PROJECT ALL DISCIPLINE MECHANICAL
CONTRACT TV-92362V UNIT 0
DESCRIPTION FIRE ENDURANCE TESTING
DOCUMENT NO. 11960-97185

QA Record

T 33 941216 898

FIRE ENDURANCE TEST OF THERMO-LAG® 330-1 FIRE PROTECTIVE ENVELOPES (Three 18 in. Cable Trays and a 3 in. Conduit)

Project No. 11960-97185

FIRE ENDURANCE TEST TO QUALIFY A PROTECTIVE ENVELOPE FOR CLASS 1E ELECTRICAL CIRCUITS

November 15, 1994

Prepared For:

Tennessee Valley Authority
P.O. Box 11127
Chattanooga, TN 37401

in cooperation with

Thermal Science, Inc.
2200 Cassens Drive
Fenton, MO 63026

OMEGA POINT LABORATORIES

ABSTRACT

Three 18 in. wide x 4 in. deep steel ladderback cable tray configurations and one 3 in. diameter steel conduit configuration, each clad with a nominal thickness of 5/8 in. Thermo-Lag® 330-1 and various upgrades as described herein, were evaluated in accordance with the Tennessee Valley Authority TEST PLAN "One Hour Fire Endurance Tests of Cable Trays Protected With The TSI Thermo-Lag Fire Barrier System," Revision 1, and Supplement 1 to the U.S. Nuclear Regulatory Commission Generic Letter 86-10.

The details, procedures and observations reported herein are correct and true within the limits of sound engineering practice. All specimens and test sample assemblies were produced, installed and tested under the surveillance of either Tennessee Valley Authority's or the testing laboratory's in-house Quality Assurance Program. This report describes the analysis of a distinct assembly and includes descriptions of the test procedure followed, the assembly tested, and all results obtained. All test data are on file and remain available for review by authorized persons.

Herbert W. Stansberry II
Project Manager

11/17/94
Date

Constance A. Humphrey
Manager, QA Dept.

11/17/94
Date

Deggary N. Priest
President

11/17/94
Date

OMEGA POINT LABORATORIES

TABLE OF CONTENTS

INTRODUCTION

The protection of vital electrical circuits from the effects of an external fire exposure is of primary concern in the design and construction of an electrical power generating plant. Typical "fire protective envelopes" are designed to protect the contents of an electrical raceway for fire exposure periods of one to three hours, during which time the electrical circuitry must remain functional.

The external fire exposure selected to evaluate protective envelope systems is that described in the ASTM E119-88 Fire Tests of Building Construction and Materials (E119 Time-Temperature Curve, described later in this document).

Typical fire test programs involve the selection and construction of a specific electrical raceway system, instrumentation for thermal and circuit integrity measurements, followed by the application of the protective envelope system by qualified personnel.

This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment that takes into account all the factors that are pertinent to an assessment of the fire hazard of a particular end use.

OBJECTIVE

The objective of this project was to evaluate a specific assembly for use as a 1-hour fire-protective envelope for redundant electrical systems. The entire program was carried out in accordance with the Tennessee Valley Authority (TVA), TEST PLAN, *One Hour Fire Endurance Tests of Cable Trays Protected with the TSI Thermo-Lag Fire Barrier System*, Revision 1, which may be found in Appendix B of this document. For reasons of clarity and to reduce redundancy, many items discussed in the Test Plan have not been duplicated elsewhere in this document.

TEST PROCEDURE

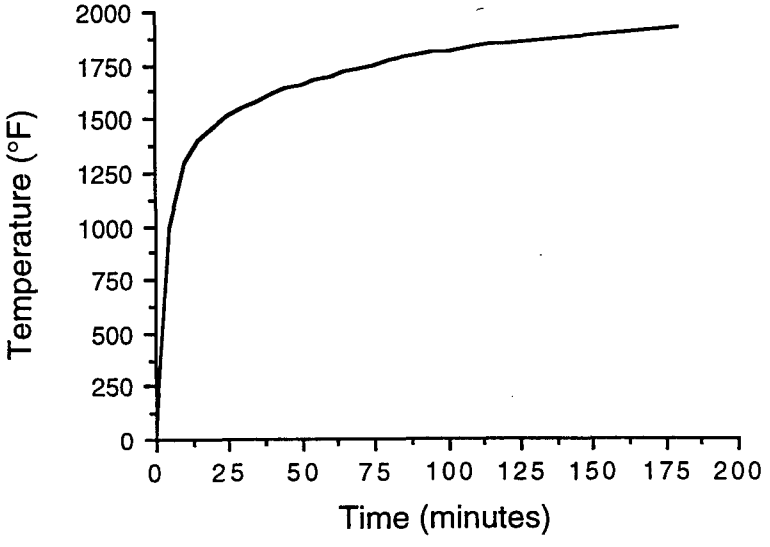
FIRE TEST FURNACE

The test furnace is designed to allow the specimen to be uniformly exposed to the specified time-temperature conditions. It is fitted with symmetrically located

propane gas burners designed to allow an even heat flux distribution across the surface of a test specimen.

The temperature within the furnace is determined to be the mathematical average of thermocouples located symmetrically within the furnace and positioned 12 in. away from representative parts and locations of the test specimen. The exact positioning of the thermocouples is such that the average fire exposure across the entire test specimen can be determined. The materials used in the construction of these thermocouples are those suggested in the E119 test standard. During the performance of a fire exposure test, the furnace temperatures are monitored at least every 15 seconds and displayed for the furnace operator to allow control along the specified temperature curve. All data is printed to paper every 30 seconds and saved to magnetic disk every minute.

The fire exposure is controlled to conform with the standard time-temperature curve shown in Figure 1, as determined by the table below:



Temperature (°F)	Time (min)
1000	5
1300	10
1462	20
1550	30
1700	60
1792	90
1850	120
1888	150
1925	180

Figure 1

The test furnace used consists of a large horizontal exposure chamber, with internal dimensions of 12 ft (length) by 7 ft (width). The furnace is equipped with diffuse-flame propane gas burners symmetrically located across the floor of the furnace and controlled by individual gas flow valves, with the overall gas flow to the furnace being controlled by a single gas control valve. Capable of a maximum heat output of 5 million Btu/hour, these burners are arranged well below the exposed face of the specimen to ensure an even temperature at the surface of the specimen. Windows are located on two sides of the furnace to allow observation of

the specimen during fire exposure. The depth of the furnace is variable, being increased to the desired amount by the addition of concrete blocks around the perimeter ledge. These blocks are lined with ceramic fiber blanket to minimize the heat loss from the furnace and to decrease the time required for the furnace walls to heat up. For these tests, the walls are built up from their normal height of 40 in. to a total height of slightly over 79 in. from the furnace floor to the top of the ledge.

The fire test is controlled according to the standard time-temperature curve, as indicated by the average temperature obtained from the readings of the furnace interior thermocouples symmetrically located across the specimen, 12 in. away. The thermocouples are enclosed in protection tubes of such material and dimensions that the time constant of the thermocouple assembly lies between 5.0 and 7.2 minutes, as required by the E 119 standard. The furnace temperature during a test is controlled such that the area under the time-temperature curve is within 10% of the corresponding area under the standard time-temperature curve for the one hour test period.

The furnace pressure is controlled to be as nearly neutral with respect to the surrounding laboratory atmosphere as possible, measured at the vertical mid-height of the test specimen. Adjusting the neutral plane at that position results in a nominal +0.015 in. WC pressure at the top of the specimen (under the surface of the deck) and –0.015 in. WC pressure at the bottom of the specimen.

THERMOCOUPLES

Temperatures on the interior of the fire protected systems were measured with Type K, 24 gauge, Chromel-Alumel electrically welded thermocouples formed from Chromel and Alumel wires of "special limits of error (±1.1°C)," and covered with Teflon® PFA insulation. The Teflon® insulation material begins to break down at temperatures above 500°F. Temperature readings above 500°F can not be guaranteed as accurate since the thermocouple conductors may no longer be adequately separated. Thermocouples installed on the steel support members under the 3M material were covered with standard fiberglass braided insulation.

DATA ACQUISITION SYSTEM

The outputs of the test article thermocouples and furnace probes are monitored by a data acquisition system consisting of a John Fluke Mfg. Co., Model HELIOS 2289A Computer Front End, a John Fluke Mfg. Co., Model HELIOS 2281A Extender Chassis (in the case of the 200 channel capacity unit), and an Apple Computer Co., Macintosh Classic microcomputer. The Computer Front End is

connected to the RS422 Serial Interface Port of the Macintosh and the Extender Chassis is serially connected to the Computer Front End. The computer is programmed in Microsoft BASIC to command the HELIOS units to sample the data input lines, receive and convert the data into a digital format, and to manipulate the raw data into usable units for display on screen and paper and for storage on hard disk.

Two data acquisition units are used for the majority of tests due to the number of data channels. One data acquisition unit is configured for monitoring 200 data input channels and is used to sample all (or most) of the test article thermocouples. A second data acquisition unit is configured for monitoring 100 data input channels and is used to sample the ambient laboratory temperature, furnace temperature probes and, if necessary, the remaining test article thermocouple inputs.

HOSE STREAM TEST

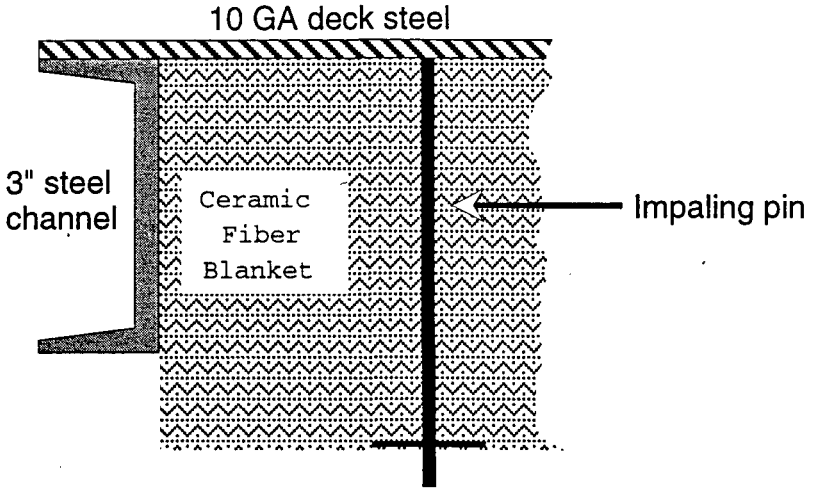
According to the Test Plan, following the fire exposure test, the test specimen is removed from the test furnace and exposed to the impact, erosion, and cooling effects of a hose stream directed perpendicular to the exposed surface of the test specimen as outlined in the standard. The stream is delivered, for a minimum period of 5 minutes, through a 1-1/2 in. fog nozzle with an adjustable stream, with a nozzle pressure of 75 psi, a spray angle of 30° and with the tip of the nozzle a distance of 5 ft. from the exposed face. The nozzle is to flow a minimum of 75 gpm during the hose stream test. It is recognized that, with a three-dimensional object, not all surfaces can be attacked by the hose stream test. For this reason, the hose is moved about to allow the stream to play against the sides, inside and outside vertical surfaces and the underside of the item, resulting in little, if any, direct force being applied to the inside top surface of the specimen.

TEST ASSEMBLY

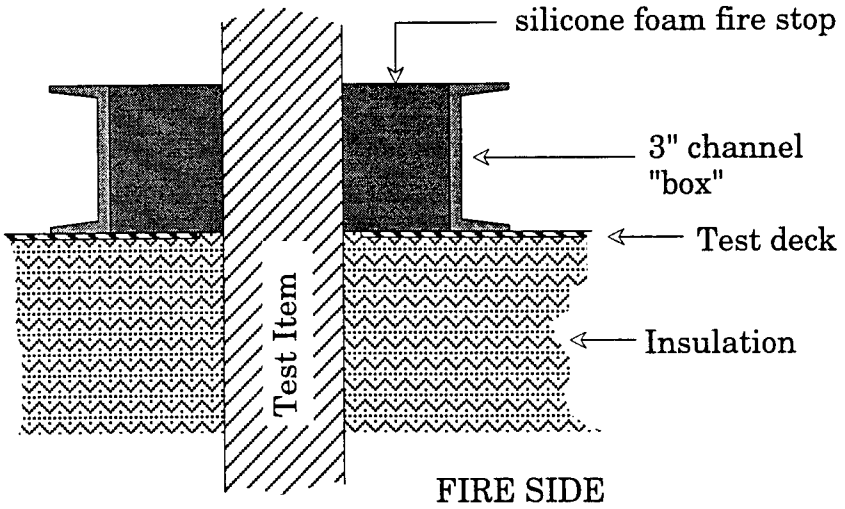
TEST DECK

The test deck consisted of a perimeter of 3 in. structural steel channel, welded together into an 8 ft by 13 ft rectangle, with the flanges outward. Over the top of this framework, a layer of 10 GA steel sheet was welded to form a continuous, smooth top. Pipe sockets (4 in. ø, sch. 40 steel pipe) were then welded onto each corner, so that 3 in. ø steel pipe legs could be attached to hold the assembly at a comfortable working level. A similarly constructed assembly was attached vertically as a front wall on the test deck. The steel deck front wall was 13 ft. long by 8 ft. high. Triangulated cantilever supports were fashioned from 3 in. steel

channel to brace the front wall assembly. Holes were then cut into the deck steel at the appropriate locations to allow the test item to be installed into the deck assembly and through the front wall assembly. Structural elements were typically attached to the test item on the exterior of the deck, to rigidly fix the item to the deck. Following the installation of the test item, the deck was reinforced with steel channel positioned so as to minimize any warping, bending or sagging during the fire test (the size of the channel being selected on the basis of the amount of stiffness required for that particular assembly), and then insulated on the fire-side with two 2 in. thick layers of 6 pcf ceramic fiber blanket, held in place with impaling pins, spaced a maximum of 12 in. o.c. The figure below illustrates a cross-sectional view of one edge of a typical deck assembly, showing the structural steel, the decking and the insulation.



Following complete installation of the test item, the underside of the deck was insulated as previously described, with the ceramic blanket being pushed into direct contact with the test item. A "box" around the penetration point in the deck steel was formed of 3 in. steel channel on edge and the enclosed area completely filled to a nominal depth of 3 in. with silicone foam fire seal.



CROSS-SECTION VIEW OF POINT OF PENETRATION
OF THE DECK BY A TEST ITEM

This method of sealing around the point where a test item penetrates the test deck has proven very effective at withstanding the 60 minute fire exposure. Since the penetration seal is considered a part of the support system, and is not in itself being evaluated by this test method, the important aspect of the seal is that it be "typical" of a field installation and withstand the fire exposure test. The silicone foam system used in this design does not unduly act as a heat sink, nor does it offer significant physical support to the penetrating item. Its purpose is to seal the gap without affecting the evaluation of the protective envelope system.

TEST ITEMS (GENERAL)

As with cable tray and conduit materials installed at TVA's Nuclear Power Plants (NPP), the materials used in the test were subjected to on-site commercial grade dedication programs prior to acceptance and subsequent installation. The conduit and cable tray used in the test were provided by various vendors, and were similar in design and representative of those installed in TVA's NPPs.

Electrical cables used in this test were also provided by TVA. Cables used were as follows:

DESCRIPTION	DIAMETER (in.)	CROSS-SECTIONAL AREA (in^2)	WEIGHT (lbs/lin. ft.)
4/C #16 AWG 600v.	0.443	0.154	0.240

The diameter and cross-sectional area listed herein represent the Laboratory's average of ten measurements of the cable type.

WEIGHT OF RACEWAY AND CONTENTS

RACEWAY	CABLING (lbs/lin. ft.)	CABLE TRAY/CONDUIT (lbs/lin. ft.)	TOTAL (lbs/lin. ft.)
Left 18" Tray	69.36	4.00	73.36
Center 18"Tray	6.24	4.00	10.24
Right 18" Tray	0.00	4.00	4.00
3" Conduit	0.00	6.70	6.70

* Bare #8 copper conductor is considered negligible and is therefore not included

Thermo-Lag® 330-1 Materials/Installation

Thermo-Lag® 330-1 materials were supplied by Thermal Science, Inc. (TSI), St. Louis, MO. Each Thermo-Lag® 330-1 V-ribbed panel is 5/8 in. thick (nominal) x 47 in. wide x 77 in. long, with the stress skin monolithically adhered to the panel on one face. The stress skin is installed adjacent to the surface of the protected device. Other materials supplied by TSI were 330 Pre-Formed Conduit Sections (nominal 3/8 in. thick, 3 ft. long). All Thermo-Lag® 330-1 panels were measured, saw cut and installed onto the respective test assembly by Tennessee Valley Authority craft personnel (insulators) using approved TVA drawings, procedures and specifications. The phases of installation and inspection were under direct supervision of TVA engineers.

Other Materials

Materials used in conjunction with Thermo-Lag® 330-1 components, but furnished by other vendors to TVA as commercial grade products included: 16 GA type 304 stainless steel annealed tie wire, external stainless steel stress skin

ASTM E-437 (type 304, plain weave and 8x8 square wire cloth, 0.017 in. wire diameter).

TEST ITEM (CABLE TRAYS AND CONDUIT)

Each of the three cable trays consisted of 18 in. wide x 4 in. deep steel ladderback tray (6" rung spacing) assembled into an "L-shaped" configuration having a horizontal dimension of 112 in. and a vertical dimension of 76 in. Each vertical leg transitioned through the upper steel deck into a zero-radius 90° bend formed by adjustable splice plates and extended straight out the front deck wall. The distance from the bottom of the trays to the top of the support angle measured 36 in. The distance from the inside surface of the front deck wall to the back side of each vertical tray leg was 70 in. The 3 in. diameter conduit similarly transitioned through the upper steel deck into a standard radius 90° elbow and continued horizontally out the front deck wall.

A hole in the steel deck was provided around each penetrating raceway section. The perimeter of each hole was edged with 3 in. steel channel (flanges out). Each blockout was sealed with Dow Corning 3-6548 RTV silicone foam material (after installation of the fire barrier material onto the raceways). Internal seals were similarly constructed at all locations where a raceway exited the test furnace enclosure.

Drawings of the test items and supports are located in Appendix A: Construction Drawings.

RACEWAY SUPPORTS

All three cable trays were supported and held in position by a single "trapeze" type hanger using 3 in. steel channels bolted and welded together. The assembly consisted of a single horizontal span of 3 in. steel channel traversing beneath the three cable trays which was supported at four locations by vertical runs of 3 in. steel channel. The free ends of the vertical channels were attached to 6 in. long sections of 4 in. x 4 in. x 1/2 in. steel angle, by fillet welding the angle to the sides of the channel. The angle sections were then attached to the 10 GA steel deck skin using 1/2 in. threaded steel rod and nuts. The angle sections were separated from the deck skin with two layers of 2 in. thick calcium silicate board (Promat Fire Protection, Inc., Promat-L Board). The hanger was mounted 38 in. from the outer-most side of the vertical tray sections. An additional length of 3 in. steel channel was bolted and welded to the vertical channel adjacent to the right tray. This section of channel passed horizontally over the top of the 3 in. steel conduit (which was fastened to the channel with a pipe strap) and was supported on the

opposite side with another vertical channel section, similarly attached to the steel deck.

ELECTRICAL CABLES

Electrical cables were installed in the cable trays in this test assembly to determine the affects of varying fill densities on the performance of the barrier systems. The left cable tray was loaded with the maximum possible fill to remain at or below the level of the top of the tray side rail (with the exception of the zero-radius, 90° bend, in which cables rose above the top surface of the tray side rails). The center tray was loaded with a single layer fill spaced evenly across the rungs, the right tray and the 3 in. steel conduit were left empty. The table below outlines the number of cables installed and the percent of total area taken up in each tray. The cable trays had a maximum usable cross-sectional areas of 72 in^2 (the 4 in. maximum usable depth multiplied by the 18 in. maximum usable width).

RACEWAY	NUMBER PRESENT	CROSS-SECTIONAL AREA	% OF TOTAL AREA (in^2)	TOTAL WEIGHT (lbs/lin. ft.)
Left Tray	289	44.463	61.75	69.36
Center Tray	26	4.000	5.56	6.24
Right Tray	0	0	0.00	0.00

THERMOCOUPLE PLACEMENT

In order to monitor temperatures in the interior of the raceways, bare #8 AWG stranded copper wire was instrumented with 24 gauge, Type K, Chromel-Alumel electrically-welded thermocouples (Special Limits of Error: ±1.1°C, purchased with lot traceability and calibration certifications) placed nominally every 6 in. along the length of wire. The thermocouples were attached to the bare #8 AWG stranded copper wire by placing the thermojunction in direct contact with the top surface of the wire and crimping the junction to the copper wire with a copper Buchanan 2011S open-end splice cap fastened in place with a Buchanan C-24 "pres-SURE" tool. Wires instrumented as such were installed in the following locations: one on top of the cable bundle in the left tray, one secured to the bottom of the tray rungs in the left tray, one on top of the cable bundle in the center tray, one secured to the bottom of the tray rungs in the center tray, one on top of the cable tray rungs in the right tray and one pulled through the conduit assembly.

In order to get a realistic measurement of the temperatures on the cable tray side rail and conduit surfaces, similar thermocouples were positioned nominally

every 6 in. along the cable tray side rails and the bottom surface of the conduit, being held in position by clamping under the head of a #8 x 32 x 1/4 in. long stainless steel round-head machine screw in a drilled and threaded hole at each location. The thermocouple leads were run in the tray cavity where possible and were taped securely to the conduit at points away from the thermojunction by wrapping the tape completely around the conduit and thermocouple lead.

THERMO-LAG® 330-1 INSTALLATION HIGHLIGHTS

Thermo-Lag® 330-1 materials were installed in accordance with Tennessee Valley Authority design drawings and procedures. Short abstracts of the installation are included herein to clarify specific details. Drawings of the installed Thermo-Lag® 330-1 on the test assembly are shown in Appendix G.

Thermo-Lag® 330-1 V-Ribbed Panel (5/8 in. nominal thickness)

These panels were used to construct the cable tray enclosures, and to cover the structural support members.

Thermo-Lag® 330-1 Subliming Trowel Grade Material

This material was used to pre-butter all joints, seams and interior surfaces of the V-ribbed panels and pre-shaped sections, to fill in edges and to form the skim coat.

Thermo-Lag® 330-1 Pre-Shaped Conduit Sections (3/8 in. nominal thickness)

This material was used to construct the protective envelope for the conduit.

Application Methods

The enclosure for each cable tray was constructed from nominal 5/8 in. thick V-ribbed panels. The bottom and side pieces were formed from a single piece of panel with the V-ribs hammered flat as necessary. The panel was cut and scored to fit snugly to the bottom and sides of the cable tray. This piece was pre-buttered with Thermo-Lag® 330-1 Trowel Grade material and secured to the tray with 16 GA stainless steel tie wire with a 6 in. spacing. The top piece was cut to fit over the tray and flush with the outside edges of the side pieces. The V-ribs were oriented perpendicular to the cable tray side rails and were hammered flat only at the edges. This piece was pre-buttered along the edges, where it mated with the tray side rail and barrier side panel. The panel was then secured with 16 GA stainless steel tie wire with 6 in. spacing. All joints and seams were filled in with

trowel grade material. The joints where the vertical and horizontal interfaced were laced together with 16 GA stainless steel tie wire with 5 in. spacing.

A skim coat of trowel grade material was applied to the enclosure and external stress skin was stretched over this and stapled down with 1/2 in. long staples. The overlap of external stress skin (~2 in.) was stitched together with 16 GA stainless steel tie wire on 3 to 5 in. spacing. Trowel grade material was then applied over the external stress skin. This coat of trowel grade was just thick enough to cover the external stress skin such that the external stress skin was not visibly discernible. The enclosure was allowed to dry overnight and then the final tie wires were installed with 6 in. spacing.

The 3 in. conduit was enclosed with Thermo-Lag® 330-1 Pre-Shaped sections (nominal 3/8 in. thick), except for approximately 3 ft. of vertical section above the radial bend which was enclosed with 5 layers of 3M Corp. M20A wrap. The Thermo-Lag® 330-1 sections were pre-buttered with trowel grade material and secured to the conduit with 16 GA stainless steel tie wire. When this layer was dry, a second layer of nominal 3/8 in. thick Thermo-Lag® 330-1 Pre-Shaped sections was installed in the same manner as the first layer.

The pre-shaped sections installed on the 90° radial bend were scored and bent to fit onto the fitting. After the second layer was applied to the radial bend section, the bend section was wrapped with external stress skin secured by stainless steel tie wire. A skim coat of trowel grade material was applied over the external stress skin and any low spots on the enclosure. The enclosure was allowed to dry overnight and then the final tie wires were installed with 6 in. spacing.

The top 3 ft. of the conduit was enclosed with 3M Corp. M20A mat. The mat was tightly wrapped around the conduit until five layers were achieved. The edge was sealed with 3M tape. A collar approximately 6 in. wide and two layers thick was installed over the Thermo-Lag® 330-1 to 3M interface joint with approximately 3 in. overlapping the Thermo-Lag® 330-1. Stainless steel tie wire was installed over the 3M material with 6 in. spacing.

The "Eighteen Inch Rule" for Thermo-Lag® 330-1 was applied to the supports. The remaining portions of the supports were enclosed with one layer of 3M M20A, secured with stainless steel tie wire on 6 in. spacing.

TEST RESULTS

After allowing the completed test specimen to cure for minimum of thirty days, the completed test specimen was placed on the Laboratory's horizontal fire test furnace. The thermocouples were then connected to the data acquisition system and their outputs verified.

The test was conducted on September 7, 1994, by Herbert W. Stansberry II, Project Manager, with the following persons present:

Pat Madden	-	USNRC
J.J. Pierce	-	T.V.A.
Mark Salley	-	T.V.A.
Bill Baker	-	T.V.A.
Ben Loveless	-	T.V.A.
Bernard McQueen	-	T.V.A.
Rich Lohman	-	TSI
Deggary N. Priest	-	Omega Point Laboratories, Inc.
Kerry Hitchcock	-	Omega Point Laboratories, Inc.
Connie Humphrey	-	Omega Point Laboratories, Inc.
Cleda Patton	-	Omega Point Laboratories, Inc.
Richard Beasley	-	Omega Point Laboratories, Inc.
Laudencio Castanon	-	Omega Point Laboratories, Inc.

The furnace was fired at 9:47 a.m. and the ASTM E119 standard time-temperature curve followed for a period of 60 minutes. The pressure differential between the laboratory surrounding the furnace and a point within the furnace level with the vertical midpoint of the exposed portion of the specimen was maintained at approximately 0.00 in. water column throughout the test. By 1:12 (min:sec) the outside surface of the test item was beginning to turn brown, and by 2:10 (min:sec) had ignited fairly uniformly across the exposed surfaces. By 3:14 (min:sec) the furnace was filled with intense smoke and heavy flaming. At 27:10 (min:sec) the fire seal on the front deck wall in the end of the right tray began leaking stream, which continued to the end of the fire exposure. During the fire exposure, no visual openings into the raceway were observed.

At the end of the fire exposure period, the thermocouples were disconnected, the furnace extinguished and the specimen removed from the furnace. When the test item was removed from the furnace it was still flaming, which slowly decreased as it was positioned for the hose stream test. Prior to the hose stream test, the exposed surfaces of the test items were observed to be covered with a layer of black ash and the external stress skin was observed to be exposed in spots where the trowel grade material had peeled away.

The test specimen was supported with the bottom of the wall resting on the floor while being exposed to a 30° angle spray nozzle hose stream test with a minimum pressure at the nozzle of 75 psi at a distance of 5 feet, for a 5 minute duration. The minimum flow from the nozzle was 75 gpm. The hose stream was thus positioned to attack the sides, bottom and inside vertical surfaces of the test item, with only minimal exposure to the top surface.

Following the hose stream test, the Thermo-Lag® 330-1 pieces remained firmly affixed and the stainless steel tie wire was still tightly wrapped around the assemblies. The layer of external stress skin was exposed in the conduit elbow and across most of the tray surfaces. Much of the 3M material on the supports and the vertical conduit section had become dislodged by the water hose stream. An in-depth description of the condition of the protective envelope is presented later in this document.

The significant temperatures within the raceway system at the end of the fire exposure test are presented in the table below (shaded values indicate temperatures in excess of the allowable limits). An explanation of the allowable limits is given following the table.

LOCATION	MAX. TEMP. (°F)	AVG. TEMP. (°F)
LEFT 18" CABLE TRAY (maximum fill)		
Left Tray Side Rail	212	207
Right Tray Side Rail	238	218
Bare #8 Wire on Cables	261	224
Bare #8 Wire under Rungs	272	231
CENTER 18" CABLE TRAY (single layer fill)		
Left Tray Side Rail	328	280
Right Tray Side Rail	319	273
Bare #8 Wire on Cables	305	289
Bare #8 Wire under Rungs	314	285
RIGHT 18" CABLE TRAY (empty tray)		
Left Tray Side Rail	349	306
Right Tray Side Rail	358	290
Bare #8 Wire on Rungs	370	346
3" STEEL CONDUIT		
Conduit Surface	273	214
Bare #8 Wire in Conduit	237	195

The average initial temperature for all thermocouples at the start of the test was 83°F, yielding an allowable temperature increase of 250°F, or 333°F actual for the average temperatures. (A 325°F increase above the 83°F initial temperature yields

a maximum allowable individual temperature of 408°F, in accordance with ASTM E119-88.) Only the average of the thermocouples on the bare #8 wire within the right cable tray system (empty tray) failed to meet the stated criteria.

Post-Test Examination

Immediately following the hose stream test, the test item was systematically disassembled and examined for damage and general condition. A listing of those findings follows. In all cases, when describing a particular Thermo-Lag® 330-1 V-Ribbed Panel or Pre-Shaped Conduit Section, the term "panel" or "pre-shaped section" will be used, respectively.

LEFT 18 in. CABLE TRAY

LOCATION	OBSERVATION
Outside vertical section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining.
Inside vertical section.	Up to 3/4 in. char depth across panel, still covering layer of external stress skin. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. Material completely intact where cables rise above the level of the top of the tray rails. No visible degradation to cable jackets.
Top horizontal section.	Stress skin exposed along edges of panel. Up to 3/4 in. char depth across panel, still covering layer of external stress skin. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. No visible degradation to cable jackets.

LOCATION (cont.)	OBSERVATION
Bottom horizontal section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. No visible degradation to cable jackets.
Tray side rails.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. uncharred materials remaining against rails.

CENTER 18 in. CABLE TRAY

LOCATION	OBSERVATION
Outside vertical section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining.
Inside vertical section.	Up to 3/4 in. char depth across panel, still covering layer of external stress skin. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. No visible degradation to cable jackets.
Top horizontal section.	Panel sagging inward approximately 1-1/2 in. Stress skin exposed along edges of panel. Up to 3/4 in. char depth across panel, still covering layer of external stress skin. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. No visible degradation to cable jackets.
Bottom horizontal section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. No visible degradation to cable jackets.
Tray side rails.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. uncharred materials remaining against rails.

RIGHT 18 in. CABLE TRAY

LOCATION	OBSERVATION
Outside vertical section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining.
Inside vertical section.	Up to 3/4 in. char depth across panel, still covering layer of external stress skin. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining.
Top horizontal section.	Panel sagging inward approximately 1-1/2 in. Stress skin exposed along edges of panel. Up to 3/4 in. char depth across panel, still covering layer of external stress skin. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining.
Bottom horizontal section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining.
Tray side rails.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. uncharred materials remaining against rails with several spots having only 1/8 in. uncharred material.

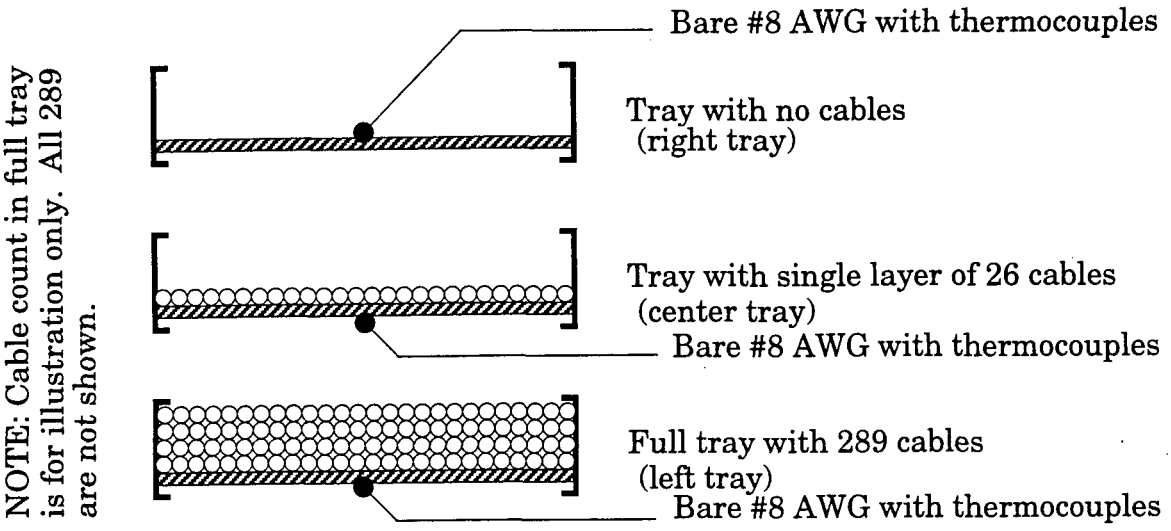
3 in. STEEL CONDUIT

LOCATION	OBSERVATION
Vertical section. (3M Corp. M20A)	Most of outer two layers of material were dislodged by hose stream test (4th and 5th layer). The next two layers were easily frangible and darkened (2nd and 3rd layers). The innermost (1st) layer was mostly intact and in place on the conduit.
Radial Bend.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Approximately 1/4 in. of uncharred material remaining in the outermost layer. Inner layer completely intact.
Horizontal section.	Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 3/8 in. char depth under external stress skin. Approximately 1/16 in. of uncharred material remaining in the outermost layer. Inner layer completely intact.

CONCLUSIONS

Two of the cable tray configurations (left and center) and the conduit configuration evaluated in this test procedure, clad with Thermo-Lag® 330-1 material and upgrades as presented herein, met the requirements of the TEST PLAN for a fire resistance rating of one hour. The right cable tray side rail temperature met the requirements of the TEST PLAN but the internal bare #8 AWG wire exceeded the allowable limits for average temperature rise.

To investigate the effect of cable tray loading, this test deck was fitted with three 4 in. x 18 in. steel ladderback cable trays, each of which contained a different number of identical electrical cables. One had no cables (right cable tray), one had 26 cables in a single layer(center cable tray) and the third contained 289 cables (100% visual fill in left cable tray). All cables used were 4/C #16 AWG. Each tray contained a bare #8 AWG copper conductor fitted with thermocouples every 6" along its length, located under the tray rungs (down the centerline) if the tray contained cables, and on the rungs if it did not.



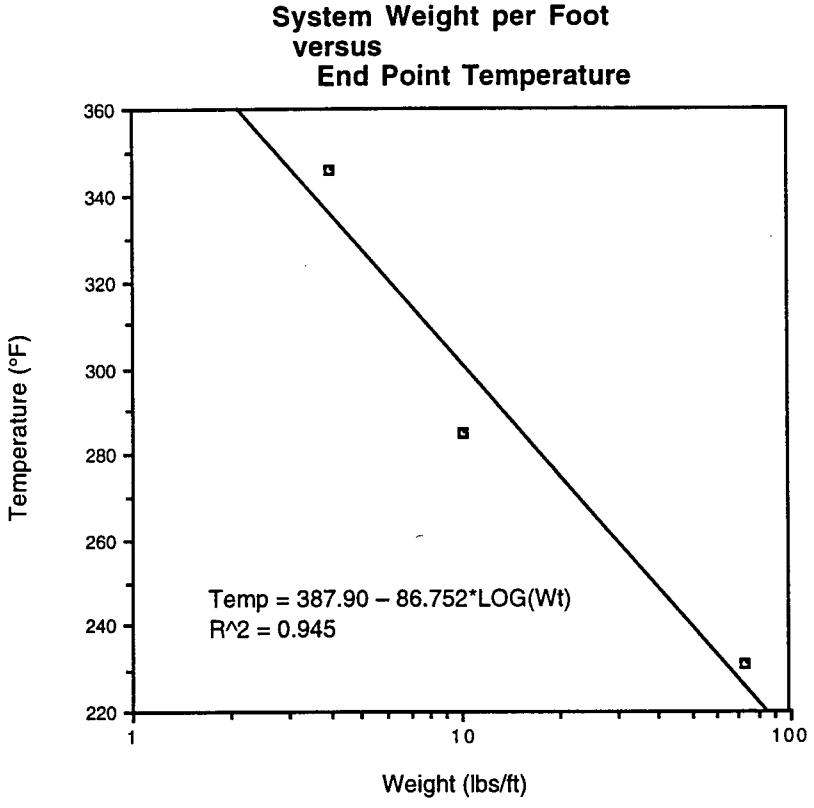
The cable tray side rails were also instrumented with thermocouples every six inches and the trays containing cables contained a bare #8 AWG copper conductor instrumented every six inches placed on top of the uppermost row of cables. However, since the bare #8 AWG on the tray with no cables was the only one to exceed the maximum allowable temperature rise, the thermocouples in that position were the only ones used in this evaluation.

The cables used weighed 0.24 pounds per foot and the cable trays weighed 4.00 pounds per foot. The average temperature of these bottom thermocouples at the end of the 60 minute fire exposure, compared to the weight per foot of each tray system is as follows:

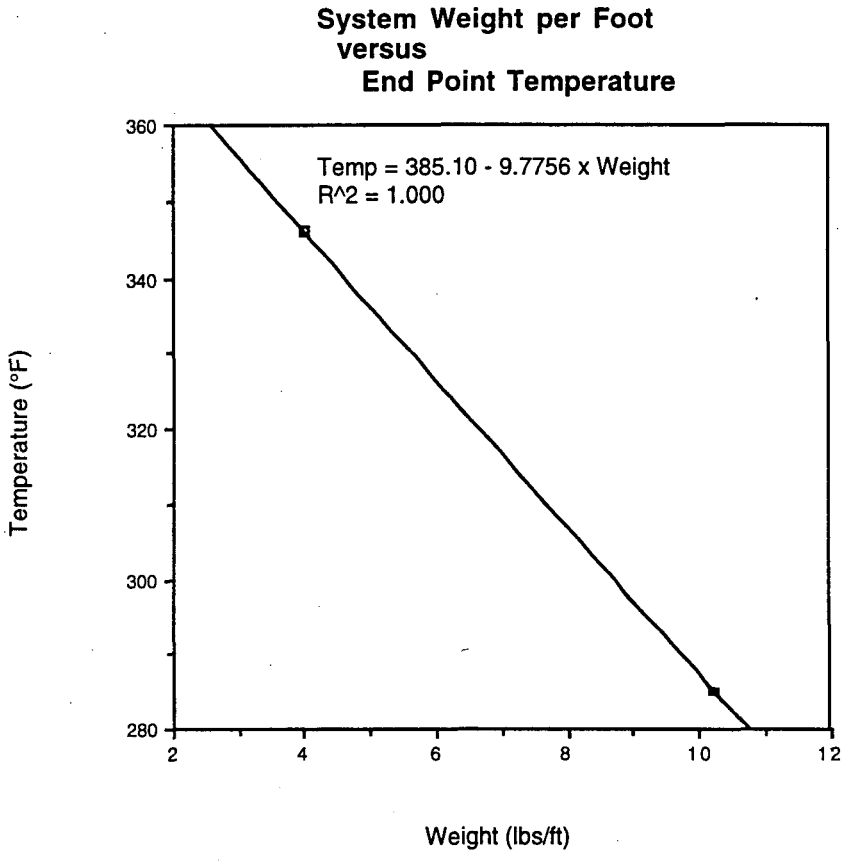
No. of Cables in Tray	Weight per Foot of Tray System (lbs)	Average Bottom Temperature at end of Test (°F)
0	4.00	346
26	10.24	285
289	73.36	231

The average temperature at the start of the test was 83°F, yielding the maximum allowable temperature of 333°F for any tray average. By plotting the weight of each system versus its temperature at the end of the fire test, it can be seen that the curve is best fit with a logarithmic equation (the mathematical equation shown on the graph is the result of a linear regression, method of least squares, fit of the data performed by computer). This indicates that the more cables

present, the slower the heat soaks into them, due to the thermal resistance of the cable insulation (see plot below).



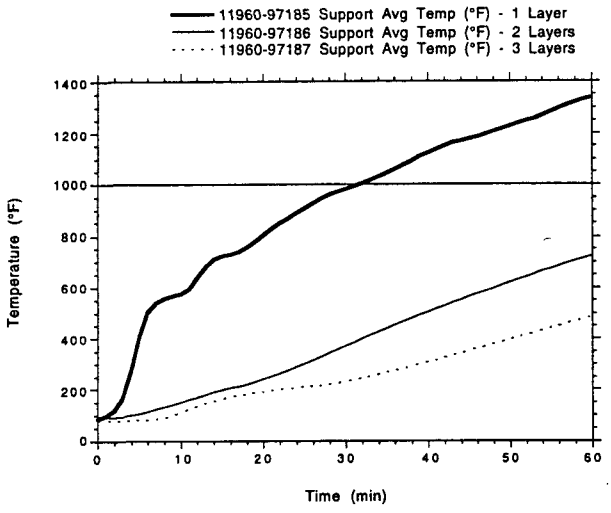
The effect of adding additional cables becomes less important as the tray fill increases from a single layer to multiple layers. This is to be expected since the thermal resistance of the cable insulation slows the transfer of heat to the copper conductors. Consequently, if a plot is made of the temperatures for no cables and 26 cables, the resultant linear equation (once again determined through the method of least squares) which describes the system's thermal behavior is much more severe than the logarithmic fit. This approach provides a very conservative approximation of the minimum amount of cable loading allowable.

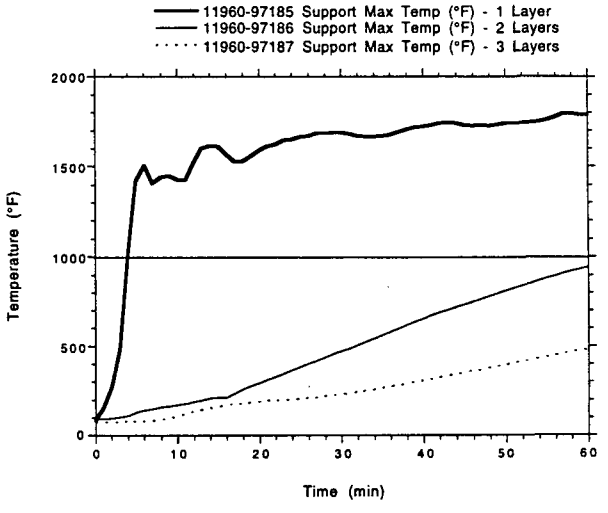


The linear fit shown above predicts the end point temperature as a function of the weight of the system. Solving this linear equation in the range of temperatures of interest, indicates that a weight of 5.33 lbs/foot would result in the system reaching the maximum allowable temperature of 333°F at the end of the one hour ASTM E119 fire exposure. **Subtracting out the 4.00 lbs/foot of the cable tray determines a minimum allowable cable loading of 1.33 lbs/foot for this performance.** As an example, for the cables in this test, this would translate to an integral number of five cables.

This test also investigated the feasibility and performance of non-Thermo-Lag fire barrier material interfacing with Thermo-Lag® 330-1. The steel supports were protected a minimum of 18 in. from the electrical raceway with a single layer of nominal 5/8 in. Thermo-Lag® 330-1 board material. 3M Corp. M20A Fire Barrier Material was installed from this 18 in. point up to the support mounting points under the steel test deck. The 3M Corp. M20A overlapped the Thermo-Lag® 330-1 by approximately 6 in. Prior to cladding, the support members were instrumented with glass insulated Type K thermocouples meeting the same requirements as those used throughout the test sample. Fiberglass insulated wires were used due to their higher heat resistance of over 900°F. One layer of the

M20A was applied to the support members in the deck presented herein. Two layers of material were installed on the test deck for Project No. 11960-97186 and three layers were applied to Project No. 11960-97187. These three tests are intended to compare the efficacy of the M20A material at different total wrap thicknesses to determine the minimum requirement to maintain a steel temperature of less than 1000°F* at the end of the one hour standard fire exposure. The graphs below present the averages of all the support steel temperatures in each deck and the maximum temperature for each deck and allows a direct comparison among the three. The horizontal line represents the 1000°F allowable temperature limit.



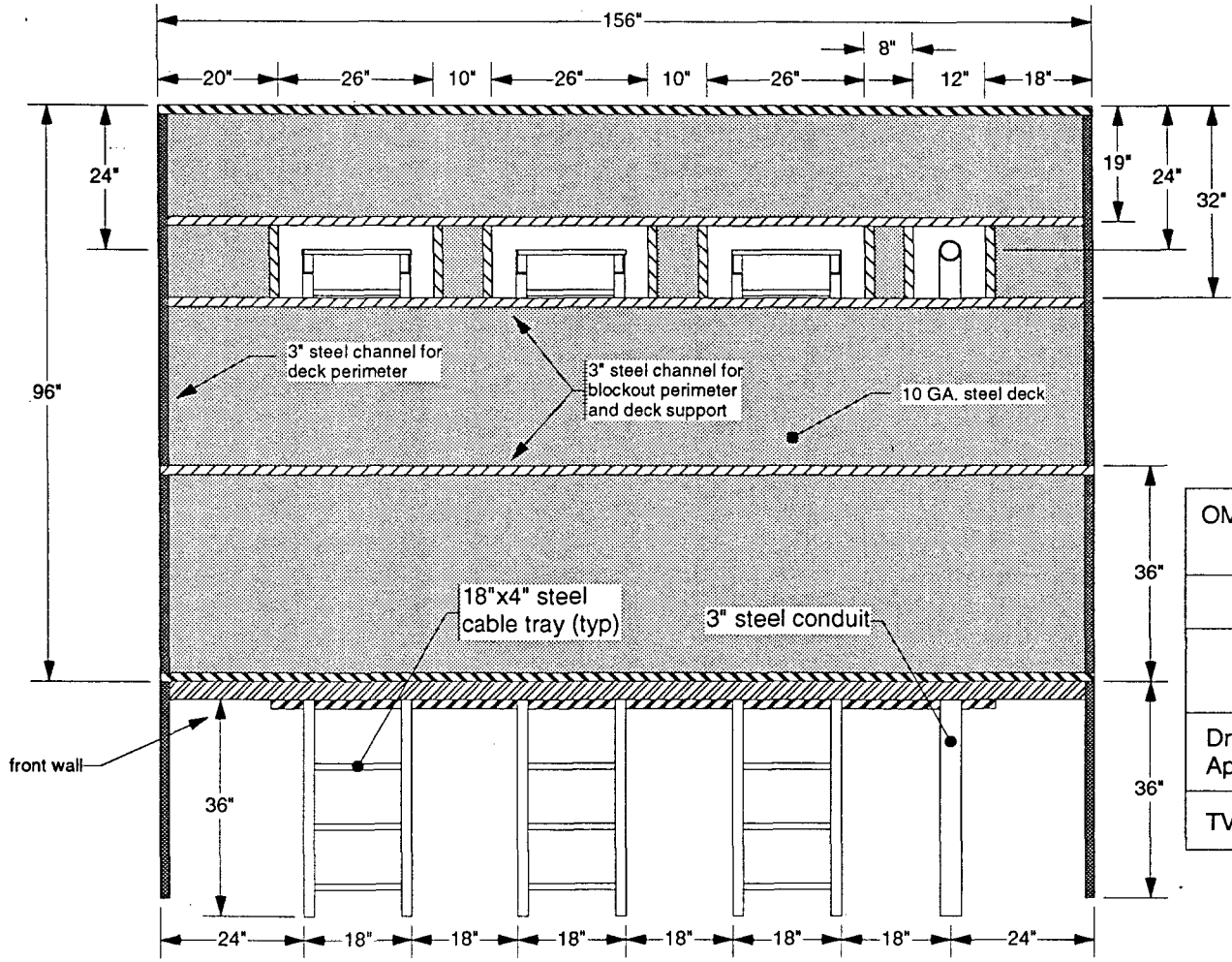


As the above graphs illustrate, a two layer thick application of the 3M Corp. M20A mat material is sufficient to maintain both average and maximum support steel temperature at a level below 1000°F.

* Note: ASTM E119 does not recognize a unique criteria for testing structural steel electrical raceway supports. The 1000°F (temperature acceptance criteria) is derived from ASTM E119-88 sections 25 (columns) and 39 (beams).

