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NUCLEAR UTILITY GROUP

2/12/92

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ENCLOSURE C

OFFICE OF SECRETARY DOCKETING & SERVICE BRANCH

#### MEHORANDUM

January 9, 1987

TO:

Nuclear Utility Group On Equipment Qualification

FROM:

Phil Holzman

SUBJECT:

CECO SPLICE QUALIFICATION TEST INFORMATION

This memorandum and its attachments have been prepared to assist Group members in their decision regarding participation in the purchasing of the Commonwealth Edison (CECo) splice in the purchasing of the Commonwealth Edison in this memo is qualification test reports. The information in this memo is technical in nature. The contractual information is addressed elsewhere.

The qualification testing was completed in December, 1986. Due to the large number of samples, the testing was conducted in three groups, one PWn group and three BWR groups. The test results will be summarized in two (one PWR and one BWR) test results will be summarized in two (one PWR and one BWR) test reports. Both preliminary reports have been issued to CECo by reports. Both preliminary reports have been issued to CECo by wyle Labs for review and comment. The final reports will be wyle Labs for review and comment. The final reports will be issued in late January of early February, 1987. CECo has issued in late January of early February, 1987. CECo has requested that distribution of the preliminary reports not be made although they are available for inspection at CECo's Chicago engineering office.

# MUCLEAR REGULATORY COMMISSION

AMA POWER CO.
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Witness

Attachment A is the final revision of the qualification plan for the entire group of tests. The plan contains information on:

Normal and accident service conditions
 Thermal aging and activation energies

3. Splice descriptions

- 4. Test configuration, including mounting, electrical loading, and test circuitry
- Acceptance criteria
   Test measurements

The test reports summarize the test results and provide report data including:

 Test specimen inspection descriptions pre and post testing.

2. Specimen photographs pre and post testing

3. Description and results of each functional test

4. Data sheets for al) IR tests

Peak recorded leakage currents for each splice
 Plots of leakage currents for certain splices

7. Instrument equipment sheets

8. Notices of anomalies and associated discussions

#### SUMMARY TEST RESULTS

The acceptance criterion was to demonstrate electrical integrity (e.g. the ability to maintain rated voltage and current). Leakage currents were monitored continuously during the LOCA testing for information only. Insulation resistance (IR) measurements were made at the completion of each functional test for information only. The post-LOCA IR measurements were made while the samples were still in the test vessel.

#### PWR TEST

Specimens Z11 and Z12 (V-type splice: Kerite tape over braided silicon motor leads) and B4 (V-type splice Okonite tape over Okonite cable) were unable to hold their specified voltages without blowing fuses. All other splices met the test acceptance criteria. The peak recorded leakage current for each splice and copies of the post-LCCA IR measurements are provided as Attachment B.

Post test inspections indicate that all the Raychem splices were intact and in good order with the following exceptions:

1. Bl and B3 sleeves had split approximately 3/4 of their length. The internal connection points were visible.

2. Z2 and Z3 sleeve adhesive end seals to Kapton wire "open" on both specimens.

The Bl. B2 specimens were "three" wire into one tube splices. The B3 specimen was a "five" wire into one sleeve splice. The splitting of the B1 and B3 tubes may have been caused by the unusual configuration or possible excessive splice holdout.

The Z2 and Z3 splices were apparently unaffected by the lack of full end sealing as evidenced by the leakage current and post test IR values.

#### BWR TESTS

Splices D18, Q16, and Q18-Q20 (AMP window splices) and L7 (Raychem sleeve with 1/8" overlap over Rapton lead) were unable to hold their straified vor ages without blowing fuses. In addition, splices D19, Q13-Q15, AND Q17 were severely damaged, based on post test visual inspections. The failure point of the Raychem splice (L7) was isolated to the Rapton lead wire and judged to be random. The peak recorded leakage current for each splice and copies of the post-LOCA IR measurements are provided as Attachment C.

Post test inspections indicate that all the Raychem splices were intact and in good order with the following exceptions:

1. Ll, L2, and L8 did not have good adhesion at the end of tube to the Kapton wires.

The LL, L2 and L8 splices were apparently unaffected by the lack of full end sealing as evidenced by the similarity of their leakage current and post test IR values to the other Raychem splices.

The peak leakage current values for many of the Raychem splices were higher than might have been anticipated. Since the relationship between ac leakage currents at 528 Vac and do leakage currents for low voltage do instrument circuits is not well established, the use of some of the test results may be limited to power and control circuits. Specimens 22 and 23, with 1/2" and 3/4" overlap respectively, were powered at 36 Vdc and exibited 0 ma. leakage and high post test IR values.

#### WYLE LABORATORIES GENERITME BUTTYSCHE & BYETSME GRE P O BOX 1008 - MUNTSVILLE ALABAMA THOS THE BID TOP SEES - TELEPHONIS 1999; 657-4411

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# QUALIFICATION PLAN

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REVISION A - 8/28/86 REVISION 5 - 9/18/86 REVISION C - 12/3/86

MALIFICATION

. Johnson

ENVIRONMENTAL QUAI TICATION UF RAYCHEM WOSF-N NUCLEAR CABLE SPLICES ORONITE TAPES, SCOTCH TAPES, KERITE TAPES AND AMP SPLICES

DBB C

AS INSTALLED ON VARIOUS WIRE INSULATIONS AT

COMMONWEALTH EDISON COMPANY'S LASALLE COUNTY, ZION, DRESDEN, QUAD CTITES BYRON, AND BRAIDWOOD NUCLEAR GENERATING STATIONS

> APPROVED BY PROJECT MANAGER Horsman APPROVED BY QUALITY ASSUPANCE. PREPARED BY PROJECT ENGINEER J. Hazeltine

REVISIONS

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#### 1.0 SCOPE

This document has been prepared by Wyle Laboratories for Commonwealth Edison Company (CECo) for nuclear environmental qualification of various configurations of Raychem nuclear sleeves and kits, Scotch Splice Tape, Kerite Splice Tape, Okonite Splice Tape and Amp splice Connectors.

#### 1.1 Objectives

The purpose of this qualification plan is to present the approach, methods and general procedures for qualifying Raychem splices installed over various wires and cables. Parallel qualification shall be attempted on Okonite tapes, Scotch tapes and Kerite tapes over various wires and cables.

Nuclear environmental qualification of any safety-related device to meet the intent of IEEE Std. 323-1974 is usually a three-step process; i.e., 1) radiation exposure; 2) aging; and 3) design basis event qualification. The purpose of the first two steps is to put the sample equipment to be used for qualification into a condition that represents the worst state of deterioration that a plant operatively permit prior to taking corrective action, i.e., its end-of-qualified-L. condition. The next step demonstrates that it has adequate integrity remaining to withstand the added environmental stresses of specified design basis events and still perform its safety-related functions.

It is incumbent on CECo to assure that the components and materials contained in the equipment actually placed into service are the same as those qualified.

# 1.2 Applicable Qualification Standards, Specifications, and Documents

- o TEEE Std. 323-1974, "TEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations."
- o IEEE Std. 383-1974, "IEEE Standard for Type Testing Of Class 1E Cables, Field Splices, and Connections For Nuclear Power Generating Stations."
- NUREG-0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Revision 1, dated July 1981.
- o Regulatory Guide 1.89.
- o 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants"
- o Telecopy, Sargent & Lundy, 11 pages from John Regan.
- o Commonwealth Edison Company Purchase Order No. 806121.

#### Equipment Description 1.3

The test specimens shall be as described in Table 1 and Appendix 1.

#### Qualification Sequence 1.4

The test specimen assemblies shall be subjected in order, to the following testing:

- Visual Inspection 0
- Baseline Functional Tests
- Normal Radiation Exposure 0
- Functional Tests
- Thermal Aging 0
- Functional Tests 0
- Accident Radiation Exposure
- Functional Tests 0
- Accident (LOCA)/Post-Accident Simulation 0
- Post-Tert Inspection
- Functional Tests

B

# 2.0 QUALIFICATION REQUIREMENTS

# 2.1 Definition of Service Conditions

Service conditions as specified by CECo do not include margin. To account for normal variations in commercial production of equipment and variations in service conditions, margins per Paragraph 6.3.1.5 of IEEE 323-1974 shall be added to the applicable conditions.

o Temperature

+15°F (Accident - peak temperature)

o Pressure

+10% (not greater than 10 psig)

o Voltage

+10%

o Time

+10% (Post-Accident)

#### 2.1.1 Normal Conditions

# 2.1.1.1 LaSalle, Dresden And Quad Cities

The following normal service conditions are as specified by CECo:

o Temperat e

150°F

o Relative Humidity

40-90%

Radiction (TID air equivalent)

1.6E" rads gamma

o Pressure

(-) 0.5 to 2.0 psig

Note: Operating temperature of the specimens is equal to ambine temperature since heat rise is judged to be negligible due to the low current typical of signal and instrumentation circuitry and due to the short operating our ation of valve operator motors.

# 2.1.1.2 Byron, Braidwood And Zion

The following normal service conditions are as specified by CECo:

o Temperature

122°F

o Relative Humidity

20-70%

o Radiation (TID air equivalent)

3.5E6 reds gamma

o Pressure

(-) 0.25 to 0.30 psig

Note: Operating temperature of the specimens is equal to ambient temperature since heat rise is judged to be negligible due to the low currents typical of control and instrumentation circuitry and due to the short operating duration of valve operator motors.

2.0	QUALIFICATION REQUIRE: ENTS (Continued)
919	Design Basis Event (DBE) Conditions

#### LaSalle, Dresden And Quad Cities 2.1.2.1

#### Accident (LOCA) Conditions Inside the Drywall (Zone H2) 2.1.2.1.1

Temperature (OF)	340	320	250	200
Pressure (psig)	-2 to 48.3	-2 to 48.3	0 to 25	0 to 20
Relative Humidity	Steam	Steam	100%	100%
Duration	0-3 hr	3-6 hr	6 hr to 1 day	1 day to 100 days

Radiation

2 x 108 rads gamma (integrated)

Chem'cal Spray: Continuously spray vertically downward with demineralized water at a rate of 0.15 gal/min./ft.2 of horizontal area of the test specimen holding fixtures. Chemical spray commences at the 6-hour point and cor inues for 24-hours after initiation.

#### Byron, Bridwood And Zion

Temperature (°F)	330	270	170-155	155
Pressure	50	50	Saturated Steam	Saturated Steam
Relative Humidity	Steam	Steam	100%	100%
Duration	10-180 sec.	5-20 min.	1-120 days	120-365 days
Redistion 2	x 108 rads (inte	grated) - See A	ttachment B	

Chemical Spray: Continuously spray vertically downward for first 24 hours with a solution of the following composition at a rate of 0.15 gal/min ft2 of the horizontal area of the test specimen holding fixture. Chemical spray commences after 3 minutes and continues for 24-hours after initiation.

- 0.28 "colar H3BO3 (3000 ppm)
- 0.064 Molar MasS203 0
- NaOH to make a pH of 10.5 at 770F

The chemicals shall be mixed according to Wyle Procedure No. 543-100.

