REPORT ON QUALIFICATION TESTS

FOR

FIREWALL III IRRADIATION

CROSS-LINKED POLYETHYLENE CONSTRUCTIONS

FOR

CLASS 1E SERVICE IN NUCLEAR

GENERATING STATIONS

THE ROCKBESTOS COMPANY
NEW HAVEN, CT 06511
OCTOBER 8, 1985

REPORT #QR-5805

TABLE OF CONTENTS

	Page No.
Summary	1
Referenced Documents	2
Objective	3
Representative Cables	3
Cable Description	3
Sample Selection	5
Preliminary Sample Evaluation - Summary	8
Test Procedure.	8
Sample Conditioning	8
Post Conditioning Evaluation - Summary.	11
Environmental Profile	11
Post LOCA Tests	13
Pass/Fail Criteria.	16
Certified Conclusion.	17
Review/Approval	17
Unanticipated Variations.	18
Margin.	23
Data Sections:	
1. Normal Production Tests.	24
2. Preliminary Sample Evaluation.	36
3. Sample Conditioning.	41
A. Arrhenius	42
B. Oven Charts.	45
C. Irradiation Certificate.	47
4. LOCA Chamber Description	49
A. Thermocouple Placement	51
B. Chamber Photos	52
5. Post Conditioning Evaluation	54
Section 6 & 7 Data Logger Channel Reference	61
Typical Data Logger Recordings.	62
LOCA Profile Summary.	65
6. Data Logger Environmental Data	66
A. Data Analysis.	71
7. Data Logger Cable Electrical Load Data	72
A. Electrical Schematic	73
B. Data Analysis	80
8. Insulation Resistance Measurements	81
9. Equipment Calibration Records	84

TEST SUMMARY

The Rockbestos Company Firewall III wire and cable constructions have successfully completed the test program outlined in Test Plan TP-4805 in support of Qualification for Class 1E Service in Nuclear Generating Stations.

The primary insulation material used in these constructions was a Firewall III Irradiation Cured, Flame Retarded Cross-linked Polyethylene designated KXL-760G.

Cable samples tested included Power, Control, Instrumentation (Signal) and Thermocouple Extension.

Samples were subjected to a sequence of thermal conditioning, irradiation conditioning, environmental exposure simulation of a LOCA, and Post LOCA testing, within the guidelines established by IEEE Std. 323-1974 and IEEE Std. 383-1974.

By successful completion of the test and conditions described herein, it has been concluded that the subject wire and cable is suitable for its intended application and during design basis event postulated to occur at any time during the design life of forty years.

Referenced Documents:

1. IEEE 323-1974 - Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

2. IEEE 383-1974 - Standard for Type Test of Class 1E Electric Cables Field Splices, and connections for Nuclear Power Generating Stations.

3. ICEA-S-66-524 - Cross-linked Thermosetting Polyethylene Insulated Wire and Cable for Transmission and Distribution of Electrical Energy.

4. ICEA-S-19-81 - Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

5. National Electrical Code 1984.

6. The Rockbestos Company, Technical Manual for Class 1E Qualification Tests - July 9, 1984 Rev. 5.

7. Nuclear Regulatory Commission Guide 1.131 dated August, 1977.

8. The Rockbestos Company, Qualification Test Procedure Manual.

9. Nuclear Regulatory Commission NUREG 0588.

10. Nuclear Regulatory Commission 10 CFR Part 50, App. B.

11. Rockbestos Specification Sheet - 3-021 (RSS 3.021)

12. Test Plan 4805 in Support of Qualification: FWIII Irradiation Cross-linked Polyethylene, Generic Nuclear Incident, Class 1E Service in Nuclear Generating Power Stations.

13. Sandia National Laboratories Report SAND 81-2027/1 of 2.

14. EPRI Final Report EL-938, (Electrical Power Research Institute)

THE ROCKBESTOS COMPANY
FW III IRRADIATION CROSS-LINKED WIRE
NUCLEAR INCIDENT
TEST REPORT 5805

PART 1 ENVIRONMENTAL

1 OBJECTIVE

To conduct a program of predetermined conditions and tests to support the use of irradiation cross-linked insulation material for Class 1E applications as outlined in Test Plan 4805.

The results of this test program are intended to demonstrate the suitability of Rockbestos Company Firewall-III wires cables for Class 1E Service for Nuclear Generating Stations as outlined by standards IEEE-323-1974 and IEEE-383-1974. Results will also be utilized to reinforce the conclusions of previous Rockbestos Class 1E reports of similar constructions including:

QR1808	QR1806,R, R1, R2, R3	QR3802		
QR2803	QR1809	QR1813	QR2802	QR2805
QR1805	QR1810	QR1814	QR2804	QR2810

2 REPRESENTATIVE CABLES:

Products of interest fall into four categories. Power, Control, Instrumentation (Signal), and Thermocouple Extension. A design variation in insulation thickness for individual conductors of some control cable, .030" and .025", results in a fifth basic construction of interest.

3 CABLE DESCRIPTIONS

Cables described below are Standard cables. For accounting internal charge purposes, Rockbestos Product Codes are preceeded by "E" to reflect their use as an engineering qualification project rather than customer product.

Cable "A"

7/C #14 AWG Control Cable 600V 90 Degrees C

Rockbestos Product Code C07-0070

7 x 1/C #14 AWG 7 Strand x .0242" Tinned Copper
.030" FW III Irradiation Cross-Linked Flame Retardant
Polyethylene KXL-760G Cabled with
.002" Nomex Binder Tape,
.045" Neoprene Jacket
ICEA Print Method 1

Cable "B"

7/C #14 AWG Control Cable 600V 90 Degrees C

Rockbestos Product Code E41-0110

7 x 1/C #14 AWG 7 Strand x .0242" Tinned Copper
.025" FW III Irradiation Cross-Linked Flame Retardant Polyethylene KXL-760G Cabled with
.002" Nomex Binder Tape,
.045" Hypalon Jacket
ICEA Print Method 4

Cable "C"

2/C #20 AWG Type KX Shielded Thermocouple Extension Cable 90 Degrees C

Rockbestos Product Code E41-0101

1/C #20 Solid Chromel
.020" FW III Irradiation Cross-Linked Flame Retardant Polyethylene (Yellow) KXL-760G

1/C #20 Solid Alumel
.020" FW III Irradiation Cross-Linked Flame Retardant Polyethylene (Red) KXL-760G

2/C Cabled with Flame Retardant Polypropylene Fillers

1/C #20 AWG 19 Strands x .008" Tinned Copper Drain Wire
.002" Aluminum/Mylar Shield Tape (.001/.001) Overall
.002" Nomex Binder Tape
.045" Hypalon Jacket

Cable "D"

2/C #16 AWG Instrumentation Cable 300V 90 Degrees C

Rockbestos Product Code E41-0106

2 x 1/C #16 AWG 7 Strand x .0912" Tinned Copper
.020" FW III Irradiation Cross-Linked Flame Retardant Polyethylene KXL-760G

2/C Cabled with Flame Retardant Polypropylene Fillers

1/C #18 AWG 16 Strands .010" Tinned Copper Drain Wire

.002" Aluminum/Mylar Shield Tape (.001/.001) Overall
.002" Nomex Binder Tape
.045" Neoprene Jacket

Cable "E"

1/C #6 AWG Power Cable 90 Degrees C

Rockbestos Product Code 1KM-0001

#6 AWG 7 Strand x .0612" Tinned Copper
.045" FW III Irradiation Cross-Linked Flame Retardant Polyethylene KXL-760G

4 SAMPLE SELECTION:

All samples were selected at random from completed cable which had successfully completed normal production Quality Control tests. These include all tests for dimensional, physical, and electrical requirements for insulation and jacket materials described in ICEA-S-66-524, S-19-81 and Rockbestos RSS-3-021.

Certified Test Reports containing results of normal production tests are found in Data Section 1.

A, B, and E Samples - For the environmental portion of the IEEE-383 suggested Type Test, single conductor samples are representative of the Power and Control cable types, and were utilized for this program.

D Samples - For the environmental portion of the IEEE-383 suggested Type Test, 1 pair shielded is representative of Instrumentation (Signal) cable and was utilized of this program.

C Samples - For the environmental portion of the IEEE-383 suggested Type Test, 2/C #20 AWG is representative of the Thermocouple Extension cable and was utilized for the program.

IEEE-383 further requires demonstration that samples be subjected to the most severe postulated conditions. For possible synergistic effects upon the electrical, chemical, and mechanical performance, "most severe" is interpreted as the other constructional extreme.

For control cable, the other constructional extreme from the IEEE-383 suggested Type Test is completed cable. The difference in potential failure mode, between control cable singles and completed cable, is created by the interaction of completed cable components. Since the cable components are of proven industry design, verified by such as U/L, the major anticipated potential failure mode variation is mechanical. This will be created by the interaction of component expansion and/or constriction during thermal excursions. On that basis, the largest volume expansion, therefore, greatest potential for change, will occur in the control cable with the thicker insulation. The completed Control Cable sample therefore, was the construction utilizing .030" insulation thickness.

Considering the Instrumentation and Thermocouple Extension cable together, since both utilize .020" insulation thickness, single conductors from the Instrumentation cable were chosen as the other constructional extreme. Again, completed cable components are of proven industry design. The singles from the Instrumentation cable were chosen on the basis of slightly larger exposed insulation surface area, due to conductor size.

Only single conductor Power cable was tested. Constructional variations between single conductor Power and multi-conductor Power, are similar to those involved in Control cable. However these variances are manifested to a greater degree in the 7 conductor control cable than a typical 3 conductor power cable. Synergistic effects due to constructional extremes for Power cable were not evaluated separately by testing.

Items for this program were manufactured under a standard production order utilizing normal manufacturing techniques and materials of construction. Completed cable lengths were sufficient to provide a selection consistent with random sampling philosophy.

All samples were approximately 15 feet, including terminations, taken from completed cable.

"A" Sample Environmental Profile (LOCA)

TP-4805 A1. Completed cable section
TP-4805 A2. Completed cable section
TP-4805 A3. Single conductor removed from cable
TP-4805 A4. Single conductor removed from cable
TP-4805 A5. Single conductor removed from cable
TP-4805 A6. Single conductor removed from cable

"B" Sample Environmental Profile (LOCA)

TP-4805 B1. Single conductor removed from cable
TP-4805 B2. Single conductor removed from cable
TP-4805 B3. Single conductor removed from cable
TP-4805 B4. Single conductor removed from cable

"C" Sample Environmental Profile (LOCA)

TP-4805 C1. Completed cable section
TP-4805 C2. Completed cable section

"D" Sample Environmental Profile (LOCA)

TP-4805 D1. Completed cable section
TP-4805 D2. Completed cable section
TP-4805 D3. Single conductor removed from cable
TP-4805 D4. Single conductor removed from cable
TP-4805 D5. Single conductor removed from cable
TP-4805 D6. Single conductor removed from cable

"E" Sample Environmental Profile (LOCA)

TP-4805 E1. Completed cable section
TP-4805 E2. Completed cable section
TP-4805 E3. Completed cable section
TP-4805 E4. Completed cable section

5 PRELIMINARY SAMPLE EVALUATION

Samples were evaluated for physical and electrical integrity prior to test initiation, to assure mechanical damage had not occurred in storage, transfer, or in the removal of single conductor samples from completed cable. Since normal production acceptance tests were previously performed, verification only was necessary to demonstrate suitability.

See Data Section 2 for detailed evaluation results. The evaluation results were all satisfactory.

6 TEST PROCEDURE - ENVIRONMENTAL

Testing was conducted in accordance with procedures outlined in the latest revision of the Rockbestos Technical Manual and applicable sections in the Rockbestos Qualification Test Procedure Manual.

7 SAMPLE CONDITIONING

Preparation: Completed cable sections from all cables were obtained. Completed cable sections from cables "A", "B" and "D" were disassembled to obtain the necessary single conductor samples. Care was exercised during disassembly so as not to damage the single conductor samples.

Each sample, single conductor and completed section, had a permanent metal tag affixed, each embossed with the appropriate sample number.

All samples had termination points prepared, i.e., exposed metal conductor at each end of the sample.

Thermal Aging: For those samples which required it, thermal aging was accomplished prior to irradiation aging. Results reported by Sandia National Laboratories SAND 81-2027/1 of 2, indicated comparable final results, whether conditioning is accomplished simultaneously or in either sequence of thermal and irradiation conditioning.

121 Degree C Aging - Jacketed samples TP-4805-A1, A2, C1, C2, D1, D2, were placed in a hot air circulating oven at a temperature of 121 Degrees C for 168 hours. The samples were arranged on perforated shelves located in the center one-third of the oven space. They were in coil form with an approximate diameter of 20 inches. IEEE 383 is not specific for coil diameters during aging. Post LOCA performance tests include a 40X diameter bend. By inference, 40X should be more severe than prior test portions.

The temperature and time for these samples were selected as a compromise for the aging capabilities of the jackets. The thermal aging utilized does not represent end of life condition for the complete cable. It does represent significant aging for the jackets. This is based upon thermal aging parameters outlined in ICEA S-66-524 which requires 50% or 65% retained elongation after thermal aging of 168 hours at 100 degrees C for Neoprene and Hypalon respectively.

By the increase in temperature, (121 degrees C) the thermal aging utilized was intended to demonstrate that "significant" aging of the jackets occurred. Therefore, any effects upon cable performance by interaction of the jacket material has occurred and would be manifested in final test results.

150 Degree C Aging - Single Conductor Samples TP-4805-A3, A4, B1, B2, D3, D4, E1, and E2 were placed in a hot air circulating oven for 909.5 hours at 150 degrees C. The samples were mounted on a metal mandrel consisting of two circular rings, supported by eight equally spaced 1/2" stainless pipe, resulting in an approximate circumscribed diameter of 20 inches. Samples were supported along the surface of the pipes by metal hooks. The mandrel was placed on a shelf in the oven such that the mandrel was located in the center- half of the oven space. The temperature and time for these samples were utilized on the basis of Arrhenius aging characteristics for the primary insulation material. A normal operating service temperature 90 degrees C was adopted as this is the industry recognized temperature for cross-linked polyethylene.

This thermal aging to represent end-of-life condition for a 40 year postulated life, with margin, for the primary insulation material.

At 150 degrees C, the intersection of the Arrhenius plot for the primary insulation is 850 hours. 909.5 Hours of exposure represents in excess of 45 years at 90 degrees C. This represents in excess of 10% above the postulated 40-year life. Reference Data Section 3.

For normal operating temperatures below 90 degrees C, margin is increased.

Irradiation Aging:

All samples, thermally aged and not thermally aged, were Irradiation aged. Those samples thermally aged at 150 degrees C remained on the mandrel. The unaged samples and the samples aged at 121 degrees C were mounted on the mandrel. Care was exercised during the mounting procedure to avoid damage. The mandrel and samples were suitably protected from damage during transportation to and from Isomedix Inc.

Irradiation was performed by Isomedix Inc., Parsippany, NJ, and they documented dose rate, time of exposure and total dose.

While still on the mandrel, all samples were exposed to Gamma radiation from a Cobalt 60 source in air at a average dose rate of .40 megarads per hour for 503.5 hours, resulting in a total accumulated dose of 200.14 megarads. Refer to Data Section 4 for Isomedix report.

Samples were not exposed to Beta radiation. Industry accepts that for purposes of demonstration of damage, equal doses of Beta or Gamma produce equal damage. Gamma radiation therefore, satisfied irradiation conditioning requirement.

8 POST CONDITIONING EVALUATION

Upon completion of the irradiation conditioning of the samples a visual examination, and an electrical evaluation consisting of Dielectric Withstand and Insulation Resistance measurement, were conducted. This was accomplished to insure sample integrity prior to the extended environmental exposure. See Data Section 5 for detailed evaluation results.

9 ENVIRONMENTAL PROFILE (LOCA)

On the basis of the Post Conditioning Evaluation, one of each configuration was selected for the LOCA. Duplicate samples were withdrawn from the program at this point.

Samples to be subjected to the LOCA test were selected on the basis of physical condition first, Insulation Resistance second, and Conductor Resistance third, or random in the case of comparable evaluation. See Section 5 for explanation of evaluation, and part A of "Unanticipated Variations."

Preconditioning Summary:

LOCA Samples

Sample	Thermal Aging	Irradiation Aging
TP-4805-A2	121 Deg C/168 Hours	200.14 Megarads
A3	150 Deg C/909.5 Hours	"
A6	None	"
B1	150 Deg C/909.5 Hours	"
B4	None	"
C1	121 Deg C/168 Hours	"
D1	121 Deg C/168 Hours	"
D3	150 Deg C/909.5 Hours	"
D6	None	"
E1	150 Deg C/909.5 Hours	"
E4	None	"

Preparation:

An extension lead consisting of a multi-conductor control cable, was utilized to connect the samples within the vessel, to exit the penetration of the environmental test vessel. Connection was made by crimp connectors covered by nuclear grade heat sealable shrink tubing to complete a water tight connection.

LOCA

General - Samples were remounted on the mandrel and installed in the vessel oriented parallel to the mandrel axis. All samples were connected to an extension lead. All electrical connections to the samples under test were made external to the test vessel through the extension leads.

All input data to the Data Logger was scanned at the fixed design rate of every two (2) seconds. In addition, the initial transients of the first and second peak thermal excursions were monitored by a continuous recording thermocouple measurement instrument.

Inputs to the data logger and continuous recorder are analog voltages developed by the various instruments used for the various test parameters.

Print cycles were varied and were dependent upon the change rates of the measured parameters. Maximum print rate was utilized during profile ramps. Lesser print rates were utilized during extended stabilized profile portions. Printed data represents trends for the selected print cycle time periods.

Profile - The intended LOCA profile is described in IEEE-323-1974 Appendix A Fig. A1, combined PWR/BWR.

When the maximum temperature of the first transient of the profile was achieved, a chemical spray was initiated and continued for 24 hours.

Total cumulative environmental exposure was 111 days.

See Data Section 6 for tabulated data acquisition of all Data Logger channels for environmental parameters. Also refer to Unanticipated Variations sections B and C.

With the exception of the Insulation Resistance measurements, which were planned, and other short-term unanticipated interruptions, samples were electrically energized at their rated voltage and current as interpreted from the National Electric Code - 1984. See Data Section 7 for tabulated voltage and current loadings.

Insulation Resistance measurements were made on each sample through the extension cables during the environmental profile at the various temperature levels. See Data Section 8 for tabulated measurements.

10 POST LOCA TESTS

Upon completion of the enviromental profile, the samples were allowed to cool to room temperature and were removed from the test vessel. After resolution of difficulties encountered in preparing the samples for POST LOCA TESTS (Refer to section E, Unanticipated Variations), the samples were tested as below. Prior to the voltage withstand test, each sample was straightened and wrapped around an approximate 40X diameter metal mandrel, secured in this orientation, removed from the mandrel, and placed in room temperature tap water.

POST LOCA DIELECTRIC TEST

1st Test, After 1 hour Soak

Sample	40X (inches)	Wraps (360 deg.)	80 v/mil (5 minutes)	Active Length (feet)
TP-4805-A2	21.05	2		
Green			Pass	10
Blue			Pass	10
White			Pass	10
TP-4805-A3	5.28	6	Pass	10
-A6	5.28	6	Pass	10
TP-4805-B1	5.0	7	Pass	10
B4	5.0	7	Pass	10
TP-4805-C1	2.0	3		
Yellow			Pass	10
Red			Pass	10
TP-4805-D1	11.0	3		
#1			Pass	10
#2			Pass	10
TP-4805-D3	4.0	8	Pass	10
D6	4.0	8	Pass	10
TP-4805-E1	11.0	3	Pass	10
E4	11.0	3	Pass	10

Insulation Resistance Test, after 6 hours immersion and 2nd Dielectric Test after 24 hour soak

Sample	80 v/mil 5 minute	Insulation Resistace Megohms - 1000 feet	Temperature (Deg. C)
TP-4805-A2			
Green	Pass	75,000	22
Blue	Pass	50,000	"
White	Pass	50,000	"
TP-4805-A3	Pass	25,000	"
A6	Pass	100,000	"
TP-4805-B1	Pass	24,000	"
B4	Pass	90,000	"
TP-4805-C1			
Yellow	Pass	116,000	"
Red	Pass	120,000	"
TP-4805-D1			
#1	Pass	40,000	22
#2	Pass	45,000	"
TP-4805-D3	Pass	28,000	"
TP-4806-D6	Pass	100,000	"
TP-4805-E1	Pass	30,000	"
E4	Pass	56,000	"

Test Variations:-

A minor variation from the test plan also occurred relative to soak time prior to dielectric test. The test plan indicates a minimum 6 hour soak. This requirement was derived from ICEA standards which is in reference to full reel production testing. In that vein, the intent of the 6 hour soak is to insure sufficient time is given for the water to penetrate to the inner layers of the reels to be tested and to allow temperature to stabilize for Insulation Resistance measurements. For the samples included in this program, i.e. 10-15 feet, immediate water contact is achieved, and 1 hour is sufficient for temperature stabilization. Therefore, a minimum of 1 hour soak was adopted.

Test plan also states that each individual insulated conductor will be tested. Rockbestos tested three of the seven conductors. Refer to Section 5 item D.

11 PASS/FAIL CRITERIA

Samples were considered to have passed the LOCA test by:

1. Successful withstand of the continuous application of voltage and current, with the exception of Insulation Resistance measurement time, for a cumulative 100 Days environmental exposure; and

2. By successful withstand of 80 volts/mil AC RMS 60 Hz stress after a 40X diameter bend.

Results Evaluation:

All samples met the established criteria and passed the test.

12 CERTIFIED CONCLUSION

Firewall III Irradiation Cured Cross-linked Polyethylene material, and wire and cable constructions utilizing this material, have successfully withstood the conditions and tests documented in the preceeding pages. Therefore, it is certified that they can be expected to function in their normal intended application and during conditions simulated herein, postulated to occur at any time during the anticipated installed life of forty years.

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Unanticipated Variations

A. Approximatly one minute after the start of the 1st transient, the extension cable connected to sample A-2 extruded approximate two feet from the pentration hole, dragging the rise time thermocouple with it.

At the end o/ the 1st transient the autoclave was opened for approx. five to ten minutes for examination of the samples. However, there was no apparent damage to sample A-2 and the thermocouple moved approximately two inches from the original placement. Originally the thermocouple was wrapped around the Robert Shaw thermocouple bulb. The extrusion of A-2 caused the unwrapping of the thermocouple.

During the 2nd transient and after completion of insulation resistance, samples E1 and E4 failed to re-energize with 600 Vac. when cables were re-energized there was no loss of current. Retest of a insulation resistance indicated short circuit to ground.

Approximately 24 hours after the start of the test the Environmental system was shut down and the autoclave door opened for visual examination of the E samples. It was determined that the fault was caused by inadequate orientation of the connecting extension lead at the autoclave penetration. One lead was pressed against the edge of the cyllindrical penetration opening at the entranc? point of the main chamber. Due to the softening effect at the high temperature, the mechanical stress of the stiff conductor forced the extension toward the 90 degree angle surface until the soft insulation separated sufficiently to have contact between the metal conductor of the extension lead and the metal body of the pressure vessel.

Upon removal of the extension lead at the problem area, it was confirmed that the metal conductor in the extension lead was exposed.

The damaged section was removed and the extension lead was spliced and covered with a heat shrink splice. Voltage and current loads were reapplied successfully prior to recharging the vessel to 250 degrees F. Total down time was approximately two hours. To compensate for the downtown the profile was entended two hours at 250 degrees F.

B. Loss of steam pressure occurred ten times during the course of the 200 degree F portion of the profile.

Eight Occurances were of significance

The first of significance occured during day 33, with the lowest measured temperature of 116.3 degrees F. Time and temperature below the planned 200 degrees F was 9.75 hours.

