RUBIN FELDMAN, P.E.
President

December 22, 1993

United States Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Carl H. Berlinger, Chief
Electrical Engineering Branch, Division of Engineering
Office of Nuclear Reactor Regulation

Dear Mr. Berlinger:

The following is being submitted in response to your letter of November 8, 1993.

SECTION I. GENERAL QUESTIONS

Question I-A.

To the best of your knowledge, which NRC licensees use the THERMO-LAG 330-660 Flexi-Blanket fire barrier material or system to meet NRC fire protection requirements or guidelines?

Response to Question I-A.

Thermal Science, Inc. 's submittal to the Grand Jury, in the United States District Court fro the District of Maryland, in compliance with their subpoena for documents, included all purchasing and shipping records from January 1, 1982 through January 1, 1993. As a result we are somewhat handicapped in responding to your questions. To the best of our knowledge, the following are the licensees who purchased the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material for use in their nuclear power generating plants:

Carolina Power & Light Co.	Brunswick
Cleveland Electric Illuminating Co.	Perry Nuclear Plant
Commonwealth Edison	Braidwood Station
Entergy Operations	Waterford III

9403040347 931222
PDR ORG NRRB
PDR

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: Domestic 44-2384 • Overseas 209901 • Telecopier (314) 349-1207

Consumers Power	Palisades
Florida Power Corporation	Crystal River Unit 3
Fluor Engineers Co.	San Onofre
Georgia Power	E. I. Hatch & Plant Vogtle
Gulf States Utilities	River Bend
GPU Nuclear	Oyster Creek & Three Mile Island
Long Island Lighting	Shoreham
Iowa Electric	Duane Arnold Plant
Northern States Power	Prairie Island
South Carolina Electric & Gas Co.	Virgil C. Summer
Tennessee Valley Authority	Browns Ferry & Watts Bar
Toledo Edison Co.	Davis Besse Power Station
Texas Utilities Electric	Comanche Peak Units 1 and 2
Washington Public Power Supply System	WPN-2

Question I-B.

In the TSI Bid Document 618 (attached) dated June 25, 1986 for Northeast Utilities Service Company (Millstone Units 1 and 2) you stated in Section 5.2 regarding the ampacity derating for THERMO-LAG 330-660 material that "we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1 Subliming Material, that this material will produce similar test results ... THERMO-LAG 330-1". Provide copies of all documentation you have to support this statement.

Response to Question I-B

Section 5.2 in the reference to TSI Bid Document 618 is captioned "Ampacity Derating Tests and Analysis" and states in full:

> TSI has not conducted ampacity derating tests on the THERMO-LAG 330 Flexi-Blanket Thermal Barrier Material. However, we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1

Subliming Material, that this material will produce similar test results to those of the THERMO-LAG 330-1 Subliming Material. If these tests are required, TSI would be pleased to discuss the arrangements for such tests in further detail with Northeast Utilities.

The documentation which supports this statement would include the ampacity derating tests referenced in Section II of this letter pertaining to THERMO-LAG 330-660 ampacity derating tests performed by Texas Utilities.

The formulations of the THERMO-LAG 330-660 and THERMO-LAG 330-1 are similar. As to specific formulation and composition of these TSI products, they are confidential and proprietary trade secrets. They do use different resins. THERMO-LAG 330-660 also utilizes certain plasticizers which further enhances the flexibility of the material, while the THERMO-LAG 330-1 Subliming Material is more rigid.

SECTION II. AMPACITY DERATING

Question II-A.

What are the ampacity derating values for the 1-hour and 3-hour (if applicable) THERMO-LAG 330-660 Flexi-Blanket fire barrier system?

Response to Question II-A.

The ampacity derating values obtained by TU Electric/Omega Point Test Laboratories for test articles protected with the a one hour design (2 x 0.250" layers) of the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material are as follows:

3C/#6 Air Drop	21.2%
750 kC Mil in Air Drop	31.8%

The above results are reported in Omega Point Test Report "Ampacity Derating Of Fire Protected Cables, Project No. 12340-94583, 95165-95168, 95246, Electrical Test To Determine The Ampacity Derating Of A Protective Envelope For Class 1E Electrical Circuits", dated March 19, 1993.