# 2.0 QUALIFICATION REQUIRE. "TS (Continued)

#### 2.1.2.2 Seismic

Seismic testing is not required for cable/splice qualification.

#### 2.1.3 Other Service Conditions

o Voltage o Current See Table I

#### 2.2 Safety-Related Functions

The safety classification of this equipment is Class 1E. The subject equipment provides essential services in support of emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or is otherwise essential in providing support to prevent significant release of radioactive material to the environment. The safety-related functions are described in the following paragraph.

#### 2.2.1 Description

The subject splices are installed in various Class 1E power (e.g. valve operator motors), control, and instrumentation circuits at the LaSalle County, Dresden, Quad Cities, Zion, Byron and Braidwood Nuclear Power Generating Stations.

#### 2.2.2 Acceptance Criteria

The acceptance criteria for the test specimen assemblies is to demonstrate, during accident and post-accident simulation, electrical integrity. Circuit currents of Table 1 will be applied while powered at Table 1 voltages to the appropriate fused circuits.

Insulation resistance shall be measured at each functional test for information only.

Leakage currents to ground on each specimen shall be measured continuously for informational purposes only during the LOCA tests.

#### 3.0 QUALIFICATION PROGRAM

#### 3.1 Baseline Punctional Tests

#### 3.1.1 Visual Inspection

A visual inspection of the test specimen components shall be performed by Wyle Laboratories. This inspection will consure that the equipment has no obvious visible damage and that the components are as described in Paragraph 1.3. Specimen assemblies shall be tagged to facilitate their Hentification throughout the qualification program.

#### 3 1.2 Specimen Preparation

The test specimens shall be prepared by CECo and forwarded to Wyle Laboratories. All specimens prepared at Wyle shall be accomplished with the CECo technical representative present and to his/her instructions. The test specimens shall be prepared in accordance with the splice preparation procedures in Appendix 1.

#### 3.1.3 Functional Test

The insulation resistance of each specimen shall be measured (for information only) by applying 500 VDC for a minimum of 1 minute between conductor and ground.

A megohimmeter with accuracy of ±5% shall be used for measuring insulation resistance. Record insulation resistance values on the data sheet. If the measured resistance is less than 5.0E5 ohms, reduce the megohimmeter voltage until an insulation resistance value can be measured.

#### 3.2 Aging

#### 3.2.1 Normal Radiation Exposure

The worst-case normal radiation requirement as specified by Common ealth Edison Company, is 1.6E? rads gamma. Therefore, the test specimens (except Q15 through Q16) shall be irradiated to a normal radiation exposure of 1.6E? rads gamma using a Cobalt 60 source. The dose rite shall be approximately 1E6 rads per hour.

The Quad Cities inside containment 40-year normal radiation requirement is 1.4E6 rads, gamma. Five-year Specimens Q13 and Q14 shall be irradiated to 1.75E5 rads, and 10-year Specimens Q15 and Q16 shall be irradiated to 3.5E5 rads (5-and 10-year levels respectively) using a Cobalt-50 source at a dose rate of approximately 1E5 rads per hour.

At the direction of CECo, additional specimens supplied by them shall be irradiated as follows and held by Wyle for possible future testing.

# 3.0 QUALIFICATION Program (Continued)

# 3.2.1 Normal Radiation Exposure (Continued)

- Two specimens (Q17 and Q18) shall be irradiated to 5.25E5 rads (Quad Cities 15-year requirement) at a dose rate of approximately 1E5 rads per hour.
- The two remaining specimens (Q19 and Q20) shall be irradiated to 7.0E5
  rads (Quad Cities 20-year requirement) at a dose rate of approximately 1E5
  rads per hour.

The dose rate shall be measured at the geometric centerline of the test specimens. The specimens shall be rotated as necessary during the exposure to wasure a uniform dose distribution.

Dosimetry used shall be traceable to the National Bureau of Standards.

Specimen powering is not required during radiation exposure.

# 3.2.1.1 Pret-Normal Radiation Exposure Functional Tests

The tests of Paragraph 3.1.3 shall be repeated on all specimens.

#### 3.2.2 Time-Temperatue Effects

#### 3.2.2.1 Desired Qualified Life

A literature search of Wyle's Aging Library has been utilized to obtain auditable aging data for the component materials used in the various test specimen splices in this qualification program. Aging temperatures of 266°F, 248°F, and 239°F were selected based on past aging programs for similar materials. The aging times shall be as listed in Table II and in Paragraph 3.2.4.

#### 3.2.2.2 Activation Energies

# 3.2.2.2.1 Specimens Z-1 - Z-6, Z8-Z10, B1-B3, L1-L10, D1, D2, D5-D17 and Q7-Q12

The activation energy of the limiting material in these specimens is 1.29eV for rosslinked polyolefin which is the material used in Raychem WCSF-N heat shrink tubing. This activation energy is contained in Wyle Library Code (WLC) 036080A.

#### 3.2.2.2.2 Specimens 27, Z11, Z12, and Z13

The insulating material in the splices in these specimens is Kerite tape which is 180°C rated Scotch Number 70 silicone rubber tape. An activation energy of 1.25eV has been selected. This activation energy is for 50 percent loss of elongation for 180°C G.E. silicone rubber wire insulation. It is judged that the thermal properties of the Kerite tape are equivalent to those of the 180°C silicone rubber wire insulation and the 1.25eV activation energy contained in WLC 067382 shall, therefore, be used to develop the program for these specimens.

#### 3.2.2.2.3 Specimens D3 and D20

It is judged that the Scotch Number 70 tape is the primary insulating material of the test samples splices containing a combination of 3M tapes - Number 70, Number 17, and 130C. Therefore, the activation energy of 1.25eV shall be used to develop the aging program for these specimens per the discussion in the preceding paragraph. This activation energy is contained in WLC 067382.

#### 3.2.2.2.4 Specimens B4-B7 and L11

The activation energy for Okonite T-95 insulation tape (Crosslinked ethylene propylene) is 1.26eV as contained in WLC 051781. This is the primary insulation material used in the above specimens.

#### 3.2.2.2.5 Specimens D4, D21, Q1, Q2, Q3, and Q4

The primary insulation in these specimens is Scotch 33+ tape which is PVC (polyvinyl chloride) with an activation energy of 1.15eV as contained in WLC 049981.

#### 3.2.2.2.6 Specimens D18, D19, Q5, Q6, Q13 through Q20

The insulating material used in the AMP window splices in these test specimens is Nylon (polyamide). The thermal properties of the splice material are judged to be equivalent to those of 125°C Nylon 6/6 (Zytel 101) for 50 percent loss of electrical strength as contained in WLC 003278A. The activation energy of this Nylon is 1.17eV.

The same

# 3.0 QUALIFICATION PROGRAM (Continued)

#### 3.2.3 Relative Humidity

Relative humidity is not considered an aging mechanism for the cables. For insulation systems, its effect is usually not the primary failure mechanism, as noted in WAL 0255-80 with respect to motor insulations, "However, in nost cases, moisture plays only a secondary role in the failure. It does not produce the damage in the insulation, the insulation wears away or cracks for other reasons. Moisture merely provides a direct electrical pathway between these matured devices and ground."

Therefore, the ability of the cables to perform their safety-related functions within their relative humidity environment shall be demonstrated during the accident/post-accident test.

#### 3.2.4 Thermal Aging Program Summary

The specimens shall be aged in accordance with Table II and the following paragraphs. Tolerances on aging temperature are +5, -0 deg. F and on aging time are +2, -0 hours.

#### 3.2.4.1 Specimens Z1-Z6, Z8-Z10, and B1-B3

As specified by CECo, the desired qualified life for these specimens is 40 years. The thermal aging time to simulate 40 years at the Zion and Byron/Braidwood maximum normal ambient temperature of 122°F (50°C) is 149 hours at an aging temperature of 239°P based on an activation energy of 1.25eV.

#### 3.2.4.2 Specimens Z7, Z11, Z12, and Z13

As specified by CECo, the desired qualified life for these specimens is 40 years. The thermal aging time to simulate 40 years at the Zion maximum normal ambient temperature of 122°F (50°C) is 190 hours at an aging temperature of 239°F based on an activation energy of 1.25eV.

#### 3.2.4.3 Specimens B4-37

As specified by CECo, the desired qualified life for these specimens is 40 years. The thermal aging time to simulate 40 years at the Byron/Braidwood maximum normal ambient temperature is 122°F (50°C) is 1°9 hours at an aging temperature of 239°F based on an activation energy of 1.25eV.

#### 3.2.4.4 Specimens L1-L10

As specified by CECo, the desired qualified life for these specimens is 40 years. The thermal aging time to simulate 40 years at the LaSalle maximum normal ambient temperature of 150°F (66°C) is 298 hours at an aging temperature of 266°F based on an activation energy of 1.29eV.

#### 3.2.4.5 Specimen L11

As specified by CECo, the desired qualified life for this specimen is 40 years. The thermal aging time to simulate 40 years at the LaSalle maximum normal ambient temperature of 150°F (66°C) is 352 hours at an aging temperature of 266°F based on an activation energy of 1.26eV.

# 3.2.4.6 Specimens D1, D2, D5-D17, Q8, Q10, and Q12

As specified by CECo, the desired qualified life for these specimens is 30 years. The thermal aging time to simulate 30 years at the Dresden and Quad Cities maximum normal ambient temperature of 150°F (66°C) is 224 hours at an aging temperature of 266°F based on an activation energy of 1.29eV.

#### 3.2.4.7 Specimen D3

As specified by CECo, the desired qualified life for this specimen is 30 years. The thermal aging time to simulate 30 years at the Dresden maximum normal ambient temperature of 150°P (66°C) is 279 hours at an aging temperature of 266°F based on an activation energy of 1.25eV.

#### 3.2.4.8 Specimens D4, Q2, and Q4

As specified by CECo, the desired qualified life for these specimens is 30 years. The thermal aging time to simulate 30 years at the Dresden and Quad Cities maximum normal ambient temperature of 150°F (66°C) is 482 hours at an aging temperature of 266°F breed on an activation energy of 1.15eV.

#### 3.2.4.9 Specimens D18 and D19

As specified by CECo, the desired qualified life for these specimens is 15 years. They have been in service for 10 years and will, therefore, require an additional 5 years' equivalent aging to bring them up to a total of 15 years. The thermal aging time to simulate 5 years at the Dresden maximum normal ambient temperature of 150°F (66°C) is 170 hours at an aging temperature of 248°F based on an activation energy of 1.17eV.

#### 3.2.4.10 Specimen D20

As specified by CECo, the desired qualified life for this specimen is 15 years. The thermal aging time to simulate 15 years at the Dresden maximum normal ambient temperature of 150°F (66°C) is 140 hours at an aging temperature of 266°F based on an activation energy of 1.25eV.