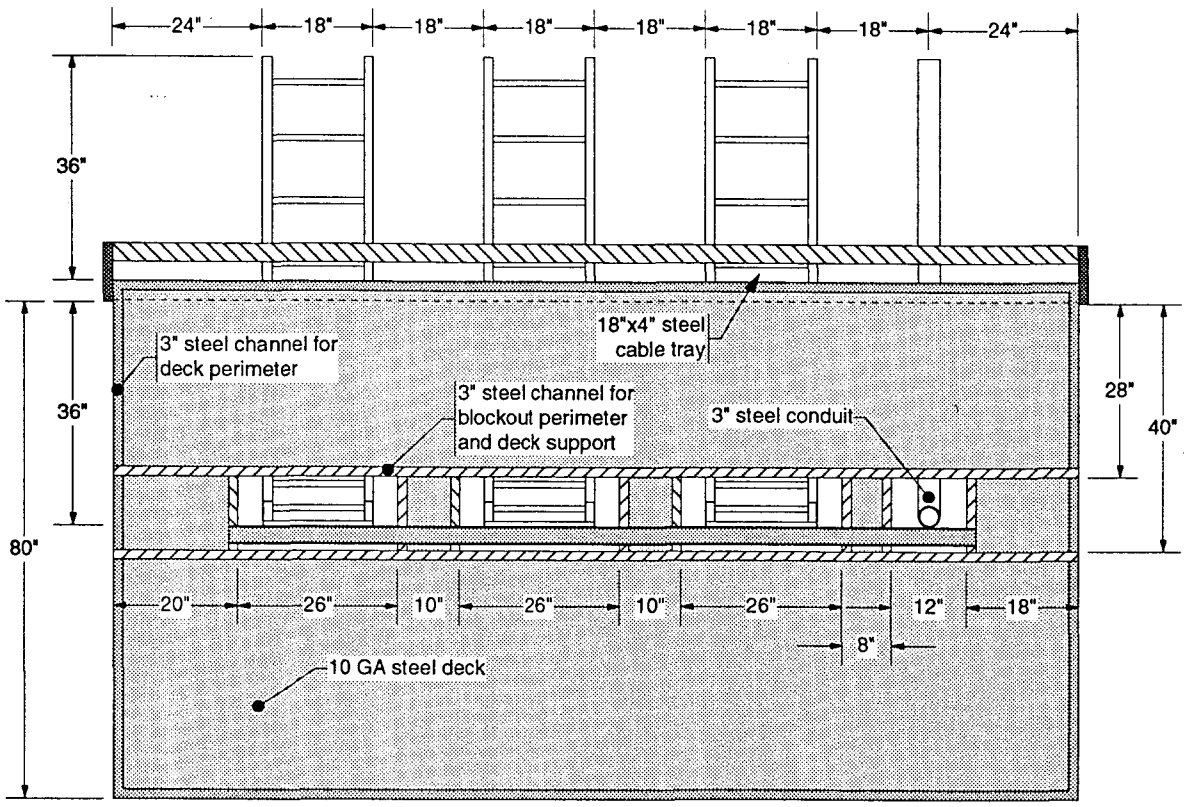
Appendix A

CONSTRUCTION DRAWINGS



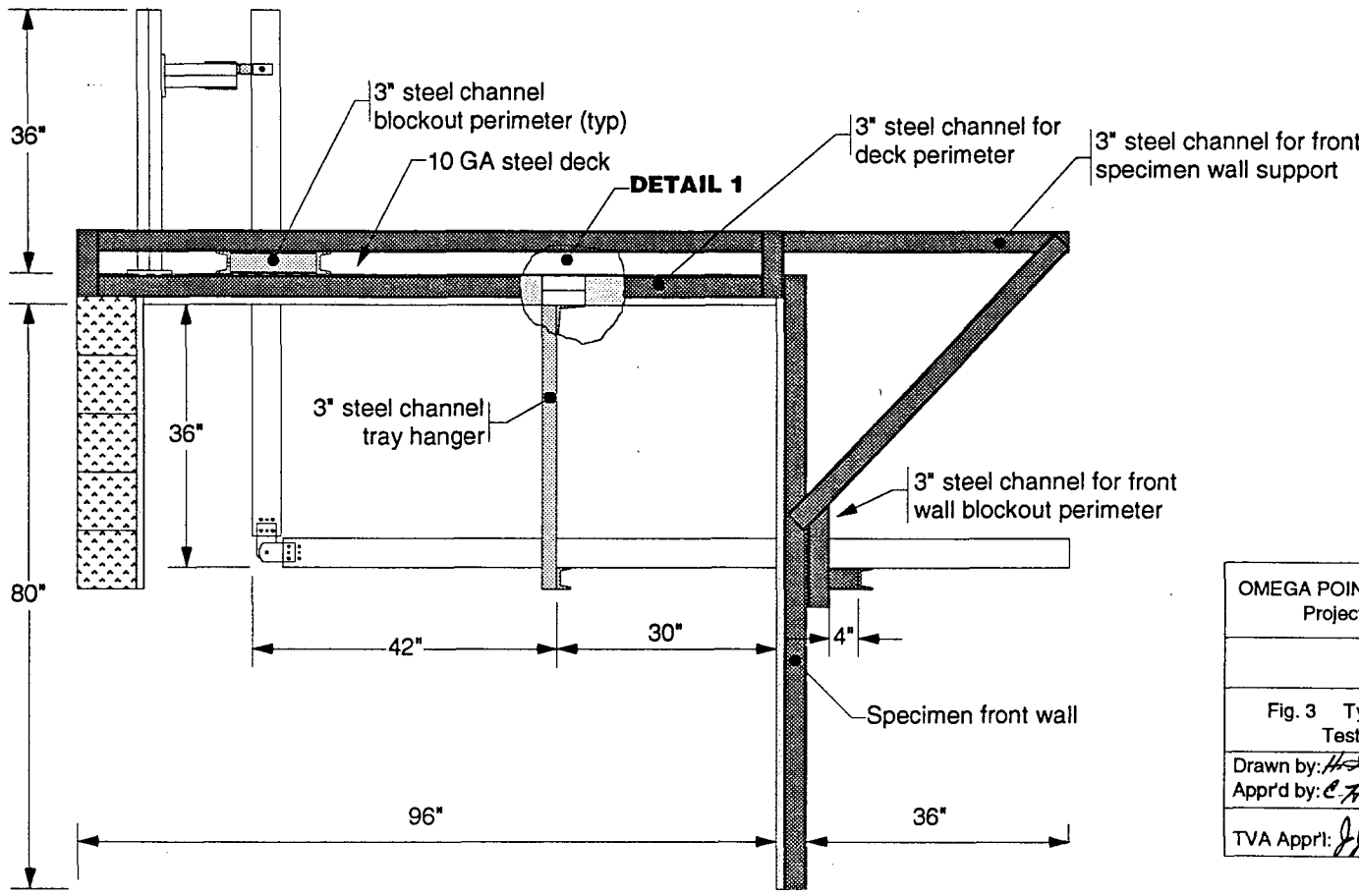
NOTE:
A silicon foam firestop was installed into each penetration blockout prior to testing.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 1 Plan View (Above Deck) - Test Deck #1, Rev. 1
Drawn by: [illegible] Date: 7/11/94 Appr'd by: C Humphrey Date: 7/1/94
TVA Appr'l: JJ Price Date: 7/5/94

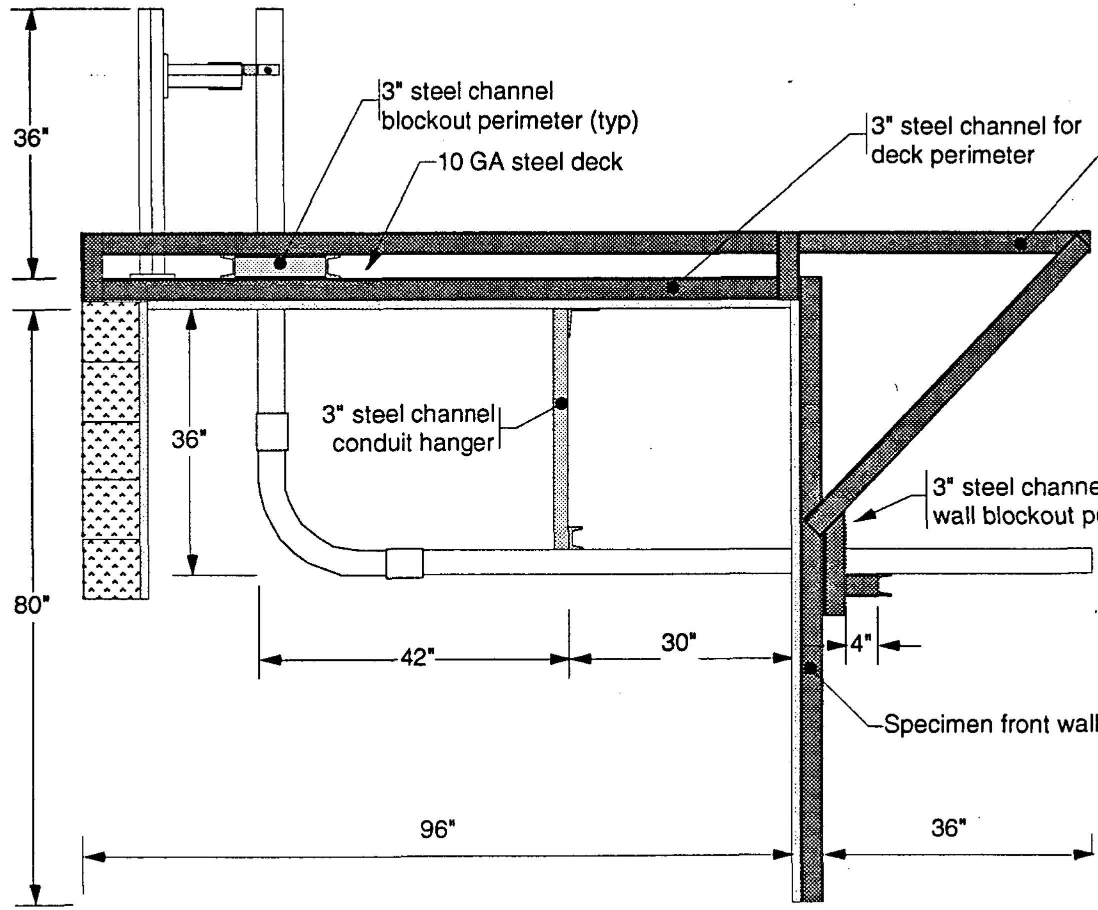


NOTE:
A silicon foam firestop was installed into each penetration blockout prior to testing.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA/ TSI
Fig. 2 Frontal View (Deck Layout) - Test Deck #1, Rev. 1
Drawn by: [signature] Date: 7/1/94 Appr'd by: [signature] Date: 7/1/94
TVA Appr'l: [signature] Date: 7/5/94

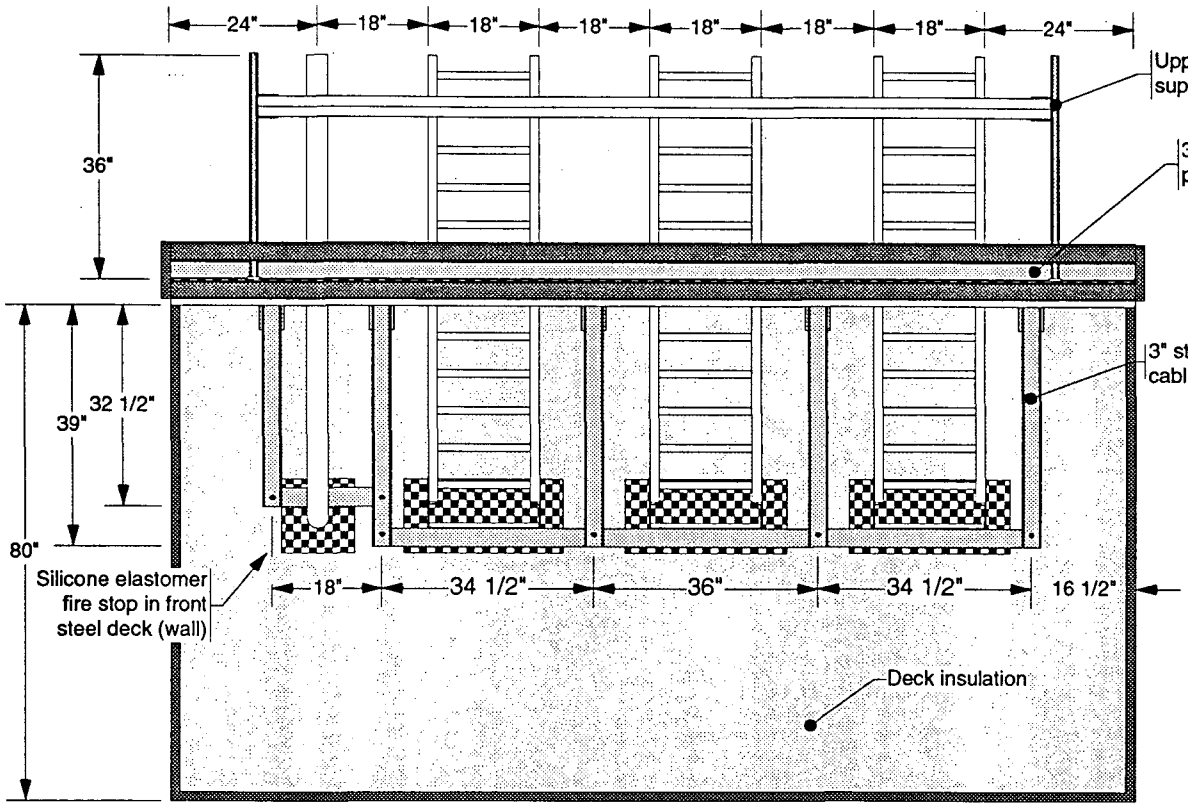


OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 3 Typical Tray Side View - Test Deck #1, Rev. 1
Drawn by: [signature] Date: 7/11/94 Appr'd by: [signature] Date: 7/1/94
TVA Appr'l: [signature] Date: 7/5/94

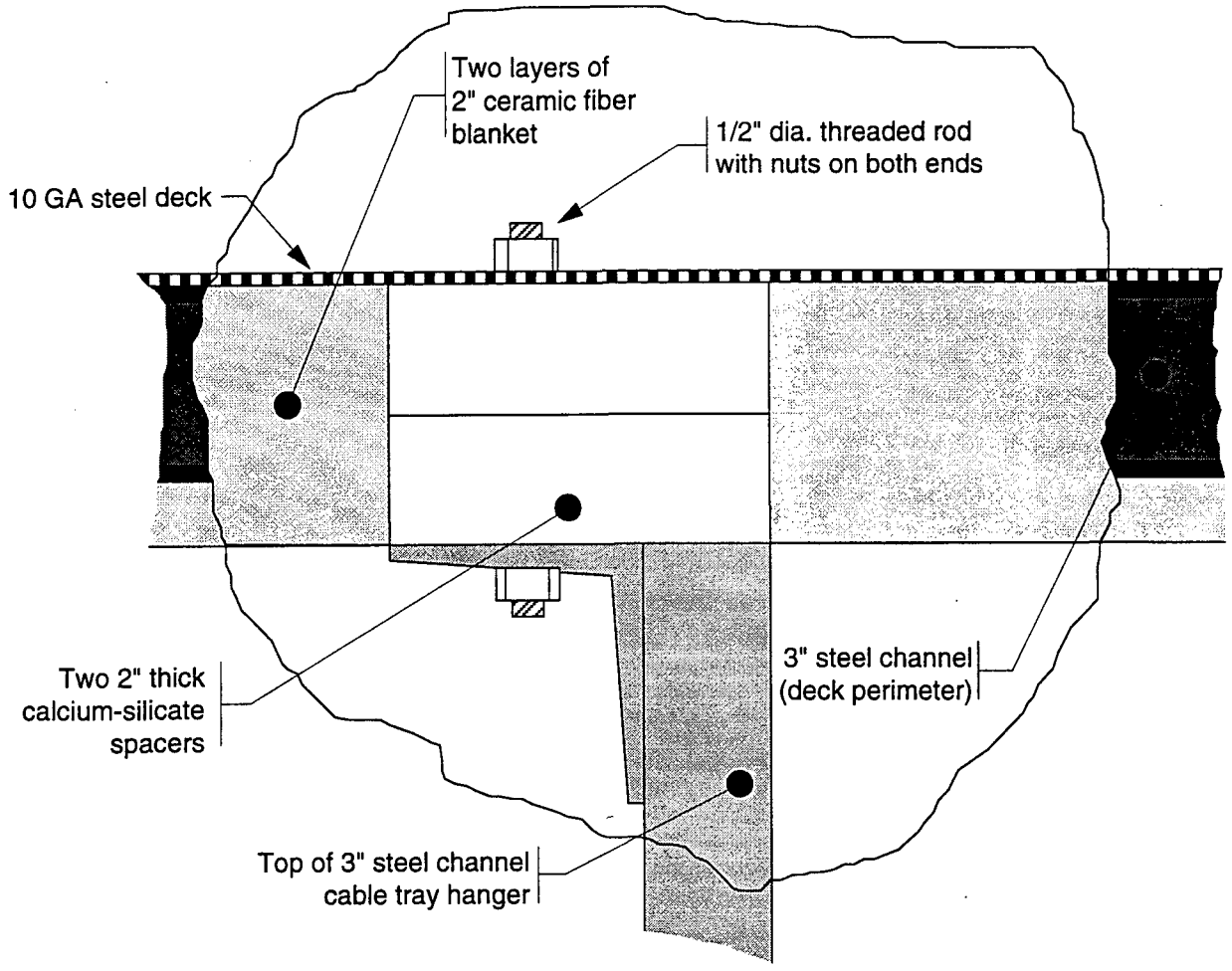


OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 4 Conduit Side View - Test Deck #1, Rev. 1
Drawn by: [signature] Date: 7/1/94 Appr'd by: C Humphrey Date: 7/1/94
TVA Appr'l: JJ Pierce Date: 7/5/94

27



OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 5 Rear Elevation View - Test Deck #1, Rev. 1
Drawn by: H Stanley Date: 7/11/94 Appr'd by: C Humphrey Date: 7/1/94
TVA Appr'l: JJ Pierce Date: 7/5/94



DETAIL 1

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 6 DETAIL 1 - Hanger Mount and Insulation

OMEGA POINT LABORATORIES

Appendix B

TEST PLAN

ONE HOUR FIRE ENDURANCE TESTS OF CABLE TRAYS PROTECTED WITH THE TSI THERMO-LAG FIRE BARRIER SYSTEM

REVISION 1

PREPARED BY J.J. PIERCE

SIGNATURE J.J. Pierce

DATE 7/11/94

CHECKED BY MARK H. SALLEY

SIGNATURE Mark H. Salley

DATE 7/11/94

ONE HOUR FIRE ENDURANCE TESTS OF ARTICLES PROTECTED WITH THE TSI THERMO-LAG FIRE BARRIER SYSTEM

1.0 SCOPE

This test plan describes the methods and guidelines for three fire endurance tests. This test plan includes the preparation of the test decks and specimens, installation of the Thermo-Lag, performance of fire endurance and hose stream tests, temperature monitoring, and applicable documentation of these tasks and test results.

2.0 OBJECTIVE

The objective of these tests is to qualify a protective generic fire barrier system for redundant essential cables at Tennessee Valley Authority's (TVA) nuclear power plants (NPP). Successful results of this test program will provide documented evidence that the electrical raceway fire barrier systems (ERFBS) will satisfactorily withstand an ASTM E-119-88 fire exposure for a period of one hour, followed by a hose stream test. These tests shall satisfy the requirements for fire testing the ERFBS as detailed in Underwriter's Laboratories, Inc. (UL) Subject 1724, "Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems", Issue Number 2, August 1991, and NRC Generic Letter 86-10, Supplement 1, except where clarified and, in the absence of other standards for these specific types of tests, standard pratice shall be invoked.

3.0 ACCEPTANCE CRITERIA

3.1 The exterior surface temperature of each electrical raceway will be recorded (cold side of the barrier). If the average temperature recorded by the exterior raceway thermocouples does not exceed 250° F (139° C) above their initial temperature and no individual thermocouple is in excess of 325° F (181° C) above its initial temperature, the ERFBS shall be acceptable for use with any type cable.

3.2 The thermocouples located on the bare copper cable (#8 AWG) installed inside the electrical raceway will be recorded. The highest thermocouple temperature rise above its initial temperature and the average temperature rise above their initial temperature will be recorded for each ERFBS. These results will be analyzed, if required, at a later date to determine the unique electrical applications.

3.3 A hose stream test as described in Section 8.2 will be performed at the end of the fire endurance test. If the hose stream test does not cause any openings through which the electrical raceway is visible, the ERFBS shall be acceptable.

4.0 REFERENCES

4.1 10CFR50, Appendix R - Fire Protection Program for Operating Nuclear Power Plants.

4.2 American Society for Testing and Materials (ASTM) E119-88 - Standard Test Methods for Fire Tests of Building Construction and Materials.

4.3 Underwriters Laboratories, Inc. (UL) Subject 1724-91 - Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems.

4.4 TVA Position on Fire Testing Criteria for Fire Barrier Systems used to Protect Electrical Cables Required for 10CFR50, Appendix R Compliance.

5.0 RESPONSIBILITIES

5.1 TENNESSEE VALLEY AUTHORITY (TVA)

5.1.1 Establish the criteria, guidelines, drawings (draft quality), recommendations, etc. to govern the configuration of the test items.

5.1.2 Establish the criteria, guidelines, drawings (draft quality), recommendations, etc. to govern the installation of the fire penetration seal systems, if any (other than deck through-penetration seals).

5.1.3 Establish the criteria, guidelines, drawings (final), recommendations, hold points, etc., to govern the installation of the Thermo-Lag ERFBS to the test articles.

5.1.4 Provide specific Thermo-Lag installation procedures and work package documentation for each test.

5.1.5 Provide the electrical raceway materials (e.g., cable trays, fittings, conduits, junction boxes, cables).

5.1.6 Personnel to install the fire barrier systems.

5.1.7 Supply personnel to witness assembly and test article raceway configurations and Thermo-Lag installation at TVA's discretion.

5.2 THERMAL SCIENCE, INC. (TSI)

5.2.1 Provide the Thermo-Lag materials (5/8" and 3/8" thick ribbed and flat board, preformed conduit sections, trowel grade material), stress skin, stainless steel tie wire and bands.

5.2.2 Make the necessary arrangements with, and provide adequate funding for Omega Point Laboratories to perform the tests.

5.3 OMEGA POINT LABORATORIES, INC. (OPL)

5.3.1 Prepare the test furnace, deck and slab assemblies and provide all required test instrumentation in accordance with its Appendix B Quality Assurance and Quality Control Program and other applicable procedures.

5.3.2 Provide thermocouple calibration and instrumentation, storage temperature records, and relative humidity instrumentation.

5.3.3 Assemble, install and document the installation of the electrical raceways (i.e., trays, conduits, cables, junction boxes, etc.). Provide computer generated drawings of the electrical raceways which clearly indicate critical dimensions, thermocouple locations, etc.

5.3.4 Coordinate all phases of the fire test preparation.

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

5.3.6 Provide all applicable quality control documentation for the ERFBS materials to the test articles and attendant instrumentation on each test article.

5.3.7 Observe and document the installation of the Thermo-Lag ERFBS materials to the test articles and attendant instrumentation on each test article.

5.3.8 Conduct the fire endurance and water hose stream tests.

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

5.3.10 Notify TVA and TSI within three (3) working days of completion of each test specimen.

5.4 OPL QUALITY ASSURANCE/QUALITY CONTROL

5.4.1 Maintain the quality control documentation of the ERFBS materials used in the test program.

5.4.2 Witness and document monitoring activities of the ERFBS installation process performed by TVA.

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

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

6.0 SPECIAL PRECAUTION

6.1 PRECAUTIONS FOR INSTALLATION OF THE ERFBS

6.1.1 Observe specific precautions recommended by TSI and other's material safety data sheets.

6.2 PRECAUTIONS FOR CONDUCTING THE FIRE ENDURANCE TEST

6.2.1 Proper safety precautions shall be excerised to preclude personnel from direct exposure to the flame environment, hot object, hazardous gases, and other related hazards.

7.0 PREREQUISITES

7.1 GENERAL TEST CONFIGURATION REQUIREMENTS

The electrical raceway installation configurations for the tests shall be shown on drawings in Appendix A.

7.2 TRACEABILITY REQUIREMENTS

To ensure that the materials used in these tests are representative of those in actual use, or to be used at TVA facilities, all aspects of traceability as required by the OPL QA Program shall be applied.

All thermocouples used in these tests shall be traceable to the respective thermocouple manufacturer, with calibration certification.

7.3 DIMENSIONED DRAWINGS

All test articles shall conform to the draft dimensioned drawings (see Appendix A). Final, dimensioned drawings will be prepared by OPL.

7.4 SHIPPING, RECEIVING, MATERIAL INSPECTIONS

Make a visual inspection of all materials for damage.

Record lot numbers and expiration dates of materials as applicable.

Thermo-Lag bulk grade materials are shipped under "protective service" with an in-transit temperature chart recorder included with each shipment in an identifiable container. That container reads "RECORDER IN HERE". The chart tape produced by this recorder shall be inspected by OPL personnel upon arrival of the shipment to insure that the temperature limitations of 32° F to 100° F were not exceeded.

Thermo-Lag fire barrier materials shall be stored off the ground when not in use. The materials shall be stored in a totally enclosed and weather protected area when not in use (ANSI N45.2.2, level B or better). The bulk grade (trowel grade) material shall be maintained within the temperature limits of 32° F to 100° F.

Prior to application of the bulk grade material, check that the expiration date of the products have not passed. All bulk product expiration dates are good through the end of the expiration date month.

7.5 TEST CONFIGURATIONS

7.5.1 General

The test articles shall be sufficiently secured to the test deck by OPL personnel and sealed in accordance with written instructions and drawings.

7.5.2 Cable Trays and Conduit (Test Deck 1)

One deck will consist of three (3) 18" wide, standard weight steel cable trays with 4" side rails and rungs spaced on 6" centers. Cable tray configurations for this program will consist of "L" shaped assemblies which penetrate the steel deck, extend downwards into the furnace for a minimum of 36", turn horizontally and extend for a minimum of 68" and through the side of the furnace. The deck will also contain a 3" rigid steel conduit that penetrates the steel deck, extends downwards into the furnace for a minimum of 36", turn horizontally and extend for a minimum of 68" and through the side of the furnace (see drawing in Appendix A).

7.5.3 Special Tray Fitting (Test Deck 2)

One deck will consist of a special tray fitting and two sections four feet in length of 18" wide, standard weight steel cable trays with 4" side rails and rungs spaced on 6" centers. The special fitting and two section of cable trays shall be suspended below the steel deck a minimum of 36" into the furnace (see drawing in Appendix A).

7.5.4 Stacked Trays, Raised Cover Tray and Air Drops (Test Deck 3)

One deck will consist of three 18" wide, standard weight steel cable trays with 4" side rails and rungs spaced on 6" centers. The trays will be spaced 12" apart (bottom of tray to bottom of next tray) and extend vertically into the furnace 34" to 56", turn horizontally for approximately 84" to 108", turn back up and extend through the deck. Another 18" wide tray will be located approximately 15" beside the tray stack and extend through the deck approximately 36", turn horizontally for 96", turn back up and extend up through the deck. A solid cover with stand-off extensions will be mounted on this tray. A one inch conduit and a five inch conduit will extend approximately 6-inches through the deck near the vertical portion of the covered tray (see drawing in Appendix A).

7.6 CABLE LOADING REQUIREMENTS

7.6.1

The three cable trays identified in 7.5.2 will be used to bound cable fill attributes of the ERFBS.

One tray will contain a single #8 AWG bare copper conductor within the ERFBS and is to be in accordance with section 4.4 of reference 4.3 (UL Subject 1724). The bare copper conductor shall be instrumented along the entire length of the cable tray being protected.

One tray will contain 26-4/C #16 within the ERFBS. Two bare #8 copper conductors (one routed on top of the center cable and the other under the rungs of the tray) shall be installed and instrumented along the entire length of the tray being protected. | R1

One tray will contain 321-4/C #16 within the ERFBS. Two bare #8 copper cables (one along near the top center of the conductors and one under the tray rungs) will be installed and instrumented along the entire length of the cable tray being protected. | R1

7.6.2 The cable tray identified in 7.5.4 will be used to bound cable tray configurations where cables are above the side rail and have a raised cover. The tray will contain 321-4/C #16 within the ERFBS. A bare #8 copper conductor routed under the tray rungs will be installed and instrumented along the entire length of the tray being protected. In lieu of routing a bare conductor along the top of the insulated cables for thermocouples, the thermocouples will be attached to the raised cover along the center line for the length of the cover. | R1

7.6.3 All other ERFBS will contain a single #8 AWG bare copper conductor within the ERFBS and are to be in accordance with section 4.4 of reference 4.3 (UL Subject 1724). The bare copper conductor shall be instrumented along the entire length of the raceway being protected.

7.7 THERMOCOUPLE INSTALLATION

All thermocouples used in this test program shall be provided and intalled by OPL, with QC surveillance by OPL personnel. The thermocouple wires shall be calibrated (by Lot Number) prior to inatallation and/or use, and applicable quality control documentation records generated. All thermocouples will consist of 24 GA, type K, Chromel-Alumel Teflon PFA insulation (Special Limits of Error ±1.1° C) electrically welded thermojunctions. Calibration will consist of manufacturer supplied (and audited) certifications of calibrations at fire temperatures of thermocouples taken from both ends of each purchased lot number.

The thermocouples shall be placed at 6" intervals and methods of attachment shall be in accordance with the requirements of sections 4.18, 19, 20 and 21 of reference 4.3. The thermocouples shall be attached to the bare copper conductors by wire ties, or equivalent.

7.8 INSTALLATION OF THE ERFBS TO THE TEST ARTICLES

Thermo-Lag ERFBS shall be installed by TVA crafts in accordance with applicable specifications, design drawings and procedures provided by TVA. Details of the ERFBS configurations including fasteners, orientation of structrural ribs, etc., shall be documented in the final test report.

7.9 FIRE SEAL INSTALLATION

Upon completion of the fabrication and installation of the ERFBS to the test articles, all openings in the test articles shall be sealed by OPL. All openings in the test deck assemblies shall be sealed by OPL. All open ends of raceways (conduits, etc.) which extend through the deck shall be sealed with both internal and external fire seals. Internal seals shall consist of silicone foam material (or equal), installed to a depth of nominally 6" and located at the end of the exposed raceway.

7.10 PREBURN INSPECTION

7.10.1 Prior to the commencement of the fire endurance test, a thorough check of the test assembly and associated equipment (including data recording equipment) shall be performed and documented by OPL.

7.10.2 TVA shall inspect the ERFBS for workmanship, surface defects, etc. prior to test.

7.10.3 Written approval of the construction, assembly, installation and instrumentation will be supplied by OPL prior to performance of each fire exposure test (a sign-off sheet for this purpose will be supplied by OPL and included in the final report).

7.10.4 Fire endurance testing of assemblies will not commence until the Thermo-Lag ERFBS attains a moisture meter reading that does not exceed 20 when using a meter with a scale of 0-100 such as a Delmhorst Model DP or equivalent, or 30 days has elasped since completion of the ERFBS installation.

8.0 PROCEDURE

8.1 FIRE ENDURANCE TEST

8.1.1 The protected test article shall be exposed to the standard time/temperature curve found in ASTM E119-88 for one hour. TVA personnel may request stopping of test if premature failure of the specimen occurs.

8.1.2 OPL shall adapt their testing procedures to assure the fire test complies with the requirements established in all referenced standards. Any changes, revisions, or deviations required to comply with this requirement shall be documented and properly justified and included as a part of the final test report.

8.2 WATER HOSE STREAM TEST

8.2.1 Immediately (within 10 minutes) following the fire endurance test, accessible surfaces of the protected test article shall be subjected to the cooling, impact and erosion effects of a hose stream delivered through a 1½-inch fog nozzle set at a discharge angle of 30° with a nozzle pressure of 75 psig and a minimum discharge of 75 gpm. The nozzle orifice is to be a maximum of 5 feet from the edge of the tested assembly. R1

9.0 DATA SYSTEMS

During the fire exposure period, the thermocouples will be scanned at one minute intervals or less. Data storage for reporting purposes will be at one minute intervals (minimum); however, the furnace thermocouples should be scanned at 15 second intervals to allow close control of the furnace. A printer output of all thermocouple data should be done every 60 seconds. R1

10.0 FIRE TEST REPORT

10.1 OPL shall submit a report on the results of the test and thermocouple data. The test report shall be prepared and submitted in accordance with the requirements of sections 10.2 and 10.3 following.

10.2 OPL will assemble the final test report, containing the collected data and required quality control documentation.

10.3 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 furnace and test article
d. Calibration documentation of all thermocouples
e. Qualification and certification for QA personnel
f. Test procedures used
g. Acceptance criteria
h. Provide quality control records for:
   (1) Test article construction
   (2) Identification and installation of ERFBS
   (3) Thermocouple locations
   (4) Cables, sizes, type and location
   (5) Actual raceway fill densities (mass per linear foot)
i. Computer printout and graphic results of the fire endurance test
j. All raw data
k. 35mm photographic coverage of the test project and video tape documentation of the fire and hose stream test
l. Provide a chronological log (Event Log) of all activities from receipt of materials through final test report
m. A copy of the test plan and fire barrier installation procedures provided by TVA

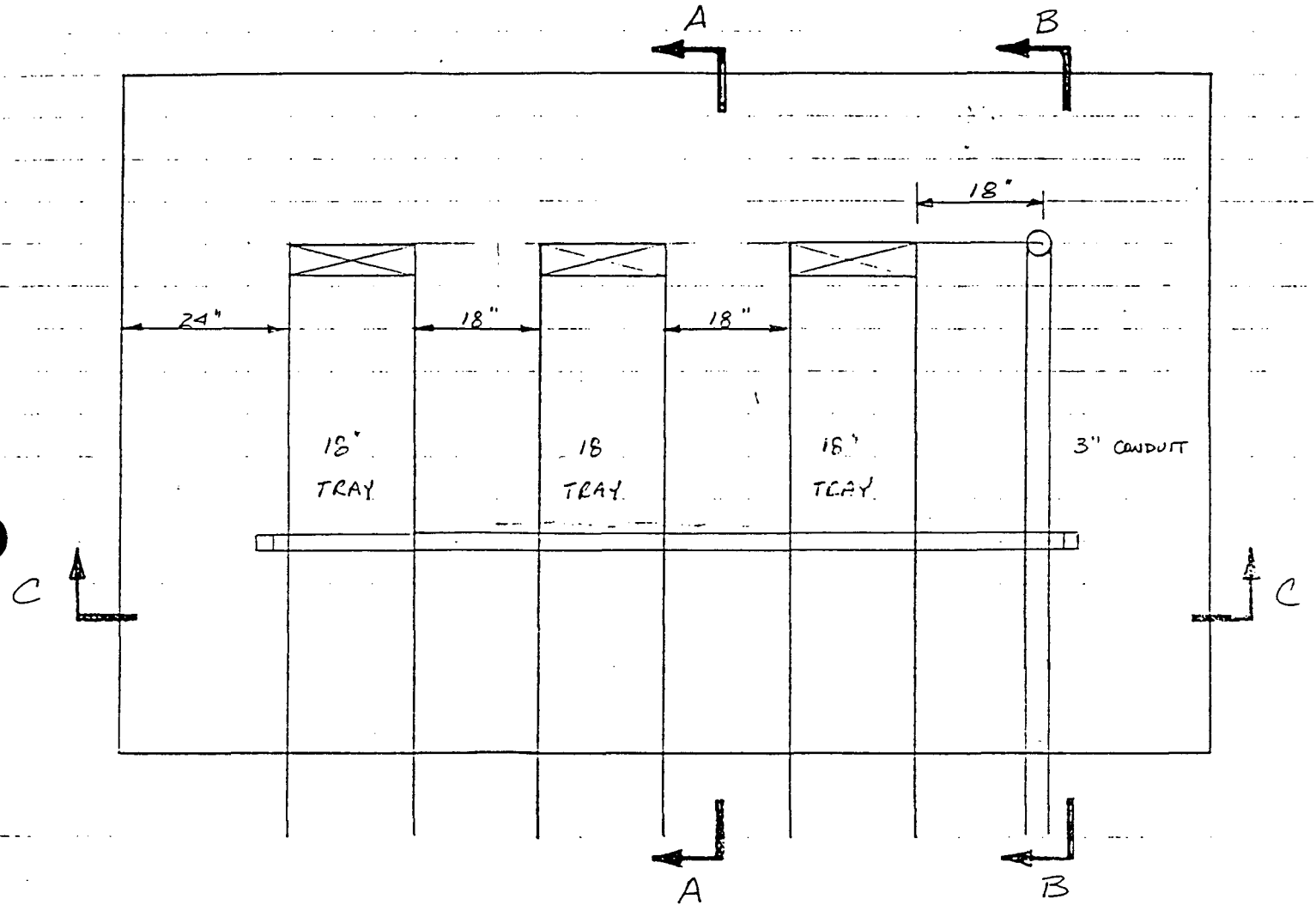
10.4 OPL shall provide six copies of each test report to TVA and one copy of each test report to TSI.

APPENDIX A

DESIGN DRAWINGS

SUBJECT TEST DECK 1 PROJECT TVA-TSI 41

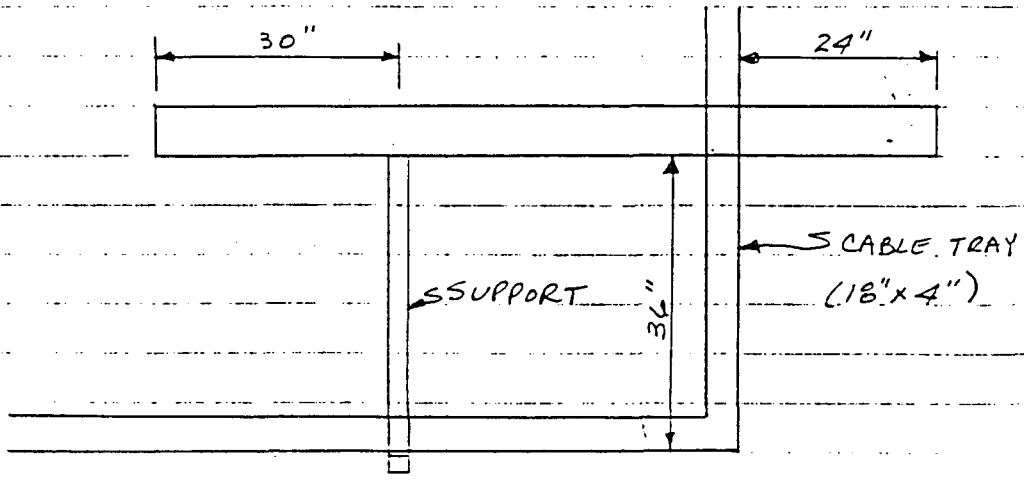
COMPUTED BY DATE CHECKED BY DATE



PLAN VIEW
TRAY FILL TEST
AND TSI-3M INTERFACE

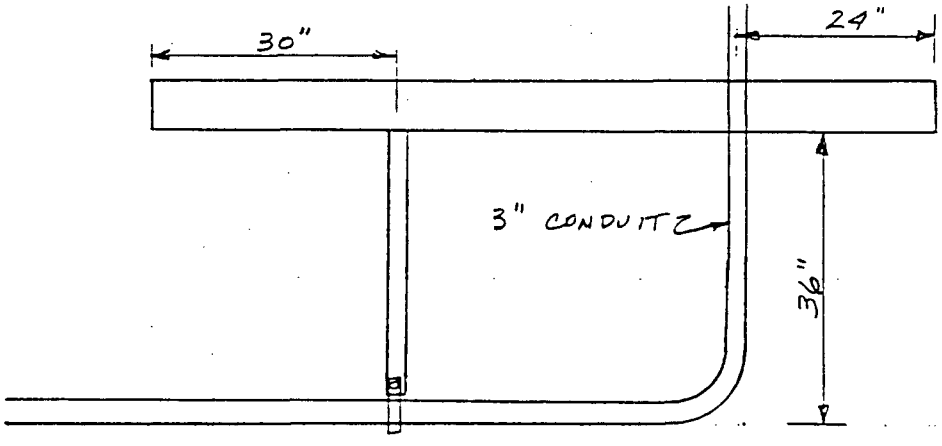
SUBJECT TEST DECK 1 PROJECT TVA-TSI

COMPUTED BY DATE CHECKED BY DATE



A-A

TYPICAL CABLE TRAY

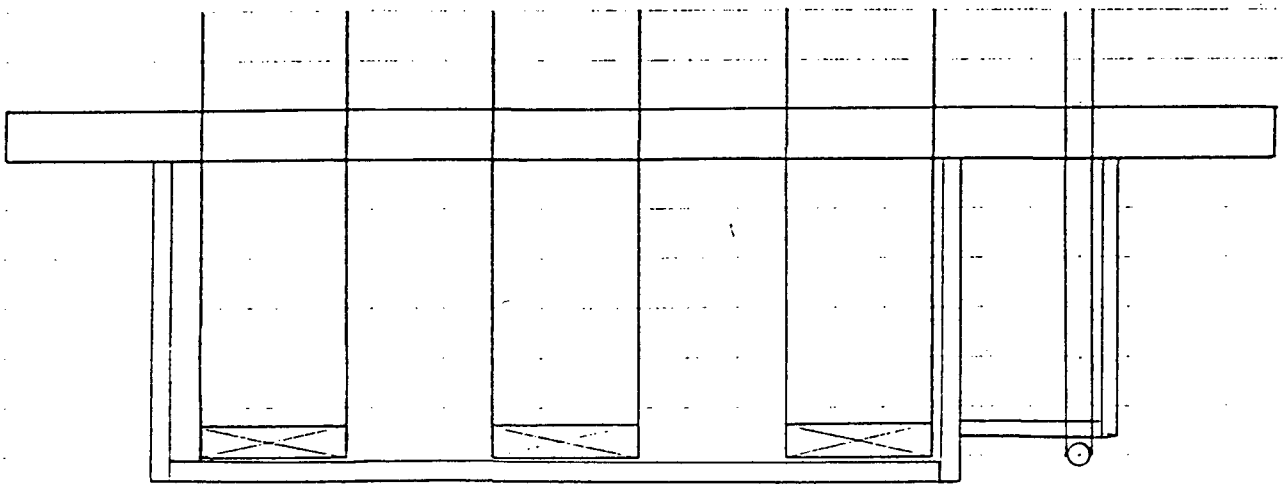


B-B

TYPICAL CONDUIT

SUBJECT TEST DECK 1 PROJECT TVA-TSI

COMPUTED BY DATE CHECKED BY DATE

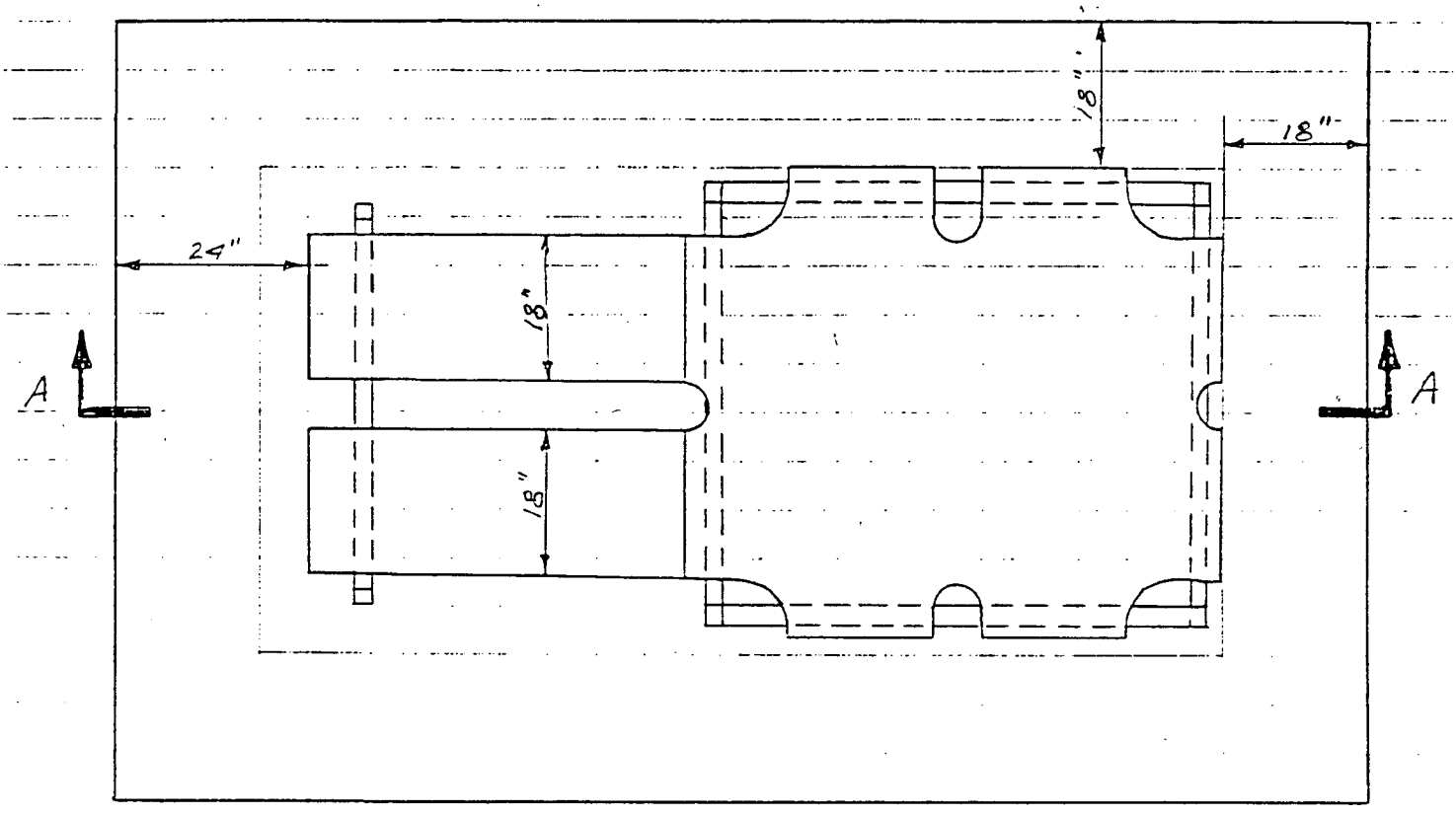


C - C
SUPPORT DETAIL

44

SUBJECT TEST DECK 2 PROJECT TVA-TSI

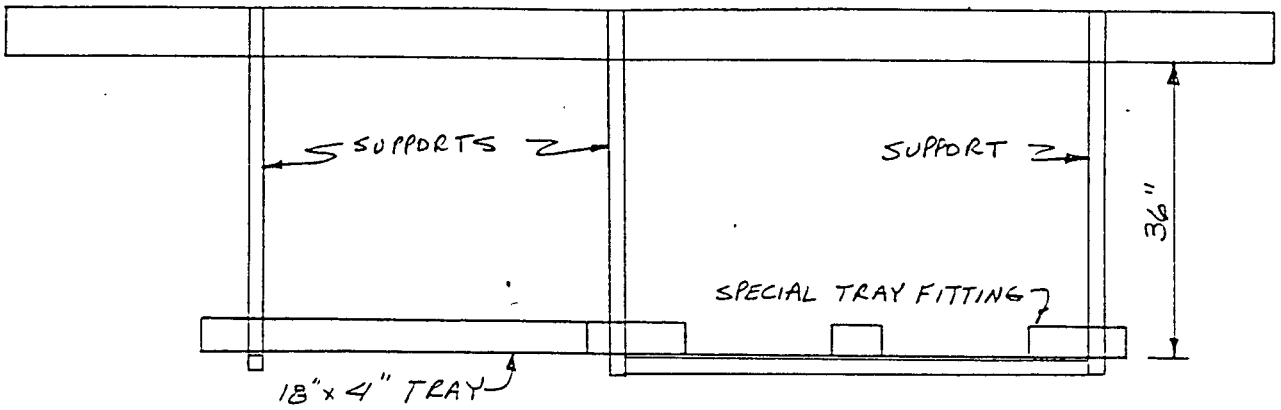
COMPUTED BY DATE CHECKED BY DATE



PLAN VIEW
SPECIAL TRAY

SUBJECT TEST DECK 2 PROJECT TVA-TSI 45

COMPUTED BY DATE CHECKED BY DATE

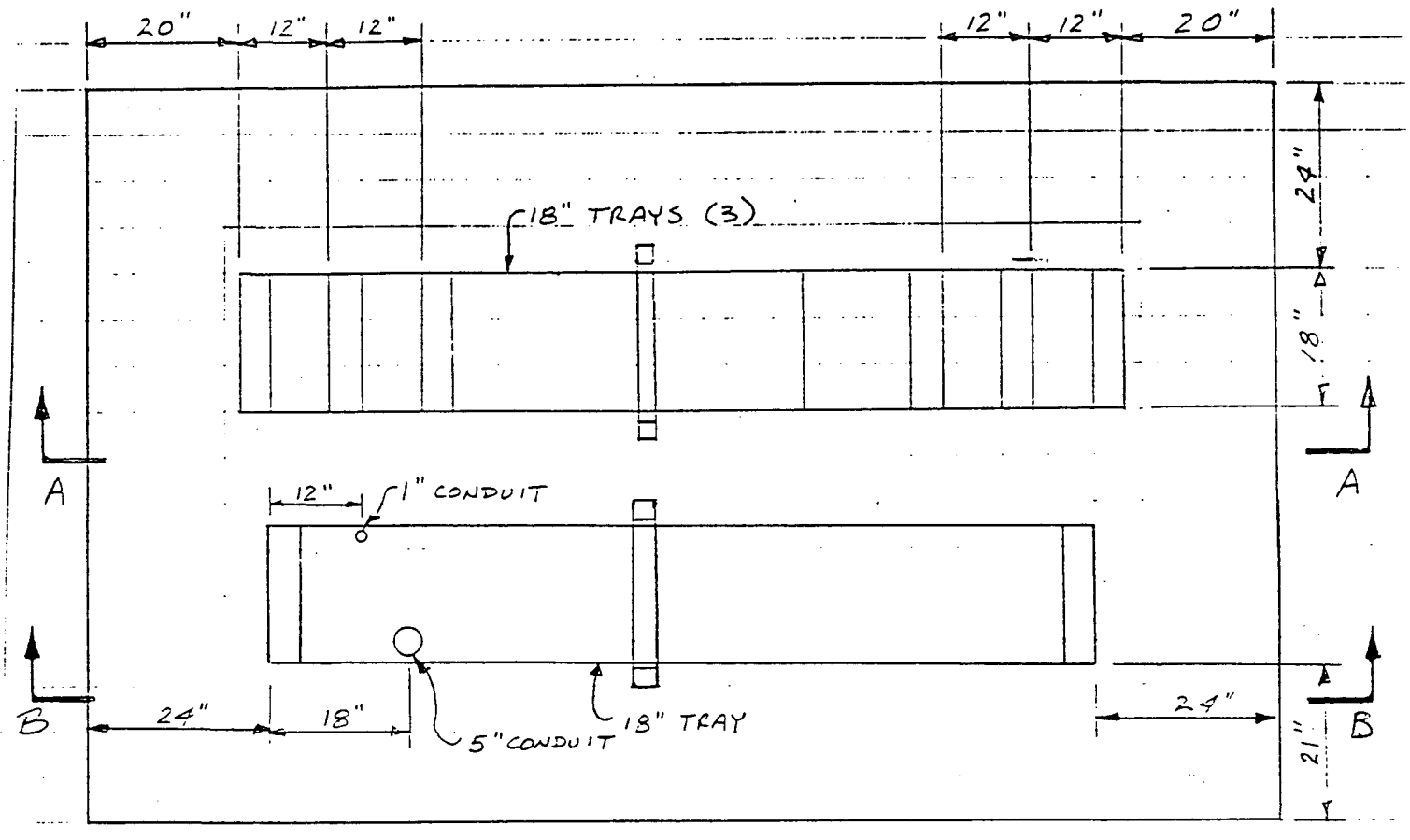


SECTION A-A
SPECIAL TRAY

46

SUBJECT TEST DECK 3 PROJECT TVA-TSI

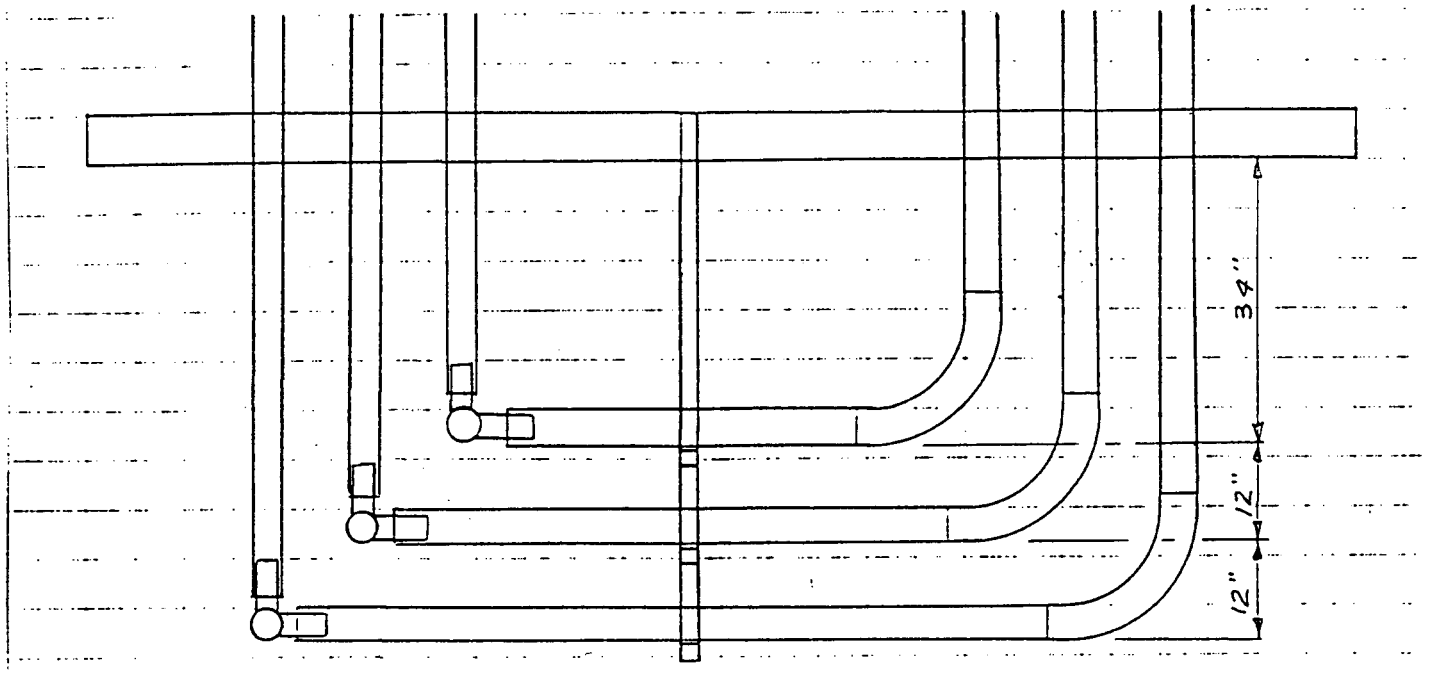
COMPUTED BY DATE CHECKED BY DATE



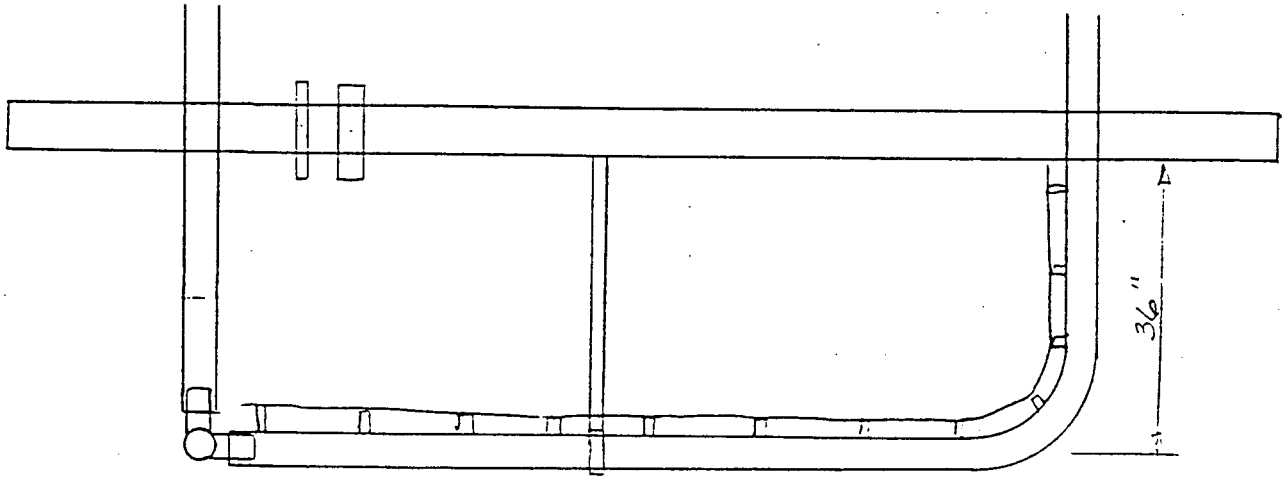
PLAN VIEW

SUBJECT TEST DECK 3 PROJECT 47

COMPUTED BY DATE CHECKED BY DATE



SECTION A-A



SECTION B-B

U.S.NRC Supplement 1 to Letter 86-10

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

March 25, 1994

TO: ALL HOLDERS OF OPERATING LICENSES OR CONSTRUCTION PERMITS FOR NUCLEAR POWER REACTORS

SUBJECT: FIRE ENDURANCE TEST ACCEPTANCE CRITERIA FOR FIRE BARRIER SYSTEMS USED TO SEPARATE REDUNDANT SAFE SHUTDOWN TRAINS WITHIN THE SAME FIRE AREA (SUPPLEMENT 1 TO GENERIC LETTER 86-10, "IMPLEMENTATION OF FIRE PROTECTION REQUIREMENTS")

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing Supplement 1 to Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements," April 24, 1986, to disseminate the review guidance contained in Enclosure 1, "Fire Endurance Test Acceptance Criteria for Fire Barriers Used to Separate Redundant Safe Shutdown Trains Within the Same Fire Area." This guidance will be used by the staff to review and evaluate the adequacy of fire endurance tests and fire barrier systems proposed by licensees or applicants in the future to satisfy existing NRC fire protection rules and regulations. This guidance refines and clarifies the fire barrier testing acceptance criteria specified by GL 86-10, for application in that specific (future review) context.

BACKGROUND

On April 24, 1986, the NRC issued GL 86-10 in order to give the industry additional guidance on implementing NRC fire protection requirements. The guidance in GL 86-10 did not change the requirement to separate one safe shutdown train from its redundant train with either a 1-hour or a 3-hour fire rated barrier. In Enclosure 2 to GL 86-10, the NRC staff responded to industry questions. Question 3.2.1 of the enclosure provided the staff position on fire endurance test acceptance criteria for fire barrier cable tray wraps. In its response, the staff stated that Chapter 7, "Tests of Nonbearing Walls and Partitions," of National Fire Protection Association (NFPA) Standard 251, "Standard Methods of Fire Tests of Building Construction," was applicable to cable-tray fire wraps.

On July 30, 1991, the NRC established a special review team to identify and evaluate technical issues related to the Thermo-Lag 330-1 fire barrier system. On August 6, 1991, the NRC issued Information Notice (IN) 91-47, "Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test." This IN gave licensees information on the fire endurance test performed by Gulf States Utilities Company on a Thermo-Lag 330-1 fire barrier installed on a wide aluminum cable tray and the associated fire test failure. On December 6, 1991, the NRC issued IN 91-79, "Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Material," which gave information on deficiencies in procedures that the Thermo-Lag vendor (Thermal Science, Incorporated) provided for constructing Thermo-Lag 330-1 fire barriers. In

response to concerns about the indeterminate qualifications of Thermo-Lag 330-1 fire barriers, on June 23, 1992, the NRC issued IN 92-46, "Thermo-Lag Fire Barrier Material Special Review Team Findings, Current Fire Endurance Tests, and Ampacity Calculation Errors." The staff found the following problems with Thermo-Lag 330-1 fire barriers: incomplete or indeterminate fire test results, questionable ampacity derating test results and a wide range of documented ampacity derating factors, some barrier installations that were not constructed in accordance with vendor-recommended installation procedures, incomplete installation procedures, and as-built fire barrier configurations that may not have been qualified by valid fire endurance tests or evaluated in accordance with the guidance of GL 86-10.

After reviewing INs 91-47 and 91-79, Texas Utilities (TU) Electric Company initiated a fire endurance test program to qualify the Thermo-Lag raceway fire barrier systems for Comanche Peak Steam Electric Station. Under this program, TU Electric performed an initial fire barrier test series during the weeks of June 15 and 22, and August 19, 1992. Notwithstanding the fire test acceptance criteria guidance specified in GL 86-10, TU Electric followed the guidance of American Nuclear Insurers (ANI) as specified in ANI Information Bulletin 5(79), "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class 1E Electrical Circuits," July 1979.

As a result of NRC interaction with TU Electric regarding its test program, the NRC concluded that there was uncertainty on the part of licensees as to whether or not the ANI test method established a level of fire barrier performance equivalent to that established by the GL 86-10 acceptance criteria. In addition, the NRC staff recognized that the 1-hour and 3-hour raceway fire barrier systems are unique and that additional guidance on the proper implementation of the GL 86-10 acceptance criteria would be useful.

AREAS OF CONCERN

The experiences with Thermo-Lag fire barrier systems at TU Electric recounted above raised the following general concerns:

(1) The fire endurance test acceptance criteria used by other fire barrier vendors, applicants, and licensees may not meet the acceptance criteria of GL 86-10, and may not fully demonstrate the fire barrier performance intended.

(2) Certain past cable functionality testing (i.e., circuit integrity monitoring) may not fully demonstrate the capability of protected circuits to function during and after a postulated fire.

FIRE ENDURANCE CAPABILITY

NRC Qualification Requirements and Guidance for Fire Barriers

Section 50.48 of 10 CFR requires that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion (GDC) 3. GDC 3 requires that structures, systems, and components important to safety be

designed and located to minimize, in a manner consistent with other safety requirements, the probability and effects of fires. Fire protection features required to satisfy GDC 3 include features to ensure that one train of those systems necessary to achieve and maintain shutdown conditions be maintained free of fire damage. One means of complying with this requirement is to separate one safe shutdown train from its redundant train with a fire-rated barrier. The level of fire resistance required of the barrier, 1-hour or 3-hours, depends on the other fire protection features in the fire area.

The NRC issued guidance on acceptable methods of satisfying the regulatory requirements of GDC 3 in Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants;" Appendix A to BTP APCSB 9.5-1; BTP Chemical Engineering Branch (CMEB) 9.5-1, "Fire Protection for Nuclear Power Plants;" and GL 86-10. In the BTPs and in GL 86-10, the staff stated that the fire resistance ratings of fire barriers should be established in accordance with NFPA Standard 251, "Standard Methods of Fire Tests of Building Construction and Materials," by subjecting a test specimen that represents the materials, workmanship, method of assembly, dimensions, and configuration for which a fire rating is desired to a "standard fire exposure.[1]"

Some licensees have used the acceptance criteria of ANI Bulletin No. 5(79), to evaluate the performance of their fire barrier systems. The ANI test methodology, which ANI issued for insurance purposes only, requires that cables within the fire barrier test specimen be monitored for circuit integrity while the test specimen is subjected to a test fire that follows the standard time-temperature curve specified in American Society of Testing and Materials (ASTM) Standard E-119, "Standard Methods of Fire Tests of Building Construction and Materials," and to a hose stream test. Under this criterion, the fire barrier system is evaluated by monitoring the capability of the cables inside the fire barrier to pass a low voltage circuit integrity test. During the fire and hose stream tests, if cable circuit integrity is maintained, the tests are considered successful. The ANI test methodology does not specify the following GL 86-10 acceptance criteria:

(1) The fire barrier design has withstood the fire endurance test without the passage of flame or the ignition of cotton waste on the unexposed side for a period of time equivalent to the fire-resistance rating required of the barrier.

