APPENDIX I

Test Procedure for Steam Accident Test of
Limitorque Control and Power Wiring and
Okonite Tape Splices

December 2, 1986

Test Procedure for Steam Accident Test of Limitorque Control and Power Wiring and Okonite Tape Splices

Report No. PEI-TR-870200-01

Prepared for
NEBRASKA PUBLIC POWER DISTRICT
Cooper Nuclear Station

P. O. No. 263120
PEI J/N 8702

patel engineers
huntsville, alabama

TECHNICAL DOCUMENT

DOCUMENT TYPE (REPORT/PLAN/PROCEDURE): Test Procedure

DOCUMENT NO.: PEI-TR-870200-01

ORIGINAL ISSUE DATE: December 2, 1986

TITLE: Test Procedure for Steam Accident Test of Limitorque Control and Power Wiring and Okonite Tape Splices

PREPARATION

PROJECT ENGINEER: Gary J. Elam

TECHNICAL REVIEWS

PROGRAM MANAGER: Gary J. Elam

ENGINEERING VERIFIER: Fred L. Roy

QUALITY ASSURANCE: Carolyn Tinley for Terry H. Utech

APPROVAL

GROUP/DIVISION DIRECTOR: Johnny F. Jenkins for

TABLE OF CONTENTS

LIST OF FIGURES

1.0 SCOPE

This test procedure was prepared for the Cooper Nuclear Station (CNS) for the steam accident testing of Limitorque control and power wiring and Okonite tape splices.

1.1 Test Assembly Description

The test assembly shall consist of two cable/splice circuit loops inside a NEMA-4 enclosure. The test specimens shall be assembled and provided by the CNS plant staff except that Patel shall install the wiring into the NEMA-4 enclosure. The enclosure shall not have a drilled "weep hole. The test assembly shall be fabricated per Figure 1. The enclosure simulates the Limitorque housings at CNS.

The 2 circuit loops shall be labeled loop 1 and loop 2. Loop 1 shall contain 2 segments (F and G) of Limitorque torque switch wire (black braid) that were naturally aged in service at CNS. Segments F and G were installed for 12 years in the CNS steam tunnel in valve operators MS-MO-M077 and MS-MO-M078, respectively. Valve operators MS-MO-M077 and MS-MO-M078 are located in high radiation and elevated ambient temperature environments. Loop 2 shall contain 2 segments (B and C) of Limitorque motor lead wire (yellow braid) that were naturally aged in service at CNS. Segments B and C were installed for 12 years in the CNS steam tunnel in valve operator MS-MO-M077. Circuit Loops 1 and 2 each contain three bolted Okonite T35/T95 tape splices. The lead wires for loops 1 and 2 shall be Rockbestos Firewall SIS 16 AWG 600V Nuclear Cable. The splices were assembled by CNS personnel in accordance with CNS procedure 7.3.26.

1.2 Test Sequence

Testing shall be performed as follows:

- o Functional Tests
- o Steam Accident Test
- o Functional Tests

2.0 TEST REQUIREMENTS

2.1 Instrumentation

All test equipment to be used in the performance of this program shall be calibrated in accordance with applicable portions of ANSI N45.2, and 10CFR50/Appendix B. Standards used in performing all calibrations shall be traceable to the National bureau of Standards.

2.1.1 Calibration

Test equipment serial numbers, calibration dates, and accuracies shall be annotated and verified on the data sheets prior to test initiation.

2.2 Acceptance Criteria

The individual leakage current readings during the accident simulation shall not exceed 30 milliamps for loop 1 and 300 milliamps for loop 2.

3.0 TEST PROCEDURES

The test specimens shall be subjected to the tests as described in the test sequence in Paragraph 1.2. The tests are described below.

3.1 Functional Tests

3.1.1 Visual Inspection

A visual inspection shall be performed. This inspection will assure that the equipment has not received any obvious visible damage during shipping and handling. Equipment identification will also be verified.