#### 3.2.4.11 Specimens D21, Q1 and Q3

As specified by CECo, the desired qualified life for these specimens is 15 years. The thermal aging time to simulate 15 years at the Dresden and Quad Cities maximum normal ambient temperature of 150°F (£3°C) is 241 hours at an aging temperature of 266°F based on an activation energy of 1.15eV.

#### 3.2.4.12 Specimens Q5 and Q6

As specified by CECo, the desired qualified life for these specimens is 40 years. The thermal aging time to simulate 40 years at the Quad Cities maximum normal ambient temperature of 150°F (66°C) is 89 hours at an aging temperature of 248°F followed by 538 hours at 266°F based on an activation energy of 1.17eV.

#### 3.2.4.13 Specimens Q7, Q9, and Q11

As specified by CECo, the desired qualified life for these specimens is 15 years. The thermal aging time to simulate 15 years at the Quad Cities maximum normal ambient temperature of 150°F (66°C) is 112 hours at an aging temperature of 266°F based on an activation energy of 1.29eV.

#### 3.2.4.14 Specimens Q13 and Q14

As specified by CICo, the desired qualified life for these specimens is 15 years. They were removed from Quad Cities Unit 2 drywell penetrations after being in service longer than 10 years. An additional 5 year's equivalent thermal aging will bring them up to a total of actual in-service life plus 5 years. The thermal aging time to simulate 5 years at the Quad Cities maximum normal ambient temperature of 150°F is 170 hours at an aging temperature of 248°F based on an activation energy of 1.17 eV.

#### 3.2.4.15 Specimens Q15 and Q16

As specified by CECo, the desired qualified life for these specimens is 20 years. They were removed from Quad Cities Unit 2 drywell (the same as Specimens Q13 and Q14 above). An additional 16 years' equivalent aging will bring them up to a total of actual in service life plus 10 years. The thermal aging time to simulate 10 years at the Quad Cities maximum normal ambient temperature of 150°F is 339 hours at an aging temperature of 248°F based on an activation energy of 1.17eV.

# 3.2.5 Post Thermal Aging Functional Tests

The tests of Paragraph 3.1.3 shall be repeated on all specimens except 217 through 220.

#### 3.2.6 Accident Radiation Exposure

The worst-case accident radiation requirement is 1.84E8 rads. The test specimens described in Table I (except Specimens Q13 through Q16) shall be exposed to a minimum radiation dose of 1.84E8 rads gamma (air equivalent) using a Cobalt-60 source at a dose rate of approximately 1E6 rads per hour.

The Quad Cities accident radiation requirement is 1.1E8 rads. Specimens Q13, Q14, Q15, and Q16 shall be exposed to a minimum radiation dose of 1.21E8 rads gamma (air equivalent) using a Cobalt 50 source at a close rate of approximately 1E5 rads per hour.

The specimens shall be rotated as necessary during exposure to ensure a uniform dose.

The radiation doses above contains 10% margin on the accident requirement.

Dosimetry utililized during radiation exposure shall be traceable to the National Bureau of Standards (NBS).

# 3.2.7 Post Accide-t Radiation Punctional Tests

The tests of Paragraph 3.1.3 shall be repeated on all specimens except Q17 through Q20.

#### 3.3 Aecident Sinulation

# 3.3.1 PWR Specimens (Byron/Braidwood and Zion) LOCA Test

#### 3.3.1.1 Accident Profile

All test specimens described in Table I (pages 23-31) shall be subjected to a simulated accident. The test profile shall envelop the profile specified by CECo which is described in Paragraph 2.1.2.1.2. It is assumed (for purposes of applying margin) that the accident (DBA) portion of the profile is the first 24 hours and the post-DBA portion is from the 24-hour mark through 365 days. Appropriate margins per Paragraph 2.1 have been added.

The initial transient shall be applied to the test specimens (powered as specified in Table I) as shown in Figure 1 beginning at 12200 and atmospheric pressure.

#### 3.3.1.1 Accident Profile (Continued)

The ramp requirement to 345°F and 55 psig shall be performed on a best-effort basis. Approximately three minutes after equilibrium is achieved at 345°F/55 psig, chemical spray as described in Paragraph 2.1.2.1.2 shall be introduced at a minimum rate of 0.15 gpm/ft² of horizontal area of the test specimen enclosure and shall continue for 24 hours. Peak conditions at 345°F/55 psig shall be held for a minimum of five minutes, followed by a decrease in temperature to 270°F saturated conditions. These conditions shall be maintained for a minimum of 5.33 hours at which time the temperature and pressure shall be decreased to 250°F saturated conditions. These conditions shall be maintained for a minimum of 40.5 hours until the 45.83 hour point (end of test).

#### 3.3.1.2 Test Specimen Mounting and Orientation

The test specimens shall be mounted to a solid bottom cable tray, or inside a NEMA 12 and NEMA 3 enclosure as listed below:

Enclosure/ Tray Type	Specimens
Tray	Z2, Z3 and Z11
NEMA 3	Z1 and Z4-Z10
NEMA 12	B1-B7, Z12 and Z13

The specimens mounted to the cable tray shall be tie wrapped in place at each end of the cable. The specimens mounted in either ther NEMA 3 or NEMA 12 enclosure shall be mounted on the bottom ledge of the enclosure except for Specimen B7 which shall be vertical inside the enclosure.

Each of the enclosures shall have a 1/4" weephole drilled in the lower right hand corner of the enclosure. A 1-1/4 inch LB fitting shall be mounted to the top center of the enclosures. All wiring shall enter or exit the enclosure through this penetration. A 18-inch conduit nipple shall be mounted to the end of the LB fitting and shall be oriented in the test chamber away from the chemical spray nozzles.

The test specimen cables shall be connected with Wyle supplied 14 AWG Teflon wire through uninsulated butt splices covered with Raychem WCSF-N sleeves. These Teflon leads shall exit the tes. chamber and shall be sealed per 'Vyle Laboratories standard practice.

# 3.3.1.2 Test Specimen Mounting and Orientation (Continued)

The test specimens shall be powered as described in Table I. The circuitry used to accomplish the electrical setup shall be as shown in Figures 7 and 8. The instrumentation channels utilized shall be as listed below:

# DAYTRONICS DATA AQUISITION SYSTEM CHANNELS

Channel No.	Specimen No.	Units -	Signal Wonitored
1	N/A	or	Chamber control thermocouple
2	N/A	or	Chamber control thermocouple
3	N/A	op	Chamber control thermocouple
4	N/A	psig	Chamber pressure control transducer
5	N/A	or	Average chamber temperature -average of channels 1, 2 and 3
6	N/A	GPM	Chemical Spray Flowrate (3.5-4.0 GPM)
7	N/A	PH	Chemical Spray PH(10.2-10.8)
8	22, 23	paig	Input pressure to Wyle Omega PX114 transmitter used as a load
9	B1	mA	Leadage current to ground
10	B2	mA	Leakage current to ground
11	B3	mA	Leakage current to ground
12	84	m.A	Leakage current to ground
13	B5	mA	Leakage current to ground
14	Z1	mA	Leakage current to ground
15	7.2	mA	Leakage current to ground
16	Z3	mA	Leakage current to ground
17	Z4	mA	Leakage current to ground
18	2.5	m A	Leakage current to ground
19	26	mA	Leakage current to ground
20	27	mA	Leakage current to ground
21	Z8	mA	Leakage current to ground
22	7,9	m A	Leakage current to ground
23	210	mA	Leakage current to ground
24	Z11	m.A.	Leakage current to ground
25	212	m.A	Leakage current to ground
26	Z13	mA	Leakage current to ground

# 3.3.1.2 Test Specimen Mounting and Orientation (Continued)

# PLUKE 2240 DATTALOGGER CHANNELS

Channel No.	Specimen No.	Units	Signal Monitornd (Range)
	B1	VAC	Input Voltage (132-136 VAC)
	B:	Amps "	Load Current (6.0-7.4A)
2 3	B2	VAC	Input Voltage (132-135 VAC)
	82	Amps	Load Current (6.0-7.4A)
	B3	VAC	Input Voltage (132-136 VAC)
4 5 6	83	Amps	Load Current (5.0-7.0A)
	B4	VAC	Input Voltage (528-544 VAC)
7 8	84	Amps	Load Current (6.0-7.4A)
9	B5	VAC	Input Voltage (528-544 VAC)
10	85	Amps	Load Current (8.0-7.4A)
11	B6	VAC	Input Voltage (528-544 VAC)
12	B6	Amps	Load Current (9.0-11.0A)
13	87	VAC	Input Voltage (528-544 VAC)
14	B7	Amps	Load Current (13.5-16.5A)
15	7.1	VAC	Input Voltage (132-136 VAC)
16	21	Amps	Load Current (6.0-7.4A)
17	Z2	VDC	Input Voltage (34.5-37 VDC)
18	7.2	mA	Load Current (36-44 mA)
19	Z3	VDC	Input Voltage (34.5-37 VDC)
20	Z3	mA	Load Current (36-44 mA)
21	7.4	VAC	Input Voltage (132-136 VAC)
22	Z4	Amps	Load Current (8.0-7.4A)
23	7,5	VAC	Input Voltage (132-136 VAC)
24	25	Amps	Load Current (8.0-7.4A)
25	28	VAC	Input Voltage (528-544 VAC)
26	26	Amps	Load Current (6.0-7.4A)
27	27	VAC	Input Voltage (528-544 VAC)
28	2.7	Amps	Load Current (5.0-7.4A)
29	2.8	VAC	Input Voltage (132-136 VAC)
30	28	Amps	Load Current (6.0-7.4A)
31	29	VAC	Input Voltage (132-136 VAC)
32	29	Amps	Load Current (6.0-7.4A)
33	Z10	VAC	Input Voltage (132-136 VAC)
34	Z10	Amps	Load Current (6.0-7.4A)
35	211	VAC	Input voltage (528-544 VAC)
36	Z11	Amps	Load Current (5.0-7.4A)
37	712	VAC	Input Voltage (528-544 VAC)
38	Z12	Amps	Load Current (5.0-7.4A)
39	213	VAC	Input Voltage (528-544 VAC)
40	Z13	Amps	Load Current (8.0-7.4A)

#### 3.3.2 BWR Specimens (LaSalle, Quad Cities and Dresden) LOCA Test

#### 3.3.2.1 Accident Profile

The test specimens described in Table I, pages 23 through 31 shall be subjected to a simulated accident. The test profile shall envelop the profile specified by CECo which is described in Paragraph 2.1.2.1.1 It is assumed (for purposes of applying margin) that the accident (DBA) portion of the profile is the first 24 hours and the post-DBA portion is from the 24-hour mark through 100 days. Appropriate margins per Paragraph 2.1 have been added.

The following description applies D BWR TESTS #1 IND # " ONLY .

