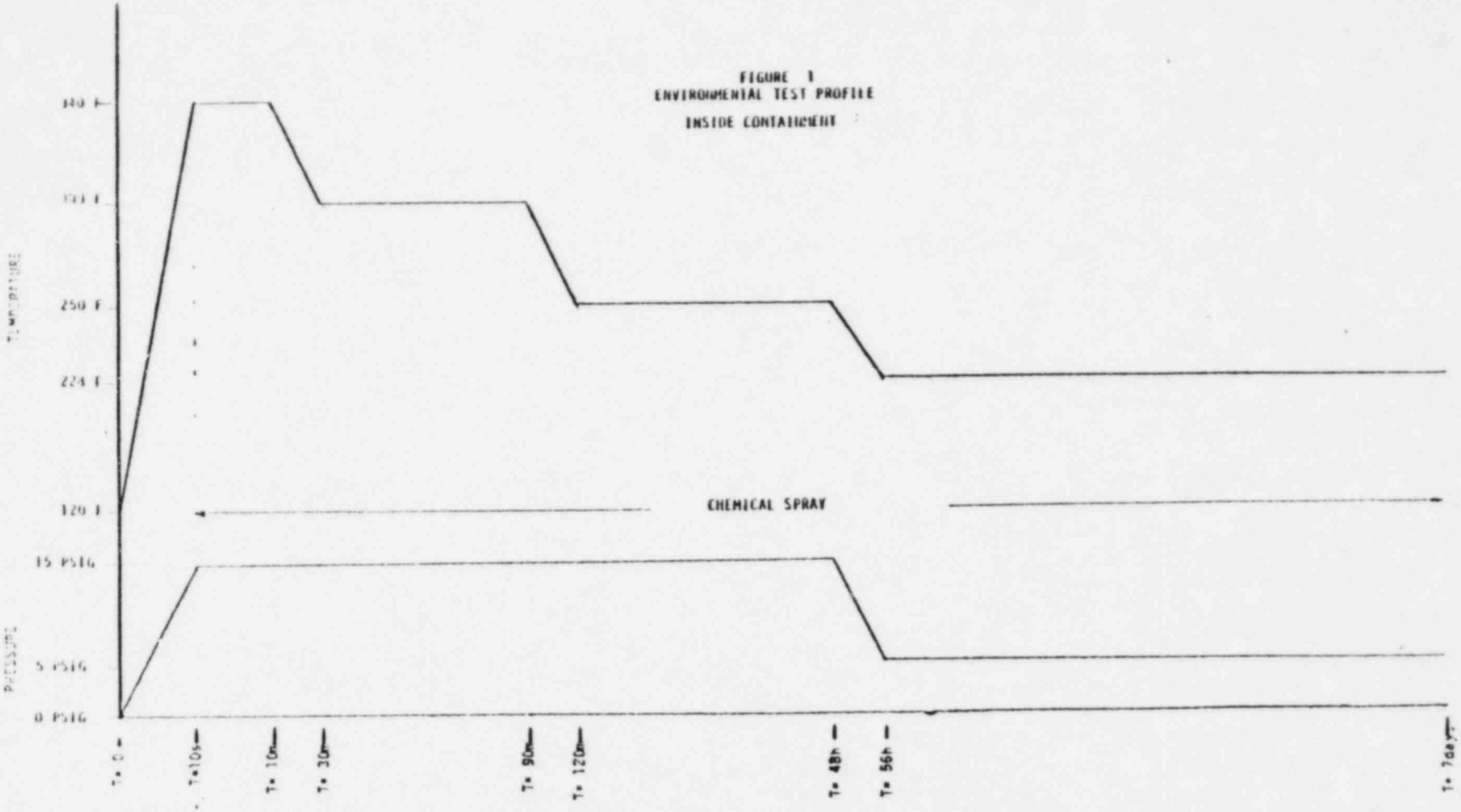

FIGURE 1
ENVIRONMENTAL TEST PROFILE
INSIDE CONTAINMENT

NOTE:
1) All steady state temperatures shall be as shown, +10°, -0°F.
2) Peak pressure shall not exceed 25 psig.
3) Steady state pressure for superheat regions shall be as shown +8°, -0°F.
4) For 250°F and below, the pressure shall follow the saturation curve for the temperature.
5) It is permissible for the initial 10-second ramp to extend out to 30 seconds.

Ⓐ

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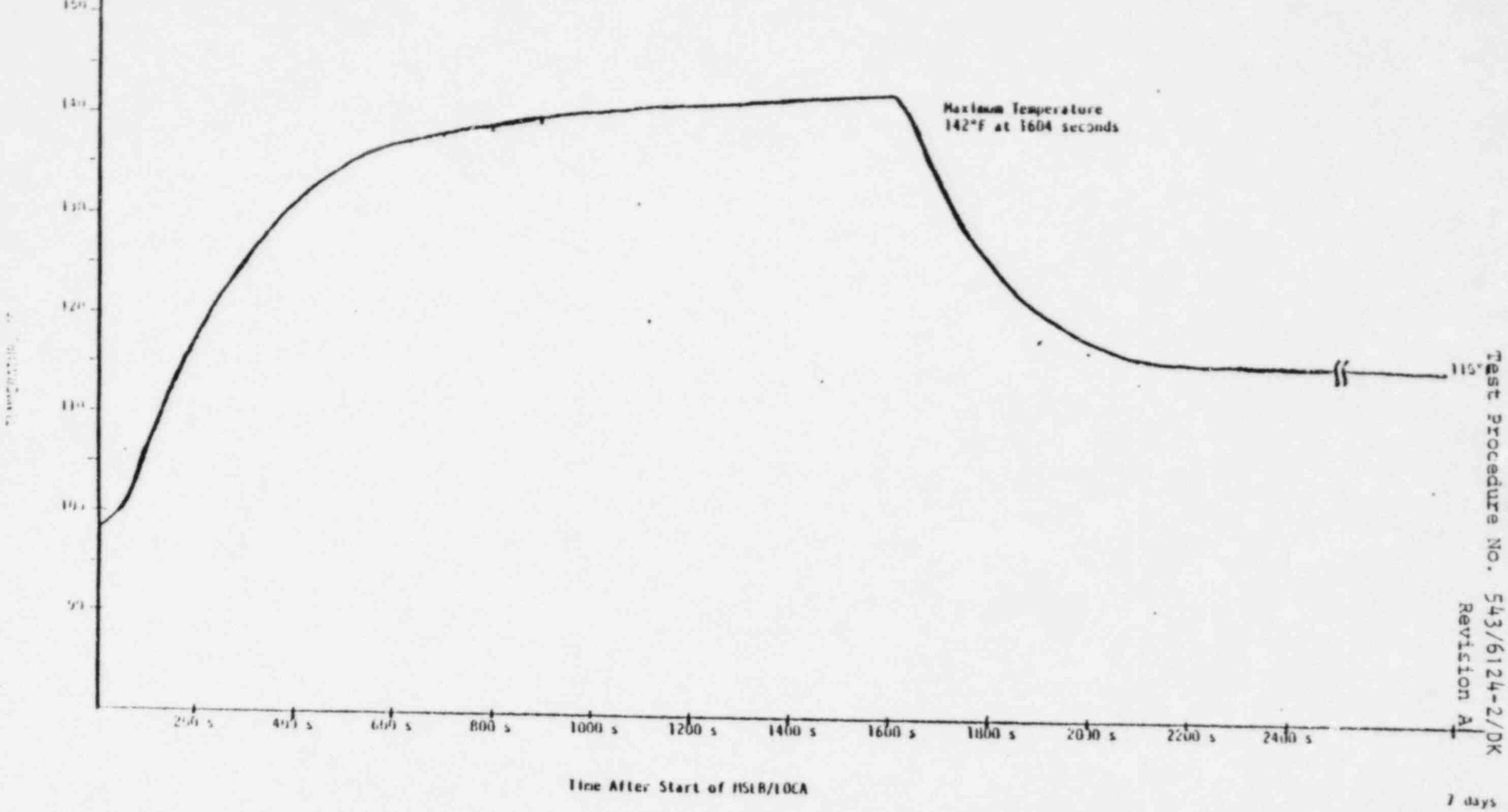
Figure 2

Annulus Temperature Profile

Combined MSLB/LOCA



NOTE: 1) The test temperature profile shall be as close to the above profile as practical during the transient.

2) After 2400 seconds, the test temperature shall be within +15°F, -0°F.