To the best of knowledge, no ampacity derating tests have been performed on the 3 hour design (5 x 0.250" layers) of the THERMO-LAG 330-660 Flexi-Blanket.

Question II-B.

What standards and test methods were used to qualify the fire barrier systems for use in nuclear power reactors to meet NRC requirements and guidelines? What specific acceptance criteria have been applied.

Response to Question II-B.

The test standards, methods and acceptance criteria, used to conduct the ampacity derating tests referenced in TSI's Response to Question II-A above are contained in Texas Utilities Electric's Test Plan, Revision 4, "Ampacity Derating Tests Of Articles Protected With The THERMO-LAG Fire Barrier System", dated March 12, 1993. A copy is enclosed.

Specific ampacity derating standards referenced in Texas Utilities Electric's Test Plan are as follows:

IEEE P848/D11 "Procedure For The Determination of the Ampacity Derating of Fire Protective Cables," Draft 11, April 6, 1992

ICEA Standard P-54-440, "Ampacities for Cables in Open-top Trays," May 1975

ICEA Standard P-46-426, "Power Cable Ampacities"

Question II-C.

Provide all test reports that document the ampacity derating characteristics of the fire barrier.

Response to Question II-C.

A copy of Omega Point Test Report "Ampacity Derating Of Fire Protected Cables, Project No. 12340-94583, 95165-95168, 95246, Electrical Test To Determine The Ampacity Derating Of A Protective Envelope For Class IE Electrical Circuits", dated March 19, 1993, is enclosed.

SECTION III. SEISMIC ANALYSES

Question III-A.

Provide the material properties of the fire barrier; i.e., density, tensile strength, compressive strength, modulus of elasticity, weight, etc. at 70°F and higher temperatures.

Response to Question III-A.

Property	Value	Test Procedure
Tensile Strength	231 psi @ RT	ASTM D638
Modulus of Elasticity	3067psi @ RT	ASTM D638
Flexural Modulus	5061 psi @ RT	ASTM D790

Property	Value	Test Procedure
Thermal Conductivity	0.12 Btu-Ft / Ft2 Hr °F @ 40°C	ASTM F433
Weight	In accord with TSI's Quality Control Specification - 1.6 Lbs/Ft2 Minimum. per 0.250" minimum thickness	

Question III-B.

Provide information on seismic tests and analyses, if any, performed for the barrier to demonstrate their integrity during and after seismic events.

Response to Question III-B.

No seismic analyses were performed by Thermal Science, Inc.

SECTION IV. FIRE RESISTANCE

Question IV-A.

Identify all the fire barrier system applications where THERMO-LAG 330-660 Flexi-Blanket fire barrier material may have been used.

Response to Question IV-A.

We do not know for certain. We believe that cable drops constituted the dominant use. There may have been other uses.

Question IV-B.

Provide all the pertinent 1 and 3 hour fire endurance test reports that support the use of THERMO-LAG 330-660 Flexi-Blanket fire barrier material.

Response to Question IV-B.

The following reports relate to fire resistive testing performed on the THERMO-LAG 330-660 Flexi-Blanket Material, and were submitted to Mr. Frank J. Miraglia, Deputy Director, Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission, on or about August 31, 1992.

ITL 85-2-382

One Hour Fire Endurance Test Conducted On Air Drop Cables and a Unistrut Section Connected to A 4 Inch Diameter Standard Electrical Conduit Protected With The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier

ITL 85-5-314

One Hour Fire Endurance Test Conducted On A Four Inch Diameter Conduit Protected With The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier System

ITL 85-6-283

Three Hour Fire Endurance Test Conducted On A Four Inch Diameter Conduit Protected With The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier System

ITL 85-11-227

One Hour Fire Endurance Test Conducted On A Four Inch Diameter Conduit Test Assembly Containing Air Drop Cables, A Junction Box and A Condulet Protected With The THERMO-LAG 330-660-N Flexi-Blanket Thermal Barrier System