(2) Analysis of temperature levels recorded on the unexposed side of the fire barrier demonstrates that the maximum temperature rise does not exceed 139 °C [250 °F] above ambient temperature.[2]

---

[1] American Society for Testing and Materials Standard E-119 was adopted by NFPA as NFPA Standard 251.

[2] The 163 °C [325 °F] temperature condition was established by allowing the temperature of the unexposed side of the fire barrier to rise 139 °C [250 °F] above the assumed 24°C [75°F] ambient air temperature, as measured by the

3) The fire barrier remains intact and does not allow water to be projected beyond the unexposed surface during the hose stream test.

Enclosure 1, "Interpretations of Appendix R," to GL 86-10, provided additional guidance with respect to the term "free of fire damage" as used in Appendix R. Interpretation 3, "Fire Damage," stated: "In promulgating Appendix R, the Commission has provided methods acceptable for assuring that necessary structures, systems, and components are free from fire damage (see Section III.G.2a, b, and c), that is, the structure, system or component under consideration is capable of performing its intended function during and after the postulated fire, as needed."

The review guidance provided in Enclosure 1 (1) clarifies the applicability of the test acceptance criteria stated in GL 86-10 to raceway fire barrier systems, (2) specifies a set of fire endurance test acceptance criteria which are acceptable for demonstrating that fire barrier systems can perform the required fire-resistive function and maintain the protected safe shutdown train free of fire damage, (3) specifies acceptable options for hose stream testing, and (4) specifies acceptable criteria for functionality testing of cables when a deviation is necessary, such as when the fire barrier temperature rise criteria are exceeded or the test specimen cables sustain visible damage.

The test methods and acceptance criteria specified in Enclosure 1 are acceptable for determining the adequacy of fire barrier systems proposed by licensees or applicants in the future to satisfy NRC fire protection rules and regulations. Applicants or licensees may propose alternative test methods and acceptance criteria to demonstrate an equivalent level of protection; the staff will review such proposals on a case-by-case basis. Enclosure 2 is a summary comparison of this review guidance against the GL 86-10 acceptance criteria.

Evaluation and Application of Fire Endurance and Functionality Test Results

The fire endurance qualification test is successful for a raceway fire barrier if the following conditions are satisfied (see Enclosure 3, "Fire Barrier Testing Acceptance Criteria/Logic Diagram"):

(1) The average internal temperature of the fire barrier system, as measured on the exterior surface of the raceway or component, did not rise more than 139 °C [250 °F] above its initial temperature; and

---

thermocouples within the test specimen at the onset of the fire exposure, during the fire test.

(2) When cables or components are included in the test specimen, a visual inspection of the protected cables or components revealed no signs of degraded conditions[3] from the thermal effects[4] of the fire exposure; and

(3) The fire barrier system remained intact during the fire exposure and hose stream tests without developing any openings through which the protected component, raceway, or cables are visible.

For raceway fire barrier systems, the staff adopted the hose stream testing methodology specified in NUREG-0800, "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 9.5.1, "Guidelines for Fire Protection for Nuclear Power Plants," Revision 2, July 1981, Position 5.a. This SRP position established the acceptability of using the fog nozzle method for hose stream testing of fire barrier penetration seals. The fog nozzle hose stream test method is an acceptable option for tests of the entire raceway fire barrier system under the new staff position.

Licensees that propose to use fire endurance test results that deviate from the acceptance criteria as the bases for qualifying and installing fire barrier configurations, should request a deviation from the acceptance criteria based on a engineering evaluation acceptable to the staff, such as demonstrating cable functionality. For those licensees required to comply with Section III.G to Appendix R, the engineering evaluation justifying the deviating conditions should be submitted with the exemption request. The review guidance provided in Enclosure 1 provides specific guidance for demonstrating cable functionality, including subjecting the cables to Megger and high-potential tests. The results of these tests can be used to determine the insulation-resistance characteristics of the thermally damaged cable and to determine if the cable insulation would have been sufficient to maintain circuit functionality during and after the fire exposure.

IMPLEMENTATION

This section describes how the NRC plans to use the review guidance contained in Enclosure 1. After this supplement to GL 86-10 is issued, except in those cases in which an applicant or licensee has proposed an acceptable alternative fire endurance test method and acceptance criteria that demonstrates an equivalent level of fire protection, the NRC will use the methods and the

---

[3] Examples of thermal degradation of cable jacket and insulation materials are: swollen, split, cracked, blistered, melted, or discolored jacket; exposed shield; exposed, degraded, or discolored conductor insulation; and exposed copper conductor.

[4] When the temperature criterion is exceeded or damage occurs, operability at the temperature conditions experienced during the fire test must be assessed. That is, fire endurance tests that are judged acceptable on the basis of a visual inspection of certain components or cables may not be applied to other components or cables without a specific evaluation.

criteria specified in the enclosed review guidance to (1) evaluate fire endurance testing programs proposed by licensees or applicants in the future for demonstrating compliance with pertinent NRC fire protection rules and regulations and (2) review the adequacy of the fire barrier systems proposed in the future by applicants or licensees.

ACTIONS REQUESTED

None.

REPORTING REQUIREMENTS

None.

BACKFIT DISCUSSION

The guidance transmitted by this generic letter supplement will be used by the staff for review and evaluation of the adequacy of fire barrier systems and fire endurance tests that may be proposed in the future to satisfy NRC fire protection rules and regulations. This guidance refines and clarifies the guidance specified in Generic Letter 86-10 for application in that future review context; specifically it (1) clarifies the applicability of the test acceptance criteria stated in GL 86-10 to raceway fire barrier systems, (2) specifies a set of fire endurance test acceptance criteria which are acceptable for demonstrating that fire barrier systems can serve the required fire-resistive function and maintain the protected safe shutdown train free of fire damage, (3) contains acceptable options for hose stream testing, and (4) specifies acceptable criteria for functionality testing of cables when a deviation would be necessary, such as if the fire barrier temperature rise criteria are exceeded or the cable sustains visible damage.

No generic or plant-specific backfitting is intended or approved at this time in connection with issuance of this review guidance. The staff may consider the need for further generic action in that regard, if the industry guidance currently under development for addressing the pertinent fire protection issues is substantively inconsistent with this staff review guidance; but such action would be separately justified in accordance with the criteria of 10 CFR 50.109 and existing NRC backfit procedures. Similarly, if plant-specific backfits are proposed by the NRC staff consistent with this review guidance, the proposed backfits would be justified on a case-by-case basis in accordance with the criteria of 10 CFR 50.109 and existing NRC backfit procedures.

If you have any questions about this matter, please contact one of the contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

Sincerely,

Luis A. Reyes
Acting Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. NRC Staff Review Guidance and Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used To Separate Redundant Safe Shutdown Trains Within the Same Fire Area.
2. Comparison of Staff Position on Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used To Separate Redundant Safe Shutdown Trains Within the Same Fire Area to the Acceptance Criteria of GL 86-10.
3. NRC Fire Testing Acceptance Criteria Logic Diagram.
4. List of Recently Issued Generic Letters

Technical contact: Patrick M. Madden, NRR
(301) 504-2854

Lead Project Manager: Marsha K. Gamberoni, NRR
(301) 504-3024

FIRE ENDURANCE TEST ACCEPTANCE CRITERIA FOR FIRE BARRIER SYSTEMS USED TO SEPARATE REDUNDANT SAFE SHUTDOWN TRAINS WITHIN THE SAME FIRE AREA

I. BACKGROUND

In 1975, the Browns Ferry Nuclear power plant experienced a serious electrical cable tray fire. This fire had a significant impact on operator response to the event from a safety perspective. The fire caused spurious instrumentation indications and affected the control of several safety systems. As a result of this fire, the NRC issued the following fire protection guidelines and regulations concerning fire protection programs at nuclear power plants:

May 1, 1976	Branch Technical Position (APCSB) 9.5-1, "Fire Protection Program."
February 24, 1977	Appendix A to Branch Technical Position APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976."
February 19, 1981	10 CFR 50.48, "Fire Protection."
February 19, 1981	Appendix R to 10 CFR Part 50, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1979."
July 1981	NUREG-0800, Standard Review Plan (SRP), 9.5.1, "Fire Protection for Nuclear Power Plants."

In addition to the above fire protection guidance and regulations, the NRC, in an effort to clarify its fire protection requirements to the industry, issued Generic Letter (GL) 81-12, "Fire Protection Rule (45 FR 76602, November 19, 1980)," February 20, 1981; GL 83-33, "NRC Position on Certain Requirements of Appendix R to 10 CFR 50," October 19, 1983; and GL 86-10, "Implementation of Fire Protection Requirements," April 24, 1986. GL 86-10, which took precedence over previous staff guidance, provided staff interpretations to Appendix R and answers to industry questions regarding the implementation of Appendix R. The NRC, in an effort to give the licensees flexibility to make changes to its plant specific fire protection program, issued GL 88-12, "Removal of Fire Protection Requirements From Technical Specifications," August 2, 1988. Through the implementation and the adoption of a standard license condition, a licensee can make changes which do not adversely affect the ability to achieve and maintain post-fire safe shutdown to its fire protection program in accordance with 10 CFR 50.59.

The aforementioned NRC documents provided NRC staff guidance concerning fire barriers separating plant fire areas, including the fire resistance (endurance) ratings for the barriers and the qualification tests that establish their fire resistance ratings. In addition, the documents provided

guidance on combustibility of structural materials and tests for demonstrating low flame spread properties.

The following sections of this document provide the objective for providing safe shutdown related fire barriers in nuclear power plants, definition of fire protection terms related to fire barriers, and the NRC fire endurance test acceptance criteria for fire barriers used to separate safe shutdown functions within the same fire area.

II. OBJECTIVE OF FIRE BARRIERS USED TO SEPARATE SAFE SHUTDOWN FUNCTIONS WITHIN THE SAME FIRE AREA

Fire rated barriers are used in nuclear power plants to provide fire area separation between redundant safety-related components and safe shutdown functions. They provide fire resistance protection, as required by Appendix R[5], to one safe shutdown train in those fire areas which contain both trains. The objective of the safe shutdown related Appendix R fire barrier is to ensure that a safe shutdown train is conservatively protected from fire-related thermal damage. The necessity for these fire barriers has been verified by multiple probabilistic risk assessments (PRAs). These PRAs indicated that, even with fire barriers installed, fires are a major contributor to core melt probabilities.

It is the position of the NRC that fire endurance ratings of building construction and materials are demonstrated by testing fire barrier assemblies in accordance with the provisions of the applicable sections of NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials," and ASTM E-119, "Fire Test of Building Construction and Materials." Assemblies that pass specified acceptance criteria (e.g., standard time-temperature fire endurance exposure, unexposed side temperature rise, and hose stream impingement) are considered to have a specific fire resistance rating.

Enclosure 1 to GL 86-10, "Interpretations of Appendix R," provided additional guidance with respect to the term "free from fire damage." Interpretation 3, "Fire Damage," states, "In promulgating Appendix R, the Commission has provided methods acceptable for assuring that necessary structures, systems, and components are free from fire damage (see Section III.G.2a, b, and c), that is, the structure, system or component under consideration is capable of performing its intended function during and after the postulated fire, as needed."

GL 86-10, Response 3.2.1, also stated that, "The resulting 325 °F cold side temperature criterion is used for cable tray wraps because they perform a fire barrier function to preserve the cables free from fire damage. It is clear that cable that <u>begins to degrade</u> at 450 °F is free from fire damage at 325 °F." (Emphasis added.) In addition, the staff response stated that, "for newly identified conduit and cable trays requiring such wrapping new materials

---

[5] For advanced reactor designs, redundant safe shutdown functions are required to be located in separate 3-hour fire areas.

which meet the 325 °F criterion should be used, or justification should be provided for the use of material which does not meet the 325 °F criterion. This may be based on an analysis demonstrating that the maximum recorded temperature is sufficiently below the cable insulation ignition temperature." (Emphasis added.)

The basic premise of the NRC fire resistance criteria is that fire barriers which do not exceed 163 °C [325 °F] cold side temperature[6] and pass the hose stream test provide adequate assurance that the shutdown capability is protected without further analyses. If the temperature criteria is exceeded, sufficient additional information is needed to perform an engineering evaluation to demonstrate that the shutdown capability is protected.

III. DEFINITIONS

In order to support the understanding of the technical terms used throughout this document, the following definitions are provided.

Combustible Material - Material that does not meet the definition of non-combustible.

Fire Barrier - Those components of construction (walls, floors and their supports), including beams, joists, columns, penetration seals or closures, fire doors, and fire dampers that are rated by approving laboratories in hours of resistance to fire and are used to prevent the spread of fire.

Fire Resistance Rating - The time that materials of a test assembly have withstood a standard ASTM E-119 fire exposure and have successfully met the established test acceptance criteria (fire barrier test acceptance criteria refer to Sections IV, V, and VI).

Noncombustible Material - (a) Material which, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat; (b) Material having a structural base of noncombustible material, with a surfacing not over 1/8-inch thick that has a flame spread rating of not higher than 50 when measured in accordance with ASTM E-84, "Surface Burning Characteristics of Building Materials." (There is an exception to this definition as defined by BTP Appendix A, Position D.1.d. This position allows the use of combustible interior finishes when listed by a nationally recognized test laboratory, such as Factory Mutual or Underwriters Laboratories, Incorporated, for a flame spread, smoke and fuel contribution of 25 or less in its use configuration.)

---

[6] The 163 °C [325 °F] temperature condition was established by allowing the temperature of the unexposed side of the fire barrier to rise 139 °C [250 °F] above the assumed 24 °C [75 °F] ambient air temperature, as measured by the thermocouples within the test specimen at the onset of the fire exposure during the fire test.

Raceway - Cable trays, conduits, junction boxes, and other components used to support and route cables from circuit termination to circuit termination.

Raceway Fire Barrier - Nonload bearing partition type envelope system installed around electrical components and cabling that are rated by test laboratories in hours of fire resistance and are used to maintain safe shutdown functions free of fire damage.

IV. FIRE ENDURANCE TEST ACCEPTANCE CRITERIA FOR FIRE BARRIER WALLS, FLOORS, CEILINGS, AND FREE STANDING EQUIPMENT ENCLOSURES USED TO SEPARATE SAFE SHUTDOWN FUNCTIONS WITHIN THE SAME FIRE AREA

To demonstrate the adequacy of fire barrier walls, floors, ceilings, and enclosures, barrier designs should be verified by fire endurance testing. NRC fire protection guidance refers to the guidance of NFPA 251 and ASTM E-119 as acceptable test methods for demonstrating fire endurance performance.

The fire endurance test acceptance criteria for the subject fire barriers are:

The fire barrier design has withstood the fire endurance test without the passage of flame or the ignition of cotton waste on the unexposed side for a period of time equivalent to the fire resistance rating required of the barrier;

The temperature levels recorded on the unexposed side of the fire barrier are analyzed and demonstrable that the maximum temperature does not exceed 139 °C [250 °F] above ambient; and

The fire barrier remains intact and does not allow projection of water beyond the unexposed surface during the hose stream test. (For acceptable hose stream test methods and time of application - See Section VII.)

If the above criteria are met for fire barrier walls, floors, ceilings, and free standing equipment enclosures separating safe shutdown functions within the same fire area, the barrier is acceptable.

NRC fire protection guidance also ensures that door and ventilation openings and penetrations are properly protected. The guidance requires that these openings be protected with fire doors and fire dampers which have been fire tested and listed by a nationally recognized test laboratory (e.g., Factory Mutual or Underwriters Laboratories, Incorporated). In addition, the construction and installation techniques for door and ventilation openings and other penetrations through these fire barriers should be qualified by fire endurance tests.

The guidance of NFPA 251 and ASTM E-119 should be consulted with regard to construction, materials, workmanship, and details such as dimensions of parts, and the size of the specimen(s) to be tested. In addition, NFPA 251 and ASTM E-119 should be consulted with regard to the placement of thermocouples on the specimen.

V. FIRE ENDURANCE TEST ACCEPTANCE CRITERIA FOR ELECTRICAL RACEWAY AND COMPONENT FIRE BARRIER SYSTEMS FOR SEPARATING SAFE SHUTDOWN FUNCTIONS WITHIN THE SAME FIRE AREA

The NRC provided guidance in Appendix A to Branch Technical Position 9.5-1, Position D.3.(d), for cable tray fire barriers. This fire protection guidance states that the design of fire barriers for horizontal and vertical cable trays should, as a minimum, meet the requirements of ASTM E-119, "Fire Test of Building Construction and Materials," including hose stream test. On November 19, 1980, the NRC issued Appendix R to 10 CFR Part 50. The technical basis for Section III.M, "Fire Barrier Penetration Seal Qualification," states that "Fire barriers are 'rated' for fire resistance by being exposed to a 'standard test fire.' This standard test fire is defined by the American Society of Testing and Materials in ASTM E-119." In addition, this technical basis stated that "[i]f specific plant conditions preclude the installation of a 3-hour fire barrier to separate the redundant trains, a 1-hour fire barrier and automatic fire suppression and detection system for each redundant train will be considered the equivalent of a 3-hour barrier." Appendix R to 10 CFR Part 50, Section III.G, "Fire protection of safe shutdown capability," provides what the NRC views as equivalent means for ensuring that one safe shutdown train remains free of fire damage.

In 1984 Appendix R workshops held with industry, and later in GL 86-10, the staff provided guidance related to fire barrier designs for raceways. In Enclosure 2, "Question and Answers," to this GL, Question 3.2.1., "Acceptance Criteria," the staff provided guidance on the cold side temperature for fire barrier cable tray wraps. In response to this question the staff stated that the acceptance criteria contained in Chapter 7 of NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials," pertaining to non-bearing fire barriers was applicable to cable tray fire barrier wraps. Chapter 5 of NFPA 251 explains the conduct of the fire test.

The following is the NFPA 251 acceptance criteria:

- The wall or partition withstood the fire endurance test without the passage of flame or gases hot enough to ignite cotton waste, for a period equal to that for which classification is desired;

- The wall or partition withstood the fire and hose stream tests specified in Chapter 5, without the passage of flame, gases hot enough to ignite cotton waste, or the hose stream. The assembly failed the hose stream test if an opening develops that permits the projection of water from the stream beyond the unexposed surface during the hose stream test; and

- Transmission of heat through the wall or partition during the fire endurance test did not raise the temperature on the unexposed surfaces more than 139 °C [250 °F] above their initial temperatures.

The staff considers the fire endurance qualification test for fire barrier materials applied directly to a raceway or component to be successful if the following conditions are met:

- The average unexposed side temperature of the fire barrier system, as measured on the exterior surface of the raceway or component, did not exceed 139 °C [250 °F] above its initial temperature; and

  (Staff Guidance: NFPA 251 and ASTM E-119 allow this temperature to be determined by averaging thermocouple temperature readings. For the purposes of this criterion, thermocouple averaging can be used provided similar series of thermocouples (e.g., cable tray side rail) are averaged together to determine temperature performance of the raceway fire barrier system. In addition, conditions of acceptance are placed on the temperatures measured by a single thermocouple. If any single thermocouple exceeds 30 percent of the maximum allowable temperature rise (i.e., 139 °C + 42 °C = 181 °F [250 °F + 75 °F = 325 °F]), the test exceeded the temperature criteria limit.)

- Irrespective of the unexposed side temperature rise during the fire test, if cables or components are included in the fire barrier test specimen, a visual inspection should be performed.[7] Cables should not show signs of degraded conditions[8] resulting from the thermal affects of the fire exposure; and

  (Staff Guidance: For those cases where signs of thermal degradation are present, the fire barrier did not perform its intended fire-resistive function. For those barriers which are not capable of performing their intended function, a deviation based on demonstrating that the functionality of thermally degraded cables or component was maintained and that the cables or component would have adequately performed their intended function during and after a postulated fire exposure may be granted. The attachment to this position provides a methodology for demonstrating the functionality of cables during and after a fire test exposure. The purpose of the functionality tests is to justify observed deviations in fire barrier performance. For those fire barrier test specimens that are tested without cables,

---

[7] When the temperature criteria are exceeded or damage occurs, component operability at the temperatures experienced during the fire test should be assessed. Fire endurance tests that are judged acceptable on the basis of a visual inspection of specific components or cables included in the test specimen may not be applied to other components or cables without a specific evaluation.

[8] Examples of thermal cable degradation are: jacket swelling, splitting, cracking, blistered, melted, or discoloration; shield exposed; conductor insulation exposed, degraded, or discolored; bare copper conductor exposed.

an engineering analysis justifying internal fire barrier temperature conditions greater than allowed can be based on a comparison of the fire barrier internal temperature profile measured during the fire endurance test to existing cable specific performance data, such as environmental qualification (EQ) tests.)

The cable tray, raceway, or component fire barrier system remained intact during the fire exposure and water hose stream test without developing any openings through which the cable tray, raceway, or component (e.g., cables) is visible. Section VII identifies acceptable hose stream test methods.

The test specimen should be representative of the construction for which the fire rating is desired as to materials, workmanship, and details such as dimensions of parts, and should be built under representative conditions. Raceway fire barrier systems being subjected to qualification fire endurance tests should be representative of the end use. For example, if it is intended to install a cable tray fire barrier system in the plant without protecting the cable tray supports, then the test program should duplicate these field conditions. In addition, the fire test program should encompass or bound raceway sizes and the various configurations for those fire barrier systems installed in the plant. It should be noted that several test specimens will be required in order to qualify various sizes of horizontal and vertical runs of cable trays and conduits, junction boxes and pull boxes, etc. The cable tray or raceway design used for the tests should be constructed with materials and configurations representative of in plant conditions (e.g., the mass associated with typical steel conduits and cable trays, representative internal and external penetration seals). If cables are included in the raceway fire barrier test specimen, these cables should be representative of the installed plant-specific cables.

Measuring cable temperatures is not a reliable means for determining excessive temperature conditions which may occur at any point along the length of the cable during the fire test. In lieu of measuring the unexposed surface temperature of the fire barrier test specimen, methods which will measure the surface temperature of the raceway (e.g., exterior of the conduit, side rails of cable trays, bottom and top of cable tray surfaces, junction box external surfaces) can be considered as equivalent if the raceway components used to construct the fire test specimen represent plant specific components and configurations. The metal surfaces of the raceway, under fire test conditions, exhibit good thermal conductivity properties. Temperatures measured on these surfaces provide a indication of the actual temperature rise within the fire barrier system.

In 1979, American Nuclear Insurers (ANI) issued a fire endurance test method for raceway fire barrier systems for insurance purposes. This method, "Fire Endurance Protective Envelope Systems for Class 1E Electrical Circuits," specified that cable temperatures be monitored by thermocouples. Industry considers this the proper location for determining the temperature rise within the raceway fire barrier system. Since cable jackets have a low thermal

conductivity, the actual local temperatures of the cable jackets indications of barrier failure and internal fire barrier temperature rise conditions during the fire exposure are masked. Monitoring cable temperatures can give indications of low internal fire barrier temperature conditions during the fire endurance test. Using this temperature monitoring approach, cable damage can occur without indication of excessive temperatures on the cables. This, linked with no loss of circuit integrity, would give indications of a successful test. The staff considers monitoring the cable temperature as the primary means of determining cable tray or raceway fire barrier performance to be nonconservative. Therefore, the staff has incorporated the provision for a post-fire visual inspection of cables that are installed in fire barrier test specimens. As discussed above, temperatures monitored on the exterior surface of the raceway provide a more representative indication of fire barrier performance.

Fire endurance tests of raceway fire barrier systems should be without cables. This method is preferred because by excluding cables from the test specimen it eliminates bias in the test results created by the thermal mass of the cables. Without this thermal mass, the internal temperature conditions measured by the test specimen thermocouples during the fire exposure will provide a more accurate determination of fire barrier thermal performance.

Thermocouple Placement - Test Specimens Containing Cables

The following are acceptable placements of thermocouples for determining the thermal performance of raceway or cable tray fire barrier systems that contain cables during the fire exposure:

Conduits - The temperature rise on the unexposed surface of a fire barrier system installed on a conduit should be measured by placing the thermocouples every 152 mm [6 inches][9] on the exterior conduit surface underneath the fire barrier material. The thermocouples should be attached to the exterior conduit surface located opposite the test deck and closest to the furnace fire source. Thermocouples should also be placed immediately adjacent to all structural members, supports, and barrier penetrations.

Cable Trays - The temperature rise on the unexposed surface of a fire barrier system installed on a cable tray should be measured by placing the thermocouples on the exterior surface of the tray side rails between the cable tray side rail and the fire barrier material. In addition to placing thermocouples on the side rails, thermocouples should be attached to two AWG 8 stranded bare copper conductors. The first copper conductor should be installed on the bottom of the cable tray rungs along the entire length and down the longitudinal center of the cable tray run. The second conductor should be installed along the outer top

[9] For the thermocouples installed on conduits, cable tray side rails, and bare copper conductors, a ±13 mm [±½ inch] installation tolerance is acceptable.

surface of the cables closest to the top and towards the center of the fire barrier. The bare copper wire is more responsive than cable jackets to temperature rise within the fire barrier enclosure. The temperature changes measured along the bare copper conductors provide indication of joint failure or material burn through conditions. Thermocouples should be placed every 152 mm [6 inches] down the longitudinal center along the outside surface of the cable tray side rails and along the bare copper conductors. Thermocouples should also be placed immediately adjacent to all structural members, supports, and barrier penetrations.

Junction Boxes (JB) - The temperature rise on the unexposed surface of a fire barrier system installed on junction boxes should be measured by placing thermocouples on either the inside or the outside of each JB surface. Each JB surface or face should have a minimum of one thermocouple, located at its geometric center. In addition, one thermocouple should be installed for every one square foot of JB surface area. These thermocouples should be located at the geometric centers of the one square foot areas. At least one thermocouple should also be placed within 25 mm [1 inch] of each penetration connector/interface.

Airdrops - The internal airdrop temperatures should be measured by thermocouples placed every 305 mm [12 inches] on the cables routed within the air drop and by a stranded AWG 8 bare copper conductor routed inside and along the entire length of the airdrop system with thermocouples installed every 152 mm [6 inches] along the length of the copper conductor. The copper conductor should be in close proximity with the unexposed surface of the fire barrier material. Thermocouples should also be placed immediately adjacent to all supports and barrier penetrations.

With the exception of airdrops, the installation of thermocouples on cables is optional and is left to the discretion of the licensee, test sponsor, or test laboratory. Cable thermocouples are to be used for engineering purposes only. Cable thermocouples alone are not acceptable for the demonstration of fire barrier performance. However, cable thermocouples may support fire barrier deviation conditions.

Temperature conditions on the unexposed surface of the fire barrier material during the fire test will be determined by averaging the temperatures measured by the thermocouples. In determining these cable tray or raceway temperature conditions, the thermocouples measuring similar fire barrier areas of performance should be averaged together and the basis of acceptance will be based on the individual averages. The following method of averaging should be followed:

Conduits - The thermocouples applied to the outside metal surface of the conduit should be averaged together.

Cable Trays - The thermocouples on each cable tray side rail should be averaged separately. For example, thermocouples placed on one side rail

will be averaged separately from the other side rail. In addition, the temperature conditions measured by thermocouples on the two bare copper conductors should be averaged separately.

Junction Boxes - For small JBs which have only one thermocouple placed on each JB surface, the individual JB surface thermocouples should be averaged together. For larger JBs which have more that one thermocouple placed on each JB surface, the thermocouples on the individual JB surfaces should be averaged together.

Airdrops - The thermocouples placed on the outer cable(s) routed in the airdrop fire barrier should be averaged together.

The averages of any thermocouple group during the fire test should not exceed 139 °C [250 °F] above the unexposed side temperature within the fire barrier test specimen at the onset of the fire endurance test. In addition, the temperature of each individual thermocouple will be evaluated. Individual thermocouple conditions should not exceed the 139 °C [250 °F] temperature rise by more than 30 percent.

Thermocouple Placement - Test Specimens Without Cables

The following are acceptable thermocouple placements for determining the thermal performance of raceway or cable tray fire barrier systems that do not contain cables:

Conduits - The temperature rise of the unexposed surface of a fire barrier system installed on a conduit should be measured by placing thermocouples every 152 mm [6 inches] on the exterior conduit surface between the conduit and the unexposed surface of the fire barrier material. These thermocouples should be attached to the exterior conduit surface opposite of the test deck and closest to the furnace fire source. The internal raceway temperatures should be measured by a stranded AWG 8 bare copper conductor routed through the entire length of the conduit system with thermocouples installed every 152 mm [6 inches] along the length of the copper conductor. Thermocouples should also be placed immediately adjacent to all structural members, supports, and barrier penetrations.

Cable Trays - The temperature rise on the unexposed surface of a fire barrier system installed on a cable tray should be measured by placing thermocouples every 152 mm [6 inches] on the exterior surface of each tray side rails between the side rail and the fire barrier material. Internal raceway temperatures should be measured by a stranded AWG 8 bare copper conductor routed on the top of the cable tray rungs along the entire length and down the longitudinal center of the cable tray run with thermocouples installed every 152 mm [6 inches] along the length of the copper conductor. Thermocouples should be placed immediately adjacent to all structural members, supports, and barrier penetrations.

Junction Boxes - The temperature rise on the unexposed surface of a fire barrier system installed on junction boxes should be measured by placing thermocouples on either the inside or the outside of each JB surface. Each JB surface or face should have a minimum of one thermocouple, located at its geometric center. In addition, one thermocouple should be installed for every one square foot of JB surface area. These thermocouples should be located at the geometric centers of the one square foot areas. At least one thermocouple should also be placed within 25 mm [1 inch] of each penetration connector/interface.

Airdrops - The internal airdrop temperatures should be measured by a stranded AWG 8 bare copper conductor routed inside and along the entire length of the airdrop system with thermocouples installed every 152 mm [6 inches] along the length of the copper conductor. The copper conductor should be in close proximity with the unexposed surface of the fire barrier material. Thermocouples should also be placed immediately adjacent to all supports and penetrations.

Temperature conditions on the unexposed surfaces of the fire barrier material during the fire test will be determined by averaging the temperatures measured by the thermocouples installed in or on the raceway. In determining these temperature conditions, the thermocouples measuring similar areas of the fire barrier should be averaged together. Acceptance will be based on the individual averages. The following method of averaging should be followed:

Conduits - The thermocouples applied to the outside metal surface of the conduit should averaged together.

Cable Trays - The thermocouples on each cable tray side rail should be averaged separately. For example, thermocouple placed on one side rail will be averaged separately from the other side rail. In addition, the temperature conditions measured by thermocouples on the bare copper conductor should be averaged separately from the side rails.

Junction Boxes - For JBs that have only one thermocouple on each JB surface, the individual JB surface thermocouples should be averaged together. For JBs that have more that one thermocouple on each JB surface, the thermocouples on the individual JB surfaces should be averaged together.

Airdrops - The thermocouples placed on the copper conductor within the airdrop fire barrier should be averaged together.

The average of any thermocouple group should not exceed 139 °C [250 °F] above the unexposed side temperature within the fire barrier test specimen at the onset of the fire endurance test. In addition, the temperature of each individual thermocouple will be evaluated. Individual thermocouple conditions should not exceed the 139 °C [250 °F] temperature rise by more than 30 percent.

If a fire barrier test specimen without cables does not meet the average or maximum single point temperature criteria, then the internal raceway temperature profile as measured by the instrumented bare copper conductors during the fire exposure can be used to assess cable functionality through air oven tests of plant specific cable types and construction.

VI. HOSE STREAM TESTS

NFPA 251 and ASTM E-119 allow flexibility in hose stream testing. The standards allow the hose stream test to be performed on a duplicate test specimen subjected to a fire endurance test for a period equal to one-half of that indicated as the fire resistance rating, but not for more than 1 hour (e.g., 30 minute fire exposure to qualify a 1-hour fire rated barrier).

For safe shutdown related fire barrier systems referenced in Section IV and duplicate electrical cable tray or raceway and component fire barrier test specimens that have been exposed to the ½-duration test fire exposure, the staff finds the hose stream application specified by the NFPA 251 acceptable. NFPA 251 requires the stream of water to be delivered through a 6.4 cm [2½-inch] hose discharging through a standard 2.9 cm [1⅛-inch] playpipe nozzle onto the test specimen after the fire exposure test. The stream is applied with the nozzle orifice positioned 6.1 meters [20 feet] away from the center of the test specimen at a pressure of 207 kPa [30 psi]. The application of the stream is to all exposed parts of the specimen for a minimum duration of 1 minute for a 1-hour barrier and 2½ minutes for a 3-hour barrier.

As an alternate for electrical raceway fire barrier test specimens, the application of the hose stream test can be performed immediately after the completion of the full fire endurance test period. If this method is used to satisfy the hose stream test criteria, the following hose stream applications are acceptable:

- The stream applied at random to all exposed surfaces of the test specimen through a 6.4 cm [2½-inch] national standard playpipe with a 2.9 cm [1⅛-inch] orifice at a pressure of 207 kPa [30 psi] at a distance of 6.1 meters [20 feet] from the specimen. (Duration of the hose stream application - 1 minute for a 1-hour barrier and 2½ minutes for a 3-hour barrier); or

- The stream applied at random to all exposed surfaces of the test specimen through a 3.8 cm [1½-inch] fog nozzle set at a discharge angle of 30 degrees with a nozzle pressure of 517 kPa [75 psi] and a minimum discharge of 284 lpm [75 gpm] with the tip of the nozzle at a maximum of 1.5 meters [5 feet] from the test specimen. (Duration of the hose stream application - 5 minutes for both 1-hour and 3-hour barriers); or

- The stream applied at random to all exposed surfaces of the test specimen through 3.8 cm [1½-inch] fog nozzle set at a discharge angle of 15 degrees with a nozzle pressure of 517 kPa [75 psi] and

a minimum discharge of 284 lpm [75 gpm] with the tip of the nozzle at a maximum of 3 meters [10 feet] from the test specimen. (Duration of the hose stream application - 5 minutes for both 1-hour and 3-hour barriers.)

VII. FIRE BARRIER COMBUSTIBILITY

The NRC's fire protection guidelines and requirements establish the need for each nuclear power plant to perform a plant-specific fire hazard analysis. The fire hazard analysis should consider the potential for in-situ and transient fire hazards and combustibles. With respect to building materials (e.g., cable insulation and jackets, plastics, thermal insulation, fire barrier materials), the combustibility, ease of ignition, and flame spread over the surface of a material should be considered by the fire hazards analysis. One method of determining combustibility is by subjecting a sample of the fire barrier material to a small scale vertical tube furnace as described by ASTM E-136. The flashover ignition temperature of the material (as determined by ASTM D-1929) and the flame spread characteristics of the material (as determined by ASTM E-84) should also be evaluated. The potential heat release of the material (as determined by ASTM D-3286 or NFPA 259), should also be factored into the fire hazards analysis.

Fire barrier materials used as radiant energy heat shields inside containment and used to achieve a combustible free zone are required to be noncombustible as defined in Section III.

VIII. REFERENCES

U.S. Nuclear Regulatory Commission

May 1, 1976 Branch Technical Position (APCSB) 9.5-1, "Fire Protection Program."

February 24, 1977 Appendix A to the Branch Technical Position APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976."

February 19, 1981 10 CFR 50.48, "Fire protection."

February 19, 1981 Appendix R to 10 CFR Part 50, "Fire Protection for Nuclear Power Plants."

February 20, 1981 Generic Letter 81-12, "Staff Position - Safe Shutdown Capability."

July 1981 NUREG - 0800, Standard Review Plan, 9.5.1, "Fire Protection for Nuclear Power Plants."

October 19, 1983 Generic Letter 83-33, "NRC Positions on Certain Requirements of Appendix R to 10 CFR 50."

April 24, 1986 Generic Letter 86-10, "Implementation of Fire Protection Requirements."

American Society for Testing and Materials

ASTM E-84, "Surface Burning Characteristics of Building Materials."

ASTM E-119, "Fire Test of Building Construction and Materials."

ASTM E-136, "Behavior of Materials in a Vertical Tube Furnace at 750°C."

ASTM D-1929, "Test Method for Ignition Properties of Plastics."

ASTM D-3286, "Test Method for Gross Calorific Value of Solid Fuel by the Isothermal-Jacket Bomb Calorimeter."

American Nuclear Insurers (ANI)

July 1979, ANI Information Bulletin No. 5 (79) test criteria for "Fire Endurance Protective Envelope Systems for Class 1E Electrical Circuits."

National Fire Protection Association (NFPA)

NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials."

NFPA 259, "Standard Test Method for Potential Heat of Building Materials."

ACCEPTABLE METHODS FOR DEMONSTRATING FUNCTIONALITY OF CABLES PROTECTED BY RACEWAY FIRE BARRIER SYSTEMS DURING AND AFTER FIRE ENDURANCE TEST EXPOSURE

I. INTRODUCTION

The NRC considers fire barrier systems that meet the acceptance criteria adequate under NRC fire protection regulations. The licensee, where the criteria are not met, should submit an engineering analysis to the staff that clearly demonstrates the functionality of the protected cables. This engineering analysis should consider the cable insulation type, actual voltage and current conditions, cable function, and thermal affects on the cable and its ability to function. This evaluation should also consider cable operating temperatures within the fire barrier at the onset of the fire exposure.

II. CABLE CIRCUIT INTEGRITY TESTS

In 1979, American Nuclear Insurers (ANI) issued a fire endurance test method for raceway fire barrier systems for insurance purposes. This method, "Fire Endurance Protective Envelope Systems for Class 1E Electrical Circuits," specified a circuit integrity test. The intent of this test was to identify the onset of fire damage to the cables within the raceway fire barrier test specimen during the fire endurance test period. The circuit integrity test voltage is 8 to 10 volts DC; therefore the loss of circuit integrity under these voltage conditions may occur only as a result of a dead short or open circuit.

During fire tests of raceway fire barrier systems, thermal damage to the cables has been observed. This thermal damage has led to cable jacket and insulation degradation without the loss of circuit integrity as monitored using ANI criteria. Since cable voltages used for ANI circuit integrity tests do not replicate cable operating voltages, loss of cable insulation conditions can exist during the fire test without a dead short occurring. It is expected that if the cables were at rated power and current, a fault would propagate. The use of circuit integrity monitoring during the fire endurance test is not a valid method for demonstrating that the protected shutdown circuits are capable of performing their required function during and after the test fire exposure. Therefore, circuit integrity monitoring is not required to satisfy NRC acceptance criteria for fire barrier qualification.

III. EQUIPMENT QUALIFICATION

Comparison of the fire barrier internal time-temperature profile measured during the fire endurance test to existing cable performance data, such as data from environmental qualification (EQ) tests, could be proposed to the staff as a method for demonstrating cable functionality. EQ testing is typically performed to rigorous conditions, including rated voltage and current. By correlating the EQ test time-temperature profile to the fire test time-temperature profile, the EQ test data would provide a viable mechanism to ensure cable functionality. A large body of EQ test data for many cable types

exists today. The use of EQ data represents a cost-effective approach for addressing cable functionality for fire tests for those cases where the 163 °C [325 °F] limit is exceeded.

The staff agrees that a comparison of fire test temperature profiles to existing EQ and Loss of Cooling Accident (LOCA) test results or air oven test results is an acceptable approach to demonstrate cable functionality provided the subject analysis incorporates the anticipated temperature rise due to self heating effects of installed power cables with the fire test results.

IV. CABLE INSULATION TESTS

The two principal materials used as cable insulation and cable jackets by the nuclear industry are thermoplastics and thermosetting polymeric materials. A thermoplastic material can be softened and resoftened by heating and reheating. Conversely, thermosetting cable insulation materials cure by chemical reaction and do not soften when heated. Under excessive heating thermosetting insulation becomes stiff and brittle. Electrical faults may be caused by softening and flowing of thermoplastic insulating materials at temperatures as low as 149 °C [300 °F]. Thermosetting electrical conductor insulation materials usually retain their electrical properties under short-term exposures to temperatures as high as 260 °C [500 °F]. Insulation resistance (Megger) tests provide indications of the condition of the cable insulation resistance, whereas the high potential (Hi-Pot) test provides assurance that the cable has sufficient dielectric strength to withstand the applied rated voltage. A cable insulation failure usually results from two breakdown modes: one failure mode is excessive dielectric loss which is due to low insulation resistance, and the other failure mode is overpotential stress which is due to loss of dielectric strength of the insulation material.

If Megger tests are not performed at frequent intervals during the fire exposure, indications of insulation damage in insulation may go undetected. When removed from elevated temperatures, insulation will reset. Megger tests of insulated cables after the fire endurance test and after the cable has sufficiently cooled may not detect degradation in the insulation resistance. Therefore, wet or dry Megger of cables after a fire exposure does not provide reasonable assurance that the cables would have functioned as intended during the fire exposure.

To provide reasonable assurance that the cables would have functioned during and after the fire exposure, Megger tests need to be performed before the fire test, at multiple time intervals during the fire exposure (i.e, every 20 minutes during the 1-hour fire test and every hour during the 3-hour fire test) for instrumentation cables only, and immediately after the fire endurance test to assess the cable insulation resistance levels. This testing will assure that the cables will maintain the insulation resistance levels necessary for proper operation of instruments.

The Megger tests (pre-fire, during the fire [if performed], and immediately after the fire test conditions) should be done conductor-to-conductor for multi-conductor and conductor-to-ground for all cables. The minimum

acceptable insulation resistance (IR) value, using the test voltage values as shown in the table below, is determined by using the following expression:

$$IR\ (\text{Mega-ohms}) \geq \frac{\{[K+1\ \text{Mega-ohm}\ ] * 1000\ (\text{ft})\ \}}{\text{Length (ft)}}$$

Where K = 1 Mega-ohm/KV * Operating Voltage (expressed in KV)

In addition, to determine the insulation resistance levels required for nuclear instrumentation cables, an assessment of the minimum insulation resistance value (e.g., one mega-ohm) and its potential impact on the functionality of these cables should be evaluated. An ac or dc high potential (Hi-Pot) test for power cables greater than 1000 volts (V) should also be performed after the post-fire Megger tests to assess the dielectric strength. This test provides assurance that the cable will withstand the applied voltage during and after a fire. The high potential test should be performed for a 5 minute duration at 60 percent of either 80 V/mil ac or 240 V/mil dc (e.g., 125 mil conductor insulation thickness x 240 V/mil dc x 0.6 = 18,000 V dc).

The table below summarizes the Megger and Hi-Pot test voltages[10] which, when applied to power, control and instrumentation cables, would constitute an acceptable cable functionality test.

TYPE	OPERATING VOLTAGE	MEGGER TEST VOLTAGE	HIGH POTENTIAL TEST VOLTAGE
Power	≥ 1000 V ac	2500 V dc	60% x 80 V/mil (ac) 60% x 240 V/mil (dc)
Power	< 1000 V ac	1500 V dc*	None
Instrument and Control	≤ 250 V dc ≤ 120 V ac	500 V dc	None

* A Megger test voltage of 1000 V dc is acceptable provided a Hi-Pot test is performed after the Megger test for power cables rated at less than 1000 V ac.

The electrical cable functionality tests recommended above are one acceptable method. Alternate methods to assess degradation of cable functionality will be evaluated by the staff for acceptability on a case-by-case basis. The above table summarizing the Megger and Hi-Pot test voltages are "typical" and the applicant can follow the applicable industry standards and manufacturer's recommendations for the specific cable application in the performance of the insulation resistance and Hi-Pot tests.

---

[10] The review guidance for Megger and Hi-Pot test voltages was derived from IEEE 383-1974, IEEE 422-1986 and IEEE 690-1984.

V. AIR OVEN TESTS

Air oven tests can be used to evaluate the functionality of cables for those cable tray or raceway fire barrier test specimens tested without cables. This testing method consists of exposing insulated wires and cables at rated voltage to elevated temperatures in a circulating air oven. The temperature profile for regulating the temperature in the air oven during this test is the temperature measured by the AWG 8 bare copper conductor during the fire exposure of those cable tray or raceway test specimen which were tested without cables.

The staff finds the test method described by UL Subject 1724, "Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems", Issue Number 2, August 1991, Appendix B, "Qualification Test for Circuit Integrity of Insulated Electrical Wires and Cables in Electrical Circuit Protection Systems", with the following modifications, acceptable:

1. During the air oven test the cables are to be energized at rated voltage. The cables are to be monitored for conductor-to-conductor faults in multi-conductor cables and conductor-to-ground faults in all conductors.

2. The cables being evaluated should be subjected to the Megger and high potential tests, recommended above in Section IV, "Cable Insulation Tests."

3. The impact force test, which simulates the force of impact imposed on the raceway by the solid stream test, described in UL 1724, Appendix B, paragraph B3.16, is not required to be performed.

VI. CABLE THERMAL EXPOSURE THRESHOLD

The following analysis, which is based on determining whether a specific insulation material will maintain electrical integrity and operability within a raceway fire barrier system during and after an external fire exposure, is an acceptable method for evaluating cable functionality. In order to determine cable functionality, it is necessary to consider the operating cable temperatures within the fire barrier system at the onset of the fire exposure and the thermal exposure threshold (TET) temperature of the cable. For example, if the TET of a specific thermoplastic cable insulation (Brand X) is 149 °C [300 °F] and the normal operating temperature within the fire barrier system is 66 °C [150 °F], then the maximum temperature rise within the fire barrier system should not exceed 83 °C [150 °F] during exposure to an external fire of a duration equal to the required fire resistance rating of the barrier. For this example the TET limit for Brand X cable is 83 °C [150 °F] above the cable operating temperatures within the fire barrier system at the onset of the external fire exposure. The cable TET limits in conjunction with a post test visual cable inspection and the Hi-Pot test described above should readily demonstrate the functionality of the cable circuit during and after a fire.

The normal cable operating temperature can be determined by loading cable specimens installed within a thermal barrier system in the test configuration with rated voltage and current. The TET temperature limits for most cable insulation may be obtained from the manufacturer's published data which is given as the short-circuit rating limit. With the known TET and normal operating temperature for each thermal barrier system configuration, the maximum temperature rise limit within a fire barrier system may then be determined.

COMPARISON OF FIRE ENDURANCE TEST CRITERIA
FOR FIRE BARRIER SYSTEMS USED TO SEPARATE
SAFE SHUTDOWN FUNCTIONS WITHIN THE SAME FIRE AREA

GL 86-10, SUPP. 1	GL 86-10	RATIONALE FOR CLARIFICATION
Temperature, as measured on the external surface of the Raceway, should not exceed 163 °C [325 °F] (Note 1). This temperature is determined by averaging temperature readings of similar series of thermocouple (e.g., cable tray side rail) (Note 2).	Temperature, as measured on the unexposed side of the fire barrier material, should not exceed 163 °C [325 °F].	Temperature - Difficult to measure a uniform temperature on the fire barrier material surface. Raceway temps provide good indication of internal temp-rise and potential barrier failure locations during the test.
Barrier Condition - Fire barrier should remain intact. No visible signs of component, raceway or cables after fire and hose stream test.	Barrier Condition - The barrier should have withstood the fire and hose stream test without the passage of flame or hot gasses hot enough to ignite cotton waste.	Barrier Condition - Cotton waste has not been used in raceway fire barrier testing as an indicator of barrier failure. Visual inspection process provides a better indication of barrier condition after the fire and hose stream test.
Hose Stream Test - solid stream test as specified in NFPA 251 on second test specimen after being subjected to a fire exposure of 1/2 duration (Note 4) or a fog stream after the full fire exposure.	Hose Stream Test - solid stream test as specified in NFPA 251.	Hose Stream Test - To reflect alternative methods found acceptable (Note 3). The use of a fog nozzle for the hose stream at the end of a full duration of the fire test provides a good method for testing erosion and cooling effects.

GL 86-10, SUPP. 1	GL 86-10	RATIONALE FOR CLARIFICATION
Cable condition - When cables are included in the test specimen, post-fire condition must be visually inspected. Cables should show no signs of degraded conditions resulting from the thermal affects of the fire exposure.	Cable condition - No consideration given to determining the material condition of the cable.	Cable condition - The objective of these fire barriers is to assure that thermal damage to protected safe shutdown cables or components does not occur.

GUIDANCE FOR ENGINEERING EVALUATIONS JUSTIFYING DEVIATIONS FROM THE FIRE BARRIER ACCEPTANCE CRITERIA

Functionality should be demonstrated if any of the preceding criteria are exceeded (Note 5). ethods when cables are excluded from test specimen: Comparison of internal temp. profiles to EQ and LOCA test data. Air oven test of cables at rated voltage with Megger and Hi-Pot tests (Note 6) Method when cables are in test specimen include megger and Hi-Pot testing (Note 7) Demonstration of functionality should also consider operating temperature of the cables inside the fire arrier at the onset of he fire exposure.	Functionality - No guidance provided. Up to licensees to demonstrate by engineering analysis. Analysis kept on file for NRC review. Engineering analysis generally based on internal temperature below the ignition temperature. No consideration given cable operating temperatures within the barrier at the onset of the fire exposure.	Functionality is considered to be a deviation from the acceptance criteria and must be justified on a case-by-case basis which includes an assessment of cable jacket material.

Note 1: The 163 °C [325 °F] temperature condition was established by allowing the internal temperature on the raceway surface to rise a maximum of 139 °C [250 °F] above the initial temperature of the test specimen (assumed to be 24 °C [75 °F]).

Note 2: NFPA 251/ASTM-E119 allows the temperature condition to be determined by averaging the thermocouple readings. The conditions of acceptance are also placed on the temperature conditions measured by a single thermocouple. Under these conditions of acceptance, if any single thermocouple exceeds 30 percent above the maximum allowable temperature rise (i.e., max. allowable 139 °C + 42 °C = 181 °C [250 °F + 75 °F = 325 °F]) the test is considered to have exceeded the criteria temperature limit.

Note 3: SRP 9.5.1 recognizes the use of a fog stream as an alternative hose stream testing method for qualifying fire barrier penetration seals.

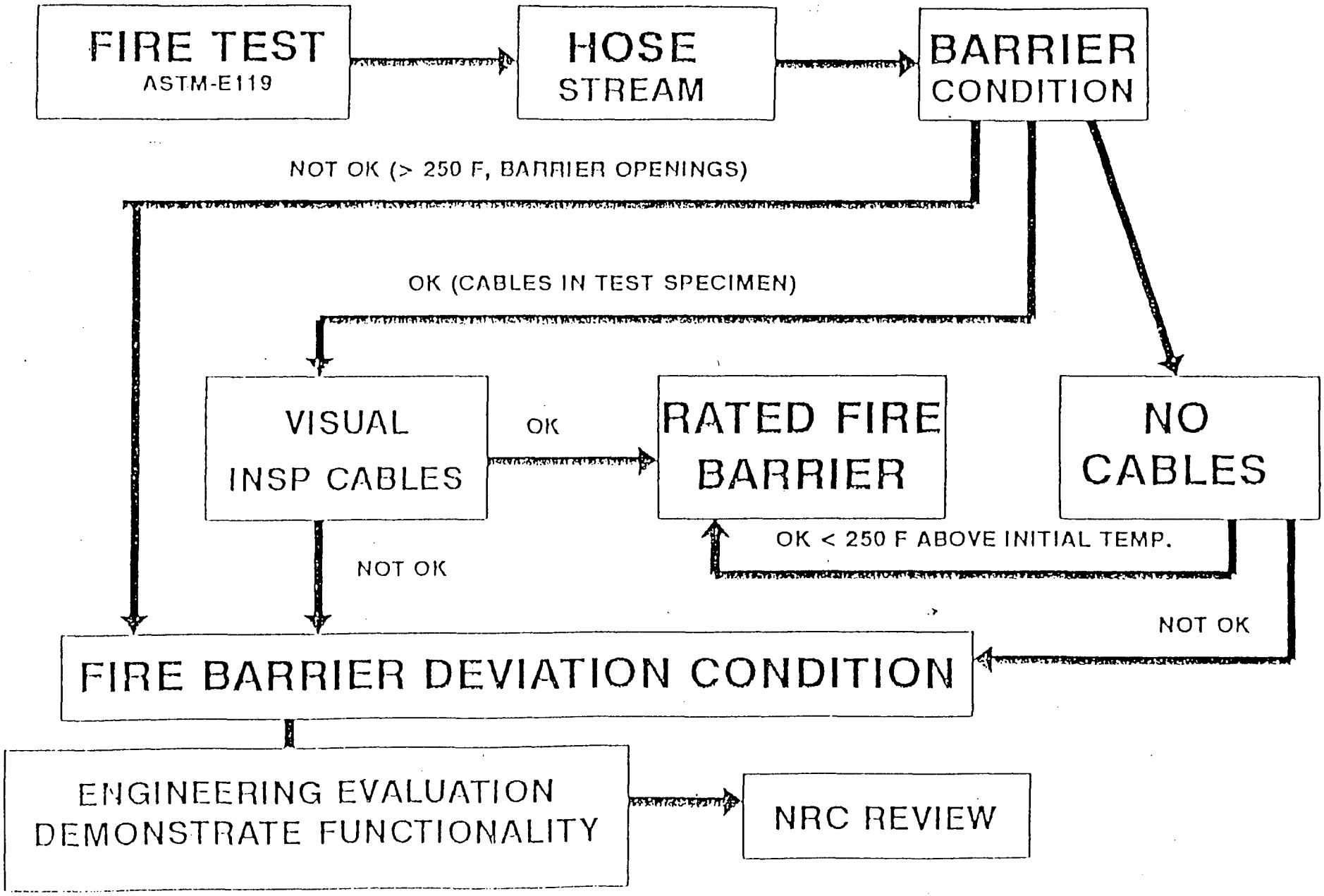
Note 4: This hose stream test method provides assurance that the cable tray or raceway fire barrier system has sufficient structural integrity to resist minor fire related barrier breaches caused by falling objects.

Note 5: A fire barrier system that does not meet the acceptance criteria is not considered a rated fire barrier. For those conditions (e.g., high raceway temperature, barrier openings, water projection, cable damage) which deviate from the acceptance criteria, an engineering analysis which clearly demonstrates the functionality of the protected components or cables should be submitted to the staff for review. The purpose of the recommended functionality tests is to justify observed deviations in fire barrier performance. Engineering analyses justifying these deviations should not rely substantially upon the equipment (e.g., cable) qualification as the basis for acceptance. Deviations will be evaluated by the staff on a case-by-case basis.

Note 6: For fire barrier systems tested without cables, plant-specific cable types should be subjected to air oven tests when the fire barrier temperature rise criteria are exceeded. These cables will be exposed to a temperature profile as determined by the internal raceway thermocouples during the fire test. Cables will be tested at rated voltage. Megger and Hi-Pot testing should be performed in a consistent manner to those tests performed for cables included in a fire barrier test specimen and subjected to the fire endurance test.

Note 7: Megger tests of cables included in the fire test specimen should be performed before, during (instrumentation cables only) and immediately after the fire exposure and subjecting power cables which have voltage ratings $\geq$ 1000 volts ac to a Hi-Pot test (60 percent) immediately after the fire exposure.

LOGIC DIAGRAM



TVA Position on Fire Testing Criteria

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT

POSITION ON FIRE TESTING CRITERIA FOR FIRE BARRIER SYSTEMS USED TO PROTECT ELECTRICAL CABLING REQUIRED FOR 10 CFR 50 APPENDIX R COMPLIANCE

Background

There is considerable discussion between the NRC, nuclear utilities and manufacturers of fire barrier systems on the appropriate test method and acceptance criteria for electrical fire barrier systems. The NRC has based its methodology and criteria on National Fire Protection Association (NFPA) 251, "Standard Method of Fire Tests of Building Construction and Materials," Chapter 7, "Tests of Nonbearing Walls and Partitions."[1] Thermal Science, Inc. (TSI), the manufacturer of Thermo-Lag, and most nuclear utilities, have based their methodology and criteria on American Nuclear Insurers (ANI) "Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class 1E Electrical Circuits."[2] Other manufacturers of fire barrier systems, such as 3M and Thermal Ceramics, Inc., have typically used Underwriters Laboratory (UL) test methods and acceptance criteria such as "UL Subject 1724, "Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems."[3] The American Society for Testing and Materials (ASTM) has recognized the need to develop a unique test method and acceptance criteria for electrical fire barrier systems. They have been working for approximately the last five years on this issue but have not issued a standard.