The initial transient shall be applied to the test specimens (powered as specified in Table I) as shown in Figure 2 beginning at 150°F and atmospheric pressure. The ramp requirement to 355°F and 53.3 psig shall be performed on a best-effort basis. Approximately 6 hours after equilibrium is achieved at 355°F/53.3 psig. demineralized water spray as described in Paragraph 2.1.2.1 shall be introduced at a minimum rate of 0.15  $\rm gpm/ft^2$  of horizontal area of the test specimen enclosure and shall continue for 24 hours. Peak conditions at  $355^{\circ}F/53.3$  psig shall be held for a minimum of 3 hours, followed by a decrease to 3200F/53.3 psig. These conditions shall be maintained for a minimum of 3 hours at which time the temperature and pressure shall be decreased to 250°F, saturated conditions. These conditions shall be maintained for a minimum of 114 hours or until the 120 hour point (end of test).

#### 3.3.2.2 Test Specimen Mounting and Orientation

The test specimens shall be mounted to a solid bottom cable tray, or inside a NEMA 3 enclosure as listed below:

Enclosure/ Tray Type	Specimens
Tray	D1, D2, D5-D15, L1-L10 and Q7-Q12
NEMA 3	Q1-Q6, D3, D4, D16-D21 and L11

The specimens mounted to the cable tray shall be tie wrapped in place at each end of the cable. The specimens mounted in the NEMA 3 enclosure shall be mounted on the bottom ledge of the enclosurered As specified by the CECO

The enclosure shall have a 1/4" weep hole drilled in the lower right hand corner. A 1-1/4 inch LB fitting shall be mounted to the top center of the enclosure. All wiring shall enter or exit the enclosure through this penetration. An 13-inch conduit nipple shall be mounted to the end of the LB fitting and shall be oriented in the test chamber away from the chemical spray nozzles.

#### 3.3.2.2 Test Specimen Mounting and Orientation (Continued)

The test specimen choles shall be connected with Wyle supplied 14 AWG Teflon wire through uninculated butt splices covered with Raychem WCSF-N sleeves. These teflon leads shall exit the test chamber and shall be sealed per Wyle Laboratories standard practice.

The test specimens shall be powered as described in Table I. The circuitry used to accomplish the electrical setup shall be as shown in Figures 7 and 8. The instrumentation channels utilized shall be as listed below:

\*Note: Due to instrumentation limitations, the BWR specimens shall be tested in two tests. The specimens in each test shall be as listed in the following tables.

DAYTRONICS DATA AQUISITION SYSTEM CHANNELS

Channel No.	Specimen No.	Units	Signal Monitored
1	N/A	op	Chamber control thermocouple
2	N/A	or	Chamber control thermocouple
3	N/A	or	Chamber control thermocouple
4	N/A	psig	Chamber pressure control transducers
5	N/A	of	Average chamber temperature -average of channels 1, 2 and 3
5	N/A	GPM	Chemical spray flowrate (3.5-4.0 GPM)
7	Q1	rn.A	Leakage current to ground
8	Q2	mA	Leakage current to ground
9	Q3	mA	Leakage current to ground
10	Q4	mA	Leakage current to ground
11	Q5	mA	Leakage current to ground
12	Q8	mA	Leakage current to ground
13	D3	mA	Leakage current to ground
14	D4	m.A	Leakage current to ground
15	D5, D7	m.A.	Leskage current to ground
16	D6	mA	Leakage current to ground
17	D8	mA .	Leakage current to ground
18	D9	mA	Leakage surrent to ground
19	D10	mA	Leakage current to ground
20	D11	mA	Leakage current to ground
21	D16	m.A.	Leakage current to ground
22	D17	m.A	Leakage current to ground
23	D18	mA	Leskage current to ground
24	D19	m.A	Leakage current to ground
25	D20	mA	Leakage current to ground
26	D21	mA	Leakage current to ground

# 3.3.2.2 Test Sperimen Mounting and Orientation (Continued)

# PLUKE 2240 DATALOGGER CHANNELS

Channel No.	Specimen No.	Units	Signal Me 'toreu (Range)
1	Q3	VAC	Input Voltage (132-155 VAC
	63	Amps	Load Current (6.0-7.4A)
2	Q4	VAC -	Input Voltage (132-136 VAC
3	Q4	Amps	Load Current (6.0-7.4A)
2 3 4 5 6 7	Q.S	VAC	Input Voltage (132-136 VAC
5	Q5	Amps	Load Current (6.0-7.4A)
7	D9	VAC	Input Voltage (132-136 VAC
8	D9	A.mps	Load Current (6.0-7.4A)
9	D19	VAC	Input Voltage (132-136 VAC
10	D19	Amps	Load Current (6.0-7.4A)
11	91	VAC	Input Voltage (528-544 VAC
12		Amos	Load Current (6.0-7.4A)
13		VAC	Input Voltage (528-544 VAC
14	W2	Amps	Load Current (6.0-7.4A VA
15	26	VAC	Input Voltage (528-544 VAC
16	Q6	Amps	Load Current (67.4A)
17	D3	VAC	Input Voltage (528-544 VAC
18	D3	Amps	Load Current (6.0-7.4A)
	D4	VAC	Input Voltage (528-544 VAC
19	24	Amps	Load Current (6.0-7.4A)
20	D5, 7	VAC	Input Voltage (528-544 VA)
21 22	D5, 7	A mps	Load Current (6.0-7.4A)
23	D6	VAC	Input Voltage (528-544 VA)
24	D6	Amps	Load Current (6.0-7.4A)
25	D8	VAC	Input Voltage (528-544 VA)
28	D8	Amps	Load Current (6.0-7.4A)
27	D10	VAC	Input Voltage (528-544 VA)
	D10	Ampr	Load Current (6.0-7.4A)
28	D11	VAC	Input Voltage (528-544 VA)
29 30	D11	Ampe	Load Current (6.0-7.4A)
	D16	VAC	Input Voltage (528-544 V.A.
31	D16	.mps	Load Current (6.0-7.4A)
32 33	D17	VAC	input Voltage (528-544 VA
	D17	Amps	Load Current (6.0-7.4A)
34	D18	VAC	Input Voltage (528-544 VA
35 36	D18	ATIPS	Load Current (5.0-7.4A)
	D20	VAC	Input Voltage (528-544 VA
37 38	D20	Amps	Load Current (5.0-7.4A)
39	D21	VAC	Input Voltage (528-544 V.A.
40	Uli	Amps	Load Current (8.0-7.4A)

# 3.3.2.2 Test Specimen Mounting and Orientation (Continued)

# BWR TEST #2

# DATTEONICS DATA AQUISITION SYSTEM CHANNELS

Charmel No.	Specimen No.	Units	Signal Monitored				
,	N/A	op *	Chamber control thermocouple				
	N/A	or	Chamber control thermocouple				
	N/A	op	Chamber control thermocouple				
4	N/A	peig	Chamber pressure control temperature				
5	N/A	op	Average chamber temperature -average of channels 1, 2 and 3				
6	NA	GPM	Chemical spray flow rate (3.5-4.0 GPM)				
7	L*	'nA	Leakage current to ground				
8	L2, L4, L10	mA	Leakage current to ground				
9	L3	mA	Leakage current to ground				
10	L5	mA	Leakage current to ground				
11	L6	mA	Leakage current to ground				
1.0	L7	m.A	Leakage current to ground				
12 13	L8	mA	Leakage current to ground				
14	L9	mA	Leskage current to ground				
15	Lii	mA	Leskage current to ground				
16	Q7	mA	Leakage current to ground				
17	28	mA	Leakage current to ground				
18	29	mA	Leakage current to ground				
19	210	mA	Leakage current to ground				
20	Q11	mA	Leakage current to ground				
21	Q12	mA	Leakage current to ground				
22	Di	mA	Leakage current to ground				
23	D2	mA	Leskage current to ground				
24	012	mΑ	Leakage current to ground				
25	D 13, 14, 15	mA	Leakage current to ground				

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# 3.3.2.2 Test Specimen Mounting and Orientation (Continued)

#### FLUKE 2240 DATALOGGER CHANNELS

Channel No.	Specimen No.	Units	Signal Monitored (Range)
1	Li	VAC .	. Input Voltage (528-544 VAC)
2	Li	A.mps	Load Current (0.9-1.1A)
3	L2, 4, 10	VAC	Input Voltage (528-544 VAC)
4	1,2, 4, 10	Amps	Load Current (0.9-1.1A)
5	L3	VAC	Input Voltage (528-544 VAC)
6 7	L3	Amps	Load Current (5.0-7.0A)
	L5	VAC	Input Voltage (528-544 VAC)
8	L5	Amps	Load Current (6.0-7.4A)
9	L6	VAC	Input Voltage (528-544 VAC)
10	L6	Amps	Load Current (6.0-7.4A)
11	L7	VAC	Input Voltage (528-544 VAC)
12	L7	Amps	Load Current (6.0-7.4A)
13	L8	VAC	Input Voltage (528-544 VAC)
14	L8	Amps	Load Current (6.0-7.4A)
15	L9	VAC	Input Current (528-544 VAC)
16	L9	Amps	Load Current (0.9-1.1A)
17	L11	VAC	Input Voltage (528-544 VAC)
18	L11	Amps	Load Current (0.9-1.1A)
19	Q7	VAC	Input Voltage (528-544 VAC)
20	Q7	Amps	Load Current (6.0-7.4A)
21	Q8	VAC	Input Voltage (528-544 VAC)
22	Q8	Amps	Load Current (6.0-7.4A)
23	Q9	VAC	Input Voltage (132-136 VAC)
24	29	Amps	Load Current (6.0-7.4A)
25	Q10	VAC	Input Voltage (132-136 VAC)
26	Q10	Amps	Load Current (8.0-7.4A)
27	Q11	VAC	inpu. Voltage (132-136 VAC)
28	Q11	Amps	Load Current (6.0-7.4A)
29	Q12	VAC	Input Voltage (132-136 VAC)
30	Q12	Amps	Load Current (6.0-7.4A)
31	D1	VAC	Input Voltage (528-544 VAC)
32	D1	Amps	Load Current (6.0-7.4A)
33	D2	VAC	Input Voltage (528-544 VAC)
34	D\$	Amps	Load Current (6.0-7.4A)
35	D12	VAC	Input Voltage (528-544 VAC)
36	D12	Amps	Load current (5.0-7.4A)
37	D13, 14, 15	VAC	Input Voltage (528-544 VAC)
38	D13, 14, 15	Amps	Load Curren: (6.0-7.4A)

# Instrumentation Setup (Continued)

#### BWR TEST #3

Channel No.	Specimen No.	White	Signal Monitored
1	N/A	of	Chamber control thermocouple
2	N/A	• F	Chamber control thermocouple
3	N/A	oF.	Chamber control thermoccupie
4	N/A	°F	Average chamber temperature -average of channels 1, 2 and 3
5	N/A	psig	Chamber pressure control transducer
5	N/A	GPM	Chemical Spray Flowrate (3.5-4.0 GPM)
7	Q17	VAC	Input Voltage (132-136 VAC)
8	Q17	Amps	Load Current (6.0-7.4A)
9	Q17	m.A	Leakage current to ground
10	Q18	VAC	Input Voltage ( 32-136 VAC)
11	Q18	Amps	Load Current (6.0-7.4A)
12	Q18	m A	Leakage current to ground
13	Q19	VAC	Input Voltage (528-544 VAC)
14	Q19	Amps	Load Current (6.0-7.4 A)
15	Q19	mA	Leakage current to ground
16	Q20	VAC	Input Voltage (528-544 VAC)
17	Q21	Amps	Load Current (6.0-7.4A)
18	Q2i	mA	Leakage current to ground

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#### 3.0 QUALIFICATION PROGRAM (Continued)

#### 3.3.3 Post-DBA Functional Tests

The functional tests (insulation resistance) of Paragraph 3.1.3 shall be performed with the specimens inside the chamber.