3.1.2 Insulation Resistance (IR)

The insulation resistance of the test specimens shall be measured at 500 VDC for 1 minute and shall be recorded. The following IR measurements shall be taken.

Loop 1 to Ground
Loop 2 to Ground

3.1.3 Continuity Verification

Circuit continuity shall be verified by measuring and recording the circuit resistance of loop 1 and loop 2.

3.2 Steam Accident Test

The test assembly shall be installed in the test chamber with the conduit opening oriented downward. The enclosure door shall be clamped shut using the enclosure mounted hardware. The test specimens shall be electrically energized as shown in Figure 2. With the test assembly energized, the test assembly shall be subjected to the following steam profile (see Figure 3):

150 to 300°F in 30 seconds
300°F/15 psig minimum for 1 minute (not including ramp)
250°F/10 psig minimum for 29 minutes
230°F/5 psig minimum for 99.5 hours

During the accident test, leakage current shall be recorded on a datalogger every 10 seconds for the first 5 minutes, every minute for the next 30 minutes and every 20 minutes thereafter. The leakage current monitoring loop shall be capable of measuring 1 milliamp. IR measurements shall be taken once during the first 30 minutes and at approximately 2 hours, 4 hours, 8 hours and every 24 hours thereafter.

Chamber temperature shall be recorded using at least 2 thermocouples that are connected to a datalogger or strip recorder. The thermocouples shall be located within 2 inches of the test assembly. Pressure shall be measured by using pressure transducers of 3% or better accuracy.

3.3 Functional Tests

Subsequent to the steam accident test, the chamber shall be opened and the test assembly allowed to cool to ambient conditions. The test assembly shall not be removed from the chamber or handled before the functional test. The functional tests described in Paragraph 3.1 shall be repeated.

3.4 Notices of Anomaly

Patel Engineers shall be notified within 24 hours of the occurrence of anomalies encountered during performance of testing. After verbal notice, a written account of the anomaly and its disposition shall be forwarded to Patel.

3.5 Reports

The report shall describe the requirements, procedures, and results for this test program.