Ⓐ

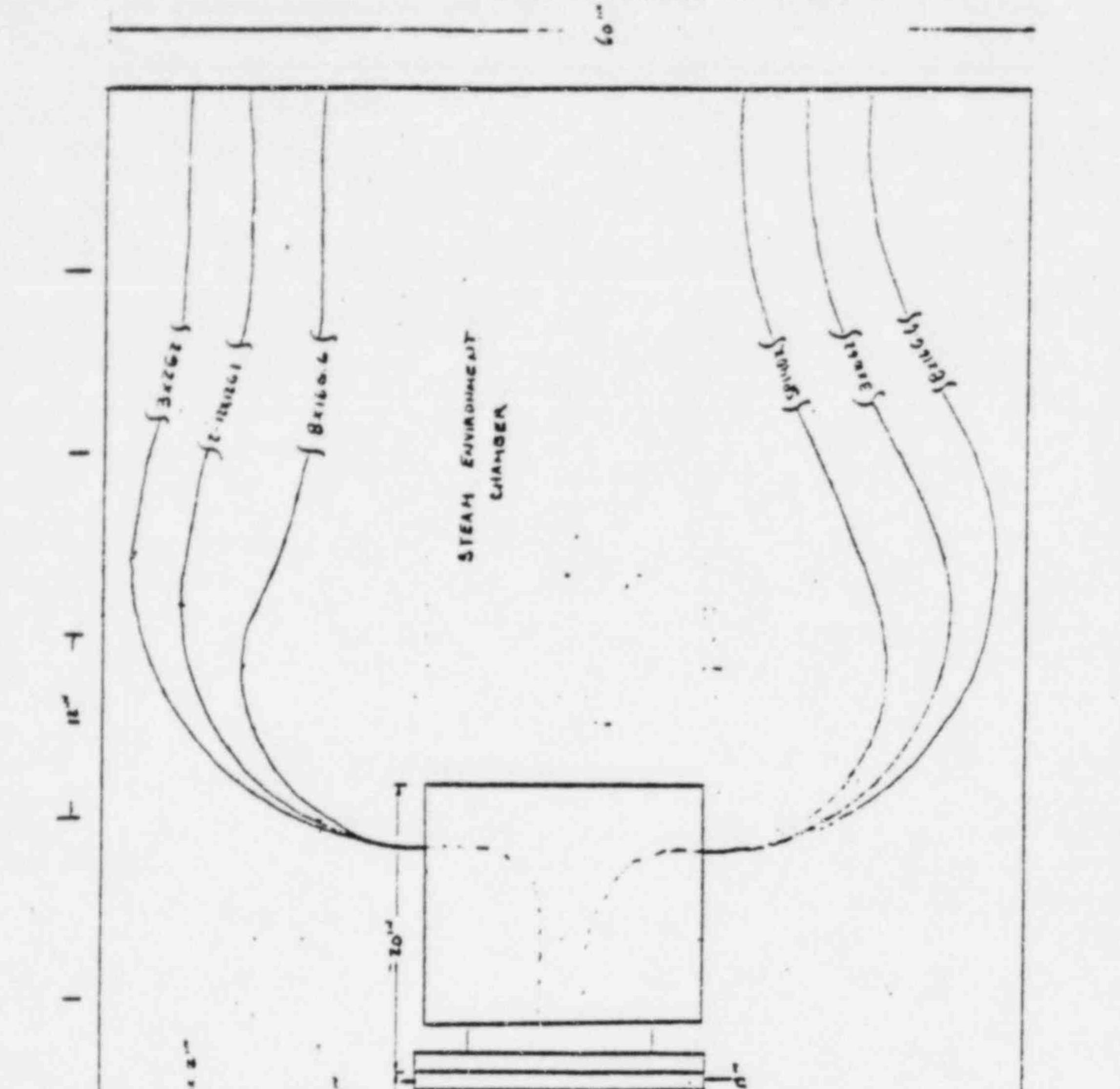
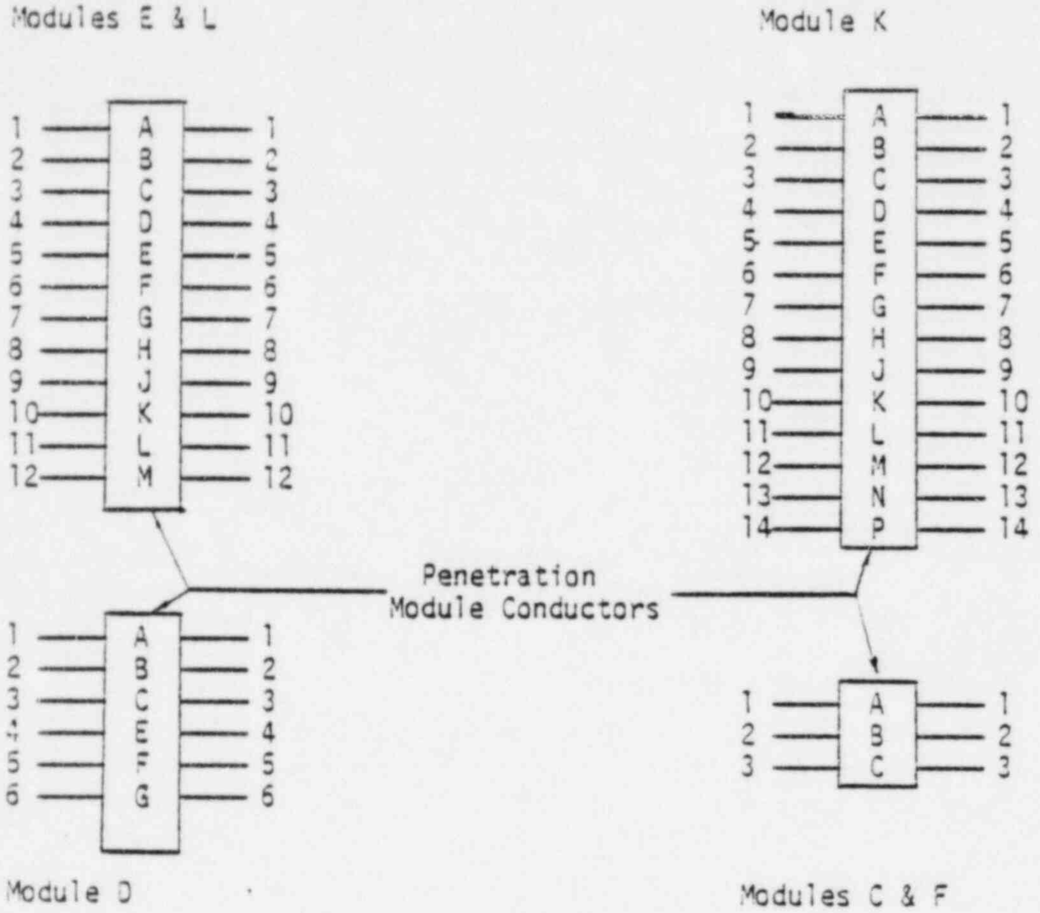


