

CAROLINA POWER & LIGHT COMPANY

DEMONSTRATION OF RAYCHEM CABLE FOR QUALIFIED USE IN
CLASS 1E SERVICE

PRIMARY & SECONDARY CONTAINMENT

FOR

BRUNSWICK STEAM ELECTRIC PLANT - UNITS 1 & 2

OUTLINE

REV. NO.	RECOMMENDED BY	CONCURRED BY	APPROVED BY	DATE
0	D.L. Rhyne/2	W. Rhyne/2 2/18/82	W. Rhyne/2	2/12/83
1	D.L. Rhyne 4/6/83	B. Rhyne/4 7-83	W. Rhyne/2 4/12/83	4/12/83
2	D.L. Rhyne 8/23/83	B. Rhyne/8 23/83	W. Rhyne/2 8/24/83	8/24/83
3	D.L. Rhyne 3-30-84	W. Rhyne/2 3/30/84	W. Rhyne/2 4/13/84	4/13/84

1. Objective:

To demonstrate by type tests that the subject cable is capable of performing its intended function as installed at BSEP under loss of coolant accident conditions specified to BSEP. Testing to be performed in accordance with applicable parts of IEEE Std 323-1974, IEEE Std 383-1974, and Regulatory Guide 1.131. Appendix A establishes CP&L's position as to the applicability of IEEE 383-1974 to this demonstration.

2. Scope

This program addresses operation during a design basis event as required in Section 2.4 of IEEE Std 383-1974. Other aspects of cable qualification for Class 1-E Service are not an issue.

3. Cable Description

Raychem-Flamtrol TM unshielded jacketed cables having combined conductor insulation and jacket wall thickness greater than .120 inches. UE&C Specification 9527-01-113-4B.

4. Cable Sample:

Test specimens to be fabricated from 7-conductor, 12 AWG, unused cable available at BSEP, selected per Appendix B. Primary insulation thickness is .045 inches and the jacket thickness is nominally .09 inches.

5. BSEP Service Conditions:

- a) Normal service voltage: 480 volts, maximum 528 volts.
- b) Maximum service current: 12 amperes.
- c) Service Life: 40 years at 66°C, 6.0×10^7 rads.

6. BSEP Conditions To Be Simulated:

- a) Normal service aging:
 - i) 8 years at 66°C, 1.2×10^7 rads.
 - ii) 40 years at 66°C, 6.0×10^7 rads.
- b) LOCA Environment:
 - i) Temperature and pressure profiles as shown in Figure 1.
 - ii) Chemical spray: demineralized water, 24 hour duration beginning 6 hours after start of environmental exposure, .15 gallons per minute per square foot of horizontal cross-section area.

6. BSEP Conditions To Be Simulated: (Cont'd)

b) LOCA environment: (Cont'd)

- iii) Radiation: 5.0×10^7 rads.
- iv) Relative humidity: 100 percent after first 24 hours.

7. Performance Requirements to Be Demonstrated:

- a) Ability to carry simulated rated load current and voltage during LOCA test.

8. Aging Simulation Procedure:

- a) Specimen: Cable specimens mounted on 30-inch diameter mandrels, effective length not less than 10 feet.
- b) Radiation Aging:
 - i) Gamma Radiation, cobalt-60 source.
 - ii) Dose rate not to exceed 1.0×10^6 rads per hours.
 - iii) Air equivalent dose: Condition A, 6.2×10^7 rads.
Condition B, 1.1×10^8 rads.
- c) Thermal Aging: (See Appendix C)
 - i) Condition A: One specimen of each configuration aged at 123°C for 100 hours simulates 8 years of service at 66°C based on Arrhenius analysis of long-term thermal life data.
 - ii) Condition B: One specimen of each configuration aged at 140°C for 100 hours simulates 40 years life at 65°C based on Arrhenius analysis of long-term thermal life data.

9. LOCA Simulation Test:

a) Physical arrangement:

- i) Mandrels with pre-aged specimens mounted in pressure vessel. Orientation depends on vessel design.
- ii) Jacket ends of one specimen on each mandrel stripped to expose the primary insulation to the environment inside pressure vessel. Individual components spliced to individual penetrations leads inside pressure vessel.
- iii) Cable ends of remaining specimen on each mandrel sealed. Exit pressure vessel through suitable penetrations.