The second of significance occurred during day 34, with the lowest measured temperature of 132.2 degrees F. Time and temperature below the planned 200 degrees F was 7. hours.

The third was of minor significance occurred during day 55, with the lowest temperature of 195 degrees F. Time and temperature below the planned 200 degrees F was 15 minutes.

The forth of significance occurred during day 79, with the lowest measured temperature of 117.3 degrees F. Time and temperature below the planned 200 degrees F was 43.5 hours.

The fifth occurred during day 86 and was the result of loss of facility electrical power. The power loss also interrupted the Data Logger monitoring system and therefore, a minimum temperature was not measured. When the Data Logger was placed into service again, environmental
parameters were normal. Data Logger monitoring was lost for approximately 5.75 hours.

The sixth was of minor significance occurred during day 97 with the lowest measured temperature of 194.8 degrees F. Time and temperature below the planned 200 degrees F was 1.5 hours.

The seventh occurred during day 105 and was the result of loss of facility electrical power. The power loss also interrupted the Data Logger monitoring system and therefore, a minimum temperature was not measured. When the Data Logger returned to service again the parameter were normal. Data Logger monitoring was lost for approximately 1.0 hours.

The eight occured during day 107 and was due to the shut off of the main substation. Again the loss of power interrupted the Data Logger and therefore a minimum temperature was not measured. When the Data Logger was placed into service again, environmental parameters were normal. Data Logger monitoring was lost for approximately 24.5 hours.

With the exception of the period of total power loss, each of the steam losses were the result of plant boiler malfunction, installation of a new steam generator and loss of the air to pneumatic steam valves.

The total enviornmental profile was therefore extended from 100 Days to 111 Days. Time/Temperature exposure accomplished by the 11 day extension more than compensated for the above variances. Thermal Thermal excursions, minor or major are considered more severe than steady state conditions. The variances and profile extension noted above therefore, may be considered as positive margin.
as positive margin.

Conclusion: Time/Temperature exposure requirements were exceeded.

C. Voltage and Current loading of the samples was interrupted at various times throughout the profile. Loading was discontinued ten times for measurement of Insulation Resistance, as noted in Data Section 8. Each occurrence was approximately 30 minutes.

In addition, the following unscheduled interruptions occurred:

Approx. Time	Approx. Duration	Affected Samples	Voltage	Current	Cause
8 Hours	19 hours	TP-4805-E1,E4	No	Yes	Short in extension lead
9 Day	53.5 hours	TP-4805-D1	Yes	No	Interuption of line voltage
52 Day	13.3 hours	TP-4805-D1	Yes	No	Interuption of line voltage
67 Day	15 mins	TP-4805-D1	No	No	Faulty external connection to current source
86 Day	5.75 hours	ALL	No	No	Shut off of main power for maintance
97 Day	15 mins	TP-4805-A2			
		A3-A6	Yes	No	Momentary interuption of line voltage due to storm
		B1-B4	No	Yes	
		C1-D1	No	Yes	
99 Day	86 hours	TP-4805-B1,B4	No	Yes	Momentary interuption of line voltage due to storm

In each case no indication of fault was present. In each case, samples were re-energized without incident. From final occurrence to profile termination, all samples withstood applicable voltage and current loading without incident.

The total environmental exposure, voltage, and current loading, was extended from 100 Days to 111 Days. Voltage and current loading exposure accomplished by the 11 Day extension more than compensated for the above variances. In addition to the extended time, minor positive margin was added by the voltage and current transients, as transients are more detrimental than steady state conditions.

Conclusion: Voltage and current loading exposure requirements were exceeded. Variances which occurred resulted in minor positive margin as transients are more detrimental than steady state conditions. Results obtained are therefore acceptable as meeting outlined parameters and criteria.

D. Preliminary Sample Evaluation:

The test plan delineated a conductor resistance measurement at this point. Inadvertantly, it was not accomplished.

Conductor resistance was measured after sample conditioning was complete i.e. post irradiation.

Conductor resistance (metal) is unaffected by either thermal or irradiation conditioning. The point in time of the measurement is therefore insignificant.

Margin

1. Temperature - As described in IEEE Std.-323-1974 Appendix A, the suggested profile, which was adopted, includes margin. The actual profile achieved included further margin by:

   A. Extension to 111 Days.
   B. Nominal Temperature of 220 degrees F after 4 Days.
   C. Thermal excursions as noted.

2. Pressure - The test vessel was charged with saturated steam and followed the pressures and temperatures associated as such. For temperatures above 240 degrees F, pressure was greater than indicated in IEEE Std.-323-1974.

3. Radiation - As described in IEEE Std.-323-1974 Appendix A, the suggested dose for condition testing is 150 megrads which includes the margin. The assumed addition of 50 megrads normal exposure, results in a total dose of 200 megrads which was accomplished.

4. Voltage - Average recorded voltage applied to the samples, exceeds nominal values.

5. Frequency - Voltage and current supplies were derived from local utility power. Nominal 60 Hz.

6. Time - Postulated life of subject cables is 40 years. From Arrhenius data, 909.5 hours @ 150 degrees C represents in excess of 45 years thermal life at a continuous temperature of 90 degrees C.

7. Environmental Transients - In addition to the planned dual transients, several unplanned excursions took place. Their range was not as broad, but represent minor positive margin nonetheless.

8. Vibration - Seismic effects are beyond the scope of this test. The 40 X diameter bend conducted at completion of the profile is intended to demonstrate adequate flexibility. Some samples, as discussed in "Unanticipated Variations," were subjected to two 40 X bends with satisfactory results.

9. POST LOCA Test - In addition to multiple 40 X bends, samples were subjected to a 5 minute dielectric integrity proof test twice.

SECTION 1

Q.C. PRODUCTION TESTS

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021

CUSTOMER: TP 4805 PURCHASE ORDER: N/A SPECIFICATION: IEEE-383-1974 IEEE-323-1974

SHOP ORDER/ITEM NO: EP84101 PRODUCT CODE: C07-0070 CONSTRUCTION: 7/C #14 XLPE/NEOPRENE JKT

Cable "A" Samples TP 4805-A1,A2,A3,A4,A5,A6

REEL NUMBER	LENGTH	DIELECTRIC c/c c/c	INSULATION RESISTANCE MIN. MEGS/M'	CONDUCTOR RESISTANCE MAX. Ohms/M'	MAX O.D.	INSULATION		JACKET	
						MIN. WALL	MIN. AVG. WALL	MIN. WALL	MIN. AVG. WALL
REQUIREMENTS	FT.	4.0 kv/ 5 min.	5452	2.78	.540 IN.	.027 IN.	.030 IN.	.036 IN.	.045 IN.
G5011217	2,076 FT.	PASSED	28,266	2.49	.530	.031	.033	.039	.049
4C2202									
T-00018	B-02094								

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE AND TYPICAL TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS

WITNESS Donna DeBuco AUTHORIZED SIGNATURE P.G. Shand DATE 10/1/85

FORM 1059

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021

CUSTOMER TP 4805 PURCHASE ORDER N/A SPECIFICATION IEEE-323-1974 IEEE-383-1974

SHOP ORDER/ITEM NO EP84101-01 PRODUCT CODE C07-0070 CONSTRUCTION 7/C #14 XLPE/NEOPRENE JKT

Cable "A" Samples TP 4805-A1,A2,A3,A4,A5,A6

Insulated Wire — Physical Properties

		REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2332
Elongation Unaged (%) Min		250	342
Vertical Flame-Out (Secs.) Max		60	0
Burning of Indicator (%) Max		25	0
Air Oven	Tensile % of Unaged Min	90	108
168 Hrs. @ 158°C	Elongation % of Unaged Min	90	102
Heat Distortion (%) Max		30	9.1
EM-60 Dielectric Constant Max		3.5	2.7
1-14 Day SIC Increase (%) Max		2.5	.8
7-14 Day SIC Increase (%) Max		1.5	.6
Stability Factor Max		0.5	.03
Alternate Stability Factor Max		0.5	.01

Outer Jacket

		REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2430
Elongation Unaged (%) Min		300	463
Set (%) Max		10	9.3
Air Oven	Tensile % of Unaged Min	80	92
168 Hrs @ 100 °C	Elongation % of Unaged Min	50	60
Oil Immer	Tensile % of Unaged Min	75	80
18 Hrs @ 121°C	Elongation % of Unaged Min	65	105
Tensile Stress 200% Elongation		750	986
Tear Strength (Lbs./In.) Min		25	45

Cable
Complies fully with IEEE 383 Class IE as applicable

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS.

WITNESS Monica Del Buco AUTHORIZED SIGNATURE P. G. Shaw DATE 10/1/85

FORM 678

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

CUSTOMER: TP 4805 PURCHASE ORDER: N/A SPECIFICATION: PSS-3-021 IEEE-323-1974 IEEE-383-1974

SHOP ORDER/ITEM NO: 92401-05 PRODUCT CODE: E41-0110 CONSTRUCTION: 7/C #14 XLPE/HYPALON JACKET

Cable "B" Samples TP 4805 - B1,B2,B3,B4

REEL NUMBER	LENGTH	DIELECTRIC	INSULATION RESISTANCE MIN. MEGS/M'	CONDUCTOR RESISTANCE MAX. Ohms/M'	MAX. O.D.	INSULATION		JACKET	
						MIN. WALL	MIN. AVG. WALL	MIN. WALL	MIN. AVG. WALL
REQUIREMENTS	FT.	2.5kv/ 5 min.	4788	2.78	.479 IN	.023 IN	.025 IN	.036 IN	.045 IN
D40789	1,374 FT	PASSED	13,533	2.52	.500	.025	.027	.058	.071
4A1069									
T-00014	B-01388								

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE AND TYPICAL TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS

WITNESS Ilonna Lulbuco AUTHORIZED SIGNATURE P.G. Short DATE 10/1/85

FORM 1059

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

CUSTOMER TP 4805 PURCHASE ORDER N/A SPECIFICATION RSS-3-021 IEEE-323-1974 IEEE-383-1974

SHOP ORDER/ITEM NO 92401-05 PRODUCT CODE E41-0110 CONSTRUCTION 7/C #14 XLPE/HYPALON JKT

Cable "B" Samples TP 4805-B1,B2,B3,B4

Insulated Wire		Physical Properties		Outer Jacket			
		REQUIRED	ACTUAL			REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2535	Tensile Strength Unaged (PSI) Min		1800	2425
Elongation Unaged (%) Min		250	347	Elongation Unaged (%) Min		300	383
Vertical Flame-Out (Secs.) Max		60	20	Set (%) Max		20	5.8
Burning of Indicator (%) Max		25	0	Air Oven	Tensile % of Unaged Min	85	99.8
Air Oven	Tensile % of Unaged Min	90	106	168 Hrs @100 °C	Elongation % of Unaged Min	65	89
168 Hrs @ 158°C	Elongation % of Unaged Min	90	98	Oil Immer	Tensile % of Unaged Min	75	90.5
Heat Distortion (%) Max		30	12.0	18 Hrs @121 °C	Elongation % of Unaged Min	75	91
EM-60 Dielectric Constant Max		3.5	2.5	Tensile Stress 200% Elongation		1000	1756
1-14 Day SIC Increase (%) Max		2.5	.94	Tear Strength (Lbs./In.) Min		25	31.6
7-14 Day SIC Increase (%) Max		1.5	.15	Cable			
Stability Factor Max		0.5	0	Complies fully with IEEE 383 Class IE as applicable			
Alternate Stability Factor Max		0.5	0				

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS.

WITNESS Donna Lilly Bueo AUTHORIZED SIGNATURE P.G. Schmidt DATE 10/1/85

FORM 67

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021
IEEE-323-1974
IEEE-383-1974

CUSTOMER: TP 4805 PURCHASE ORDER: N/A SPECIFICATION:

SHOP ORDER/ITEM NO: 92401-01 PRODUCT CODE: E41-0101 CONSTRUCTION: 2/C #20 Solid Chromel/Alumel Type KX XLPE/HYPALON JKT

Cable "C" Samples TP 4805-C1,C2

REEL NUMBER	LENGTH	DIELECTRIC (AC)	INSULATION RESISTANCE MIN. MEGS/M'	CONDUCTOR RESISTANCE MAX. Ohms-M'	MAX O.D.	INSULATION		JACKET	
						MIN. WALL	MIN. AVG. WALL	MIN. WALL	MIN. AVG. WALL
REQUIREMENTS	FT.	2.0 kv/ 5 min.	7739	N/A	.275 IN.	.018 IN	.020 IN	.036 IN	.045 IN
D40348A	2,340 FT	PASSED	148,075	N/A	.286	.019	.022	.048	.056
4A1032									
T-00810	B-03150								

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE AND TYPICAL TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS

WITNESS Donna Del Bueno AUTHORIZED SIGNATURE P. G. Shand DATE 10/1/85

FORM 1059

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021
IEEE-323-1974
IEEE-383-1974

CUSTOMER TP4805 PURCHASE ORDER N/A SPECIFICATION

SHOP ORDER ITEM NO 92401-01 PRODUCT CODE E41-0101 CONSTRUCTION 2/C #20 Solid Chromel/Alumel Type KX (Red) XLPE/HYPALON JKT

Cable "C" Samples TP 4805-C1,C2

Insulated Wire		REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2232
Elongation Unaged (%) Min		250	261
Vertical Flame-Out (Secs.) Max		60	20
Burning of Indicator (%) Max		25	0
Air Oven	Tensile % of Unaged Min	90	110
168 Hrs. @ 158 °C	Elongation % of Unaged Min	90	116
Heat Distortion (%) Max		30	11.1
EM-60 Dielectric Constant Max		3.5	2.7
1-14 Day SIC Increase (%) Max		2.5	.6
7-14 Day SIC Increase (%) Max		1.5	.8
Stability Factor Max		0.5	.04
Alternate Stability Factor Max		0.5	.04

Physical Properties		REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2274
Elongation Unaged (%) Min		300	418
Set (%) Max		20	5
Air Oven	Tensile % of Unaged Min	85	90
168 Hrs @ 100 °C	Elongation % of Unaged Min	65	100
Oil Immer	Tensile % of Unaged Min	75	95
4 Hrs @ 121 °C	Elongation % of Unaged Min	75	87
Tensile Stress 200% Elongation		1000	1409
Tear Strength (Lbs./In.) Min		25	30

Outer Jacket
Cable Complies fully with IEEE 383 Class 1E as applicable

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS.

WITNESS Donna Del Bueo AUTHORIZED SIGNATURE P. G. Short DATE 10/1/85

FORM 67

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021
IEEE-323-1974
IEEE-383-1974

CUSTOMER TP4805 PURCHASE ORDER N/A SPECIFICATION

SHOP ORDER/ITEM NO 92401-01 PRODUCT CODE E41-0101 CONSTRUCTION 2/C #20 Solid Chromel/Alumel Type KX XLPE/HYPALON JACKET

Cable "C" Samples TP4805-C1,C2

Insulated Wire — Physical Properties — Outer Jacket

	REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min	1800	2322
Elongation Unaged (%) Min	250	281
Vertical Flame-Out (Secs.) Max	60	30
Burning of Indicator (%) Max	25	0
Air Oven 168 Hrs. @ 158 °C — Tensile % of Unaged Min	90	109
Air Oven 168 Hrs. @ 158 °C — Elongation % of Unaged Min	90	92
Heat Distortion (%) Max	30	4.8
EM-60 Dielectric Constant Max	3.5	2.6
1-14 Day SIC Increase (%) Max	2.5	.8
7-14 Day SIC Increase (%) Max	1.5	.7
Stability Factor Max	0.5	0
Alternate Stability Factor Max	0.5	.06

	REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min	1800	2274
Elongation Unaged (%) Min	300	418
Set (%) Max	20	5
Air Oven 168 Hrs. @ 100 °C — Tensile % of Unaged Min	85	90
Air Oven 168 Hrs. @ 100 °C — Elongation % of Unaged Min	65	100
Oil Immer 4 Hrs @ 121 °C — Tensile % of Unaged Min	75	95
Oil Immer 4 Hrs @ 121 °C — Elongation % of Unaged Min	75	87
Tensile Stress 200% Elongation	1000	1409
Tear Strength (Lbs./In.) Min	25	30

Cable
Complies fully with IEEE 383 Class 1E as applicable

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS.

WITNESS Donna Del Bueo AUTHORIZED SIGNATURE P.A. Short DATE 10/1/85

FORM 678

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021
IEEE-323-1974

CUSTOMER: TP4805 PURCHASE ORDER: N/A SPECIFICATION: IEEE-383-1974

SHOP ORDER/ITEM NO: 92401-03 PRODUCT CODE: E41-0106 CONSTRUCTION: 2/C #16 XLPE/NEOPRENE JKT

Cable "D" Samples TP-4805-D1,D2,D3,D4,D5,D6

REEL NUMBER	LENGTH	DIELECTRIC (AC)	INSULATION RESISTANCE MIN. MEGS/M'	CONDUCTOR RESISTANCE MAX. Ohms-M'	O.D.	INSULATION		JACKET	
						MIN. WALL	MIN. AVG. WALL	MIN. WALL	MIN. AVG. WALL
REQUIREMENTS	FT.	2.0 kv/ 5 min.	4878	4.52	.309 IN.	.018 IN.	.020 IN.	.036 IN.	.045 IN.
D40317	644 FT	PASSED	114,181	4.21	.318	.020	.022	.043	.054
4A1028									
T-00662	B-00018								

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE AND TYPICAL TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS

WITNESS Donna L. Bucci AUTHORIZED SIGNATURE P. G. Stout DATE 10/1/85

FORM 1059

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021
IEEE-323-1974
IEEE-383-1974

CUSTOMER TP4805 PURCHASE ORDER N/A SPECIFICATION

SHOP ORDER ITEM NO 92401-03 PRODUCT CODE E41-0106 CONSTRUCTION 2/C #16 XLPE/NEOPRENE JKT

Cable "D" Samples TP-4805 D1,D2,D3,D4,D5,D6

Insulated Wire		Physical Properties		Outer Jacket			
		REQUIRED	ACTUAL			REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2848	Tensile Strength Unaged (PSI) Min		1800	2270
Elongation Unaged (%) Min		250	265	Elongation Unaged (%) Min		300	363
Vertical Flame-Out (Secs.) Max		60	0	Set (%) Max		10	10
Burning of Indicator (%) Max		25	0	Air Oven	Tensile % of Unaged Min	80	106
Air Oven	Tensile % of Unaged Min	90	96	168 Hrs @ 100 °C	Elongation % of Unaged Min	50	77
168 Hrs @ 158 °C	Elongation % of Unaged Min	90	103	Oil Immer	Tensile % of Unaged Min	75	87
Heat Distortion (%) Max		30	19.5	18 Hrs @ 121 °C	Elongation % of Unaged Min	65	112
EM-60 Dielectric Constant Max		3.5	2.5	Tensile Stress 200% Elongation		750	1278
1-14 Day SIC Increase (%) Max		2.5	.9	Tear Strength (Lbs/In.) Min		25	38.1
7-14 Day SIC Increase (%) Max		1.5	.54	Cable			
Stability Factor Max		0.5	.03	Complies fully with IEEE 383 Class IE as applicable			
Alternate Stability Factor Max		0.5	.03				

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS.

WITNESS Donna Del Buco AUTHORIZED SIGNATURE C. G. Short DATE 10/1/85

FORM 67

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021

CUSTOMER TP4805 PURCHASE ORDER N/A SPECIFICATION IEEE-323-1974 IEEE-383-1974

SHOP ORDER/ITEM NO 92401-09 PRODUCT CODE 1KM-0001 CONSTRUCTION 1/C #6 XLPE/FWL III

Cable "E" Samples TP 4805-E1,E2,E3,E4

Insulated Wire		REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		1800	2376
Elongation Unaged (%) Min		250	357
Air Oven	Tensile % of Unaged Min	90	94
168 Hrs. @ 158°C	Elongation % of Unaged Min	90	92
Heat Distortion (%) Max		30	8.0
EM-60 Dielectric Constant Max		3.5	2.3
1-14 Day SIC Increase (%) Max		2.5	1.0
7-14 Day SIC Increase (%) Max		1.5	.6
Stability Factor Max		0.5	.04
Alternate Stability Factor Max		0.5	.04

Physical Properties		REQUIRED	ACTUAL
Tensile Strength Unaged (PSI) Min		N/A	N/A
Elongation Unaged (%) Min			
Set (%) Max			
Air Oven ___ Hrs. @ ___°C	Tensile % of Unaged Min		
	Elongation % of Unaged Min		
Oil Immer ___ Hrs. @ ___°C	Tensile % of Unaged Min		
	Elongation % of Unaged Min		
Tensile Stress 200% Elongation			
Tear Strength (Lbs./In.) Min			

Outer Jacket
Cable Complies fully with IEEE 383 Class 1E as applicable

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS.

WITNESS Donna Dalbuco AUTHORIZED SIGNATURE P. G. Short DATE 10/1/85

FORM 67

THE ROCKBESTOS COMPANY

NEW HAVEN CONNECTICUT 06504 TELEPHONE (203) 772-2250 TELEX 710-465-2149

CERTIFIED TEST REPORT

RSS-3-021

CUSTOMER: TP 4805 PURCHASE ORDER: N/A SPECIFICATION: IEEE-323-1974 IEEE-383-1974

SHOP ORDER/ITEM NO: 92401-09 PRODUCT CODE: 1KM-0001 CONSTRUCTION: 1/C #6 XLPE/FWL III

Cable "E" Samples TP 4805-E1,E2,E3,E4

REEL NUMBER	LENGTH	DIELECTRIC (AC)	INSULATION RESISTANCE MIN. MEGS/M'	CONDUCTOR RESISTANCE MAX. Ohms-M'	MAX. O.D.	INSULATION		JACKET	
						MIN. WALL	MIN. AVG. WALL	MIN. WALL	MIN. AVG. WALL
REQUIREMENTS	FT.	5.5 kv/ 5 min.	3634	N/A	.279 IN.	.041 IN.	.045 IN.	N/A IN.	N/A IN.
69656	3,040 FT.	PASSED	110,352	N/A	.278	.043	.049	N/A	N/A

IT IS HEREBY CERTIFIED THAT THE FOREGOING IS TRUE AND TYPICAL TEST DATA AND THAT THE ABOVE CABLE MEETS APPLICABLE REQUIREMENTS OF PROCUREMENT DOCUMENTS

WITNESS: Donna Dill/Buco AUTHORIZED SIGNATURE: P. G. Shundt DATE: 10/1/85

FORM 1059

DATA SECTION 2

12.1 PRELIMINARY SAMPLE EVALUATION

All samples were examined visually with no apparent anomalies.