FIGURE 3

MOUNTING CONFIGURATION

FIGURE 4

WIRING DIAGRAM AND INSULATION RESISTANCE



NOTE: 1- On module D Pins C & E are 4 AWG and Pins A,B,F & G are 8 AWG

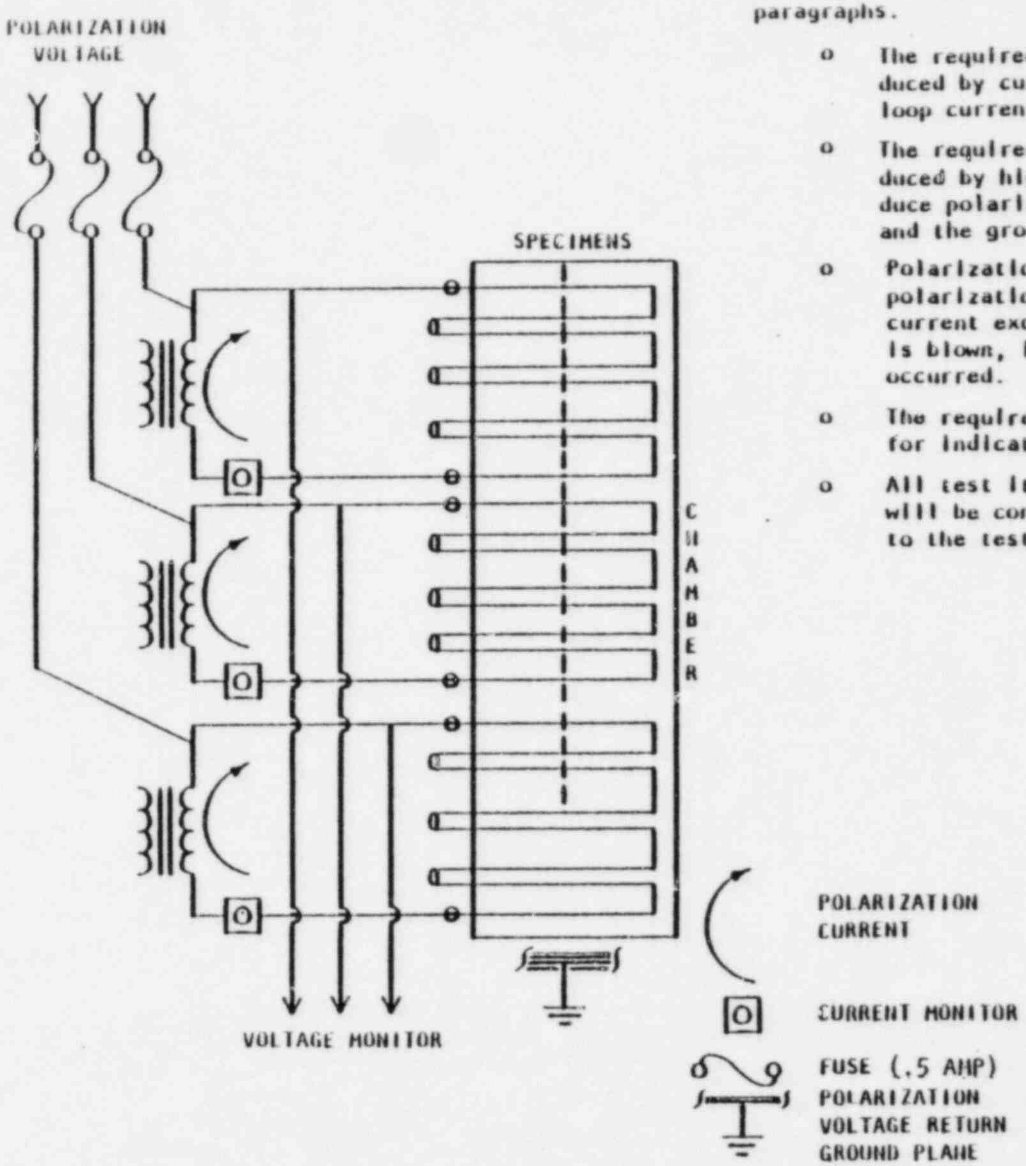
2. Insulation resistance (IR) shall be measured between each conductor and all other conductors tied to ground.

3. Insulation Resistance shall be greater than 100 megohms for modules C, D, E, and F and 10 megohms for modules K and L prior to start of testing. Readings below these values after the start of testing shall be flagged. Functional capability of the circuits is determined by the ability of the circuits to maintain the prescribed voltage.

DMM/csc

The method utilized for the application of polarization voltage and high current to the test items is described in the following paragraphs.

- o The required test currents (TBD amperes) are produced by current transformers, isolated to produce loop current through the test items.
- o The required polarization voltages (TBD VAC) are produced by high-voltage transformers, isolated to produce polarization voltages between the test items and the ground plane.
- o Polarization voltage is applied with the source polarization power supply. In the event leakage current exceeds a specified amount, the line fuse is blown, indicating that test item degradation has occurred.
- o The required current loads are monitored electrically for indications of test item discontinuities.
- o All test items requiring the same current and voltage will be connected in series with terminations external to the test chamber.



B

FIGURE 5. CONFIGURATION FOR APPLICATION OF POLARIZATION VOLTAGE AND HIGH CURRENT

TABLE 1
LIST OF SPECIMENS

Module	Plug Kit Inbd/Outbd	Mark No.	Cable Description
C (M02)	C32P1002G07 C32P1002G08	3X2G2 3X2G2	3/C #2 AWG, EP/Hypalon insulation interlocked armor, Anaconda
D (M03-1)	C32P1003G25 C32P1003G26	SP140X SP140X	4/C #8 AWG, 2/C #4 AWG, EP/Hypalon insulation, hypalon jacket, SS braid, Okonite Ⓐ
E (M 13)	C32P1015G01 C32P1015G02	12X12G1 12X12G1	12/C #12 AWG, EP/Hypalon insulation, interlocked armor, Samuel Moore
F (M 12)	C32P1004G07 C32P1004G08	3X10G2 3X10G2	3/C #10 AWG, EP insulation, interlocked armor, Anaconda
K (M10)	C32P1009G01 C32P1009G06	8X16G.6 8X16G.6	8/C #16 AWG, XLPE insulation, interlocked armor, Brand Rex (2 required per plug kit) Note 1
L (M09)	C32P1010G01 C32P1010G02	12X12G1 12X12G1	12/C #12 AWG, EP insulation, interlocked armor, Okonite

NOTE: 1: only 14 of the 16 conductors will terminate in the plug
2: Interfacial seals and cable listed on Table 2

TABLE 2
THERMAL AGING CRITERIA

Components	Quantity	Thermal Aging Temperature/Time	Comments
Plug Kits			
(1) C32P1002G07	2 ea	150°C/504 hours	Entire plug kit requires thermal aging
(2) C32P1002G08	2	" "	" " " " " "
(3) C32P1003G25	2	" "	" " " " " "
(4) C32P1003G26	2	" "	" " " " " " (A)
(5) C32P1015G01	2	" "	" " " " " "
(6) C32P1015G02	2	" "	" " " " " "
(7) C32P1004G07	2	" "	" " " " " "
(8) C32P1004G08	2	" "	" " " " " "
(9) C32P1009G01	2	" "	" " " " " "
(10) C32P1009G06	2	" "	" " " " " "
(11) C32P1010G01	2	" "	" " " " " "
(12) C32P1010G02	2	150°C/504 hours	" " " " " "
Cable			
1 3X2G2 (Ana)	50 ft	121°C/168 hours	
2 SP140X (Oko)	50	121°C/168 hours	
3 12XJ12G1 (SM)	50	121°C/168 hours	
4 3X10G2 (Ana)	50	150°C/504 hours	B
5 8X16G.6 (BR)	100	150°C/168 hours	
6 12X12G1 (Oko)	50	150°C/504 hours	
Penetration	1	150°C/504 hours	Unit is 19 inch O.D. x 20 inch long
Face Seals			
(1) C32C2060P03	3	150°C/504 hours	Module C inside end
(2) C32C2060P04	3	" " hours	Module C outside end
(3) C32C2060P05	3	" " hours	Module D inside end
(4) C32C2060P06	3	" " hours	Module D outside end
(5) C32C2060P07	3	" " hours	Module E inside end
(6) C32C2060P08	3	" "	Module E outside end
(7) C32C2060P09	3	" "	Module F inside end
(8) C32C2060P10	3	" "	Module F outside end B
(9) C32C2060P19	3	" "	Module K inside end B
(10) C32C2060P20	3	" "	Module K outside end
(11) C32C2060P17	3	" "	Module L inside end
(12) C32C2060P18	3	" "	Module L outside end

NOTES: All temperature/time values above are for 40 year equivalent life

TABLE 3 Revision B

MODULE ELECTRICAL REQUIREMENTS

Module	Conductor	Voltage	Current
C	1	600 VAC	150 Amps (± 10 amps)
	2	600 VAC	150 Amps
	3	600 VAC	150 Amps
D	1	600 VAC	25 Amps (± 2 amps)
	2	600 VAC	25 Amps
	3	600 VAC	50 Amps (± 3 amps)
	4	600 VAC	50 Amps
	5	600 VAC	25 Amps
	6	600 VAC	25 Amps
E	1	600 VAC	15 Amps (± 2 amps)
	2	600 VAC	15 Amps
	3	600 VAC	15 Amps
	4	600 VAC	15 Amps
	5	600 VAC	15 Amps
	6	600 VAC	15 Amps
	7	600 VAC	15 Amps
	8	600 VAC	15 Amps
	9	600 VAC	15 Amps
	10	600 VAC	15 Amps
	11	600 VAC	15 Amps
	12	600 VAC	15 Amps
F	1	600 VAC	30 Amps (± 3 amps)
	2	600 VAC	30 Amps
	3	600 VAC	30 Amps
K	1	120 VAC	0
	2	120 VAC	0
	3	120 VAC	0
	4	120 VAC	0
	5	120 VAC	0
	6	120 VAC	0
	7	120 VAC	0

B

TABLE 3

Module	Conductor	Voltage	Current	
K	8	120 VAC	0	B
	9	120 VAC	0	
	10	120 VAC	0	
	11	120 VAC	0	
	12	120 VAC	0	
	13	120 VAC	0	
	14	120 VAC	0	
L	1	600 VAC	5 Amps (± 1 amp)	
	2	600 VAC	5 Amps	
	3	600 VAC	5 Amps	
	4	600 VAC	5 Amps	
	5	600 VAC	5 Amps	
	6	600 VAC	5 Amps	
	7	600 VAC	5 Amps	
	8	600 VAC	5 Amps	
	9	600 VAC	5 Amps	
	10	600 VAC	5 Amps	
	11	600 VAC	5 Amps	
	12	600 VAC	5 Amps	

NOTE: All voltages ± volts AC
Tolerances on currents are noted above and applies to each conductor requiring that ampacity.