POOR QUALITY DOCUMENT

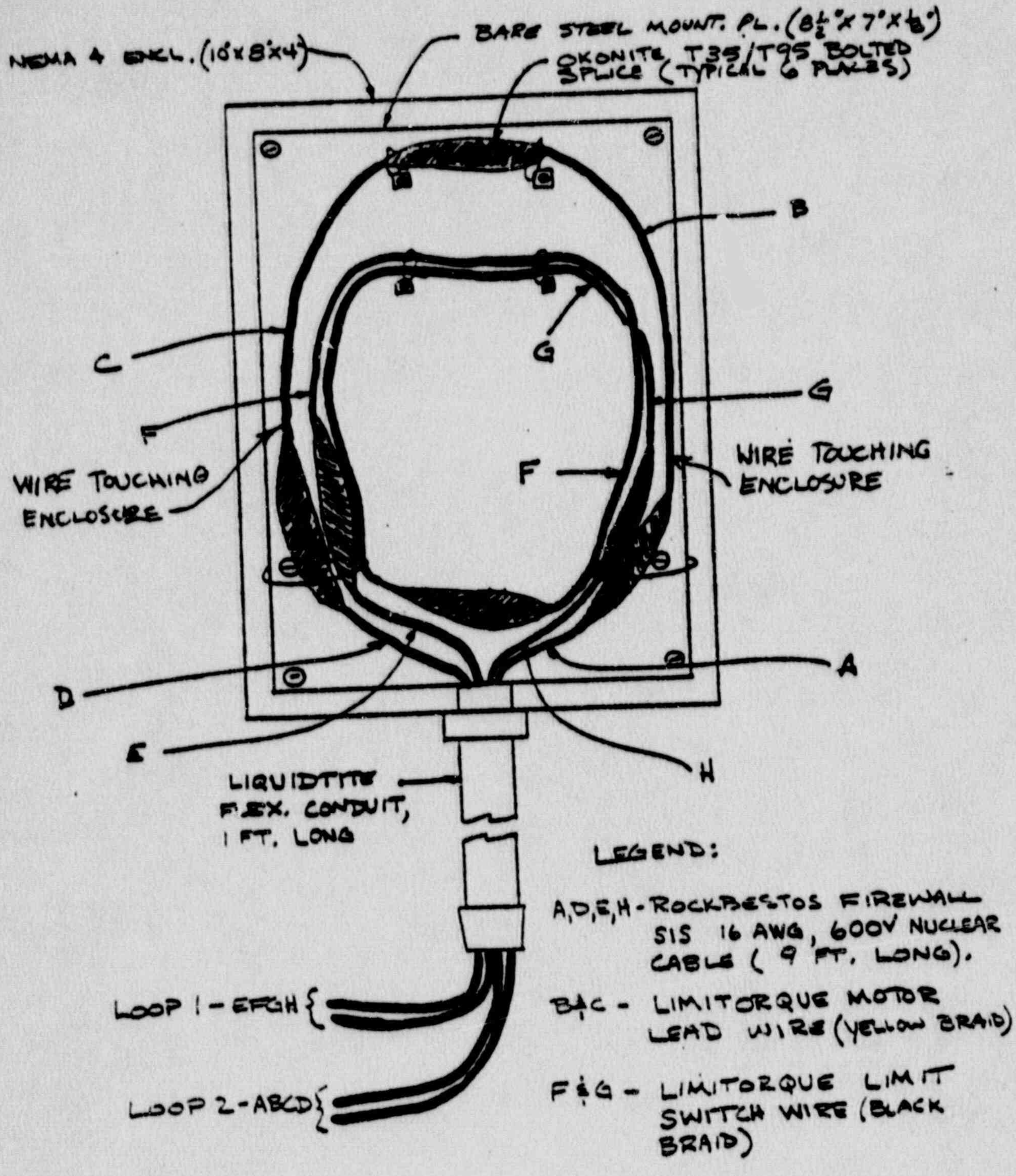