Discussion

The Code of Federal Regulations (CFR), Title 10 Part 50 Domestic Licensing of Production and Utilization Facilities, Appendix R, Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979, paragraph III.G.2 provides the requirements for fire protection and safe shutdown capability. If redundant trains are located in the same fire area and a licensee does not provide alternative or dedicated shutdown systems for the redundant equipment in that fire area, the three acceptable methods of ensuring that one of the trains is free from fire damage are:

a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;

b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

c. Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area.[4]

A fire wall design that has passed on appropriate test method (e.g., NFPA 251) is considered a "rated" barrier. Components which penetrate fire walls, such as mechanical and electrical penetrations, fire doors, and HVAC fire dampers, are "rated" under their own unique test method and acceptance criteria. There is presently no generally accepted test method and acceptance criteria specifically applicable to fire barrier enclosures applied to electrical cable systems. Existing methods intended for other purposes have been utilized to test such barrier systems, but none of these standards are fully appropriate to this unique application of fire barrier materials. In an attempt to define a test method for electrical circuit protection, American Nuclear Insurers (ANI) prepared "Guidelines for Fire Stop and Wrap Systems at Nuclear Facilities". However, this test method was intended to be used "for insurance purposes only".[2] The method and acceptance criteria in the ANI document are not definitive.

Position

The fire testing methodology and acceptance criteria for electrical cable systems should be unique to these systems. Underwriters Laboratory currently has an appropriate test method (Subject 1724), which addresses the uniqueness of electrical cable fire barrier systems. This test method was developed by UL specifically to address issues such as Appendix R electrical fire barrier rating requirements. The scope of the test method is:

- Measurement of temperature changes within the electrical circuit protective system caused by the heat transfer through the electrical circuit protective system to the electrical conductor or raceway, or both, during the external fire exposure test.

- Determination of the integrity of the electrical circuit protective system during the external fire exposure and water hose stream test.

- Determination of the ability of insulated electrical conductors to maintain electrical circuit integrity at the temperature conditions present within the electrical circuit protective system during the external fire exposure test and during the water hose stream test.[3]

Details such as thermocouple types and placements are discussed in this test method. The test follows the standard time-temperature curve specified in ASTM E-119, as used in other fire endurance tests (e.g., NFPA 251). The test allows the use of the actual installed cables or a No. 8 AWG (3.38mm^2) bare copper conductor to simulate the electrical circuits. With the bare conductor method the thermocouple measurements can be correlated to actual cable qualification tests as described in Appendix B of UL Subject 1724.

TVA considers that UL Subject 1724 is the most appropriate test method currently

available for determining the fire resistance rating of electrical fire barrier systems. TVA will use UL Subject 1724 with the following clarifications to perform tests of Thermo-lag 330 electrical circuit protective systems intended for use at Watts Bar:

(1) The exterior surface temperature of the electrical raceway will be recorded (cold side of the barrier). If the average temperature recorded by the exterior thermocouples is less than 250°F (121°C) above their initial temperature and no individual thermocouple is in excess of 325°F (163°C) above its initial temperature, the fire barrier will be considered acceptable for use with any type cable.[5]

(2) Section 6, Internal Fire Exposure Test, will not be used. TVA considers that this portion of the testing is not necessary, since an internally generated cable tray fire would be extremely unlikely. Circuits are protected with a fuse or breaker that will actuate prior to the jacket of a faulted cable reaching its auto-ignition temperature (for existing designs) or reaching its insulation damage temperature (for new designs) for all credible low impedance and bolted faults.[6] No other ignition sources exist within the protective barrier.

(3) Section 5, Hose Stream Test. TVA will follow the criteria for hose stream testing described in NUREG-0800 using one and one-half inch fog nozzle set at a discharge angle of 15° with a nozzle pressure of 75 psig and a minimum discharge of 75 gpm.[7] TVA considers that this would accurately represent the mechanical impact, erosion and cooling effects that would exist in TVA's nuclear power plant environment. The hose stream test shall be performed within ten minutes of the completion of the fire test. The duration and application will follow the requirements of UL 1724 Table 5.1. The nozzle will be located a maximum of ten feet measured horizontally from the outside edge of the testing assembly. Acceptance shall be based on the fire barrier system remaining intact with minimal material flaking. (The alternative test called for by the UL document, involving a one and one-eighth inch solid bore National Standard Playpipe operating at 30 psig, is not a realistic simulation of the challenge to barrier systems as installed in a nuclear power plant).

REFERENCES

(1) National Fire Protection Association (NFPA) 251, "Standard Method of Fire Tests of Building Construction and Materials", 1990 Edition.

Note: For the purposes of this paper NFPA 251 (90) is considered equivalent to ASTM E119-88 "Standard Test Method for Fire Tests of Building Construction and Materials".

(2) American Nuclear Insurers/Mutual Atomic Energy Reinsurance Pool (ANI/MAERP) RA "Guidelines for Fire Stop and Wrap Systems at Nuclear Facilities" Revision 0, November 1987.

(3) Underwriters Laboratories, Inc. (UL) Subject 1724, "Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems", Issue Number: 2, August 1991.

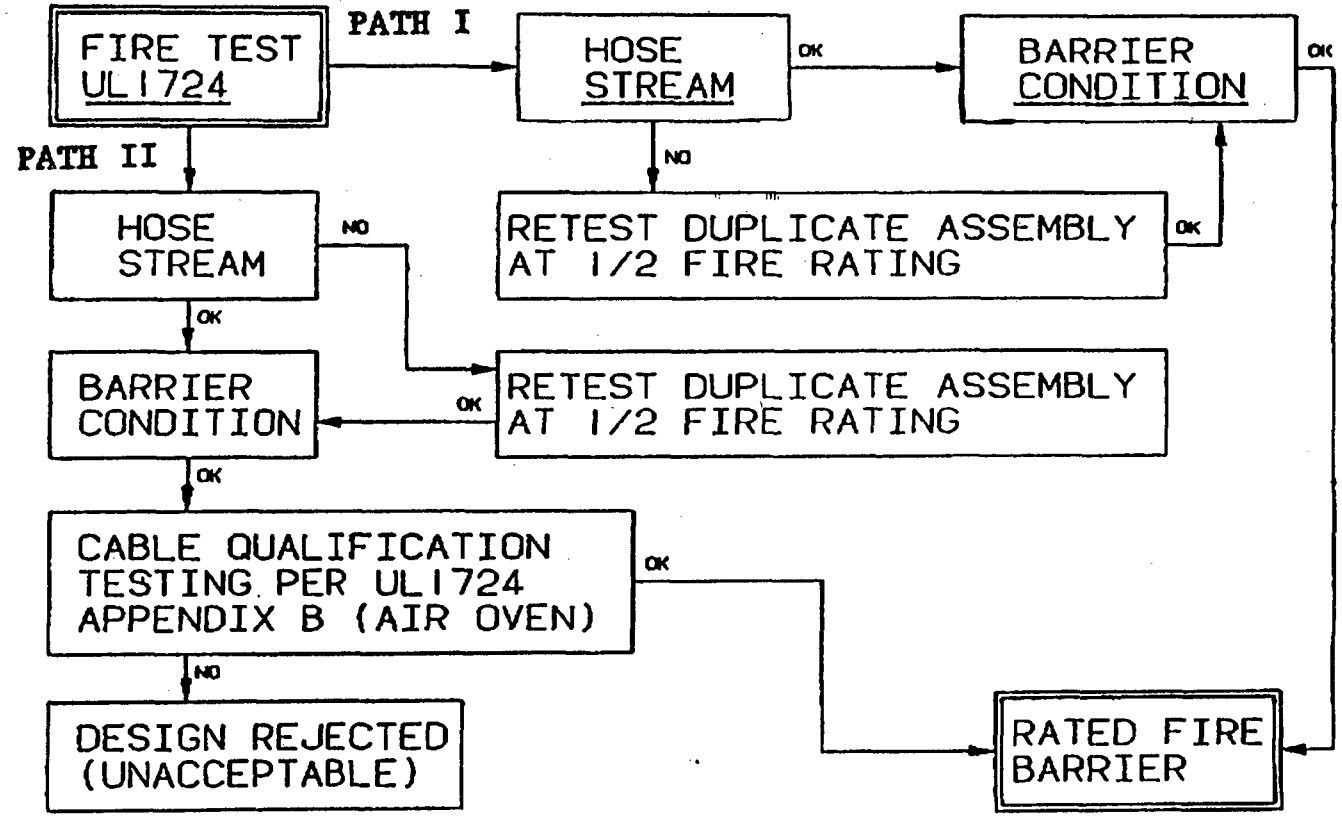
(4) Code of Federal Regulations, Title 10, Part 50, Energy, January 1, 1992.

(5) Based on a NFPA 251 (90) acceptance criteria for Nonbearing Walls and Partitions.

(6) Tennessee Valley Authority (TVA), "Watts Bar Design Criteria - WB-DC-30-13, 10 CFR 50 Appendix R Type I, II, and III Circuits". Revision 2, February 13, 1990.

(7) U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Standard Review Plan, NUREG 0800, Rev. 2, July 1981, Section 9.5.1 Fire Protection Program, page 9.5.1-29.

TVA-WBN FIRE BARRIER TESTING ACCEPTANCE CRITERIA

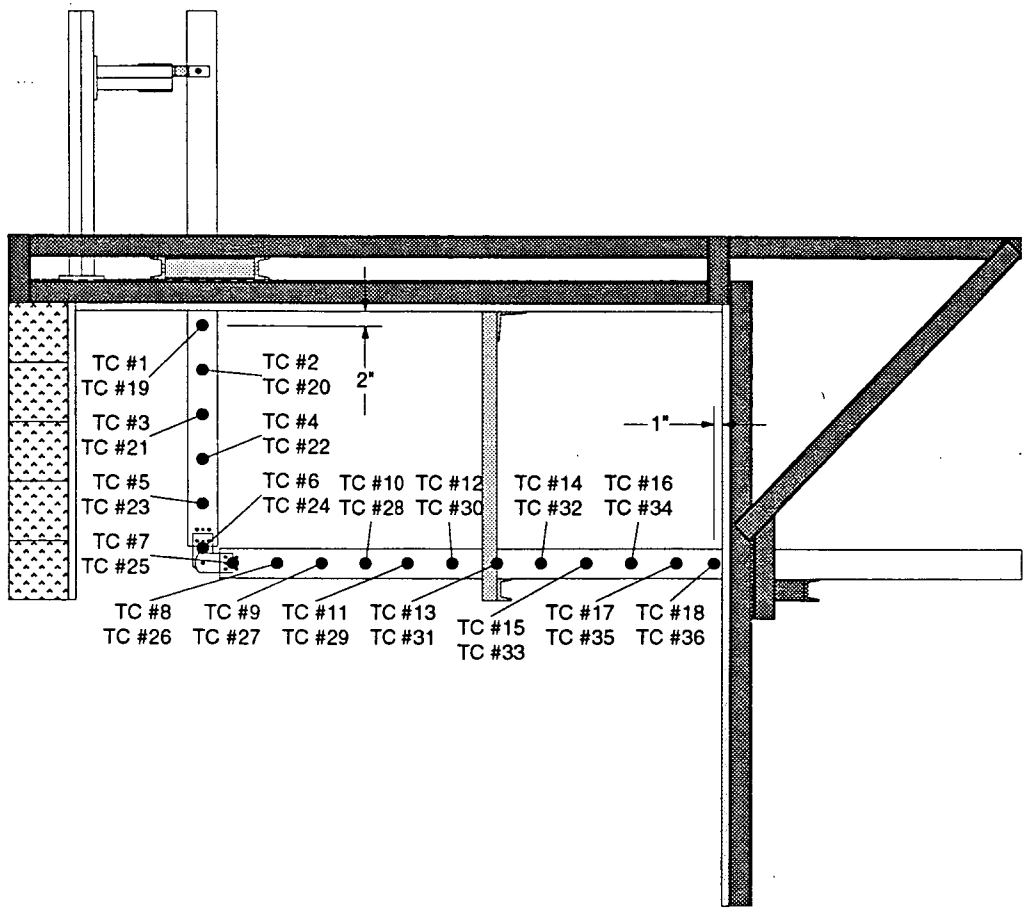


PATH I - RACEWAY $\Delta T_{avg.} \leq$ 250°F AND $\Delta T_{max.} \leq$ 325°F

PATH II - RACEWAY $\Delta T_{avg.} \geq$ 250°F OR $\Delta T_{max.} \geq$ 325°F

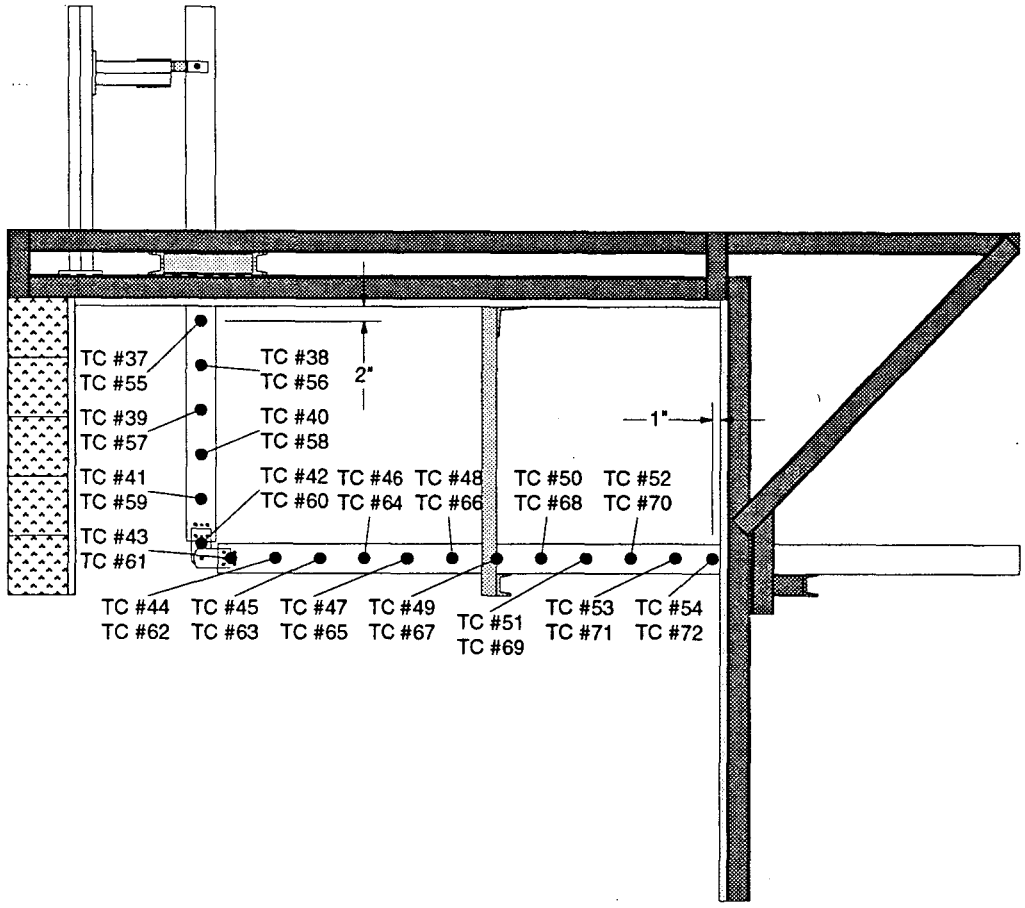
Appendix C

THERMOCOUPLE LOCATIONS



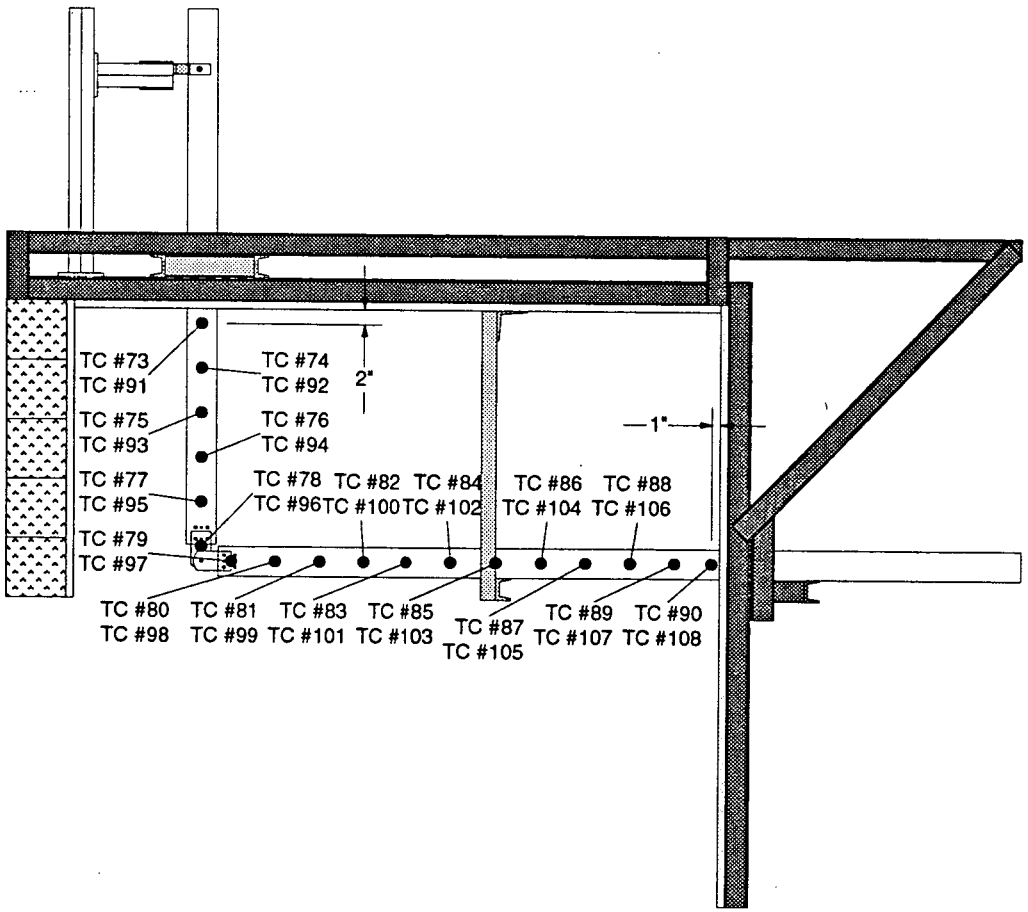
NOTE:
Top set of numbers indicates thermocouple channel numbers for the left cable tray side rail. The bottom set of numbers indicates thermocouple channel numbers from the right cable tray side rail. All thermocouples were spaced 6" o.c. and were held in place by clamping the thermojunction under the head of a small screw tapped into the tray side rails.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 7 Thermocouple Locations - Test Deck #1, Left Cable Tray, Rev. 0
Drawn by: [illegible] Date: 7/5/94 Appr'd by: C Humphrey Date: 7/5/94



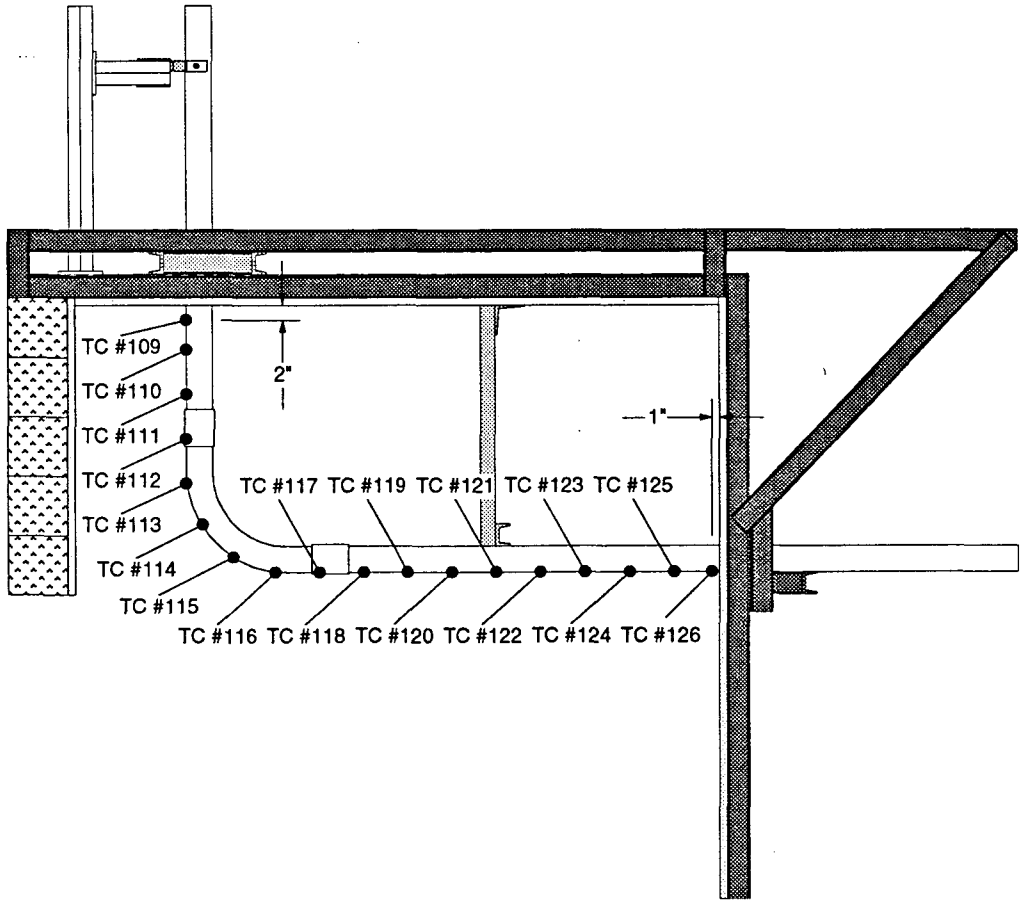
NOTE:
Top set of numbers indicates thermocouple channel numbers for the left cable tray side rail. The bottom set of numbers indicates thermocouple channel numbers from the right cable tray side rail. All thermocouples were spaced 6" o.c. and were held in place by clamping the thermojunction under the head of a small screw tapped into the tray side rails.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 8 Thermocouple Locations - Test Deck #1, Center Cable Tray, Rev. 0
Drawn by: [illegible] Date: 7/5/94 Appr'd by: C Z Humphrey Date: 7/5/94



NOTE:
Top set of numbers indicates thermocouple channel numbers for the left cable tray side rail. The bottom set of numbers indicates thermocouple channel numbers from the right cable tray side rail. All thermocouples were spaced 6" o.c. and were held in place by clamping the thermojunction under the head of a small screw tapped into the tray side rails.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 9 Thermocouple Locations - Test Deck #1, Right Cable Tray, Rev. 0
Drawn by: [illegible] Date: 7/5/94 Appr'd by: C Humphrey Date: 7/5/94



NOTE:

All thermocouples were spaced 6" o.c. and were held in place by clamping the thermojunction under the head of a small screw tapped into the bottom conduit surface.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97185
TVA / TSI
Fig. 10 Thermocouple Locations - Test Deck #1, 3" Conduit, Rev. 0
Drawn by: [illegible] Date: 7/5/94 Appr'd by: C Humphries Date: 7/5/94

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Cable Tray Left Side Rail

Left 18" Cable Tray Assembly

TC Number	Description of exact physical location
E1	On horizontal centerline of the side rail, 2" below deck insulation.
E2	On horizontal centerline of the side rail, 6" below previous thermocouple.
E3	On horizontal centerline of the side rail, 6" below previous thermocouple.
E4	On horizontal centerline of the side rail, 6" below previous thermocouple.
E5	On horizontal centerline of the side rail, 6" below previous thermocouple.
E6	On horizontal centerline of the side rail 90° plate, 6" below previous thermocouple, 2" above pivot bolt.
E7	On vertical centerline of the side rail, 4" from the pivot bolt of the side rail 90° plate.
E8	On vertical centerline of the side rail, 6" from previous thermocouple.
E9	On vertical centerline of the side rail, 6" from previous thermocouple.
E10	On vertical centerline of the side rail, 6" from previous thermocouple.
E11	On vertical centerline of the side rail, 6" from previous thermocouple.
E12	On vertical centerline of the side rail, 6" from previous thermocouple.
E13	On vertical centerline of the side rail, 6" from previous thermocouple.
E14	On vertical centerline of the side rail, 6" from previous thermocouple.
E15	On vertical centerline of the side rail, 6" from previous thermocouple.
E16	On vertical centerline of the side rail, 6" from previous thermocouple.
E17	On vertical centerline of the side rail, 6" from previous thermocouple, 5" from insulated front deck wall.
E18	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Cable Tray Right Side Rail

Left 18" Cable Tray Assembly

TC Number	Description of exact physical location
E19	On horizontal centerline of the side rail, 2" below deck insulation.
E20	On horizontal centerline of the side rail, 6" below previous thermocouple.
E21	On horizontal centerline of the side rail, 6" below previous thermocouple.
E22	On horizontal centerline of the side rail, 6" below previous thermocouple.
E23	On horizontal centerline of the side rail, 6" below previous thermocouple.
E24	On horizontal centerline of the side rail 90° plate, 6" below previous thermocouple, 2" above pivot bolt.
E25	On vertical centerline of the side rail, 4" from the pivot bolt of the side rail 90° plate.
E26	On vertical centerline of the side rail, 6" from previous thermocouple.
E27	On vertical centerline of the side rail, 6" from previous thermocouple.
E28	On vertical centerline of the side rail, 6" from previous thermocouple.
E29	On vertical centerline of the side rail, 6" from previous thermocouple.
E30	On vertical centerline of the side rail, 6" from previous thermocouple.
E31	On vertical centerline of the side rail, 6" from previous thermocouple.
E32	On vertical centerline of the side rail, 6" from previous thermocouple.
E33	On vertical centerline of the side rail, 6" from previous thermocouple.
E34	On vertical centerline of the side rail, 6" from previous thermocouple.
E35	On vertical centerline of the side rail, 6" from previous thermocouple, 5" from insulated front deck wall.
E36	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Cable Tray Left Side Rail

Center 18" Cable Tray Assembly

TC Number	Description of exact physical location
E37	On horizontal centerline of the side rail, 2" below deck insulation.
E38	On horizontal centerline of the side rail, 6" below previous thermocouple.
E39	On horizontal centerline of the side rail, 6" below previous thermocouple.
E40	On horizontal centerline of the side rail, 6" below previous thermocouple.
E41	On horizontal centerline of the side rail, 6" below previous thermocouple.
E42	On horizontal centerline of the side rail 90° plate, 6" below previous thermocouple, 2" above pivot bolt.
E43	On vertical centerline of the side rail, 4" from the pivot bolt of the side rail 90° plate.
E44	On vertical centerline of the side rail, 6" from previous thermocouple.
E45	On vertical centerline of the side rail, 6" from previous thermocouple.
E46	On vertical centerline of the side rail, 6" from previous thermocouple.
E47	On vertical centerline of the side rail, 6" from previous thermocouple.
E48	On vertical centerline of the side rail, 6" from previous thermocouple.
E49	On vertical centerline of the side rail, 6" from previous thermocouple.
E50	On vertical centerline of the side rail, 6" from previous thermocouple.
E51	On vertical centerline of the side rail, 6" from previous thermocouple.
E52	On vertical centerline of the side rail, 6" from previous thermocouple.
E53	On vertical centerline of the side rail, 6" from previous thermocouple, 5" from insulated front deck wall.
E54	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Cable Tray Right Side Rail

Center 18" Cable Tray Assembly

TC Number	Description of exact physical location
E55	On horizontal centerline of the side rail, 2" below deck insulation.
E56	On horizontal centerline of the side rail, 6" below previous thermocouple.
E57	On horizontal centerline of the side rail, 6" below previous thermocouple.
E58	On horizontal centerline of the side rail, 6" below previous thermocouple.
E59	On horizontal centerline of the side rail, 6" below previous thermocouple.
E60	On horizontal centerline of the side rail 90° plate, 6" below previous thermocouple, 2" above pivot bolt.
E61	On vertical centerline of the side rail, 4" from the pivot bolt of the side rail 90° plate.
E62	On vertical centerline of the side rail, 6" from previous thermocouple.
E63	On vertical centerline of the side rail, 6" from previous thermocouple.
E64	On vertical centerline of the side rail, 6" from previous thermocouple.
E65	On vertical centerline of the side rail, 6" from previous thermocouple.
E66	On vertical centerline of the side rail, 6" from previous thermocouple.
E67	On vertical centerline of the side rail, 6" from previous thermocouple.
E68	On vertical centerline of the side rail, 6" from previous thermocouple.
E69	On vertical centerline of the side rail, 6" from previous thermocouple.
E70	On vertical centerline of the side rail, 6" from previous thermocouple.
E71	On vertical centerline of the side rail, 6" from previous thermocouple, 5" from insulated front deck wall.
E72	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Cable Tray Left Side Rail

Right 18" Cable Tray Assembly

TC Number	Description of exact physical location
E73	On horizontal centerline of the side rail, 2" below deck insulation.
E74	On horizontal centerline of the side rail, 6" below previous thermocouple.
E75	On horizontal centerline of the side rail, 6" below previous thermocouple.
E76	On horizontal centerline of the side rail, 6" below previous thermocouple.
E77	On horizontal centerline of the side rail, 6" below previous thermocouple.
E78	On horizontal centerline of the side rail 90° plate, 6" below previous thermocouple, 2" above pivot bolt.
E79	On vertical centerline of the side rail, 4" from the pivot bolt of the side rail 90° plate.
E80	On vertical centerline of the side rail, 6" from previous thermocouple.
E81	On vertical centerline of the side rail, 6" from previous thermocouple.
E82	On vertical centerline of the side rail, 6" from previous thermocouple.
E83	On vertical centerline of the side rail, 6" from previous thermocouple.
E84	On vertical centerline of the side rail, 6" from previous thermocouple.
E85	On vertical centerline of the side rail, 6" from previous thermocouple.
E86	On vertical centerline of the side rail, 6" from previous thermocouple.
E87	On vertical centerline of the side rail, 6" from previous thermocouple.
E88	On vertical centerline of the side rail, 6" from previous thermocouple.
E89	On vertical centerline of the side rail, 6" from previous thermocouple, 5" from insulated front deck wall.
E90	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Cable Tray Right Side Rail

Right 18" Cable Tray Assembly

TC Number	Description of exact physical location
E91	On horizontal centerline of the side rail, 2" below deck insulation.
E92	On horizontal centerline of the side rail, 6" below previous thermocouple.
E93	On horizontal centerline of the side rail, 6" below previous thermocouple.
E94	On horizontal centerline of the side rail, 6" below previous thermocouple.
E95	On horizontal centerline of the side rail, 6" below previous thermocouple.
E96	On horizontal centerline of the side rail 90° plate, 6" below previous thermocouple, 2" above pivot bolt.
E97	On vertical centerline of the side rail, 4" from the pivot bolt of the side rail 90° plate.
E98	On vertical centerline of the side rail, 6" from previous thermocouple.
E99	On vertical centerline of the side rail, 6" from previous thermocouple.
E100	On vertical centerline of the side rail, 6" from previous thermocouple.
E101	On vertical centerline of the side rail, 6" from previous thermocouple.
E102	On vertical centerline of the side rail, 6" from previous thermocouple.
E103	On vertical centerline of the side rail, 6" from previous thermocouple.
E104	On vertical centerline of the side rail, 6" from previous thermocouple.
E105	On vertical centerline of the side rail, 6" from previous thermocouple.
E106	On vertical centerline of the side rail, 6" from previous thermocouple.
E107	On vertical centerline of the side rail, 6" from previous thermocouple, 5" from insulated front deck wall.
E108	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: 3" Conduit Surface

TC Number	Description of exact physical location
E109	Deleted
E110	On outside surface (bottom) of the conduit, 4" below deck insulation.
E111	On outside surface (bottom) of the conduit, 6" below previous thermocouple.
E112	On outside surface (bottom) of the conduit coupling, 6" below previous thermocouple.
E113	On outside surface (bottom) of the conduit elbow, 6" below previous thermocouple.
E114	On outside surface (bottom) of the conduit elbow, 6" below previous thermocouple.
E115	On outside surface (bottom) of the conduit elbow, 6" below previous thermocouple.
E116	On outside surface (bottom) of the conduit elbow, 6" from previous thermocouple.
E117	On outside surface (bottom) of the conduit coupling, 6" from previous thermocouple.
E118	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E119	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E120	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E121	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E122	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E123	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E124	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E125	On outside surface (bottom) of the conduit, 6" from previous thermocouple.
E126	On outside surface (bottom) of the conduit, 4" from previous thermocouple, 1" from insulated front deck wall.

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Bare #8 AWG Copper Wire under Rungs in Left Tray (Max. Fill)

TC Number	Description of exact physical location
C127	On bare #8 wire under tray rungs, 2" below deck insulation.
C128	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C129	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C130	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C131	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C132	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C133	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C134	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C135	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C136	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C137	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C138	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C139	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C140	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C141	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C142	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C143	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C144	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C145	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Bare #8 AWG Copper Wire on Cables in Left Tray (Max. Fill)

TC Number	Description of exact physical location
C146	On bare #8 wire on cables, 2" below deck insulation.
C147	On bare #8 wire on cables, 6" below previous thermocouple.
C148	On bare #8 wire on cables, 6" below previous thermocouple.
C149	On bare #8 wire on cables, 6" below previous thermocouple.
C150	On bare #8 wire on cables, 6" below previous thermocouple.
C151	On bare #8 wire on cables, 6" below previous thermocouple.
C152	On bare #8 wire on cables, 6" below previous thermocouple.
C153	On bare #8 wire on cables, 6" from previous thermocouple.
C154	On bare #8 wire on cables, 6" from previous thermocouple.
C155	On bare #8 wire on cables, 6" from previous thermocouple.
C156	On bare #8 wire on cables, 6" from previous thermocouple.
C157	On bare #8 wire on cables, 6" from previous thermocouple.
C158	On bare #8 wire on cables, 6" from previous thermocouple.
C159	On bare #8 wire on cables, 6" from previous thermocouple.
C160	On bare #8 wire on cables, 6" from previous thermocouple.
C161	On bare #8 wire on cables, 6" from previous thermocouple.
C162	On bare #8 wire on cables, 6" from previous thermocouple.
C163	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Bare #8 AWG Copper Wire under Rungs in Center Tray (Min. Fill)

TC Number	Description of exact physical location
C164	On bare #8 wire under tray rungs, 2" below deck insulation.
C165	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C166	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C167	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C168	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C169	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C170	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C171	On bare #8 wire under tray rungs, 6" below previous thermocouple.
C172	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C173	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C174	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C175	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C176	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C177	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C178	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C179	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C180	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C181	On bare #8 wire under tray rungs, 6" from previous thermocouple.
C182	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Bare #8 AWG Copper Wire on Cables in Center Tray (Min. Fill)

TC Number	Description of exact physical location
C183	On bare #8 wire on cables, 2" below deck insulation.
C184	On bare #8 wire on cables, 6" below previous thermocouple.
C185	On bare #8 wire on cables, 6" below previous thermocouple.
C186	On bare #8 wire on cables, 6" below previous thermocouple.
C187	On bare #8 wire on cables, 6" below previous thermocouple.
C188	On bare #8 wire on cables, 6" below previous thermocouple.
C189	On bare #8 wire on cables, 6" below previous thermocouple.
C190	On bare #8 wire on cables, 6" from previous thermocouple.
C191	On bare #8 wire on cables, 6" from previous thermocouple.
C192	On bare #8 wire on cables, 6" from previous thermocouple.
C193	On bare #8 wire on cables, 6" from previous thermocouple.
C194	On bare #8 wire on cables, 6" from previous thermocouple.
C195	On bare #8 wire on cables, 6" from previous thermocouple.
C196	On bare #8 wire on cables, 6" from previous thermocouple.
C197	On bare #8 wire on cables, 6" from previous thermocouple.
C198	On bare #8 wire on cables, 6" from previous thermocouple.
C199	On bare #8 wire on cables, 6" from previous thermocouple.
C200	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Bare #8 AWG Copper Wire on Rungs in Right Tray (No Fill)

TC Number	Description of exact physical location
C201	On bare #8 wire on rungs, 2" below deck insulation.
C202	On bare #8 wire on rungs, 6" below previous thermocouple.
C203	On bare #8 wire on rungs, 6" below previous thermocouple.
C204	On bare #8 wire on rungs, 6" below previous thermocouple.
C205	On bare #8 wire on rungs, 6" below previous thermocouple.
C206	On bare #8 wire on rungs, 6" below previous thermocouple.
C207	On bare #8 wire on rungs, 6" below previous thermocouple.
C208	On bare #8 wire on rungs, 6" from previous thermocouple.
C209	On bare #8 wire on rungs, 6" from previous thermocouple.
C210	On bare #8 wire on rungs, 6" from previous thermocouple.
C211	On bare #8 wire on rungs, 6" from previous thermocouple.
C212	On bare #8 wire on rungs, 6" from previous thermocouple.
C213	On bare #8 wire on rungs, 6" from previous thermocouple.
C214	On bare #8 wire on rungs, 6" from previous thermocouple.
C215	On bare #8 wire on rungs, 6" from previous thermocouple.
C216	On bare #8 wire on rungs, 6" from previous thermocouple.
C217	On bare #8 wire on rungs, 6" from previous thermocouple.
C218	Deleted

NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97185

NOTE:
This Log is to be used to document the precise location of the thermocouples located on each test item. The back of this sheet may be used for any necessary drawings or schematics.

Project #: 97185

Test Deck #: 1

Item: Bare #8 AWG Copper Wire in 3" Steel Conduit

TC Number	Description of exact physical location
C219	On bare #8 wire in conduit, 2" below deck insulation.
C220	On bare #8 wire in conduit, 6" below previous thermocouple.
C221	On bare #8 wire in conduit, 6" below previous thermocouple.
C222	On bare #8 wire in conduit, 6" below previous thermocouple.
C223	On bare #8 wire in conduit, 6" below previous thermocouple.
C224	On bare #8 wire in conduit, 6" below previous thermocouple.
C225	On bare #8 wire in conduit, 6" below previous thermocouple.
C226	On bare #8 wire in conduit, 6" from previous thermocouple.
C227	On bare #8 wire in conduit, 6" from previous thermocouple.
C228	On bare #8 wire in conduit, 6" from previous thermocouple.
C229	On bare #8 wire in conduit, 6" from previous thermocouple.
C230	On bare #8 wire in conduit, 6" from previous thermocouple.
C231	On bare #8 wire in conduit, 6" from previous thermocouple.
C232	On bare #8 wire in conduit, 6" from previous thermocouple.
C233	On bare #8 wire in conduit, 6" from previous thermocouple.
C234	On bare #8 wire in conduit, 6" from previous thermocouple.
C235	On bare #8 wire in conduit, 6" from previous thermocouple.
C236	On bare #8 wire in conduit, 6" from previous thermocouple.

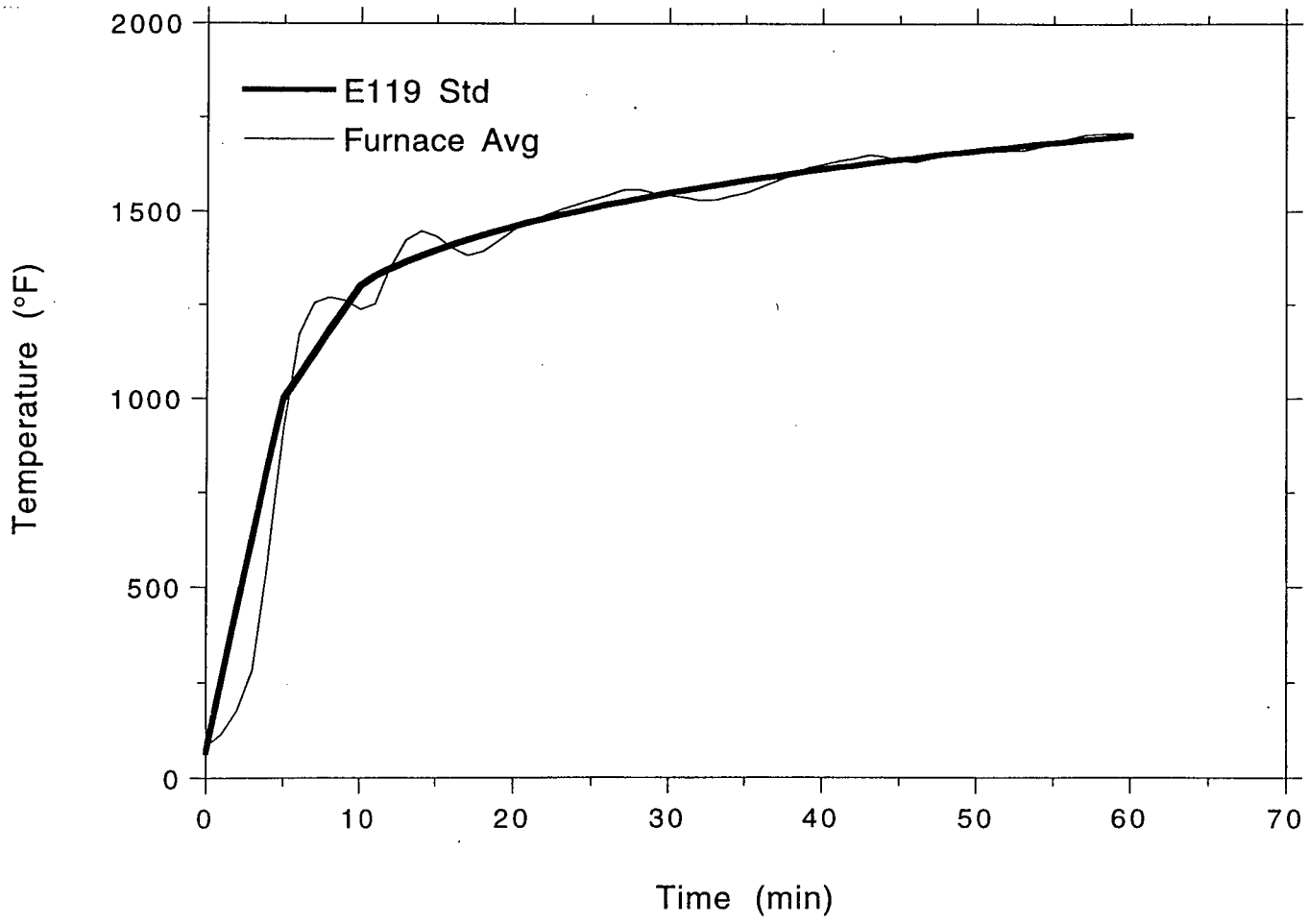
NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

PLEASE USE THE BACK OF THIS SHEET FOR DRAWINGS, IF NECESSARY

Appendix D

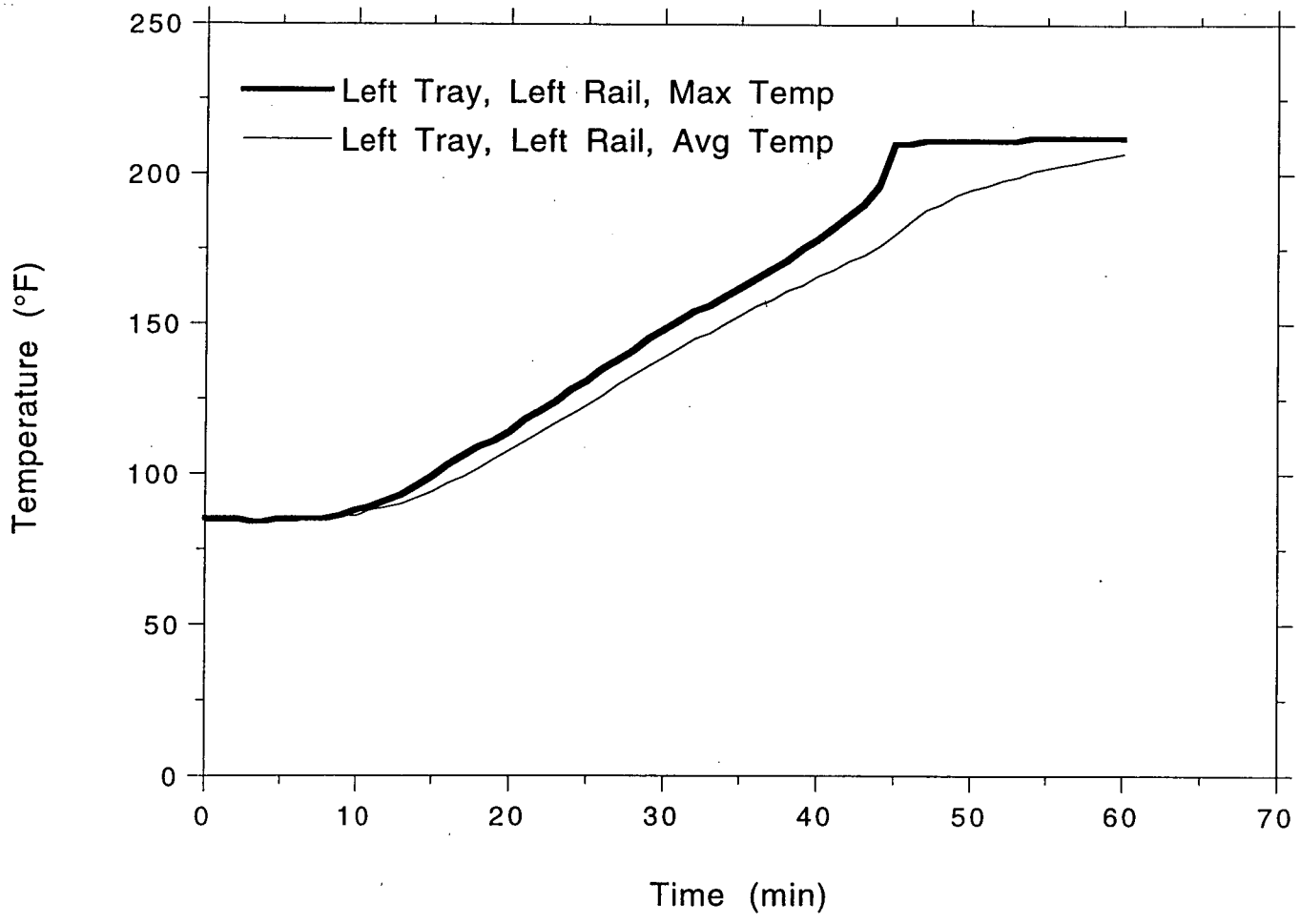
TEST DATA

TSI/TVA
Project No. 11960-97185
Furnace Temperature



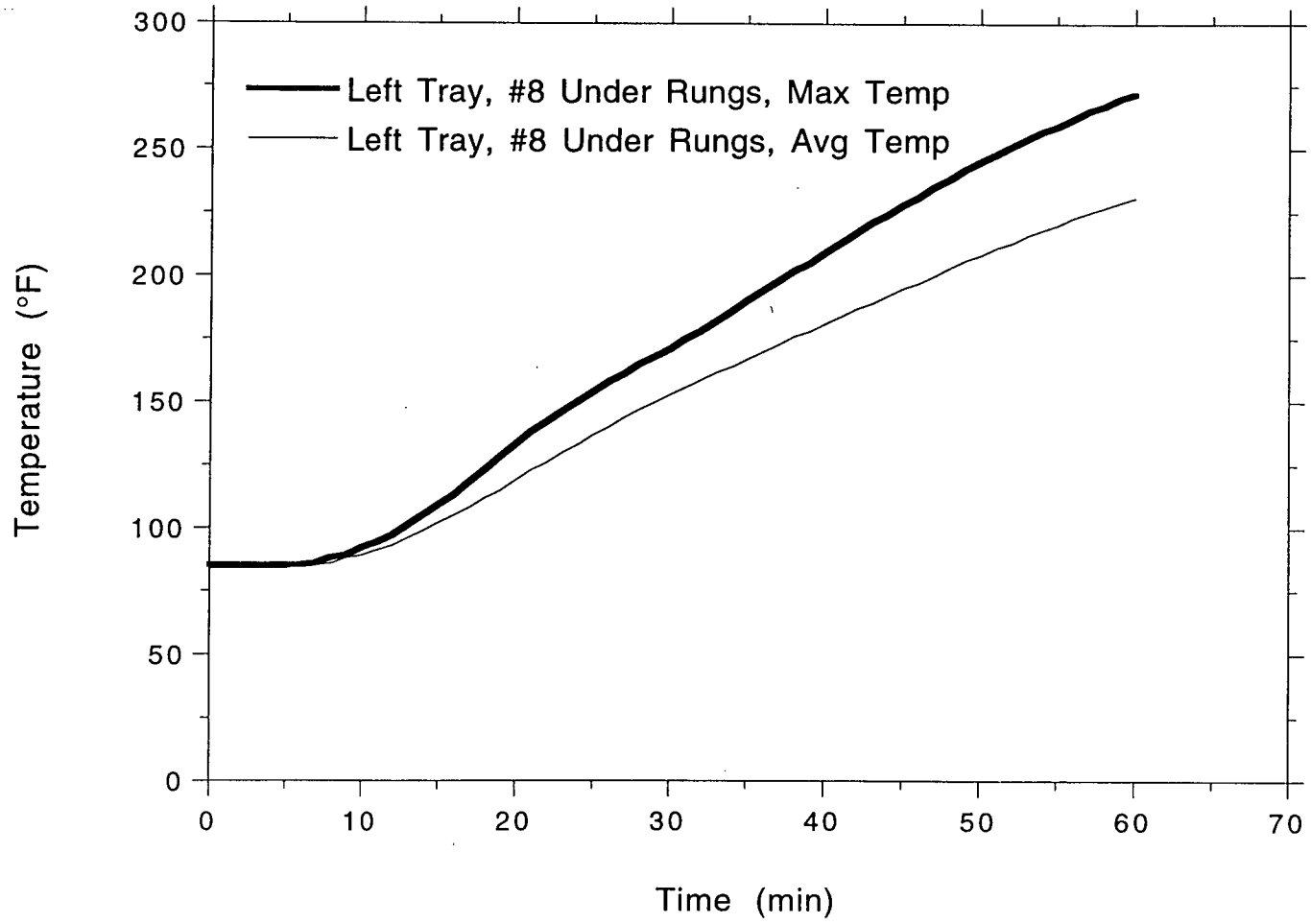
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



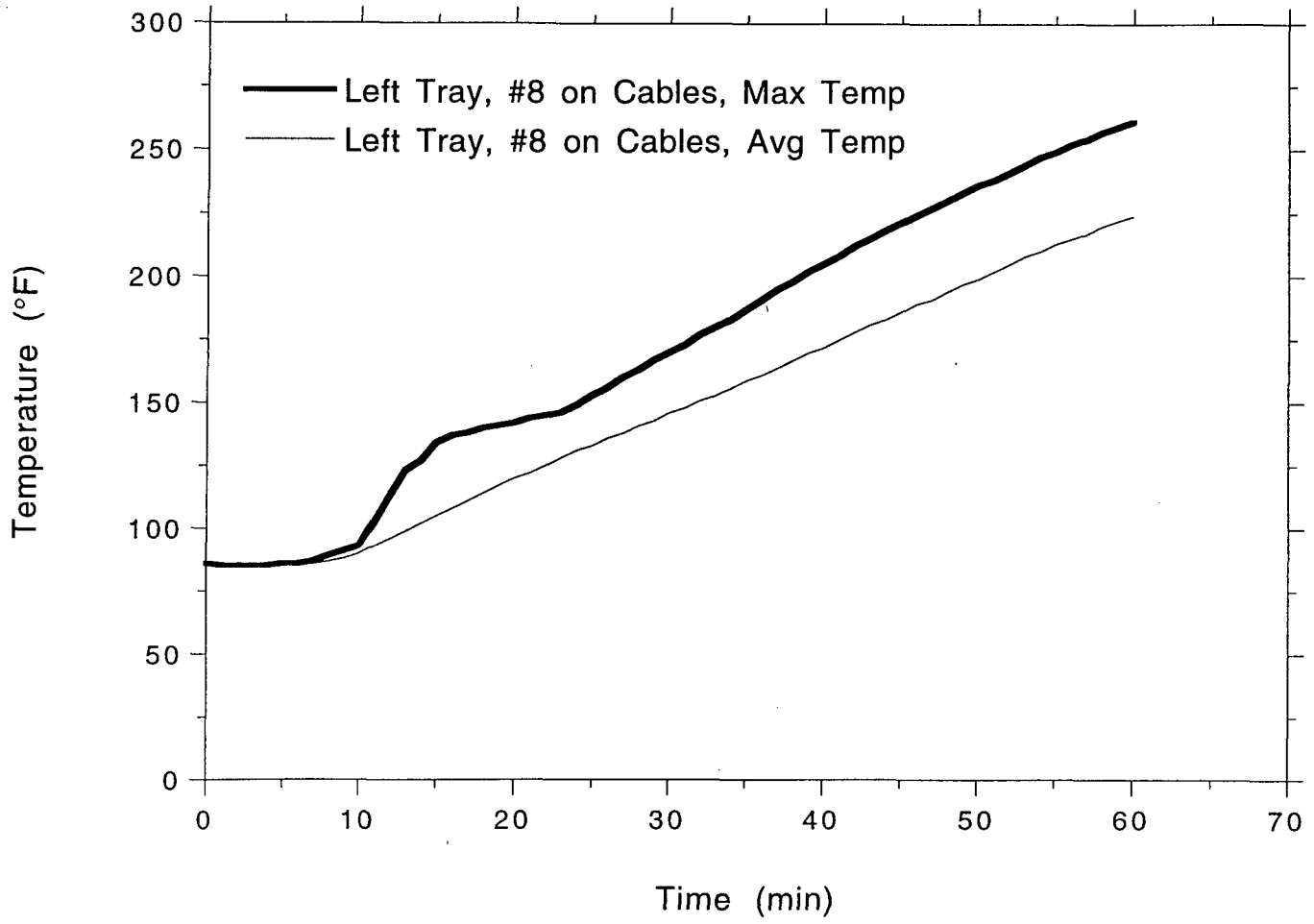
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



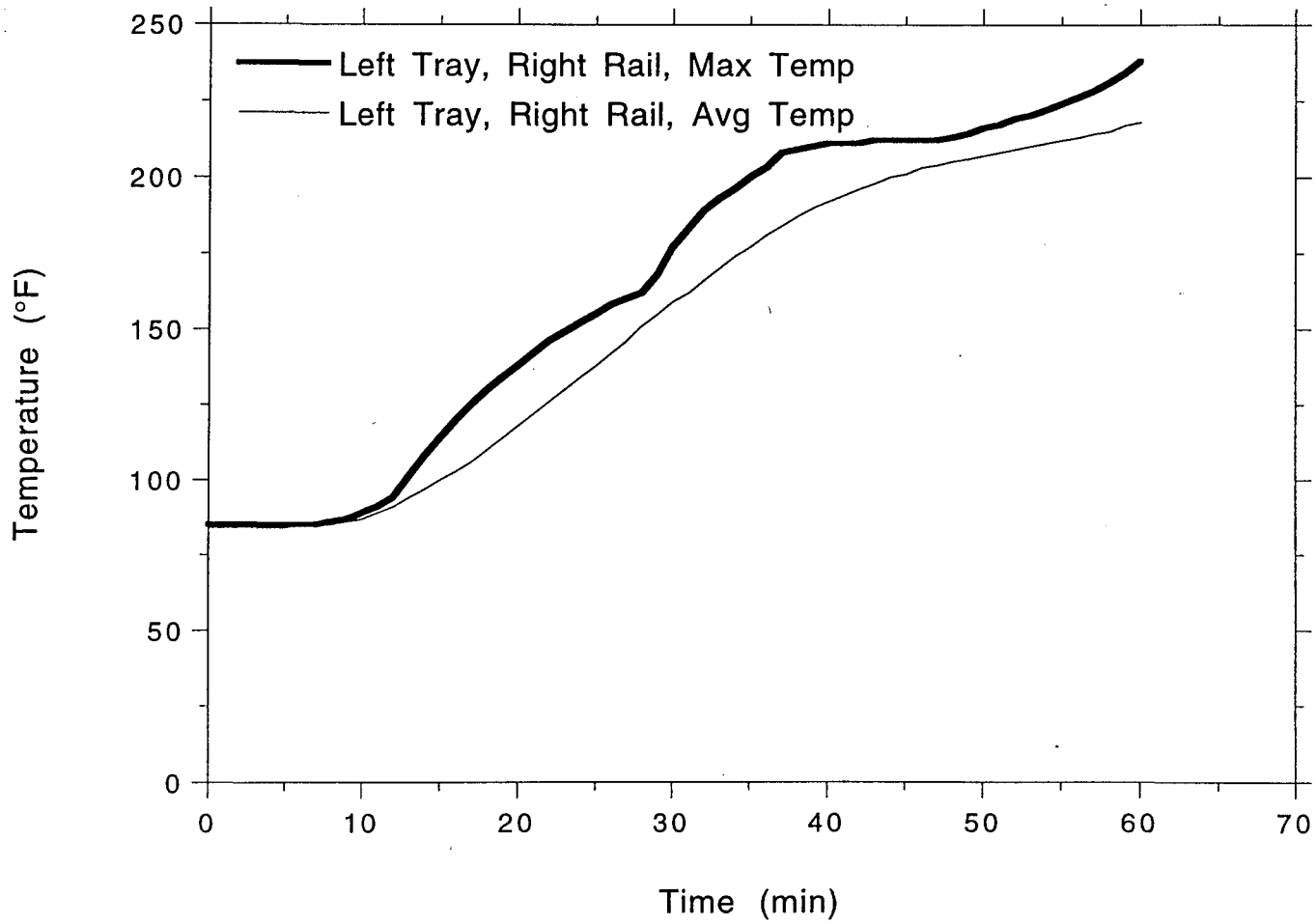
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