TABLE 4

Thermocouple Locations

Inside Steam Chamber

1	On exterior face of junction box cover	
2	Air temp inside junction box	
3	In backshell of module C	
4	" " " " D	
5	" " " " E	
6	" " " " F	
7	" " " " K	
8	" " " " L	
9	On outside of junction box mtg ring (360°)	
10	On face of flange near module C	
11	On face of flange near module K or L	
12	On 3/4 inch chamber flange plate at 360°	
13	" " " " " 90°	
14	" " " " " 180°	
15	" " " " " 270°	
16	Under armor on 3X10G2 cable from module F	
17	Under armor on 12X12G1 from module L	
18	Chamber air temperature, 6" from centerline front of junction box	B
19	Chamber air temperature, 6" from centerline side of junction box, righ side facing chamber	B
20	Chamber air temperature, 6" from bottom, centerline or junction box	B
21	On receptacle of module E	
22	On receptacle of module D	
23	Chamber air temperature (6" above centerline junction box)	B
		B

Outside Steam Chamber

26	On exterior face of junction box cover	
27	Air temperature inside junction box	
28	In backshell of module C	B
29	In backshell of module D	B
30	" " " E	
31	" " " F	
32	" " " K	
33	" " " L	

TABLE 4

Thermocouple Locations

34	Inside nozzle air temperature
35	On face of flange near module C
36	On face of flange near module K or L
37	On 3/4 inch chamber flange plate at 360°
38	" " " " " 90°
39	" " " " " 180°
40	" " " " " 270°
41	Under armor on 3X10G2 from module F
42	" " " 12X12G1 from module L
43	Annulus air temp (high)
44	Annulus air temp (center), control B
45	Annulus air temp (low)
46	On receptable of module E
47	On receptacle of module D

B

ADDENDUM NO. I

TO

WLTP 543/6124-2/DK REVISION B

EXTENDED ACCIDENT TEST

AND

POST TEST ANALYSIS OF PENETRATION

UNIT AND ASSOCIATED CABLES

1.0 INTRODUCTION

Following completion on 4-1-82 of a Qualification Test Program of an Electrical Penetration Unit conducter per Wyle Test Procedure 543/6124-2/DK, Revision B, it was decided by Duke Power to extend the test program. This Addendum describes the test procedure to be used during this extended program. The extended test program consists of (1) an extended accident test and (2) a post test analysis of the penetration unit and associated cables. Portions of (2), the post test analysis evaluation, may be deleted at Duke Power's discretion based on the results of (1), the extended accident test. The Quality Assurance and Reporting Provisions of WLTP 543/6124-2/DK, Revision B, shall also apply to this Addendum.

2.0 EXTENDED ACCIDENT TEST

2.1 Test Setup

Cables will not be used inside the accident chamber, as during the original accident test conducted per WLTP 543/6124-2/DK, Revision B. All single conductors inside the accident chamber shall be spliced by Duke Power personnel and sealed with Rachem Shrink Tubing. The K module plug on the containment side (inside the accident chamber), will be removed for analysis, and replaced with the K plug that had been used on the annulus side. A new K plug for the annulus side will be fabricated and installed for the extended accident test by Duke Power personnel. These K plug tasks shall also be performed by Duke Power personnel. The penetration assembly shall be wired per Figures 4A and 5A. This technique minimizes a cable or wire failure in the steam environment affecting the test results. The test facility shall provide steam, electrical power, chemical solution spray, and measurements, as required by the remaining paragraphs of this procedure.

2.2 Steam Requirements

The containment side of the electrical penetration unit shall be subjected to steam at saturation conditions, and shall be as shown in Figure 1A.

2.3 Chemical Spray Requirements

The initial chemical spray solution shall contain, as a minimum, 1922 ppm boron. The pH shall be between six (6) and ten (10), and it is acceptable to add NaOH, if required to adjust pH. The initial chemical spray solution shall also contain five (5) to eight (8) ppm of a fluorescent dye. The specific dye shall be one furnished by the George W. Gates Company of New York with the name GPC.

The chemical spray shall be active during the period as shown in Figure 1A. New batches of the chemical spray solution shall be made at least every four (4) days and shall replace the old chemical spray solution.

2.0 EXTENDED ACCIDENT TEST (CONTINUED)

2.4 Annulus Requirements

The annulus mockup shall be constructed as shown in Figure 3A. The temperature in the simulated annulus located between the steel containment vessel and the concrete reactor building shall be per Figure 2A. The pressure shall be atmospheric and at the prevailing conditions at Huntsville, Alabama.

2.5 Electrical Requirements

2.5.1 Baseline Functional Test (Prior to Accident Test)

Prior to the accident test, the baseline functional test shall be conducted as follows:

a. Visual Inspection - The electrical circuits shall be inspected for damage and proper labeling, and the general appearance recorded.

b. Insulation Resistance (IR) - The IR of each conductor pair shall be measured as shown in Figure 4A. Test voltage shall be 500 VDC. If the IR is less than the minimum scale or the meter, the IR shall be measured at 100 VDC. All IR's shall be recorded.

c. High Potential - A high potential test shall be conducted on modules C and F, by applying 1000 VAC across each pin and ground. The leakage current shall be recorded.

2.5.2 Conditions and Tests During Accident Test

a. The modules of the penetration unit shall be energized with the voltages and currents as shown in Table I-A

b. IR measurements per Para. 2.5.1.b shall be taken every eight (8) hours during the first 24 hours of the accident test. After the first 24 hours, IR measurements shall be taken daily and following any prescribed temperature transient. High potential measurements shall be taken per Para. 2.5.1.c each time IR measurements are taken.

2.5.3 Baseline Functional Test (After Accident Test)

The functional test per Para. 2.5.1 shall be conducted after the accident test, and the system has cooled to room temperature.

2.0 EXTENDED ACCIDENT TEST (CONTINUED)

2.6 Instrumentation During Accident Test

2.6.1 General

Temperatures, voltages, currents, and chamber pressure shall be recorded on a Data Logger. Chemical spray flow rate and pH shall be recorded daily from digital readout devices.

2.6.2 Temperature Measurements

All temperatures as shown in Table 2A shall be recorded at a minimum sample rate of one (1) sample per 15 minutes during the eight (8) hour transients, and a minimum of one (1) sample per hour during the remainder of the accident test.

2.6.3 Chamber Pressure Measurement

The chamber pressure shall be recorded at the same sampling rates as the temperature measurements.

2.6.4 Voltage and Current Measurements

Voltage on all modules, current on modules C, D, E, F, and L, and leakage current on all module K pins and conductor No. 2 of modules C and F shall be recorded at one (1) sample per 15 minutes during the eight (8) hour transients, and at one (1) sample per 30 minutes during the remainder of the accident test.

2.7 Acceptance Criteria

Insulation resistances will not be used as acceptance criteria. The test specimens shall be considered to have met the criteria of this test specification if they complete the test sequence, and still maintain circuit integrity. Circuit integrity shall be indicated by the test specimen being capable of maintaining the required voltage and/or current specified in Table 1A.

3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES

3.1 Module K Plug (Plug Used in Accident Test Completed on 4-1-82)

Prior to conducting the extended accident test, the module K plug, on the containment side (inside accident chamber) shall be removed, disassembled, a cross section cut made longitudinal, and then examined for evidence of distortion, extrusion or other evidence of excessive thermal expansion. The cable grommet plug sleeve insulator leads and contact sockets shall be mounted in a fixture supporting the plug sleeve so that it cannot rotate during the cutting process. No oil or water shall be used in the cutting process, and the cut should reveal a cross section or the plug sleeve insulator leads, and contact sockets. Record the examination results and take photographs of each half section.

3.2 Modules D, F, and K (After Extended Accident Test)

At the completion of the extended accident test and final electrical tests per Paragraph 2.0, modules D, F, and K shall be disassembled and inspected as in Paragraph 3.1 (plug K is not the same plug as in Paragraph 3.1, but the one described in Paragraph 2.1). In addition to the inspection as described in Paragraph 3.1, the presence of fluorescent dye in the internal portions of the plug shall be determined by use of an ultraviolet light.

3.3 Cable Conductors from Modules C, E, and L

3.3.1 Specimen Description

This analysis is confined to the cables below which were subjected to the accident test completed on 4-1-82, and not subjected to the extended accident test per Paragraph 2.0:

a. Conductors Nos. 1, 6, and 7 of module E (used inside LOCA chamber)

b. Conductor No. 1 of module E (not subjected to LOCA)

c. Conductors Nos. 8, 9, and 10 of module L (used inside LOCA chamber)

d. Conductor No. 8 of module L (not subjected to LOCA)

e. Conductors Nos. 2 and 3 of module C (used inside LOCA chamber)

f. Conductor No. 3 of module C (not subjected to LOCA)

All of the above conductors have been previously radiated, and thermally aged per WLTP 543/6124-2/DK, Revision B.