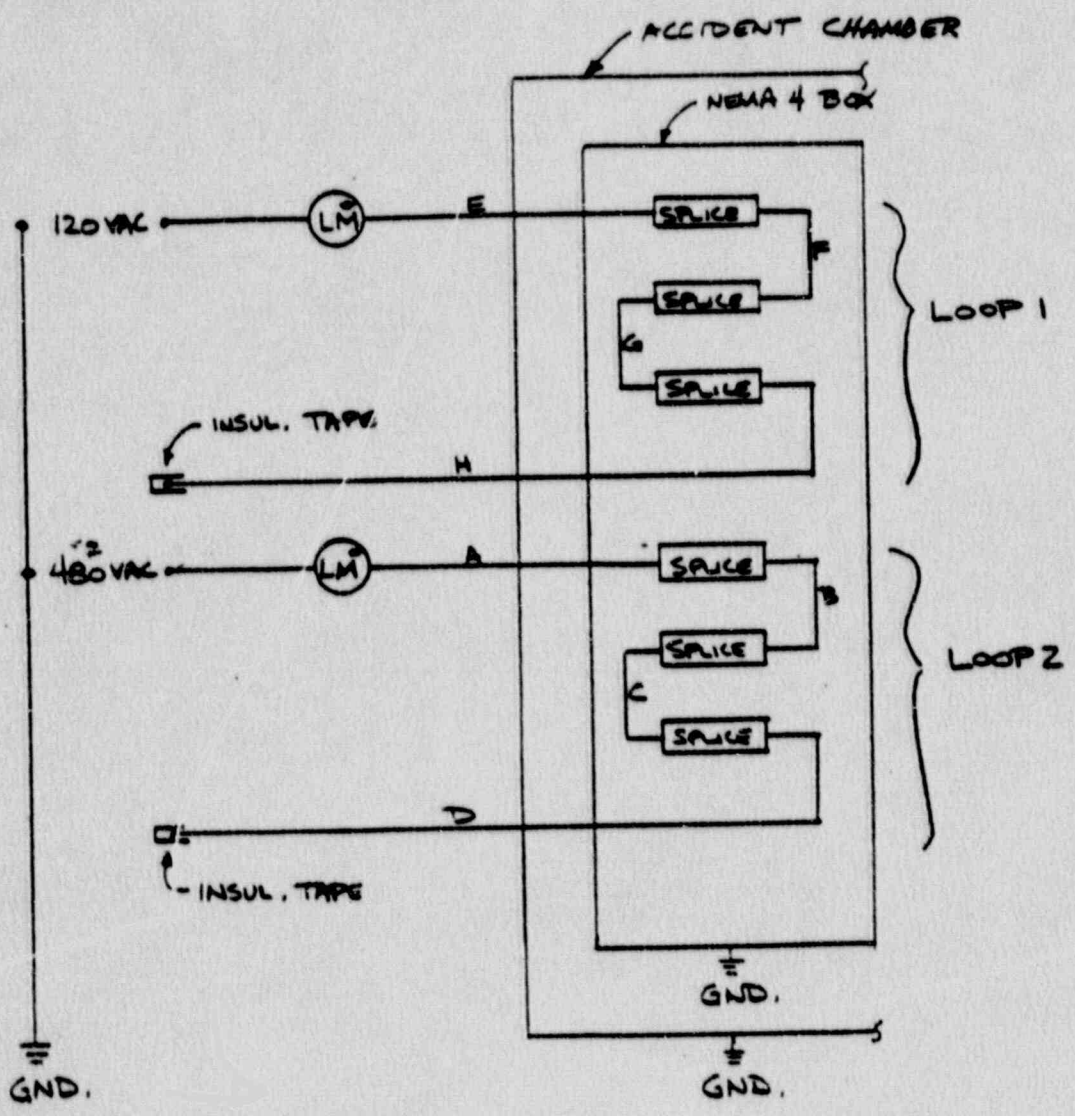