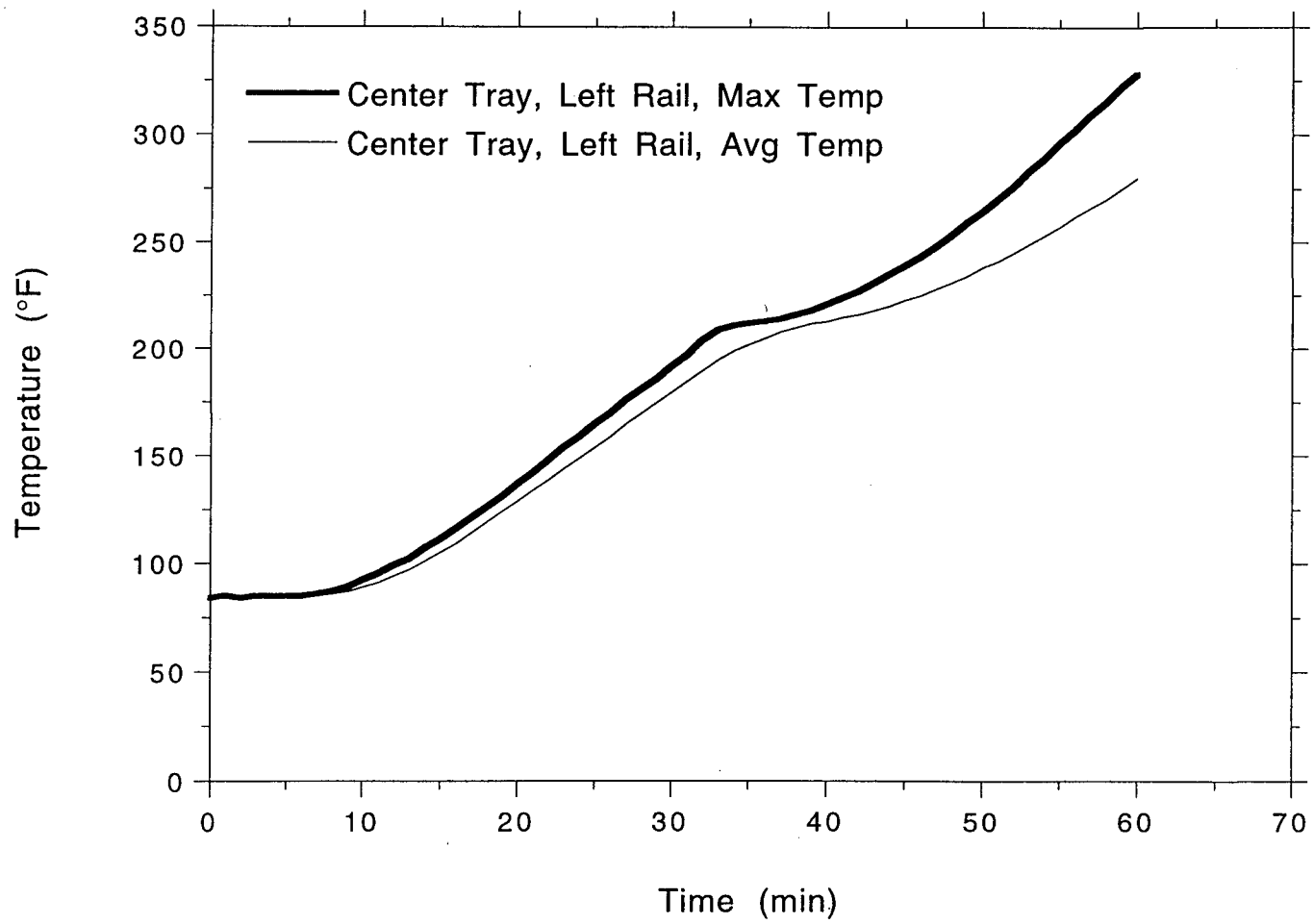
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



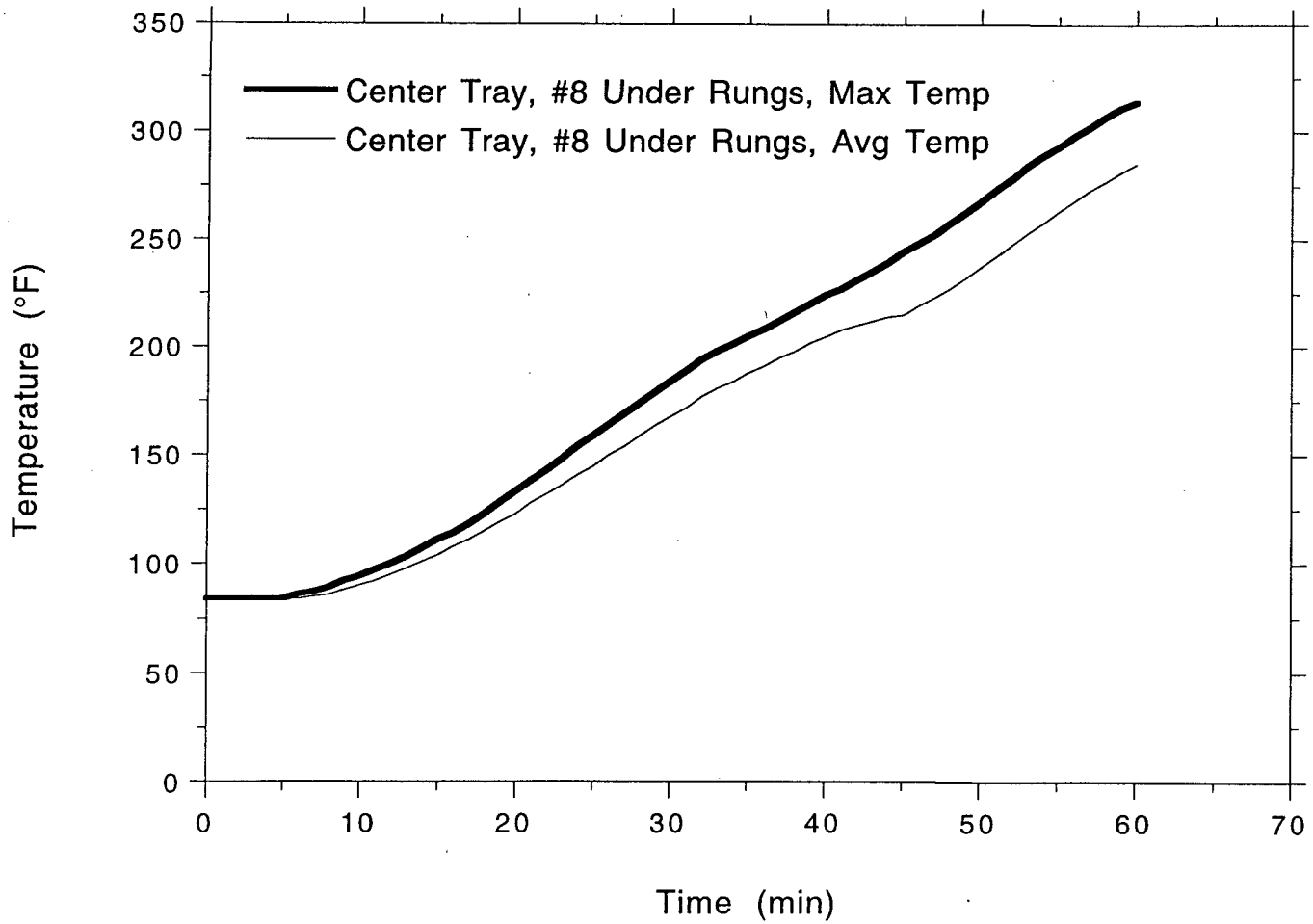
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



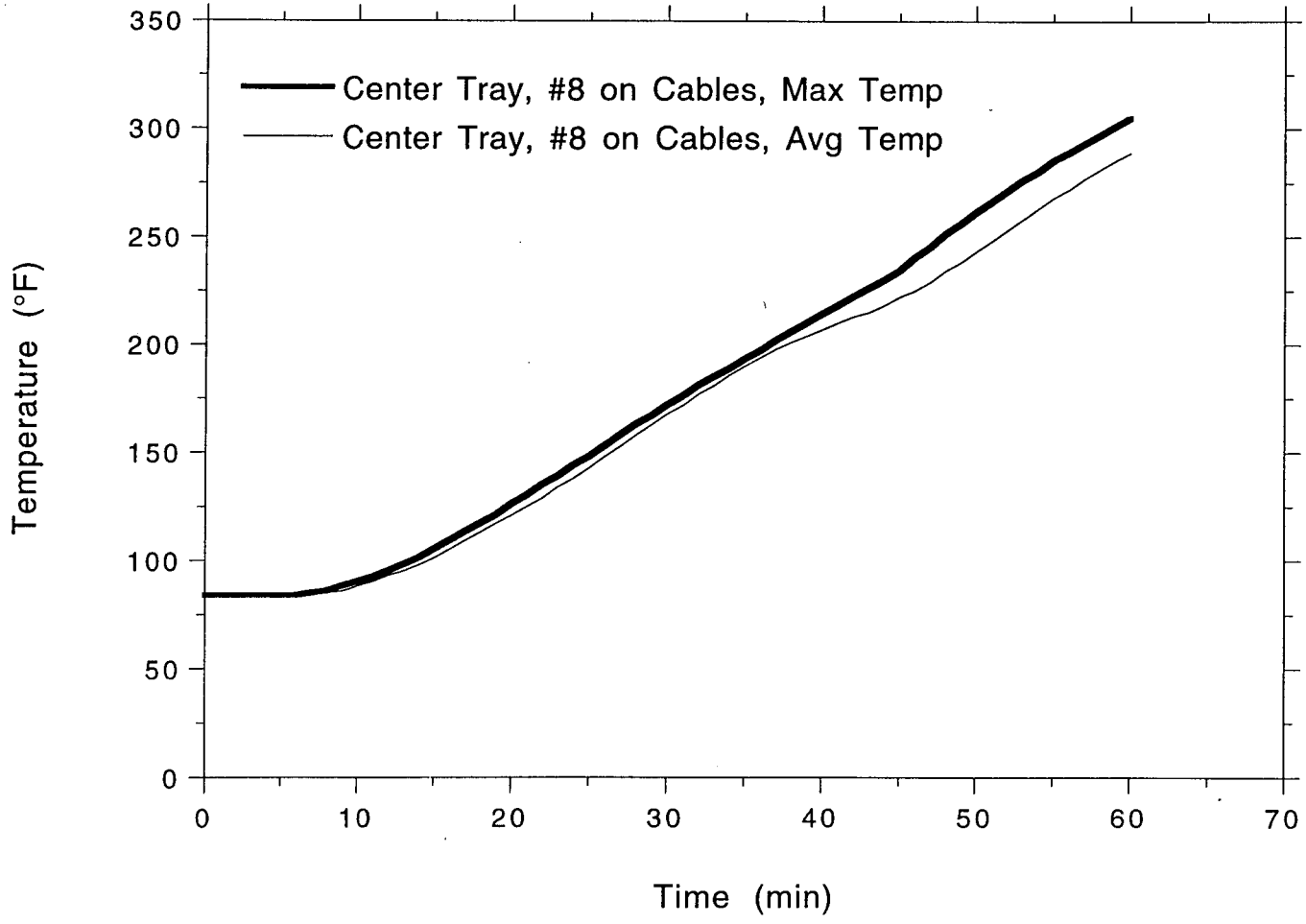
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



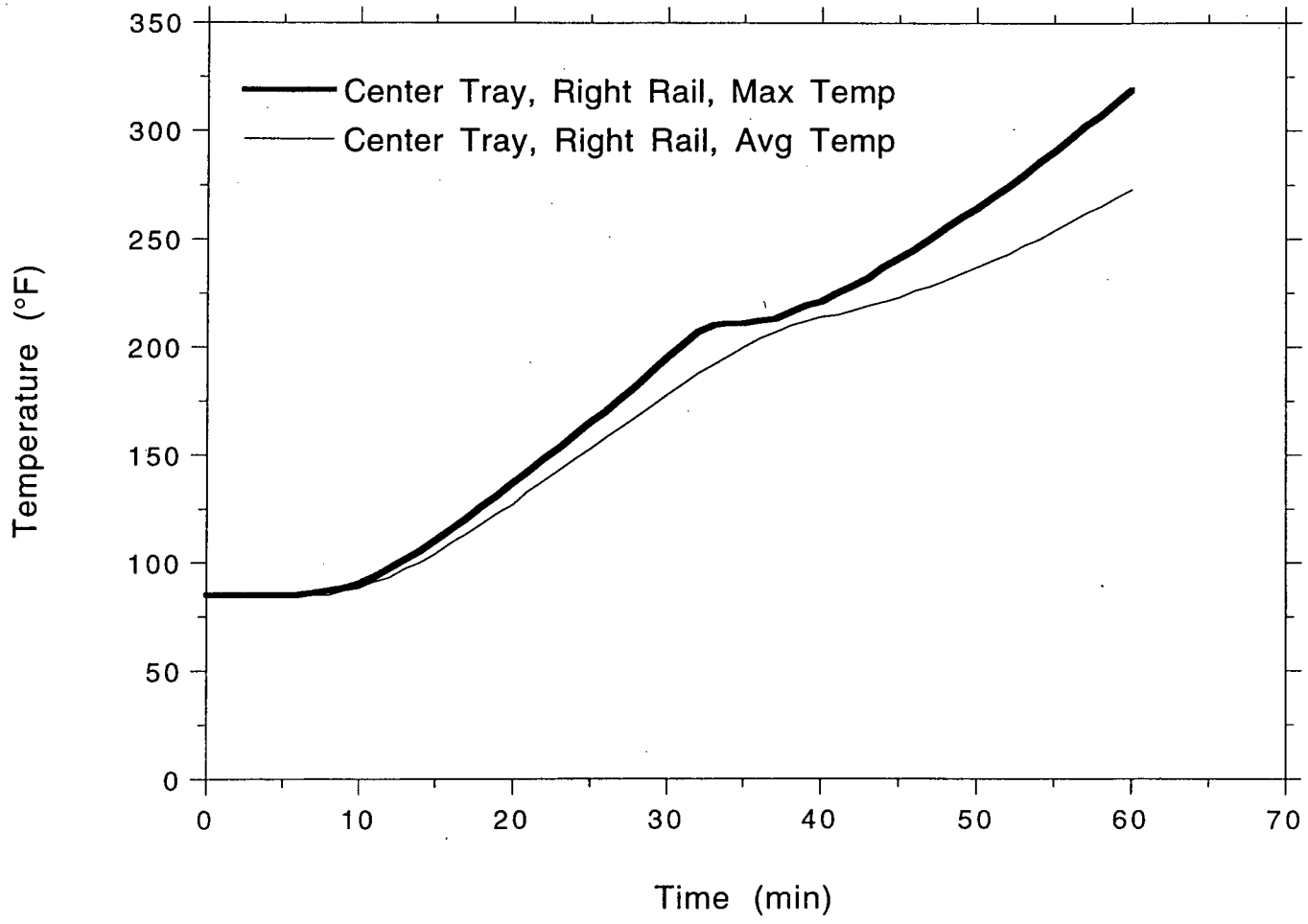
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



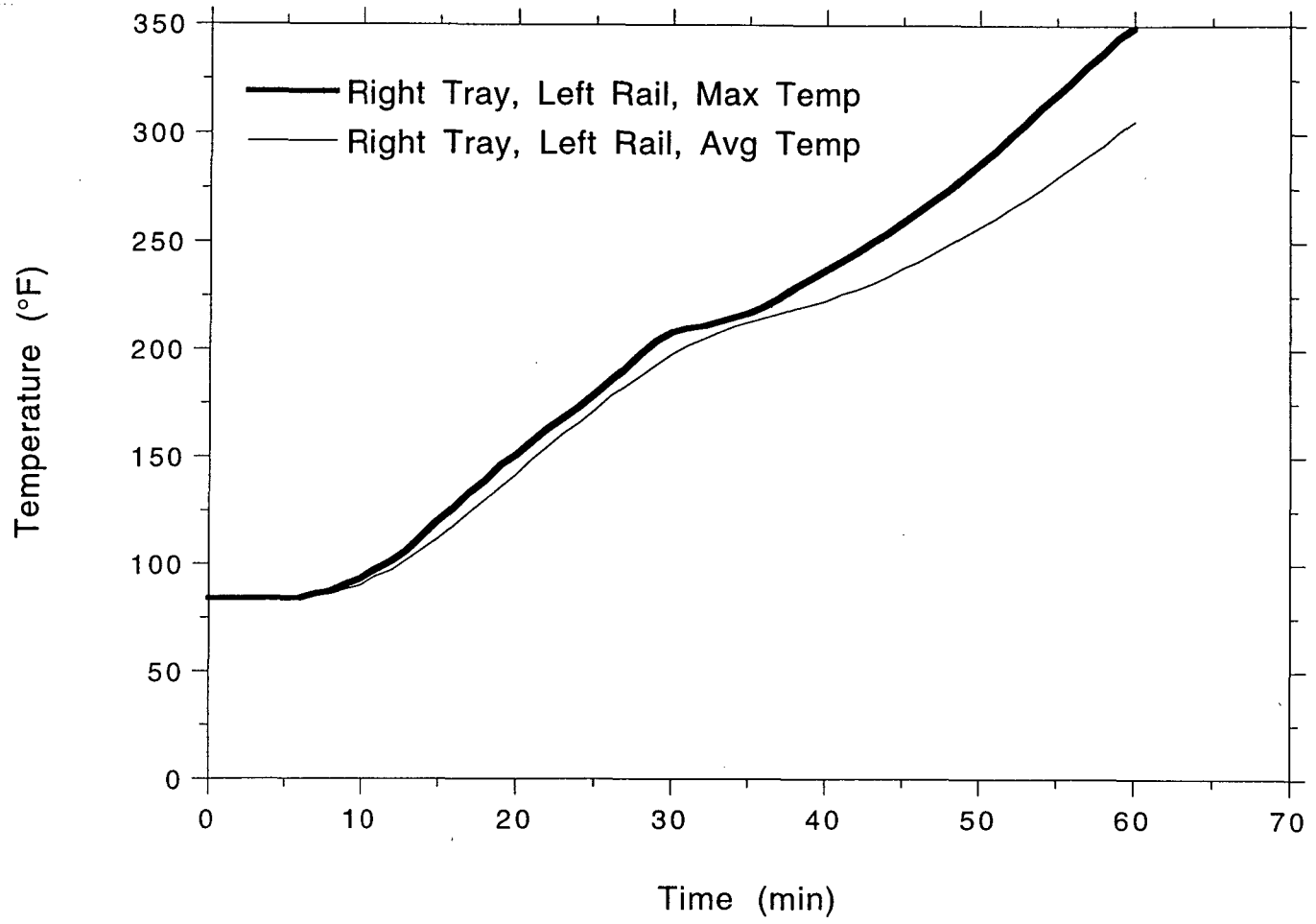
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



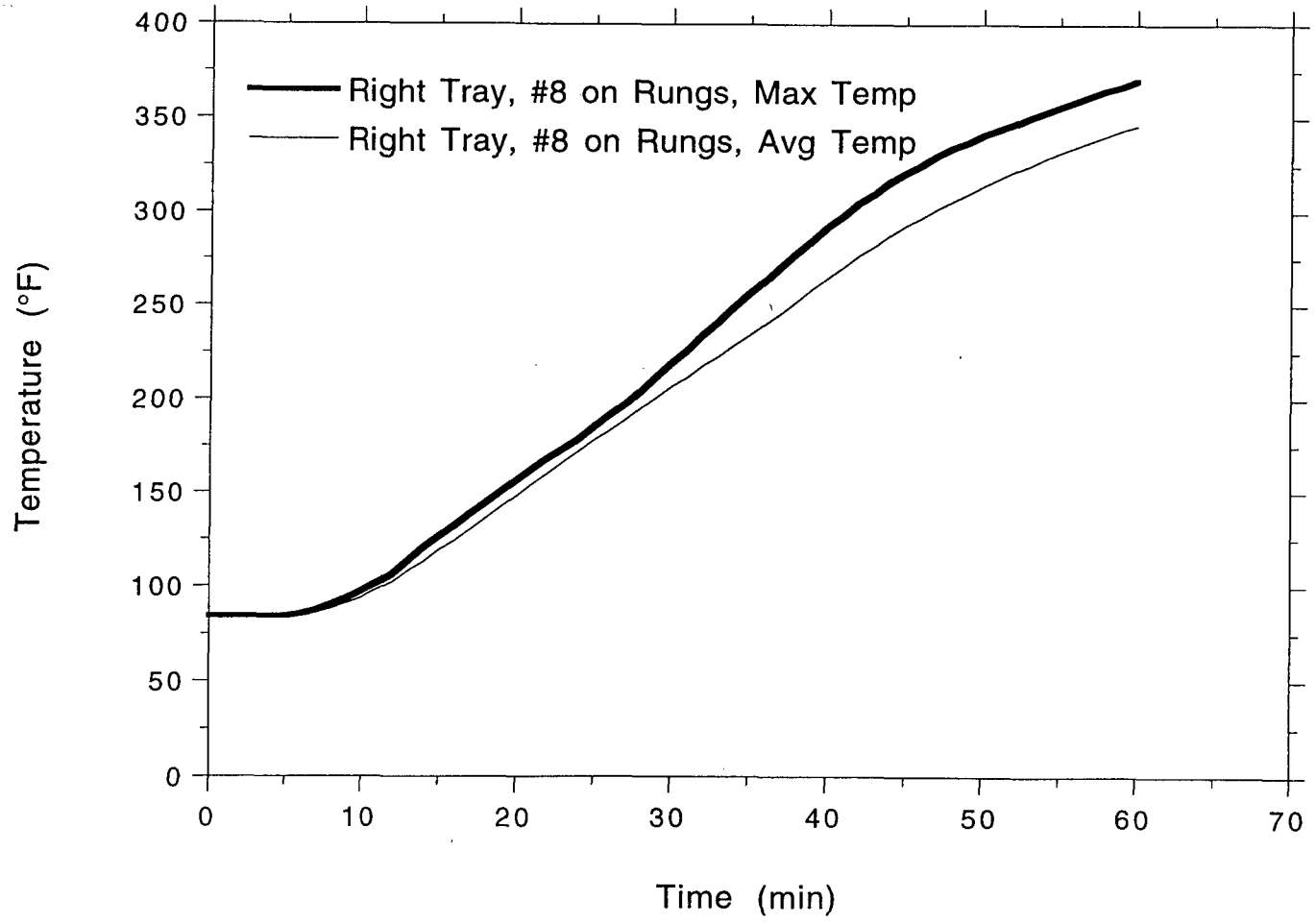
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



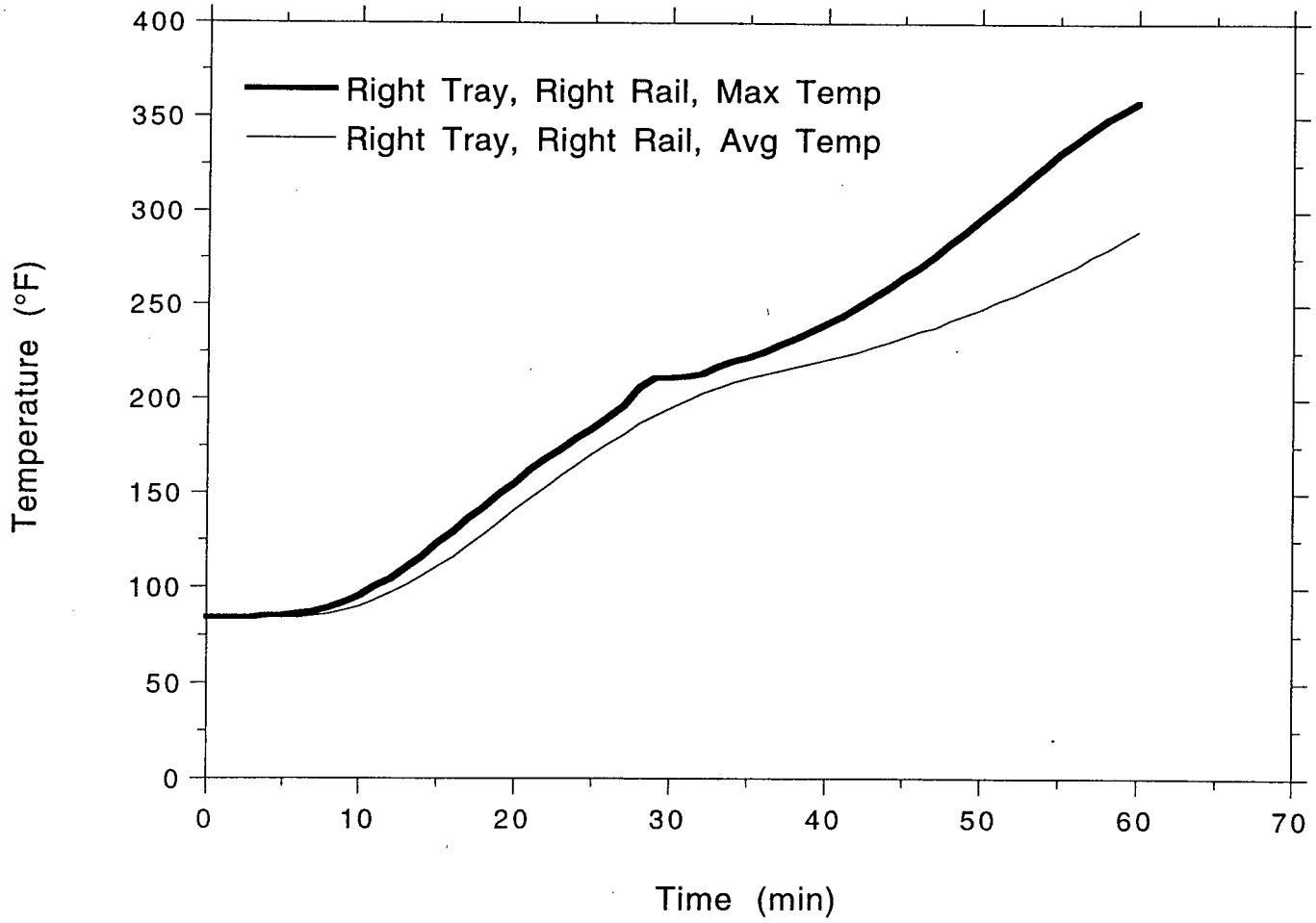
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



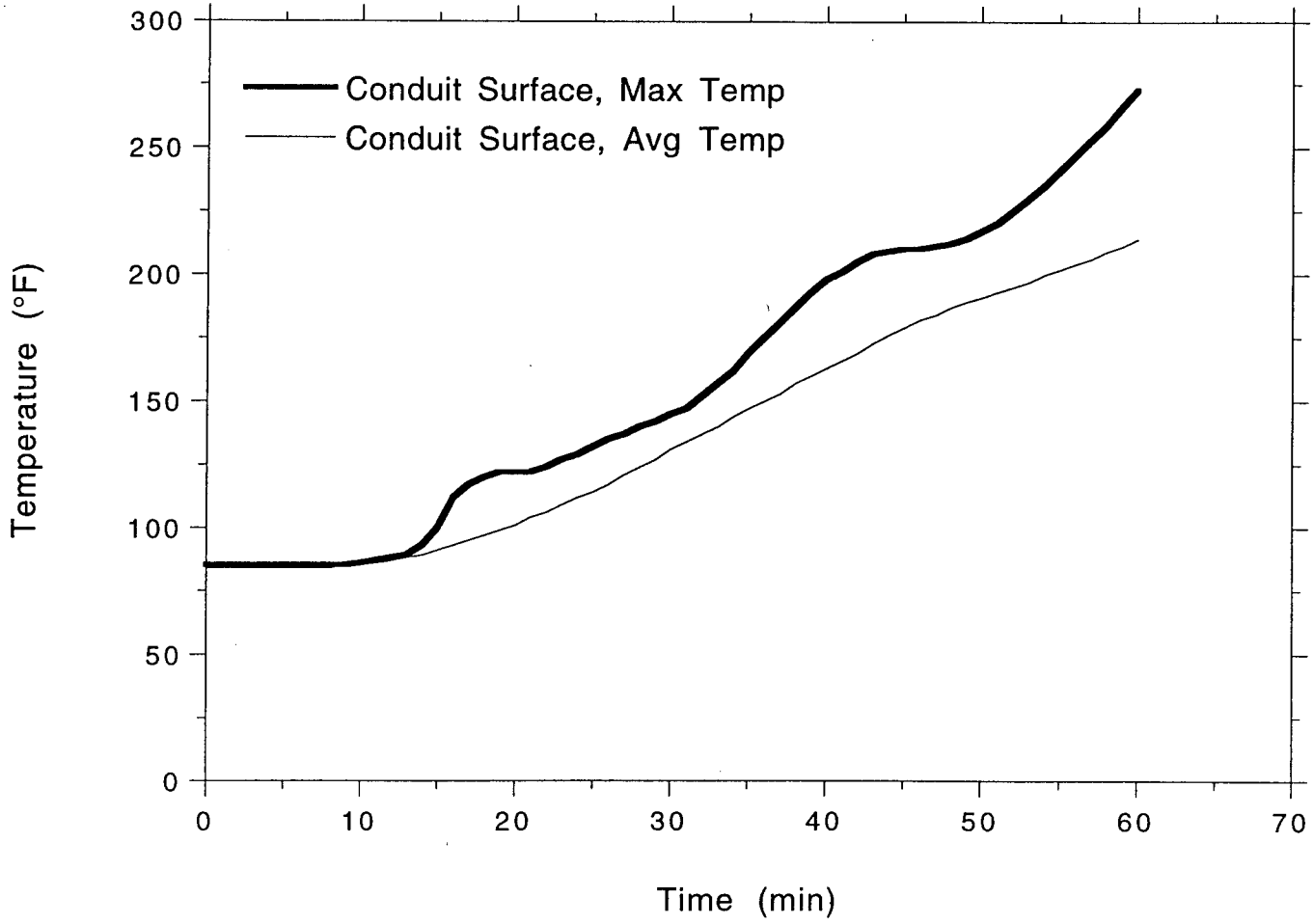
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



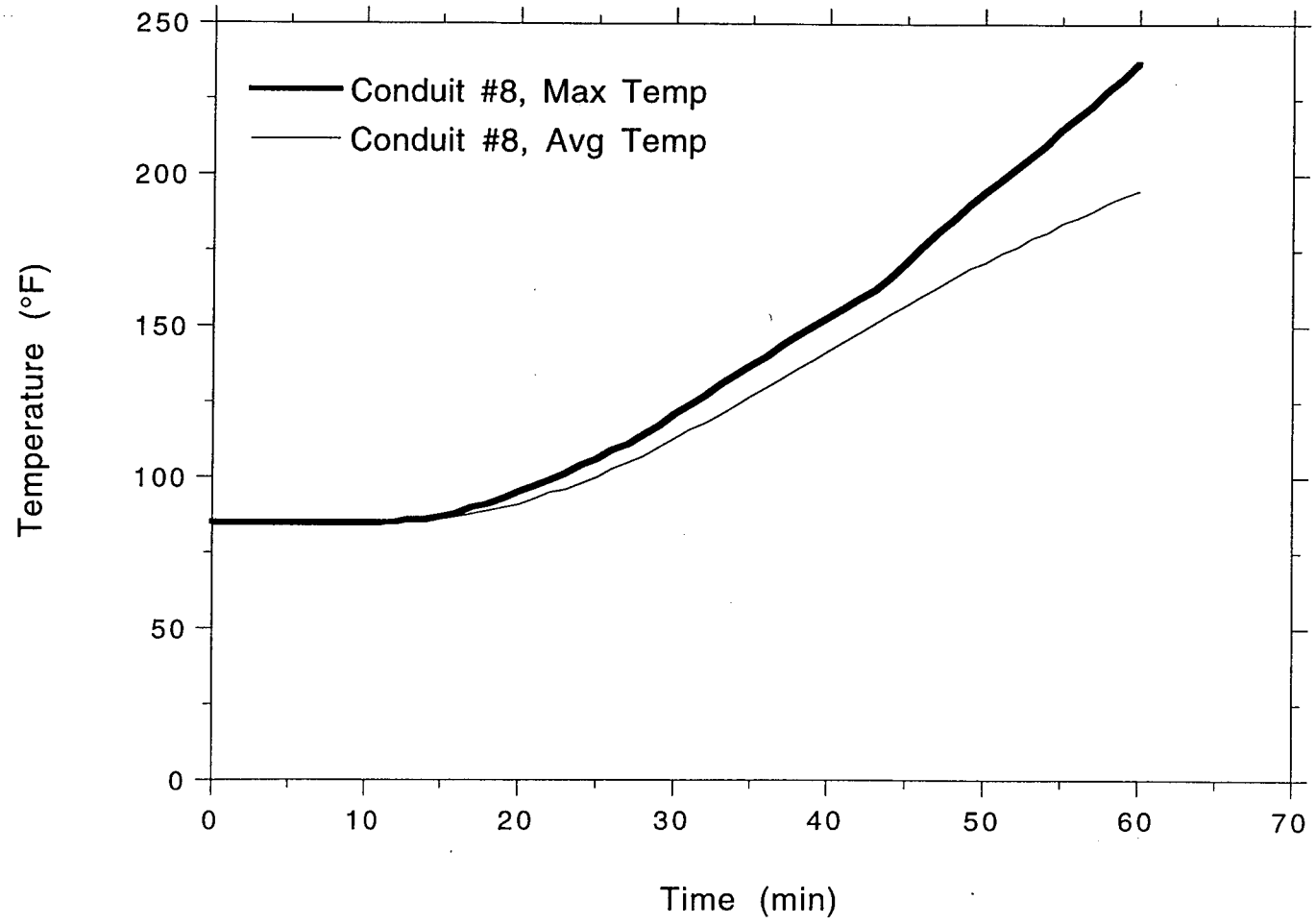
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



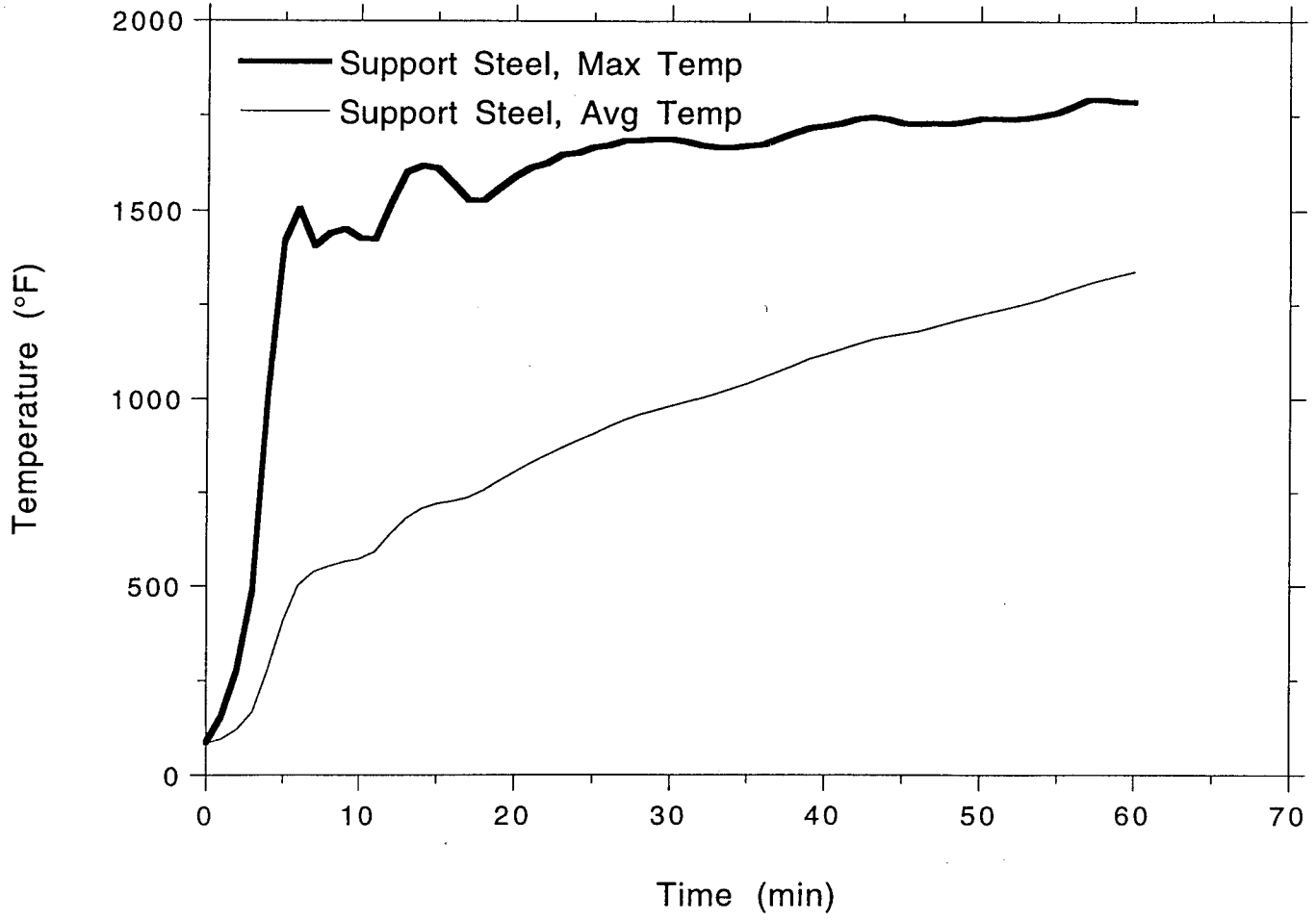
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



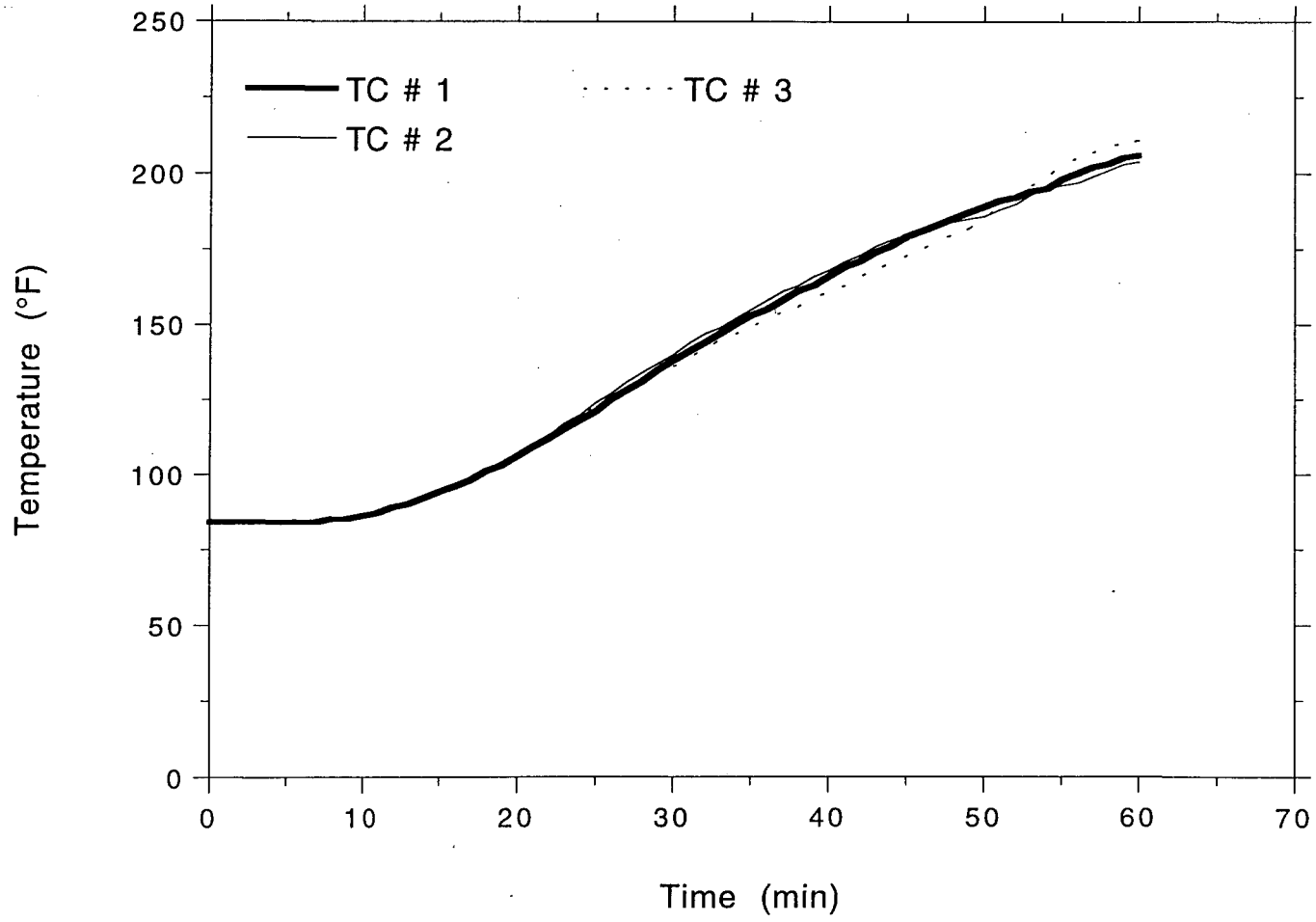
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Average/ Maximum Temperatures



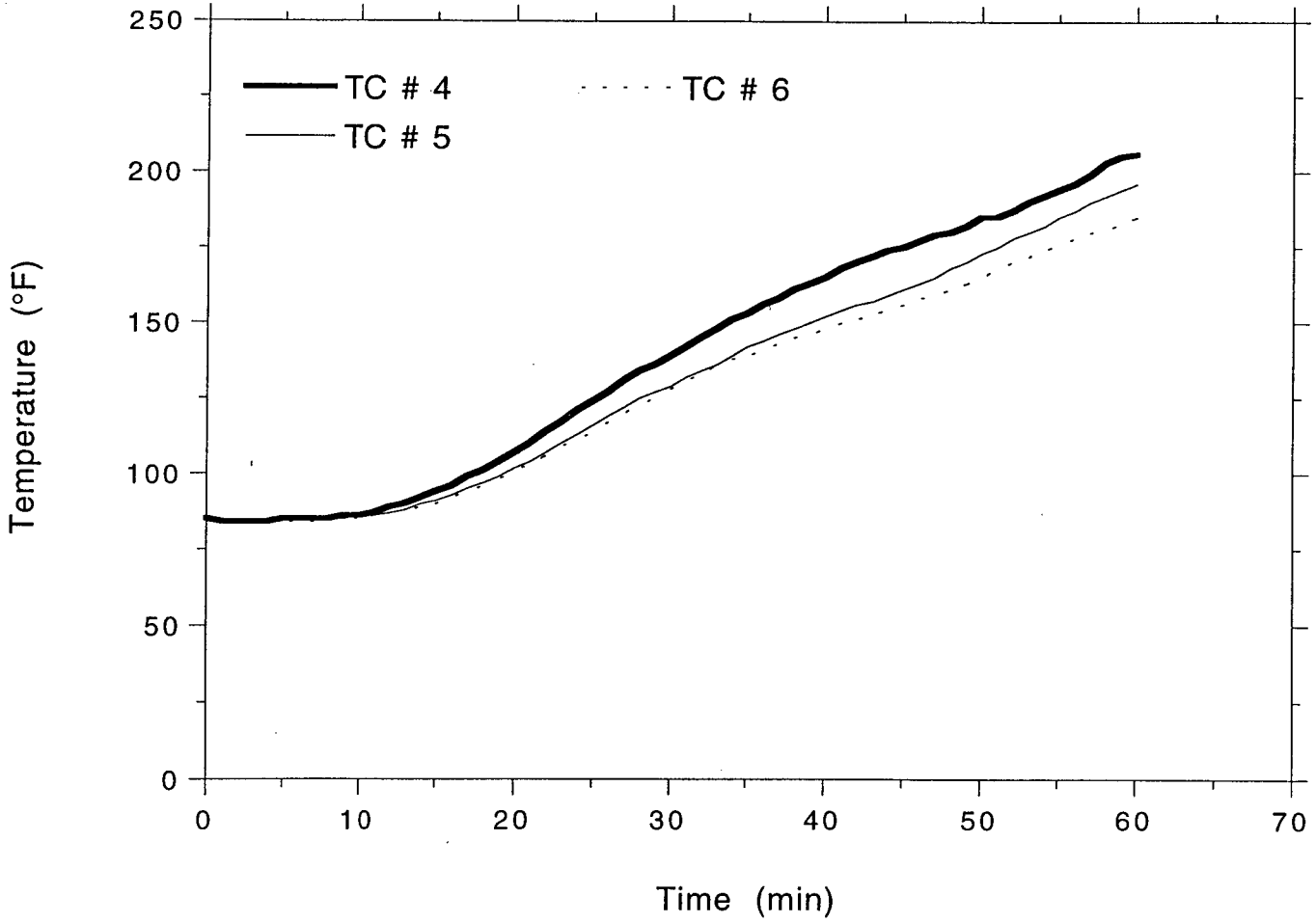
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Left Rail



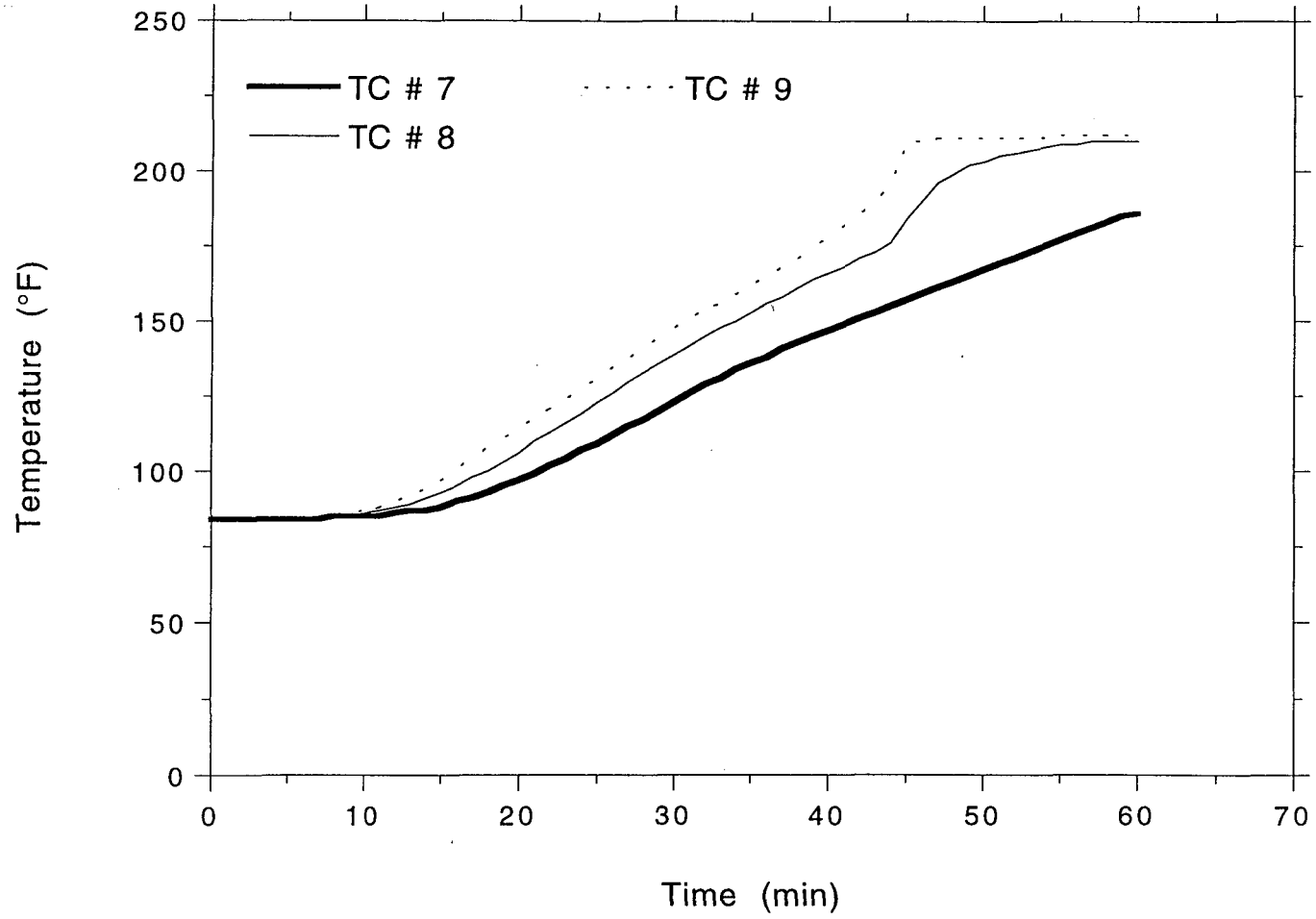
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Left Rail



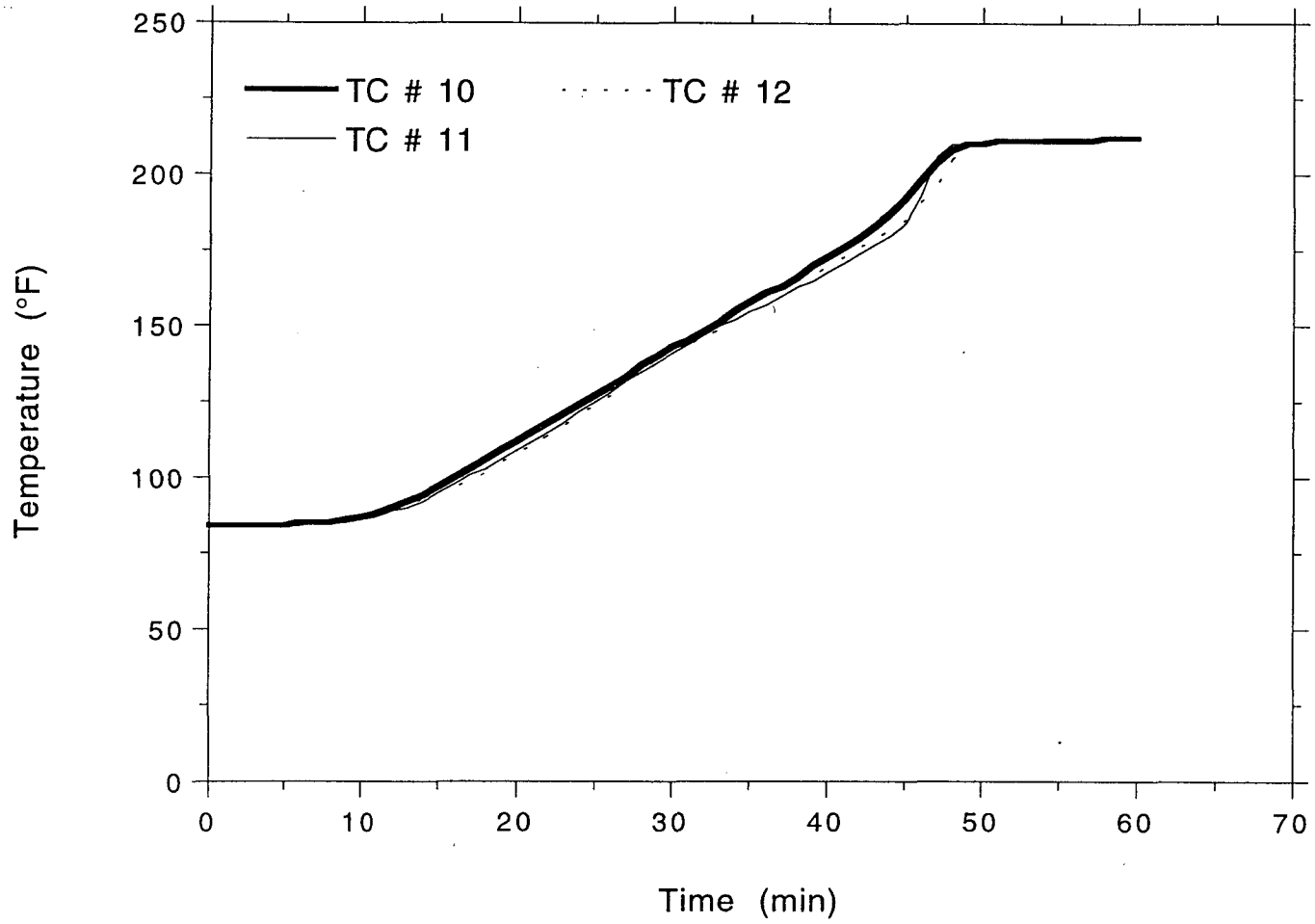
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Left Rail



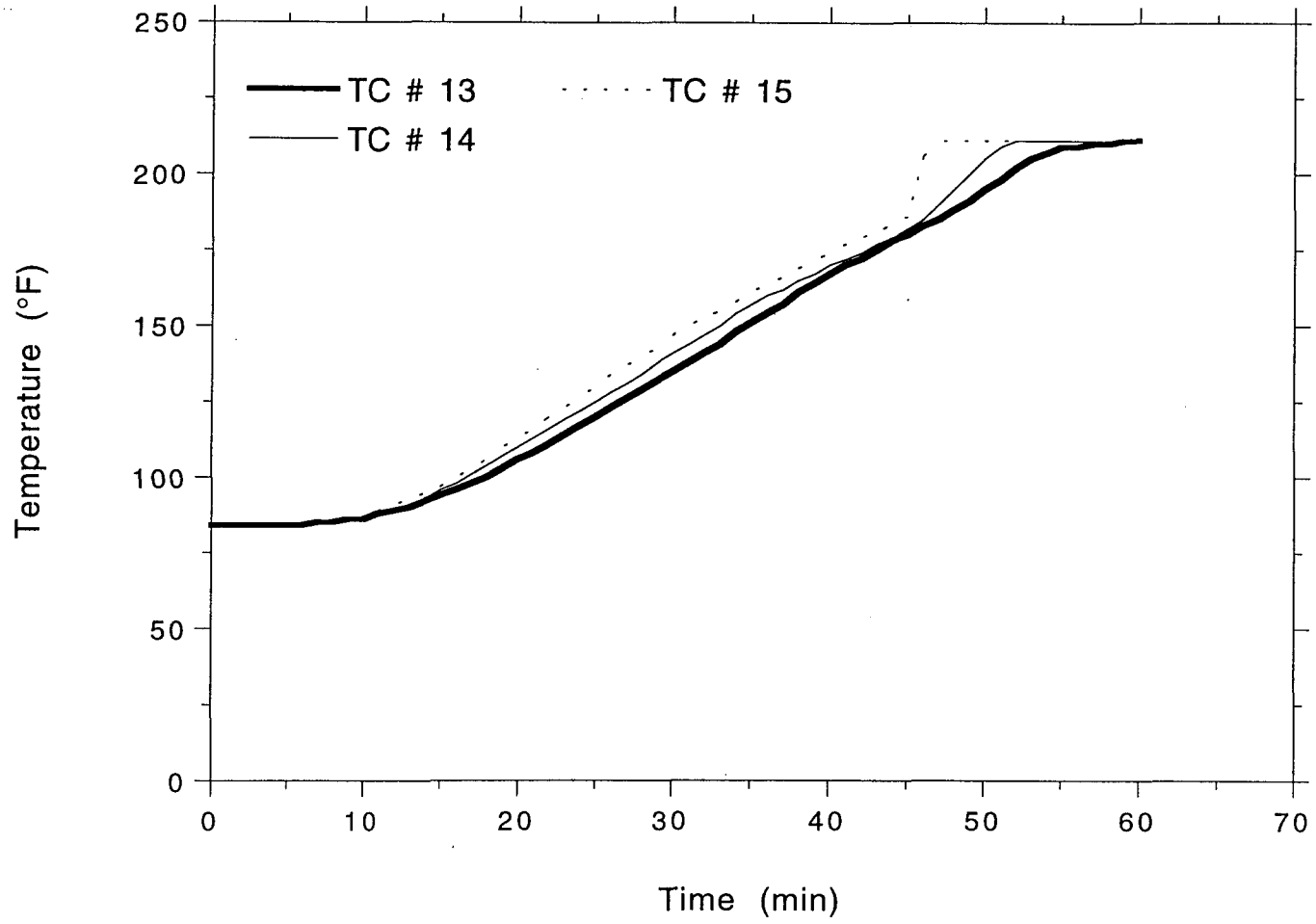
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Left Rail