3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES (CONTINUED)

3.3 Cable Conductors from Modules C, E, and L (Continued)

3.3.2 Specimen Preparation

The specimens shall be prepared as shown below:

a. Strip back the armor and separate the individual conductors approximately 12" from each end of the six (6) foot length used in the LOCA test and a length not subject to LOCA but radiated and thermally aged.

b. Seal the ends of the cable with RTV furnished by Duke Power. Allow the RTV to cure overnight.

c. Remove all of the armor from each of the cables.

d. Separate the individual conductors and carefully mark each cable with tags as to its location relative to the penetration pins, penetrator designation and whether the end is the penetrator end or test fixture end, for example: L-1-L would designate a conductor from the L cable connected to pin number 1 of the penetrator subjected to the LOCA. L-1-NL would designate a conductor from the L cable connected to Pin Number 1 of the penetrator not subjected to the LOCA.

The conductors should now be labeled E-1-L, E-6-L, E-7-L, E-1-NL, L-8-L, L-9-L, L-10-L, L-8-NL, C-2-L, C-3-L, C-3-NL.

e. Remove a portion of the RTV from one end of the conductor. Place the conductor in water with the bare end out to serve as an electrode and measure the insulation resistance between the conductor and water. If there is a hole or break, repair with RTV. Reseal the end of the conductor with RTV.

f. The conductors designated in Paragraph d shall be placed in a bath of distilled water maintained at 130°F. Each length of conductor shall be carefully wiped while submerged in the 130°F distilled water. The conductors shall be removed from the distilled water and suspended to air dry.

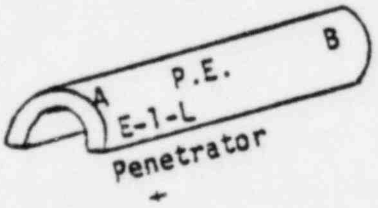
3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES (CONTINUED)

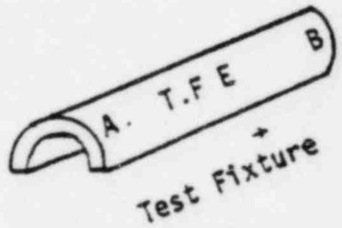
3.3 Cable Conductors from Modules C, E, and L (Continued)

3.3.2 Specimen Preparation (Continued)

g. Cut a section of conductor 7 inches long from each end of conductors designated in Paragraph d. Handle the section with plastic gloves to prevent contamination of the surface. Cut the end of the conductor one (1) inch from the end. This will leave a specimen six (6) inches long for analysis.

h. Each six (6) inch long specimen cut from the conductors designation in Paragraph g above shall be cut longitudinally at 180° spacing around the periphery of the insulating material on the conductor, leaving a 180° arc of the material six (6) inches long. The separate pieces shall be marked and placed in a plastic bag. Marking shall designate whether the conductor sample is from the penetration end and/or test fixture end and also the direction to the penetration. Mark the samples as shown below:





P.E. Penetration end

A - toward penetration

B - toward test fixture

T.F.E. Test Fixture End

A - toward penetration

B - toward test fixture

After specimens have been cut from the conductors, the remaining conductor lengths which were subjected to testing shall be pressurized to five (5) psig with distilled water. The external ends of the conductors must be sealed with epoxy and the other open conductor end will be run through a potted filling in to a test chamber. The test chamber which is filled with distilled water will be pressurized to five (5) psig. External conductors will be inspected for leaks and if leaks are detected, water samples will be obtained for analysis. If leaks are not detected, cut the conductor at the sealed end to obtain water sample for analysis.

3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES (CONTINUED)

3.3 Cable Conductors from Modules C, E, and L (Continued)

3.3.3 Cable Analysis

3.3.3.1 X-Ray Spectroscopy

One sample of the insulating material prepared in Paragraph 3.3.2.i shall be scanned on the conductor side of the insulation to search for the presence of boron and sodium in other than minute trace quantities which will normally be present in the filler. The results from the two (2) ends will be compared as well as comparing the samples not subjected to the LOCA. The scanning shall be conducted with an X-Ray spectroscope, electro micro probe, or by X-Ray imaging by EDX.

3.3.3.2 Chemical Analysis

The other 180° arc of the sample of the insulating material prepared in Paragraph 3.3.2.i shall be cleaned with distilled water on the conductor side of the insulation and the distilled water subjected to chemical analysis for the presence of boron. The distilled water samples obtained in Paragraph 3.3.2.i will also be subjected to chemical analysis.

3.4 Modules C, E, and L (After Extended Accident Test)

3.4.1 Disassembly and Visual Examination

Modules C, E, and L shall be disassembled and inspected as detailed below:

a. After completion of the electrical test of Paragraph 2.5.3, the electrical penetration assembly shall be washed down with fresh water to remove the dye from the outside of the penetrators. An ultraviolet light shall be used to excite the dye to insure that the surfaces are free of the dye. The flushing shall continue until the dye has washed from the surfaces.

b. Cut the wire on either end of the splice. Mark the wire so that it can be identified with a particular pin on the penetrator. Insure that markers do not interfere with removal of coupling ring. When all splices have been cut, remove the cable clamp from the penetration. Unscrew the coupling ring until the threads have been disengaged. Carefully dry the inside of the coupling ring with a hot air blower to prevent moisture from entering the lead ends when the coupling ring is lifted off the plug sleeve. Use a minimum amount of hot air being very careful not to

3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES (CONTINUED)

3.4 Modules C, E, and L (After Extended Accident Test) (Continued)

3.4.1 Disassembly and Visual Examination (Continued)

b. overheat the rest of the assembly. Lift the coupling ring off the plug sleeve.

c. Remove the plug assembly from the penetrator. Lift off the plug assembly by grasping the leads. The plug assembly should consist of the plug sleeve, cable grommet, plug sleeve insulator and interface seal and associated contact sockets. Use plastic gloves when handling the components. Be very careful not to contaminate the various pieces with dye or water from other parts. It is possible that the interface seal will remain in the module. If this occurs, the interface between the plug sleeve insulator and the interface seal will be exposed. Examine the interface of the plug sleeve insulator for presence of droplets of water, and examine for presence of dye with an ultraviolet light. Examine the surface for evidence of tracking or creepage of electric current which should leave a carbon tract in the epoxy glass laminate surface. Before continuing, an examination should be conducted on the interface seal surface in contact with the plug sleeve insulator. This examination should be conducted concurrently with interface of the plug sleeve insulator since droplets of water could evaporate if present. The examination should consist of (a) determination of droplets of water are present, (b) examination with an ultraviolet light for presence of dye, (c) examination of the surface for evidence of tracking or channels of electric current. Examine the area where the leads exit from the plug sleeve to insure there is no extrusion of material or necking down of the conductor insulation. If there is a doubt, probe the interface with a wet sponge and 500V "megger" to detect breaks in the insulation.

d. Remove the plug sleeve. This should expose the plug sleeve insulator and the cable grommet. Use an ultraviolet light on the leads and determine if there is dye present on the leads. If there is dye present on the leads extending out of the cable grommet, carefully wash the leads in distilled water by flushing. Do not submerge the ends of the leads in water. Do not allow the distilled water to splash into the plug sleeve insulator or interface with the plug sleeve insulator and cable grommet. Handle all components with clean plastic gloves. Remove the leads and contact sockets from the plug sleeve insulator. Place the marked leads and contact socket in plastic bags.

3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES (CONTINUED)

3.4 Modules C, E, and L (After Extended Accident Test) (Continued)

3.4.1 Disassembly and Visual Examination (Continued)

e. Removal of the leads will allow the cable grommet to be separated from the plug sleeve insulator. Mark the side of the cable grommet exposed to the environment (not in contact with the plug sleeve insulator) prior to removal from the plug sleeve insulator. Note the condition of the cable grommet, for evidence of extrusion through the plug sleeve. Use plastic gloves and only handle the side of the cable grommet, do not pick up by the interface surface. Handle the plug sleeve insulator by the side not the interface surfaces. Rest the plug sleeve insulation on its side not the interface surface. Separate the cable grommet from the plug sleeve insulators. Examine the interfaces between the cable grommet and the plug sleeve insulator should be marked to indicate the cable grommet side.

f. Examine plug sleeve insulator for the following:

(1) droplet of waters

(2) presence of dye by means of ultraviolet light

(3) tracking on the plug sleeve insulator and the cable grommet.

Examine the side of the cable grommet for evidence of dye by an ultraviolet light. Place the cable grommet in a plastic bag that fits tight so the grommet cannot turn in the bag and contaminate surfaces.

g. The plug sleeve insulator should have the remaining surface examined for evidence by dye, by the use of ultraviolet light. Place the plug sleeve insulator in a close fitting plastic bag.