After completion of the visual examination, the samples were subjected to an electrical evaluation which included:

A. Measurement of conductor continuity.

B. Measurement of Insulation Resistance. This test was conducted per ICEA S-66-524. For single conductor samples, the procedure is as follows:

1. Place specimens in room temperature water with 10 feet of wire submerged.

2. Allow to soak for a minimum of 1 hour.

3. Measure Insulation Resistance at 500 Vdc negative, the conductor energized, and the water at ground potential.

4. Measurements were recorded after the sample was energized for one minute.

For thermocouple and Instrumentation cable the procedure was as follows:

1. Measure Insulation Resistance at 500 Vdc negative on a full length.

2. Each insulated conductor was measured individually.

3. The other insulated conductor and shield drain wire at ground potential.

4. Measurements recorded after insulated conductor was energized for one minute.

For multi-conductor jacketed cable the procedure was as follows:

1. Measure Insulation Resistance at 500 Vdc negative on a full length.

2. Each insulated conductor was measured individually.

3. All other insulated conductors were at ground potential during measurement.

4. Measurements after each insulated conductor was energized for one minute.

12.2 Criteria

As a minimum, the measurements when converted, shall exceed the Insulation Resistance Constant required in ICEA S-66-524 for cross-linked polyethylene. Per paragraph 3.6.2.2 (Second Edition 1983), the requirement is 10,000 minimum at a temperature of 15.6 degrees C (60 degrees F). The Constant (K) is calculated as follows:

$$K = \frac{IR \text{ @ } 15.6 \text{ Degrees C}}{\text{Log } (D/d)}$$

Log (Base 10)

where K = Insulation Resistance Constant

IR = Measured Resistance converted to a 1,000 ft. basis

D = Diameter over single conductor insulation

d = Diameter over metal conductor

Sample #	Sample Length	Sample #	Sample Length
TP-4805-A1	15 Ft.	C2	15 Ft.
A2	15 Ft.	D1	15 Ft.
A3	15 Ft.	D2	15 Ft.
A4	15 Ft.	D3	15 Ft.
A5	15 Ft.	D4	15 Ft.
A6	15 Ft.	D5	15 Ft.
B1	15 Ft.	D6	15 Ft.
B2	15 Ft.	E1	15 Ft.
B3	15 Ft.	E2	15 Ft.
B4	15 Ft.	E3	15 Ft.
C1	15 Ft.	E4	15 Ft.

12.3 RESULTS

Sample #	Conti-nuity	Insul. Resis. Measured	@ 60 Deg.F Megohms - 1,000'	Constant (K) @ 15.6 Deg C	Cond. Resist @ R.T. ohms/1000'	Sample Status
TP-4805-A1						Pass
Red	Pass	4.5×10^6 Mohms	186,000	689,000	2.59	
Green	Pass	4.5×10^6 Mohms	186,000	689,000	2.58	
Orange	Pass	3.0×10^6 Mohms	124,000	459,000	2.58	
Blue	Pass	3.1×10^6 Mohms	128,000	474,000	2.58	
White/Blk	Pass	3.5×10^6 Mohms	145,000	537,000	2.59	
White	Pass	3.0×10^6 Mohms	124,000	459,000	2.59	
Black	Pass	5.0×10^6 Mohms	207,000	767,000	2.57	

Sample #	Conti-nuity	Insul. Resis Measured	@ 60 Deg. F Megohms - 1,000'	Constant (K) @ 15.6 Deg C	Cond. Resist @ R.T. ohms/1000'	Sample Status
TP-4805-A2		6				Pass
Red	Pass	1.7 x 10 Mohms	70,500	261,000	2.56	
		6				
Green	Pass	1.7 x 10 Mohms	70,500	261,000	2.55	
		6				
Orange	Pass	3.5 x 10 Mohms	145,000	537,000	2.55	
		6				
Blue	Pass	4.5 x 10 Mohms	186,000	689,000	2.55	
		6				
White/Blk	Pass	3.2 x 10 Mohms	132,000	488,000	2.56	
		6				
White	Pass	1.7 x 10 Mohms	70,500	261,000	2.55	
		6				
Black	Pass	4.0 x 10 Mohms	166,000	615,000	2.54	
		6				
TP-4805-A3	Pass	8.0 x 10 Mohms	331,000	1,226,000		Pass
		6				
TP-4805-A4	Pass	5.0 x 10 Mohms	207,000	767,000		Pass
		6				
TP-4805-A5	Pass	2.4 x 10 Mohms	99,400	368,000	2.60	Pass
		6				
TP-4805-A6	Pass	3.0 x 10 Mohms	124,000	459,000	2.60	Pass
		6				
TP-4805-B1	Pass	6.0 x 10 Mohms	248,000	1,046,000		Pass
		6				
TP-4805-B2	Pass	8.0 x 10 Mohms	331,000	1,396,000		Pass
		6				
TP-4805-B3	Pass	1.0 x 10 Mohms	41,400	174,683	2.57	Pass
		6				
TP-4805-B4	Pass	2.0 x 10 Mohms	82,800	349,000	2.62	Pass
TP-4805-C1		6				
Chromel	Pass	5.0 x 10 Mohms	207,000	560,000	404.2	Pass
		6				
Alumel	Pass	5.0 x 10 Mohms	207,000	560,000	163.5	
TP-4805-C2		6				
Chromel	Pass	5.0 x 10 Mohms	207,000	560,0000	408.2	Pass
		6				
Alumel	Pass	5.0 x 10 Mohms	207,000	560,000	164.8	
TP-4805-D1		6				
1-One	Pass	3.2 x 10 Mohms	132,000	463,000	4.22	Pass
		6				
2-Two	Pass	2.9 x 10 Mohms	120,000	421,000	4.23	

Sample #	Continuity	Insul. Resis. Measured	@60 Deg. F Megohms - 1,000'	Constant (K) @ 15.6 Deg C	Cond. Resist @ R.T. ohms/1000'	Sample Status
TP-4805-D2						
1-One	Pass	3.0 x 10^6 Mohms	124,000	435,000	4.20	Pass
2-Two	Pass	3.1 x 10^6 Mohms	128,000	449,000	4.21	
TP-4805-D3	Pass	5.0 x 10^6 Mohms	207,000	726,000	-	Pass
TP-4805-D4	Pass	6.0 x 10^6 Mohms	248,000	870,000	-	Pass
TP-4805-D5	Pass	3.0 x 10^6 Mohms	124,100	435,000	4.29	Pass
TP-4805-D6	Pass	1.5 x 10^6 Mohms	62,100	218,000	4.26	Pass
TP-4805-E1	Pass	1.2 x 10^6 Mohms	49,700	280,000	-	Pass
TP-4805-E2	Pass	1.5 x 10^6 Mohms	62,100	349,000	-	Pass
TP-4805-E3	Pass	3.5 x 10^6 Mohms	145,000	816,000	.410	Pass
TP-4805-E4	Pass	2.8 x 10^6 Mohms	116,000	653,000	.406	Pass

NOTE: Insulation Resistance corrected from 75 degrees F to 60 degrees F (15.6 degrees C)

12.3 SAMPLE CONDITIONING

Data Section 3

Arrhenius Data

(Thermal Aging Characteristic)

Calcultion of Arrhenius regression line based on 60% retention of elongation after air oven aging.

The equation has the form, Ref. IEEE-101A-1974,

$$\text{Life (hours)} = A \exp B/T$$

or

$$\ln (\text{hours}) = \ln A + B/T$$

A. For FW III Irradiation Cross-Linked Insulation, KXL-760G there are three data points:

Hours	Temperature Deg. C	ln Hours	Recip Abs Temp (1/Deg K x 1000)
625	150	6.4377	2.3641
3300	136	8.1016	2.4450
9650	121	9.1747	2.5381

Linear regression analysis results:

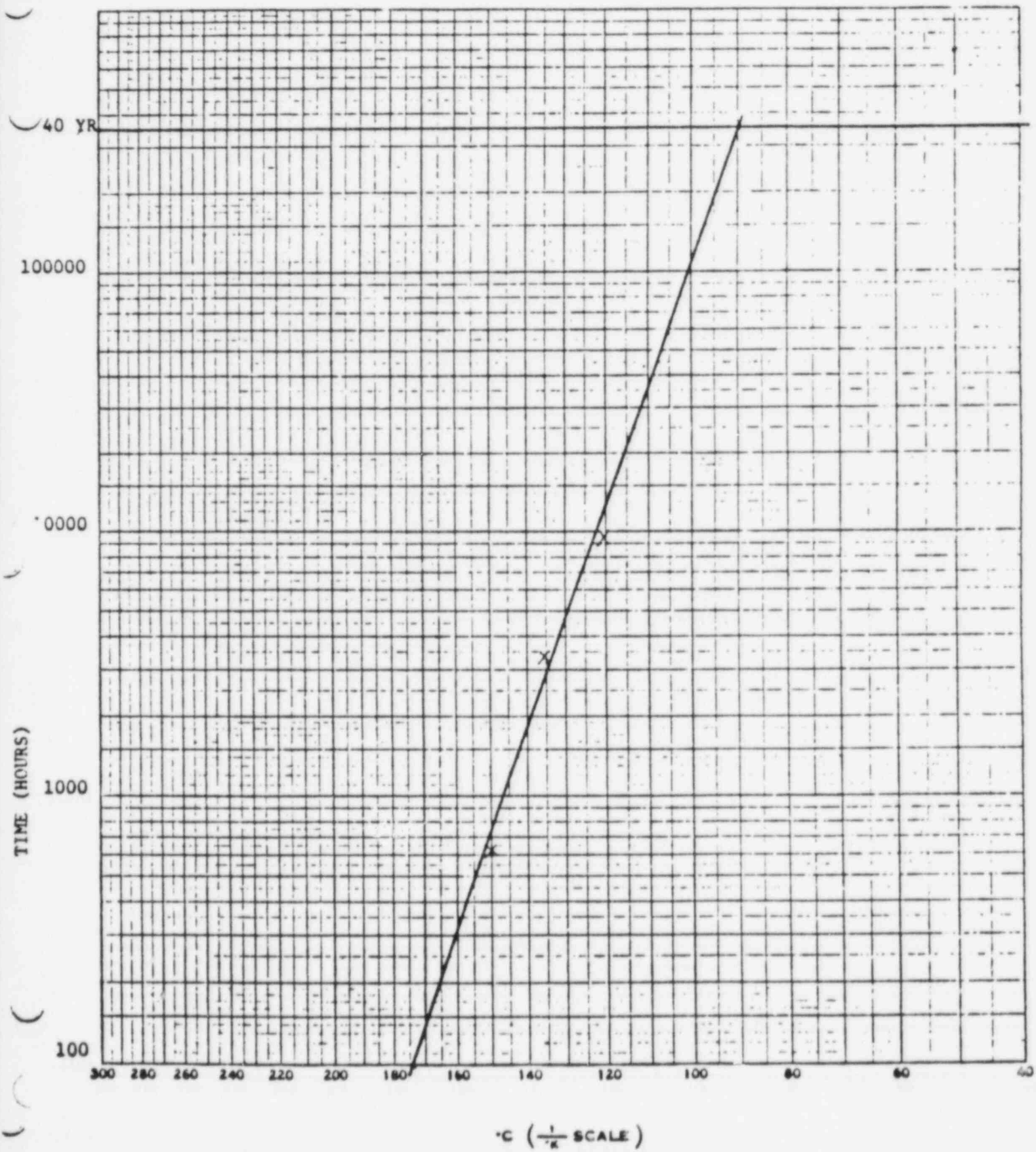
Slope (B)	= 15624.9
Intercept (ln A)	= -30.3618
Correlation Coefficient	= -.9861

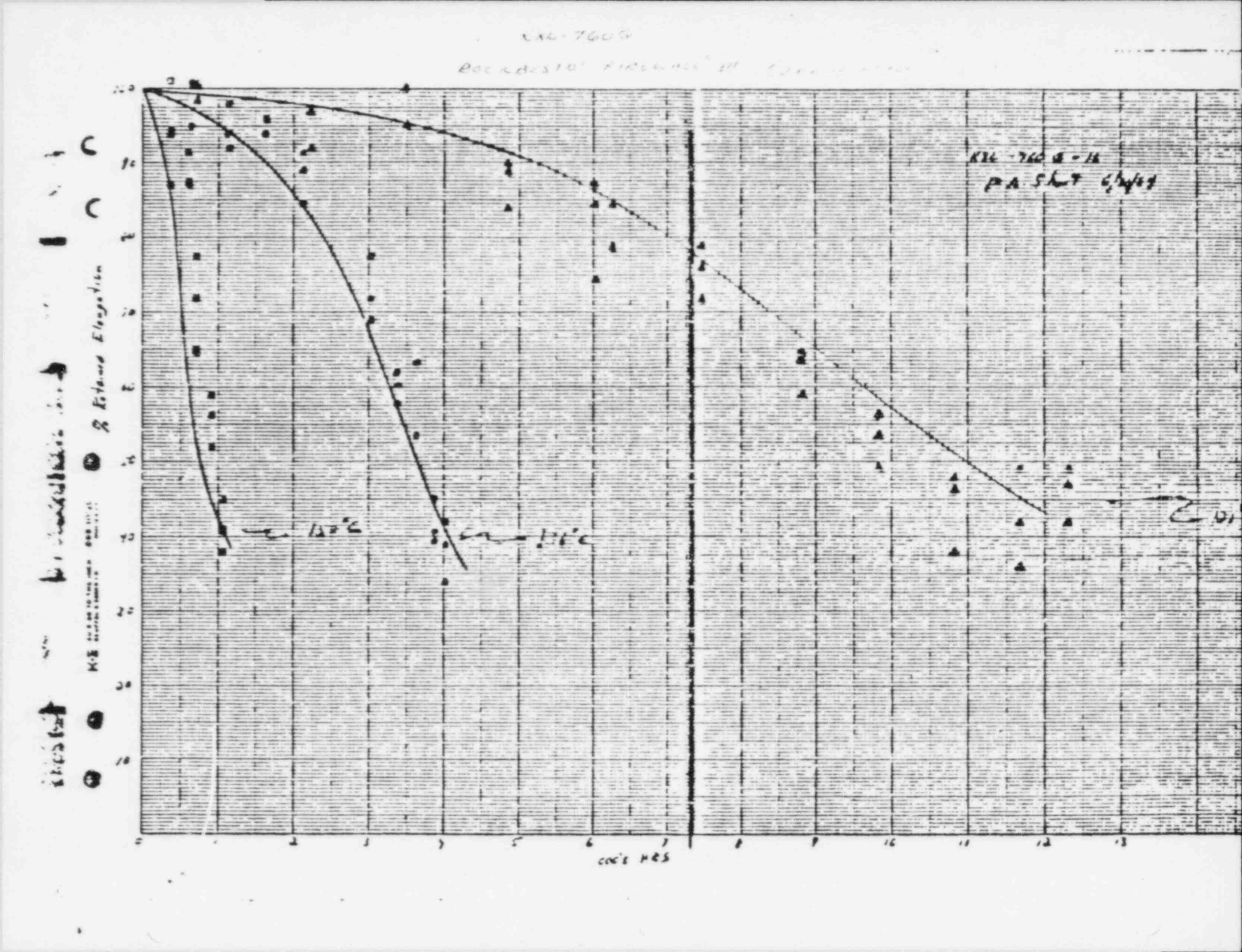
Calculated regression point temp. for 40 years = 89.3 Deg. C
Calculated regression point temp. for 100 hours = 173.8 Deg. C
Activation Energy = 1.3464 eV

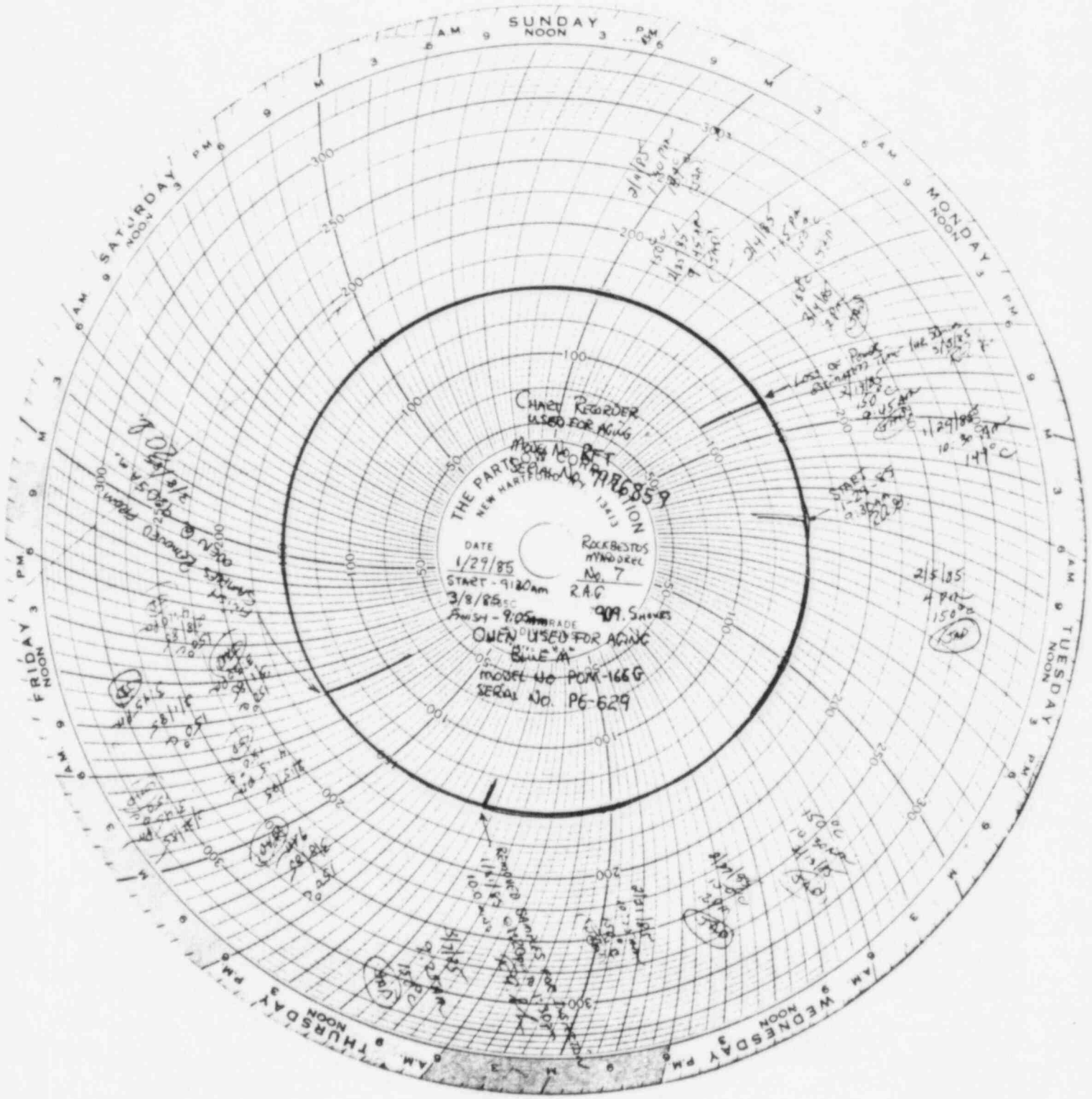
900 hours aging @ 150 Deg. C represents 403,490 hours, or 46 years at a 90 Degree C service temperature.

TEST PLAN 4805
9/84

FIREWALL III IRRADIATION CROSS-LINKED
KXL 760-G-16



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NOON
MONDAY
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WEDNESDAY
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FRIDAY
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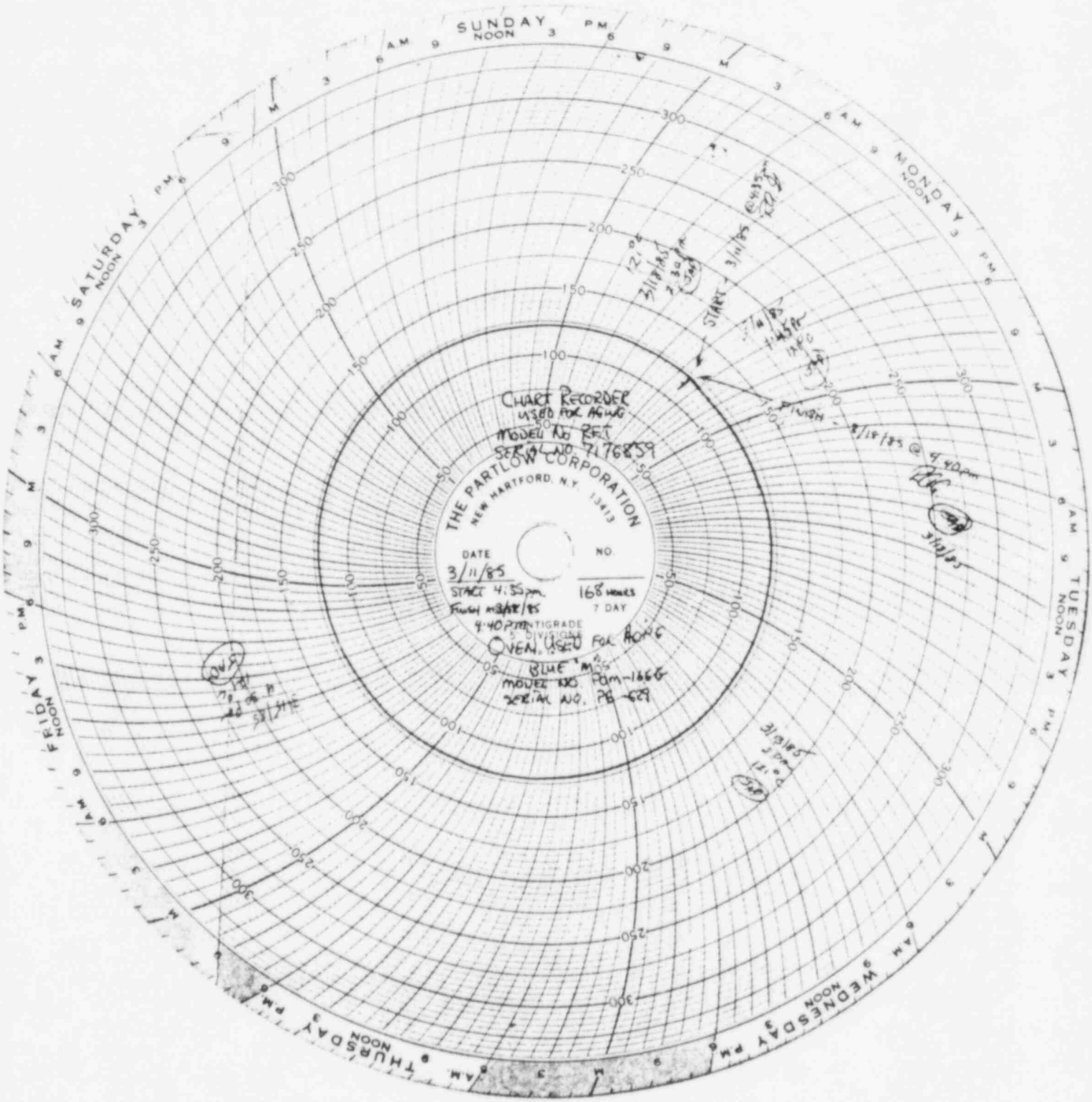
SATURDAY
NOON
Chart Recorder
used for aging
Model No. RFE
Serial No. 786859
THE PARTLOW CORPORATION
NEW HARTFORD, N.Y. 13413
DATE
1/29/85
START - 9:20 Am
3/8/85
FINISH - 9:05 Am
ROCKBESTOS
HYNDREL
No. 7
R.A.G
909. SHOWES
OVEN USED FOR AGING
BAKE "A"
MODEL NO. POM-166G
SERIAL NO. P6-629
Loss of Power
START
2/5/85
4 PM
150
END


SUNDAY
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SATURDAY
NOON
CHART RECORDER
USED FOR AGING
MODEL NO RFT
SERIAL NO 7176859
THE PARTLOW CORPORATION
NEW HARTFORD, N.Y. 13413
DATE
3/11/85
NO.
START 4:35 pm
168 HOURS
7 DAY
FINISH 3/18/85
4:40 PM
CENTIGRADE
5 DIVISIONS
OVEN USED FOR AGING
BLUE M
MODEL NO. POM-166G
SERIAL NO. PB-629
START - 3/11/85
3/18/85 @ 4:40pm

TP4605

ISOMEDIX

May 29, 1935

The Rockbestos Company
P.O. Box 1102
New Haven, Conn. 06504

Attn: Mr Jim Morganelli

Dear Mr. Morganelli:

This will summarize parameters pertinent to the irradiation of one mandrel with wire samples per your Purchase Order No. 00520-W dated 3/20/85.