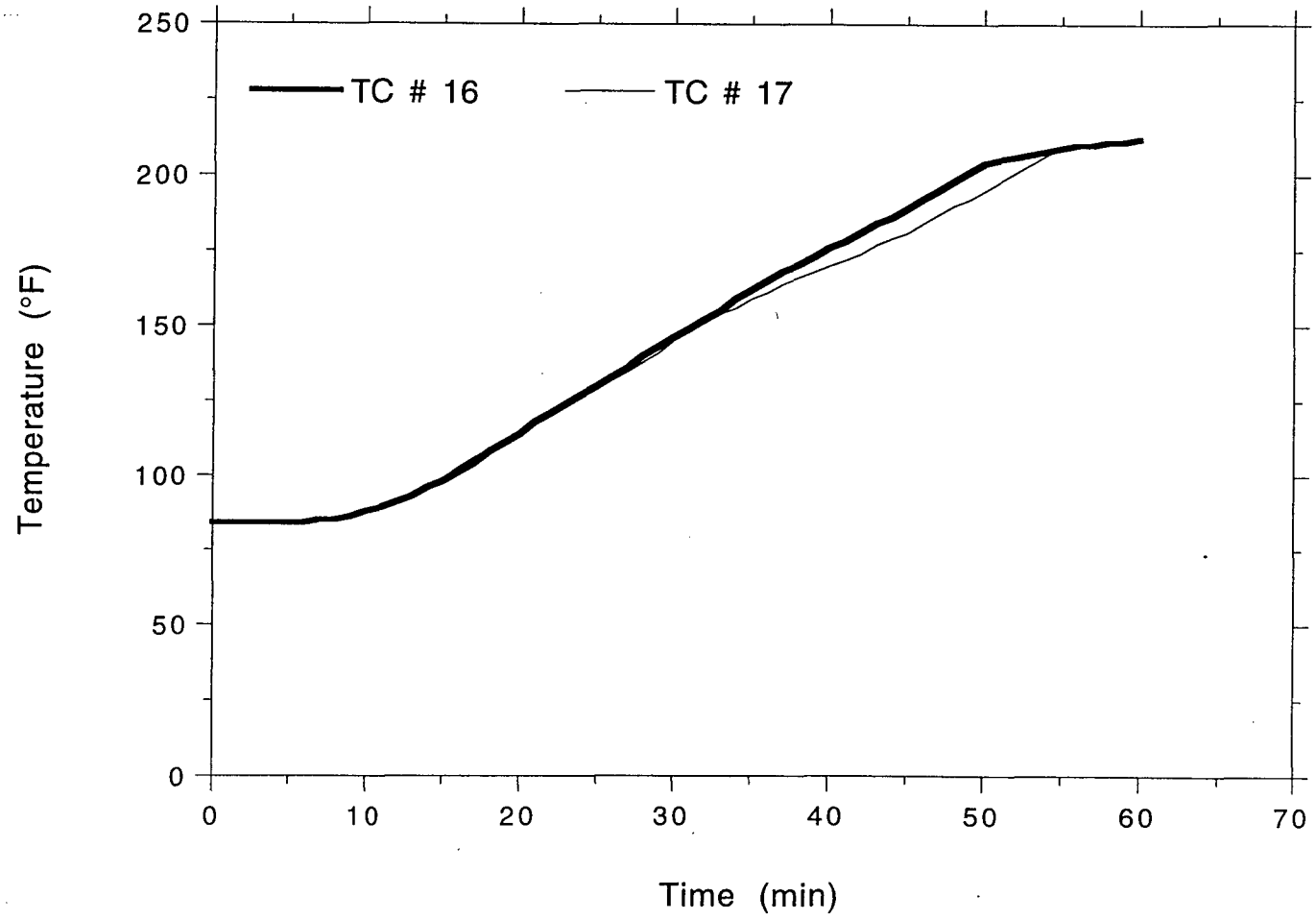
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Left Rail



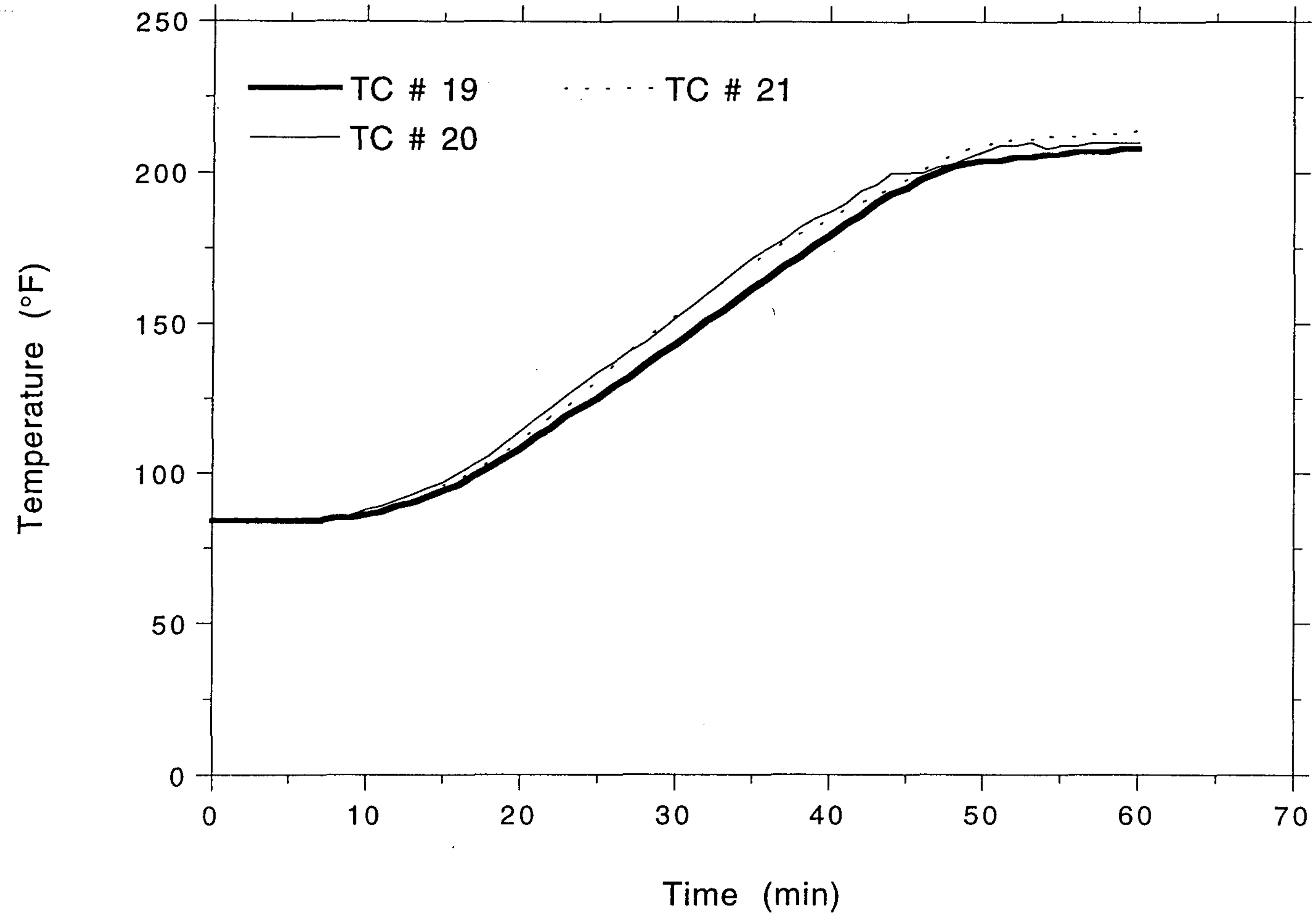
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Left Rail



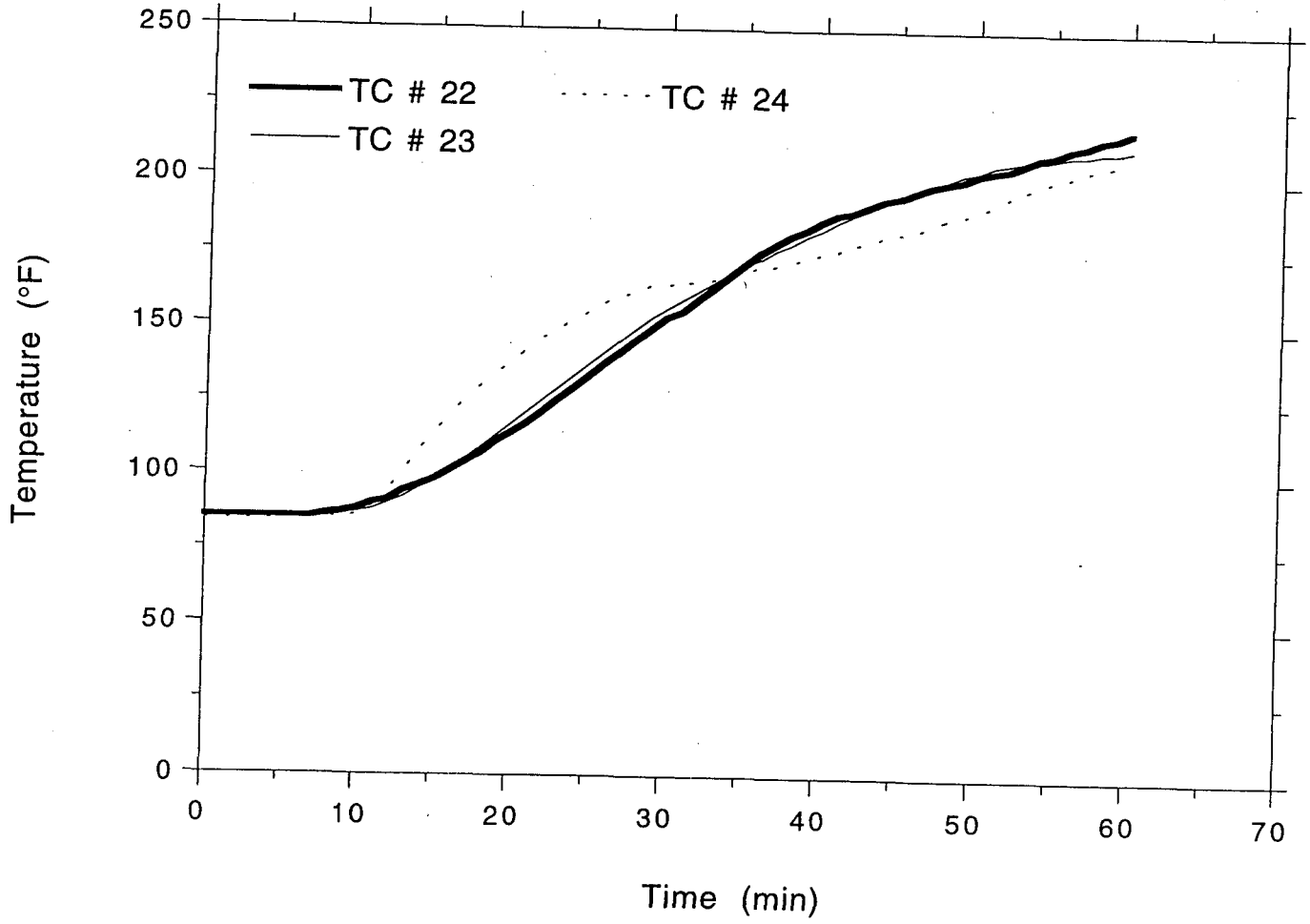
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Right Rail



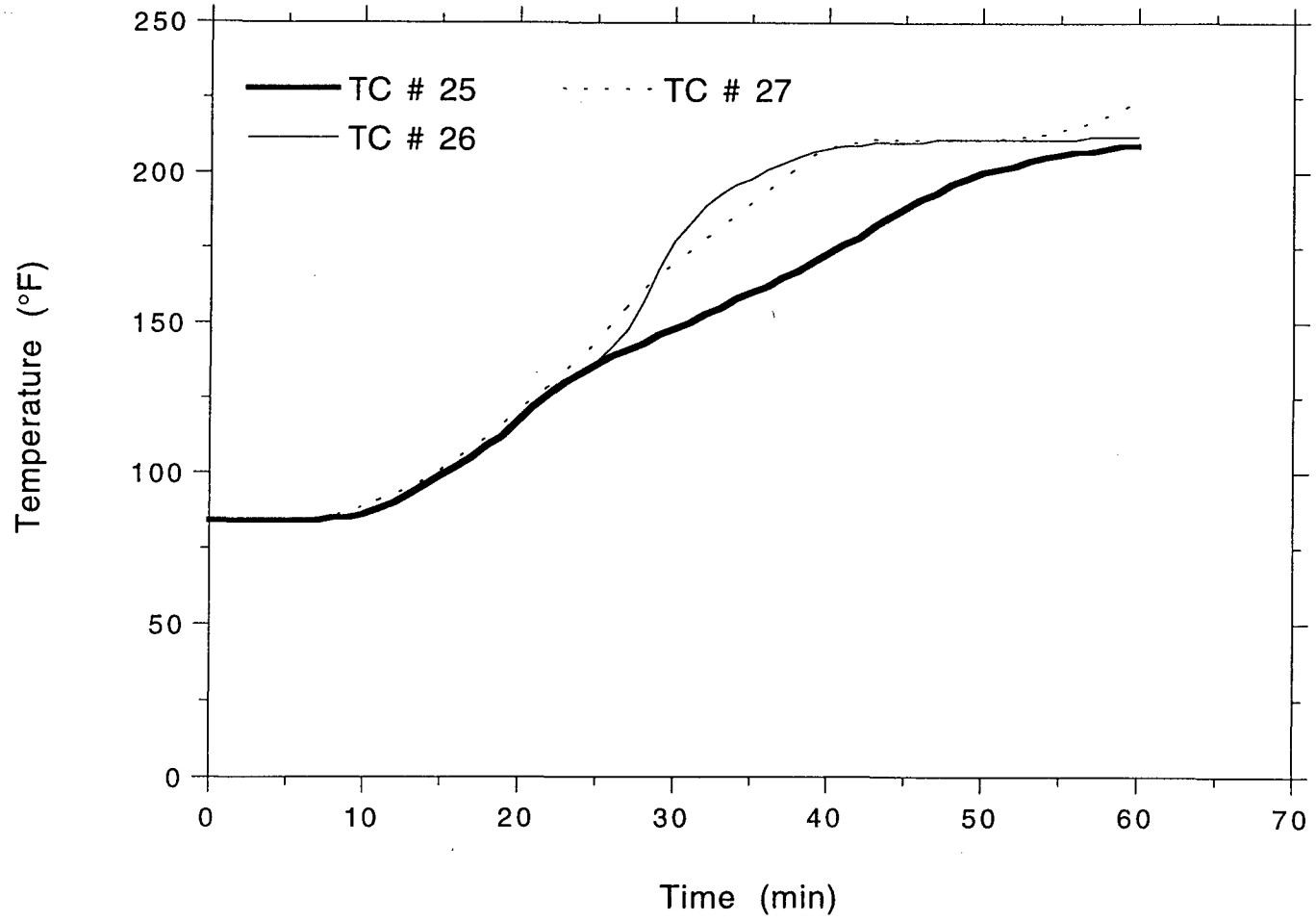
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Right Rail



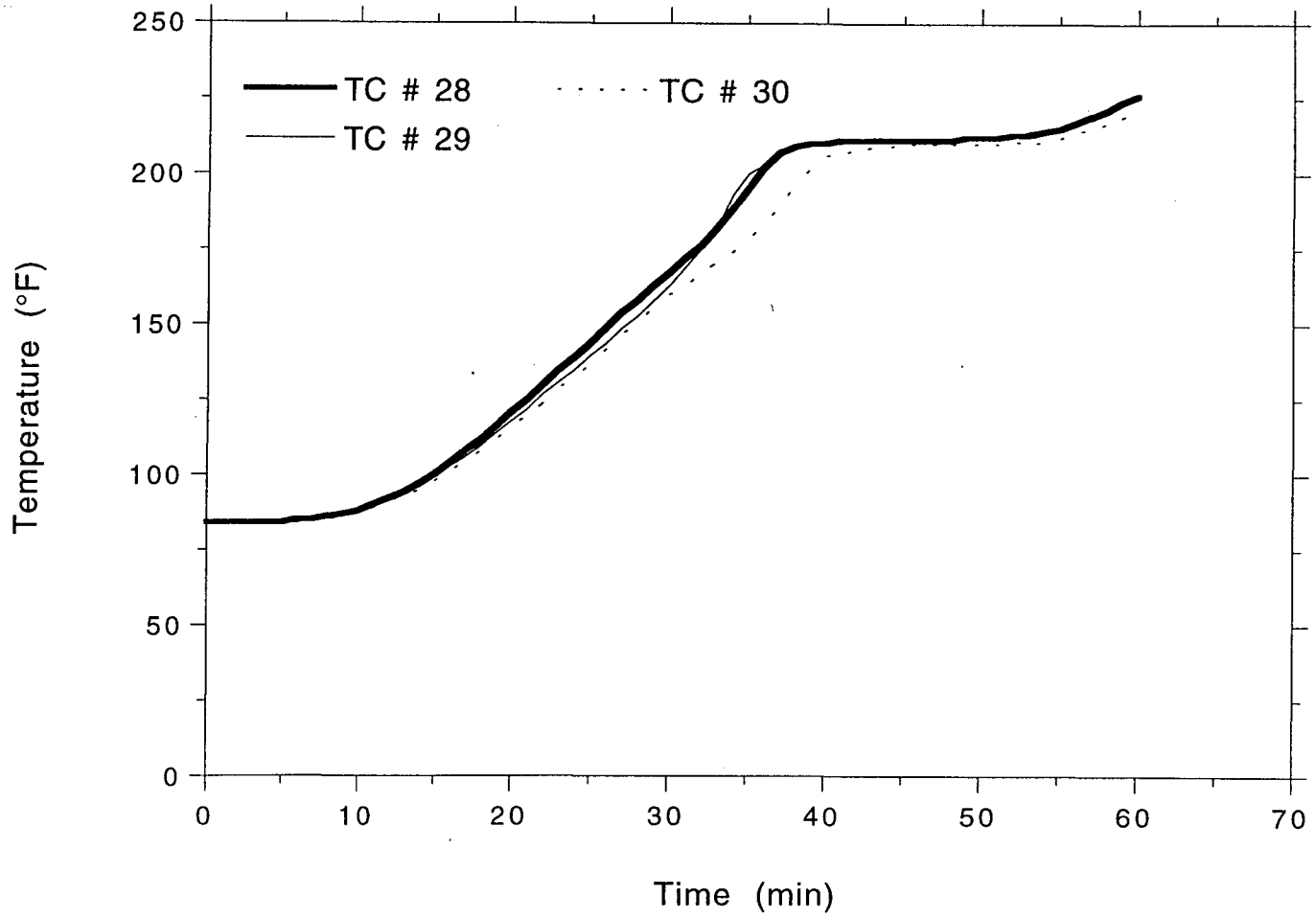
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Right Rail



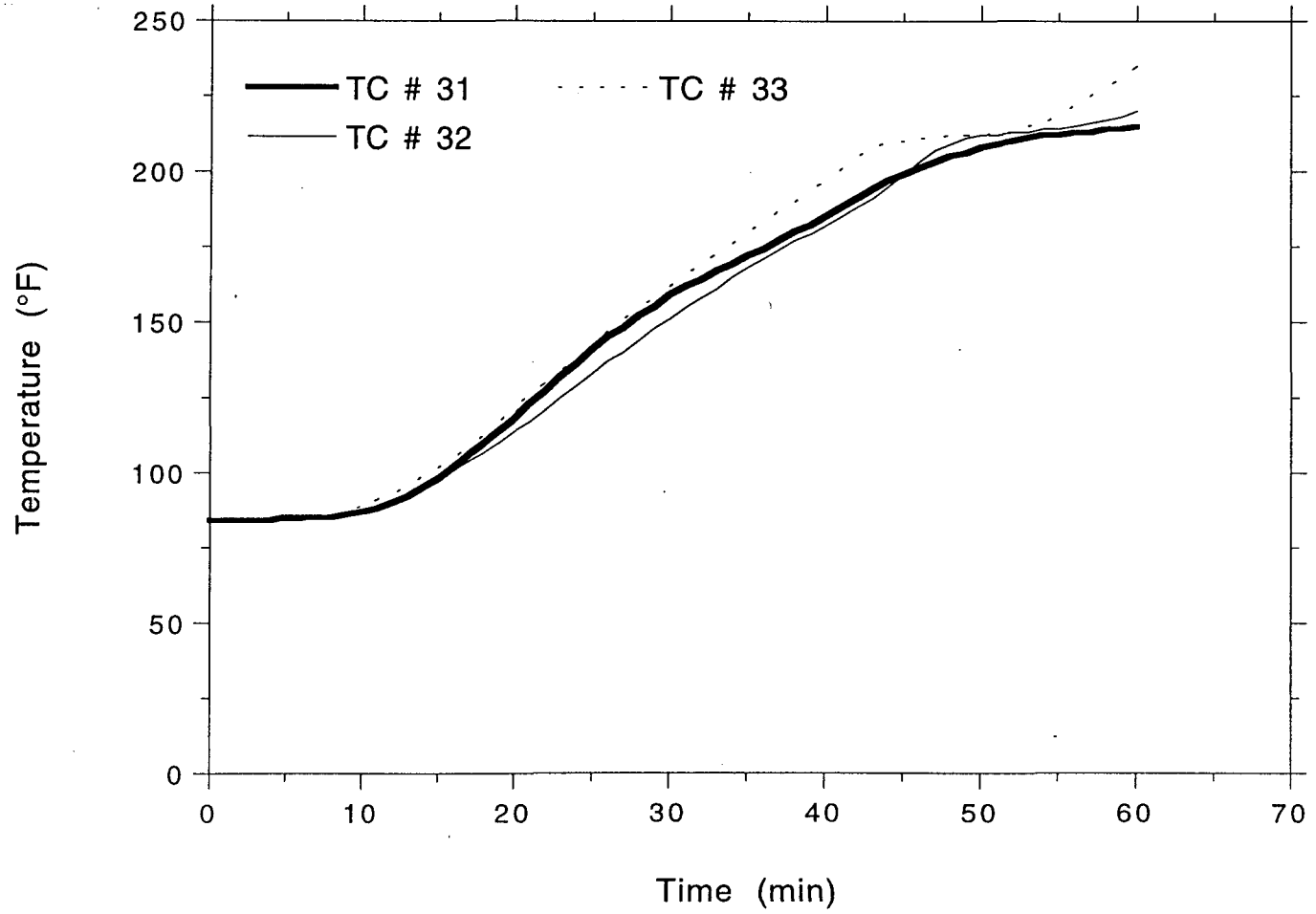
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Right Rail



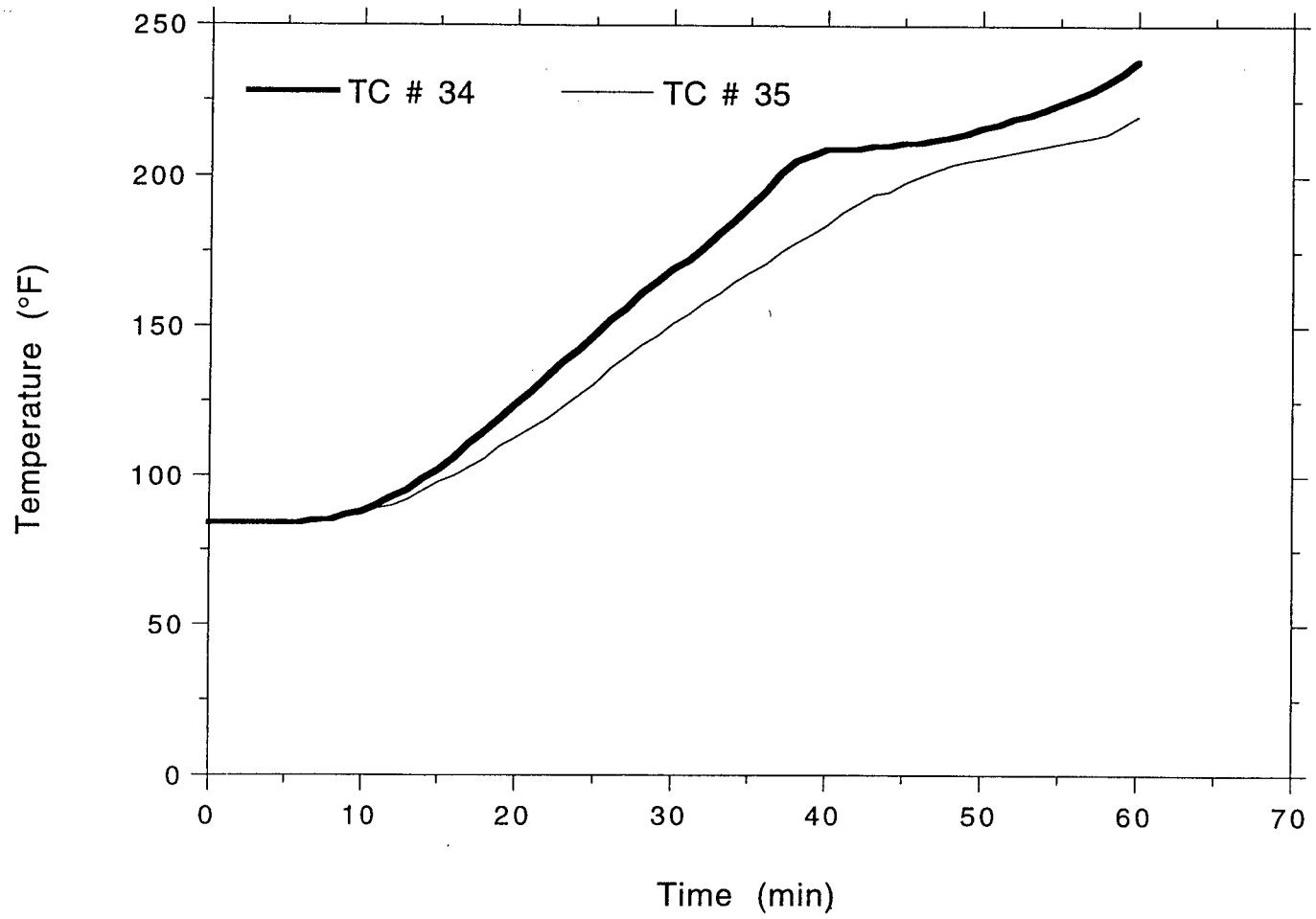
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Right Rail



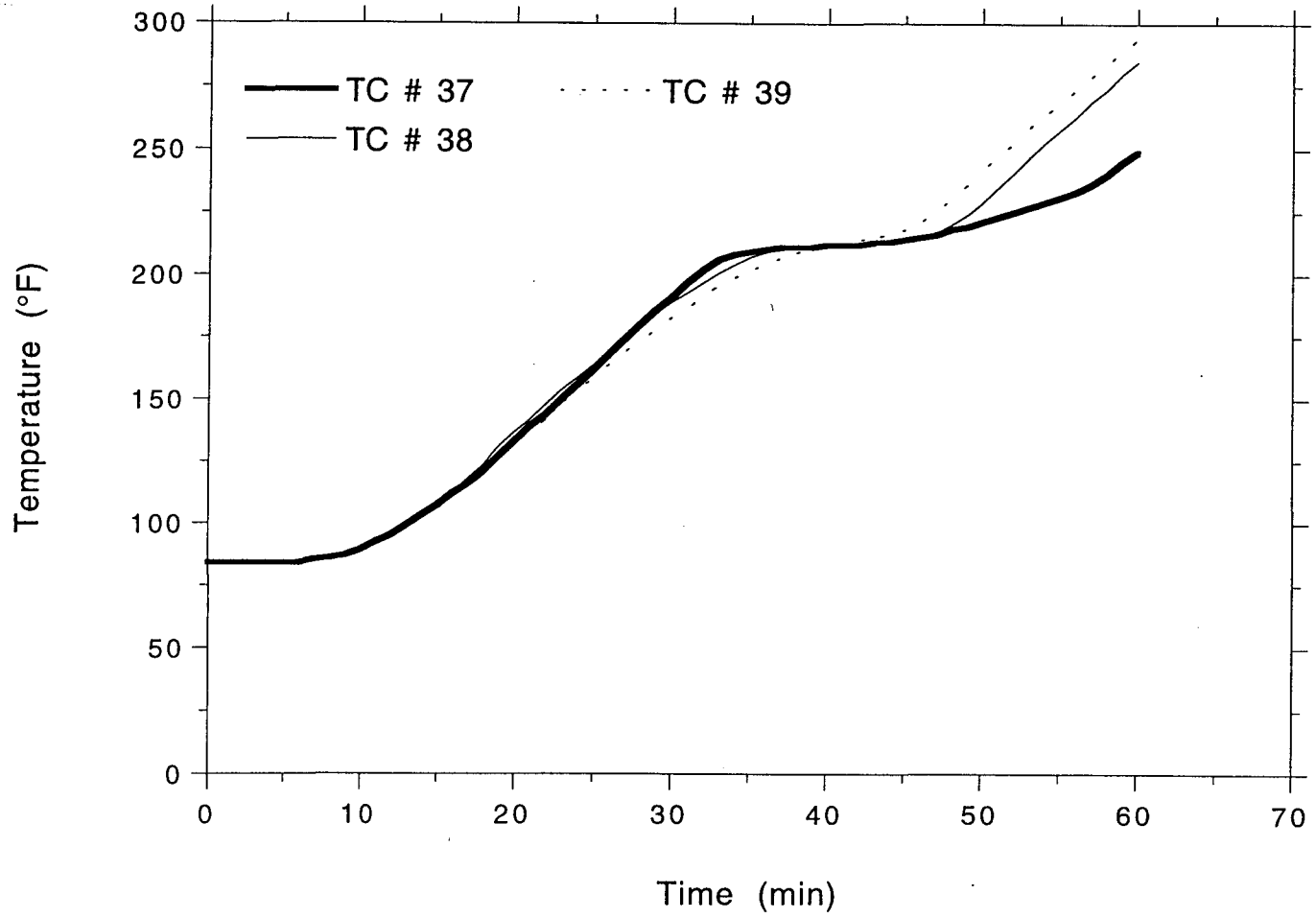
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, Right Rail



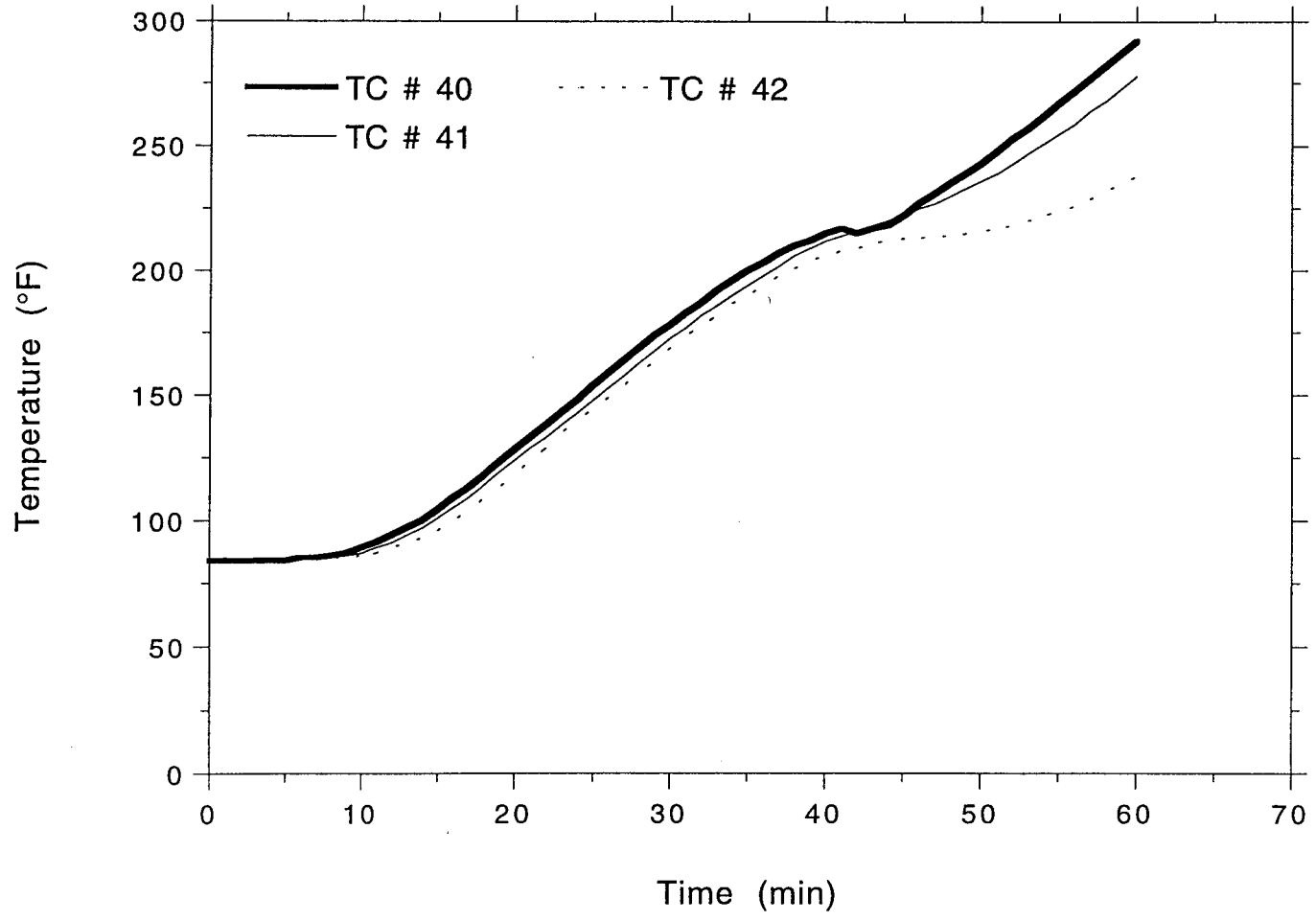
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Left Rail



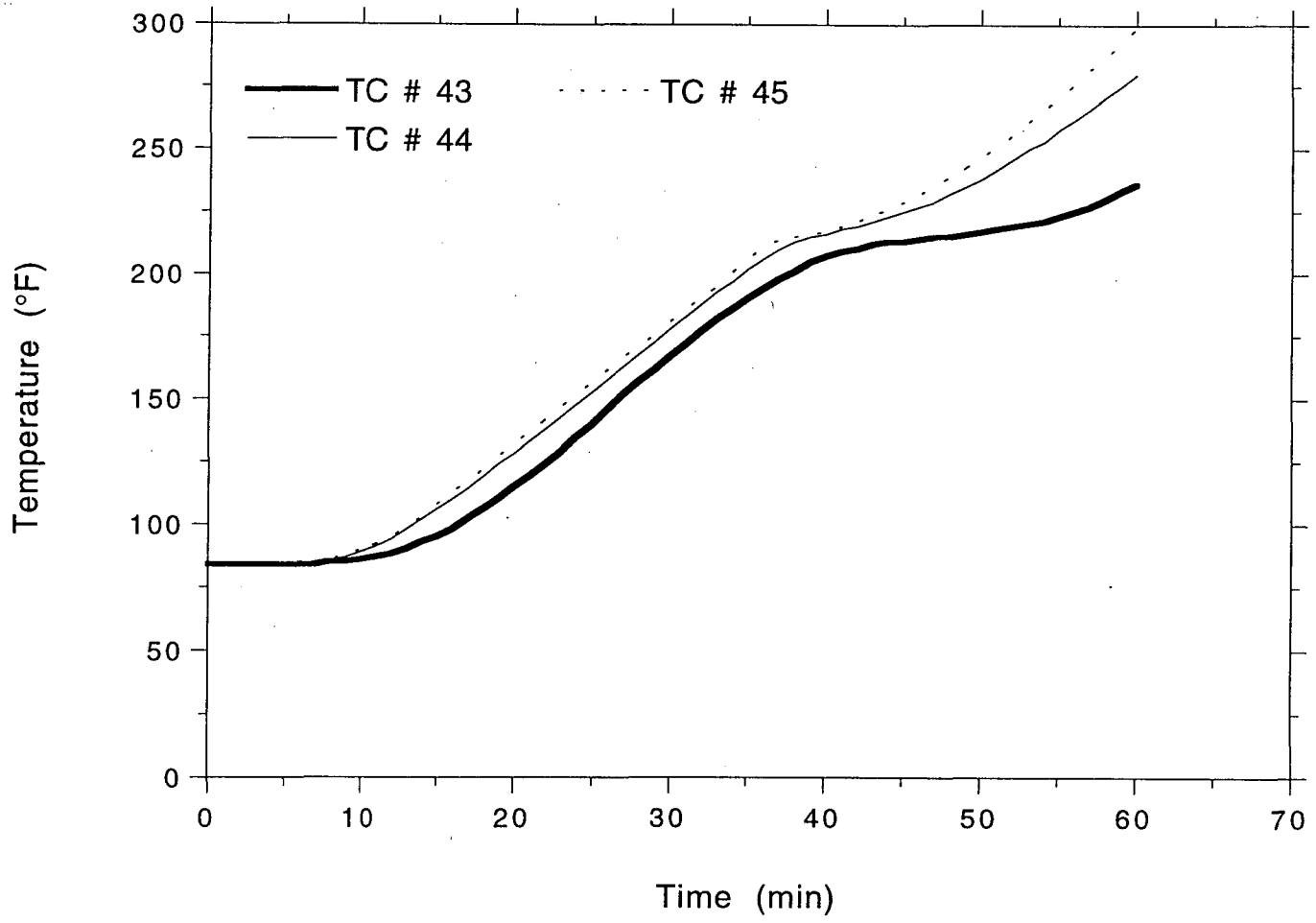
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Left Rail



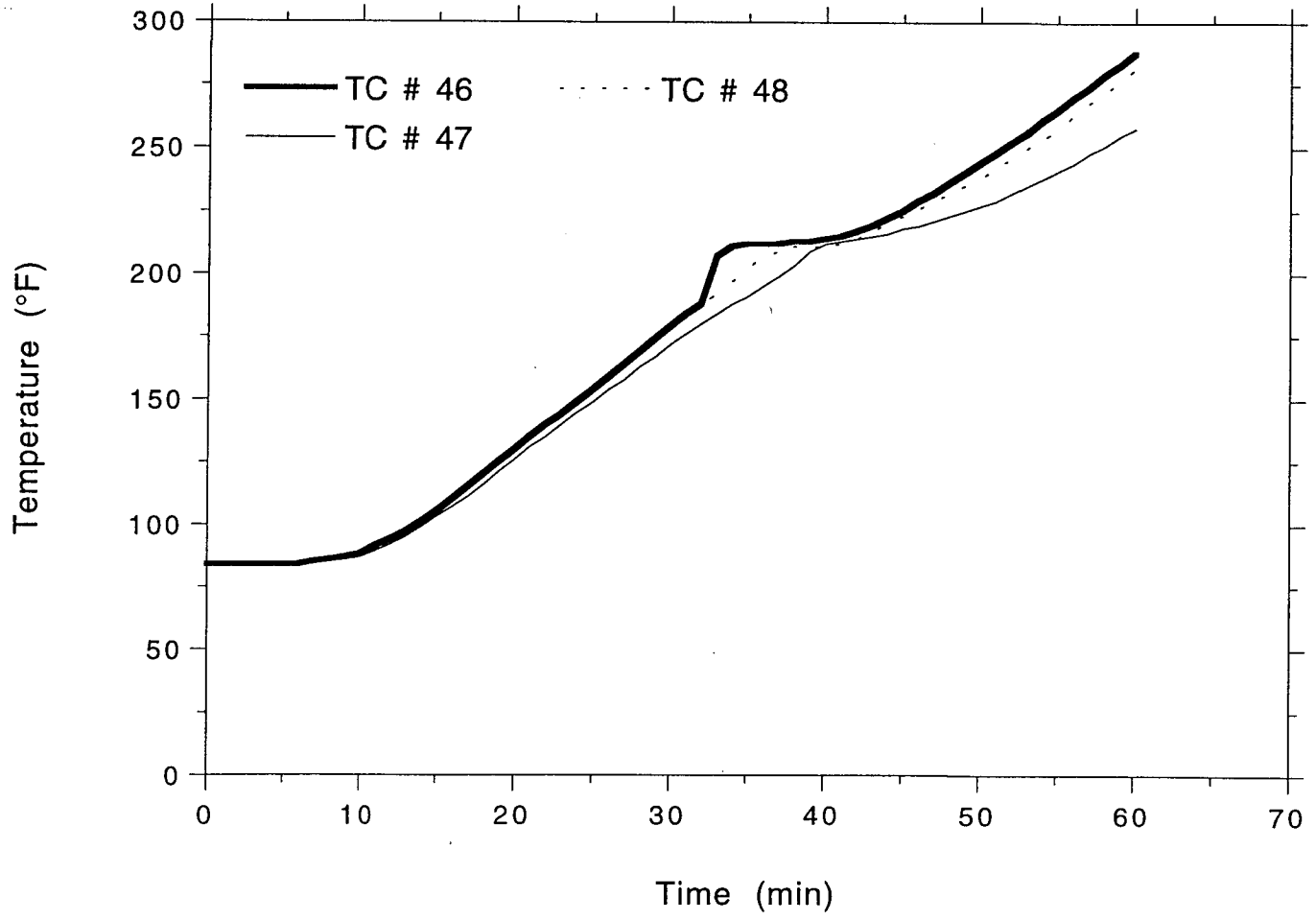
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Left Rail



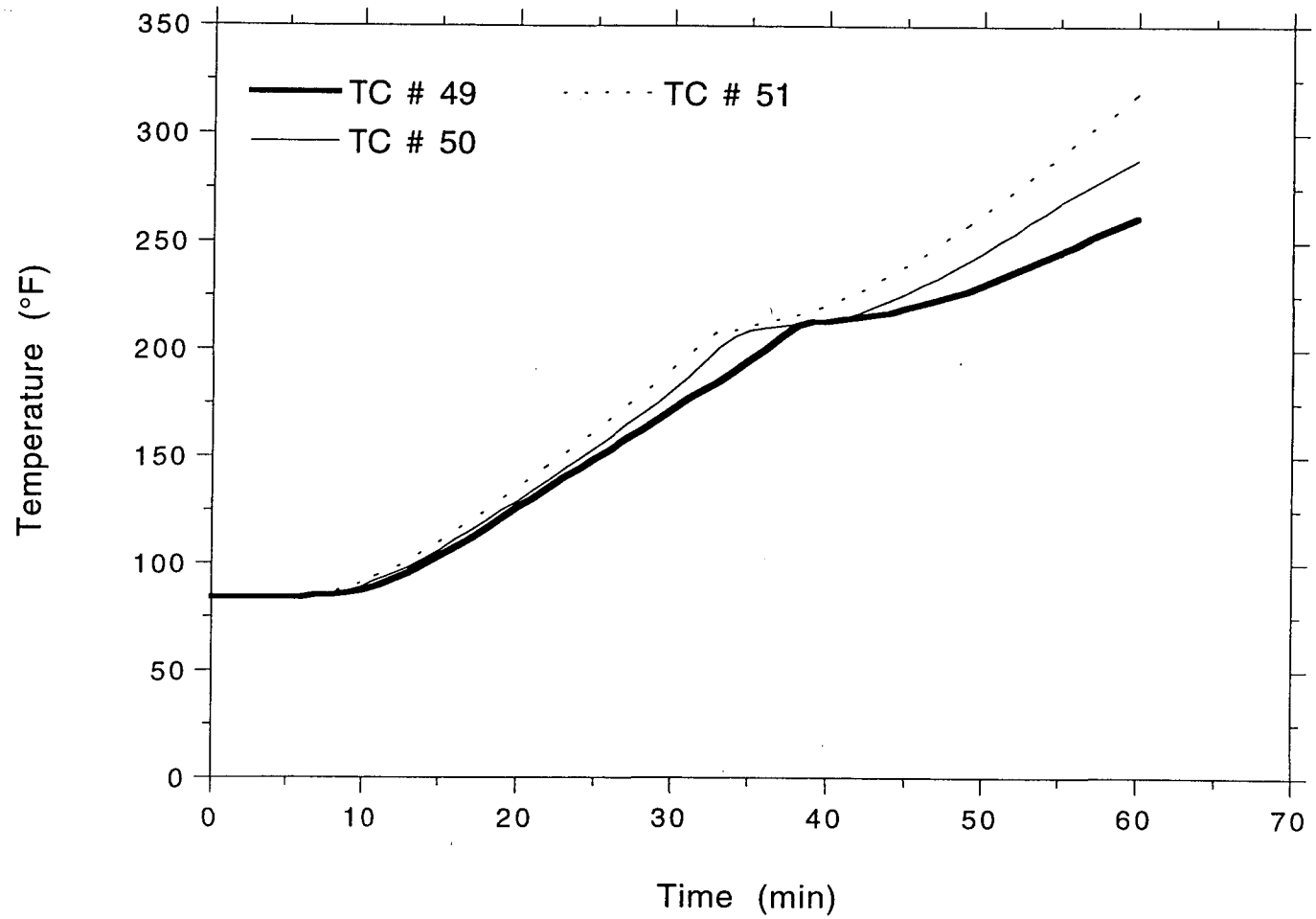
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Left Rail



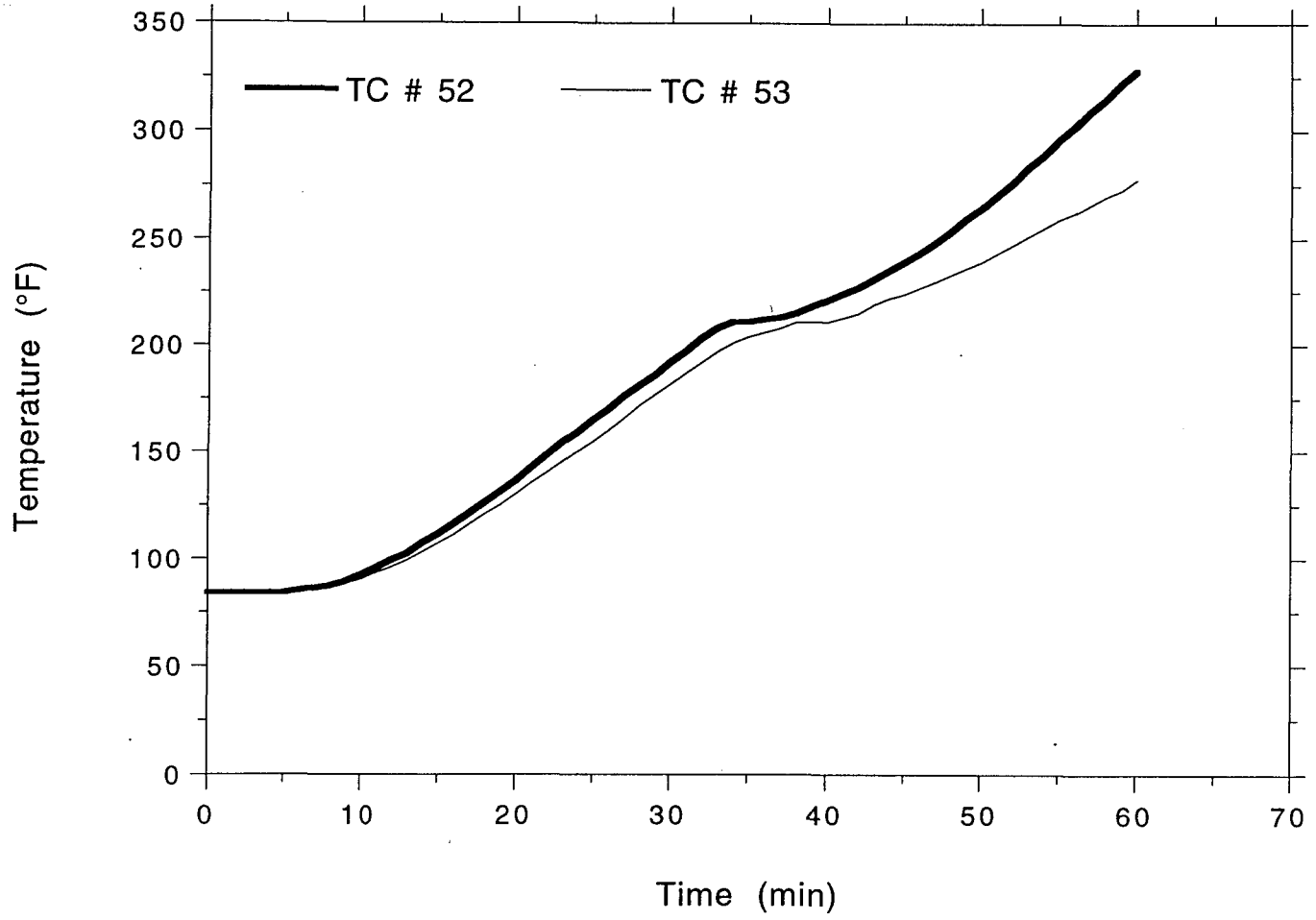
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Left Rail



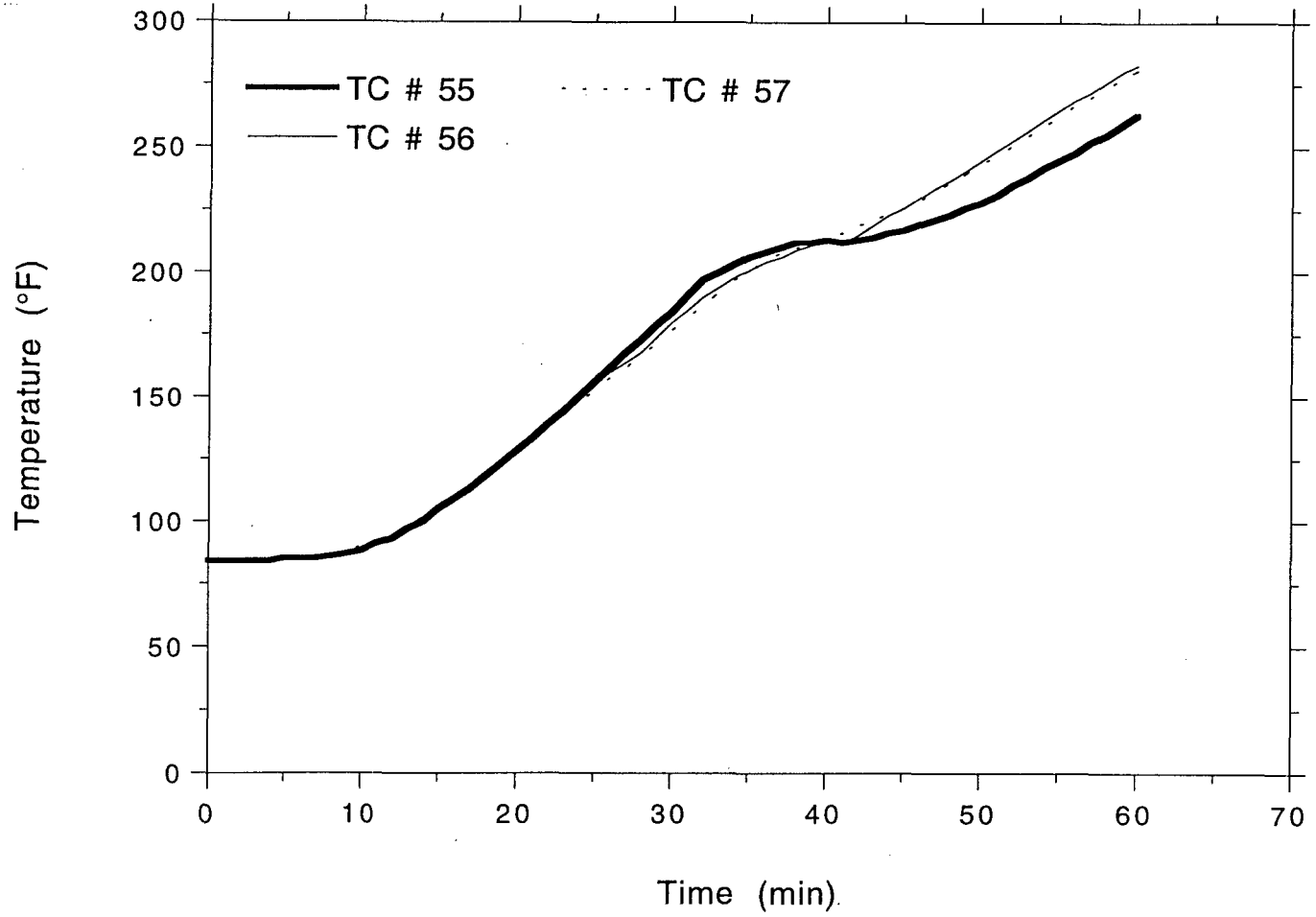
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Left Rail



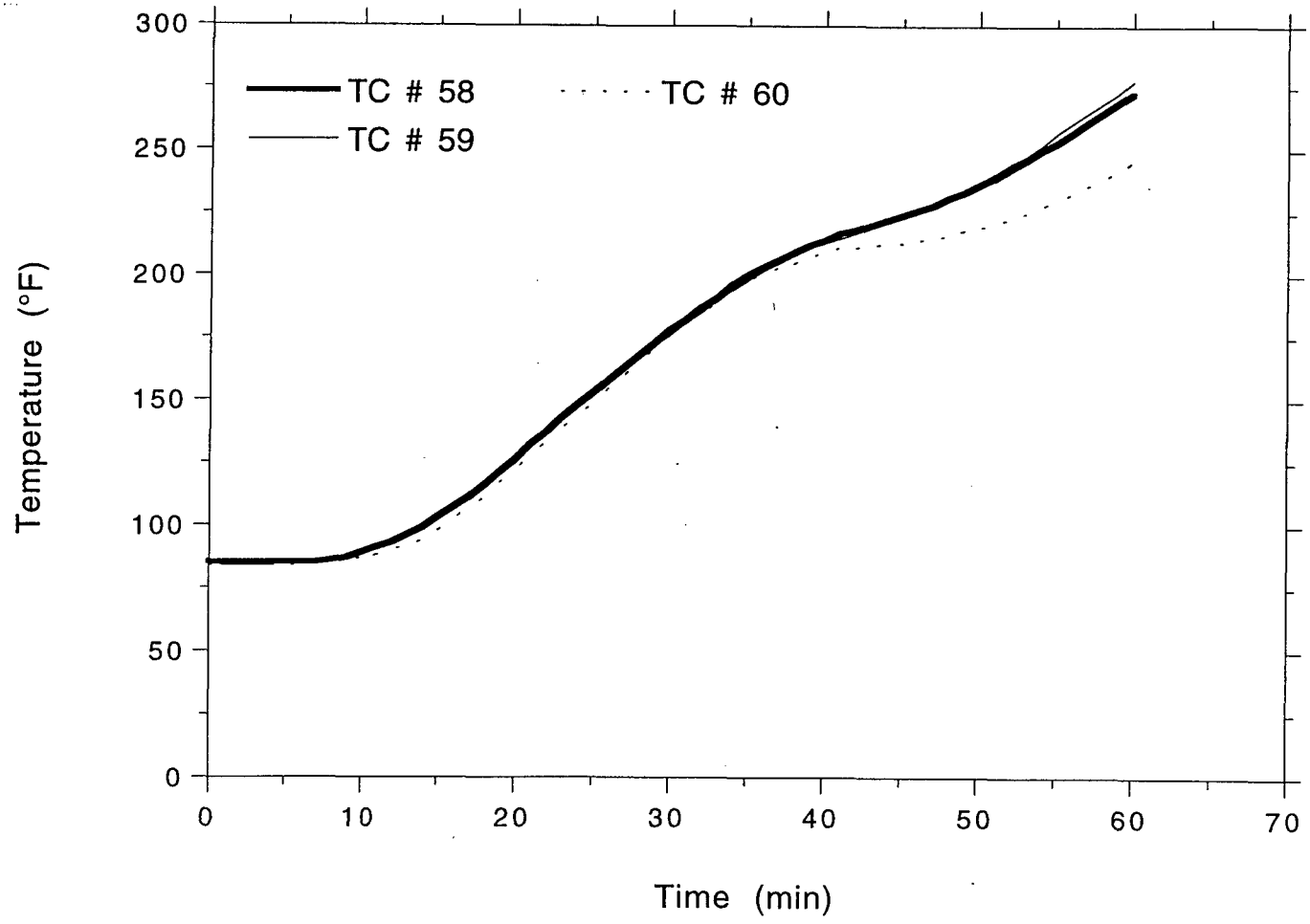
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Right Rail