#### 3.3.4 Post-Test Inspection

Upon completion of the qualification program, the specimers shall be visually impected. The specimers shall be disassembled to the extent necessary to perform the inspection. The condition of the specimens shall be recorded.

#### 3.4 In-Process Inspection

The test items shall be examined for possible damage following all severe tests. All noticeable test effects shall be logged.

Photographs shall be taken of any noticeable physical damage that may occur.

The records shall be checked for quality of performance after each test. CECo and S&L representatives shall be provided access to Wyle facilities and facords for QA program evaluation and auditing and inspection/surveillance subject to prior scheduling through Wyle Contracts and QA Departments.

#### 3.5 Instrumentation

All test equipment and instrumentation to be used in the performance of this program shall be calibrated in accordance with Wyle Laboratories' Quality Assurance Manual, which conforms to the applicable portions of ANSI N 48.2, 10 CFR 50/Appendix B, and Military Specification MIL-STD-45661 Standards used in performing all calls ations shall be traceable to the National of Standards.

#### 3.6 Report

The report shall describe the qualification requirements, procedures, and requits. The report shall also include rationale and justification required for the qualification and shall certify the qualification of those test items which passed the tests of IEEE Standard 323-1974. The customer shall receive ten bound copies and one reproducible copy of the test report.

#### 3.7 References

- 1. DuPont U.L. File No. 41938, Library Code 032-78A
- 2. Industrial Motor Users' Handbook of Insulation for Rewinds, L. J. Rejda and Kris Neville, Elsevier, 1977, Library Code 255-80
- 3. "Raychem Corporation WCSF Thermal Aging Data," EDR-2001, Library Code 360-80A
- Qualification Report, Westinghouse Electric Corporation, Type AB Circuit Breaker, Rev. 2, dated 11/30/79, Library Code 499-01
- 5. "Qualification Tests of Flame Guard PR-EP Instrumentation and Control Class 1E Electrical Cables in a Simulated Steam Line Break and Loss-of-Coolant Accident Environment," and Attachment AT-1, Franklin Institute Research Laboratory/The Anaconda Company, F-C4836-2, Library Code 517-81
- BIW Cable Systems, Inc., Letter dated September 2, 1982 with Thermal Aging Data for GE Silicone Rubber Attached, BIW, Library Code 573-82

Bponimen Number	Splice Moterial	Ccalignation	Overleg	Age	Backeure	Test Voltage	Station	Test Current
8-1	Raychem WCSF-N	Single conductor \$14 Rockbestos to 3-1 conductor \$14 Rockbestos - WCSF-N aplice	1/10	AB yee	NEMA 12 w/weephole	132 VAC	Byron/ Braidwood	8.7A
0-2	Caychem WCSF-H	Single conductor \$14 Rockbostos to 5-1 conductor \$14 Okonite - WCSF-M opiles	1/2"	40 yrs	elodgesw/m	133 VAC	Syron/ Breldwood	6.7A
9-3	Roychem WCSF-N	2 conductor #18 Rock bestos to 3-1 handwater #18 Rockbestos - MCSF-N oplice	1/2"	40 yes	HEMA 12 m/weephole	132 VAC	Syron/ Braidwood	5.0A
B-4	Okraite	#14 Okonite to #14 Okonite Sugged back in back? V-type aplice with Okonite tape and so freudation tennin crotch		40 yrs	NEMA 12 w/weephole	529 VAC	Syron/ Braldwood	6.7A
8-5	Okonite	#14 Okonite to #14 Komax (pigtall from Limitorque) (lugged back to back) 9-type aplice with Okonite tape and no Insulation in crotch		- 40 yes	NEMA 13 w/weephole	528 VAC	Pyron/ Braidwood	0.7A
9-6	Okoelt6	#16 Okonite to #18 Okonite (lugged back to beck) Y-type aplice with Okonite tape and no insulation in crotch		48 yrs	HEMA 12 " m/moephoin	528 VAC	Byron/ Braidwood	19.A
B-7	Oxonite	558 —Okonite to 586 — Okonite : 1950 splice with Okonite tape.		40 yrs	WEMA 13 W/weephole	528 VAC	Byron/ Braidwood	73A

# Qualification Flan No. 1 2500-01

# 10

Spectmen	Splice	Configuration	Gverlage	Ago	Eaclosure	Test Voltage	Station	Current
Number (s-1	Revolves	14 ge. Rockbestes to 14 ge. Rockbestes. Oversized Raychen	r	30 yre		518 VAC	Dreeden	8.7A
	WCSF-N	aptics (WCSF-286).	r	39 yrr		538 VAC	Dranden	8.7A
D-1	Reychem WCSP-M	11 gs. Rockbestos to 12 gs. Rockbestos, Understand Raymbers spilce (WCSF-879).				518 VAC	Drasden	8.7A
Ð-3	Scotch	17 ga. 323 wire to 17 ga. 323 wire. Scotch taped pigtall aplice. Sechtel Procedure EP-12. For in-drywell unser Scotch 138C, 78, 17.		36 yrs	NEMA 3 m/weephole			
D-4	Soutch	12 ge. 515 wire to 12 ge. 555 wire 3 cotch taped pigtail splice. Bechtel Procedure EF-12 - For outside dryorell uses Scotch 139C, 33*.		30 yrs	NEMA 3 w/weephois	538 VAC	Drasden	8.7X
D-5	Raychem WCSP-N	14 gs. Rockhestos to solenoid non-impregneted braided jacket coll wire. Inline splice with Raychem WC3F-113.	(4" steeve)	38 yrs		526 VAC	Dresden	6.7A
D-6	Raychem WCSF-M	14 gs. Rockbestos to solenoid non-impregnated braided jackst coll wire. Inline splice with Raychera WCSF-115.	1*	38 yrs		S28 VAC	Dresden	6.7A
13-7	Raychem WCSF-N	16 gs. Rockbeston to Impregnate 3 braid coll aire inline splice with Raychem WCSF-115	r	30 yrs		SIE VAC	Dreaden	6.74
D-8	Reychem WCSP-M	14 gs. Rockbestos 925 to impregnated braid out wire. I inline splice with Raychem WCSF-115.	1*	30 yrs		528 FAC	Ormeden	8.74
D-9	Raychem WCSF-N	16 ge. Rockbeston 513 to 16 gs. Rockbeston 583. Inline splice with Raychem WCSF-115 with min bend violation.	F	30 yrs		132 VAC	Dresden	¥.7A
15-10	Raychem WCSP-N	14 gs. Rockbestos 313 to 14 gs. Rockbestos 313 Raychem WCSF-112 over Immulated butt splice (in range).	1"	36 yes		326 VAC	Breaden.	6.74

Specimen Number	Splice Material	Configuration	Overlag	Age	Enclosure	Test Voltage	Station	Toot Current_
0-11	Raychem WCSP-N	14 ge. Rockbestos SIS to 14 ge Rockbestos SIS. Raychem WCSF-115 over insulated butt splice (outside range).	r	30 yre		S28 VAC	Dresden	6.7A
D-12	Raychom WCSF-N	14 gs. Rockbestos SS to 14 gs. Rockbestos SS. Inline splice with Rayohem WCSF-115.	1/4*	36 yrs		132 VAC	Dess-len	6.74
D-13	Raychem WCSF-N	14 gs. Rockbestos 329 to 14 gs. Rockbestos 329. Inites splice with Reychem WCSF-113.	1/2*	30 yes		133 VAC	Dreaden	6.7A
D-14	Raychem W.SF-N	14 gs. Rockbestos SIS to 14 gs. Rockbestos SIS Inline WCSF-115.	3/4"	30 yrs		135 VAC	Dresden	8.74
D-ta	Reychem WCSF-N	14 go. Rockbestos 313 to 14 gs. Rockbestos 313. Inline aplice with Raychem WCSF-115.	1*	30 yrs		DAYRE	Oresdon	8.74
D-16	Raychem N MCK	14 gs. Rockbestor 303 to 14 gs. Rockbestor 303. Raychem HMCK kit with butt tab trimmed by 1/2".		38 yrs	N2!: A 3 w/weephole	539 VAC	Dresden	8.7A
D-17	Raychem NMCX	13 gs. braided motor lead to 13 gs. braided motor lead (silicon wire), inside drywell - Raychem NMCK kit.		30 yes	нема 3 ж/жеерінів	STE VAC	Drcaden.	0.74
D-18	AMP	O.S. Vulkene SIS 14, (\$204M), Unit 3 dryweil cample with Amp window spilce.		15 yrs	MEMA 3 m/weephole	528 VAC	Dresden.	6.74
D-19	AMP	O.E. Vulkone 515 \$14, \$204% 15 years only Unit 3 drywell sample with Amp window uplice		15 yes	NEMA 3 sc/weaphole	132 YAC	Dreaden .	g.7A
D-20	Scotch	17 gs. SIS wire to 12 gs. SIS wire Scotch taped pigtail aplice -Bechtel Procedure EP-12 -Por in-drywall une: Scotch 130C, 78, 17.		15 yrs	HRMA 3 -/weephole	S28 VAC	Drenden	6.74
D-21	Scotch	12 ga. SIS wire to 12 ga. SIS wire Scotch taped pigteil apiles -Rechtei Proces, re EP-12 -For outs' je dryweil unes Scotch 130, 30+.		15 yes	NEWA 3 w/weephole	528 VAC	Drenden	8.7A1