The exposure of the mandrel was performed in four phases. An exposure phase consists of a period of time in which one of the four mandrel quadrants was closest to the gamma source. After the completion of each phase, the mandrel was rotated clockwise 90 degrees to the next quadrant. Table I shows the dose rates in each of the four quadrants. Table II shows the accumulated dose, by quadrant, during each exposure phase.

TABLE I

Quadrant No.	Dose Rate (Mr/hr)
1	.53
2	.39
3	.32
4	.35

Average dose rate .40 Mr/hr

TABLE II

Phase No.	Exposure(hrs)	Quad #1	Quad #2	Quad #3	Quad #4
1	125.7	66.62	49.02	40.22	44.00
2	125.7	44.00	66.62	49.02	40.22
3	125.7	40.22	44.00	66.62	49.02
4	126.4	49.30	40.45	44.24	66.99
TOTAL	503.5	200.14	200.09	200.10	200.23

ISOMEDIX (NEW JERSEY), INC.
9 APOLLO DRIVE, WHIPPANY, NEW JERSEY 07981 • (201) 887-2754

TP4605

Dosimetry was performed using Harwell Red 4034 Perspex dosimeters (Batch Y) utilizing a Bauch and Lomb Model 1001 spectrophotometer as the readout instrument. The dosimetry system was calibrated traceable to a recognized standards laboratory. The calibration date for the Batch Y dosimeters was 7/10/84. The spectrophotometer was calibrated by Bauch and Lomb personnel using standards traceable to NBS. The calibration date of the B & L 1001 was 1/30/85.

Irradiation was initiated on 3/22/85 and completed on 4/22/85.

Sincerely,

Jonathon C. Young
Plant Manager

ISOMEDIX (NEW JERSEY), INC.
9 APOLLO DRIVE, WHIPPANY, NEW JERSEY 07981 • (201) 887-2754

SECTION 4 - LOCA CHAMBER DESCRIPTION

DATA SECTION 4

LOCA CHAMBER CONFIGURATION

The autoclave chamber is a horizontal jacketed pressure chamber 36 inches in diameter by 54 inches long at the crown.

The test sample area is controlled by a Robertshaw Controller with the sensing element located midway along the top of the vessel and penetrates approximately 12 inches. The steam inlet is at the far end of the top of the vessel and is not in direct line with the controller sensing element. The spray nozzles are arranged in two lines parallel to the lengths of the vessel and are directed downward.

The samples are mounted on a metal mandrel consisting of two circular rings, supported by eight equally spaces 1 2" stainless pipe, resulting in an approximate circumscribed diameter of inches. Samples are supported along the surface of the pipes and metal hooks covered with teflon tape to prevent mechanical damage.

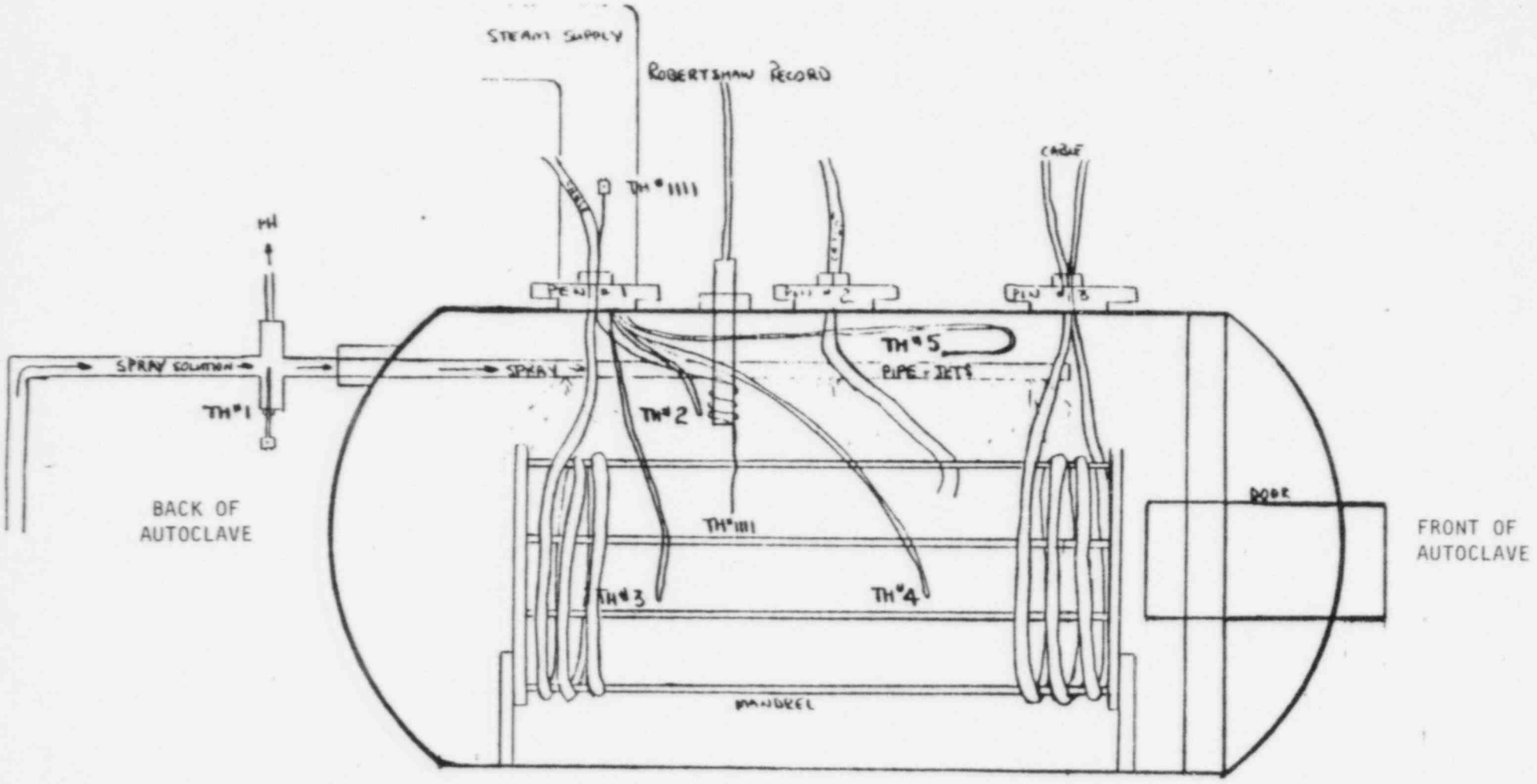
Thermocouples are positioned in the vessel to monitor temperature transients and steady state temperature.

A pressure transducer is mounted in a vessel penetration to monitor pressure.

A Doppler effect ultrasonic flowmeter is attached to the input side of the spray system to monitor spray flow rate.

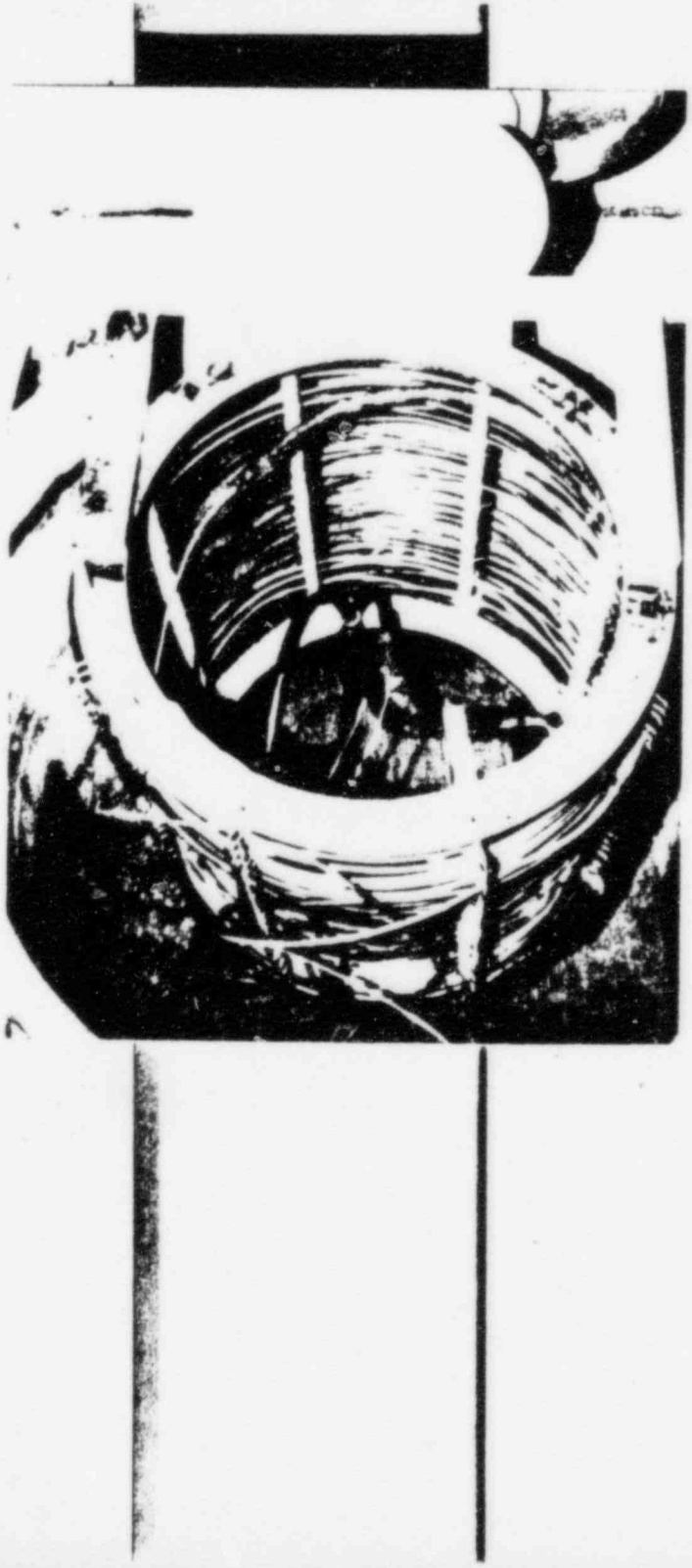
TP4805

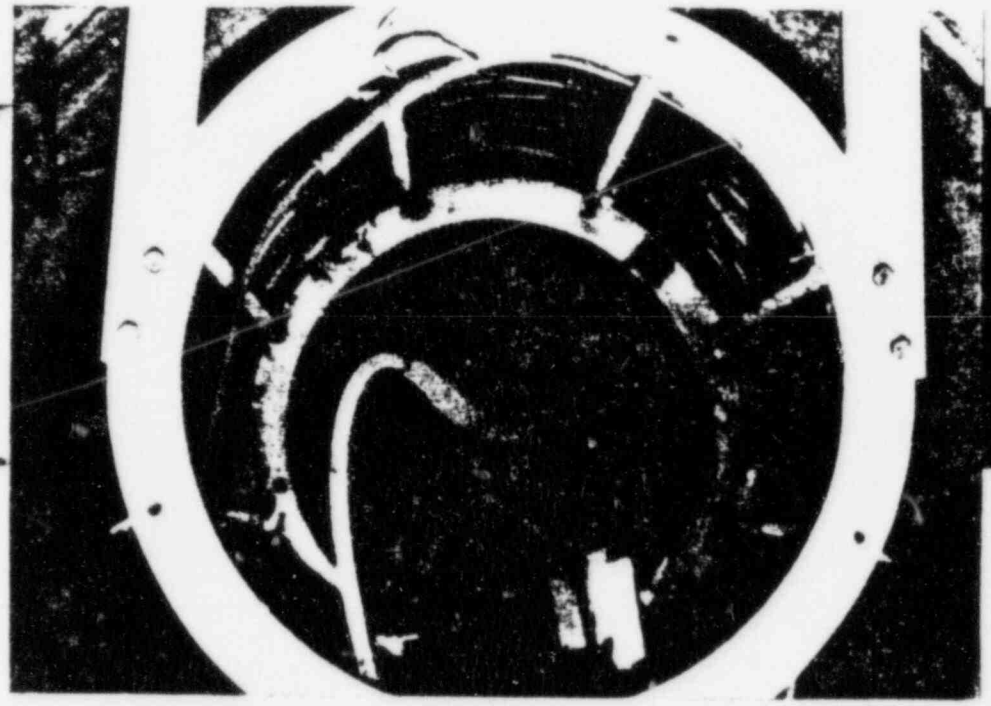
THERMOCOUPLE LOCATION IN AUTOCLAVE

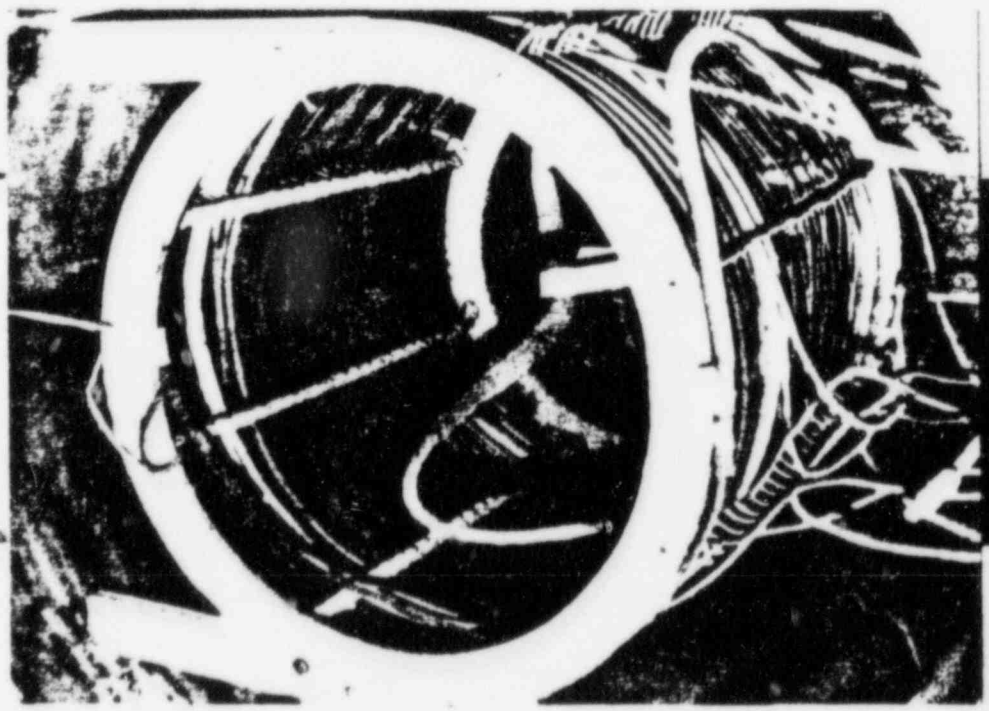


TH #1 - Connected to Channel	1	of Data Logger		(Located in Spray Solution)
TH #2 - "	"	2	"	(Located Near Robertshaw Recorder Sense Bulb)
TH #3 - "	"	3	"	(Located in Middle Back of Mandrel - Autoclave)
TH #4 - "	"	4	"	(Located in Middle Front of Mandrel - Autoclave)
TH #5 "	"	5	"	(Located at Top Autoclave Out of Spray)
TH #1111 - Connected to Strip Chart Recorder				(Located in Middle Mandrel - Autoclave)

R. A. Gehm
5/23/85







SECTION 5 - POST CONDITIONING EVALUATION

DATA SECTION 5

POST CONDITIONING EVALUATION

Upon completion of the irradiation conditioning portion of the test program, a visual and electrical evaluation was made to determine sample integrity prior to the LOCA environmental exposure.

VISUAL EVALUATION

After irradiation and prior to LOCA each sample was visually examined for mechanical damage. The results are as follows:

Sample #		Condition
TP-4805-A1	-	Slight indentations in jacket indentations were caused by mandrel hooks.
TP-4805-A2	-	Sames as TP-4805-A1
TP-4805-C1	-	No visual imperfections
TP-4805-C2	-	Very slight indentations in jacket - again indentations were caused by mandrel hooks.
TP-4805-D1	-	Jacket OK - slight impression in #1 leg caused by drain wire or alum. tape.
TP-4805-D2	-	Sames as TP-4805-D1
TP-4805-A3	-	Slight craters in insulation
TP-4805-A4	-	Craters and rust contaminants throughout entire length of sample.
TP-4805-A5	-	Some surface contaminants - also slight die drag.
TP-4805-A6	-	Scotch tape wrapped around conductor - some surface contaminants.

Sample #		Condition
TP-4805-B1	-	No visual imperfections.
TP-4805-B2	-	No visual imperfections.
TP-4805-B3	-	Some slight deformation from contact of one leg to another.
TP-4805-B4	-	No visual imperfections.
TP-4805-D3	-	No visual imperfections.
TP-4805-D4	-	Some slight deformation from contact of one leg to another.
TP-4805-D5	-	Same as TP-4805-D4
TP-4805-D6	-	Same as TP-4805-D4
TP-4805-E1	-	Some slight craters on surface.
TP-4805-E2	-	Some slight craters on surface.
TP-4805-E3	-	No visual imperfections.
TP-4805-E4	-	No visual imperfections.

ELECTRICAL EVALUATION

This evaluation consisted of the following:

A. Measurement of Insulation Resistance conducted per ICEA S-66-524. For single conductor samples, the procedure was as follows:

1. Place specimens in room temperature tap water with 10 feet of wire submerged.

2. Allow to soak a minimum of 1 hour.

3. Measure Insulation Resistance at 500 Vdc negative. The conductor was energized and the water at ground potential.

4. Measurements were recorded after the sample had been energized for one minute.

For thermocouple and Instrumentation cable this procedure was as follows:

1. Measure Insulation Resistance at 500 Vdc negative on a nominal 15 foot length.

2. Each insulated conductor was measured individually.

3. The other insulated conductor and shield drain wire were at ground potential.

4. Measurements were recorded after insulated conductor has been energized for one minute.

For multi-conductor jacket cable the procedure was as follows:

1. Measure Insulation Resistance at 500 Vdc negative on a nominal 15 foot length.

2. Each insulated conductor was measured individually.

3. All other insulated conductors were at ground potential during measurement.

4. Measurements were recorded after each insulated conductor had been energized for one minute.

B. Dielectric Proof Test - Immediately following the Insulation Resistance measurement, all samples were subjected to 80 v/mil RMS stress for 1 minute utilizing the same electrical connection configuration as IR. Nominal thickness was utilized to calculate applied voltage.

C. Conductor Resistance Measurement - Using a "Kelvin" bridge, connect leads to opposite ends of the sample metal conductor. Insure good electrical contact between metal conductor and test leads. Adjust the bridge for balance and record measured resistance. Record temperature at time of measurement.

D. For sample Nos. TP-4805-A1, A2, it was determined that conductor Green, Blue and White conductor: would be energized during the environmental exposure, with the remaining conductors at ground potential. Therefore, the Green, Blue and White conductors were tested in this evaluation.

Sample	Insultn. Resis. Megohms 1000 Ft.	K	80v/mil Withstand Volts	1 Min.	Conductor Resis. (@ RT) Ohms/1000'
TP-4805-A1					
Green	2500	25,600	2400	Pass	2.57
Blue	2100	21,400	2400	Pass	2.55
White	2000	20,400	2400	Pass	2.56
TP-4805-A2					
Green	3500	35,800	2400	Pass	2.52
Blue	2600	26,600	2400	Pass	2.50
White	3500	35,800	2400	Pass	2.53
TP-4805-A3	5000	51,100	2500	Pass	2.53
A4	3000	30,700	2500	Pass	2.54
A5	2800	28,622	2500	Pass	2.59
A6	1900	19,422	2500	Pass	2.56
TP-4805-B1	3000	34,935	2000	Pass	2.52
B2	1900	22,100	2000	Pass	2.58
B3	1700	19,800	2000	Pass	2.55
B4	2200	25,620	2000	Pass	2.60
TP-4805-C1 (Alumel)					
Red	3000	22,400	1600	Pass	171.3
(Chromel)					
Yellow	2800	20,900	1600	Pass	404.4
Red & Yellow	1600	- -	- -	- -	- -
TP-4805-C2					
Red	3000	22,400	1600	Pass	165.1
Yellow	2200	16,415	1600	Pass	407.3
Red & Yellow	1500	- -	- -	- -	- -
TP-4805-D1					
#1	1700	16,463	1600	Pass	4.23
#2	2100	20,300	1600	Pass	4.24
#1 & #2	1300	- -	- -	- -	- -
TP-4805-D2					
#1	1100	10,600	1600	Pass	4.18
#2	1200	11,621	1600	Pass	4.20
#1 & #2	590	- -	- -	- -	- -

Sample	Insultn. Resis. Megohms 1000 Ft.	K	80v/mil Withstand Volts	1 Min.	Conductor Resis. (@ RT) Ohms/1000'
TP-4805-D3	5000	48.400	1600	Pass	4.23
D4	2200	21.305	1600	Pass	4.21
D5	2800	27.100	1600	Pass	4.29
D6	2400	23.242	1600	Pass	4.26
TP-4805-E1	1900	29.500	3600	Pass	.403
E2	1200	18.600	3600	Pass	.402
E3	1200	18.600	3600	Pass	.414
E4	1300	20.191	3600	Pass	.411

Note: Electrical measurements for single conductor and multi-conductor at 24 degrees C ambient.

Calculation of K was based upon the correction factors of unconditioned insulation for comparison with the unconditioned results. For measurements made at 24 degrees C, K was calculated on the basis of 2.76 correction factor for Insulation Resistance corrected from 24 degrees to 15.6 degrees C.

Sample TP-4805-A1 or A2 - A2 was chosen on a random basis. There was virtually no discernable difference in the visual examination. Although minor differences are apparent in the electrical evaluation, they are negligible from a practical standpoint.