ITL 86-7-472

Exploratory Three Hour Fire Endurance Test Conducted On Two Conduit Test Samples Submitted By Washington Public Power Supply System (3 Hour Fire Endurance Test, Sample No. 1-A, 2" Diameter Conduit modified to include a layer of Flexi-blanket)

ITL 87-5-435

Thirty Minute Fire Endurance Test Conducted On A Ladder Cable Tray With A P1000 Unistrut Attachment Protected With The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier

ITL 87-6-350

One Hour Fire Endurance Test conducted On A Ladder Cable Tray With A P1000 Unistrut Attachment Protected With The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier

ITL 85-[illegible]-106

Three Hour Fire Endurance Test Conducted On Flex Conduit Connected To A Ladder Cable Tray Protected With The THERMO-LAG 330 Fire Barrier System Designs

ITL 85-4-377

One Hour Fire Endurance Test Conducted On A 4 Inch Diameter Aluminum Conduit Test Assembly With A Condulet, An Air Drop Cable Installed in a 3/4 Inch Fluid Type Flex Conduit And A P1000 Unistrut Protected With The THERMO-LAG 330 Fire Barrier System Designs

We trust the above information answers your questions.

Yours truly,

Rubin Feldman
President

RF/meg
Enclosure

Appendix B

TEST PLAN

March 12, 1993

TEST PLAN Rev. 4

AMPACITY DERATING TESTS OF ARTICLES PROTECTED WITH THE THERMO-LAG FIRE BARRIER SYSTEM

1 SCOPE

This test plan describes the methods and guidelines to be utilized for the preparation of test specimens, installation of the THERMO-LAG Fire Barrier Systems (hereafter referred to as "Thermo-Lag"), performance of ampacity derating tests and all applicable documentation of these tasks and the test results.

2 OBJECTIVE

The objective of these tests is to determine the ampacity derating factors for a protective generic fire barrier system for cables at TU Electric's Comanche Peak Steam Electric Station. Results of this test program will provide documented evidence of the necessary current derating factors for a different cable installation configurations. These tests shall satisfy the requirements for ampacity derating by testing the cable raceway fire barriers as detailed in the IEEE P848 "Procedure for the Determination of the Ampacity Derating of Fire Protected Cables," Draft 11, dated April 6, 1992, except as otherwise outlined herein. (Note: IEEE-P848/D11 is presently undergoing review by members of Subcommittee 12 of the Insulated Conductors Committee of the IEEE. TU Electric has incorporated into this procedure those revisions expected to be included in Draft 12. These deviations from Draft 11 are highlighted in bold italics throughout the procedure).

3 REFERENCES

3.1 Documents

3.1.1 IEEE P848/D11 Procedure for the Determination of the Ampacity Derating of Fire Protective Cables," Draft 11, April 6, 1992

3.1.2 Thermal Science, Inc.'s Technical Note 20684, Revision V "THERMO-LAG 330 Fire Barrier System, Installation Procedures Manual, Power Generating Plant Application," including TSI letters of clarification thereto.

3.1.3 Specification CPES-M-2032, Rev. 0, "Procurement and Installation of Fire Barrier Fireproofing Material."

3.1.4 ICEA Standard P-54-440, "Ampacities for Cables in Open-top Trays", May 1975

3.1.5 ICEA Standard P-46-426, "Power Cable Ampacities"

3.1.6 Construction/Quality Procedure CQP-CV-107, Rev 0, "Application of Fire Barrier and Fireproofing Material."

3.1.7 Construction/Quality Procedure CQP-EL-222, Rev.1, "Installation and Fabrication of Conduit Raceway Systems."

4 RESPONSIBILITIES

4.1 Texas Utilities Electric (TU Electric) and Associated Contractor Organizations

4.1.1 Establish the criteria, guidelines, drawings (draft quality), recommendations, etc., to govern the installation of the test items. Supply the test item pieces, including all hardware, electrical cables, conduit, tray systems, etc.

