

H 04/07/78

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)
DISTRIBUTION FOR INCOMING MATERIAL 50-220

REC: CASE E G
NRC

ORG: DISE D P
NIAGARA MOHAWK PWR

DOC DATE: 04/03/78
DATE RCVD: 04/07/78

DOCTYPE: LETTER NOTARIZED: NO COPIES RECEIVED
SUBJECT: LTR 1 ENCL 1
FORWARDING TEST PLAN AND SPECIFICATION FOR LOCA ENVIRON SIMULATION TEST OF
ELEC PENETRATION CONNECTOR ASSEMBLIES USED AT SUBJECT FACILITY, UNIT 1, PHASE
II - REVISION 1, DTD 03/21/78...W/ATT SUPPORTING INFO.

PLANT NAME: NINE MILE PT - UNIT 1

REVIEWER INITIAL: XJM
DISTRIBUTOR INITIAL:

***** DISTRIBUTION OF THIS MATERIAL IS AS FOLLOWS *****

GENERAL DISTRIBUTION FOR AFTER ISSUANCE OF OPERATING LICENSE.
(DISTRIBUTION CODE A001)

FOR ACTION: BR CHIEF LEAR**W/7 ENCL

INTERNAL: REG FILE**W/ENCL
~~I & F**W/2 ENCL~~
HANAUER**W/ENCL
EISENHUT**W/ENCL
BAER**W/ENCL
GRIMES**W/ENCL
J. MCGOUGH**W/ENCL

NRC PDR**W/ENCL
OELD**LTR ONLY
CHECK**W/ENCL
SHAO**W/ENCL
BUTLER**W/ENCL
J COLLINS**W/ENCL

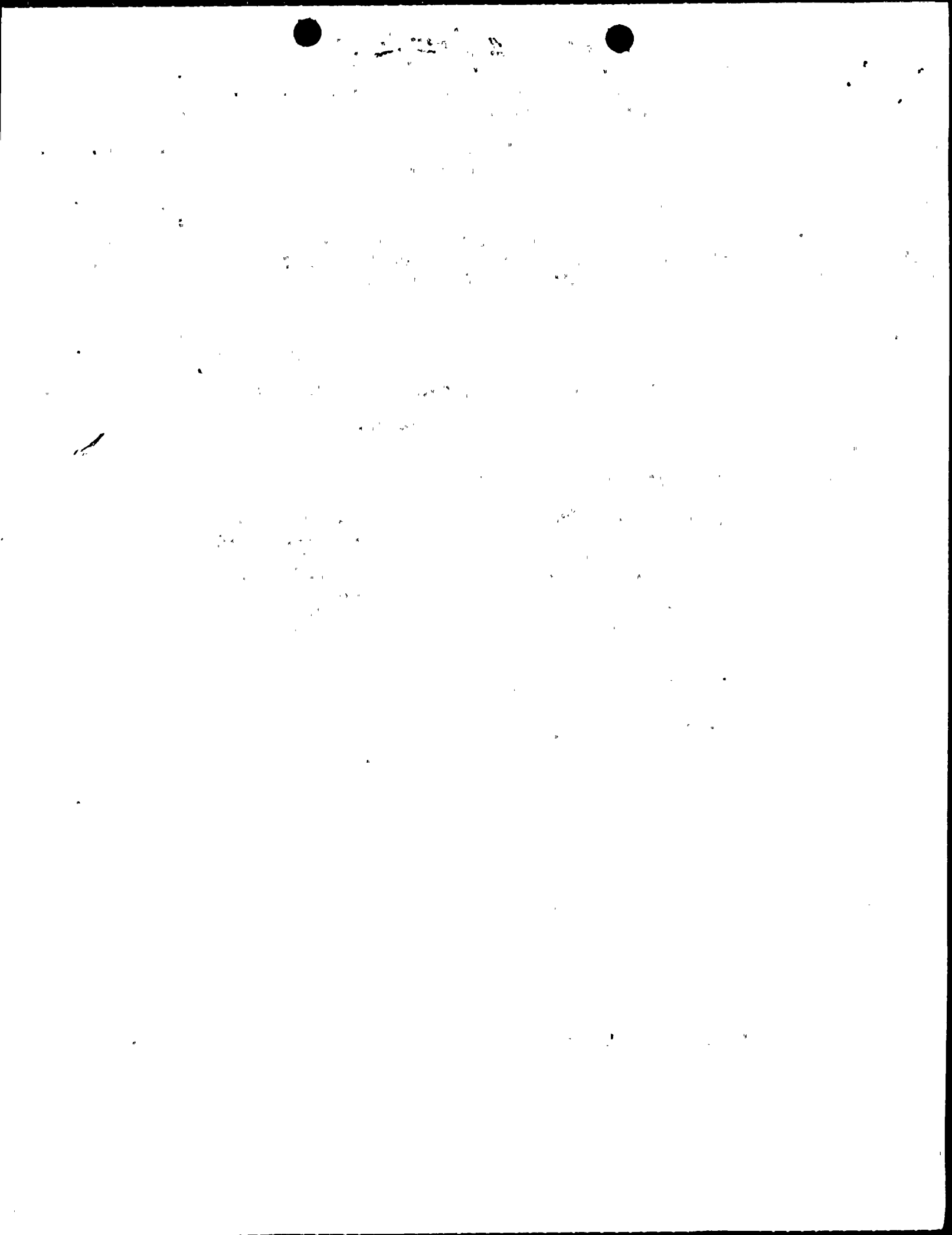
EXTERNAL: LPDR'S
OSWEGO, NY**W/ENCL
TIC**W/ENCL
NSIC**W/ENCL
ACRS CAT B**W/16 ENCL

DISTRIBUTION: LTR 40 ENCL 39
SIZE: 2P+9P+4P

CONTROL NBR: 780970027

***** THE END *****

2



April 3, 1978

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

US NRC
DISTRIBUTION SERVICES
BRANCH

1978 APR 7 AM 10 35

RECEIVED DISTRIBUTION
SERVICES UNIT

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Dear Mr. Case:

We have completed Phase II testing of the electrical connectors used at Nine Mile Point Unit 1. The test was performed in accordance with the "Test Plan and Specification for LOCA Environmental Simulation Test of Electrical Penetration Connector Assemblies Used at Nine Mile Point Nuclear Station Unit #1, Phase II, Revision 1, 3/21/78." The test plan, attached, was followed with three minor exceptions:

- 1) The actual temperature and pressure profiles were as close as practical and generally more conservative than the test plan.
- 2) The electrical connector used for "power" at Unit 1 was energized for the entire test. This was a more conservative test.
- 3) The thermocouple within the water at the bottom of the test "tee" was too far below the emersion heater to verify a high humidity condition. However, since the heater was near the surface of the water, it is believed that a high humidity condition was achieved.