Sample TP-4805-A3 or A4 - A3 was chosen on a random basis. (See A1)

Sample TP-4805-A5 or A6 - A6 was chosen on a random basis. (See A1)

Sample TP-4805-B1 oR B2 - B1 was chosen on a random basis. (See A1)

Sample TP-4804-B3 or B4 - B4 was chosen on a random basis. (See A1)

Sample TP-4804-C1 or C2 - C1 was chosen on a random basis. (See A1)

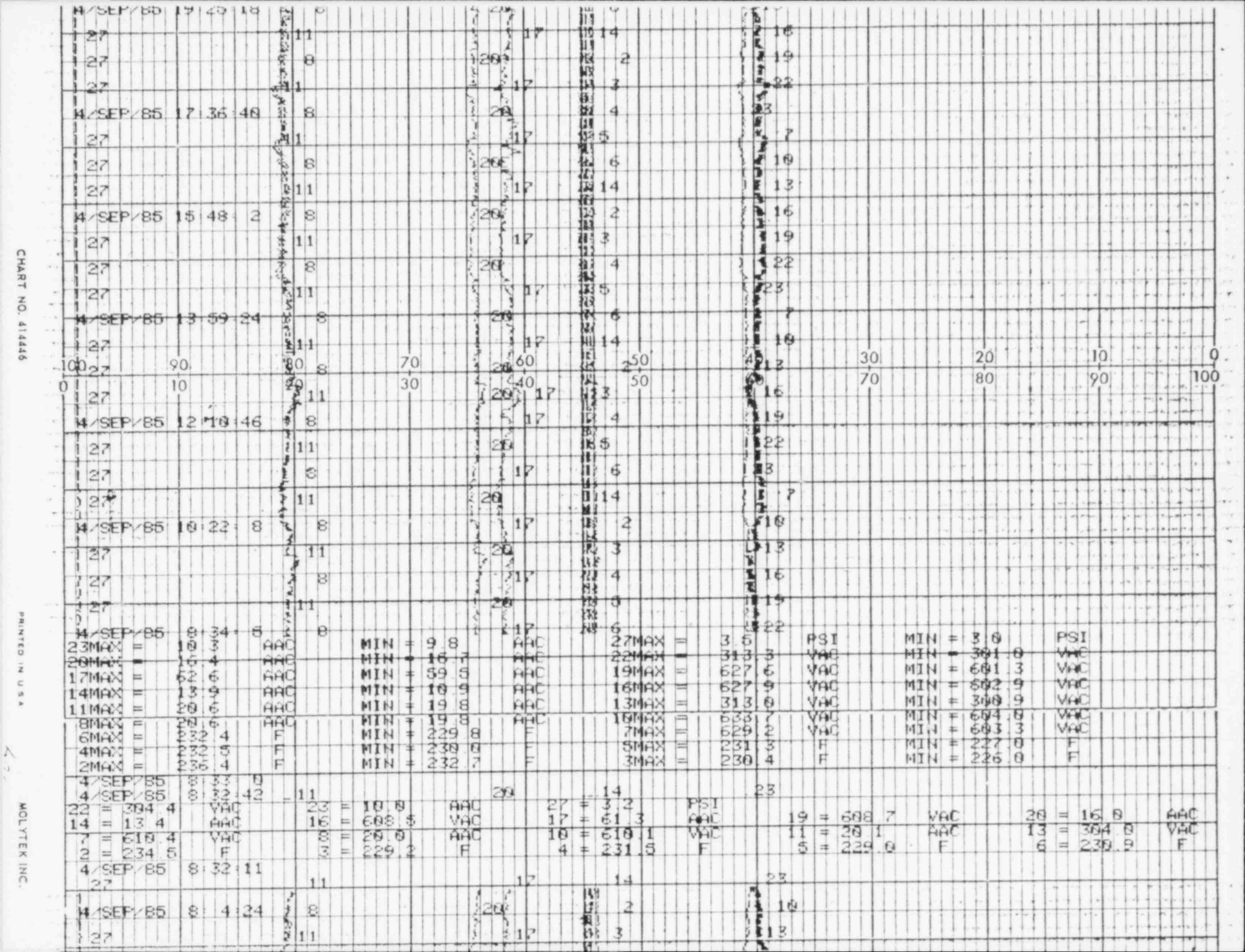
Sample TP-4804-D1 or D2 - D1 was chosen on a random basis. (See A1)

Sample TP-4804-D3 or D4 - D3 was chosen on a random basis. (See A1)

Sample TP-4804-D5 or D6 - D6 was chosen on a random basis. (See A1)

Sample TP-4804-E1 or E2 - E1 was chosen on a random basis. (See A1)

Sample TP-4804-E3 or E4 - E4 was chosen on a random basis. (See A1)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20MAX = 16.4 AAC
17MAX = 52.6 AAC
14MAX = 13.4 AAC
11MAX = 20.6 AAC
8MAX = 20.6 AAC
6MAX = 232.4 F
4MAX = 232.6 F
2MAX = 235.4 F
MIN = 9.8 AAC
MIN = 16.7 AAC
MIN = 59.5 AAC
MIN = 10.9 AAC
MIN = 19.8 AAC
MIN = 19.8 AAC
MIN = 229.8 F
MIN = 230.0 F
MIN = 232.7 F
27MAX = 3.5 PSI
22MAX = 313.3 VAC
19MAX = 627.6 VAC
16MAX = 627.9 VAC
13MAX = 313.0 VAC
10MAX = 630.7 VAC
7MAX = 629.2 VAC
5MAX = 231.3 F
3MAX = 230.4 F
MIN = 3.0 PSI
MIN = 301.0 VAC
MIN = 601.3 VAC
MIN = 602.9 VAC
MIN = 300.9 VAC
MIN = 604.0 VAC
MIN = 603.3 VAC
MIN = 227.0 F
MIN = 226.0 F
22 = 304.4 VAC
14 = 13.4 AAC
7 = 610.4 VAC
2 = 234.5 F
10.0 AAC
608.5 VAC
29.0 AAC
229.2 F
27 = 3.2 PSI
17 = 61.3 AAC
10 = 610.1 VAC
4 = 231.5 F
19 = 608.7 VAC
11 = 20.1 AAC
5 = 229.0 F
28 = 16.8 AAC
13 = 304.0 VAC
6 = 230.9 F
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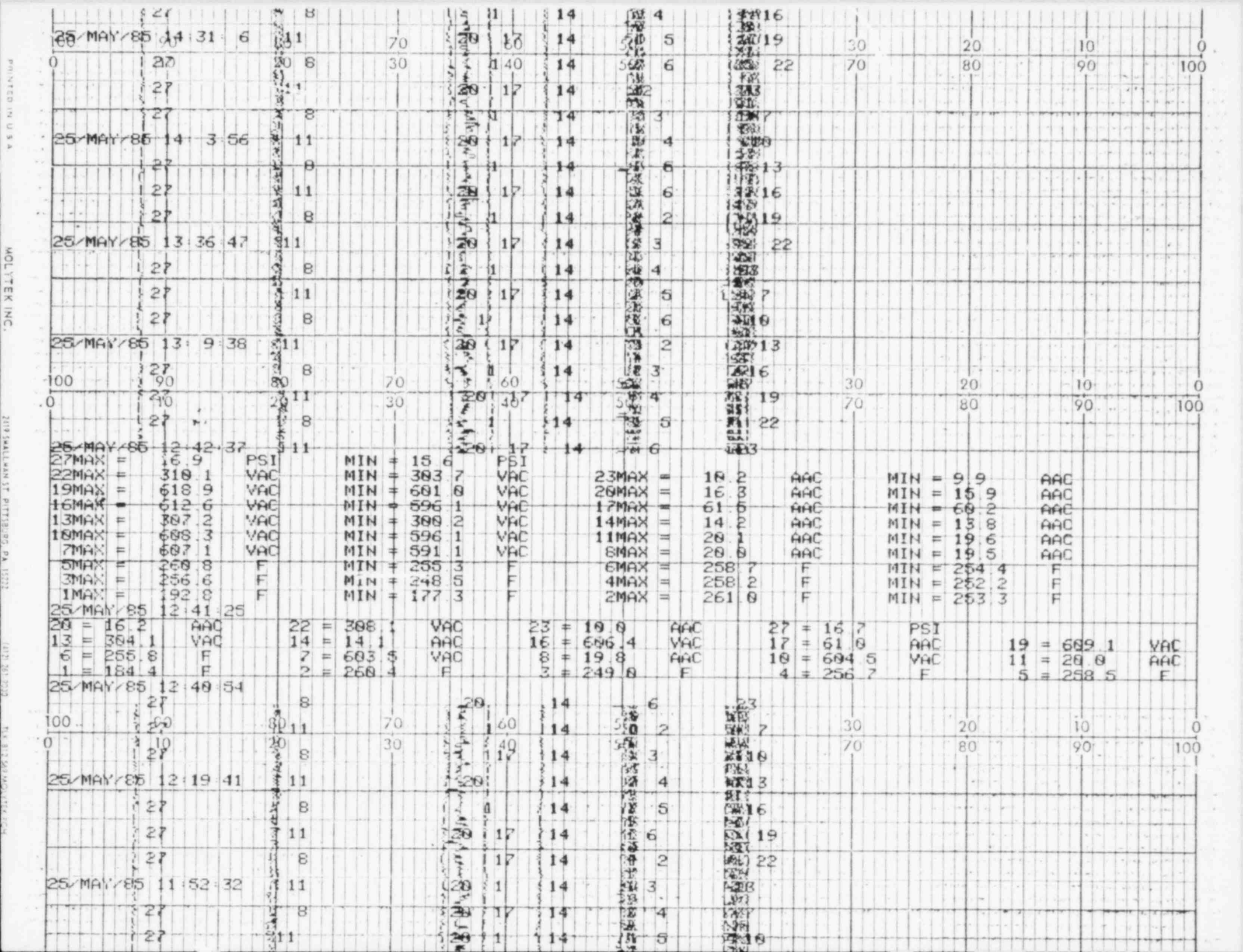
0 10 20 30
70 80 90 100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27MAX = 16.9 PSI MIN = 15.6 PSI
22MAX = 310.1 VAC MIN = 383.7 VAC
19MAX = 618.9 VAC MIN = 681.8 VAC
16MAX = 612.6 VAC MIN = 596.1 VAC
13MAX = 307.2 VAC MIN = 388.2 VAC
10MAX = 608.3 VAC MIN = 596.1 VAC
7MAX = 607.1 VAC MIN = 591.1 VAC
5MAX = 260.8 F MIN = 255.3 F
3MAX = 256.6 F MIN = 248.5 F
1MAX = 192.8 F MIN = 177.3 F
23MAX = 18.2 AAC MIN = 9.9 AAC
20MAX = 16.3 AAC MIN = 15.9 AAC
17MAX = 61.6 AAC MIN = 60.2 AAC
14MAX = 14.2 AAC MIN = 13.8 AAC
11MAX = 20.1 AAC MIN = 19.6 AAC
8MAX = 20.0 AAC MIN = 19.5 AAC
6MAX = 258.7 F MIN = 254.4 F
4MAX = 258.2 F MIN = 252.2 F
2MAX = 261.0 F MIN = 253.3 F
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20 = 16.2 AAC 22 = 306.1 VAC 23 = 19.0 AAC 27 = 16.7 PSI
13 = 304.1 VAC 14 = 14.1 AAC 16 = 696.4 VAC 17 = 61.0 AAC 19 = 689.1 VAC
6 = 255.8 F 7 = 603.5 VAC 8 = 19.8 AAC 10 = 604.5 VAC 11 = 20.0 AAC
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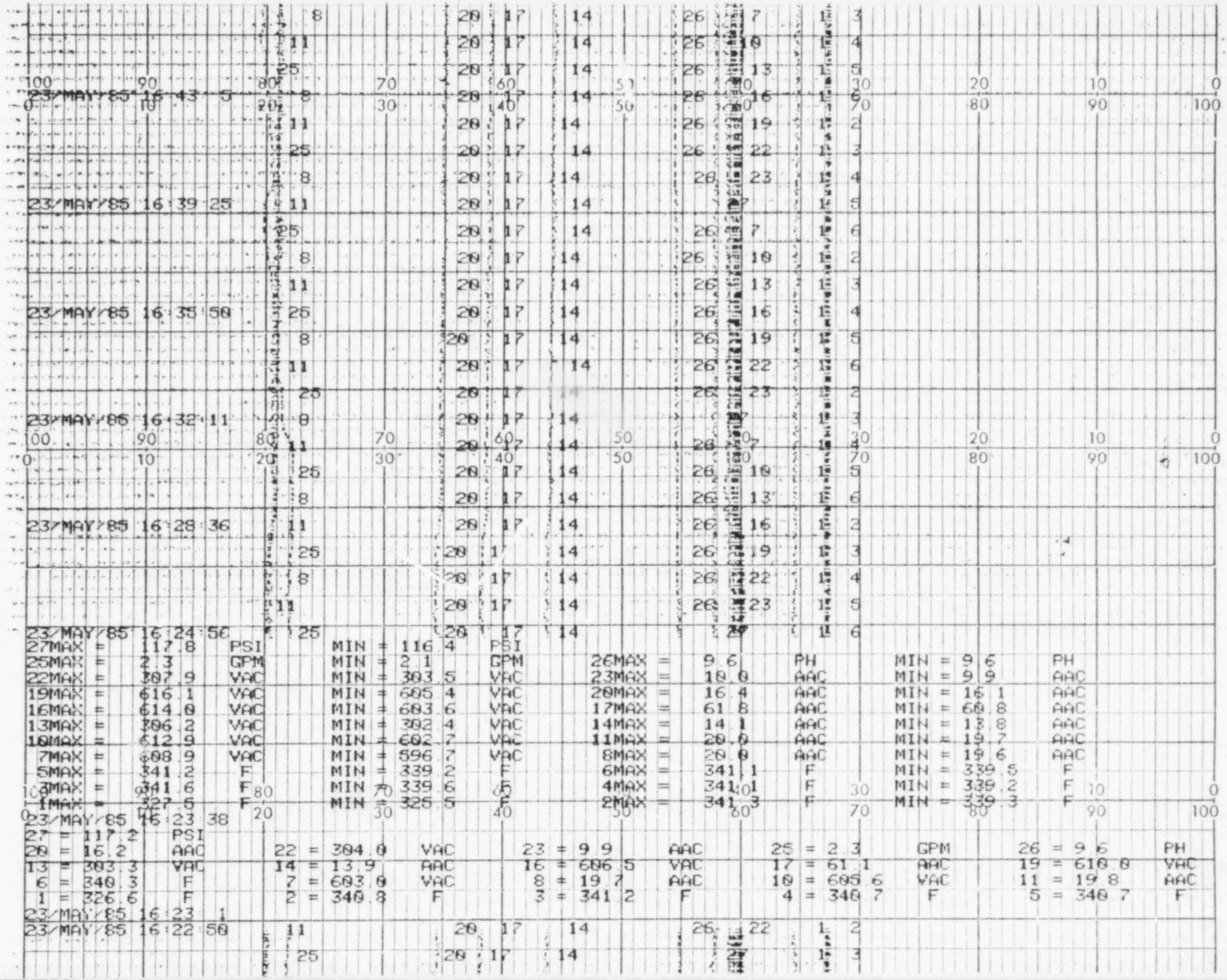
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25MAX = 2.3 GPM MIN = 2.1 GPM
22MAX = 307.9 VAC MIN = 303.5 VAC
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13MAX = 306.2 VAC MIN = 302.4 VAC
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7MAX = 608.9 VAC MIN = 596.7 VAC
5MAX = 341.2 F MIN = 339.2 F
3MAX = 341.6 F MIN = 339.6 F
1MAX = 327.6 F MIN = 325.5 F
26MAX = 9.6 PH MIN = 9.6 PH
23MAX = 10.0 AAC MIN = 9.9 AAC
20MAX = 16.4 AAC MIN = 16.1 AAC
17MAX = 61.8 AAC MIN = 60.8 AAC
14MAX = 14.1 AAC MIN = 13.8 AAC
11MAX = 20.0 AAC MIN = 19.7 AAC
8MAX = 20.0 AAC MIN = 19.6 AAC
6MAX = 341.1 F MIN = 339.5 F
4MAX = 341.1 F MIN = 339.2 F
2MAX = 341.3 F MIN = 339.3 F
27 = 117.2 PSI
20 = 16.2 AAC
22 = 304.0 VAC
23 = 9.9 AAC
25 = 2.3 GPM
26 = 9.6 PH
13 = 303.3 VAC
14 = 13.9 AAC
16 = 606.5 VAC
17 = 61.1 AAC
19 = 610.0 VAC
6 = 340.3 F
7 = 603.0 VAC
8 = 19.7 AAC
10 = 605.6 VAC
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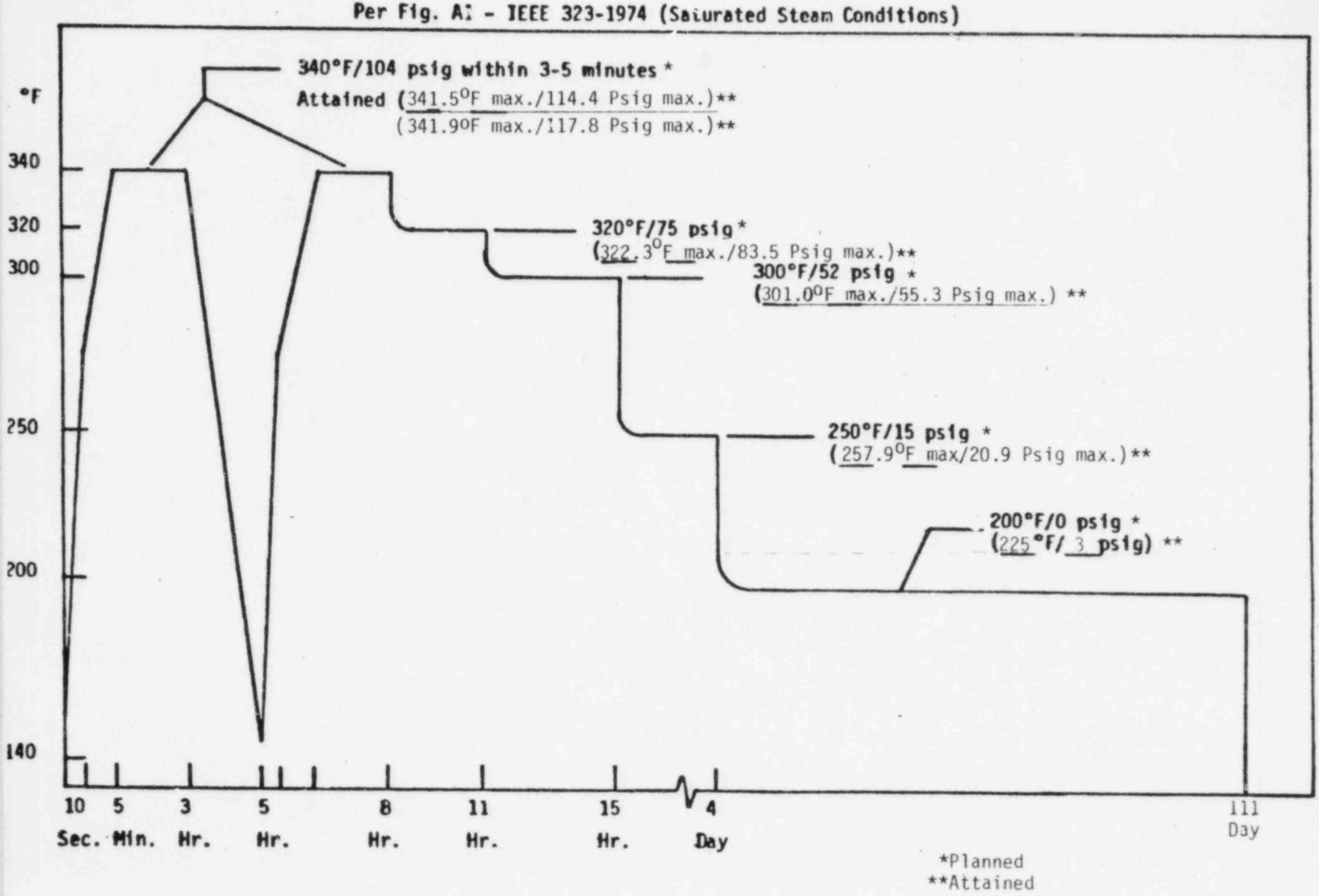
4 = 340.7 F
5 = 340.7 F

LOCA PROFILE



SECTION 6 - DATA LOGGER ENVIRONMENTAL DATA (CONDENSED)

DATA SECTION 6

Measurements @ Time Indicated

Channel	1	2	3	4	5	6	25	26	27
Time	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	GPM	pH	psig
Initial	85.5	114.3	90.8	94.1	127.3	107.3	0.0	10.7	0.0
1 hour	141.7	333.7	334.2	333.3	333.7	333.5	2.5	10.6	107.8
2 "	318.5	336.5	336.2	336.7	335.6	335.8	1.3	10.3	109.5
3 "	296.1	338.2	338.6	337.3	338.6	338.4	2.0	10.1	111.8
4 "	151.8	238.6	216.9	218.8	247.0	230.8	1.6	10.1	8.0
5 "	121.4	119.7	89.1	115.6	122.0	111.1	0.1	10.0	1.0
6 "	321.0	335.5	335.8	336.3	335.5	336.0	1.4	9.7	113.1
7 "	326.6	340.8	341.2	340.7	340.7	340.3	2.3	9.6	117.2
8 "	328.5	341.7	342.1	341.4	341.7	341.8	2.1	9.4	117.2
9 "	308.7	321.7	322.1	321.3	321.5	321.5	2.0	9.3	82.9
10 "	295.5	320.9	321.2	320.2	321.0	321.0	1.8	9.3	81.1
11 "	296.3	321.4	321.4	320.9	321.6	321.4	1.3	9.2	81.4
12 "	285.3	300.7	300.5	300.1	300.2	300.2	2.2	9.2	55.2
13 "	282.3	300.5	300.3	299.8	300.1	300.4	1.8	9.1	54.8
14 "	285.5	300.7	301.2	300.4	300.9	300.7	2.0	9.1	55.1
15 "	283.0	300.3	300.5	300.5	300.4	300.5	1.8	9.1	55.0
16 "	244.2	250.4	250.6	250.2	250.5	250.4	1.3	9.1	16.6
17 "	243.7	250.2	250.1	249.8	249.9	250.2	1.1	9.1	16.4
18 "	245.6	251.6	251.7	251.3	251.4	251.6	1.2	9.0	17.3
19 "	245.2	251.5	251.9	251.4	251.4	251.6	1.2	9.0	17.3
20 "	244.4	251.1	251.6	251.1	251.1	251.1	1.2	9.0	17.0
21 "	244.9	251.8	252.2	251.8	252.0	251.8	1.1	9.0	17.6
22 "	244.2	251.8	251.8	251.6	251.6	251.7	1.3	9.0	17.1
23 "	244.4	250.9	251.4	251.0	251.1	251.0	1.2	9.0	16.9
24 "	245.4	251.8	252.0	251.6	251.8	251.8	1.1	8.9	17.3
25 "	Spray	80.2	105.0	77.6	85.3	86.4	Spray	Spray	0.9
26 "	off	110.7	87.0	94.9	121.7	103.3	off	off	0.7
27 "		251.4	252.3	252.1	252.2	251.3			17.2
28 "		262.3	254.2	260.7	259.4	259.5			19.4
29 "		259.9	255.1	256.4	256.7	257.0			16.5
30 "		260.7	253.2	258.8	258.0	257.5			17.2
31 "		260.6	256.0	258.3	256.9	257.9			16.2
35 "		259.8	255.0	257.9	260.4	259.2			16.4
39 "		259.9	255.0	256.6	258.9	257.5			16.1
43 "		258.6	254.1	256.4	257.1	255.9			15.7
47 "		258.5	254.0	256.7	257.0	256.6			16.1
51 "		260.4	249.0	256.7	258.5	255.8			16.7

Channel	1	2	3	4	5	6	25	26	27
Time	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	GPM	pH	psig
55 "		259.5	253.5	257.7	258.2	257.7			16.3
59 "		258.4	254.9	256.6	258.7	257.3			15.8
63 "		259.1	254.7	255.6	257.6	256.5			15.7
67 "		258.2	254.3	256.1	257.8	256.3			15.2
71 "		258.9	249.5	256.4	257.2	255.3			15.7
75 "		260.5	255.7	256.8	258.4	257.5			16.4
79 "		256.6	252.3	254.2	255.4	254.3			14.6
83 "		256.1	251.2	253.2	255.2	254.2			13.7
87 "		255.6	250.3	253.0	253.1	252.9			13.5
91 "		255.2	250.7	252.6	254.9	253.4			13.2
95 "		255.2	250.0	251.6	254.3	253.4			13.4
99 "		248.9	247.7	248.4	247.7	248.2			14.3
5 days		229.9	222.9	225.8	226.6	226.4			2.7
6 "		228.7	222.1	226.0	225.4	225.0			2.8
7 "		230.1	223.2	225.8	226.8	225.9			2.4
8 "		229.6	220.3	226.5	225.6	226.2			2.5
9 "		231.5	224.9	227.7	228.4	227.6			2.9
10 "		219.7	225.1	227.3	228.3	225.0			3.0
11 "		219.7	223.6	228.2	227.8	224.8			3.3
12 "		231.4	218.5	227.7	227.1	226.1			2.7
13 "		231.7	223.1	227.2	227.2	227.2			2.5
14 "		232.3	223.1	228.0	227.8	227.1			2.7
15 "		232.0	223.8	228.2	227.8	227.8			2.9
16 "		232.9	221.8	228.7	228.7	227.6			2.9
17 "		232.6	219.4	228.5	227.8	227.1			3.3
18 "		231.1	225.1	228.5	227.9	227.8			3.2
19 "		222.1	219.8	227.3	227.8	224.9			3.0
20 "		230.8	223.3	227.6	227.2	226.3			2.8
21 "		230.8	220.3	226.6	226.8	226.4			3.1
22 "		231.3	220.2	227.7	227.4	226.5			2.8
23 "		233.7	219.8	229.0	228.7	227.6			3.2
24 "		223.1	224.7	228.3	227.6	226.0			3.3
25 "		232.8	223.6	228.0	228.6	227.9			3.1
26 "		232.2	219.0	228.0	227.2	226.4			3.3
27 "		233.3	225.2	228.3	228.7	228.8			3.1
28 "		233.9	221.8	228.2	229.6	227.9			3.5
29 "		233.8	227.3	229.7	228.8	230.7			3.3
30 "		234.0	227.7	230.6	229.4	230.7			3.4
31 "		233.5	225.8	229.4	229.4	229.5			3.5
32 "		232.7	227.5	229.3	228.5	229.5			3.0
33 "		232.1	225.8	229.2	228.1	228.7			3.9
34 "		219.9	227.0	228.6	227.7	225.9			2.9
35 "		221.0	227.1	230.8	229.5	226.7			3.3