3.0 POST TEST ANALYSIS OF PENETRATION UNIT AND ASSOCIATED CABLES (CONTINUED)

3.4 Modules C, E, and L (After Extended Accident Test) (Continued)

3.4.1 Disassembly and Visual Examination (Continued)

h. The last surface to examine is the interface between the interface seal and the glass to metal seal surfaces. Use plastic gloves and attempt to pry the interface seal out of the module assembly. Attempt to preserve as much of the interface surface with the glass to metal seal area as possible. Mark the interface seal on the side to indicate the two (2) surfaces.

Do not attempt to mark or handle the interface areas if possible. Handle by the side of the interface seal. Examine the surface between the interface seal and glass to metal seal area for evidence of (1) dye, by means of ultraviolet light, (2) tracking or channels on the interface seal material from electric current and (3) droplets of water. Wrap the interface seal piece in thin polyethylene film (such as "Saran Wrap"), and then it can be put in a larger plastic bag.

3.4.2 Penetration Unit Analysis

The penetration unit shall be analyzed per Table 3A using X-Ray spectroscope, electro micro probe, or by X-Ray imaging by EDX.

TABLE 1A

MODULE ELECTRICAL REQUIREMENTS

MODULE	CONDUCTOR	VOLTAGE	CURRENT
C	1	600 VAC	150 Amps (± 10 amps)
	2	600 VAC	0 Amps
	3	600 VAC	150 Amps
D	1	600 VAC	25 Amps (± 2 amps)
	2	600 VAC	25 Amps
	3	600 VAC	50 Amps (± 3 amps)
	4	600 VAC	50 Amps
	5	600 VAC	25 Amps
	6	600 VAC	25 Amps
E	1	600 VAC	15 Amps (± 2 amps)
	2	600 VAC	15 Amps
	3	600 VAC	15 Amps
	4	600 VAC	15 Amps
	5	600 VAC	15 Amps
	6	600 VAC	15 Amps
	7	600 VAC	15 Amps
	8	600 VAC	15 Amps
	9	600 VAC	15 Amps
	10	600 VAC	15 Amps
	11	600 VAC	15 Amps
	12	600 VAC	15 Amps
F	1	600 VAC	30 Amps (± 3 amps)
	2	600 VAC	0 Amps
	3	600 VAC	30 Amps
K	1	120 VAC	0
	2	120 VAC	0
	3	120 VAC	0

MODULE	CONDUCTOR	VOLTAGE	CURRENT
K	4	120 VAC	0
	5	120 VAC	0
	6	120 VAC	0
	7	120 VAC	0
	8	120 VAC	0
	9	120 VAC	0
	10	120 VAC	0
	11	120 VAC	0
	12	120 VAC	0
	13	120 VAC	0
	14	120 VAC	0
L	1	600 VAC	5 Amps (± 1 amp)
	2	600 VAC	5 Amps
	3	600 VAC	5 Amps
	4	600 VAC	5 Amps
	5	600 VAC	5 Amps
	6	600 VAC	5 Amps
	7	600 VAC	5 Amps
	8	600 VAC	5 Amps
	9	600 VAC	5 Amps
	10	600 VAC	5 Amps
	11	600 VAC	5 Amps
	12	600 VAC	5 Amps

NOTE: Tolerance on 600 VAC is ± 10V, and on 120 VAC + 5 VAC
Tolerances on currents are noted above and applied to each conductor requiring that ampacity.

TABLE 2A

Thermocouple Locations

INSIDE STEAM CHAMBER

1 On exterior face of junction box cover
2 temp inside junction box
3 backshell of module C
4 " " " " D
5 " " " " E
6 " " " " F
7 " " " " K
8 " " " " L
9 On outside of junction box mtg ring (360°)
10 On face of flange near module C
11 On face of flange near module K or L
12 On 3/4 inch chamber flange plate at 360°
13 " " " " " 90°
14 " " " " " 180°
15 " " " " " 270°
16 Chamber air temperature
17 Chamber air temperature
18 Chamber air temperature
19 On receptacle of module E
20 On receptacle of module D
21
22
23

OUTSIDE STEAM CHAMBER

24 On exterior face of junction box cover
25 Air temperature inside junction box
26 On backshell of module C

JST/csc

Thermocouple Locations

27 Inside nozzle air temperature

28 On face of flange near module C

29 On face of flange near module K or L

30 On 3/4 inch chamber flange plate at 360°

31 " " " " " 90°

32 " " " " " 180°

33 " " " " " 270°

34 Annulus air temp (high)

35 Annulus air temp (center)

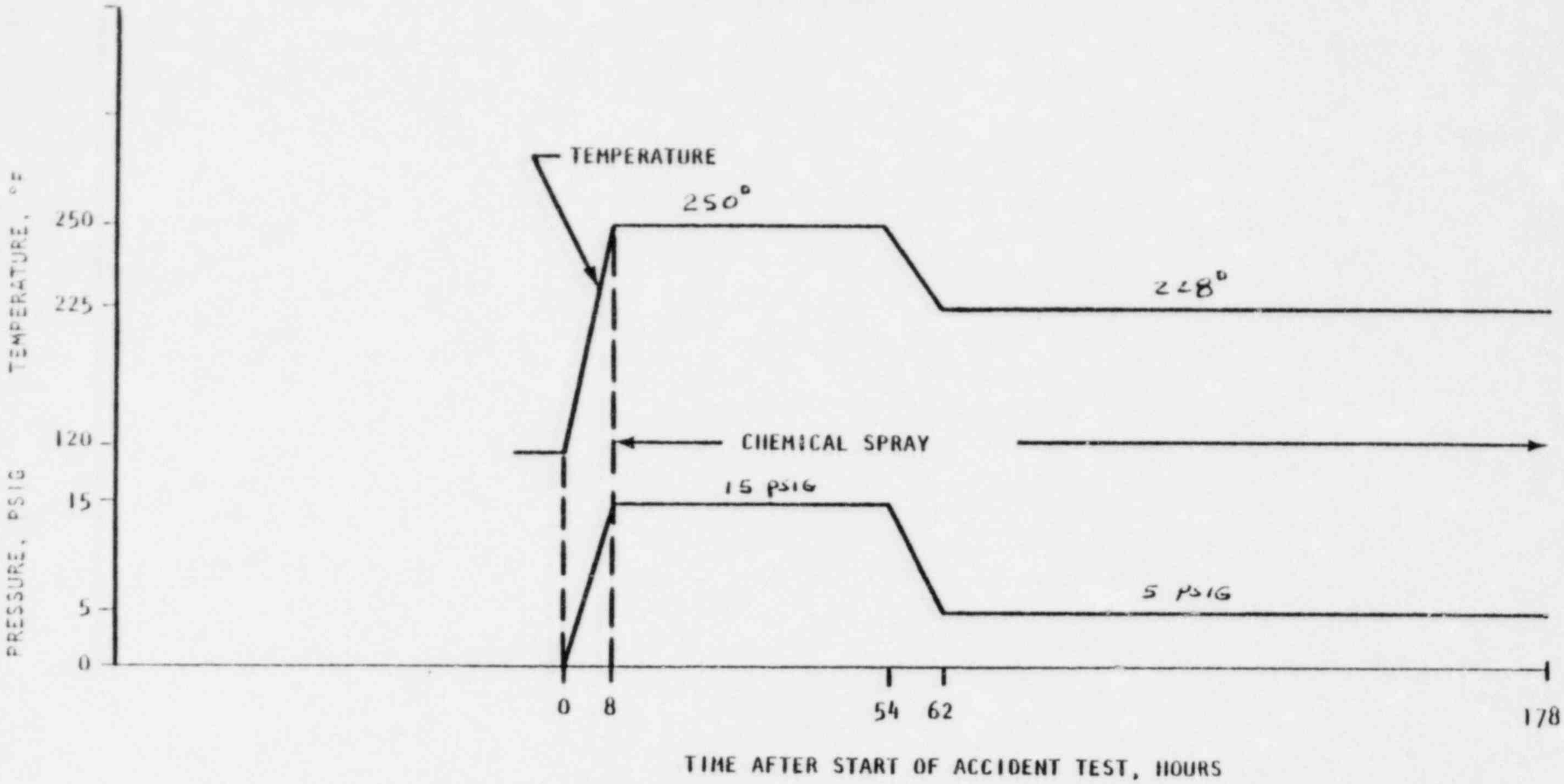
36 Annulus air temp (low)

TABLE 3A PENETRATION UNIT ANALYSES

SPECIMEN	LOCATION	TEST	PURPOSE
Lead Wire	Conductor side of lead wire insulation	Ultra-violet X-ray spectroscopy or Electron Micro Probe Analysis	Presence of water by dye deposits. Presence of water by boron deposits
Cable Grommet	Interface with plug sleeve insulator	X-ray spectroscopy or Electron Micro Probe Analysis	Presence of water by boron deposits
Plug Sleeve Insulator	Interface with cable grommet	"	" " " "
Plug Sleeve Insulator	Interface with Interface Seal	"	" " " "
Interface Seal	Interface with Plug sleeve insulator	"	" " " "
Interface Seal	Interface with glass to metal seal surface	"	" " " "
Plug Sleeve Insulator	Internal Surface	"	" " " " and direction that water moved if located.