In summary, the test of the Unit 1 "control" and "power" connectors verified their operability throughout a postulated Loss of Coolant Accident. This test included an exposure of 26 megarads, and two rapid rises in temperature and pressure to 300F and in excess of 43 psig, respectively. This was followed by 27.7 hours of decreasing temperatures and pressures to a final level of 115F and 5 psig. The "power" and "control" connectors are required to mitigate Loss of Coolant Accidents.

780970027

A001
5
11

Additionally, instrumentation connectors were tested for information. This type of connector is not required to mitigate accidents. During the test, resistance readings decreased to 10^5 ohms after 18 hours of elapsed time. These reduced levels are believed to be caused by an upset in the test. After 15 hours of elapsed time, the temperature of the water decreased. Hot water was added which caused a sloshing effect in the pipe "tee." It is believed that this upset reduced the resistance readings.

The systems which use the (4 conductor #16 AWG) instrumentation connector normally operate between 1. to 5 volts A.C. which is below that indicated in the worst case reduced condition. The connectors were checked with a megaohm meter at 10 volts or more during the test with a resistance of 0.66×10^5 or more. Therefore, these connectors would be expected to operate as designed.

Very truly yours,

NIAGARA MOHAWK POWER CORPORATION



Donald P. Dise
Vice President-Engineering

NLR/szd

Attachment

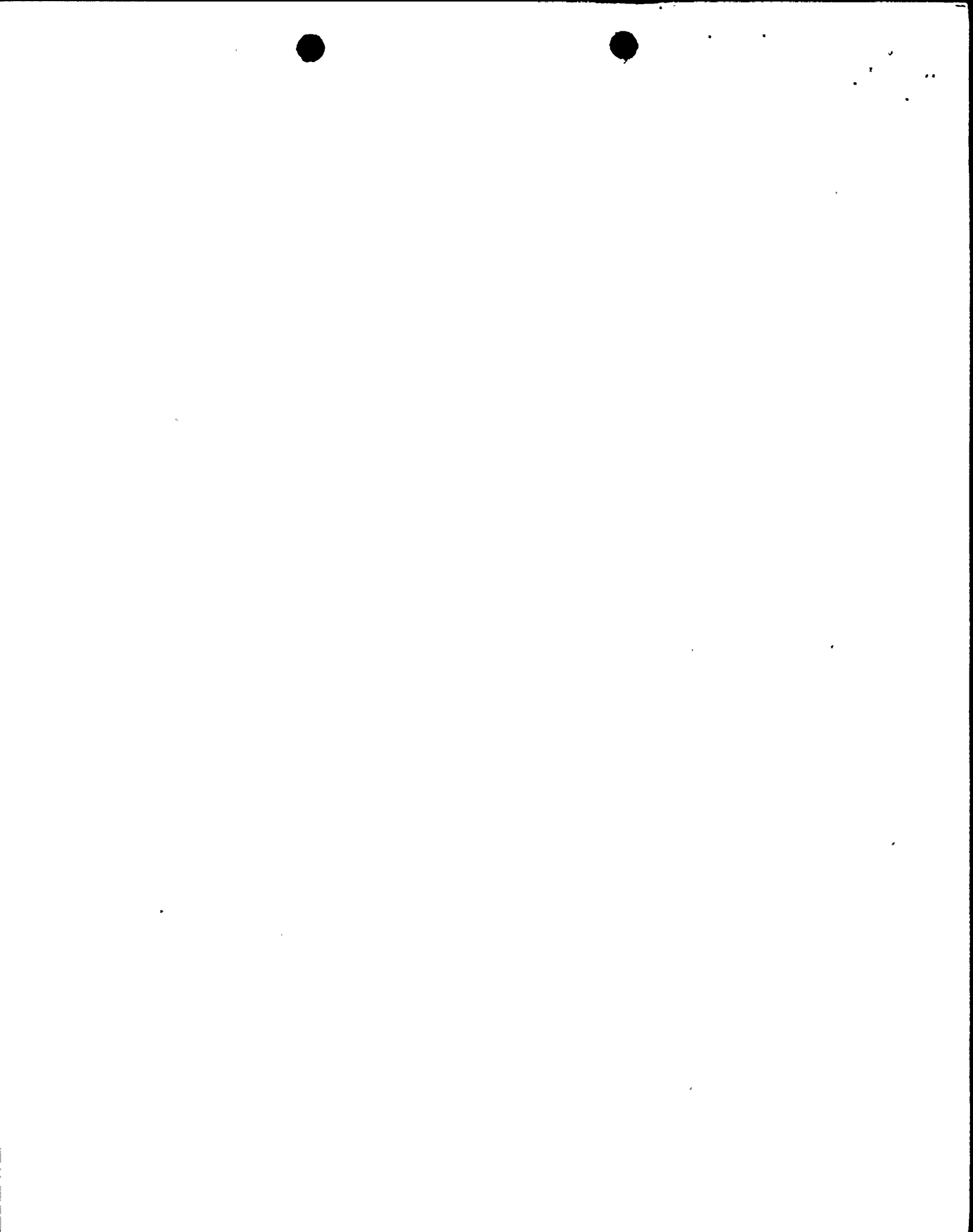


Handwritten marks in the top right corner, possibly initials or a signature.

TEST PLAN AND SPECIFICATION FOR
LOCA ENVIRONMENTAL SIMULATION TEST
OF
ELECTRICAL PENETRATION CONNECTOR ASSEMBLIES USED AT
NINE MILE POINT NUCLEAR STATION UNIT #1
PHASE II

REVISION 1

3/21/78



NINE MILE POINT NUCLEAR STATION UNIT #1
ELECTRICAL PENETRATION CONNECTOR ASSEMBLY
LOCA ENVIRONMENTAL SIMULATION TEST
PHASE II
FRANKLIN INSTITUTE RESEARCH LABORATORIES

1.0 Purpose

The purpose of this test program is to provide assurance that the containment electrical penetration connector assemblies at Nine Mile Point Nuclear Station Unit #1 will perform their intended electrical function during and subsequent to simulated environmental conditions resulting from a postulated loss of coolant accident.