Channel	1	2	3	4	5	6	25	26	27
Time	Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	GPM	pH	psig
36 "		233.5	227.5	229.8	229.1	230.0			3.2
37 "		238.4	232.5	234.6	237.8	235.8			4.8
38 "		242.4	234.4	238.5	240.0	238.8			6.4
39 "		232.7	226.5	228.6	226.9	228.7			2.5
40 "		232.5	225.0	228.5	226.9	228.1			2.5
41 "		233.0	227.0	228.5	226.8	228.8			2.7
42 "		231.9	225.6	227.6	226.3	227.6			2.1
43 "		231.7	225.2	227.5	228.3	228.2			2.1
44 "		231.2	226.1	227.5	226.1	227.9			2.2
45 "		230.7	224.4	227.2	226.0	227.1			2.1
46 "		232.9	223.2	229.1	227.4	228.1			2.9
47 "		233.0	226.7	228.9	227.5	229.0			2.7
48 "		232.7	227.0	228.9	227.5	229.1			3.0
49 "		232.4	226.5	228.9	226.6	228.6			2.8
50 "		233.6	227.5	229.4	227.4	229.5			2.8
51 "		233.4	227.2	229.6	227.0	229.5			2.7
52 "		232.8	227.2	229.5	227.8	229.3			2.8
53 "		233.2	227.7	229.8	228.0	229.6			3.0
54 "		233.0	227.8	227.3	228.1	229.0			3.0
55 "		207.4	195.5	200.5	205.6	202.4			-5.9
56 "		233.0	227.3	228.9	228.1	229.3			3.0
57 "		233.4	220.2	228.9	228.1	227.8			3.0
58 "		233.6	220.0	229.9	228.8	228.0			2.9
59 "		233.0	219.7	229.3	227.7	227.4			2.8
60 "		231.9	224.4	228.4	227.4	228.0			2.8
61 "		232.3	219.0	228.6	227.6	226.9			2.6
62 "		233.3	219.6	229.3	228.3	227.7			2.7
63 "		232.4	219.4	228.5	227.9	227.1			2.5
64 "		232.2	217.7	228.3	227.1	226.3			2.8
65 "		234.2	218.4	229.2	227.7	227.4			2.3
66 "		233.9	218.6	229.3	228.4	227.5			2.3
67 "		233.9	218.8	229.3	228.0	227.5			3.0
68 "		234.0	219.3	229.7	230.4	228.4			2.8
69 "		234.2	219.0	229.9	227.8	227.8			2.5
70 "		232.5	218.4	229.3	227.7	227.0			2.4
71 "		233.3	219.1	230.9	228.7	228.0			2.6
72 "		219.2	219.2	230.8	228.8	224.4			2.6
73 "		232.5	219.2	230.1	230.2	228.1			2.6
74 "		233.3	219.7	230.4	229.4	228.2			2.7
75 "		234.5	219.7	230.9	227.9	228.2			2.7
76 "		227.9	221.9	224.2	227.6	225.4			2.4
77 "		228.4	221.6	224.4	227.6	225.4			2.5
78 "		227.9	220.2	224.2	227.1	224.9			2.4
79 "		232.5	226.1	226.3	232.1	229.8			2.6
80 "		131.5	119.3	124.6	130.0	126.3			-3.9
81 "		220.8	220.8	221.4	221.1	221.0			3.5

Channel Time	1 Deg F	2 Deg F	3 Deg F	4 Deg F	5 Deg F	6 Deg F	25 GPM	26 pH	27 psig
82 "		218.9	227.7	229.3	228.2	226.1			2.6
83 "		218.9	227.5	229.0	227.2	225.6			2.8
84 "		218.9	227.6	229.3	228.1	226.0			2.8
85 "		219.4	228.0	229.9	228.0	226.3			3.0
86 "		223.6	224.6	224.0	223.8	223.9			4.2
87 "		220.0	229.1	231.3	228.4	227.2			2.8
88 "		219.3	227.1	230.1	229.0	226.4			2.8
89 "		220.4	228.9	231.2	229.9	227.6			3.6
90 "		221.0	229.7	231.8	231.5	228.5			3.4
91 "		221.3	229.7	231.9	230.7	228.4			3.5
92 "		220.9	229.4	232.1	230.7	228.5			3.5
93 "		221.6	221.8	232.8	230.6	226.7			3.5
94 "		221.4	230.7	232.8	230.5	228.8			3.4
95 "		236.2	222.9	232.4	231.0	230.7			3.4
96 "		235.2	221.6	231.8	230.1	229.7			3.4
97 "		233.9	219.8	230.8	228.9	228.3			2.9
98 "		219.6	228.4	230.2	229.8	227.0			2.9
99 "		234.8	228.0	230.0	229.0	230.4			2.9
100"		236.7	229.6	231.6	230.1	232.1			3.0
101"		235.8	230.4	232.3	229.7	232.0			3.1
102"		236.3	230.4	232.6	229.9	232.3			3.2
103"		236.0	230.2	232.1	230.3	232.1			3.2
104"		234.5	229.2	231.5	229.0	230.9			3.2
105"		233.6	228.4	230.5	228.6	230.4			3.0
106"		232.4	228.0	230.1	227.6	229.4			2.8
107"		-POWER OUTAGE ON 9/7/85-							
108"		220.7	220.9	220.9	220.7	220.5			2.9
109"		233.2	228.6	230.5	228.3	230.2			3.0
110"		230.7	226.8	228.9	226.1	228.1			2.4
111"	SHUTDOWN								

ANALYSIS OF DATA SECTION 6

Channel 1 - Chemical Spray Temperature
Channel 25 - Chemical Spray Flow Rate
Channel 26 - Chemical Spray pH.

Chemical Spray Temperature and Flow Rate were measured on the input side of the spray system to the test vessel. The spray system, while externally located from the test vessel, is at vessel pressure during operation as it is a recirculating system with input and return lines.

Spray was initiated approximately 5 minutes after the start of the environmental profile, after the first transient peak temperature was stabilized.

During stable environmental conditions, spray temperature and flow rate were also reasonably stable, with the flow being slightly more variable.

During temperature transitions, both temperature and flow rate varied slightly. Temperature primarily decreased; flow rate fluctuated in both directions.

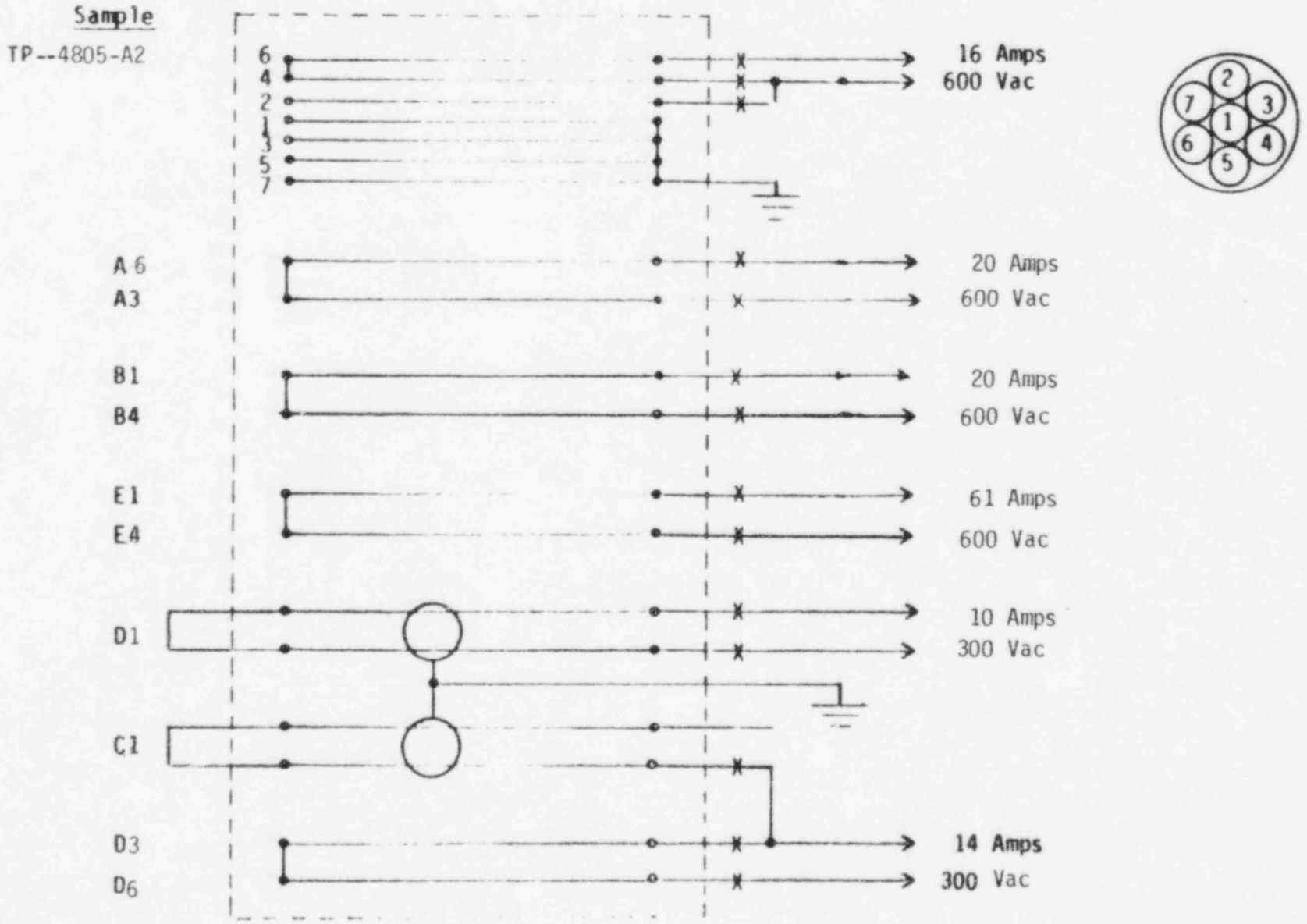
Each of these periods coincided with changes in vessel environment temperature, and pressure. It is postulated that the variations were caused by interaction of:

1. Vapor formation in the spray system.
2. Vapor condensation.
3. Reaction time of spray system to pressure changes.
4. Variation of back pressure in spray system.
5. Other similar phenomenon.

Excluding the initial and 5 hour measurement, the average instantaneous value of Flow is 1.6 GPM or 2,000+ gallon for the 24 hour period of the spray.

SECTION 7 - DATA LOGGER
CABLE ELECTRICAL LOAD DATA (CONDENSED)

SCHEMATIC FOR CABLE
ELECTRICAL CONNECTIONS



X - Breakpoints for Insulation Resistance Measurements

SECTION 7

DATA LOGGER CABLE ELECTRICAL LOAD DATA

Data Section 7

Voltage and Current Loading During LOCA Profile

Sample	Voltage	Current (Amps) *
TP 4805 A2	600 (3 Cndr.)	16 (2 Cndr.)
A3	600	20
A6	600	20
TP 4805 B1	600	20
B4	600	20
TP 4805 C1	300	0
TP 4805 D1	300	10
D3	300	14
D6	300	14
TP 4805 E1	600	61
E4	600	61

* NEC ampacities based upon 30 degrees C ambient. NEC allowable correction factor for higher ambients to be applied. Typical ambient temperature for cable installed for Class 1E applications is 65 degrees C. The derating factor is .58. This is very conservative compared to the ambient temperature during the environmental profile. Current indicated is applied during environmental profile.

Time	7 Volts	8 Amps	10 Volts	11 Amps	13 Volts	14 Amps	16 Volts	17 Amps	19 Volts	20 Amps	22 Volts	23 Amps
Init.	602.7	19.7	606.2	19.9	301.7	13.9	601.1	61.7		16.2	300.0	9.8
1 hour	602.0	19.9	601.4	20.2	302.7	14.1	599.1	61.5	607.0	16.3	302.8	9.9
2 "	606.1	19.8	607.0	20.2	303.8	14.1	601.6	61.5	608.7	16.3	303.9	9.9
3 "	596.0	19.7	602.7	19.9	301.9	14.0	597.6	60.9	605.8	16.1	302.0	9.8
4 "	601.7	20.2	605.1	20.4	302.9	14.4	600.5	62.2	607.5	16.6	303.6	10.1
5 "	604.4	21.5	610.4	21.9	304.7	15.8	602.6	63.9	608.0	17.2	304.6	11.0
6 "	603.3	19.4	602.9	19.7	302.0	13.9	603.8	60.5	607.4	16.3	303.7	9.9
7 "	603.0	19.7	605.6	19.8	303.3	13.9	606.5	61.1	610.0	16.2	304.0	9.9
8 "	Insulation Resistance Measurements											
9 "	603.2	19.6	608.6	19.6	302.0	14.2	-	61.7	605.0	16.1	301.6	10.0
10 "	605.5	19.8	613.8	19.8	305.2	14.3	-	62.4	611.4	16.4	305.3	10.1
11 "	Insulation Resistance Measurements											
12 "	601.8	19.8	606.6	19.9	304.7	14.2	-	63.1	603.1	16.2	302.9	9.7
13 "	613.7	20.0	614.6	20.1	308.5	14.4	-	63.3	612.3	16.4	306.7	9.8
14 "	599.7	19.7	610.9	19.8	304.3	14.2	-	63.3	607.4	16.1	300.6	9.8
15 "	601.1	19.4	607.9	19.5	303.2	13.9	-	62.6	604.8	16.4	304.7	9.6
16 "	596.7	19.8	604.8	19.9	301.8	13.9	-	61.4	605.0	16.3	303.0	9.8
17 "	599.7	19.9	609.5	20.0	303.6	14.0	-	62.2	611.4	16.3	305.0	10.0
18 "	596.3	19.8	606.1	19.8	301.2	13.9	-	61.5	607.2	16.2	302.6	9.9
19 "	602.3	19.8	607.8	19.9	301.7	13.9	-	61.9	609.4	16.3	303.8	10.0
20 "	600.6	19.9	609.5	19.9	303.2	14.0	-	62.1	611.4	16.3	304.4	10.0
21 "	597.2	19.7	605.0	19.8	301.0	13.9	-	61.8	603.6	16.1	302.5	10.0
22 "	589.6	19.5	598.3	19.6	296.3	13.7	-	61.1	597.8	16.1	299.0	9.8
23 "	Insulation Resistance Measurements											
24 "	600.6	19.3	612.5	19.4	303.5	13.9	-	59.1	609.7	16.0	302.2	9.8
25 "	609.2	21.9	617.0	22.1	305.6	16.3	-	65.3	614.3	17.1	304.3	11.0
26 "	597.5	20.1	600.2	19.9	301.1	14.0	-	-	612.6	16.1	301.7	10.1
27 "	599.6	19.6	600.8	19.8	300.0	14.0	609.3	60.6	607.8	16.3	302.0	9.9
28hrs	601.1	19.5	594.1	19.6	296.5	13.8	603.3	61.1	600.6	15.7	298.4	10.0
29 "	604.8	19.7	599.1	19.7	299.4	14.0	609.5	60.4	609.8	15.8	300.6	10.1
30 "	612.5	19.9	609.1	19.8	302.6	14.0	618.6	60.9	614.2	16.1	304.1	10.1
31 "	608.3	19.9	607.1	20.0	304.4	14.1	604.8	61.1	611.3	16.2	304.4	10.1
35 "	596.8	19.7	602.1	19.8	303.5	14.0	605.9	60.8	609.4	16.1	305.7	10.0
39 "	591.3	19.5	595.1	19.6	299.3	13.8	596.6	60.0	600.2	15.8	301.3	9.9
43 "	593.9	19.7	598.2	19.7	301.5	14.0	602.5	60.5	604.5	16.0	304.9	10.0
47 "	598.3	19.9	605.1	20.0	304.9	14.1	607.5	61.3	610.7	16.3	308.4	10.1
51 "	603.5	19.8	604.5	20.0	304.1	14.1	606.4	61.0	609.1	16.2	308.1	10.0
55 "	597.1	19.8	603.4	19.8	305.5	14.0	608.0	61.1	612.6	16.1	309.3	10.0
59 "	601.8	19.9	604.9	19.9	305.6	14.0	608.4	61.1	612.7	16.2	309.7	10.0
63 "	595.1	19.8	601.1	19.9	304.7	14.0	603.9	60.9	614.8	16.1	308.0	10.0
67 "	598.3	19.9	604.4	19.9	305.6	14.1	605.9	61.2	615.9	16.2	309.1	10.1
71 "	603.0	19.9	606.0	20.0	306.1	14.1	607.1	61.3	616.8	16.2	309.6	10.1
75 "	601.1	19.8	604.8	19.9	305.9	14.0	606.7	61.1	613.2	16.1	309.4	10.0
79 "	611.0	20.0	603.9	20.0	303.6	14.1	599.2	61.2	597.9	16.2	298.6	10.1

Time	7 Volts	8 Amps	10 Volts	11 Amps	13 Volts	14 Amps	16 Volts	17 Amps	19 Volts	20 Amps	22 Volts	23 Amps
83 "	610.2	20.0	603.2	19.9	303.5	14.1	597.0	61.3	599.0	16.2	298.5	10.1
87 "	614.8	20.0	604.2	20.0	303.7	14.2	598.5	61.4	599.9	16.2	298.9	10.1
91 "	610.6	20.0	602.9	20.0	302.9	14.1	596.2	61.3	598.1	16.2	298.0	10.1
95 "	605.7	19.8	596.6	19.8	298.9	14.0	588.4	60.6	587.5	16.0	294.2	9.9
99 "	Insulation Resistance Measurement											
5 days	607.0	19.6	601.2	19.8	300.8	13.9	602.4	60.6	607.1	16.0	303.0	9.8
6 "	597.7	19.6	597.7	19.7	297.5	13.8	599.8	60.0	600.9	15.9	300.3	9.6
7 "	594.6	19.7	598.9	19.7	300.5	13.8	594.5	60.6	601.4	16.0	299.2	9.8
8 "	606.0	19.8	603.9	19.9	304.2	13.8	599.7	61.0	601.8	16.1	301.5	9.9
9 "	623.1	20.3	626.2	20.4	314.9	14.2	623.3	62.7	625.9	16.5	313.7	-
10 "	614.6	20.0	616.4	20.1	311.1	14.1	615.9	61.9	618.5	16.3	309.0	-
11 "	598.6	19.7	600.0	19.8	301.5	13.8	599.7	60.5	597.8	16.0	300.1	9.9
12 "	599.3	19.7	599.8	19.8	301.1	13.8	594.7	60.5	598.8	15.9	299.4	9.8
13 "	604.0	20.0	603.0	19.9	301.9	13.9	600.6	60.8	597.7	16.1	300.6	9.9
14 "	613.7	20.1	609.3	20.1	305.0	14.1	607.6	61.4	605.7	16.3	304.7	10.0
15 "	607.8	20.0	605.2	20.0	304.0	14.0	602.4	61.0	605.1	16.1	302.9	9.9
16 "	624.4	20.1	622.1	20.2	307.0	14.2	620.8	62.9	618.1	16.5	304.6	10.0
17 "	622.5	20.0	619.6	20.1	306.2	14.1	619.8	62.7	614.3	16.4	306.5	10.0
18 "	610.2	19.9	612.0	19.8	305.0	14.0	609.4	62.0	611.3	16.2	309.2	9.9
19 "	611.0	19.9	610.7	19.8	304.2	14.0	606.4	61.8	606.9	16.1	306.9	9.9
20 "	603.2	19.6	605.5	19.6	301.1	13.9	603.1	61.2	601.9	16.0	305.2	9.9
21 "	610.0	19.8	605.4	19.8	301.9	14.0	603.9	61.9	606.3	16.1	305.1	10.0
22 "	616.3	19.9	611.4	20.0	304.9	14.1	609.7	62.0	612.7	16.2	307.3	10.1
23 "	631.1	20.3	630.9	20.4	314.4	14.4	625.5	63.8	629.3	16.7	318.0	10.3
24 "	623.5	20.2	622.9	20.2	310.4	14.2	616.2	63.1	619.1	16.4	313.6	10.2
25 "	599.5	19.7	601.1	19.7	303.3	13.4	595.5	61.8	599.2	16.0	298.0	9.9
26 "	595.9	19.7	599.6	19.7	302.1	14.2	598.5	61.4	602.6	16.1	296.6	9.7
27 "	600.6	19.9	603.5	19.9	304.9	14.2	605.0	62.0	608.5	16.1	299.4	9.6
28 "	599.3	19.8	603.8	19.8	304.4	13.7	604.4	61.8	606.1	16.1	298.5	9.9
29 "	599.6	19.7	602.4	19.7	303.6	13.6	603.7	61.6	606.1	16.0	298.8	9.7
30 "	607.2	19.8	608.7	19.9	307.0	13.8	609.4	62.4	616.5	16.3	302.6	9.8
31 "	610.2	19.9	612.6	19.9	308.7	13.8	611.8	62.5	619.4	16.3	304.0	9.8
32 "	609.4	19.7	614.9	19.7	302.6	13.7	607.3	61.6	610.2	16.1	304.7	9.6
33 "	610.6	18.7	604.0	18.6	302.6	13.1	603.2	59.0	603.8	14.9	304.2	9.1
34 "	608.2	19.8	607.1	19.7	300.4	13.8	610.6	61.8	608.0	16.0	302.4	9.7
35 "	613.6	19.8	613.2	19.8	304.3	14.0	613.8	62.3	619.4	16.0	306.9	9.7
36 "	608.6	19.6	610.1	19.7	302.0	14.0	613.2	62.1	617.1	16.1	305.9	9.6
37 "	626.7	19.9	626.1	20.0	308.6	14.1	627.3	62.9	630.2	16.2	312.8	9.7
38 "	625.1	19.8	625.2	19.9	309.2	13.9	625.7	62.6	631.2	16.1	311.5	9.6
39 "	614.5	19.9	614.1	19.9	303.2	13.9	604.9	62.1	612.4	16.0	306.8	9.8
40 "	612.7	19.9	612.3	19.9	302.6	13.8	599.6	61.7	603.8	15.9	304.5	9.7
41 "	610.5	19.8	610.6	19.8	302.2	13.8	599.6	61.7	603.5	15.8	304.1	9.6
42 "	629.6	20.3	629.9	20.3	310.9	14.1	616.7	63.5	621.1	16.3	314.2	9.8