9. LOCA Simulation Test (Cont'd)

b) Electrical Connections:

- i) Specimens continuously energized as shown in Figure 2. A, B, and C connected to 4-wire, 3-phase, Y-connected transformer with grounded neutral. Each lead fused at 0.5 amperes. Line voltage adjusted to 600 volts.
- ii) Simulated load current of 20 amperes obtained as shown in Figure 2.

c) Environmental Exposure:

- i) Simulated LOCA temperature and pressure profiles as shown in Figure 1.
- ii) Demineralized water spray for 24 hours beginning 6 hours after start of environmental cycle. Spray directed vertically downward at minimum rate of 0.15 gallons per minute per square foot of horizontal cross-sectional area of pressure vessel.

d) Measurements:

Monitor the following parameters:

Voltage
Voltage Circuit Continuity
Load Current
Pressure
Temperature
Relative Humidity
Insulation Resistance Values

10. Bases for Acceptance - See Appendix D

11. Documentation:

To comply with IEEE Std 383-1974, Section 1.4.

12. Appendices

A - Demonstration of Raychem Cable for use in Class 1E Service with Reference to IEEE 383-1974

B - Selection of Test Samples for Adverse Environment Testing

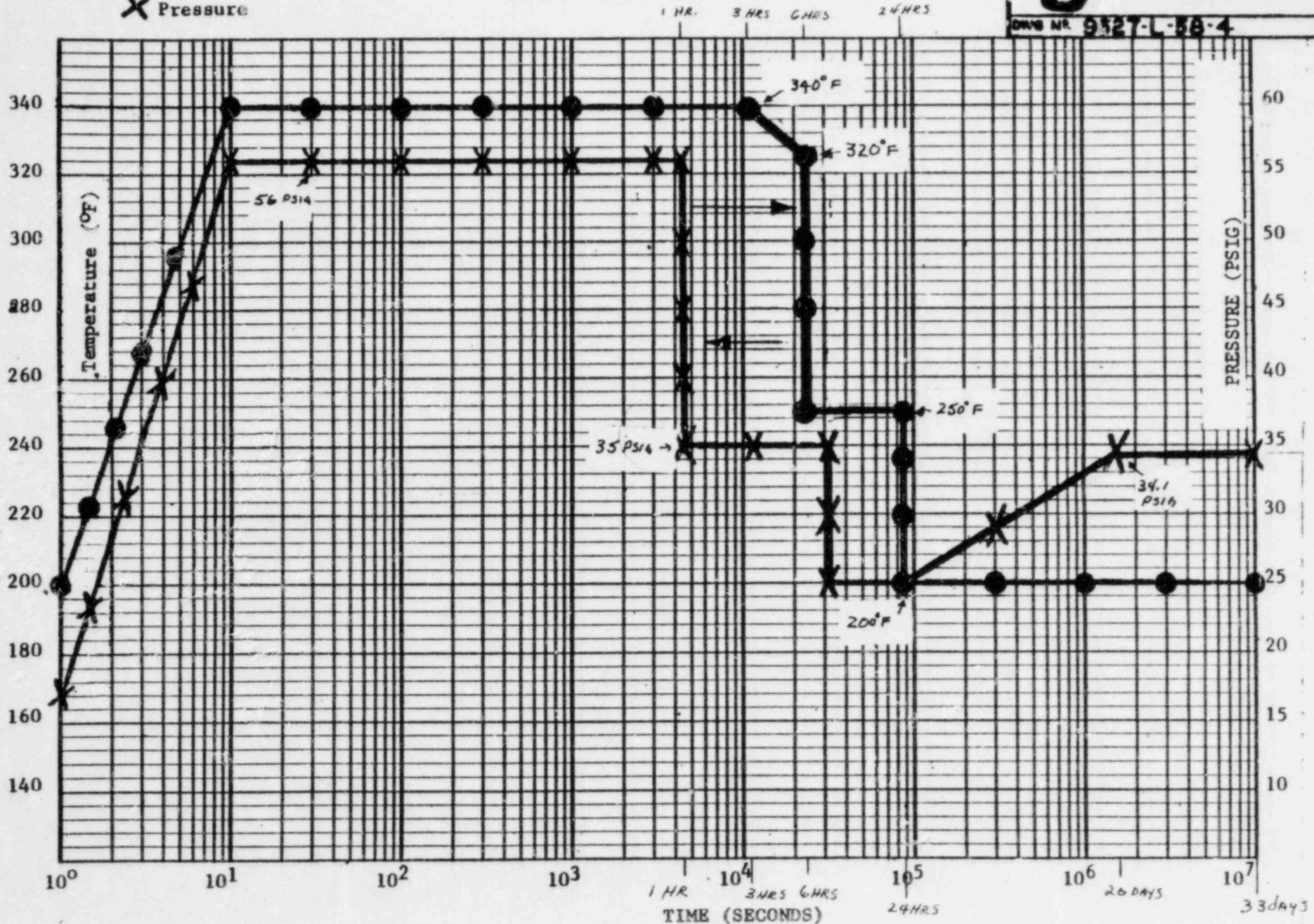
C - Method of Determining Accelerated Aging Parameters to Simulate Service Aging of Raychem-Flamtrol Cables