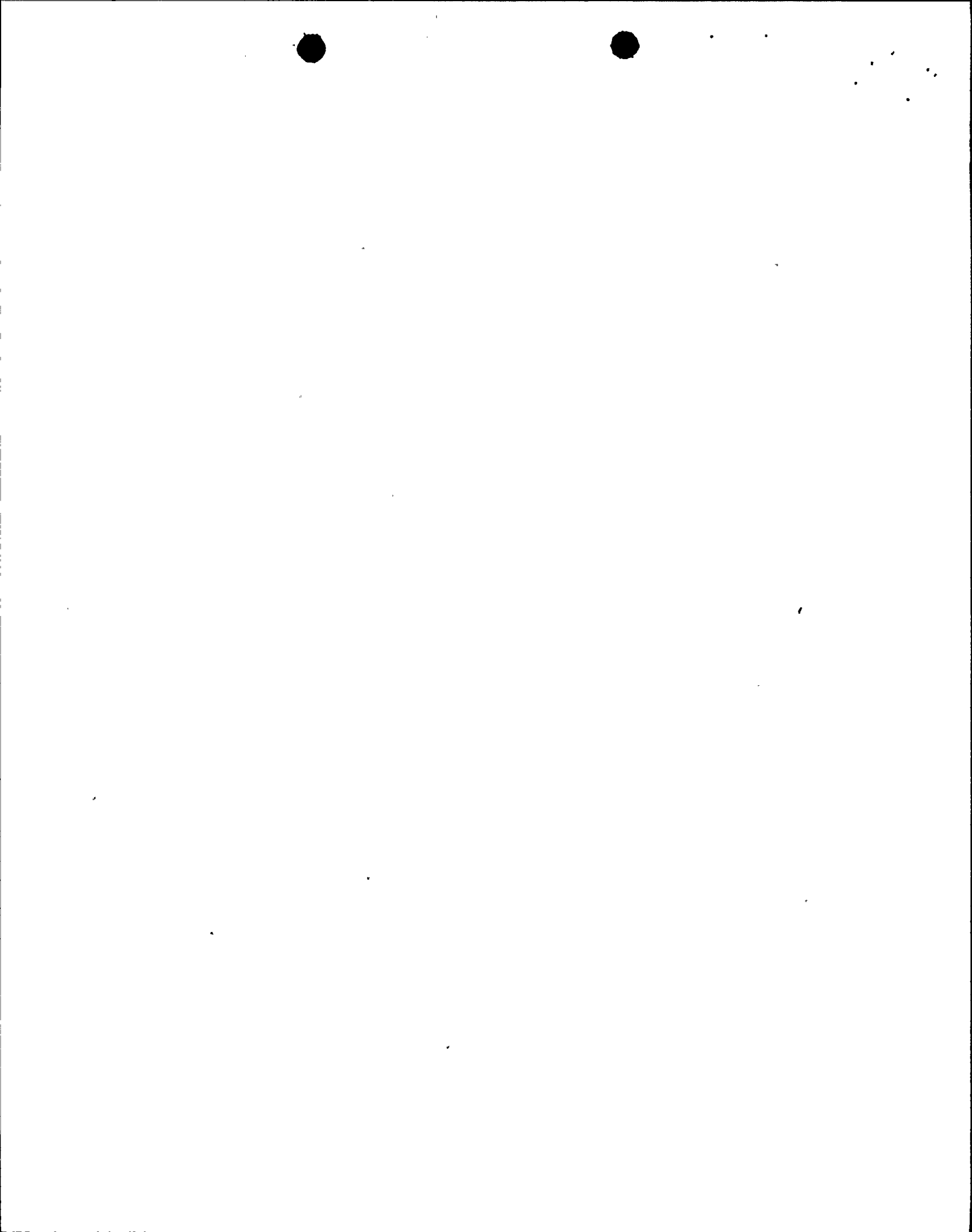
2.0 Scope

The penetration connector assemblies selected for test purposes are identical or similar in construction to those installed throughout the Nine Mile Point Unit #1 containment which are required to perform their intended electrical function during or subsequent to a loss of coolant accident. The simulated environmental conditions applied in this test include temperature, pressure, radiation and humidity. This test is intended to verify acceptable electrical performance of the connector assemblies.

3.0 Electrical Connector Assemblies to be Tested

3.1 Receptacles - manufactured by D. G. O'Brien, Inc. 600 volt rating.

<u>QUANTITY</u>	<u>MODEL NUMBER</u>	<u>NO. OF PINS</u>	<u>PIN SIZE (AWG)</u>
1	106-8-4P/HF	4	# 8
1	101-16-28P/HF	28	#16
1	106-16-19P/HF	19	#16
2	106-16-5P/HF2	5	#16



3.2 Plugs - manufactured by D. G. O'Brien, Inc. 600 volt rating.

<u>QUANTITY</u>	<u>MODEL NUMBER</u>	<u>NO. OF PINS</u>	<u>PIN SIZE (AWG)</u>	<u>FRONT INSULATOR</u>	<u>MIDDLE INSULATOR</u>	<u>REAR INSULATOR</u>
1	101-8-452	4	# 8	HDPE	HDPE	GMG
1	101-16-2853	28	#16	DIAL	DIAL	GMG
1	101-16-1953	19	#16	DIAL	DIAL	DIAL
2	101-16-554	5	#16	DIAL	NONE	GMG

Material Abbreviations: HDPE-High Density Polyethylene
GMG-Glass Impregnated Melamine
DIAL-Diallyl Phthalate