4.1.2 Establish the criteria, guidelines, drawings (final, report quality if needed), recommendations, etc., to govern the installation of the Thermo-Lag Fire Barrier System Materials to the test articles.

4.1.3 Provide the specific Thermo-Lag installation procedures and work package documentation.

4.1.4 Provide materials representative of existing or future site installations.

4.1.5 Provide the Thermo-Lag Fire Barrier System materials and installation tools and equipment.

4.1.6 Provide scheduling of personnel, equipment and material necessary to perform the installation and QC documentation of the fire barrier system materials utilizing the appropriate installation procedures.

4.1.7 Coordinate all phases of the ampacity test preparation with the testing organization including approval of variations .

4.1.8 Apply the fire barrier system to the test articles.

4.1.9 Supply QC and construction personnel to witness and document assembly and test article raceway configurations.

4.1.10 Perform as a liaison with the testing organization and provide the testing organization with all applicable TU Electric Documents as identified in Section 3. 1.

4.1.11 Provide all applicable quality control documentation for the fire barrier system materials, cables, and installation of the fire barrier system and penetration seal materials to each test article.

4.1.12 Perform and document inspections of the fire barrier system materials at various points during the installation process.

4.2 Omega Point Laboratories, Inc. (Laboratory)

4.2.1 Prepare the test assemblies and provide all required test instrumentation in accordance with Appendix B Quality Assurance and Quality Control Programs and other applicable procedures.

4.2.2 Provide thermocouple calibration and instrumentation, storage temperature recorder, and relative humidity instrumentation.

4.2.3 Assemble, install and document the installation of all trays, conduits, cables, etc. to be supplied by TU Electric. Provide computer-generated drawings of tray, conduit and cabling systems which clearly indicate dimensions, thermocouple locations, etc.

4.2.4 Observe and document the installation of the Thermo-Lag Fire Barrier System Materials to the test articles, and attendant instrumentation on each test article.

4.2.5 Conduct the ampacity baseline and derating tests.

4.2.6 Document the test parameters and provide a formal detailed written report of the test program and test results.

4.2.7 Provide 35mm photographic coverage of the test project.

4.3 Laboratory Quality Assurance/Quality Control

4.3.1 Verify TU Electric's quality control documentation exist for the fire barrier system materials used in the test program.

4.3.2 Witness TU Electric's installation procedures utilized in the installation of the fire barrier system materials.

4.3.3 Inspect and document the construction and instrumentation of the test articles.

4.3.4 Provide written calibration documentation of all thermocouples, ammeters, measurement devices and data acquisition systems used in this test program.

5 SPECIAL PRECAUTIONS

5.1 Precautions For Installation Of The Fire Barrier System Materials

5.1.1 Thermo-Lag Fire Barrier System materials shall be installed by TU Electric in accordance with applicable specifications, design drawings and procedures (Ref, 3.1.6, 3.1.7 and 3.1.8) such that the test articles are representative of CPSES upgraded Thermo-Lag installations.

5.1.2 Observe specific precautions recommended by Thermal Science, and other's material safety data sheets.

6 PREREQUISITES

6.1 Traceability Requirements

To insure that the materials used in this test are representative of those in actual use at Comanche Peak Steam Electric Station (CPSES), all aspects of traceability as required by the Laboratory QA Program shall be applied.

The cables used in this test program shall be traceable to the respective cable manufacturer and shall be supplied by TU Electric or the Laboratory with documentation of traceability.

All thermocouples used in this test program shall be traceable to the respective thermocouple manufacturer, with calibration certification.

6.2 Test Configuration

6.2.1 Cable Tray Test Article

One(1) tray article will be tested as prescribed in the IEEE P848/D11 draft test method; a 24" wide x 4" deep straight section of ladder back cable tray, 12 feet long , filled to a 2.95 inch depth with 3/C 6AWG Cu 600V cable. The entire assembly shall be clad in 1/2"Thermo-lag.