D - Bases for Acceptance of the Raychem Cable Through Performance of the Demonstration Program Outline, With Comments on IEEE STD 383-1974 Section 2.4.4

CAROLINA POWER & LIGHT COMPANY
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UNITS 1 & 2 - J.O. 9527-058

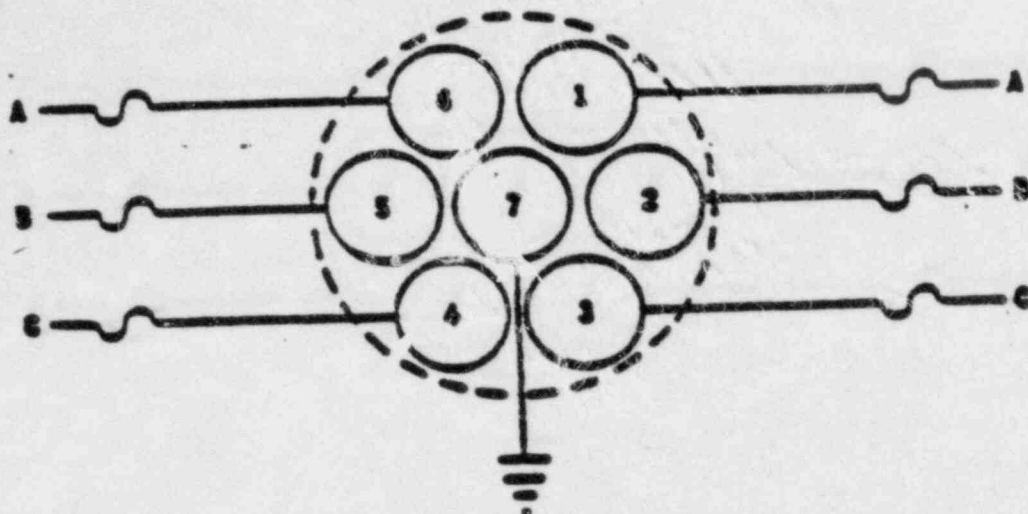
DATE	DESCRIPTION	ENG
7/29/81	UNIT 1	ENG
DRAWING NO. 9527-L-58-4		

● Temperature
X Pressure



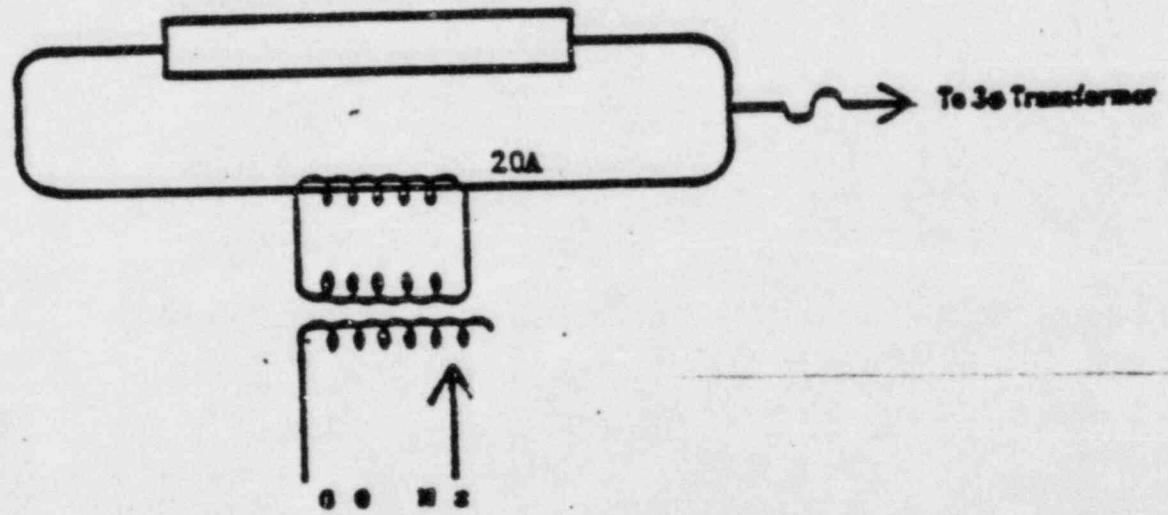
ENVIRONMENTAL PROFILE INCLUDING IEEE 323-74 MARGINS FOR PRIMARY CONTAINMENT

Figure 1



CONDUCTOR DETAIL

INDIVIDUAL CONDUCTOR



TEST ENERGIZATION CIRCUIT (TYPICAL)

Figure 2