3.3 Cables - manufacturer-General Electric Co.

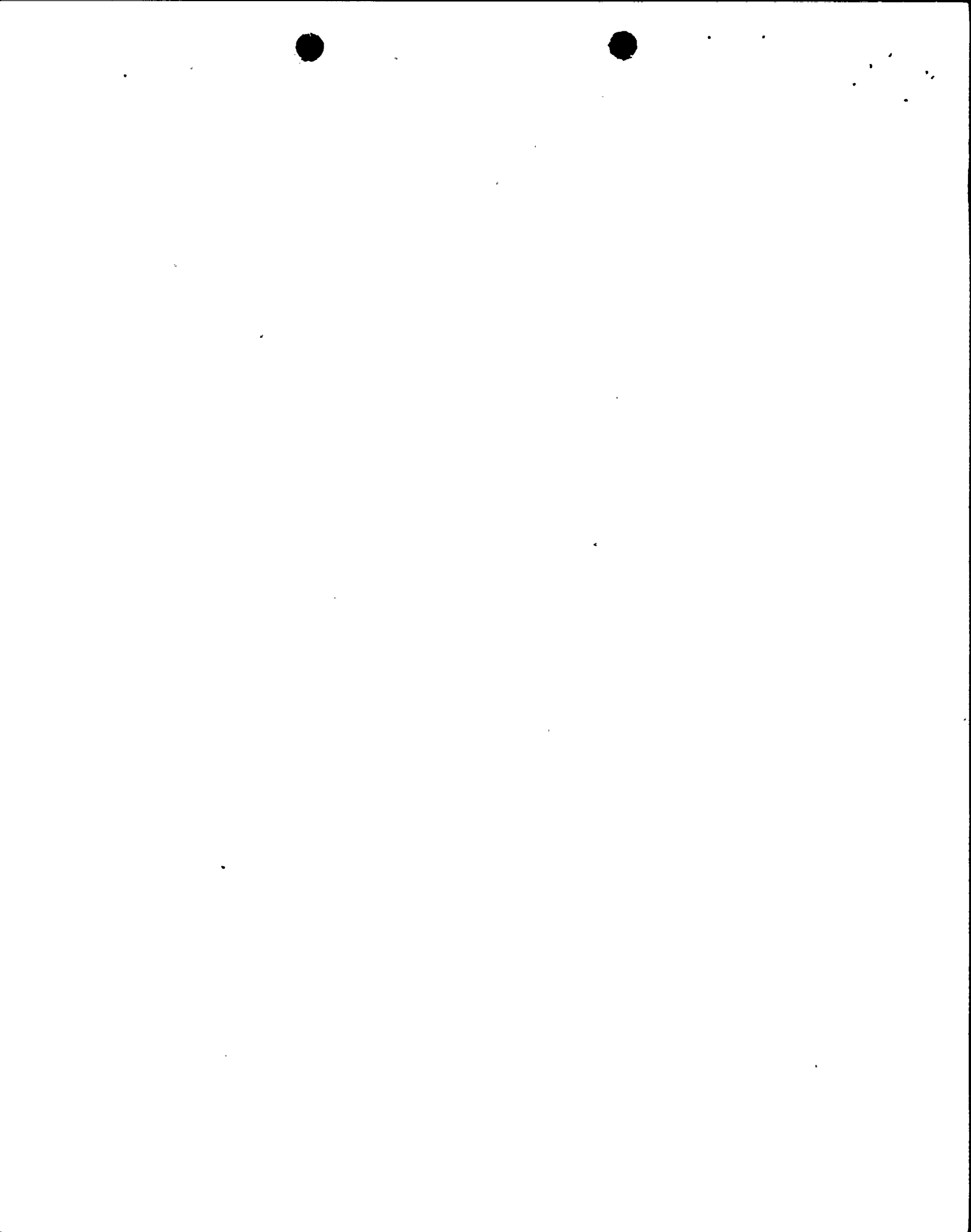
<u>NUMBER OF CONDUCTORS</u>	<u>CONDUCTOR SIZE (AWG)</u>	<u>INSULATION MATERIAL</u>	<u>JACKET MATERIAL</u>	<u>VOLTAGE RATING</u>
4	# 8	cross-linked polyethylene	polyvinyl chloride	600
7	#12	cross-linked polyethylene	polyvinyl chloride	1,000
4	#16	cross-linked polyethylene	polyvinyl chloride	600

3.4 Cable Support Material

Polyurethane - manufacturer-Products Research and Chemical Corp.
Heat Shrinkable Boot - manufacturer-Raychem

4.0 Test Chamber Preparation

4.1 A standard 12 inch diameter, 300 psi rated, pipe tee shall be utilized as the test chamber. Blind flanges shall be drilled in accordance with drawing EM-1 Revision 1. After drilling, blind flanges shall be bolted onto the pipe tee flanges in accordance with drawings.