Time	7 Volts	8 Amps	10 Volts	11 Amps	13 Volts	14 Amps	16 Volts	17 Amps	19 Volts	20 Amps	22 Volts	23 Amps
43 "	632.7	20.3	632.4	20.4	312.3	14.1	620.8	63.6	625.4	16.3	315.9	9.8
44 "	635.8	20.4	636.0	20.4	314.0	14.1	622.6	63.8	628.3	16.4	317.2	9.7
45 "	628.6	20.1	629.9	20.3	310.3	14.0	615.7	63.3	621.5	16.3	313.6	9.6
46 "	612.4	19.7	614.7	19.9	302.9	13.7	603.1	61.8	607.2	15.9	306.7	9.6
47 "	604.9	19.7	605.3	19.8	298.6	13.8	602.4	62.0	604.1	15.9	299.4	9.8
48 "	590.2	19.4	591.3	19.7	299.3	13.5	587.5	60.6	589.8	15.5	292.7	9.5
49 "	606.9	19.6	604.1	19.6	302.7	13.5	595.2	61.1	595.5	15.6	301.3	9.5
50 "	615.2	19.9	609.4	19.9	306.3	14.1	609.7	61.3	615.6	16.2	309.8	9.9
51 "	633.7	20.3	625.8	20.3	313.6	14.3	626.8	62.4	630.1	16.6	317.4	9.7
52 "	629.9	20.2	622.5	20.2	312.2	14.3	621.4	62.1	628.1	16.5	315.6	9.7
53 "	610.8	19.8	607.9	19.8	303.9	14.0	606.0	61.0	608.8	16.1	308.8	9.9
54 "	608.0	19.7	607.2	19.7	303.2	13.8	603.6	61.7	607.4	16.0	307.8	10.1
55 "	615.7	20.2	613.6	20.4	305.8	14.4	610.0	63.5	613.5	16.6	310.5	10.3
56 "	613.4	19.7	611.7	19.8	305.3	13.8	607.6	61.9	614.3	16.1	310.6	9.9
57 "	614.8	19.7	612.0	19.8	305.5	13.7	608.6	62.1	612.6	16.1	308.8	9.9
58 "	625.7	20.0	619.8	20.2	310.5	13.9	618.8	63.2	624.0	16.4	314.5	10.1
59 "	628.2	20.0	623.5	20.2	311.9	13.9	622.4	63.7	629.5	16.5	316.5	10.2
60 "	607.7	19.6	606.6	19.7	302.9	13.9	603.4	61.3	608.2	16.0	306.7	9.9
61 "	610.4	19.6	608.1	19.8	304.2	13.7	606.8	62.2	611.4	16.1	308.8	9.7
62 "	610.0	19.6	608.1	19.8	303.1	13.8	604.5	62.1	608.7	16.1	307.9	9.5
63 "	603.6	19.9	609.0	19.9	299.1	13.7	602.0	61.2	606.1	16.0	301.1	10.2
64 "	613.0	20.1	619.0	20.1	303.2	14.0	611.6	61.7	614.5	16.2	305.3	10.2
65 "	628.6	20.5	635.9	20.5	311.2	14.2	627.0	63.5	632.2	16.6	313.7	10.5
66 "	621.4	20.2	625.7	20.3	307.3	14.0	618.7	62.4	623.6	16.3	308.4	10.4
67 "	620.3	20.3	626.3	20.3	307.0	14.2	617.4	62.9	623.0	16.4	304.3	10.1
68 "	621.6	20.4	629.6	20.4	307.9	14.2	620.9	62.2	625.5	16.4	305.8	10.1
69 "	616.7	20.2	622.8	20.2	304.7	14.0	614.0	62.3	619.3	16.3	302.5	10.1
70 "	623.5	20.4	631.4	20.4	308.1	14.1	621.7	61.3	627.4	16.5	306.7	10.1
71 "	630.1	20.5	636.7	20.6	311.4	14.3	628.5	62.7	632.5	16.6	309.9	10.3
72 "	625.2	20.4	623.3	20.7	312.6	14.2	625.6	62.3	622.6	16.7	310.4	10.3
73 "	621.0	20.2	619.0	20.5	310.5	14.1	620.3	61.8	618.8	16.5	308.4	10.2
74 "	621.9	20.3	621.2	20.6	310.9	14.2	620.8	62.1	619.3	16.6	309.8	10.2
75 "	621.0	20.3	621.3	20.5	310.5	14.1	620.1	62.0	617.9	16.5	308.4	10.2
76 "	617.9	20.3	618.7	20.6	309.4	14.2	617.8	62.3	617.4	16.7	308.2	10.3
77 "	618.4	20.3	619.7	20.5	309.7	14.1	617.5	62.2	616.8	16.6	308.8	10.2
78 "	614.2	20.3	616.5	20.5	306.7	14.1	614.5	61.3	611.6	16.6	305.7	10.2
79 "	628.2	20.5	627.2	20.8	312.6	14.3	626.1	63.2	624.2	16.9	311.2	10.4
80 "	615.8	22.2	617.0	22.5	307.3	15.6	615.2	66.4	613.4	18.2	306.2	11.5
81 "	611.2	20.4	613.0	20.6	306.3	14.2	611.1	62.0	611.6	16.9	304.4	10.4
82 "	614.7	20.1	615.2	20.3	306.7	14.1	613.5	60.7	613.0	16.4	305.9	10.1
83 "	600.1	19.6	603.9	19.8	301.4	13.6	601.2	60.9	601.7	15.9	301.6	9.9
84 "	605.6	19.7	607.5	19.9	303.1	13.7	605.6	60.7	605.0	16.0	302.9	9.9
85 "	608.6	19.8	610.7	20.0	304.7	13.8	607.4	61.1	607.9	16.1	304.5	10.0
86 "	615.2	20.6	616.5	20.6	305.6	14.4	612.8	64.3	615.0	17.0	310.2	10.3
87 "	616.3	20.3	611.2	20.2	306.7	14.0	616.6	62.1	617.0	16.2	308.0	10.2

Time	7 Volts	8 Amps	10 Volts	11 Amps	13 Volts	14 Amps	16 Volts	17 Amps	19 Volts	20 Amps	22 Volts	23 Amps
88 "	599.9	19.8	597.4	19.7	298.7	13.6	601.4	60.6	600.9	15.9	301.1	10.0
89 "	596.3	19.6	592.3	19.5	297.2	13.9	597.1	61.9	597.4	15.9	299.9	9.9
90 "	596.1	19.7	592.4	19.7	297.4	14.0	597.7	62.0	597.3	15.9	300.4	9.9
91 "	590.9	19.5	587.6	19.5	295.3	13.9	594.7	61.2	595.8	15.8	299.7	9.8
92 "	596.1	19.6	592.7	19.6	297.5	13.8	596.3	61.7	596.5	15.8	299.2	9.8
93 "	607.8	19.9	603.3	20.0	302.5	14.2	611.1	63.5	609.0	16.3	305.3	10.1
94 "	616.0	20.1	609.4	20.2	306.3	14.2	618.0	64.3	616.6	16.4	308.6	10.2
95 "	597.4	19.6	593.4	19.6	297.9	14.0	599.2	62.4	598.3	15.9	300.8	9.9
96 "	594.2	19.5	591.7	19.5	297.2	13.8	596.6	62.0	597.5	15.8	300.1	9.9
97 "	603.0	19.7	604.4	19.8	300.8	13.9	602.1	61.2	601.3	15.9	303.1	9.9
98 "	607.8	20.0	614.3	20.0	304.7	13.8	608.1	61.0	610.3	15.8	306.1	10.0
99 "	619.1	20.3	624.5	20.3	309.1	14.0	617.9	62.5	617.9	16.1	308.9	10.1
100"	629.1	20.8	-	20.8	316.4	14.3	635.9	64.5	634.8	16.6	316.9	10.4
101"	625.0	20.6	-	20.7	314.0	14.2	631.1	63.8	629.0	16.5	314.7	10.3
102"	629.9	20.7	-	20.7	314.1	14.0	630.3	63.3	629.2	16.5	314.0	10.3
103"	613.4	20.4	-	20.4	307.9	13.7	616.9	61.9	616.5	16.2	307.2	10.1
104"	610.4	20.0	610.1	20.1	304.0	13.4	608.5	61.3	608.7	16.0	304.4	10.0
105"	615.9	20.2	618.1	20.2	307.8	13.5	613.9	61.1	614.8	16.1	308.3	10.1
106"	615.1	19.8	615.3	19.9	306.6	13.5	611.4	62.5	613.5	16.1	301.4	10.2
107"	Power Outage on 9/7/85											
108"	613.6	20.1	620.3	20.4	305.1	14.0	603.6	65.5	621.4	16.5	307.0	10.7
109"	608.7	19.8	606.2	19.8	304.0	14.0	606.0	62.4	608.2	15.8	304.9	10.1
110"	609.7	19.9	606.9	19.8	304.1	14.0	605.0	62.0	608.2	16.0	306.1	10.2
111"	Shutdown											

13 DATA ANALYSIS:

Channel 7, 10, 13, 16, 19 & 22 - Sample Voltage

Channel 8, 11, 14, 17, 20 and 23 - Sample Current

Minor fluctuation occurred in all channels. They were the result of:

A. Instrument adjustment
B. Conductor Resistance Change - Temperature Changes
C. Building Voltage fluctuation due to plant machine loads.

Average values for the term of application for each channel exceed the nominal value outlined for the test program.

Scheduled shutdowns for Insulation Resistance measurements represent transient conditions, and are generally recognized to be more severe than steady state conditions.

Conclusion:

Test plan variations relative to sample electrical loading were the result of normal expected influences. An integrated view of these variations result in a slightly more severe condition than intended. Results are therefore acceptable as meeting outlined parameters and criteria.

DATA SECTION 8

INSULATION RESISTANCE MEASUREMENTS

500 Vdc - 1 Minute

Insulation Resistance (Megohms - 1000 ft.)

Time	Temp.	Samples (TP4805)							
		A2			A3	A6	B1	B4	
	Deg. F	WHITE	BLUE	GREEN					Comments
---	RT	28,200	28,200	28,200	81,744	28,200	13,533	13,533	Prod. Test
Initial	60C	70,500	136,000	70,500	331,000	124,000	248,000	82,800	
PreLOCA	RT	3500	2600	3500	5000	1300	3000	2200	
8 Hrs	341	.330	.144		.150		.144		
11 "	321	.675	.270		.300		.285		
15 "	300	1.50	.600		.675		.675		
23 "	251	12.75	4.50		4.65		5.100		
99 "	255	7.50	3.75		6.75		8.40		
14 Dav	227	25.50	12.75		21.00		24.00		
46 "	227	30.00	16.50		6.75		8.70		
62 "	226	28.50	16.50		8.55		9.75		
85 "	226	25.50	15.00		5.25		6.00		
111 "	227	33.00	18.00		4.50		5.25		
Final	RT	50,000	50,000	75,000	25,000	100,000	24,000	90,000	

DATA SECTION 8

INSULATION RESISTANCE MEASUREMENTS

500 Vdc - 1 Minute

Insulation Resistance (Megohms - 1000 ft.)

Time	Temp	Samples (TP-4805)						
	Deg. F	C1 Red	C1 Yellow	D1 #1	D1 #2	D3	D6	Comments
-	RT	156,000	156,000	114,000	114,000	100,000	100,000	Prod. Test
Initial	60C	207,000	207,000	132,000	120,000	207,000	62,100	
PreLOCA	RT	3000	2800	1700	2100	5000	2400	
8 hrs.	341	.138	.144	.125	.120	.146		
11 hrs.	321	.225	.270	.225	.240	.300		
15 hrs.	300	.450	.585	.450	.450	.675		
23 hrs.	251	2.40	3.60	2.40	2.40	4.35		
99 hrs.	254	2.40	4.5	1.65	2.40	8.85		
14 days	227	6.75	10.8	4.50	6.75	27.00		
46 days	227	6.00	10.2	3.00	3.30	11.25		
62 days	226	6.75	10.5	2.40	2.55	15.00		
85 days	226	5.25	9.30	1.65	1.80	8.40		
111days	227	5.25	8.85	1.80	1.95	7.50		
Final	RT	120,000	160,000	40,000	45,000	28,000	100,000	

Time	Temp	E1	E3	Comments
-	RT	110,000	110,000	
Initial	60C	40,700	176,000	
PreLOCA	RT	1900	1300	
8 hrs.	340.9	.090		
11 hrs.	321	-		Short in exten. lead
15 hrs.	300	-		
23 hrs.	251	-		
99 hrs.	254	8.55		
14 days	227	195.0		
46 days	227	165.0		
62 days	226	144.0		
85 days	226	117.0		
111days	227	45.0		
Final	RT	30,000	130,000	

Note 1 - Measurements indicated during LOCA for TP 4805-A2 conductor #4-Green, # 6-Blue; TP-4805-A3, A6, TP4805-B1 and B4, TP-4805-E1, E4, are composite based upon overall length of series combination. These samples were connected in series for current loading.

Note 2 - Measurements indicated during LOCA are based on sample length(s). A parallel, therefore reducing resistance is included in the measurement due to extension leads. Actual values therefore, are greater than indicated during LOCA.

SECTION 9 - EQUIPMENT CALIBRATION RECORDS

NUCLEAR QUALIFICATION TEST
INSTRUMENT CALIBRATION

Verification of accuracy is conducted on a routine frequency to provide assurance that equipment accuracies conform to the accepted requirements for commercial wire and cable test.

The calibration program is conducted to meet the requirements as outlined in MIL Std. 45662A with documentation traceable to NBS.

Calibration documentation is available for inspection at:

The Rockestos Company
285 Nicoll Street
New Haven, Connecticut 06511

Calibration documentation is included as part of the backup documentation maintained on file for this program.

Equipment Usage

The appropriate written procedures shall be followed relative to individual equipment operation and data acquisition. Departure from these procedures shall be noted. Said departures shall be evaluated as to effect upon parameter measured and overall test program.

Raw data sheets shall include identification of actual instrument used to acquire the data, by model and serial number.

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	702-5	**SERIAL NO.**	8909-1
INSTRUMENT	H.V. Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-1 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaio QAS
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4·86

TEST REPORT

358086 1

TEST INST.: Hv test set
PROC. NO. manual MFR Hipotronics MODEL 702-5 SER. No 8909-1
TESTED BY JB/WH DATE 4·22·85 ACCEPTED BY [signature] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.
	.4KV	.1Kv	.1016	.1016	
		.3Kv	.3073	.3073	
		.4Kv	.4065	.4065	
	.8KV	.2Kv	.2001	.2001	
		.6Kv	.6105	.6105	
		.8Kv	.8079	.8079	
	2KV	.5Kv	.5102	.5102	
		1.5Kv	1.5362	1.5362	
		2Kv	2.031	2.031	

Form #400 ASSETS USED 9815, 9502

EIL®
INSTRUMENTS, INC.

Rockbestos Company
P.O. 15074NH

Certificate of Calibration

MODEL NO.	702-5	**SERIAL NO.**	8909-2
INSTRUMENT	AC Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-2 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaria (for)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

TEST REPORT

CAL DUE 4·86

358086 2

TEST INST.: AC test set
PROC. NO. manual MFR Hipotronics MODEL 702-5 SER. No. 8909-2
TESTED BY JB/WH DATE 4·22·85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	.4KV	.1KV	.1014	.1014		
		.3KV	.2964	.2964		
		.4KV	.3971	.3971		
	.8KV	.2KV	.1963	.1963		
		.6KV	.5907	.5907		
		.8KV	.7872	.7872		
	2KV	.5KV	.4907	.4907		
		1.5KV	1.484	1.484		
		2.0KV	1.982	1.982		

Form #400 ASSETS USED 9815, 9502

EIL®
INSTRUMENTS, INC.

Rockbestos Company
P.O. 15074NH

Certificate of Calibration

MODEL NO.	702-5	**SERIAL NO.**	8909-3
INSTRUMENT	AC Voltage Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-3 Dated 4-22-85

Due 4-86

Certified by: W.H./J.B.

Barbara DeMaio (QA)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

CAL DUE 4·86

TEST REPORT

358086 3

TEST INST.: AC Test Set
PROC. NO. manual MFR. Hipotronics MODEL 702-5 SER. No. 8909-3
TESTED BY JA/WH DATE 4·22·85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	.4KV	.1KV	.0974	.0974		
		.3KV	.3010	.3010		
		.4KV	.3985	.3985		
	.8KV	.2KV	.1981	.1981		
		.6KV	.6027	.6027		
		.8KV	.7974	.7974		
	2KV	.5KV	.4926	.4926		
		1.5KV	1.5239	1.5239		
		2KV	2.007	2.007		

Form #400 ASSETS USED 5236, 9502, 9815

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	702-5	**SERIAL NO.**	8909-4
INSTRUMENT	AC Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-4 Dated 4-22-85

Due 4-86

Certified by: J.B.

Barbara DeMaio (QAS)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

Rockbestos
PO #15074NH

Sheet 1 of 1

EIL
INSTRUMENTS INC.

CAL DUE 4-86

TEST REPORT

358086-4

TEST INST.: AC Test Set
PROC. NO. MANUAL MFR. Hipotronics MODEL 702-5 SER. No. 8909-4
TESTED BY J.B DATE 4-22-85 ACCEPTED BY [illegible] DATE 4-30-85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	.400 KV	.1 KV	.1011 KV	.1016 KV		
		.3 KV	.3089 KV	.3044 KV		
		.4 KV	.4101 KV	.4045 KV		
	.800 KV	.2 KV	.2057 KV	.2001 KV		
		.6 KV	.6155 KV	.6029 KV		
		.8 KV	.8165 KV	.8017 KV		
	2 KV	.5 KV	.5145 KV	.4099 KV		
		1.5 KV	1.54 KV	1.511 KV		
		2 KV	2.032 KV	2.003 KV		

Form #400 Assets 9815, 9502

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	702-5	**SERIAL NO.**	8909-5
INSTRUMENT	AC Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-5 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaria (QA)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

CAL DUE 4.86

TEST REPORT

358086 5

TEST INST.: AC test set
PROC. NO. manual MFR. Hipotronics MODEL 702-5 SER. No. 8909-5
TESTED BY JB/WH DATE 4.22.85 ACCEPTED BY [illegible] DATE 4/22/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	.4 KV	.1KV	.1013	.1013		
		.3 KV	.3036	.3036		
		.4KV	.4020	.4020		
	.8KV	.2KV	.2021	.2021		
		.6KV	.6046	.6046		
		.8KV	.8006	.8006		
	2KV	.5KV	.5059	.5059		
		1.5KV	1.525	1.525		
		2KV	2.017	2.017		

Form #400 ASSETS USED 9815, 9502

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	702-5	**SERIAL NO.**	8909-6
INSTRUMENT	AC Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-6 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaria (QAD)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4·86

TEST REPORT

358086 S

TEST INST.: AC test set
PROC. NO. manual MFR. Hipotronics MODEL 702-5 SER. No. 8909-6
TESTED BY JB/WH DATE 4·22·85 ACCEPTED BY [illegible] DATE 4/8/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	.4KV	.1KV	.1008	.1005		
		.3KV	.3006	.2998		
		.4KV	.3998	.3976		
	.8KV	.2KV	.2027	.2002		
		.6KV	.6042	.6010		
		.8KV	.8020	.7968		
	2KV	.5KV	.5100	.5062		
		1.5KV	1.524	1.515		
		2KV	2.020	2.000		

Form #400 ASSETS USED 9815, 9502

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	700RAG-1	**SERIAL NO.**	740697-2
INSTRUMENT	Ammeter	**MANUFACTURER**	Rockbestos

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-7 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaria QMS
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4.86

TEST REPORT

358086 7

TEST INST.: ammeter
PROC. NO. com data MFR Rockelustron MODEL 700RAG-1 SER. No. 7406697-2
TESTED BY JB/WH DATE 4.27.85 ACCEPTED BY JAO DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	25A	10A	10.662	10.662		
		20A	21.277	21.277		
		25A	26.638	26.638		
	50A	20A	21.5011	21.5011		
		40A	42.252	42.252		
		50A	52.358	52.358		
	150A	60A	60.3635	60.3635		
		105A	107.296	107.296		

THE OUT OF TOLERANCE CONDITION HAS NO EFFECT ON THE VALIDITY OF PREVIOUS TEST RESULTS OR ON THE ACCEPTABILITY OF ITEMS PREVIOUSLY TESTED SINCE THE ERROR WAS KNOWN AND CORRECTION FACTORS WERE APPLIED IN ADDITION TO INDICATED VALUES RESULTING ACTUAL VALUES WERE HIGHER THAN IN MORE CONSERVATIVE TESTING.

P.G. Shaw

Recalibration cycle will be increased to each 6 months when appropriate potentiometer's are installed for adjustments. Until then, P.G. Shaw correction factors will be used.

Form #400 ASSETS USED Empro HA150-100, 9502, 8143

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	700RAG-1	**SERIAL NO.**	740697-3
INSTRUMENT	Ammeter	**MANUFACTURER**	Rockbestos

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-8 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaria (QA)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

CAL DUE 4-86

TEST REPORT

358086 8

TEST INST.: ammeter
PROC. NO. Common Data MFR. Rockbestos MODEL 700 RAG-1 SER. No. 140697-3
TESTED BY JB/WH DATE 4-22-85 ACCEPTED BY [signature] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	25A	10A	10.4507	10.4507		
		20A	21.3079	21.3079		
		25A	26.8796	26.8796		
	50A	20A	20.8714	20.8714		
		40A	42.5825	42.5825		
		50A	53.8279	53.8279		
	150A	60A	59.7654	59.7654		
		105A	107.355	107.355		

THE OUT OF TOLERANCE CONDITION HAS NO EFFECT ON THE VALIDITY OF PREVIOUS TEST RESULTS IN THAT THE ERROR ON THE ACCEPTABILITY OF ITEMS PREVIOUSLY TESTED SINCE THE WAS KNOWN AND CORRECTION FACTORS WERE APPLIED TO ADDITIONAL, ACTUAL VALUES WERE HIGHER THAN INDICATED VALUES RESULTING IN MORE CONSERVATIVE TESTING

[signature]

Recalibration cycle will be increased to each 6 months when appropriate potentiometers for adjustment are installed. Until then, correction factors will be used.

Form #400 ASSETS USED Empro HA150-100, 9502.8143

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	700RAG-1	**SERIAL NO.**	740647-4
INSTRUMENT	Ammeter	**MANUFACTURER**	Rockbestos

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-9 Dated 4-22-85

Due 4-86

Certified by: W.H./J.B.

Barbara DeMaria (QA)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

CAL DUE 4.86

TEST REPORT

358086 9

TEST INST.: ammeter
PROC. NO. Commercial MFR. Rockwell MODEL 700RAB-1 SER. No. 740647-4
TESTED BY JB/WH DATE 4-22-85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	25A	10A	10.4356	10.4356		
		20A	20.9315	20.9315		
		25A	26.322	26.322		
	50A	20A	21.0213	21.0213		
		40A	41.6529	41.6529		
		50A	52.3285	52.3285		
	150A	60A	61.0249	61.0249		
		105A	107.0561	107.0561		

THE OUT OF TOLERANCE CONDITION HAS NO EFFECT ON THE VALIDITY OF PREVIOUS TEST RESULTS OR ON THE ACCEPTABILITY OF ITEMS PREVIOUSLY TESTED SINCE THE ERROR WAS KNOWN AND CORRECTION FACTORS WERE APPLIED IN ADDITION ACTUAL VALUES WERE HIGHER THAN INDICATED VALUES RESULTING IN MORE CONSERVATIVE TESTING.

RG

Recalibration cycle will be increased to each 6 months when appropriate potentiometers for adjustments are installed. P.G. Short
Until then, correction factors will be used.

Form #400 ASSETS USED Empro HA150-100, 9502, 8143

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	700RAG-1	**SERIAL NO.**	740697-5
INSTRUMENT	Ammeter	**MANUFACTURER**	Rockbestos

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-10 Dated 4-26-85

Due 4-86

Certified by: J.B.

Barbara DeMarco (QAS)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS, INC.