Specimen Number	Splice Staterial	Configuration	Overlap	Age	Enclosers	Test Voltage	Station	Test Current
t-1	Raychem WCSF-N	Repton impleted \$16 AMO wire connected to Eston Corp. (Semuel Moore Dekoron) \$16 AMO wire. Overlap of Raychem sleeve on each wire insulation in 1/8°.	1/6*	48 yrs		132 VAC	LaSello	1.0A
L-I	Raychem WC3F-N	Kepton traviated #16 AWG wire connected to Eaton Corp. (Samuel Moore Deboran) #16 AWG wire. Overlap of Raychem sleevs on each wire insulation in 1/4°.	1/4*	62 yrs		131 VAC	f.s5alle	1.04
t-3	Raychem WC9F-N	Eston Corp. (Samuel Moors Dekoran) \$18 AWG_XLPE insulated wire, 2 lengths. Overlap of Raychem sleeve on each wire localistion in 1/8".	d 1/8"	48 yes		131 VAC	LaSalie	1.04
1.4	Raychem WCSF-N	Eaton corp. (Samuel Moore Dekoran) \$16 AWG, RLPE involuted wire, 2 lengths. Overlap of Raycham sleave on each wire insulation in 1/4".	1 1/4*	68 yes		131 VAC	LaSalie	1.04
L-5	Raychem WC3F-M	Oxonite \$14 AWG EPR insulated wire, 2 lengths. Overlap of Raychem sleave on each wire insulation is 1/8".	1/8*	40 yes		SSW VAC	LaSalle	6.7A
6.4	Raychem WC3F-N	Okonite \$14 AWO EPR insulated wire, \$ lengths. Overlap of Raychem sleeve on each wire insulation is \$14".	1/4*	40 yes		528 VAC	LaSelle	8.7A
1-7	Raychem W/3F-H	Kaptor insulated \$14 AWG wire connected to Okonite \$16 wire EPR insulated wire. Overlap of Raychem sleave on each wire insulation is 1/8".	1/8*	40 yes		S28 VAC	LeSelle	6.7A
L-8	Raychem WCSP-M	Kapton insulated \$14 wire AWO wire connected to Okonite \$14 wire EPR insulated wire. Overlap of Raychem sleevs on each wire insulation at 1/4".	1/4*	40 yrs		\$36 VAC	LeSalie	6.74
1.4	Raychem WCSF-H	Raychem Plantrol #16 AWG XLPO Insulated wire connected to Eeton Corp. (Samuel Moore Dekoron) #16 AWG XLKPE Insulated wire. Overlap of Raychem sleeve on each wire insulation to 1/8".	1/8*	10 yes		132 VAC	LaSelle	1.04

Specimen Humber	Splice Material	Configuration	Overlage	Age	Enclosure	Tent Voltage	Station	Current_
1,-18	Raychem trCSP-N	Raychem Flamtrol \$18 AWG XLPE insulated wire connected to Eaton Corp. (Samuel Moore Dekoran) \$18 AWG XLPE insulation wire, overlap of Reychem on each wire is 1/4"	1/4"	46 yes		131 VAC	LaSalle	1.04
b-11	Okonite	Eaton Corp. (Samuel Moore Dekoran) \$15 AWG RLPE, 2 lengths. Okonite \$7-85 insulating tape and No. 35 jacketing tape. Spliced in accordance with procedure HPFCO-WI-506.		40 yrs	NEMA 3 w/weephole	133 VAC	LaSelle	2.8A

#### TABLE & TEST SPECIMEN DESCRIPTION

Apecimen	Spiles Material	Configuration	Preclap	Age	Enclosure	Test Voltage	Station	Test Current
Number Q-1	Scoloh	\$14 Rockbestos SIS to \$14 Eston Dekoron (Samuel Moore). Scotch taped splice 139C, 33+ (Reference QC \$5).	•	15	MEMA 3 w/weephole	828 YAC	Qued Cities	0.7A
Q-1	Seetch	\$14 Sockbeston SIS \$14 Eston Dekoren (Samuel Moore). Sootch taped spilce 139C, 33+ (Reference QC \$5).		30	NEMA 3 m/weephole	SIS VAC	Quad Cities	4.7A
6.2	Scotch	\$14 Rockbeston SIS to \$14 Eaton Devoran (Samuel Moore). Scotch taped splice 138C, 23* (Reference QC #5).		15	HEMA 3 w/weephola	131 VAC	Qued Cities	6.7A
9-1	Spotch	\$14 Rockbestos 35 to \$14 Eaton Dekoran (Samuel Moore). Soutch taped splice 138C, 33* (Reference QC #5).		38	NEMA 3 w/weephole	132 VAC	Quad Cities	6.7A
Q-5	AMP	\$14 Rockbestos SES to \$14 Eston Dekoran (Samuel Moore) Amp Commercial grade window splices (PIDG splice, Model 328578) In NEMA 3 enclosure w/weepholes (Ref. QC \$1)		40	NEMA 3 w/weephole	135 VAC	Qued Cittles	8.7A
Q+	AMP	\$14 Rookbestos SB to \$14 Eston Dekoran (Samuel Moore). Amp Commercial grade window splices (PIDG splice, Model 328579) In NEMA 3 enclosure w/weephole (Ref. QC \$1).		49	NEMA 3 w/weaphole	STR VAC	Quad Cities	8.74
Q-7	Raychem WCSF-N	814 Rockbestos SB to 814 Eston Dekoran (Samuel Moore). Raychem steeve WCSF-78 over Amp window spilous (PDIG apilo) Model 320578) (Ref. QC 84).	. "	15		E38 VAC	Quad Cities	8.74
Q-e	Roychem WCSF-N	#14 Rockbeston 323 to 1:6 Zeton Dekoren (Samuel Moore). Raychem sleeve WCSF-76 over AMP window splices (PDIG splic Model 329579) (Ref. QC #4).	e, T*	30		138 VAC	Quad Cities	6.7A
Q-8	Reychers WCSF-N	\$16 Rockbeston SIS to \$16 Enton Deboran. Raychem sleave WCSF-115 over 1/2" bolted connection (Ref. QC \$2).	1-1/2**	15		138 VAC	Quad Cities	6.7A
Q-18	Raychem WCSF-H	#15 Rockbestos SIS to #14 Eston Dekoran Raychem sleave WCSP-115 over 1/2" boiled connection (Ref. QC #2).	1-1/1*	39		132 VAC	Qued Cities	6.7A

TABLE & TEST SPECIMEN DESCRIPTION

Specimen Number	Spiles Nate/tal	Configuration	Gverleg	Age	Bactooure	Test Voltage	Station	Current	
Q-11	Raychem WCSF-N	\$14 Rockbeston Std to \$14 Saton Dekorce. Raychem sleeve WCSF-206 over 1/2" boiled connection (Ref. QC #3).	1-1/1*	18		133 YAC	Quad Cities	4.7A	
Q-13	Raychem WCSF-H	#14 Rockbeston 573 to #14 Ealon Dakoran. Raychem sleeve WCSS-196 over 1/3" boiled connection (Ref. QC #3).	1-1/2*	28		132 VAC	Qued Cities	6.7A	
Q13	AMP	9.8 Vulkene 5.5 \$1 2 one end only. Specimes removed from Unit 2 drywer penetration after in service a minimum of 10 years, AMP window splice.		15	HEMA 3 w/wsephole	133 VAC	Qued Cities	6.7A	
Q.4	AMP	O.S. Voi one 315 \$16 one and only. Specimes removed from Unit 2 drywell penetration effec in sorvice a minimum of 16 years. AMP window spiles.		15	HEMA 3 w/weeqhole	528 VAC	Quad Cities	6.7A	
dia	AMP	G. S. Vulkene SIS \$14 one and only. Specimen removed from Unit 2 drywell penetration efter in service a mining of 18 years. AMP window spiles.		28	S AMBH w/weeph/Ac	122 VAC	Quad Cities	0.7A	
Qte	AMP	O. B. Vulkene SEV \$14 one and only. Specimes removed from Unit 1 drywell penetration after in se. doe a minimum of 10 years. A NP mindow splice.		26	MEMAS * w/weephole	528 VAC	Quad Cities	6.7A	
Q17	AMP	O.E Vulkene 383 \$14 one and only. Specimen removed from Unit 1 drywell panetration after in service a continue of 16 years. AMP window apiles.		*	MEMA 3 w; asephole	133 VAC	Qued Cities	6.7A	
Q18	AMP	U.E. Yulkene 318 914 one end only. Specimen removed from Unit 2 drys 31 penetration after in service a minimum of 16 years. AMP window spitce.			MEMA 3 w/weephote	STO VAC	Quad Cities	8.74	
Q19	AMC	G. c. Vulkens 900 \$14 one end only. Specimen removed from Sinit I drywell penetration after in vervice a minimum of 10 years. AMP window splice.		9	MSMA 3 w/weephote	132 VAC	Quad Cities	8.7A	
QX6	AMP	O. 6. Volker- 515 \$14 one and only. Specimen removed from Unit 2 drywell penetration after in service a minimum of			NEMA 3 n/weephole	528 VAC	Quad Cities	8.7A	
		10 years. AMP window spilos.							

#### TABLE & TEST SPECIMEN DESCRIPTION

Specimen	Splice Material	Consiguration	Overlag	Age	Enclosure	Test Folloge	Station	Test ( rest
Mumber Z1	Reychem NPKV	#14 BiWiDocton Inculated Wire) single conductor to ASCO scienced valve lead wire w/non-impregnated breid -Raychem st type connector NPKY-2-18A	ub.	40 yrs	NEWA 3 er/weephole	123 YAC	Zion	4.74
7,3	Raychers NPX9	\$14 Blw to \$15 Kepton insideted wire -Raychem NPKS-1-11A	1/3*	40 yes		36 YDC	Zion	20mA*
2.3	Raychem MPMS	\$14 BIW to \$18 Kapton insulated wire -Raychem NPKS-5-11A	3/4*	49 yrs		36 VDC	Zion	20 mA*
2.4	Raychers NPKS	\$14 BIW single conductor to Statte O-Ring awitch lead wire w/Impregnated braid -Raychem NPKS-1-11A	1/1"	40 yrs	w/weephole	132 VAC	Zion	#.7A
25	Raychem	#14 DIW single con stor to Static O-Ring switch lead wire sr/impregnated bras when NPKS-1-11A	3/4*	40 yrs	NEMA 3 w/weephole	133 VAC	Zion	6.7A
7.8	Reychem	\$14 floid conductor BIN is allicone histemp braid motor lead -Raychem MPKY-3-10A	*	40 yre	NEWA 3	328 VAC	Zion	TA
27	Kerite	sic Biw to \$14 Biw - V-type splice with Kerite tape		46 yrs	MEMA 3 w/weephole	529 VAC	Zion	8.74
7.0	Raychem NPKS	\$14 SIW to \$14 DIW -Reychem NPSS-1-11A with 186 dogree bend	1/2"	46 Ase	NEMA 3 w/weephote	132 VAC	Zion	6.7A
2.9	Raychem NPK3	\$14 BlW to \$14 EDW -Reychens NPKS 1-11A with 188 degree bend	1*	10 yrs	NEMA 3 w/weephole	132 VAC	Zion	8.7A
7.10	Raychem NPKS	\$14 NW to \$14 MW -Raychem MPRS 1-11A with 128 degree band	3*	40 yrs	NEWA 3 w/weaphole	131 VAC	Zion	6,74
7.11	Kerite	\$16 BIW to sillcome Ne-temp braid motor lead - Kerite tape over boiled V connector with putly in crotch		48 yrs		528 VAC	Zion	6.74

<sup>&</sup>quot;Full scale output of a Omega differential pronous transmitter.