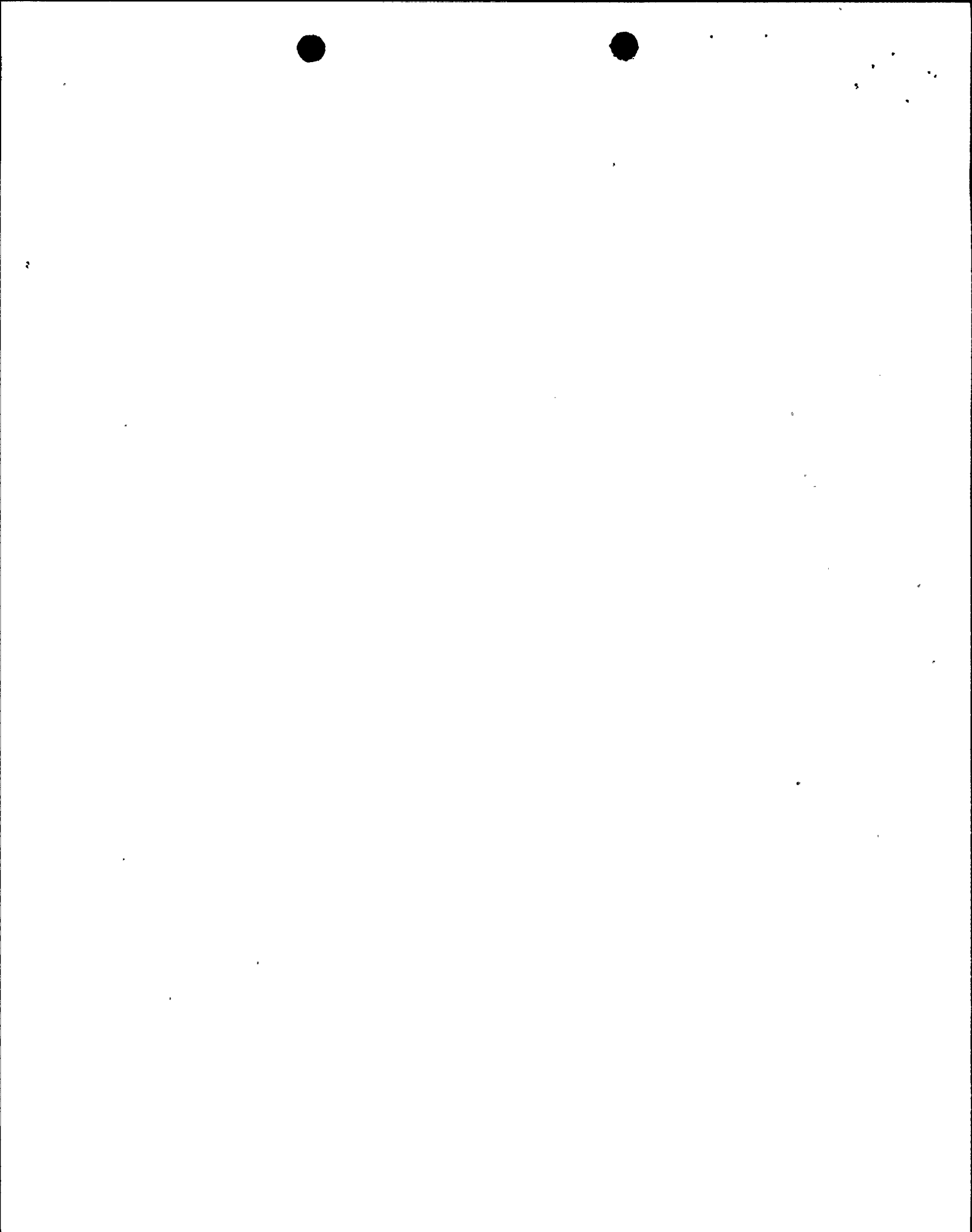


5.0 Pretest Insulation Resistance Readings and Radiation Pre-aging of Connector Assemblies

- 5.1 Assembled connectors received from the manufacturer shall be inspected for obvious physical damage and compliance to drawing EM-1 Revision 1.
- 5.2 Connector plugs and receptacles shall be cleaned in accordance with Appendix A to this procedure.
- 5.3 Connector plugs and receptacles shall be interconnected for the purpose of pretest I.R. readings. The insulation resistance of each pin shall be measured with respect to all other pins and the shell tied together and to a ground potential. Only the pins that have cable connections shall be considered for the purposes of insulation resistance tests. Insulation resistance readings shall take place after energization at 500 volts DC for one minute. If any readings less than 100 M-OHMS are measured, the suspect plug and receptacle shall be cleaned in accordance with Appendix A and retested until measurements of greater than 100 M-OHMS are obtained.
- 5.4 The connector assemblies shall be mounted in the flanges for the purposes of radiation aging. Flanges shall be mounted in the radiation cell in accordance with sketch RAD-1. The connectors shall be exposed to a minimum of 26 megarads.

The exposure shall be verified with the use of calibrated radiation monitors. The monitoring devices should be located as close as practical to the connectors so that they measure the actual exposure.

- 5.5 A visual inspection shall be performed after radiation pre-aging and any damage documented. Photographs of the connectors shall be made after the radiation exposure.
- 5.6 An insulation resistance test shall be performed on the connectors after the radiation exposure. The I.R. test shall be performed in accordance with Section 5.3 of this specification.
- 5.7 The connectors shall be mounted in the 300 psi pipe tee in accordance with drawing EM-1 Revision #1. Provisions shall be made within the test chamber for the injection and removal of steam, air, thermocouples and materials required to simulate the environmental conditions specified in Table 1.
- 5.8 The following test equipment and instrumentation is required for use as described in Section 6.0.
 - A. 500 volt megger
 - B. Continuous pen and multipoint recorders
 - C. Pressure gage(s)
 - D. Thermocouples or RTD's
 - E. 660V A.C. 3 phase voltage source
 - F. Saturated steam supply
 - G. Air supply
 - H. Strip and immersion heaters

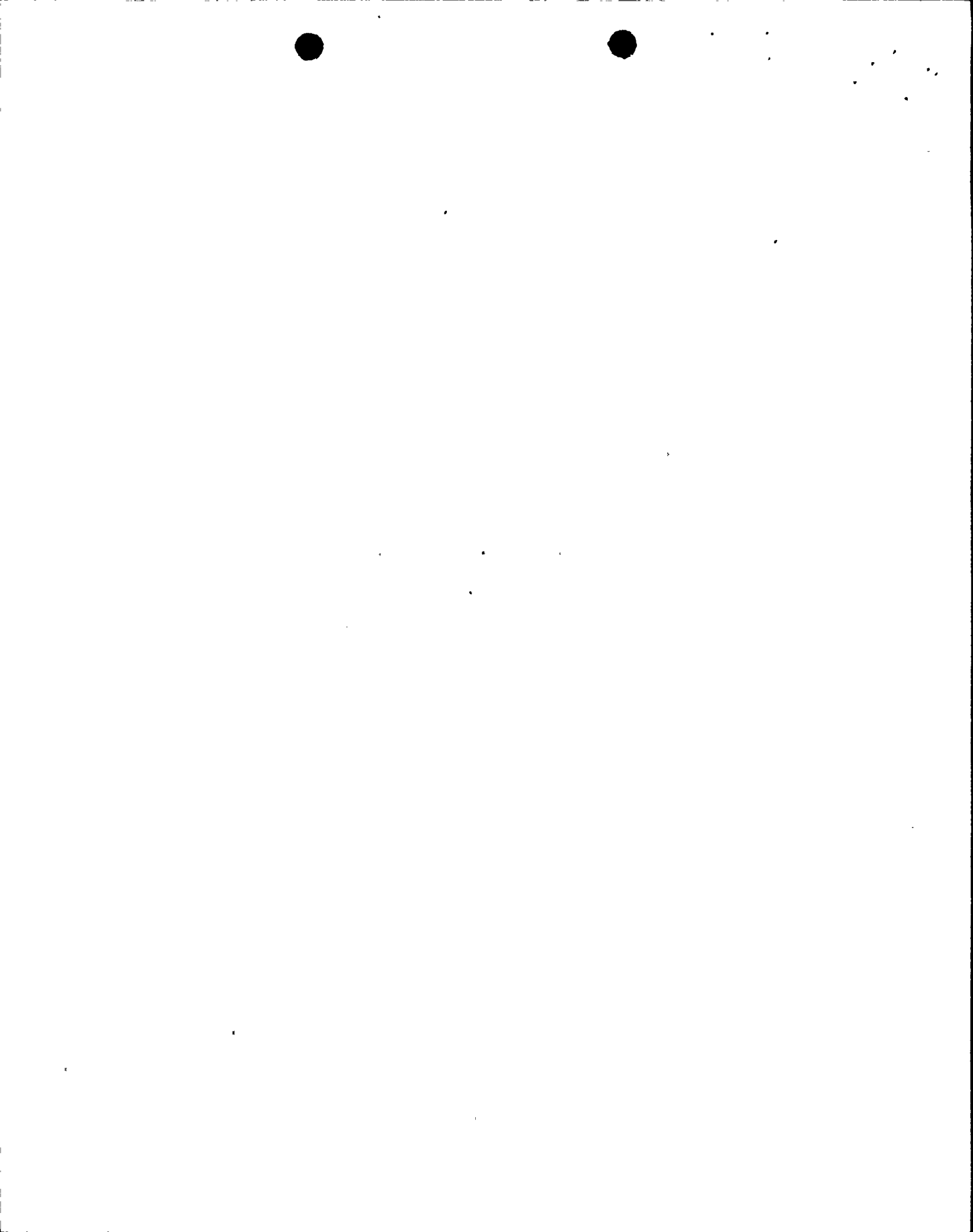


5.8 Continued

- I. Elapsed time clock
- J. Test chamber - 300 psi pipe tee
- K. 1 Amp circuit breaker
- L. Other equipment and instruments required to establish test conditions or monitor results