CAL DUE 4.86

TEST REPORT

35808610

TEST INST.: ammeter
PROC. NO. commercial MFR. Rockwell MODEL 700RAG-1 SER. No. 7401497-5
TESTED BY JB DATE 4.26.85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	25A	10A	10.4	10.4		
		20A	20.8	20.8		
		25A	26.2	26.2		
	50A	20A	20.6	20.6		
		40A	41.48	41.48		
		50A	52.46	52.46		
	150A	60A	60.87	60.87		
		105A	107.9	107.9		

Form #400 ASSETS USED Empro HA 150-100, 9502, 8143

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	700RAG-1	**SERIAL NO.**	740697-6
INSTRUMENT	Ammeter	**MANUFACTURER**	Rockbestos

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-11 Dated 4-22-85

Due 4-86

Certified by: J.B.

Barbara D'Maria (QAS)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

CAL DUE 4.86

TEST REPORT

35808611

TEST INST.: ammeter
PROC. NO. Commondata MFR. Rockwell MODEL 700RAG-1 SER. No. 740697-6
TESTED BY JB DATE 4.22.85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	25A	10A	10.4657	10.4657		
		20A	20.8863	20.8863		
		25A	26.0815	26.0815		
	50A	20A	21.4112	21.4112		
		40A	41.6229	41.6229		
		50A	51.848	51.848		
	150A	60A	61.8946	61.8946		
		105A	107.655	107.655		

Form #400 ASSETS USED Empro HA150-100, 9502, 8143

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	700RAG-1	**SERIAL NO.**	740697-7
INSTRUMENT	Ammeter	**MANUFACTURER**	Rockbestos

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-12 Dated 4-26-85

Due 4-86

Certified by: J.B.

Barbara DeMaria (QAS)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

CAL DUE 4-86

TEST REPORT

35808612

TEST INST.: ammeter
PROC. NO Common data MFR. Rockwell MODEL 700 RAG-1 SER. No. 740697-7
TESTED BY JB DATE 4-26-85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	25A	10A	10.21	10.21		
		20A	20.42	20.42		
		25A	25.75	25.75		
	50A	20A	20.48	20.48		
		40A	40.9	40.9		
		50A	51.6	51.6		
	150A	60A	59.675	59.675		
		105A	106.15	106.15		

Form #400 ASSETS USED Empro HA150-100, 9502, 8143

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	RFT	**SERIAL NO.**	7176795
INSTRUMENT	Temp. Indicator	**MANUFACTURER**	Partlow

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-13 Dated 4-22-85

Due 4-86

Certified by: P.G.

Barbara DeMaio

Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL

CAL DUE 4.86

TEST REPORT

85808613

TEST INST.: Temp Indicators
PROC. NO. manual MFR. Fluke MODEL RFT SER. No. 7176795
TESTED BY RJG DATE 4.22.85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	100-200°C	100	102.9	102.9		
		150	151.9	151.9		
		200	204.3	204.3		

Form 8100 ASSETS USED [illegible]

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	RFT	SERIAL NO.	7176796
INSTRUMENT	Temp. Indicator	MANUFACTURER	Partlow

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-14 Dated 4-22-85

Due 4-86

Certified by: P.G.

Barbara DeMarino
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	23112		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4-86

TEST REPORT

35808614

TEST INST.: temp indicator
PROC. NO. manual MFR. Partlow MODEL RFT SER. No. 7176796
TESTED BY PJG DATE 4-22-85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	85-185°C	85°	86.2	86.2		
		136°	138.1	138.1		
		185°	186.4	186.4		

Form #400 ASSETS USED 8256

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	RFT	**SERIAL NO.**	3176797
INSTRUMENT	Temp. Indicator	**MANUFACTURER**	Partlow

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-15 Dated 4-22-85

Due 4-86

Certified by: P.G.

Barbara DeMaina

Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4.86

TEST REPORT

35808615

TEST INST.: temp indicator
PROC. NO. manual MFR. Partlow MODEL RFT SER. No. 3176197
TESTED BY RJG DATE 4.22.85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.
	70-190°C	70°	70.4	70.4	
		121°	122.3	122.3	
		190°	191.6	191.6	

Form #400 ASSETS USED 8256

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	RFT	SERIAL NO.	7266667
INSTRUMENT	Temp. Indicator	MANUFACTURER	Partlow

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-16 Dated 4-22-85

Due 4-86

Certified by: P.G.

Barbara DeMaria

Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4·86

TEST REPORT

35808616

TEST INST.: temp indicator
PROC. NO. manual MFR. Partlow MODEL RFT SER. No. 7266667
TESTED BY PJG DATE 4·22·85 ACCEPTED BY [illegible] DATE 4/22/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	60-160°C	60°	61.9	61.9		
		110°	112.7	112.7		
		160°	162.8	162.8		

Form #400 ASSETS USED 8256

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	260-7	**SERIAL NO.**	712397
INSTRUMENT	VOM	**MANUFACTURER**	Simpson

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-19 Dated 4-22-85

Due 4-86

Certified by: W.H.

Barbara DeMaio (BAD)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4.86

TEST REPORT

35808619

TEST INST.: VOM
PROC. NO. manual MFR. Simpson MODEL 260-7 SER. No. 712397
TESTED BY WH DATE 4.22.85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.
	DCV	1v	1.001	1.001	
		2.5v	2.507	2.507	
		10v	10.00	10.00	
		50v	50.00	50.00	
		250v	250.0	250.0	
		500v	500.0	500.0	
		1000v	1000	1000	
	-DCV	-10v	-10.01	-10.01	
	ACV	2.5v	INOP	INOP	*
		10v			*
		50v			*
		250v			*
		500v			*
	50uA/250mv	50uA	50.00	50.00	
		250mv	252.4	252.4	
	DCmA	1mA	1.015	1.006	
		10mA	10.25	10.06	
		100mA	101.5	99.8	
		500mA	507.5	499.8	
	10A	1A	1.01	1.00	
	RX1	10Ω	9.5	9.5	
		100Ω	100	100	
	RX100	1KΩ	10	10	
		10KΩ	100	100	
	RX10,000	100KΩ	10	10	
		1MΩ	100	100	

Form #400 ASSETS USED 8464

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	710-1	**SERIAL NO.**	7962-00
INSTRUMENT	AC Volt Test Set	**MANUFACTURER**	Hipotronics

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-23 Dated 4-22-85

Due 4-86

Certified by: J.B./W.H.

Barbara DeMaio QAS
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4.86

TEST REPORT

35808623

TEST INST.: AC test set
PROC. NO. manual MFR. Hipotronics MODEL 710-1 SER. No. 79677-00
TESTED BY JB/WH DATE 4.22.85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.
	2.5KV	.5 KV	.4890	.4996	
		1.5KV	1.5099	1.4907	
		2.5KV	2.521	2.487	
	5KV	1 KV	.9573	.9695	
		3KV	2.974	2.987	
		5KV	4.950	4.970	
	10KV	2KV	1.911	1.892	
		7KV	6.939	6.951	
		10KV	9.753	9.889	

Form #400 ASSETS USED 5236, 9502

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	4287	**SERIAL NO.**	1824344
INSTRUMENT	Kelvin Bridge	**MANUFACTURER**	Leeds & Northrup

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-37 Dated 4-24-85

Due 4-86

Certified by: W.H.

Barbara DeMaria (QA)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

TEST REPORT

35808637

CAL DUE 4·86

TEST INST.: Kelvin bridge
PROC. NO. manual MFR. L & N MODEL 4287 SER. No. 1824344
TESTED BY WH DATE 4.24.85 ACCEPTED BY [illegible] DATE 4/24/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	OHMS					
	10^{-4}	.6664Ω	.6650	.6650		
	10^{-3}	9.98mΩ	9.9795	9.9795		
	10^{-2}	.1001Ω	.1000	.1000		
	10^{-1}	.9999Ω	1.0001	1.0001		
	1	.9999Ω	1.000	1.000		
		9.998Ω	9.9995	9.9995		
	10	99.997Ω	99.985	99.985		

Form #400 ASSETS USED 8143, 3391, 3404, 3354, 4122

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	1864	**SERIAL NO.**	2311
INSTRUMENT	I R Set	**MANUFACTURER**	General Radio

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 o and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-40 Dated 4-24-85

Due 4-86

Certified by: W.H.

Barbara DeMaria QAS
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

Zockbestos

PO. 15074/NH

Cal Due 4-86

EIL INSTRUMENTS INC.

TEST REPORT

358086-40

TEST INST.: I.R. Set

PROC. NO. Mfgs Manual MFR. Gen. Radio MODEL 1864 SER. No. 2311

TESTED BY WH DATE 4-24-85 ACCEPTED BY [illegible] DATE 4-30-85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	OHMS					
	100KΩ	50KΩ	.5 (x100K)	.5 (x100K)		
		100KΩ	1 (x100K)	1 (x100K)		
	1MΩ	1MΩ	1MΩ	1MΩ		
	10MΩ	19.98MΩ	2.0 (x10M)	2.0 (x10M)		
	100MΩ	1.013GΩ	10 (x100M)	10 (x100M)		
	1GΩ	1.013GΩ	1GΩ	1GΩ		
	10GΩ	9.97GΩ	1 (x10G)	1 (x10G)		
	100GΩ	98GΩ	1 (x100G)	1 (x100G)		
	1TΩ	1.047TΩ	1TΩ	1TΩ		
	1MΩ	4.5MΩ	4.5MΩ	4.5MΩ		
	10MΩ	19.98MΩ	2.0 (x10M)	2.0 (x10M)		
	100MΩ	1.013GΩ	10 (x100M)	10 (x100M)		
	1GΩ	1.013GΩ	1GΩ	1GΩ		
	10GΩ	9.973GΩ	1 (x10G)	1 (x10G)		
	100GΩ	98GΩ	1 (x100G)	1 (x100G)		

Form #400 Assets: 3779, 6780, 6781, 6782, 6776

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	RFT	**SERIAL NO.**	7176859
INSTRUMENT	Temp. Indicator	**MANUFACTURER**	Partlow

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-51 Dated 4-22-85

Due 4-86

Certified by: P.G.

Barbara DeMaina (QAS)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

CAL DUE 4·86

TEST REPORT

35808651

TEST INST.: temp. indicator
PROC. NO. manual MFR. Partlow MODEL RFT SER. No. 717-859
TESTED BY PJG DATE 4·22·85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	100 - 200°C	100°	99.4	99.4		
		122°	122.1	122.1		
		150°	151.8	151.8		
		200°	204.1	204.1		

Form #400 ASSETS USED 8256

EIL®
INSTRUMENTS, INC.

Rockbestos Company
P.O. 15074NH

Certificate of Calibration

MODEL NO.	595	**SERIAL NO.**	60501
INSTRUMENT	Chart Recorder	**MANUFACTURER**	Omega

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-60 Dated 4-25-85

Due 4-86

Certified by: W.H.

Barbara DeMarie (QAS)

Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

TEST REPORT

35808660

CAL DUE 4-86

TEST INST.: Chart recorder
PROC. NO. manual MFR. Omega MODEL 595 SER. No. 10301
TESTED BY WH DATE 4-24-85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.
	Lower range	1mv	1.004	1.004	
	1mv - 5v	2mv	2.004	2.004	
		5mv	5.010	5.010	
		10mv	10.020	10.020	
		20mv	20.02	20.02	
		50mv	50.05	50.05	
		100mv	100.0	100.0	
		200mv	199.9	199.9	
		500mv	499.8	499.8	
		1v	1.000	1.010	
		2v	2.000	2.000	
		5v	5.000	5.000	
	Middle range	1mv	1.000	1.002	
	1mv - 5v	2mv	1.998	2.000	
		5mv	4.999	5.001	
		10mv	10.000	10.002	
		20mv	19.95	19.98	
		50mv	49.88	50.05	
		100mv	99.88	100.1	
		200mv	199.0	199.0	
		500mv	498.0	499.0	
		1v	.993	.999	
		2v	1.987	2.000	
		5v	4.967	4.987	
	Upper range	1mv	1.001	1.001	
	1mv - 5v	2mv	2.002	2.002	
		5mv	5.010	5.010	
		10mv	10.03	10.03	
		20mv	20.03	20.03	
		50mv	50.06	50.06	
		100mv	100.06	100.06	
		200mv	200.0	200.0	
		500mv	500.0	500.0	
		1v	.998	.998	
		2v	1.998	1.998	
		5v	4.993	4.993	

Form #400 ASSETS USED 8464

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	0-160PSI	**SERIAL NO.**	354
INSTRUMENT	Pressure Gage	**MANUFACTURER**	Helicoid

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-75 Dated 4-26-85

Due 4-86

Certified by: W.H.

Barbara DeMaina (QS)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

TEST REPORT

CAL DUE 4.86

S5808675

TEST INST.: pressure gage
PROC. NO common data MFR. Helicoid MODEL 160psi SER. No. 354
TESTED BY WH DATE 4.26.85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	20-160psi	20psi	20	20		
		40psi	40	40		
		60psi	60	60		
		80psi	80	80		
		100psi	100	100		
		120psi	120	120		
		140psi	140	140		
		160psi	160	160		

Form #400 ASSETS USED 4784

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	0-160PSI	**SERIAL NO.**	355
INSTRUMENT	Pressure Gage	**MANUFACTURER**	Helicoid

Calibration traceable to The National Bureau of Standards has been accomplished on the above-hamed instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 C and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-76 Dated 4-26-85

Due 4-86

Certified by: P.G.

Barbara DeMaria (QA)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC

TEST REPORT

CAL DUE 4-86

85808676

TEST INST.: pressure gage
PROC. NO. commondata MFR. Helicoid MODEL 160 psi SER. No. 355
TESTED BY PJG DATE 4-26-85 ACCEPTED BY [illegible] DATE 4/29/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.
	20-160 psi	20 psi	19	19	
		40 psi	40	40	
		60 psi	60	60	
		80 psi	82	82	
		100 psi	102	102	
		120 psi	122	122	
		140 psi	143	143	
		160 psi	163	163	

Form #400 ASSETS USED 4784

Rockbestos Company
P.O. 15074NH

EIL®
INSTRUMENTS, INC.

Certificate of Calibration

MODEL NO.	N/A	SERIAL NO.	96576
INSTRUMENT	Thermometer	MANUFACTURER	Ertco

Calibration traceable to The National Bureau of Standards has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request.

Calibration Report No. 358086-77 Dated 4-26-85

Due 4-86

Certified by: W.H.

Barbara DeMaina (for)
Quality Assurance Manager

Traceability Data:

N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz.
Resistance	231129		Boulder, Co.
Capacitance	231031	Inductance	230390

Form 401, Rev. 10/83

EIL
INSTRUMENTS INC.

TEST REPORT

CAL DUE 4-86

85808677

TEST INST.: thermometer
PROC. NO. Commondata MFR. Ertco MODEL — SER. No. 96576
TESTED BY LLH DATE 4-26-85 ACCEPTED BY [illegible] DATE 4/30/85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	0-90°C	0°	0	0		
		89.9°	90	90		

Form #400 ASSETS USED 8256

EIL®
INSTRUMENTS, INC.

Rockbestos Co.

P.O.#15074 NH

Certificate of Calibration

MODEL NO.	2702S2-1-4-R	**SERIAL NO.**	840424044-2S
INSTRUMENT	Recorder	**MANUFACTURER**	Malytek

Calibration traceable to The National Bureau of Standards in accordance with MIL-STD-45662 has been accomplished on the above-named instrument by comparison with standards maintained by E.I.L. Instruments. The accuracy and stability of all standards maintained by E.I.L. Instruments are traceable to national standards maintained by The National Bureau of Standards in Washington, D.C. and Boulder, Colorado. Calibration was accomplished at a temperature of 23 ° and at a relative humidity of L 50 per cent.

Complete record of all work performed is maintained by E.I.L. Instruments and is available for inspection upon request. The instrument was/was not out of tolerance when initially received by E.I.L. Instruments, Inc.

Calibration Report No. 358352 Dated 5-20-85

Certified by: W.H. Barbara DeMaria (QA)
Quality Assurance Manager

Traceability Data:
N.B.S. Test Report Numbers

D.C. Voltage	230514	A.C. Voltage	229434
D.C. Current	230514	A.C. Current	227237
	230537	Frequency	WWVB 60Khz
Resistance	231129	Boulder, Co.	
Capacitance	231031	Inductance	230390
Temperature	229053		

Form 401, Rev. 1/85

Rockbestos
PO# 15074NH
CAL Due 5-86

EIL
INSTRUMENTS INC.

TEST REPORT

358352

TEST INST.: Recorder
PROC. NO Common Data MFR. Molytek MODEL 270252-I-4-R SER. No. 8406234044-25
TESTED BY W.H. DATE 5-20-85 ACCEPTED BY [illegible] DATE 5-30-85

PROC. STEP NO.	FUNCTION TESTED	NOMINAL VALUES	MEASURED VALUES AS FOUND	MEASURED VALUES AS LEFT	OUT OF TOL.	
	°F, Type "K"					
	CH1	32°	34.7°	32.1°		
		100°	102.6°	99.8°		
		200°	202.8°	200.1°		
		300°	302.9°	300.0°		
		400°	402.4°	399.8°		
	CH2	32°	34.2°	31.9°		
		100°	102.2°	99.7°		
		200°	202.6°	200.1°		
		300°	302.6°	299.9°		
		400°	402.3°	399.8°		
	CH3	32°	34.1°	32.0°		
		100°	102.3°	99.8°		
		200°	202.3°	200.0°		
		300°	302.3°	300.1°		
		400°	402.2°	399.8°		
	CH4	32°	33.8°	31.8°		
		100°	101.6°	99.8°		
		200°	202.2°	200.1°		
		300°	302.2°	299.9°		
		400°	401.6°	399.7°		
	CH5	32°	33.7°	32.0°		
		100°	101.6°	99.8°		
		200°	202.0°	200.2°		
		300°	301.7°	300.0°		
		400°	401.6°	399.7°		
	PSI Transducer	5 psi	5.0 psi	5.0 psi		
		10 psi	9.9 psi	9.9 psi		
		15 psi	14.7 psi	14.7 psi		
		25 psi	24.6 psi	24.6 psi		
		45 psi	44.6 psi	44.6 psi		
		85 psi	84.6 psi	84.6 psi		
		105 psi	104.5 psi	104.5 psi		
		125 psi	124.7 psi	124.7 psi		
		145 psi	144.8 psi	144.8 psi		
		165 psi	165.0 psi	165.0 psi		
		185 psi	185.2 psi	185.2 psi		
	Calibrated with Hydronics model TH2 pressure Transducer SN# 010493					

Form #400 Assets. # 4784, 8146

KAUFMAN INSTRUMENT LABORATORY
DIV. OF TECHNIFAB INDUSTRIES, INC.
CHIMNEY SQUARE SUITE 1A
1128 DIXWELL AVENUE HAMDEN, CT 06514
TEL. 776-7201

SALES AND SERVICE
SIMPSON

STANDARDIZING
LABORATORY

24 May, 1983

Subject: L & N Mod. 8690 Millivolt Potentiometer, s/n 1602248
Mfg. Rated Accuracy: Per Manual
Deviation When Tested: None
Submitted By: CEROCK WIRE & CABLE
Activity: Certification
Test No: 33952

Standard: R.F.L. Model 1605, s/n 144, certified to an accuracy of .02% of actual reading, directly traceable to N.B.S. 5 June, 1982, Due: 5 June, 1983.
Ref. N.B.S. Test Nos:
Standard Cell Test # 230273
Source: N.B.S. Date:4/12/83 Due: 4/12/84
Current Transfer: # 521/222331
Voltage: # 521/222331
Res. Standard: # 221.01/220188

Our calibration system complies with MIL-STD-45662.

Tests were conducted at an ambient temperature of 70° F. and 48% relative humidity.

The subject item was calibrated within the manufacturers specications.

By: _____

KAUFMAN INSTRUMENT LABORATORY

THE ROCKBESTOS COMPANY

NEW HAVEN, CONNECTICUT 06504 USA TELEPHONE: (203) 772-2250 TELEX: 710-465-2149

Calibrated By: R.G. [illegible]

AUG 29, 1984 **Date**

Equipment: STOPWATCH (DEPARTMENT STANDARD)

Manufacturer: ACCUSPLIT

Model: 460

Serial #: B39427

CWC #:

Scale: 0.0 - 59.999 min

Location:

±2.5 **% Maximum Allowable Error**

-0.1 **% Maximum Measured Error**

Remarks: NEW DEPARTMENT STANDARD FIRST OR INITIAL CALIBRATION

Standards Used:

WWV TRANSMISSION - DIRECT FROM NBS - CONTINUOUS

STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR	STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR
MINS	MINS						
1.0	0.999	-0.001	-0.1				
2.0	2.001	+0.001	+0.05				
3.0	3.000	0.000	0				
4.0	4.000	0.000	0				
5.0	5.001	+0.001	+0.02				
10.0	10.000	0.000	0				
15.0	14.998	-0.002	-0.013				
30.0	30.000	0.000	0				
45.0	45.001	+0.001	+0.002				
60.0	59.999	-0.001	-0.0016				
7							

THE ROCKBESTOS COMPANY

NEW HAVEN, CONNECTICUT 06504 USA TELEPHONE: (203) 772-2250 TELEX: 710-465-2149

Calibrated By: RG Sh

MAY 23, 1985 Date

Equipment: DIGITAL pH METER

Manufacturer: ORION RESEARCH

5.0 % Maximum Allowable Error

0 % Maximum Measured Error

Model: 501

Serial #: 48229

CWC #:

Scale: 0-14 pH 0°C - 80°C

Location: AUTOCLAVE

Remarks: CALIBRATED BEFORE EACH USE.

Standards Used:

BUFFER pH 10.00
STANDARD BUFFER SOLUTION

TEMP OF BUFFER SOLUTION = 25.6°C

STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR	STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR
10.00@ 25°C	10.00	0	0				

THE ROCKBESTOS COMPANY

NEW HAVEN, CONNECTICUT 06504 USA TELEPHONE: (203) 772-2250 TELEX: 710-465-2149

Calibrated By: R.G. [illegible]

1/4/85 Date

Equipment: TYPE K THERMOCOUPLES

Manufacturer: OMEGA

Model: TYPE K

Serial #: TH1 - TH5 + TH1111

CWC #:

Scale:

Location: AUTOCLAVE

±5.0 % Maximum Allowable Error

NONE % Maximum Measured Error

Remarks:

Standards Used:

LEEDS + NORTHRUP MILLIVOLT POTENTIOMETER
S/N 5690 S/N 1602248
ICE BATH + BOILING DISTILLED WATER

STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR	STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR
		TH1				TH 1111	
32°F	32°F	0	0	32°F	32°F	0	0
212°F	212°F	0	0	212°F	212°F	0	0
		TH2					
32°F	32°F	0	0				
212°F	212°F	0	0				
		TH3					
32°F	32°F	0	0				
212°F	212°F	0	0				
		TH4					
32°F	32°F	0	0				
212°F	212°F	0	0				
		TH5					
32°F	32°F	0	0				
212°F	212°F	0	0				

THE ROCKBESTOS COMPANY
NEW HAVEN, CONNECTICUT 06504 USA TELEPHONE: (203) 772-2250 TELEX 710-465-2149

Calibrated By: RA Gehm

Date: JAN 3, 1985

Equipment: CLAMP-ON ULTRASONIC FLOWMETER

Manufacturer: CONTROLOTRON

20.0 % Maximum Allowable Error

+ 6.3 % Maximum Measured Error

Model: 484N1AAT3

Serial #: 29C47B

CWC #:

Scale: -40 to +40 FT/SEC

Location: AUTOCLAVE MEZZ

Remarks: NEW EQUIPMENT

Standards Used:

STOPWATCH m/n 46C s/n B39427

STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR	STD. VALUE	TEST VALUE	DIFFER. FROM STD.	% ERROR
4.850 LITERS/min							
↓							
1.281 GAL/min	1.2 GAL/min	0.081	+ 6.34				