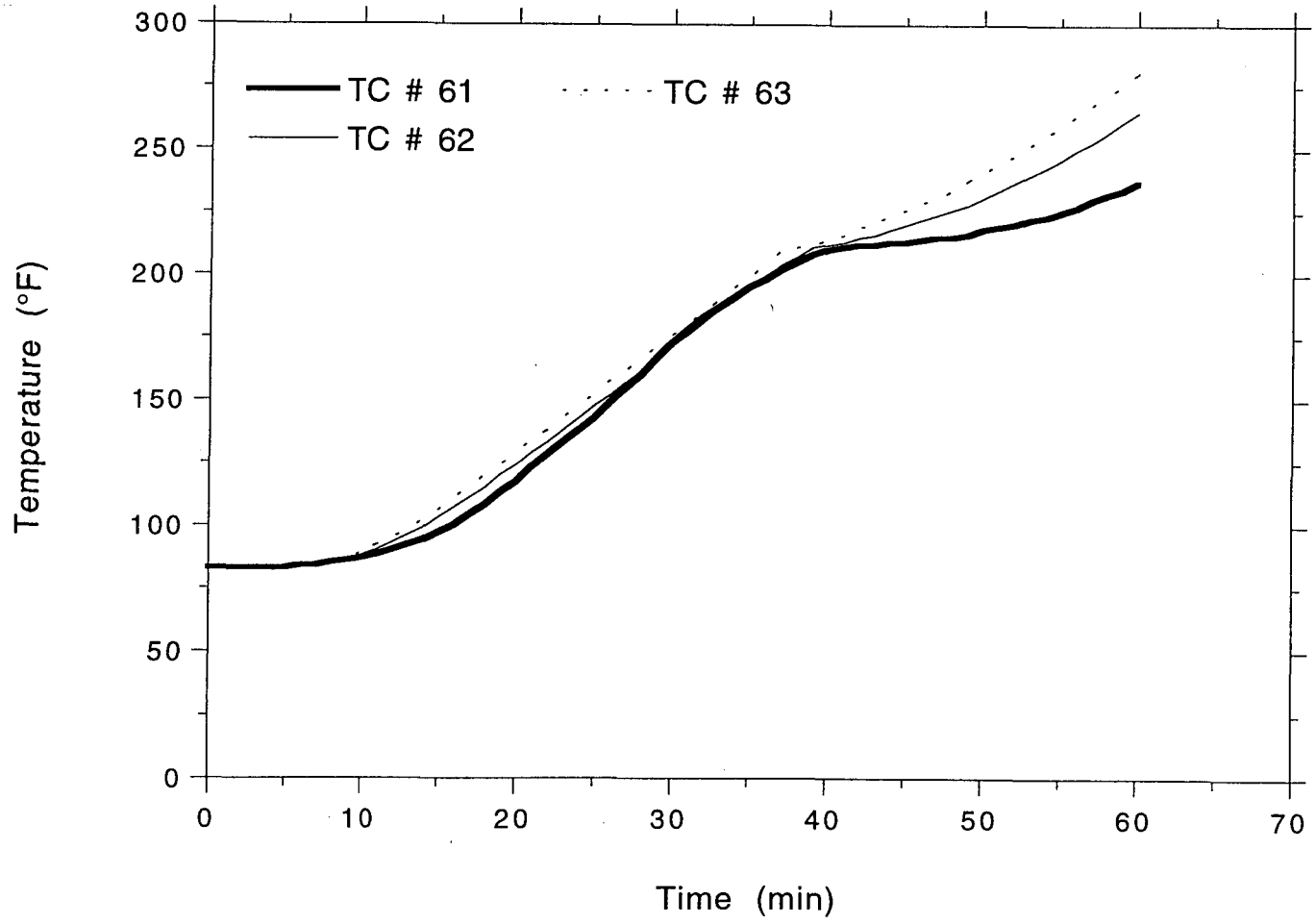
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Right Rail



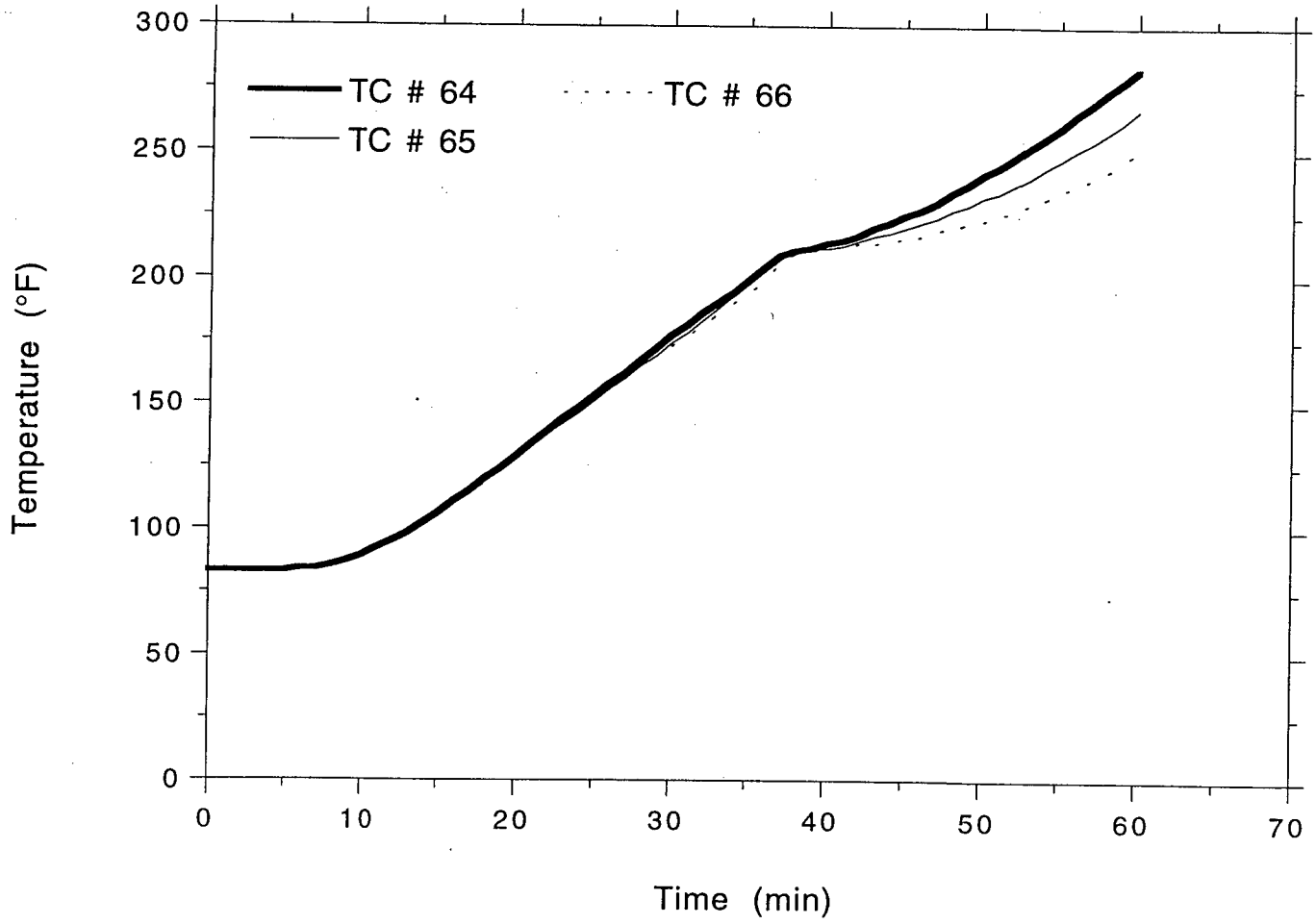
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Right Rail



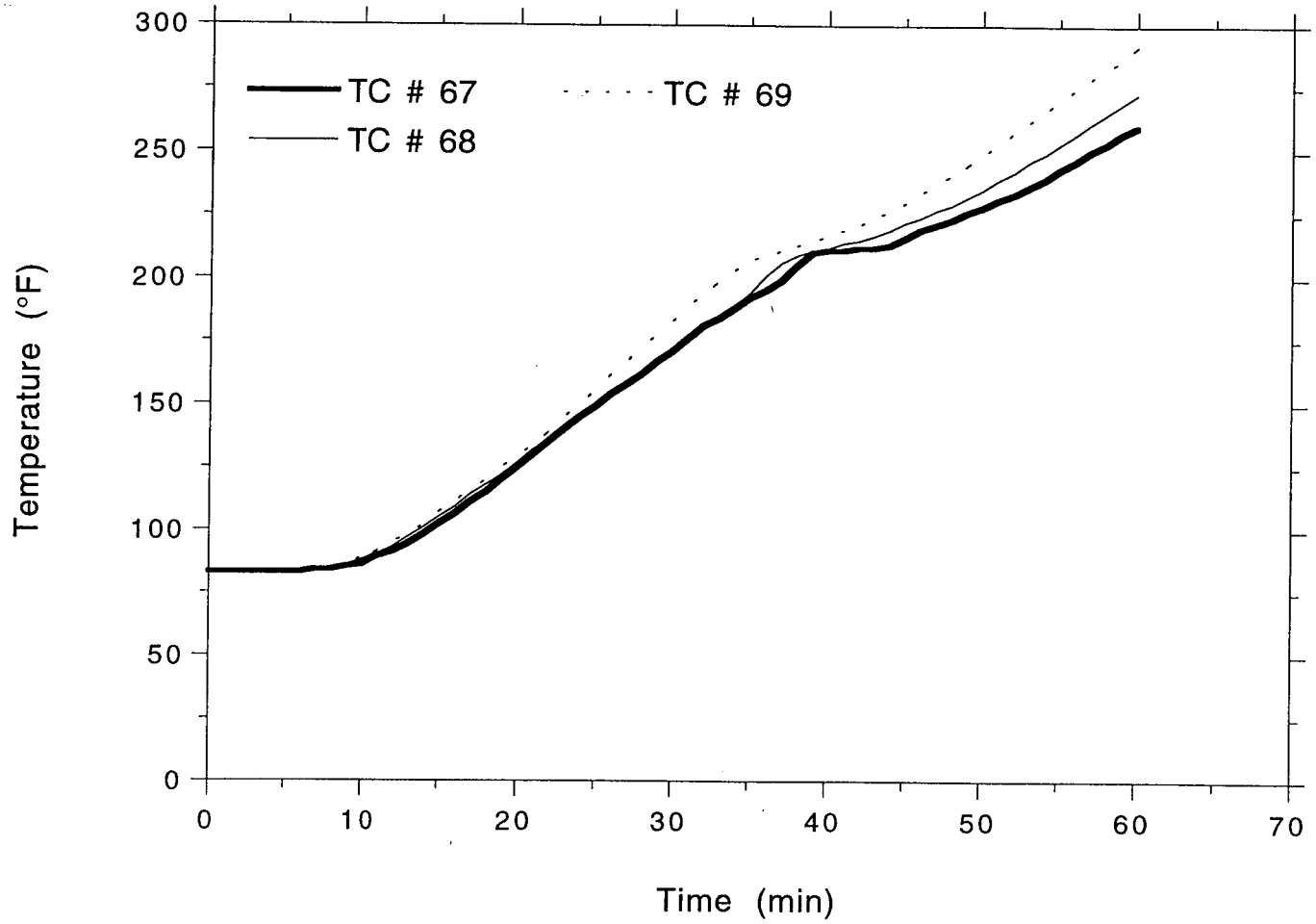
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Right Rail



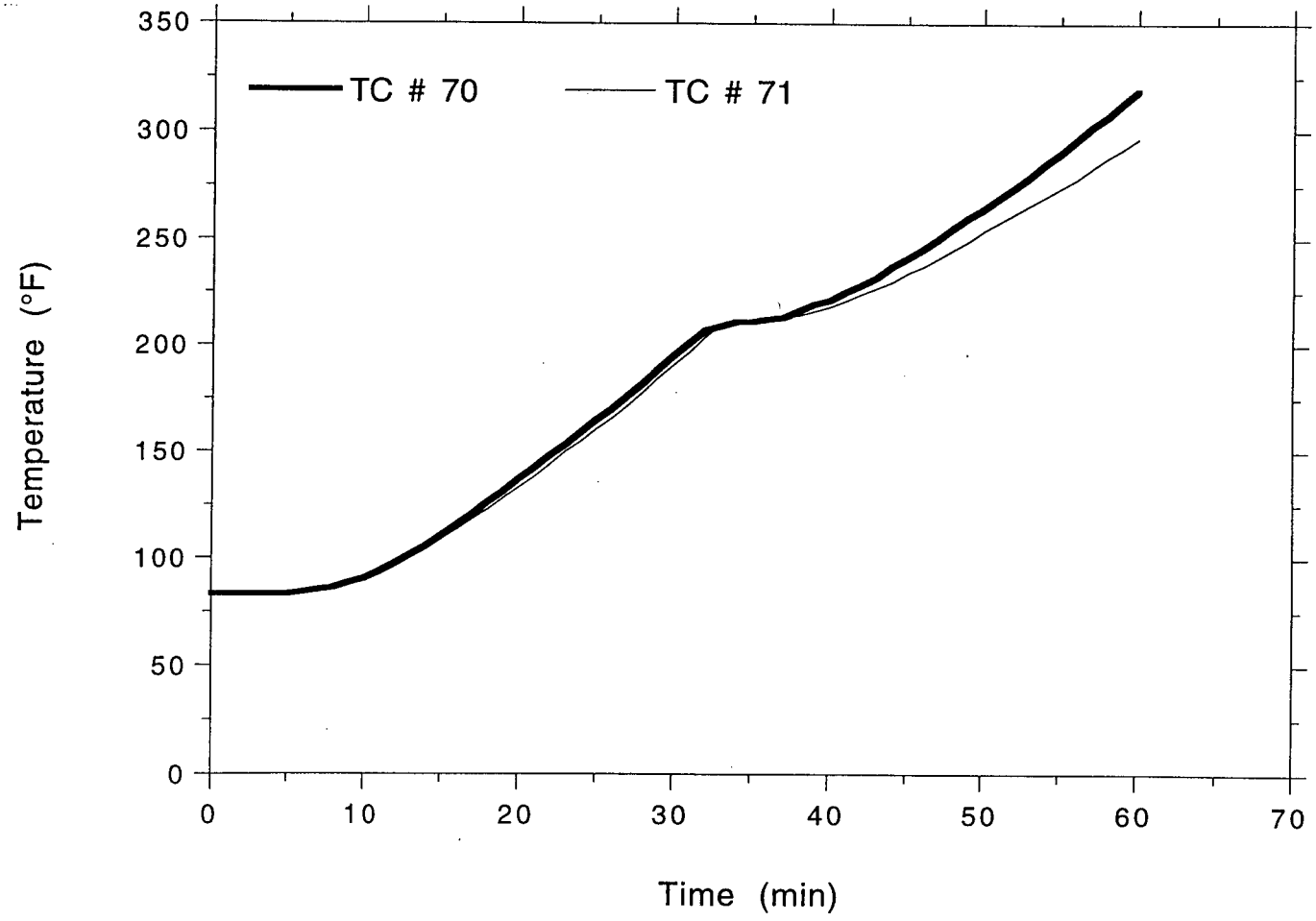
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Right Rail



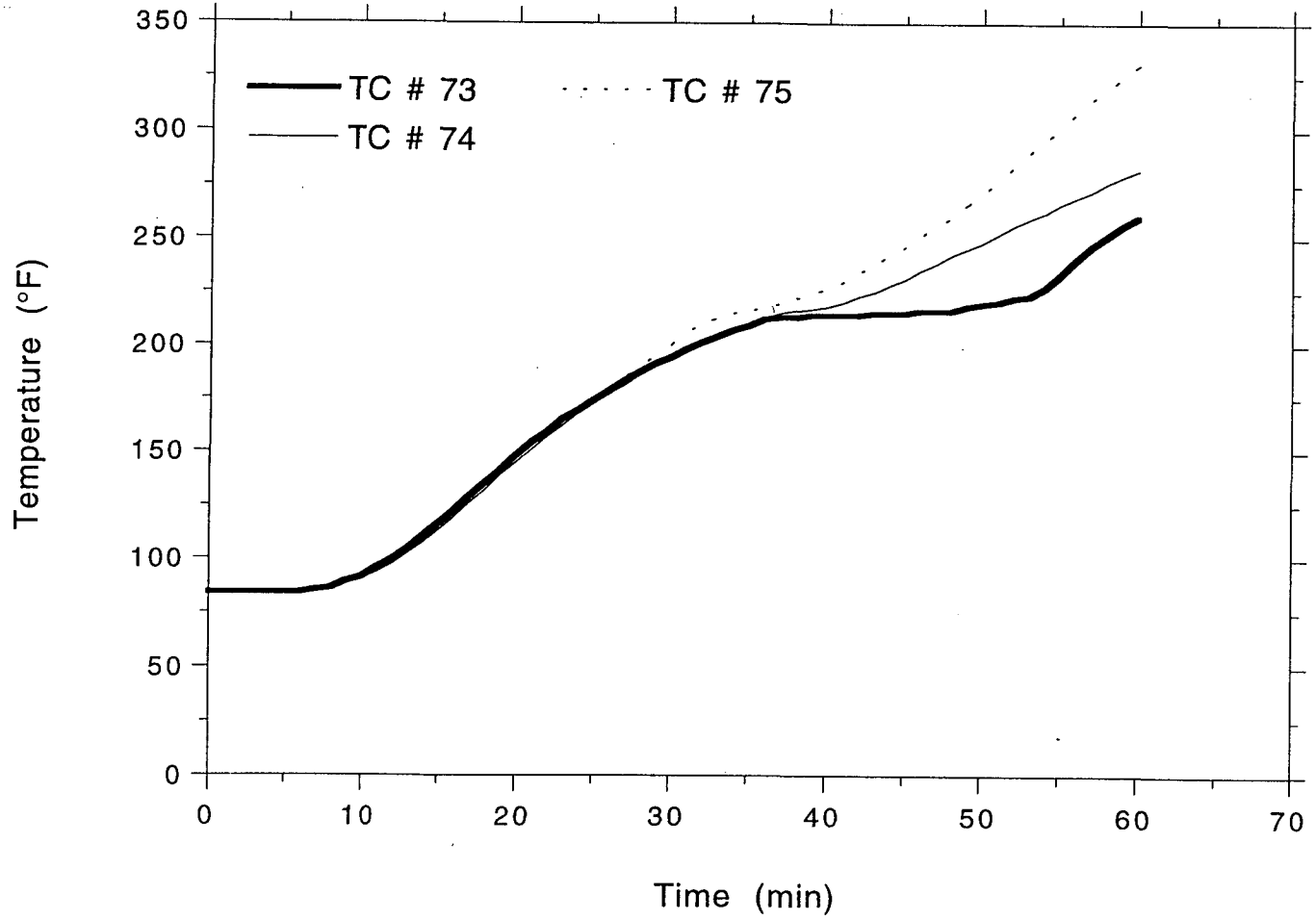
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, Right Rail



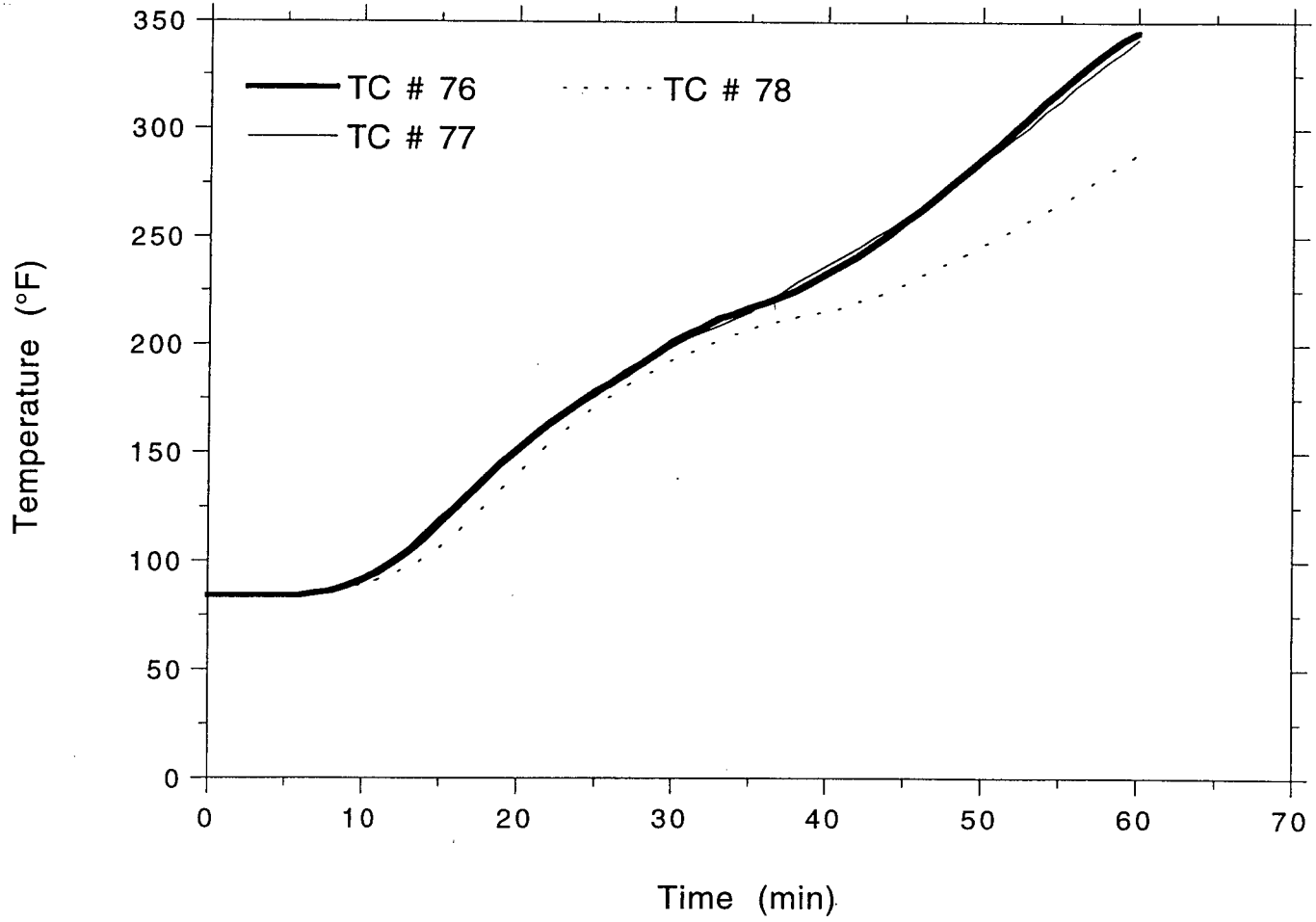
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Left Rail



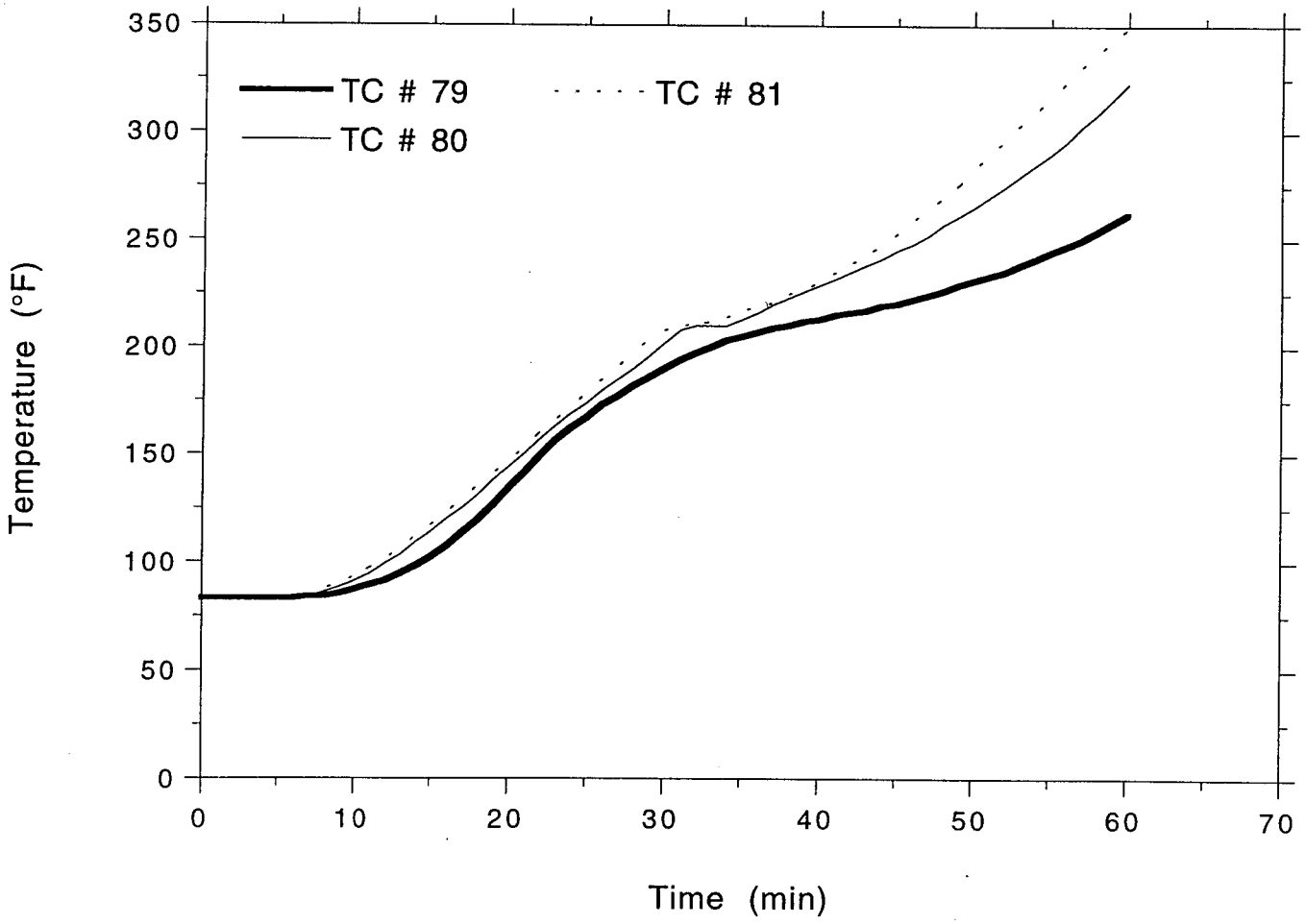
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Left Rail



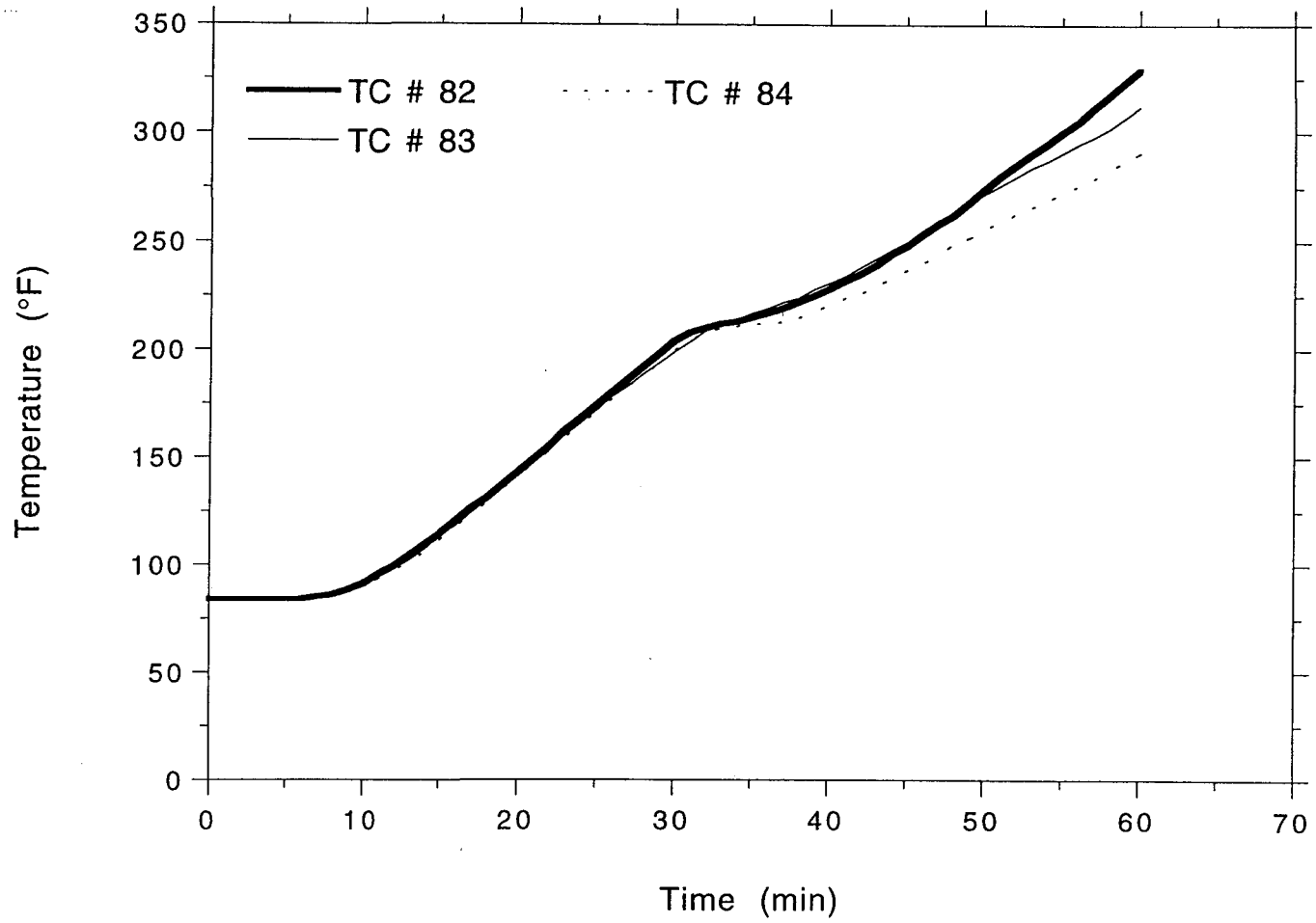
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Left Rail



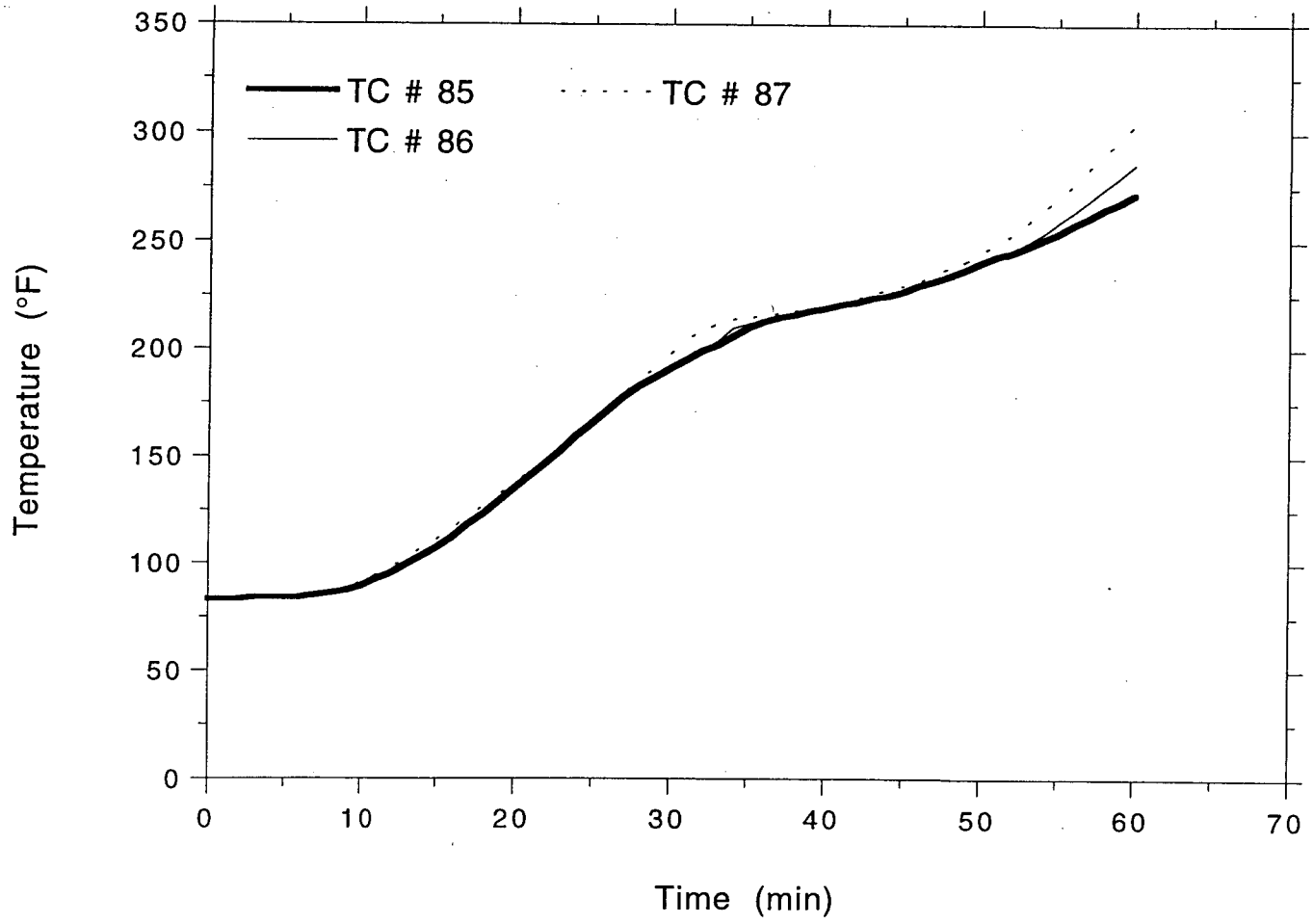
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Left Rail



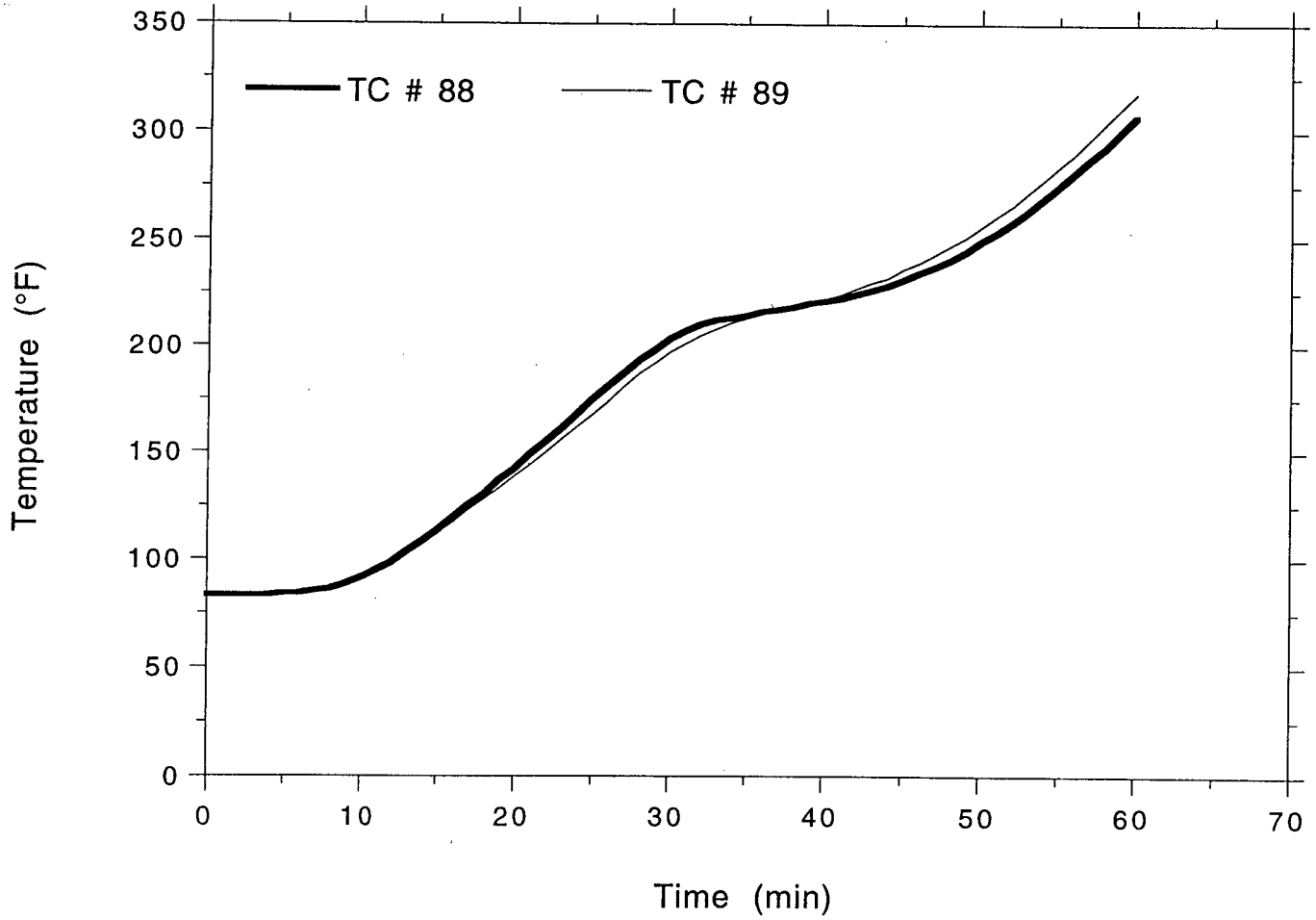
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Left Rail



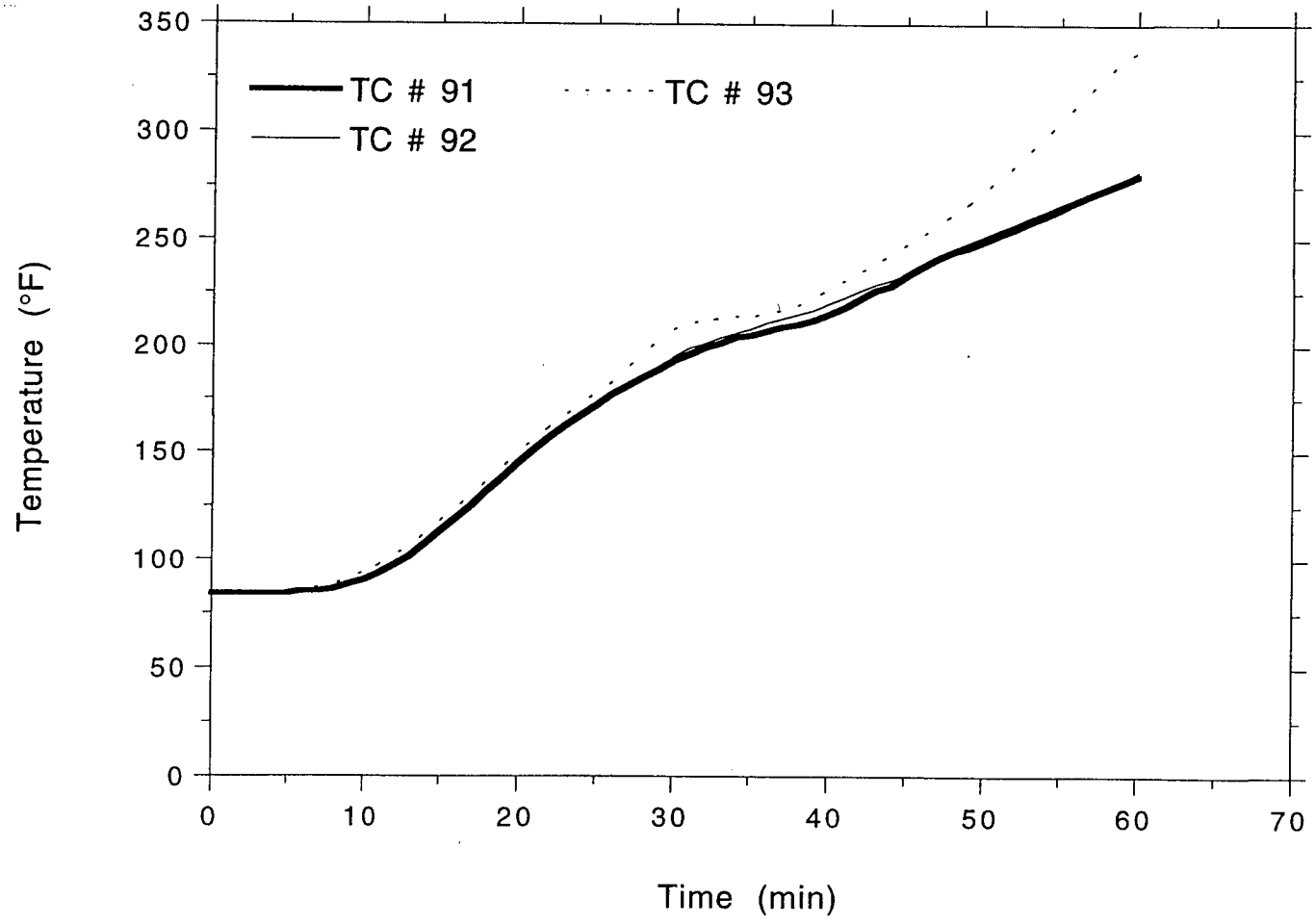
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Left Rail



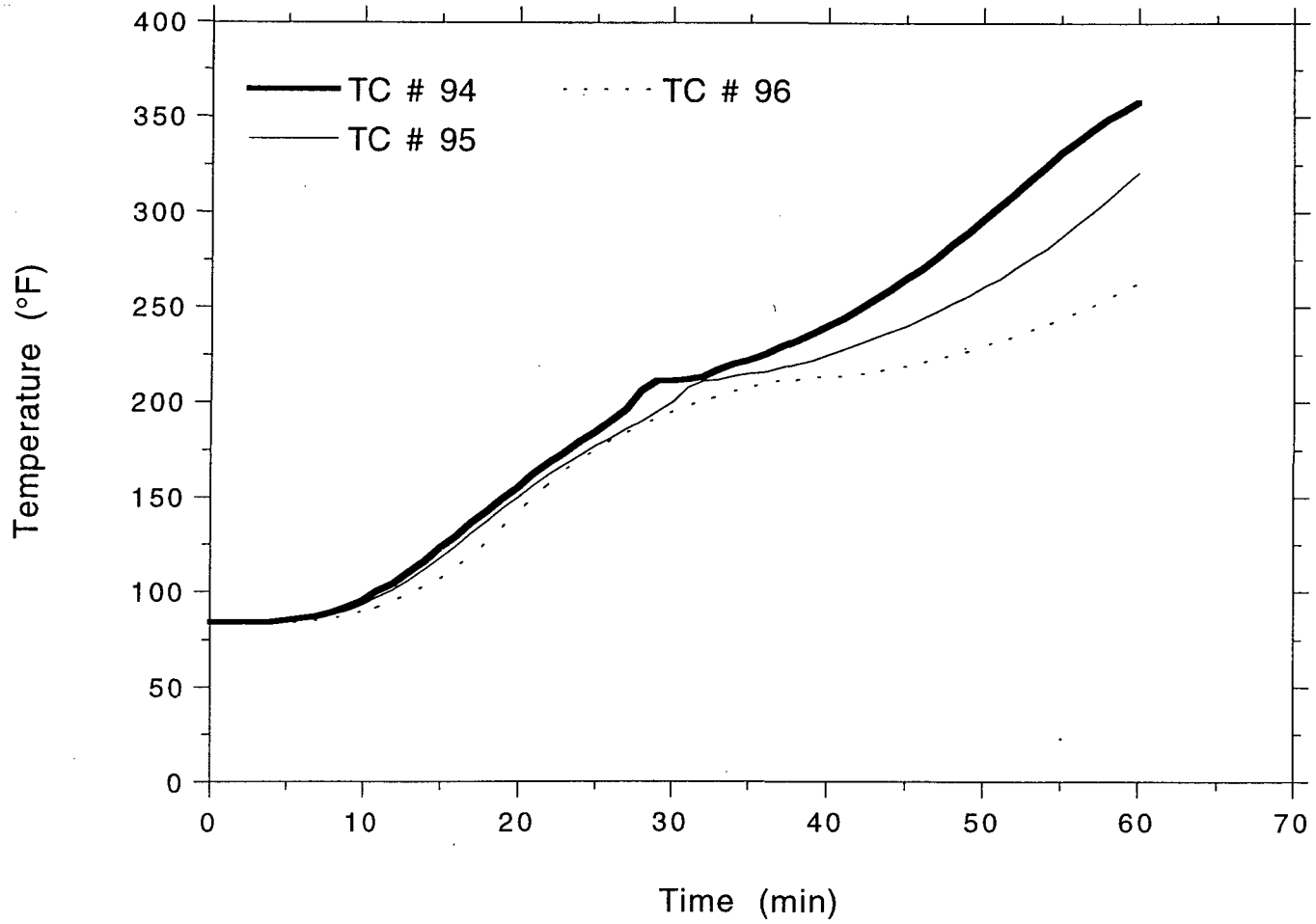
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Right Rail



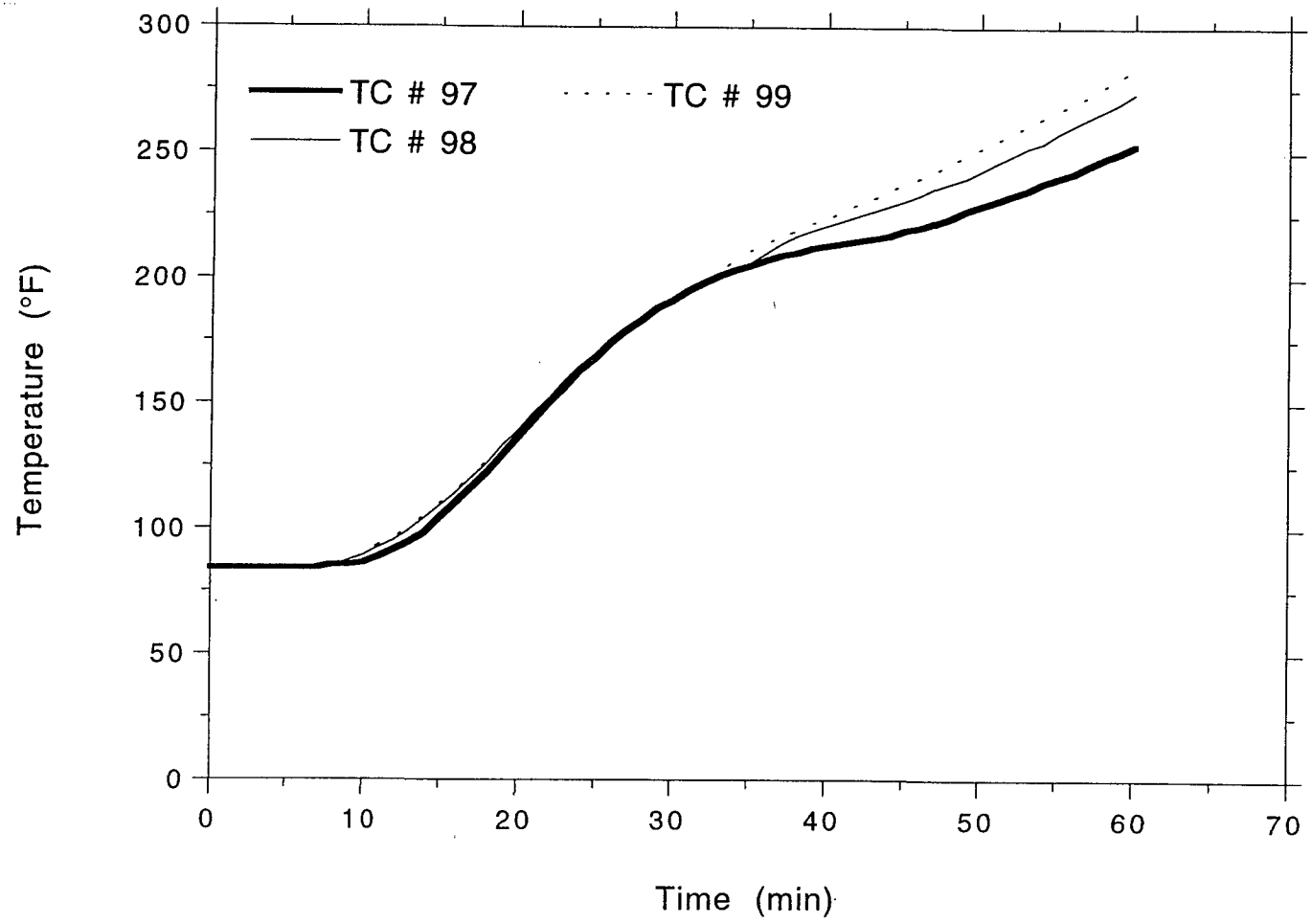
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Right Rail



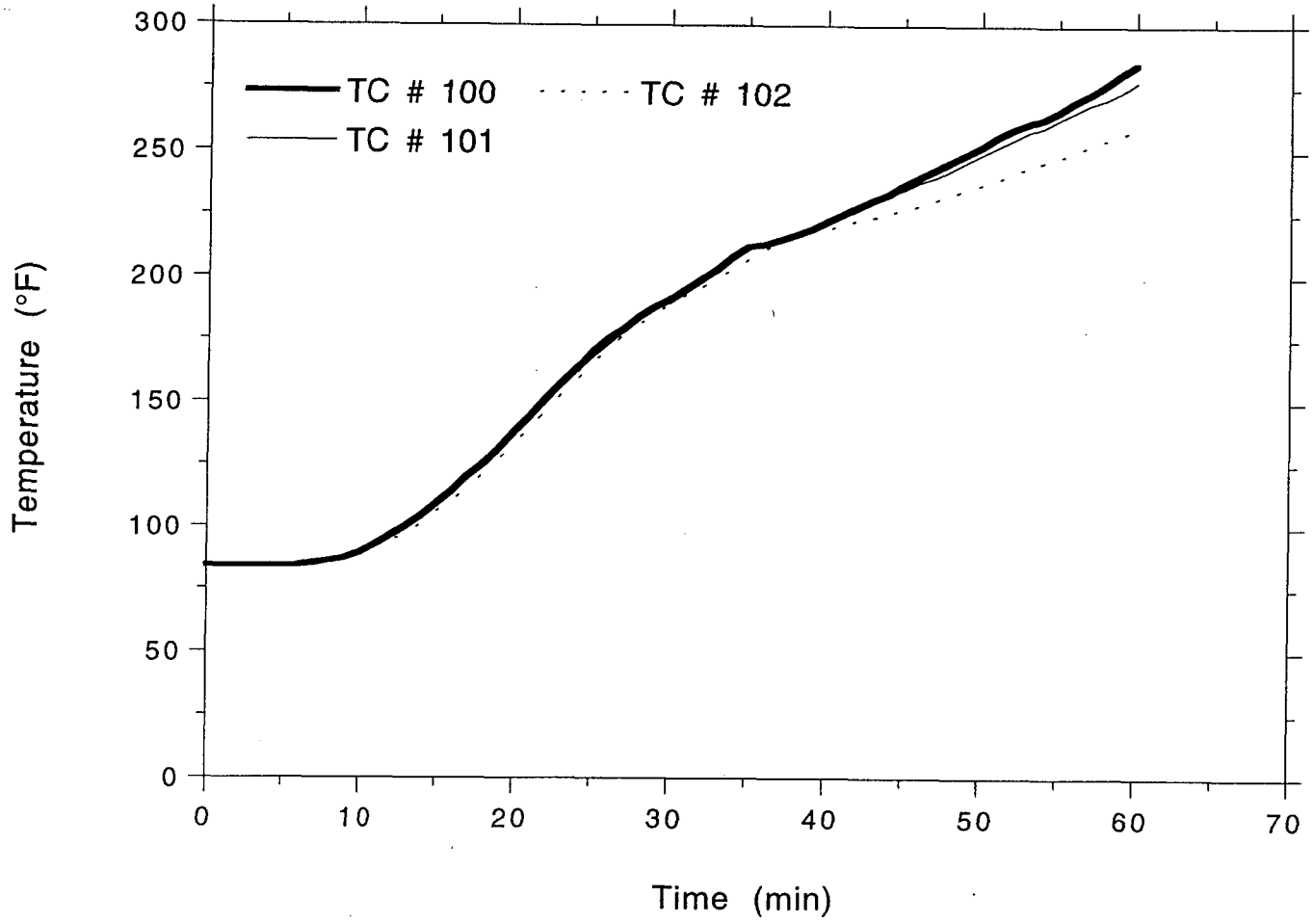
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Right Rail



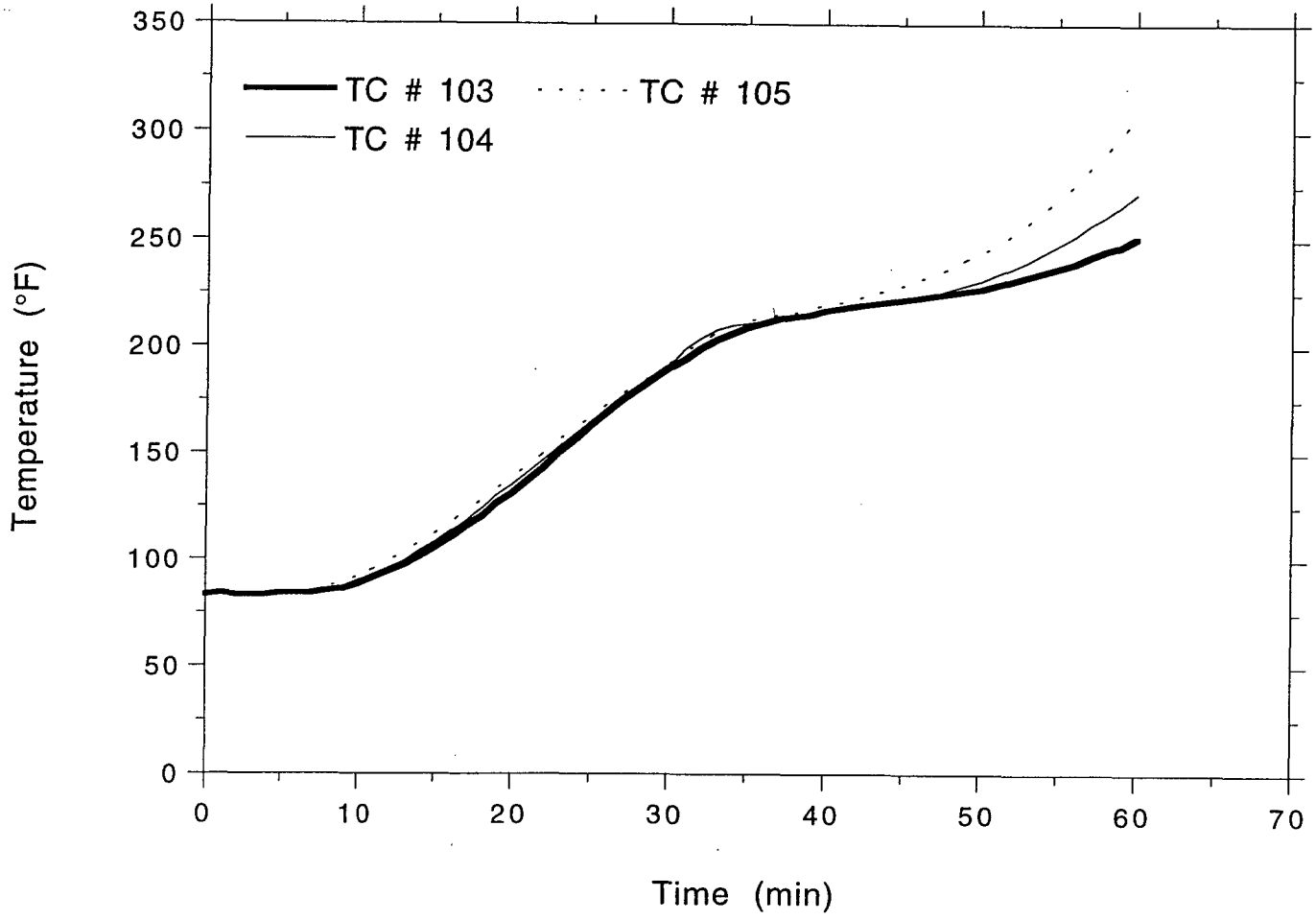
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Right Rail