6.0 Test Procedure - LOCA Simulation

- 6.1 Conductor to conductor insulation resistance measurements shall be made at ambient conditions for base line data. The insulation resistance will be measured as indicated in Appendix B and Drawing EM-1, Revision 1.
- 6.2 The test chamber shall be elevated to the following approximate conditions (temperature 150°F, pressure 1.5 psig, humidity 100%). These conditions shall be maintained until temperature and pressure readings stabilize. Insulation resistance measurements shall be made for each cable for additional base line data. The insulation resistance will be measured as indicated in Appendix B and Drawing EM-1, Revision 1.
- 6.3 The LOCA temperature and pressure conditions shall be initiated by the addition of saturated steam, air and other means necessary to obtain required values. Humidity shall be maintained throughout the test by providing a means to maintain a level of water within the test chamber. The standing water shall be maintained at a higher temperature than the air in the chamber by an immersion heater within the test chamber water. Instrumentation shall be monitored to insure these test chamber conditions.
- 6.4 Every effort shall be made to actually follow the established temperature, pressure curves throughout the test. Any error should take place in the conservative direction (higher temperature and pressure, longer times).
- 6.5 Temperature and pressure shall be continuously recorded throughout the test to monitor required environmental conditions.
- 6.6 The following electrical tests and measurements shall be made throughout the LOCA simulation.
 - a) Energization of the 4 conductor #8 AWG cable at 660 volts 3 phase A. C. for approximately 30 seconds starting at the initiation of the first temperature pressure transient (see



6.6 Continued

the attached Table #1) and again for 400 seconds at the initiation of the second transient. Conductor to conductor voltage should be monitored and documented during these periods of energization to reveal any possible connector or cable failure (see Section 7.1). The voltages displayed on meters will be visually monitored. If any one energized conductor or pin should fault or cause a charging or leakage current drain in excess of 1.0 amps, a circuit breaker will activate removing all potentials. The operator will immediately attempt to re-energize the conductors. If not successful, the faulted conductor will be isolated and removed from the circuit; the remaining conductors will be re-energized. This process may require approximately 1-5 minutes. Upon completion of the second 30 second energization, insulation resistance measurements shall be recorded for information only for the remaining duration of the test. The insulation resistance will be measured as indicated in Appendix B and Drawing EM-1, Revision 1.

- b) Energization of the 7 conductor #12 AWG at 660 volts, 3 phase A. C. for the duration of the test except for those periods when measuring insulation resistance described below.
- c) Insulation resistance readings between conductors shall be measured with a 500 volt megger at the following times after test initiation. The insulation resistance will be measured as indicated in Appendix B and drawing EM-1 Revision 1.

Immediately following first transient	5 hours
400 seconds after second transient	10 hours
20 minutes	15 hours
40 minutes	20 hours
60 minutes	24 hours
2 hours	Immediately following test

The cable shall be de-energized for the insulation resistance test and re-energized after the readings are taken. The insulation resistance readings shall be documented with the corresponding time the readings were taken. Insulation resistance measurements are for information only.

- d) Throughout the duration of the test, the 4 conductor #16 AWG cable shall be measured for insulation resistance for information only at the times specified in 6.6c above.
- e) Upon completion of the test, the 4 conductor #8 AWG cable shall be energized at 660 volts 3 ϕ A.C. for a period of 60 seconds for information only. Voltage between conductors should be monitored for possible dielectric breakdown.



6.7 Throughout the test, any test irregularities or unusual occurrences shall be noted.

6.8 Upon test completion, connector assemblies shall be disassembled, examined, and their condition noted.

7.0 Acceptance Criteria

7.1 4 Pin #8 AWG Connector Assemble - Dielectric Breakdown (loss of voltage) of either the connector insulation or cable insulation during either of the first two periods of energization shall be considered failure of the test.

7.2 19 Pin #16 AWG and 28 Pin #16 AWG Connector Assembly - Dielectric Breakdown (loss of voltage) of either the connector or cable insulation during the period of energization shall be considered failure of the test.

7.3 5 Pin #16 AWG Connector Assembly - This connector is not required to function in order to mitigate an accident at Nine Mile Point Nuclear Station Unit #1. The test on this connector is being run for information only.

8.0 Test Failures and Retests

8.1 In the event there is an observed failure during the test, the test may be terminated or continued as determined by the Niagara Mohawk Power Corporation Engineer.

8.2 The cause of any failure shall be postulated after connector disassembly. FIRL will assist in the postulation.

8.3 A retest may be instituted after examination and replacement of any degraded materials. All parts shall be cleaned and prepared prior to any retest. The entire test sequence must be repeated if there is an initial test failure for valid test results.

9.0 Quality Assurance

9.1 The laboratory shall implement a well documented Quality Assurance program which meets all applicable portions of Appendix B to 10CFR50. Adequacy of FIRL QA program will be determined by NMPC.

9.2 The test program shall be conducted in accordance with the applicable portions of IEEE 323-1974 and IEEE 317-1976 unless otherwise specified.

9.3 Niagara Mohawk reserves the right to audit the QA Program and its implementation. Franklin Institute shall cooperate fully with such audits and shall grant Niagara Mohawk Representatives free access to all documents and work areas deemed necessary to perform thorough and meaningful audits, limited to areas and documents appropriate to this project. Furthermore, Franklin Institute shall act promptly to obtain Niagara Mohawk acceptance of remedial or corrective action required by nonconformances and shall implement the same promptly after receipt of Niagara Mohawk acceptance.