6.2.2 Conduit Test Articles

Three(3) configurations of galvanized rigid steel conduit supplied by TU Electric will be tested. All will be 12 feet long and will contain electrical cables as described below.

a. *A 3/4" diameter conduit, with a single 3/C 10 AWG 600V Cu cable, clad in a 1/2 inch thick layer of Thermo-Lag with a 1/4" overlay*

b. *A 2" diameter conduit, with a single 3/C 6 AWG 600V Cu cables, clad in a 1/2 inch thick layer of Thermo-Lag with a 1/4" overlay*

c. *A 5 " diameter conduit, with four-1/C 750 kcmil Cu, 600 V EPR-insulation/Hypalon jacket cables, clad in 1/2 inch thick layer of Thermo-Lag.*

Note: These configurations were chosen to be consistent with CPSES installation (i.e., 3/4" to 5" instead of 1" to 4" specified in the standard).

6.2.3 *Free Air Drop Test Articles*

Two (2) configurations of cable bundle free air drops supplied by TU Electric will be tested. Each will consist of a 12 foot long cable bundle as described below.

a. *A single 3/C 6 AWG Cu 600 V cable, clad in three layers of 660-Flex Blanket Thermo-Lag*

b. *Three 1/C 750 kcmil Cu 600 V EPR-insulation/Hypalon jacket cables, clad in three layers of 660-Flex Blanket Thermo-Lag*

6.2.4 Base-line Test Articles

Baseline evaluation for a tray assembly shall be performed on the same physical specimen used for the derating test. Baseline and derating evaluation for the conduits and free-air drops shall be performed using the same instrumental cable set.

6.2.5 *Test articles shall be supported on wood blocks during the performance of the ampacity tests.*

6.3 Cable Installation

An itemized listing of cable types and quantities including the percentage cable fill to be installed in the test articles will be prepared by the Laboratory and included in the final report. Cable location within the test articles shall be documented and included with data to be evaluated by the testing laboratory. All conductors inside each test article will be connected into a single, series electrical circuit.

6.4 Thermocouple Installation

All thermocouples used in this test program shall be provided and installed by the Laboratory, with QC surveillance by Laboratory personnel. The thermocouple wires shall be calibrated (by Lot No.) prior to installation and for use, and applicable quality control documentation for record purposes generated. *Type T special accuracy thermocouples shall be used on the conduit and free air drop configurations and for all ambient temperature measurements. Type K thermocouples will be used for tray configurations and adjustment made to account for any difference in accuracy.* All thermocouples will be electrically welded at the thermojunctions.

Calibration will consist of manufacturer-supplied (and audited) certifications of calibrations at five temperatures of thermocouples taken from both ends of each purchased lot number.

Three thermocouples shall be installed at each location for the conduit and the free air drop test articles.. Thermocouples in the cable tray test articles shall be installed in locations that are consistent with the requirements of IEEE-P848/D11.

6.5 Ammeter Installation

Current transformer type ammeters with an accuracy of ±2% will be used to monitor current during the test. The current measurement will be used in conjunction with cable temperature measurements to regulate current supplied to the test articles (refer to Section 8). Once temperature and current have reached equilibrium, a high accuracy clamp-on type ammeter with an accuracy of ±1% will be used to obtain the ampacity values that will be used to calculate the ampacity derating.

6.6 Pretest Inspection

6.6.1 Prior to the commencement of the test, a thorough check of each test assembly and associated equipment (including data recording equipment) shall be performed and documented by the testing laboratory.

6.6.2 Approval of the construction, assembly, installation and instrumentation will be documented by TU Electric and the Laboratory prior to performance of each test (a sign-off sheet for this purpose will be supplied by the Laboratory).

6.6.3 Ampacity derating testing of assemblies will not commence until Thermo-Lag Fire Barrier Materials attain a moisture meter reading that does not exceed 20% content. A meter with a scale of 0-100 (with 100 being 20% actual moisture content) such as a Delmhorst Model DP or equivalent shall be used.

7 PROCEDURE

7.1 Ampacity Baseline Tests

7.1.1 The unprotected test articles shall be energized with 60 Hz AC voltage as specified in IEEE P848/D11 and the baseline current ampacity determined as that which results in a thermal equilibrium at 90°C at the hottest location at the center of the test article.