FIGURE 1A

ENVIRONMENTAL TEST PROFILE
INSIDE CONTAINMENT



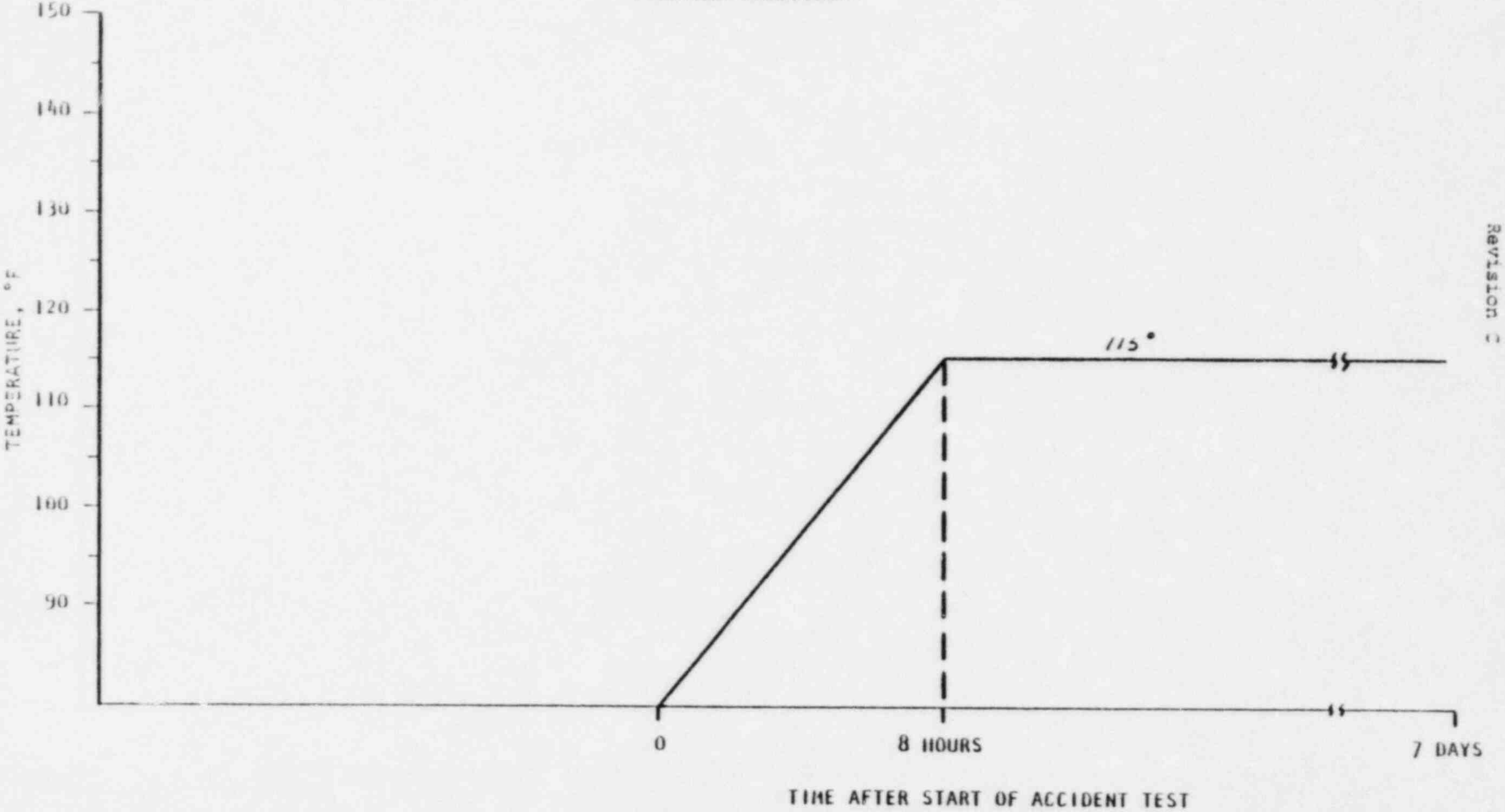
NOTES: (1) All steady state temperatures shall be as shown, +10°F, -0°F.

(2) Peak pressure shall not exceed 25 psig.

FIGURE 2A

ANNULUS TEMPERATURE PROFILE

COMBINED MSLB/LOCA



NOTES: (1) The test temperature profile shall be as close to the above profile as practical during the transient.

(2) After 2400 seconds, the test temperature shall be within +15°F, -0°F.

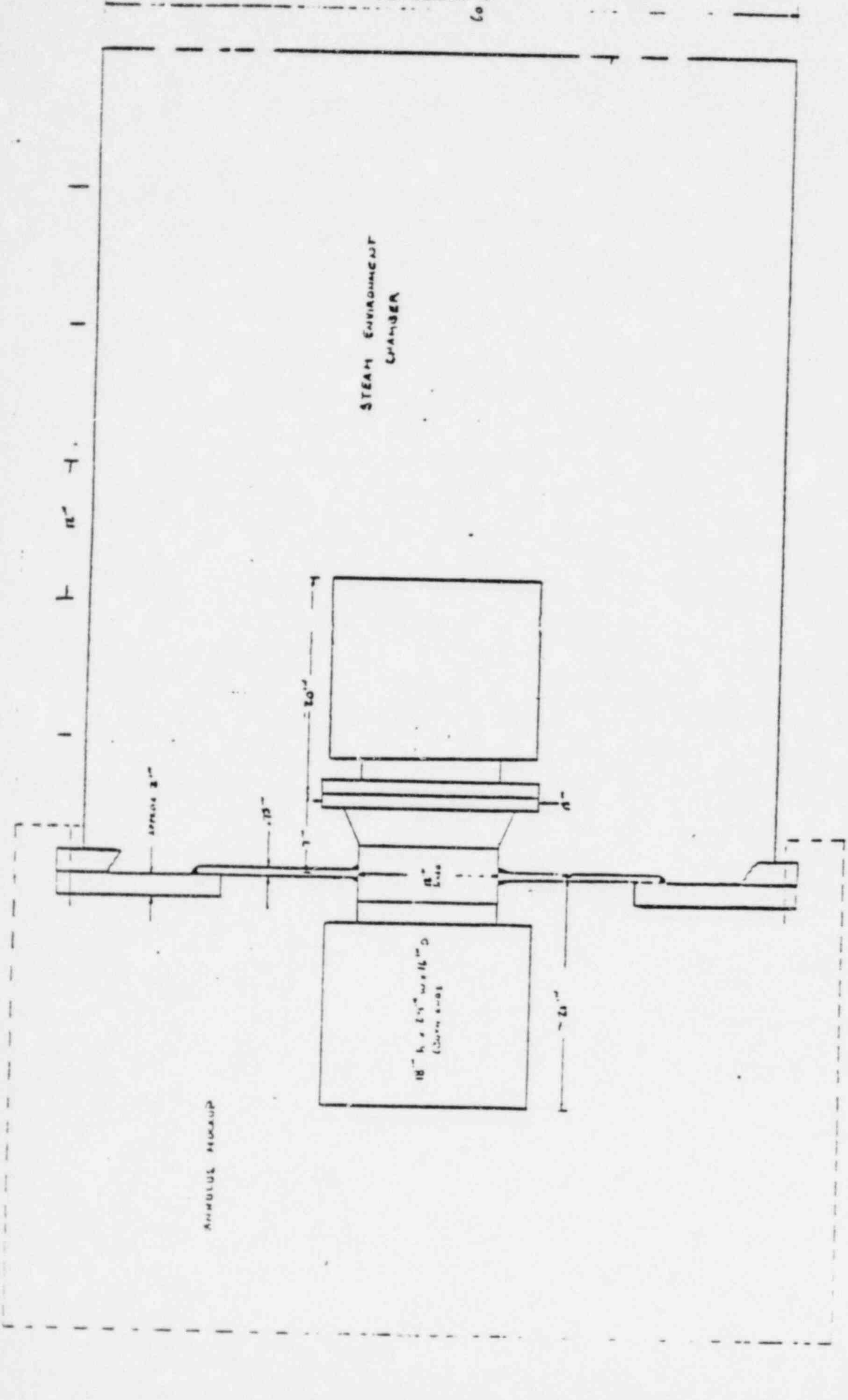
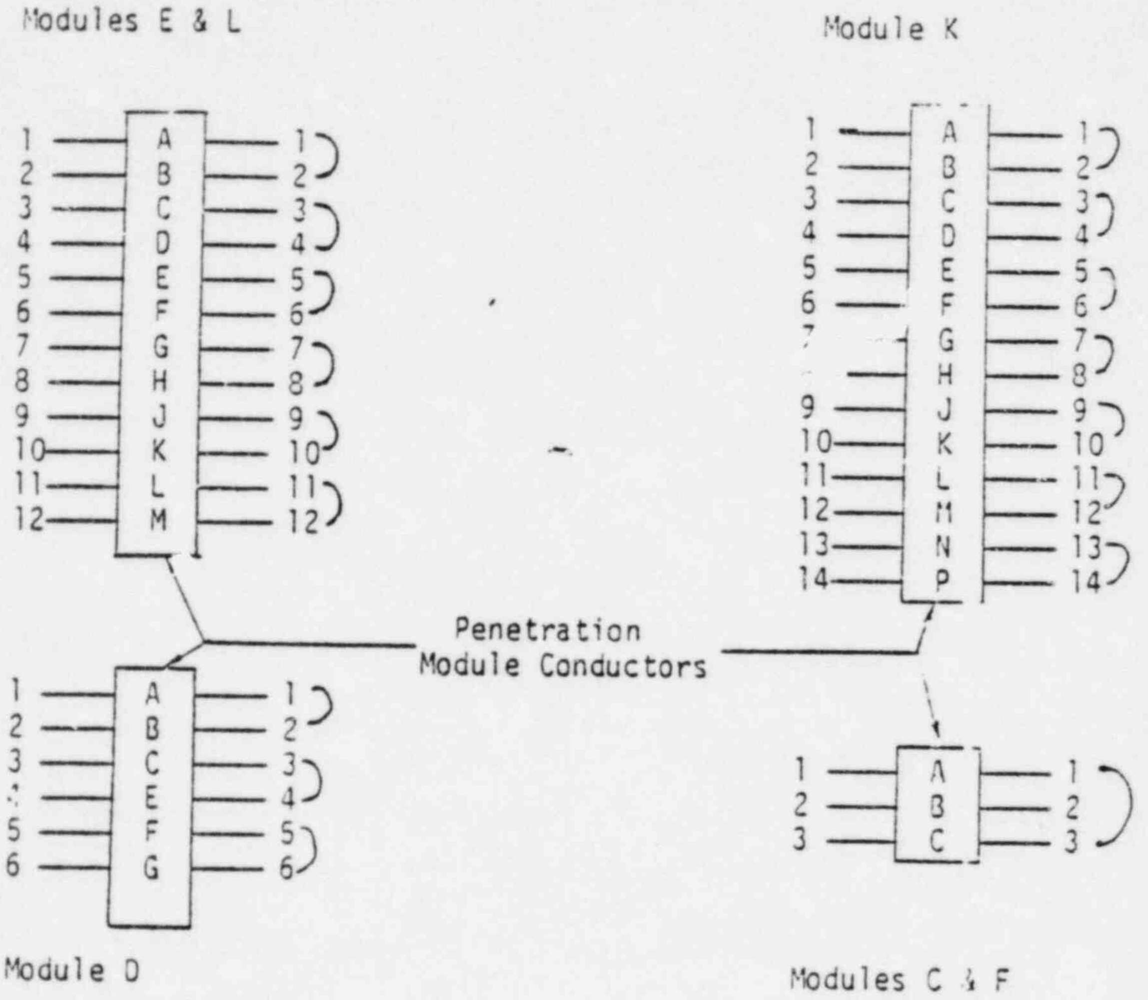