- 9.4 Niagara Mohawk Engineers or Inspectors shall have the right at any time to witness tests and inspect test equipment used or to be used in connection with the test program. Franklin Institute shall provide sufficient and safe facilities for such inspection.
- 9.5 Measures shall be implemented to assure test tools, gauges, instruments and other measuring and testing devices which may affect the test program are properly calibrated and adjusted at specified periods to maintain accuracy within necessary limits. All calibration shall be traceable to the National Bureau of Standards.
- 9.6 Franklin Institute shall furnish to Niagara Mohawk, or shall retain copies of all controlled documents such as calibration records and test results. Prior to disposal of these documents, Franklin Institute shall provide notice to Niagara Mohawk of the pending disposal and the right to claim the documents. FIRC will file records for 5 years or they may be delivered to NMPC.

10.0 Documentation

10.1 The following information and documentation shall be recorded and provided by Franklin Institute in a test report at the termination of the test program:

- A. Test Plan or equivalent
- B. Report of Test Results
 - 1. Objective
 - 2. Specific equipment used (including identification number)
 - 3. Description of the test facility and instrumentation used including calibration records reference
 - 4. Test Procedure including radiation pre-aging
 - 5. Test data and accuracy (results)
 - 6. Summary, conclusions and recommendations
 - 7. Supportive data
 - 8. Approval, signature and data
- C. Report and explanation of any test irregularities or unusual occurrences.

10.2 A "Quick Look" report shall be issued to Niagara Mohawk prior to the formal report within three working days of the test program completion. This report shall briefly describe the test, identify the results and a preliminary conclusion.



10.3 Photographs shall be taken prior to irradiation, after irradiation, after installation within the test chamber and after LOCA simulation testing.

10.4 All test data, test results, photographs (including negatives), test reports and related documentation shall become the sole property of Niagara Mohawk at the termination of the test program. None of this material shall be released to anyone without prior written approval of an authorized Niagara Mohawk Power Corporation Officer. FIRL will file records for 5 years or they may be delivered to NMPC.



APPENDIX A

RECEPTACLE AND PLUG ASSEMBLY CLEANING PROCEDURE

- 1) Trichloroethylene or freon shall be applied to the receptacle or plug face. The surface shall then be scrubbed with an acid brush.
- 2) Surface shall be rinsed with acetone or alcohol and dried with warm air (200°-300°F).
- 3) If acceptable insulation resistance values are not obtained, repeat procedure and evacuate receptacle while applying 200°-300°F heat to receptacle body.



Small horizontal marks or artifacts near the bottom center of the page.

APPENDIX B

THE FRANKLIN INSTITUTE
RESEARCH LABORATORIES
PHILADELPHIA, PA. 19103

PROJECT

SHEET OF

CLIENT

Niagara Mohawk Power Corporation

INSULATION
RESISTANCE
MEASUREMENTS

TEST PHASE OR PURPOSE OF MEASUREMENT

Phase II - IR During LOCA

CABLE TEMPERATURE AND TEST CONDITIONS

See temperature profile

MEASUREMENT INSTRUMENT

General Radio Model #1864 megohmmeter

DATE	OPERATOR	CLOCK TIME (2400)	ELAPSED TIME (HR)	SAMPLE NO.	CONDUCTORS ON TERMINALS		RESISTANCE (MEG OHMS)		REMARKS
					I (GROUND) Pin #	II Pin #	SCALE READING	SCALE MULTIPLIER	
				1/C #12	V	NRT			
					V	PSU			
					PSU	NRT			
				4/C #8	D	A			
					D	BC			
					BC	A			
				4/C #16	E	AB			
					E	C			
					C	AB			

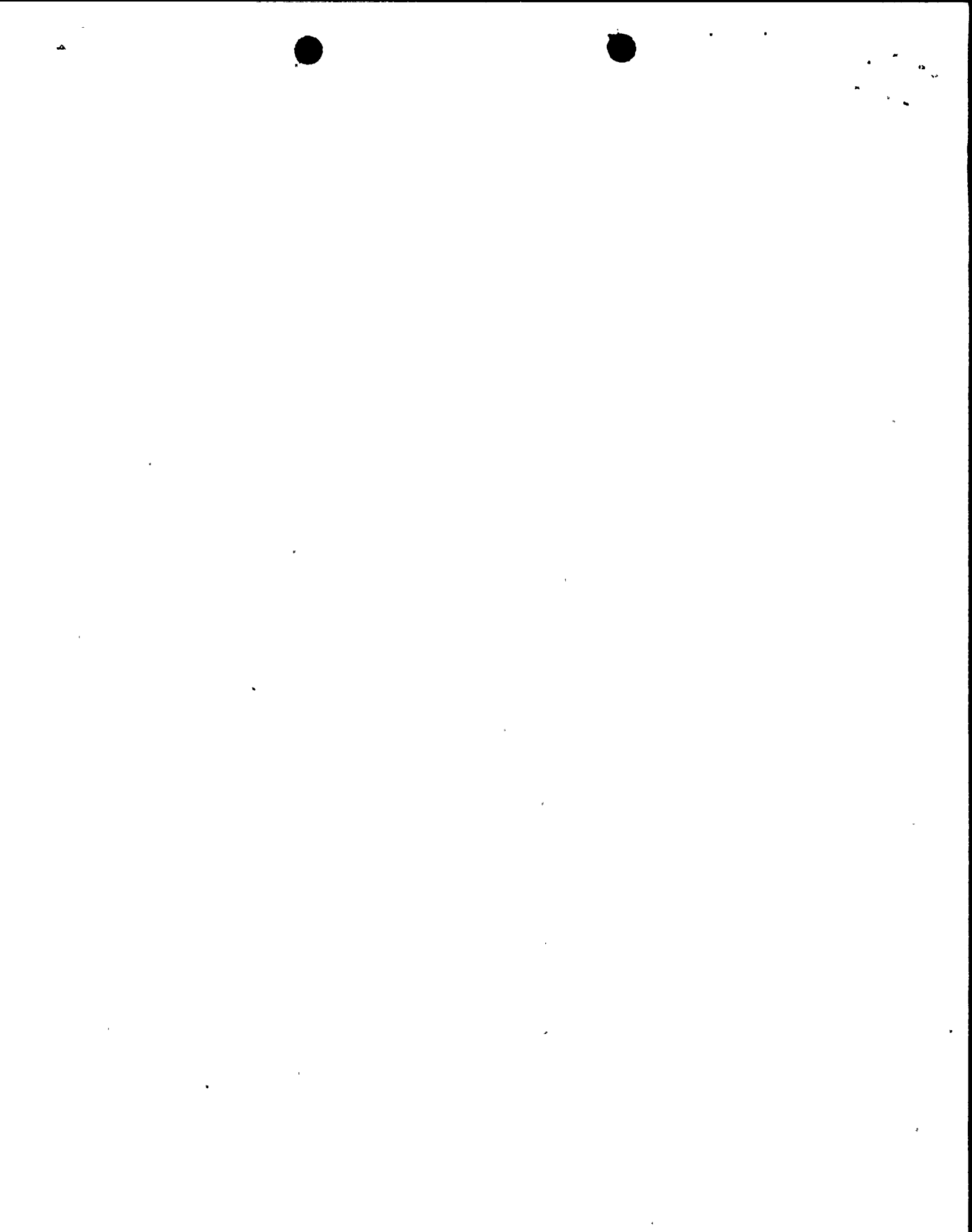
NOTES
All readings taken after 1 minute application of 500 VDC unless otherwise specified. See drawing EM-1, Rev. 1 for detailed connector-cable connections.