7.1.2 The conditions specified in IEEE P848/D11 for ambient temperature and current/temperature equilibrium will be adhered to.

7.1.3 *If the final conductor and ambient temperatures are not 90°C and 40°C respectively for any test, the measured current shall be normalized as outlined in ICEA P-46-426.*

7.1.4 *Baseline tests may be run before or after the TSI protected raceway/free air drop test assemblies; in accordance with Section 6.2.4.*

7.2 Ampacity Derating Tests

7.2.1 The protected test articles shall be energized with 60 Hz AC voltage as specified in IEEE P848/D11 and the baseline current ampacity determined as that which results in a thermal equilibration at 90°C at the hottest location at the center of the test article.

7.2.2 The conditions specified in IEEE P848/D11 for ambient temperature and current/temperature equilibrium will be adhered to.

7.2.3 *If the final conductor and ambient temperatures are not 90°C and 40°C respectively for any test, the measured current shall be normalized as outlined in ICEA P-46-426.*

7.3 Calculation of Ampacity Derating

7.3.1 Ampacity derate factors shall be calculated in accordance with IEEE P848/D11.

7.3.2 *The normalized measured current for the baseline configuration shall be used in computing the cable ampacity derating factor.*

8 DATA SYSTEMS

8.1 During the ampacity test period, all thermocouples will be scanned at one minute intervals or less.

8.2 The data acquisition computer will determine the hottest single point at the center of each assembly and, using Proportional, Integral and Derivative (PID) process control computer routines, will output a voltage signal which will update the position of a motor-driven variable transformer to drive the system to equilibrium at 90°C.

8.3 The data acquisition computer will concurrently measure the current flow through the assembly, by interfacing with a calibrated current loop circuit. When equilibrium has been reached (in accordance with the P848/D11 Draft standard), the system will be de-energized and the test will be complete.

9 TEST REPORT

9.1 The Laboratory will submit a report on the results of the test and thermocouple data.

9.2 The Laboratory will assemble the final test report, containing the collected data and required quality control documentation.

9.3 The test report shall be prepared in sufficient detail to summarize the total testing activity. The report shall include as a minimum:

a) Date of the test
b) Location of the test
c) Description of the test equipment and test articles
d) Calibration documentation of all thermocouples
e) Qualification and certification for test personnel
f) Test procedures used
g) Ampacity values determined and accompanying equilibration temperatures.
h) Provide quality control records for:

- Test article construction
- Qualification and certification for installation and inspection personnel
- Identification and installation of fire barrier material
- Thermocouple locations
- Cables, size, type, and location
- Actual tray and conduit cable fill
- Actual calculated cable depths in tray

i) Computer printout and graphic results of the ampacity test
j) All raw data
k) 35mm photographic coverage of the test project
l) Provide a chronological log (Event Log) of all activities from receipt of materials through final test report

Disposition Details

The cables utilized during the 24" cable tray test were acceptable. The cables are used to provide a heat source, and current is measured to monitor the amount of heat input into the assembly being tested. The fact that the cables were not provided by TU Electric can not have an impact on the test. The test is Technically acceptable.

Justification/Comments

As stated above the cable type will not impact the ampacity derating. The cable tray percent fill was inaccordance with the requirements P 848/D11 "IEEE Standard Procedure for the Determination of the Ampacity Derating of Fire Protected Cables", and was technically acceptable.

RESOLUTION FORM

ORIGINAL

REFERENCE ONE FORM 93-635

☐ Use-As-Is ☐ Repair ☐ Rework ☐ Scrap ☒ N/A

Disposition Details (References documents, design changes, or other actions taken to resolve non-conformance)

See page three

☒ Continued

Cause Code(s) B3a

Generic Implications There are no generic implications. The mistake was made by the test lab, and has no impact on the plant.