FIGURE 1
TEST ASSEMBLY CONFIGURATION

8706170028



*(LM) = LEAKAGE CURRENT MEASUREMENT CIRCUIT.

FIGURE 2
ACCIDENT TEST CONFIGURATION

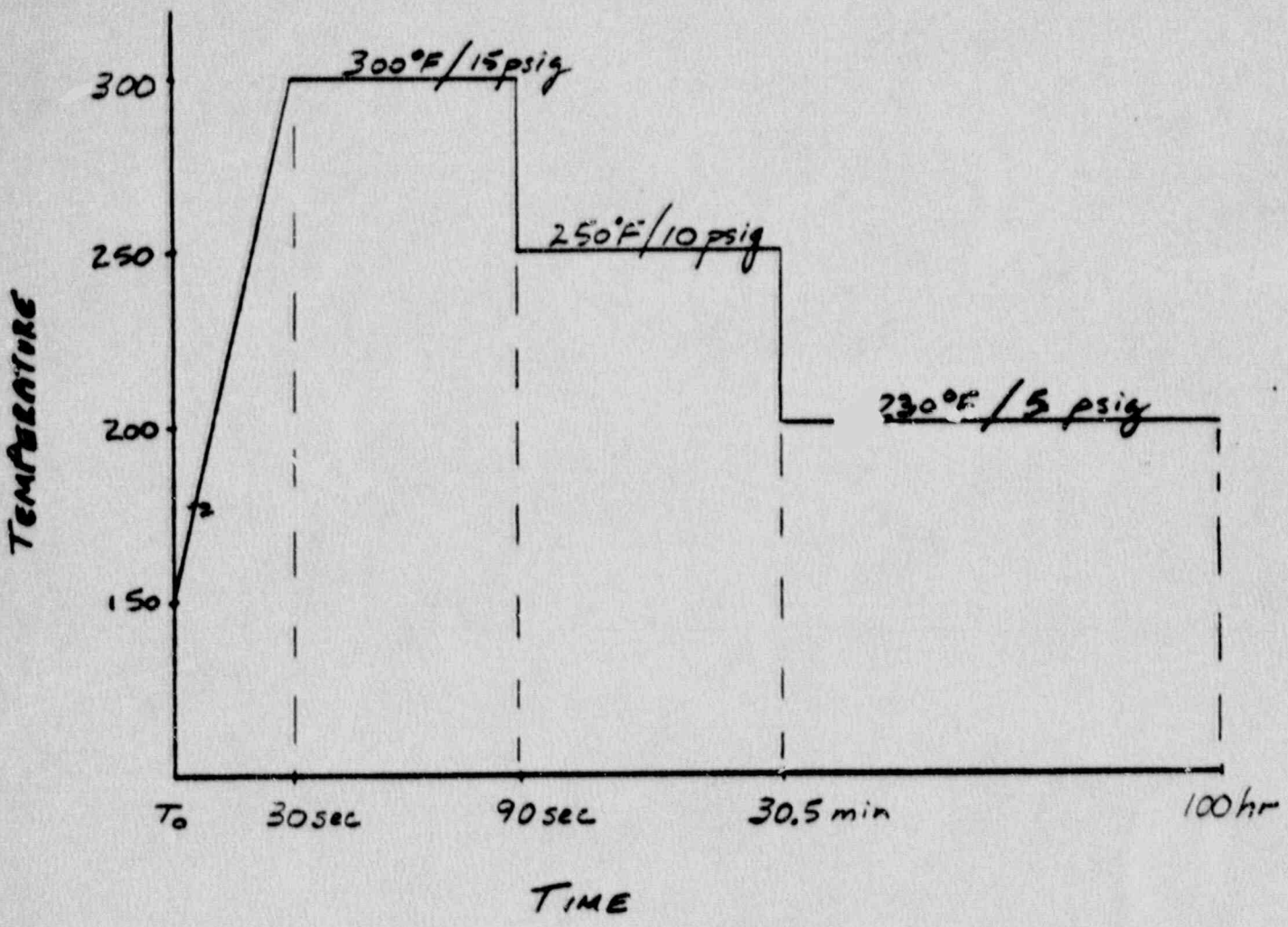


FIGURE 3
ACCIDENT TEST PROFILE

APPENDIX III

Post Accident Visual Inspection, 12/16/86

CONTACT REPORT

Contact Report Of: Johnny F. Jenkins JFJ Telephone: ☐ Visit: ☒

Date of Contact: 12/16/86 Follow-Up Date: _____

Agency Or Company & Address	CCL P. O. Box 30096 Raleigh, North Carolina 27622
Phone	
Person(s) Contacted and Title	Pete Rutten, Technician Don Hatmaker, Test Engineer
Purpose	Limitorque Wire, Post Accident Inspection
Discussion	1. Reviewed test data and ROAs - preliminary copies provided. 2. Re-check IR with same results as post accident; approximately 600 Kohms. 3. No damage of conduit seal penetration. 4. IR taken upon removal from chamber 4-600 Kohms. 5. "C" cable appears to have some degree of damage (fraying) where it is touching left side of junction box. 6. Water standing in bottom of junction box - surface layer. 7. Flood level not visually discernable. Pete's evaluation of data and other observations have convinced him that water level was above thermocouples which is higher than test specimen, i.e., specimen was completely submerged. 8. C cable was separated from side of junction box - no change in IR. When cable was pressed against junction box, IR went to 0 - dead short. 9. B cable/end splice had similar damage appearance as C cable, but not as extensive. 10. When Specimens "B" and "C" were both separated from the enclosure walls, the IR increased to 40 Mohms.
Action Item	
Copies To	PEI-TR-870200-02, Bob Minadeo, Gary Elam

PEI Form No. 625 - 6/[illegible]