FIGURE 3A
MOUNTING CONFIGURATION

FIGURE 4A

WIRING DIAGRAM AND INSULATION RESISTANCE

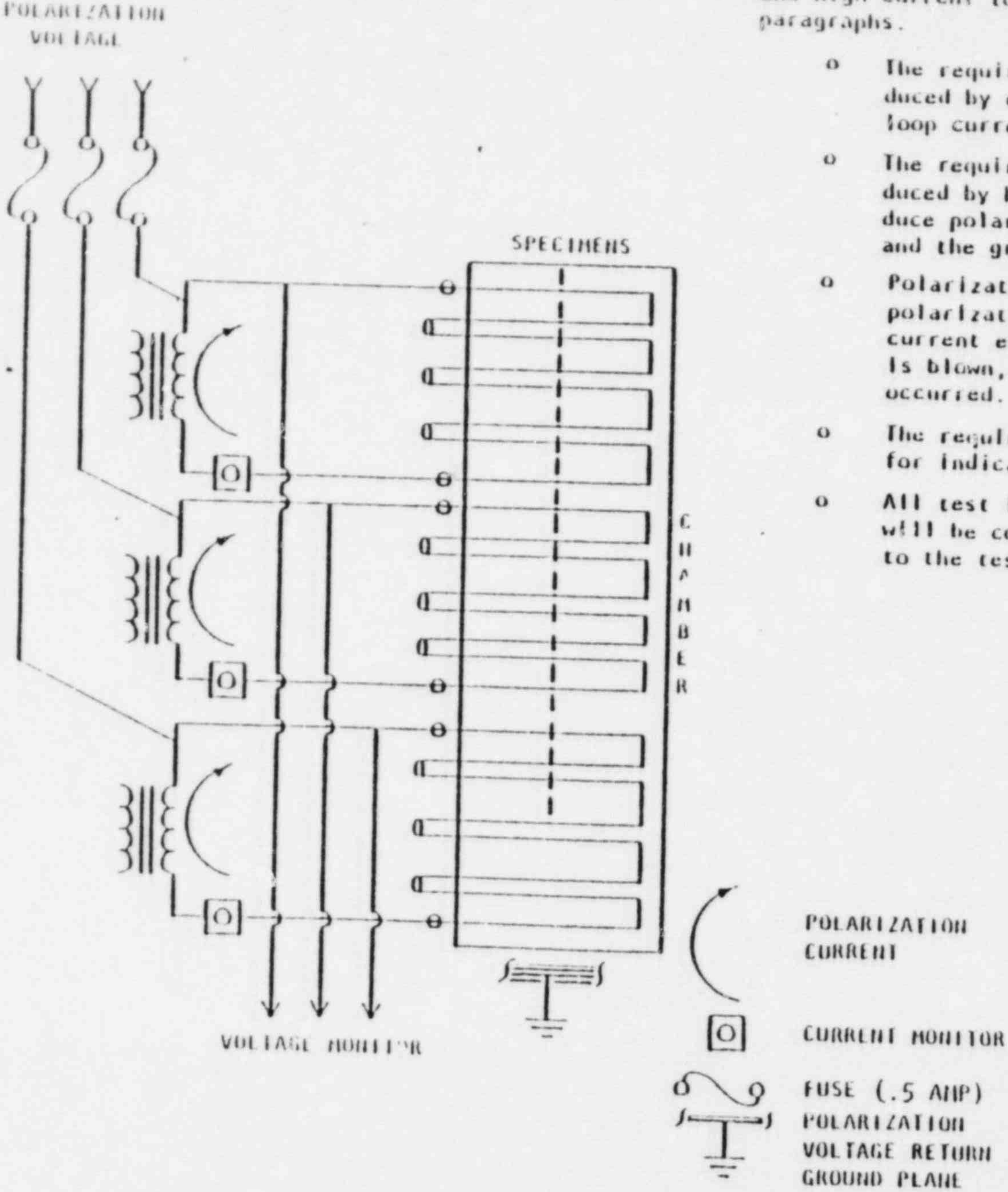


NOTE: 1- On module D Pins C & E are 4 AWG and Pins A,B,F & G are 8 AWG

2. Insulation resistance (IR) shall be measured between each conductor and all other conductors tied to ground.

3. Insulation Resistance shall be greater than 100 megohms for modules C, D, E, and F and 10 megohms for modules K and L prior to start of testing. Readings below these values after the start of testing shall be acceptable. Functional capability of the circuits is determined by the ability of the circuits to maintain the prescribed voltage.

FIGURE 5A
ELECTRICAL CONNECTIONS



The method utilized for the application of polarization volta and high current to the test items is described in the follow paragraphs.

- The required test currents (TBD amperes) are produced by current transformers, isolated to produce loop current through the test items.
- The required polarization voltages (TBD VAC) are produced by high-voltage transformers, isolated to produce polarization voltages between the test items and the ground plane.
- Polarization voltage is applied with the source polarization power supply. In the event leakage current exceeds a specified amount, the line fuse is blown, indicating that test item degradation has occurred.
- The required current loads are monitored electricall for indications of test item discontinuities.
- All test items requiring the same current and voltag will be connected in series with terminations exter to the test chamber.