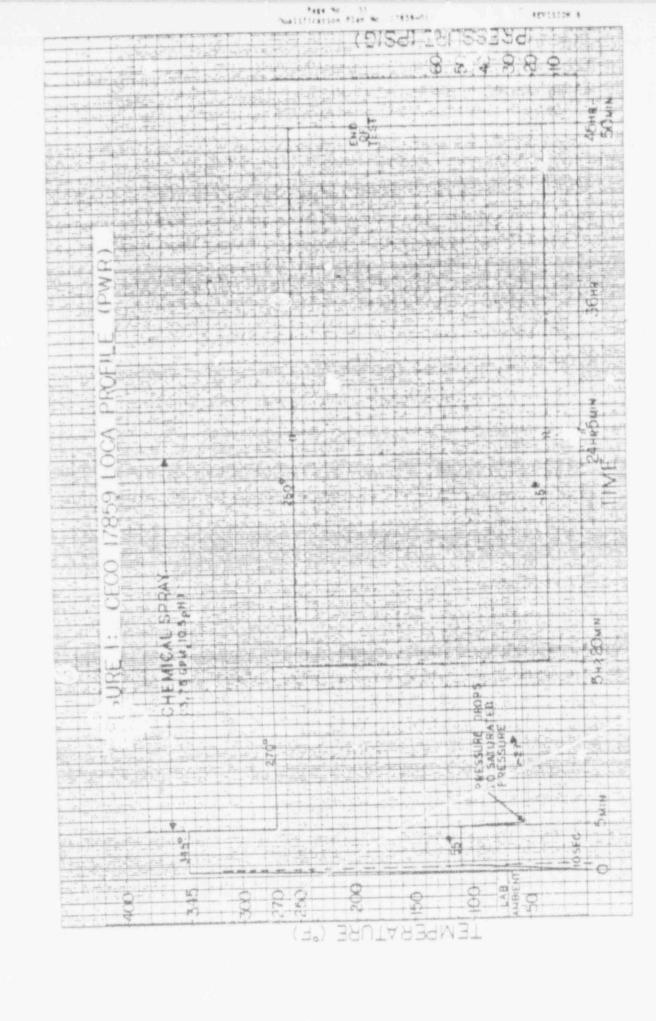
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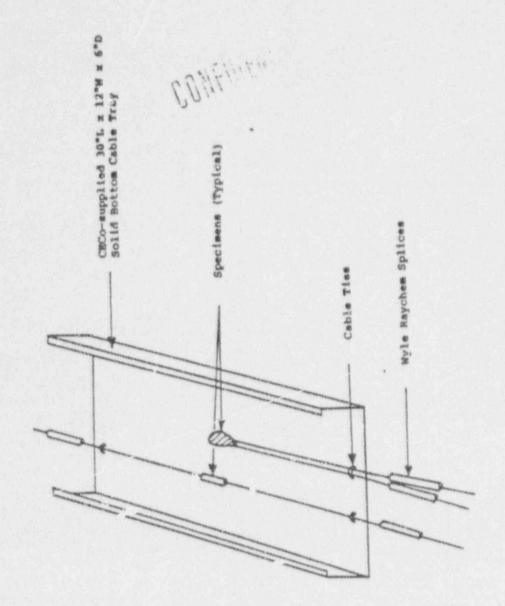
#### TABLE & THET SPECIMEN DESCRIPTION

Specimen Number	Splice Material	Configuration	Overisp	Age	Enclosure	Tast Yollege	Station	Current
Z19	Kerlin	\$14 BSW to ellicone M-temp brend motor lead -Kerite tape over boiled V connector with putty in crotch		40 yrs	MEMA 12 m/weephole	528 VAC	Zion	6.7A
Z13	Kerite	\$14 BIW to \$14 BIW - Y type spline with Kerite tape		48 yrs	MENA 12 m/weephole	526 VAC	Zios	6.7A

#### TABLE B: CECO ITESS ACENG MATRIX

Specimen	Spi os Material	He,(aV)	GL ( sel(gre)	Reseller Temp.(C)	Aging, Temp.(C)	Aging Time, (ive)	Comments
Z-1 - Z-6	Raycham WCSF-H	1.29	46	58	115	149	
Z7, Z11, 7.13	Kerite Tape	1.35	40	50	115	190	Kerite tape le Scotch ailicone rubber
Z8, - Z19	Raychem WCSF-N	1.29	46	50	115	149	
B1 - B3	Raychem WCSF-N	1.29	40	50	115	149	
84 - 87	Okonite Tapes	1.26	40	50	115	179	Okonite T-95 is Insul. tape
L1 -L(0	Raychem WCSF-N	1.29	49	65.56	138	298	
L 11	Okonite Tapes	1.26	40	65.56	130	352	Obsolite T-95 is insul. tape
D1, D2, D5-D17	Raychem WCSF H	1.29	30	65.56	130	224	
03	Scotch 130C, 76, 17	1.18	38	65,56	120	279	Assume Scotch 78 is limiting
D4	Scotch 138C, 33+	1.15	30	65.56	130	482	33° is insulation per CECo plus additional
D18, D19	A MP window spile.	1.17		65.56	120	170	*18 years in survice Hylon - 1.17 eV is 50% of eject, str
D29	Scotch 138C, 10, 17	1.25	15	65.56	130	170	Same se D3
D92	Scotch 139C, 23+	1.15	15	65,58	130	241	Same as D4
Q1, Q3	Scotch 138C, 33*	1.15	15	65.56	138	241	Same so D4
Q1, Q4	Seriob 139C, 23*	1.15	30	65.56	130	482	Same on D4
Q5	AMP PIDG splice	1.17	40	65.58	120/130	89/538	Nylor.
Q#	AMP PIDG splice	1.07	48	65.54	120/130	89/538	Same es Q5
Q7, Q8, Q11	Raychem WCSF-N	1.29	15	65,58	138	117	
Q8, Q18, Q12	Raychers MCSF-N	1.29	38	95.50	138	224	
Q13, Q14	AMP window splice	1.17	15	65.56	130	178	Same as Diff and Diff
Q15, 18	AMP window spiles	1.17	20	65.56	120	239	Some as D18 and D15
Q17-Q26	AMP window splice	1.17		45.56	115	53	





TYPICAL CABLIN TRAY SETUP

FIGURE 3.

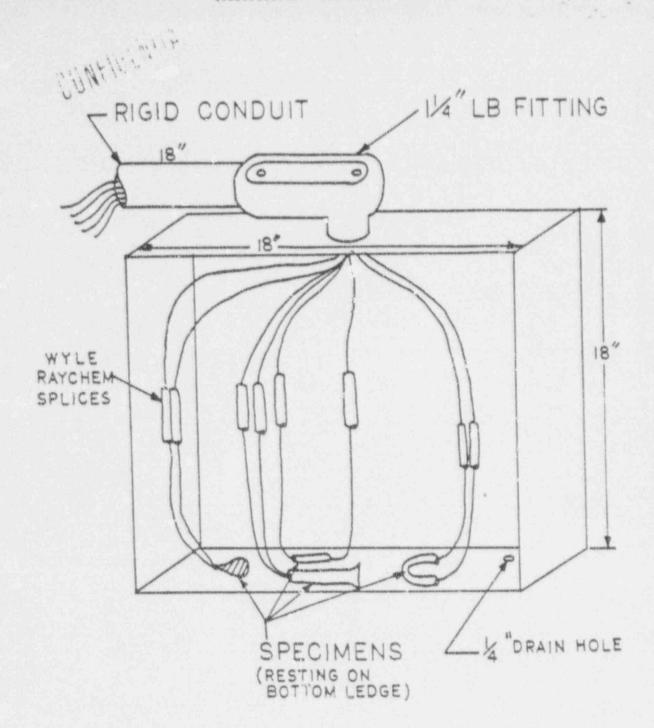


FIGURE 4. TYPICAL NEWA 3 ENCLOSURE TEST SETUP

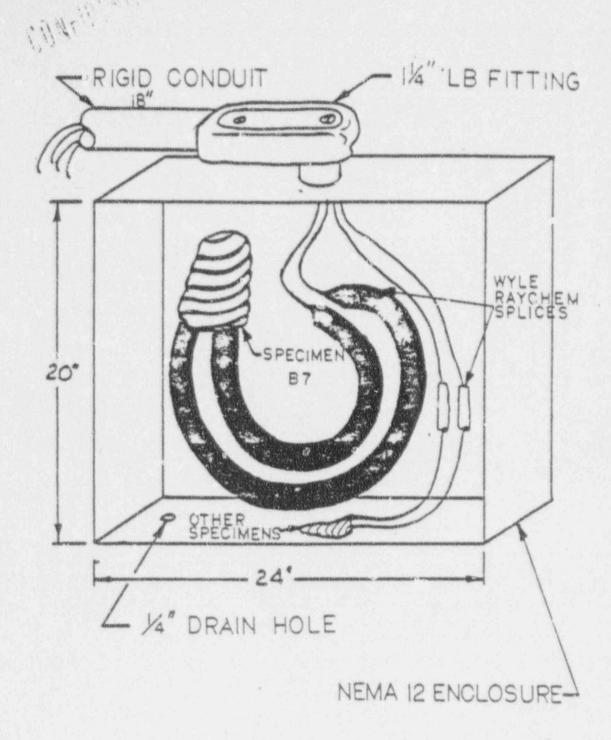


FIGURE 5. NEWA 12 ENCLOSURE TEST SETUP

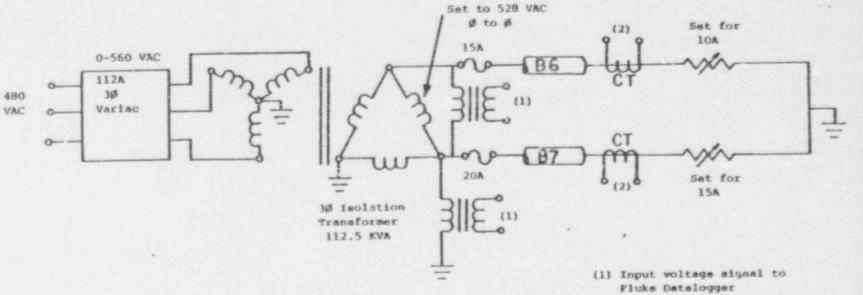
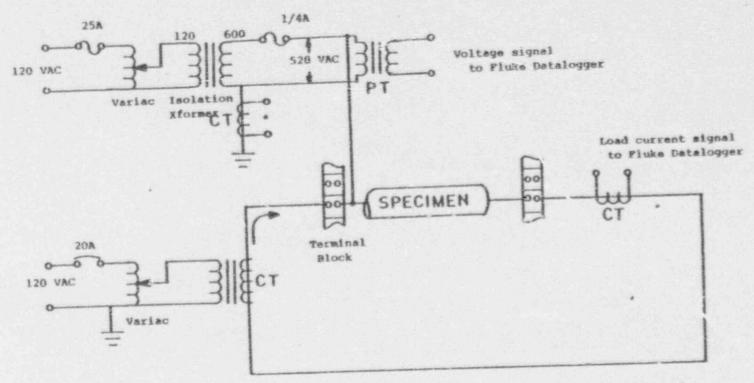


FIGURE 6. ELECTRICAL SETUP FOR SPECIMENS B6 AND B7

5...

(2) Applied current signal to fluke Datalogger



\*Leakage current to ground signal to Daytronics Data Acquisition System.