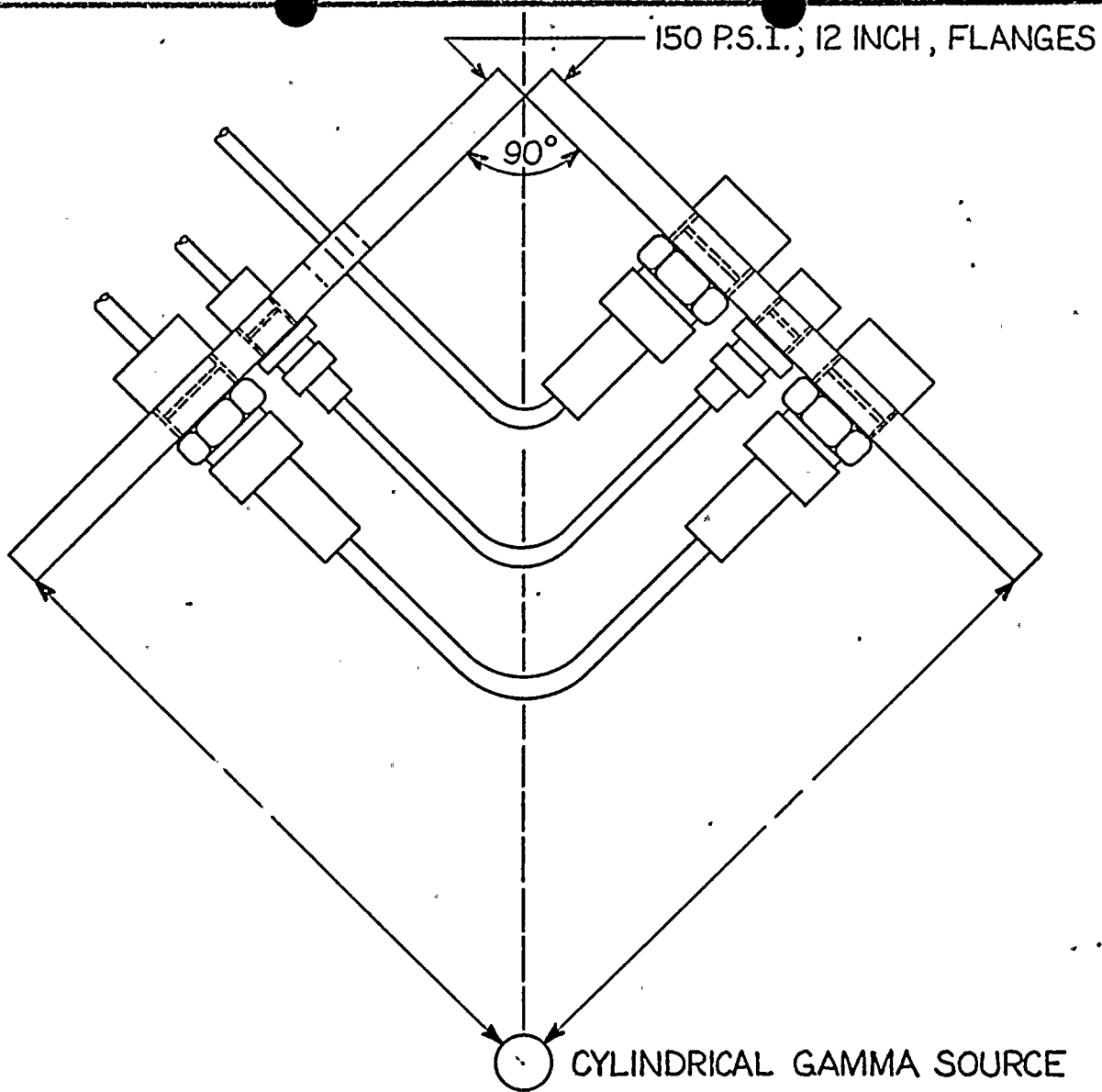


TABLE 1

<u>Elapsed Time During Drop (secs)</u>	<u>Pressure (psig)</u>	<u>Temperature (°F)</u>
-	0	~ 150
0 - 12	*	300
-	0	~ 150 (reestablish steady state)
0 - 60	*	300
60 - 80	*	288
80 - 100	*	280
100 - 200	<u>></u> 17	262
200 - 400	<u>></u> 15	225
400 - 500	<u>></u> 8	210
500 - 1000	<u>></u> 6	200
1000 - 3,200	<u>></u> 5	185
3,200 - 21,600	<u>></u> 5	160
21,600 - 100,000	<u>></u> 5	140

* Pressure for saturated steam at that temperature





NOTES :

- 1.) SOURCE TO BE EQUIDISTANT FROM EACH EDGE OF FLANGE AND AT A CONVENIENT DISTANCE TO EXPOSE CONNECTORS TO 26 MEGARADS.
- 2.) FLANGES SHALL BE PERPENDICULAR TO EACH OTHER AND MOUNTED AS SHOWN BUT MAY BE SEPARATED TO ALLOW FOR CABLE PLACEMENT.

NO.	DATE	BY	REVISION	CK.	APP.

NIAGARA MOHAWK			
NIAGARA MOHAWK POWER CORPORATION SYRACUSE, N. Y.			
ELECTRICAL PENETRATION CONNECTOR L.O.C.A. SIMULATION TEST, PHASE II RADIATION AGING SET-UP			
DES. DR.	TR.	CHK. <i>RS</i>	DATE
APPROVED <i>Sandwich</i>	APPROVED	SCALE NONE	
APPROVED	APPROVED	INDEX	
APPROVED	APPROVED	NO. RAD-1	