Justification/Comments

See page three

☒ Continued

Disposition Accomplished

N/A

☐ Continued

Submitted by (Print)	Signature/Date	Dept.	Ext.
John L. White	3/31/93	ENGSUP	6674
Responsible Manager (Print)	**Signature/Date**	**Dept.**	**Ext.**
Dale L Walling	4-1-93	CEGE	3767

STA-423-7
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Rev. 2

FF9304150023

TU ELECTRIC

ONE Form

ONE 93 - 635

Unit	System	Tag No.	Level	Bldg.	Room
2	—	THERMOLAG	—	—	—

Discovery Date & Time: 3-4-93 11:50 AM

Immediate Action Taken: INITIATED ONE FORM

Related Documents: P.O. B-SE 46494-001

ORIGINATOR

Condition Description and Comments:

CONTRARY TO PARAGRAPH 4.1.1 OF THE AMPACITY DERATING TEST PLAN AND THE SCOPE OF WORK/P.O., THE 24" TRAY AND CABLES UTILIZED WAS NOT SUPPLIED BY TU ELECTRIC.

☐ Continued

Originator Name (Print): RON STAMATES

Signature/Date/Time: 3/4/93 12:00 AM

Dept.: 70A

Ext.: 0702

SHIFT SUPERVISOR REVIEW

☐ Operability Affected ☐ Reportable (Explain) ☐ Plant Incident ☐ Conditional Release

Comments:

☐ Continued

Shift Supervisor/Date/Time: 3/4/93 1520

☒ None of the above

WORK CONTROL CENTER REVIEW

☐ Reportable per _____ ☒ Not Reportable

☐ [redacted] ☐ [redacted]

☒ [redacted] ☐ [redacted]

☐ [redacted] ☐ [redacted]

☐ [redacted] ☐ [redacted]

☒ [redacted] ☐ [redacted]

☐ [redacted] ☐ [redacted]

Comments: B) ENGR ANALYSIS DEFICIENCY RELATIVE TO HAVING CONTRACTOR WORK OUTSIDE OF PO SCOPE

C) ENGR QUALIFICATION OF ADEQUACY OF TEST USING THIS MATL

☐ Continued

Responsible Manager: MANAGER

Responsible Org.: ENGR MGR

Due Date: 3/5/93

Reviewer Name (Print): D. KEATING for D. DAVID

Signature: David Keating

Date: 3/5/93

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4/5/93

TEST SPECIMEN DEVIATION RESOLUTION

The cables utilized at Omega Point, for the tray ampacity test, were 3/c #6 AWG 600V copper with a thermosetting XLP insulation and a PVC jacket. The test specimen was built to earlier drafts of IEEE Standard P848 "Procedure for the Determination of the Ampacity Derating of Fire Protected Cables". The previous revision of the standard allowed for the use of several different types of material in the construction of the cables utilized in the ampacity test (e.g. PVC, Hypalon, XLPE, Rubber). In order to provide consistency between ampacity derating tests, the standard was revised to recommend the use of a 3/c #6 AWG copper cable, with a XLPE insulation and a Hypalon jacket. TU Electric believes that for the reasons stated below the minor differences in construction will have no adverse effect on the ampacity derating factor established by CPSES testing at Omega Point:

> When determining the ampacity derating for a system, the ultimate goal is to determine how much heat can be dissipated through the wrap material. Considering the aforementioned, the critical criteria for cable selection is not the cable size or construction, but ensuring that uniform heat is generated within the tray. This can be accomplished with any type of cable or cable construction provided that uniformity and symmetry are maintained during both the Baseline and Wrapped test configurations. This was analyzed by Oscar M. Esteves[1] in which, he demonstrated that for any given cable depth, the cable losses in watts/sq. ft. were all substantially the same, regardless of conductor size, cable diameter or type. It is also noted that, when cables are designed in accordance with P-54-440, uniform heat generation within the cable tray is maintained.

TU Electric has concluded that the test specimen constructed for the ampacity test will satisfy the technical requirements for an acceptable ampacity derating test, and the derating factor is representative of CPSES and any facility utilizing P-54-440 for its cable tray design.

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[1] O. M. Esteves, "Derating Cables in Trays Traversing Firestops or Wrapped in Fireproofing," IEEE Transactions on Power Apparatus and Systems. Vol. PAS-102, p. 1478-1481, 1983.