PIGURE 7. TYPICAL ELECTRICAL SETUP FOR 528 VAC AND 6.7A OR 5A CIRCUITS

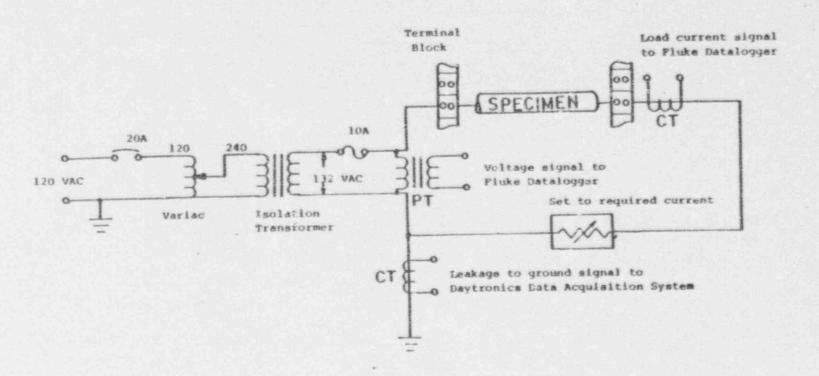


FIGURE 8. TYPICAL ELECTRICAL SETUP POR 132 VAC CIRCULTS

FIGURE 9. TYPICAL ELECTRICAL SETUP FOR SPECIMENS Z2 AND Z3

#### APPENDIXI

Splice Preparation Procedures

WI-500 Addendum #3

Ral

ADDENTING - WI-500



51

## ADDEDDUM ON FIELD TEST OF T-95 & #35 CKONITE TAPE

The shelf life for T-95 Okonite tape is 12 months. from date of manufacture. The shelf life for #35 Okonite tape is 24 months from date of manufacture. Okonite tapes remain usuable beyond shelf life expiration date, provided the following two (2) infield tests can be passed.

- When stretching the tape to 3/4 of its original width, the tapo should not rupture or tear.
- 2. Wrap several half-lapped layers around a dowel or any other object to simulate a cable. The layers should be applied under a tension described above. After lightly squeezing the half-lapped layers, slice open the taped mass along the axis of the dowel. If the taped layers are inseparable, (fused together), the tape is acceptable for use.

The Craft shall notify Quality Control prior to performing the test. Quality Control shall monitor the tests through in-process inspections.

References:

Mark Teras memo dated 1/14/83.

R=1

XEFOX TELECOPIER 298 :

· live

#### PROCEDURE CLARIFICATION

Terminations made at motors 480V and below are to be performed in the following manner:

- lugs are to be bolted together with the appropriato bolt type and associated hardware. Bolting material for bolt diameter of 3/8" and larger are to be stainless steel in accordance with CECo Standard C-849.
- 2. Any voids that exist between the ettached lugs are to be filled by the use of Okonite rubber comunt and sufficient layers of Okonite nits T-95 taps as applicable to prevent moisture crespage.
- 3. Apply Okonite rubber cement over both lugs and exposed conductor area. Let dr until cement becomes tacky.
- 4. Using Okonite T-95 tape, wrap both lugs a minimum of two half-laps, paying attention to empletely softening the bolt attachment.

5. Apply a minimum of two half-laps of Okonite 0-35 tape. The layers of 0-35 should extend approximately one inch past the boundary of the lugs on to the cable jacket.

Richard Duzts Manager, Quality (HPFCo)

Ken V Stale 6/24/79

X. Steele CBCo Project Engineer

References: . .

HPFCo WI-500, Rev. 7 S&L Std. EA-209 S&L Dwg. 1E-0-3089 CECo Std. C-849

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WI-500 Addendum #3

R-1

January 11, 1983

Mr. Jim Phelen Principal Engineer Commonwealth Edison Company Post Office Box 767 Chicago, Illinois 60690

RE: T-95, #35 Okonite Tapes

Dear Nr. Phelan:

The shelf life for the subject tapes remains as stated below and as in my previous December 21, 1982 letter:

T-95 -- 12 months from date of manufacture

135 -- 24 Months from date of manufacture

However, the term shelf life must be further defined so that unnecessary restrictions are not invoked regarding the use of Chomite tages. Okonite tapes remain useable provided that the following two (2) in-field tests can be passed:

- 1. When stretching the tape to 3/4 of its original width, the tape should not rupture or tear.
- 2. Wrap several half-lapped layers around a dowel or any other object to simulate a cable. The layers should be applied under the tension described above. After Lightly squeezing the half-lapped layers, slice open the taped mass along the axis of the dowel. If the taped layers are inseparable, (fused together), the tape is acceptable for use.

Due to the many varying conditions under which tapes are stored Due to the many varying conditions under which tapes are stored in the field, the "shelf life" parameter is used to assist the the customer in keeping fresh, useable tape on the jobsite. Expiration of the recommended shelf life does not mandate that the tape is not suitable for use.

Please advise this office if you have further questions in this. matter.

Very gruly yours,

THE OKONITE COMPANY

Donald W. Martin Page 3 Distric Manager

D334: FE

### 3.0 DESTYTTES INVOLVED (con't.)

R-10

21. All wiring shall be complete, supported, neat in appearance and shall comply with the latest revision of the A/E's wiring diagrams. Any unique termination problems will be referred to the Owner and A/E for disposition.

R-10 22. The bending radii of cables trained in place shall not exceed values given in Table A.

#### 3.3 Cable Terminations Revisions

1. When a termination is changed per drawing revision a new termination card is filled out noting the reason for the termination change in the comment section of the termination cards. All revisions to cables terminated must be coordinated under the direction of Commonwealth Edision's Operational Analysis Department.

#### 3.4 Power Terminations

- 1. Manufacturers termination kits are required for 6900 and 4160 V cables per S&L drawings LE-0-3088. 3089, and 3039A.
- Terminations of 600v and below made with uningulated lugs are to be taped with the "Okonite Matho
  (see section 3.4.3 for lug to lug connections and
  uninsulated butt splices). The cable, insulation
  uninsulated butt splices). The cable, insulation
  and jacket shall be cleaned with a suitable solver
  and allowed to dry. The entire surface to be tape
  shall be coated with Okonite cament. The lug bars
  shall be coated with Okonite cament. The lug bars
  and conductor shall be wrapped or softened by two
  and conductor shall be wrapped or softened by two
  half-lapped layers of Okonite T-95 tape, followed
  by sufficient but not less than 2 half-lapped laye
  of Okonite 0-35 insulation tape. The total insulation thickness should be approximately 15 times
  the thickness of the factory applied cable jacket
  insulation. (See Addendum #3)

R-10

3. Lug to lug terminations (both insulated and uninsulated) of 600V and below need not be individual
insulated prior to connection. Only the total
bolted connection requires insulation by the Okonite method. If lugs are connected in such a mar
nite method. If lugs are connected in such a mar
nor as to leave a void area between the lugs, thi
area is filled in with Okonite T-95 taping mater:
to prevent moisture creepage. Uninsulated butt
splices are to be taped to the Okonite method or
covered by WCSF Rachem shrink tubing.
(See Addendum #4)

R-10

### PWR TEST LEAKAGE CURRENT RESULTS

CONFINENTIA!

The peak recorded leakage currents recorded during this test were as follows:

Specimen,		
	Peak Leakage	
Number	Current (ma)	Notes
21	. 157	Addition
<b>Z</b> 2	0	
Z3		
Zn	o o	
Z3	0	
26	· ·	
Z7	· ·	
28		
29	0	
210	0	
	0	
Z:1	> 250	(1)
212	>250	(1)
213		(1)
B1		
82	38	
B3		
B4	35	
B5	>250	(1)
B6	. 7	
B7	Not measured	(2)
D/	Not measured	(2)
		1777

Notes: (1) Specimen blew, repeatedly, a 1/4 ampere fuse to ground.

(2) Leakage current to ground signals were not measured because these specimens would not be overly affected by small current signals.

stomer	CIECO	THE SECURE OF THE PROPERTY OF		WYLELABORATORIES
Secimen ************************************	Cables and Splices	THE THE PERSON NAMED AND ADDRESS OF THE PERSON NAMED AND ADDRE	77.00	11000
art No.	Various	Amb. Temp	7605	Job No. 17859 17859-02
000	WLQF 17859-01	Photo	Y 55	Start Oste 9-20-96
17 B.	3.1.3	Test Med	ALI Adapted	
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Page No. IX-18 Test Report No. 1785 -02P

### DATA SHEET

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### BWR TEST I FAXAGE CURRENT RESULTS

### Results of BWR Test #1

The peak recorded leakage on each specimen (or group of specimens) were as follows:

Specimen No.	Peak Leakage Current
Q1 Q2 Q3 Q4 Q5 Q6 D3 D4 D5 and D7 in series D6 D8 D9 D10 D11 D16 D17	29 mA 2 mA 0 mA 5 mA 1 mA 81 mA 12 mA 53 mA 7 niA 2 mA 2 mA 0 mA 8 mA 2 mA 6 mA
D18 D19 D20 D21	≥2000 mA* 1474 mA 263 mA 217 mA

<sup>\*</sup>Specimen D18 blew two 2 ampere fuses immediately after insertion into the circuit.

#### Results of BWR Test #2

OB B B

The peak recorded leakage currents on each specimen (or group of specimens) during this test were as follows:

Specimen No	Peak Leakage Cuttent
L1 L2, L4 and L10 in series L3 L5 L6 and L8 in series L7 L9 L11 Q7, Q9 and Q11 in series Q8 Q10 Q12 Q13 Q14 Q15 Q16 D1 D2 D12 D13, L11 and D15 in series	10 mA 18 mA 11 mA 16 mA 24 mA 219 mA 1 mA 0 mA 15 mA 0 mA 9 mA 11 mA 23 mA 9 mA 1 mA 0 mA 353 mA 1 mA 0 mA

#### Results of BWR Tan #3

The peak recorded leakage currents on each specimen during this test were as follows:

Specimen No.	ensk Leakann Suntal
'Q17	ens and
QIE	530 mA
Q19	4737 mA
Q20	>25 amperes*

"Specimen blew a 25 ampere fuse.

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lorier	CECo	economic supersymmetric supersymmetr		MALE LABORATURIES
cinten	Cables and Splices	Amb. Temp	72°F	JOD NO. 17859
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DE AB Commonweard Esison Company WYLE LABORATORIES Specimen Lables AND Spices JOB NO 17859 7205 PER NO VARIOUS Amb. Temp. Spec While 17859-01 REU B VES Photo STRAM Test Med. Specimen Temp. 250°E 2057 - LOCA TINSULATION RESISTANCE TEST (CONTINUED) No INVILLATION RESISTANCE Spramen No 191108 2 9.81100 013 1.6 ×10" ~ 014 1,21/012 015 5,0010 -11110-2 1. 1×10 -012 4.0x10 r D13 9247m XX L/X10 -2-D1# 1.1 110 2 D15 66×10 -DI

Notice of

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	DATA SHEET
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