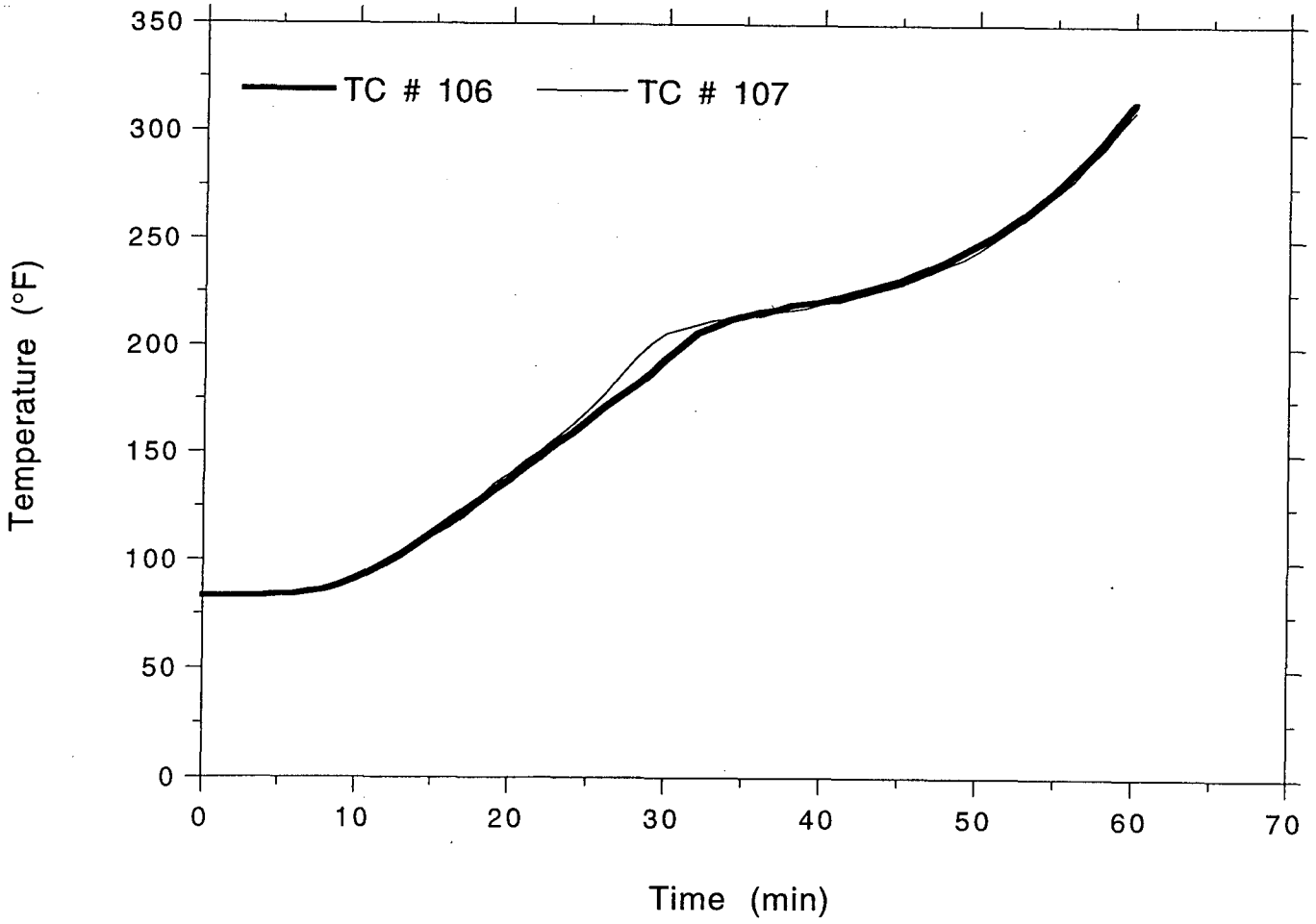
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Right Rail



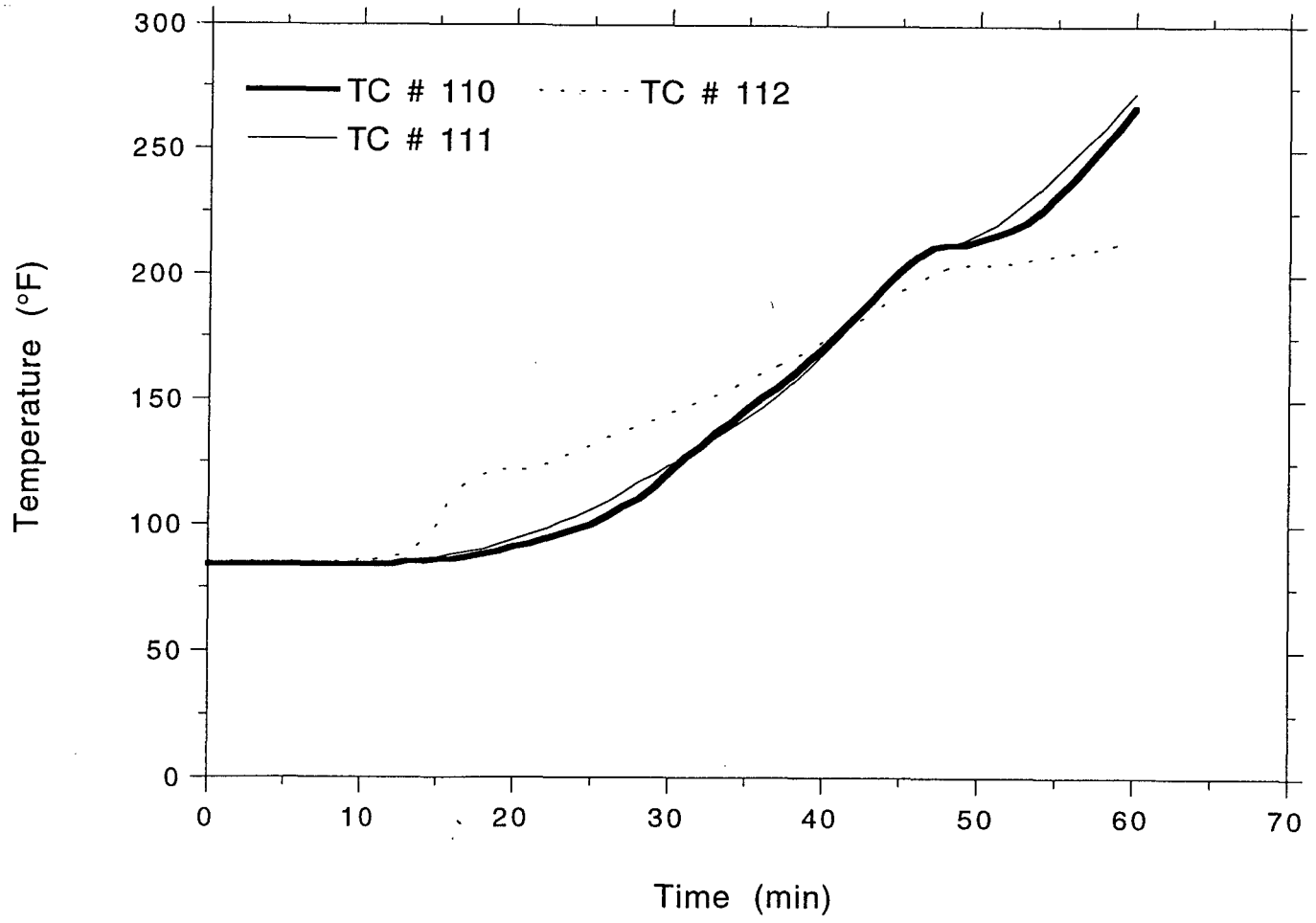
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, Right Rail



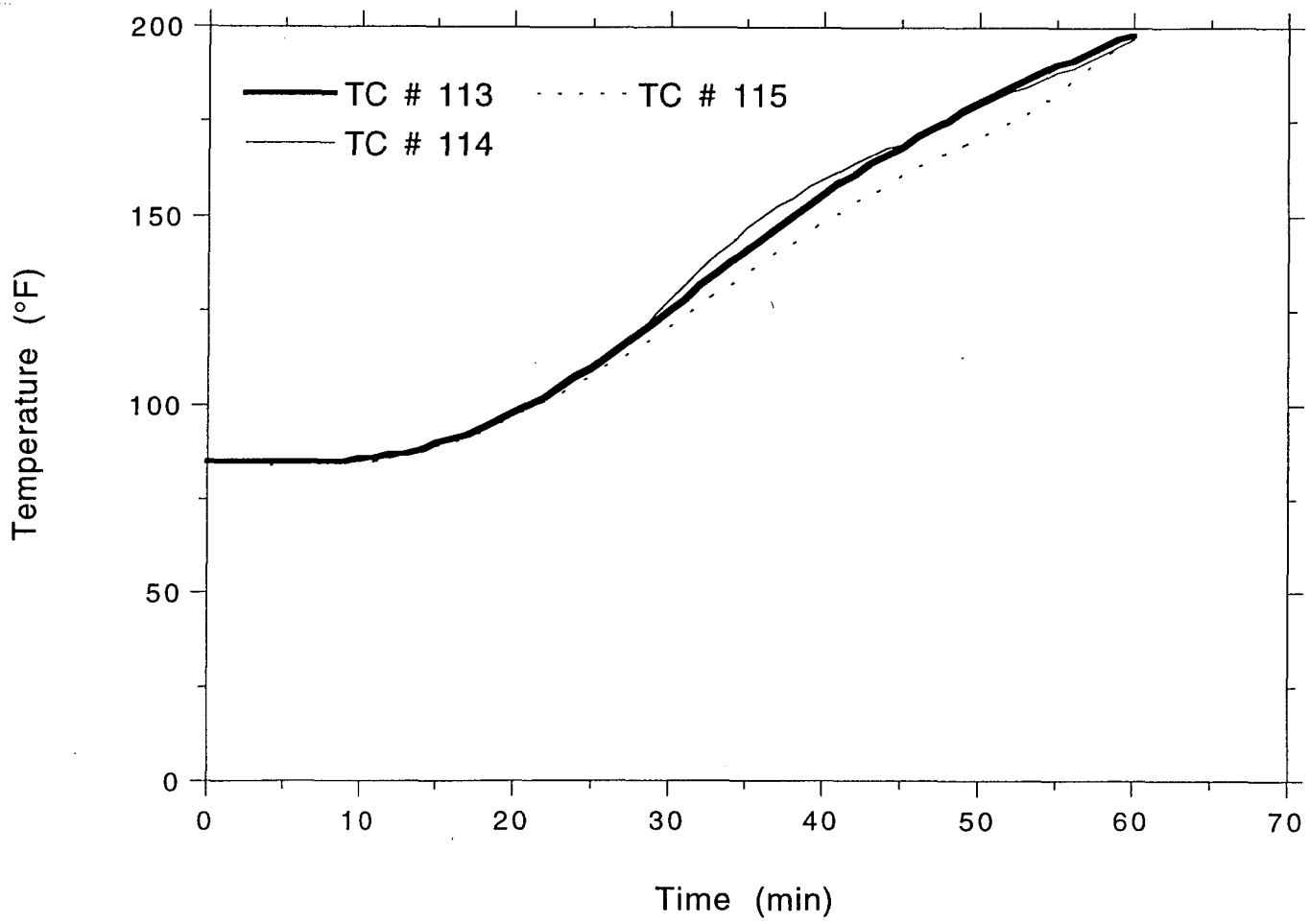
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Conduit Surface



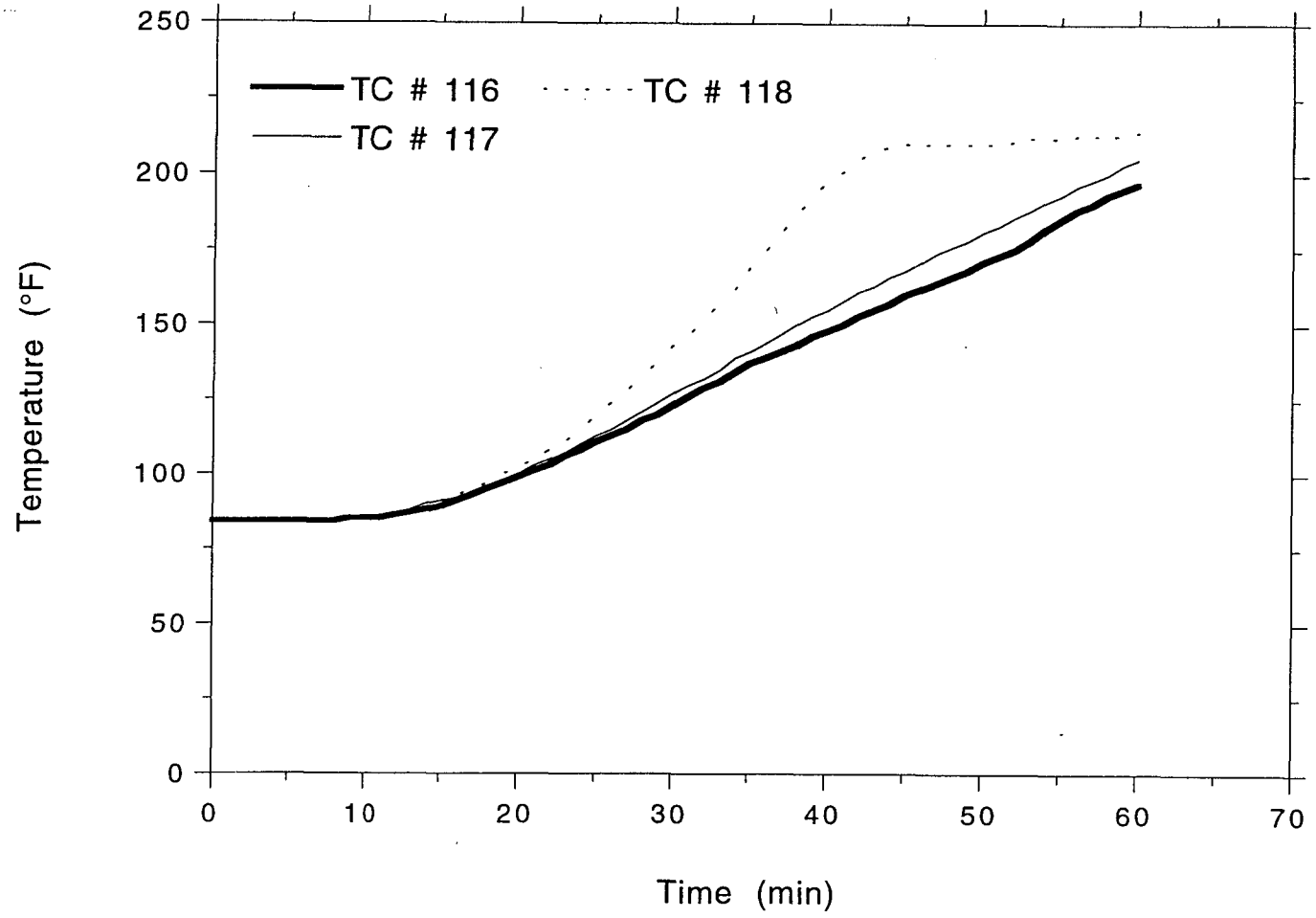
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Conduit Surface



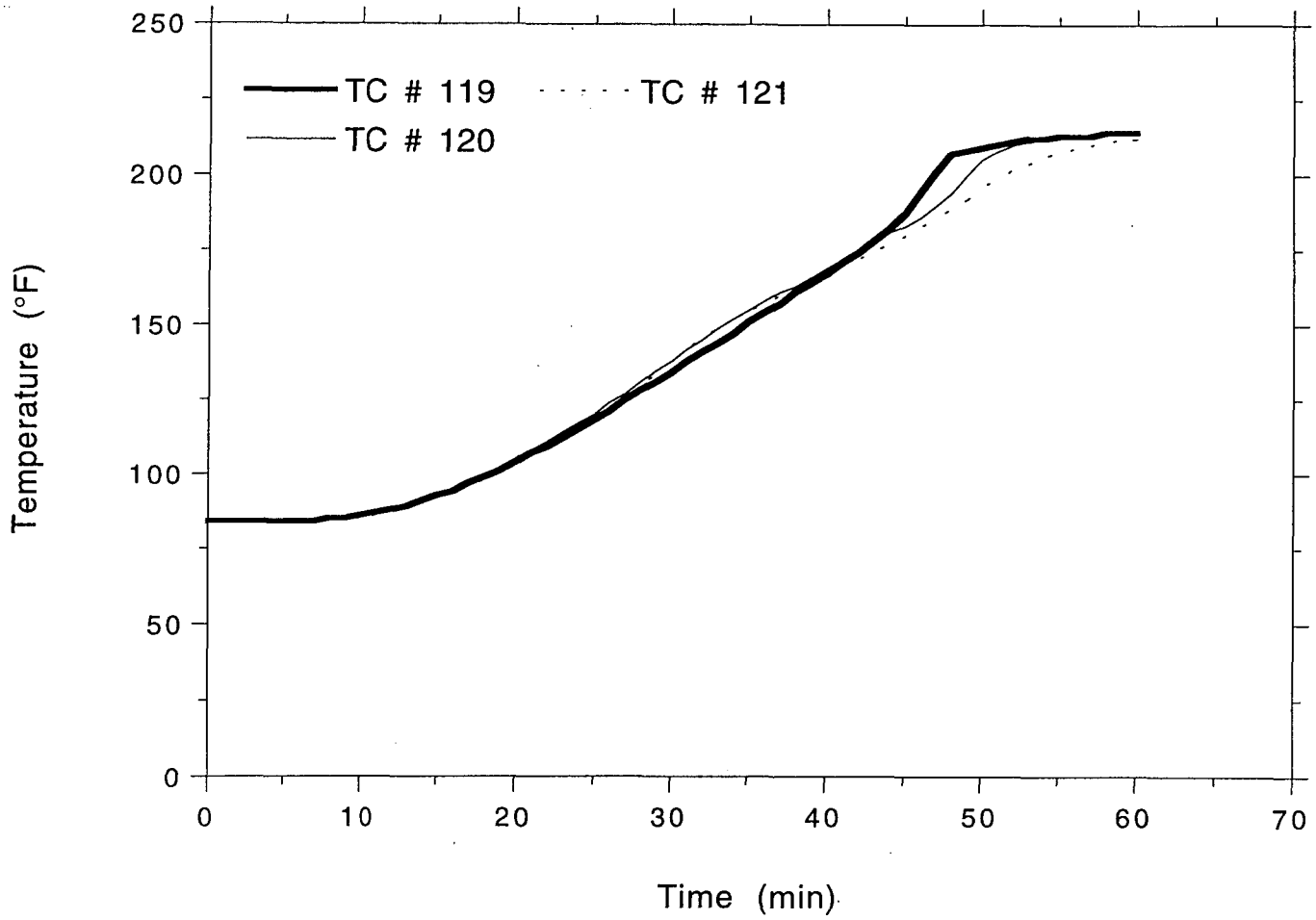
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Conduit Surface



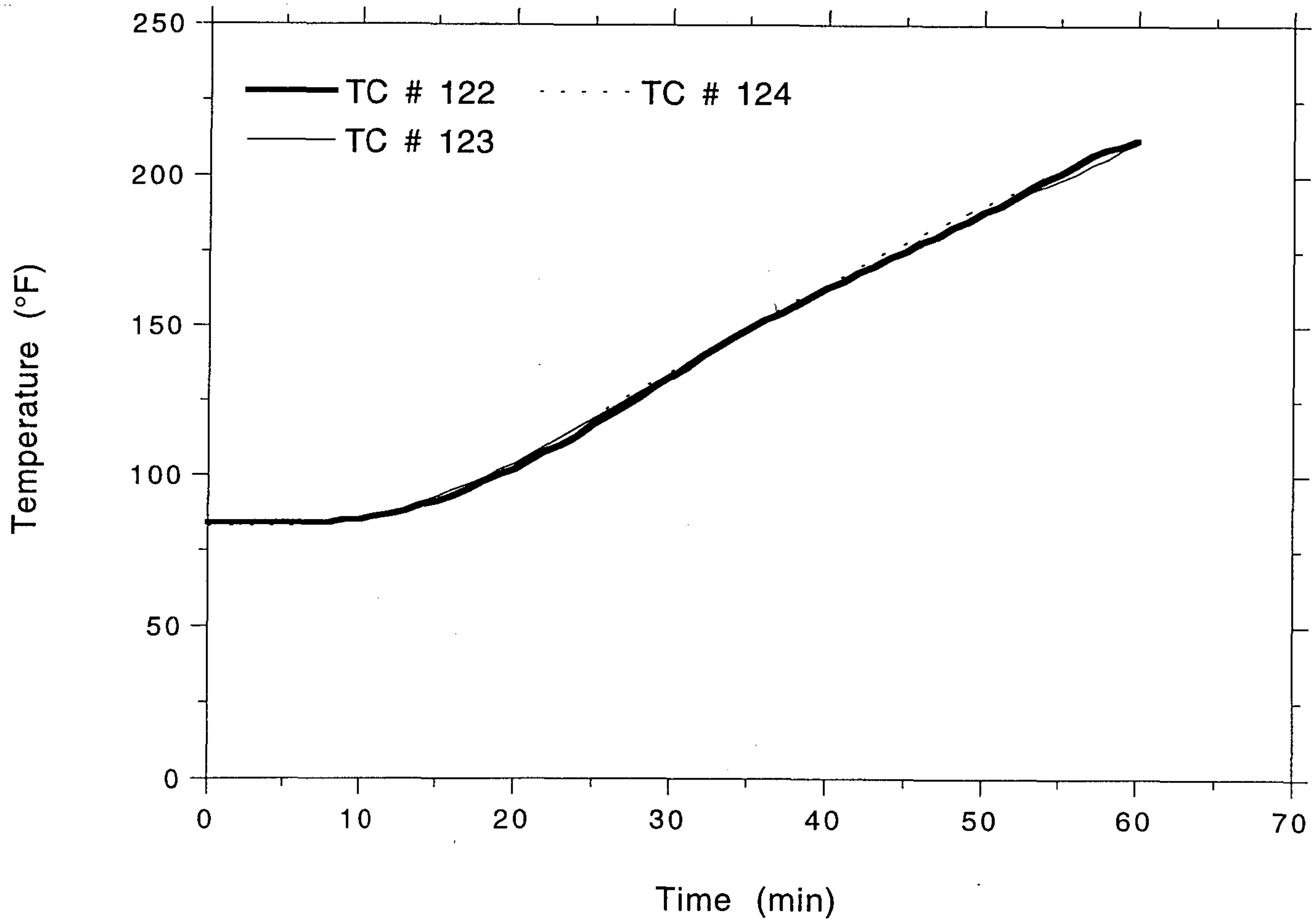
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Conduit Surface



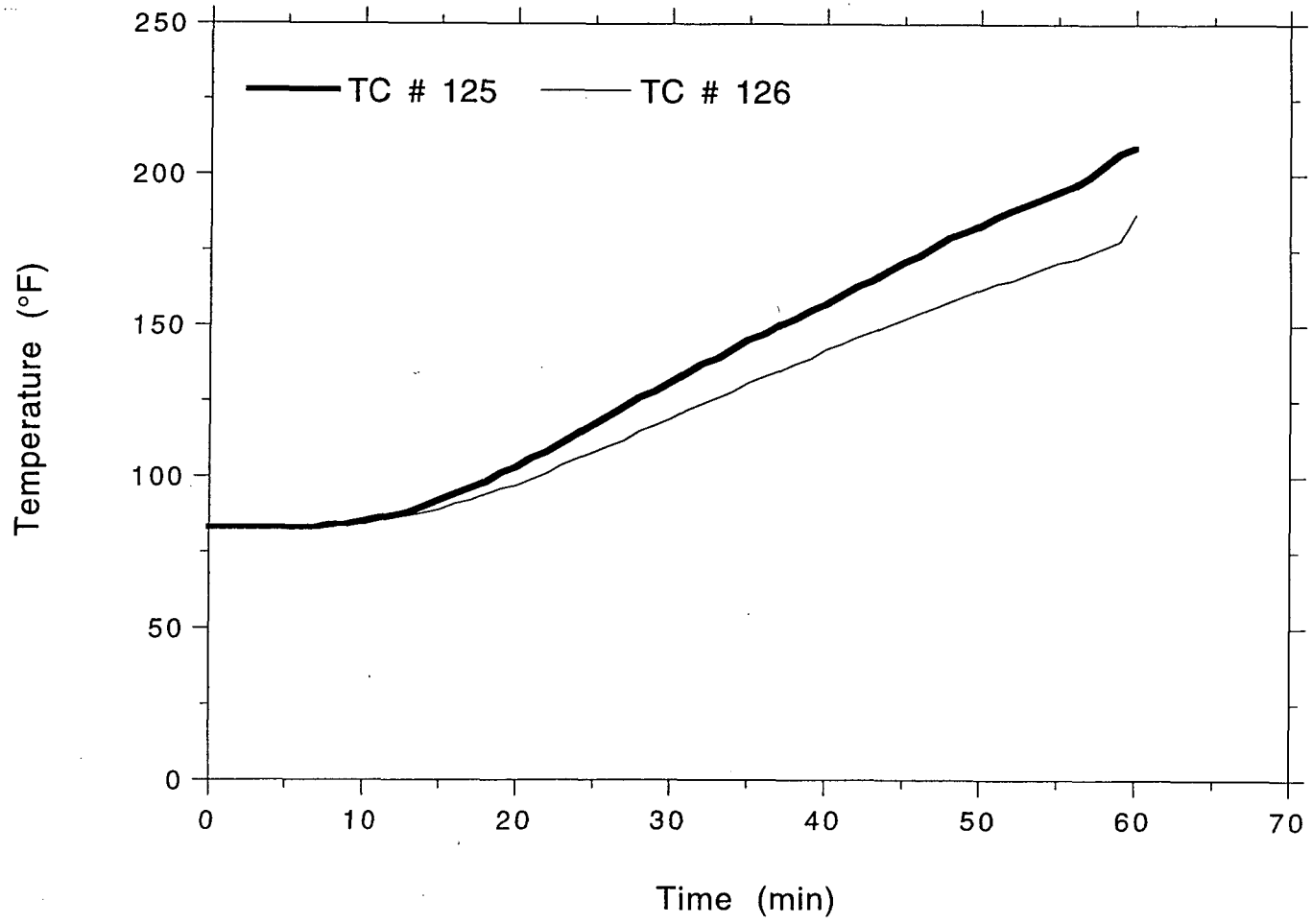
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Conduit Surface



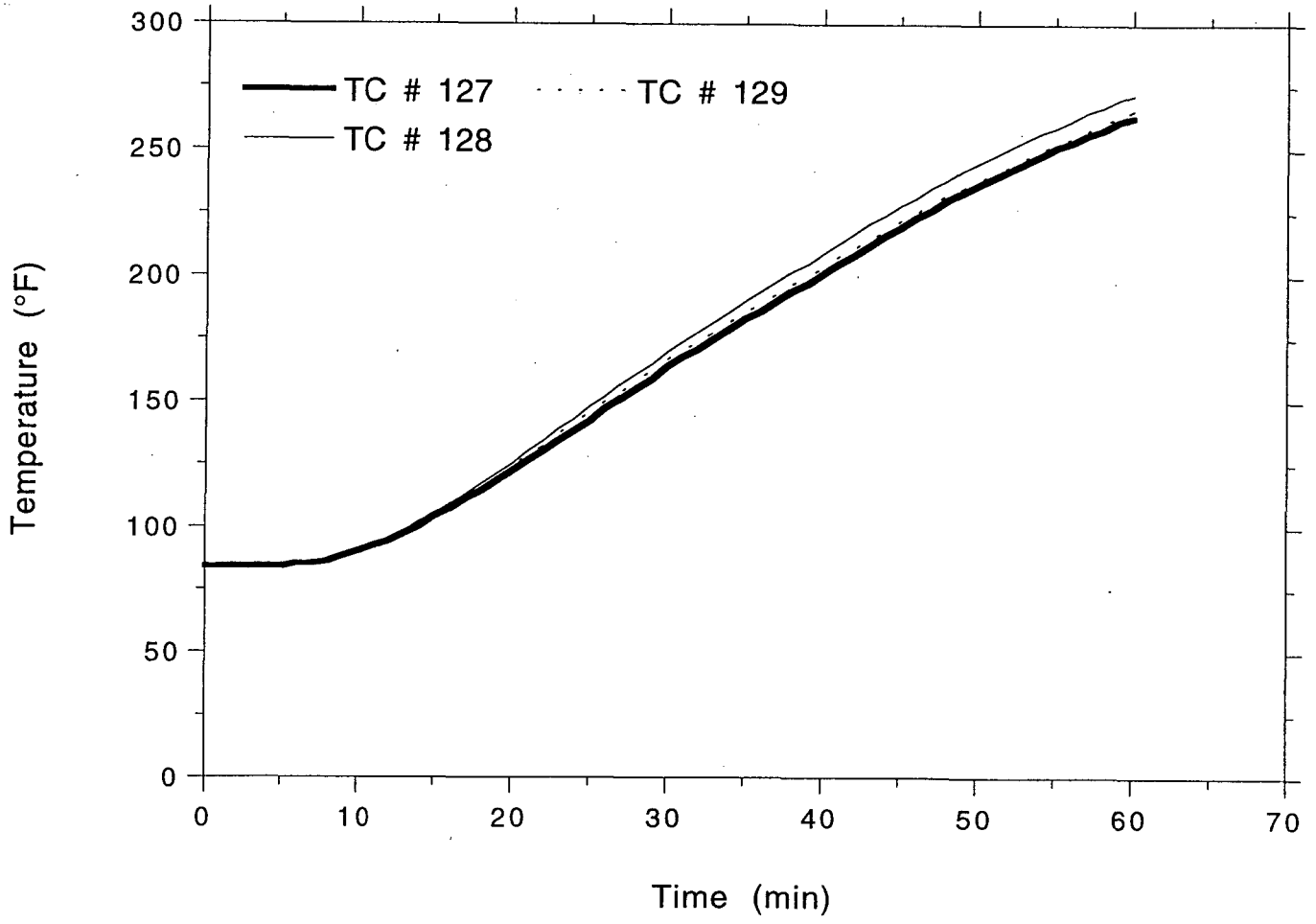
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Conduit Surface



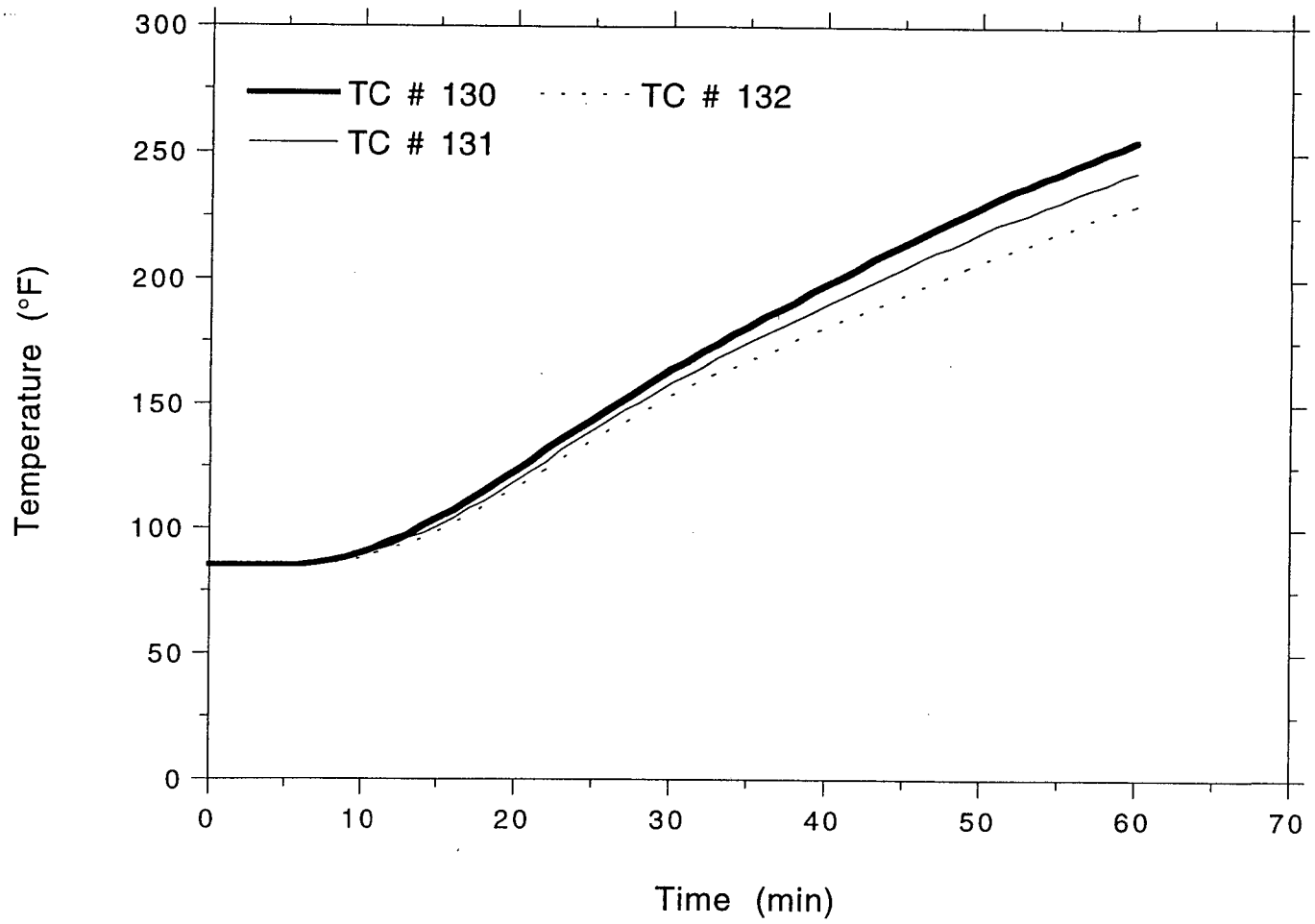
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 under Rungs



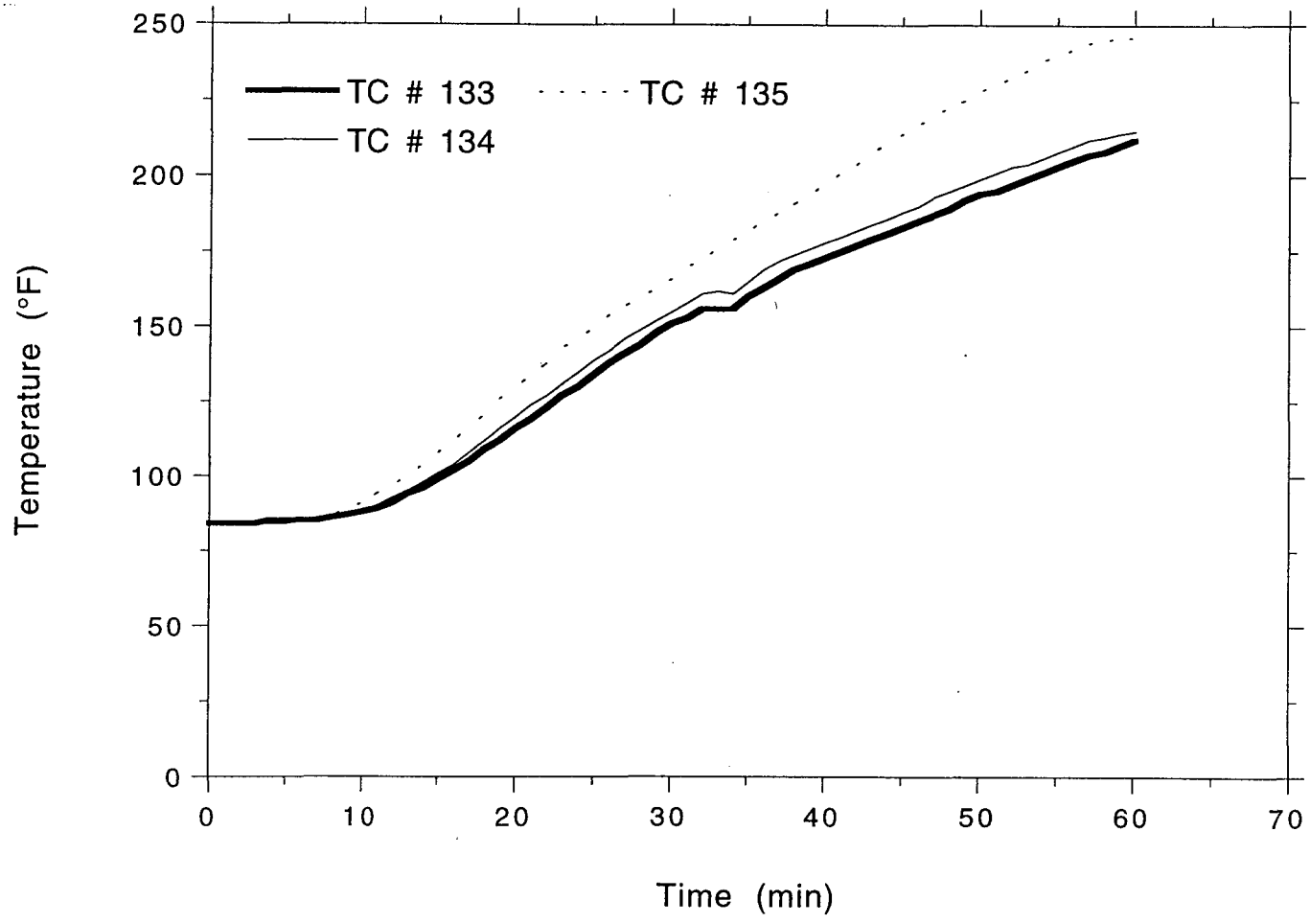
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 under Rungs



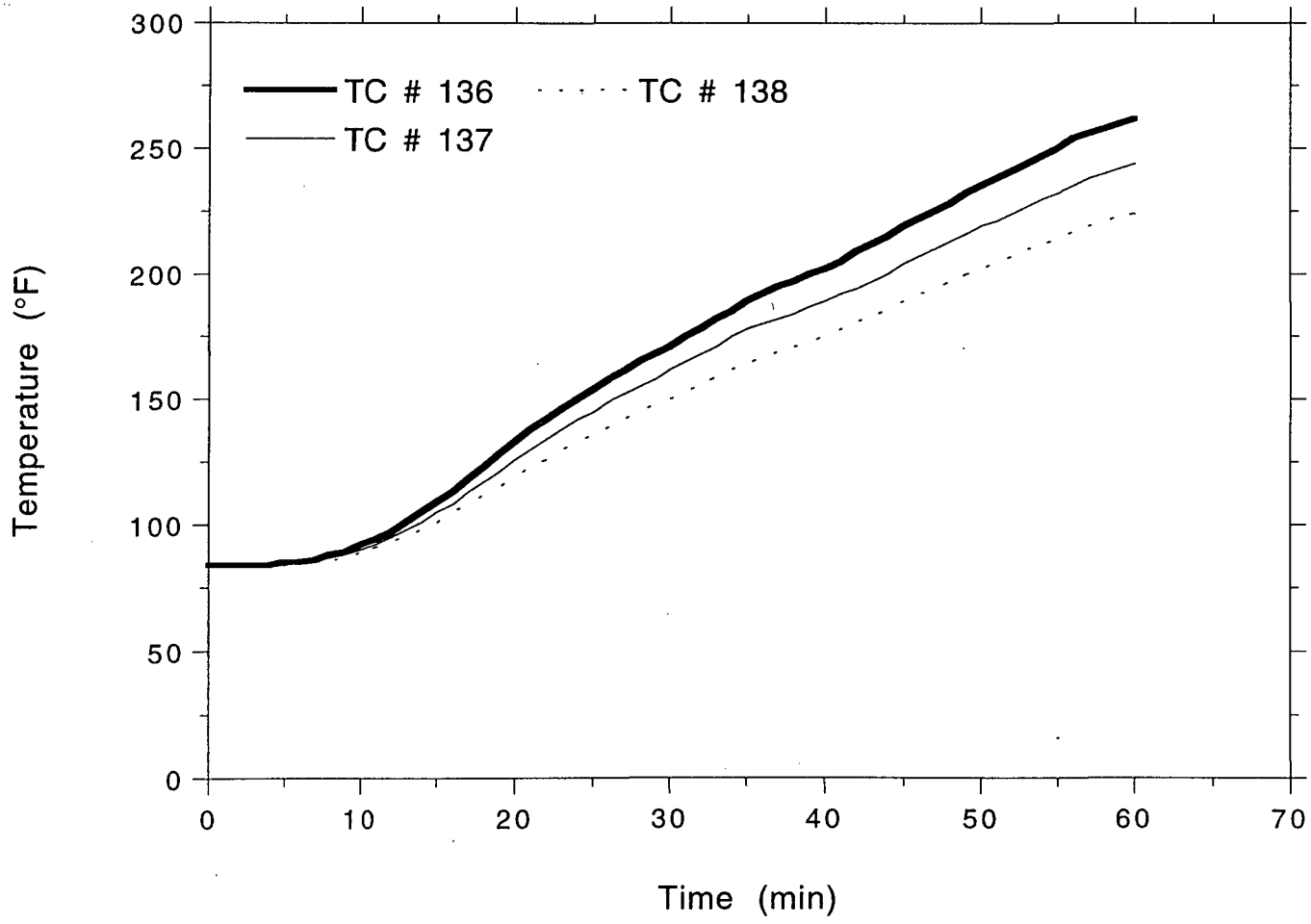
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 under Rungs



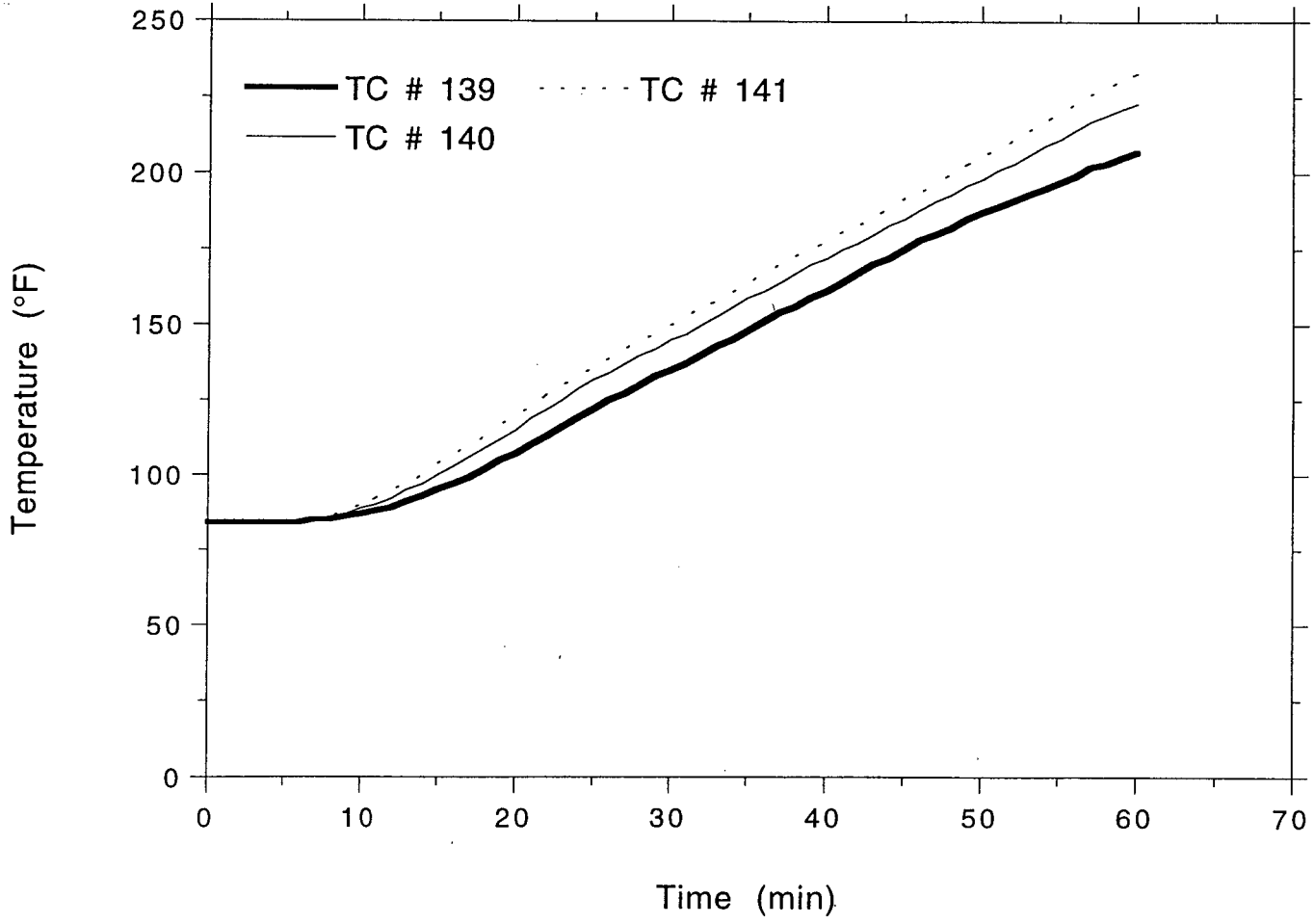
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 under Rungs



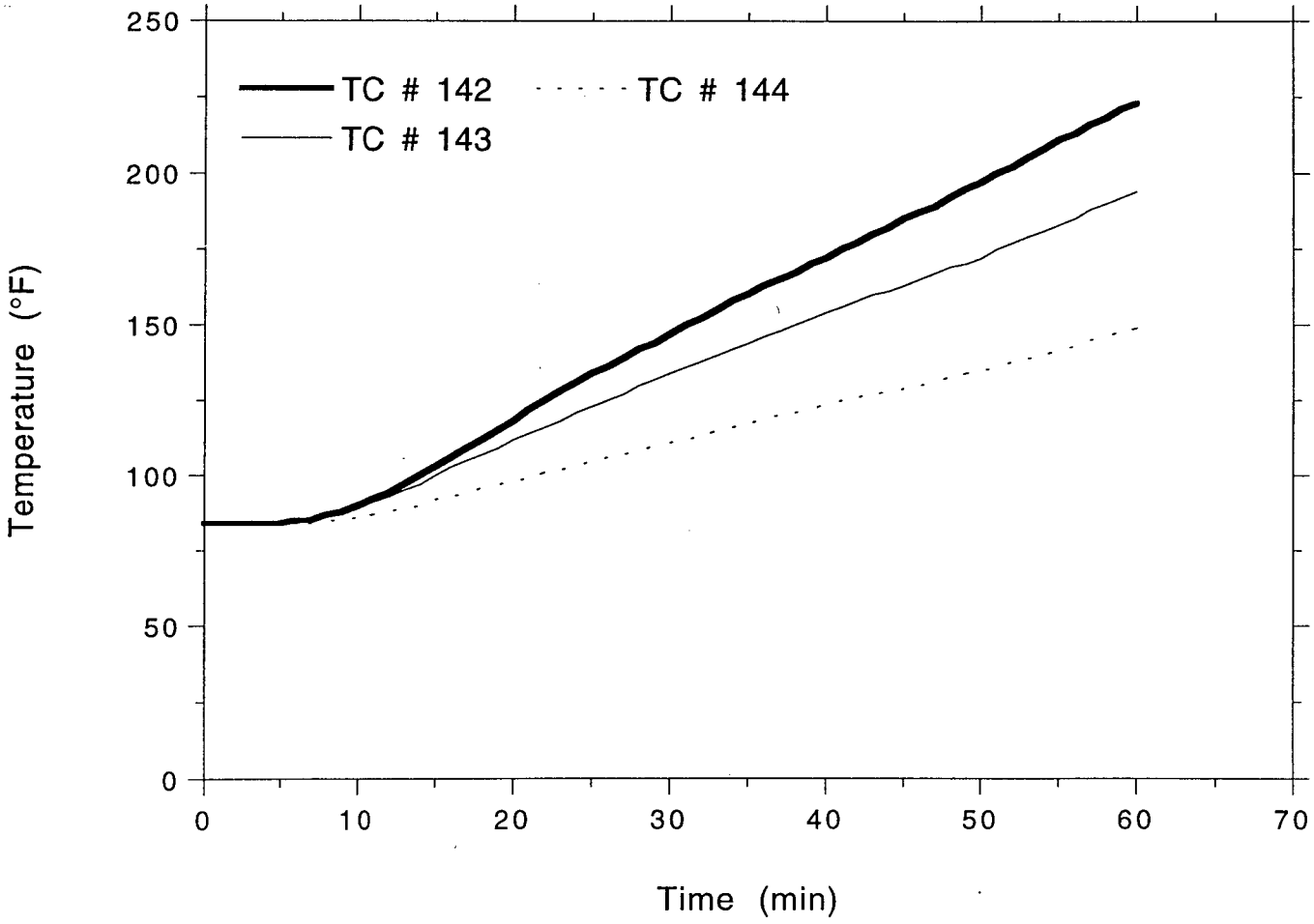
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 under Rungs



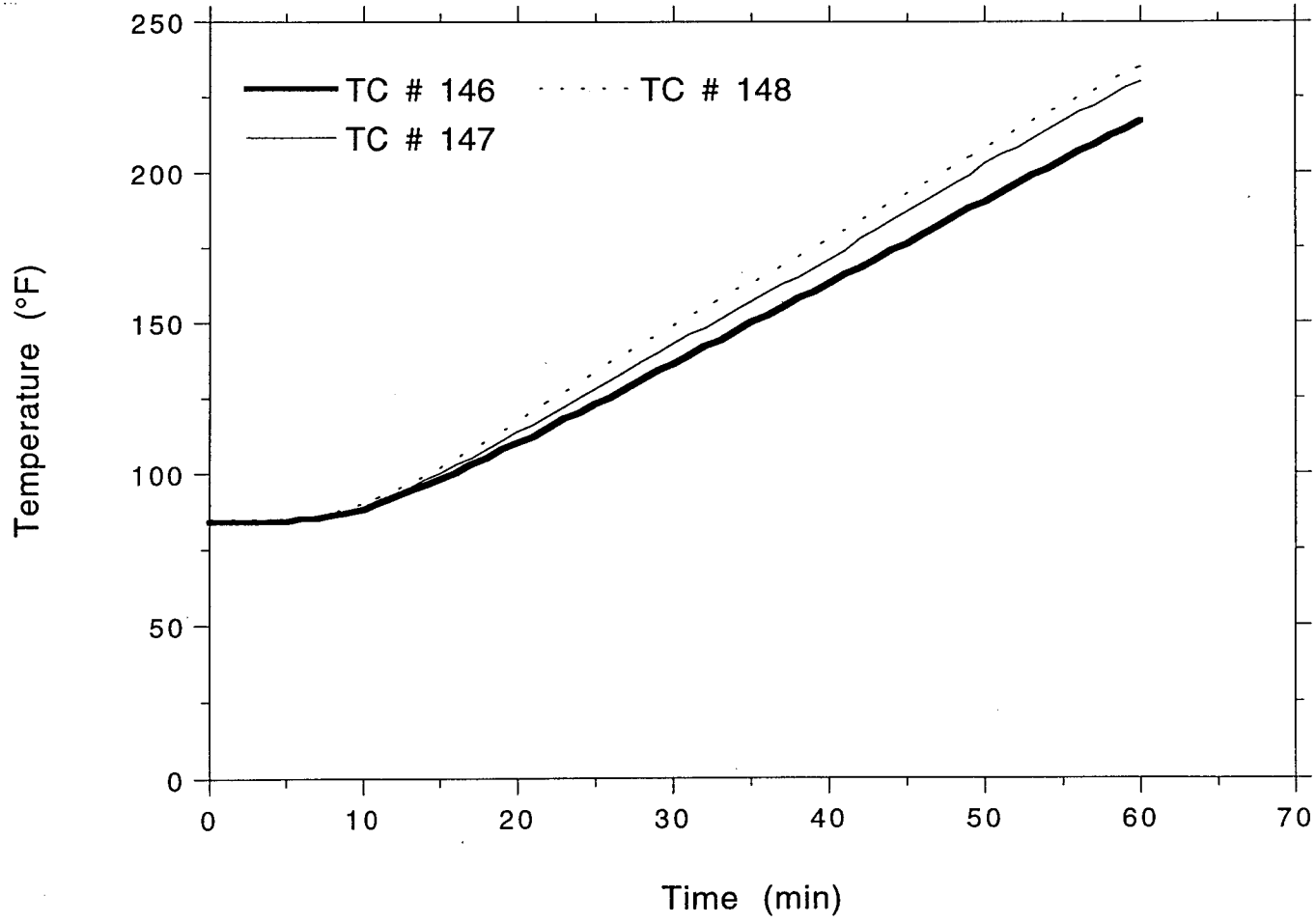
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 under Rungs



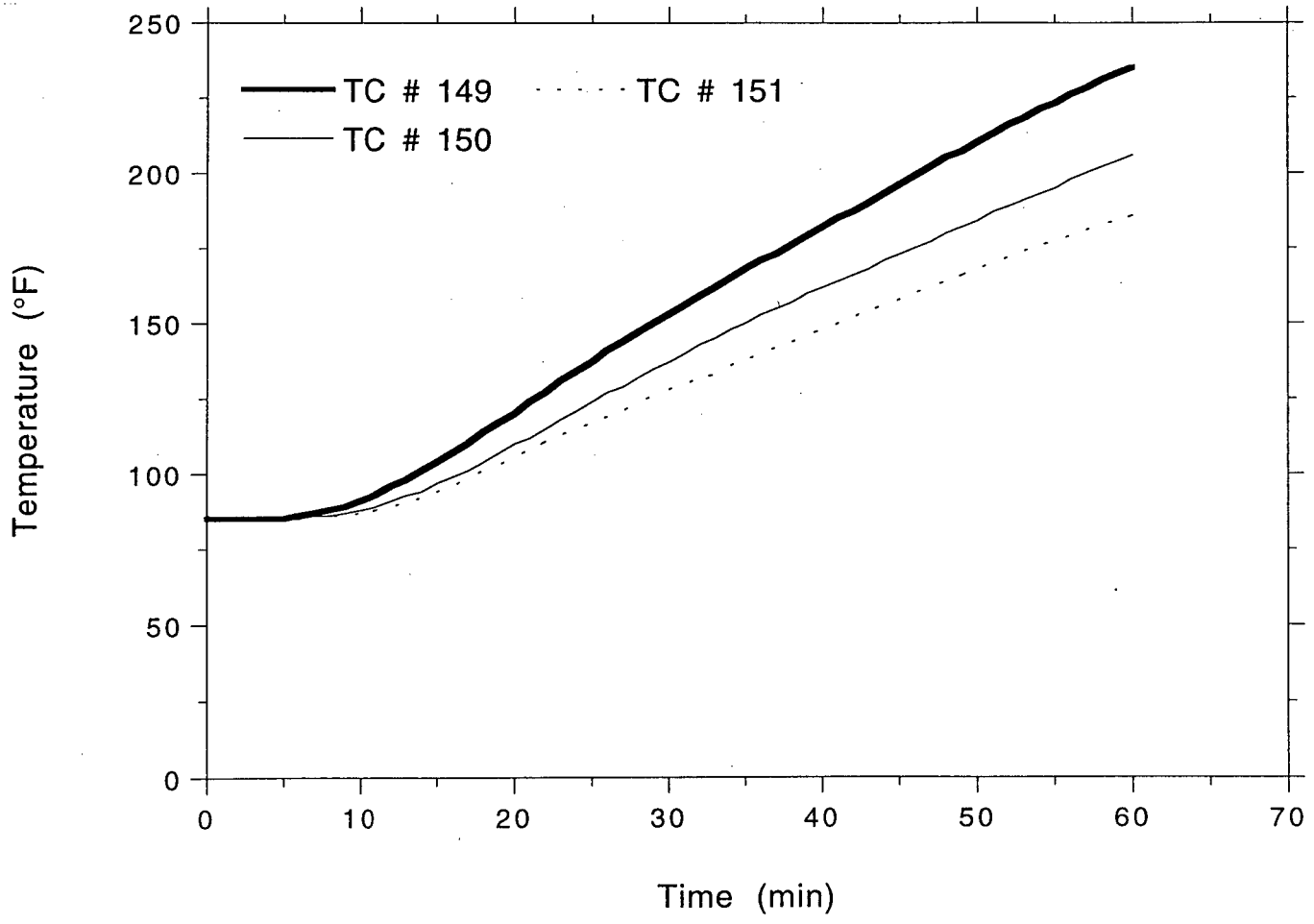
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 on Cables



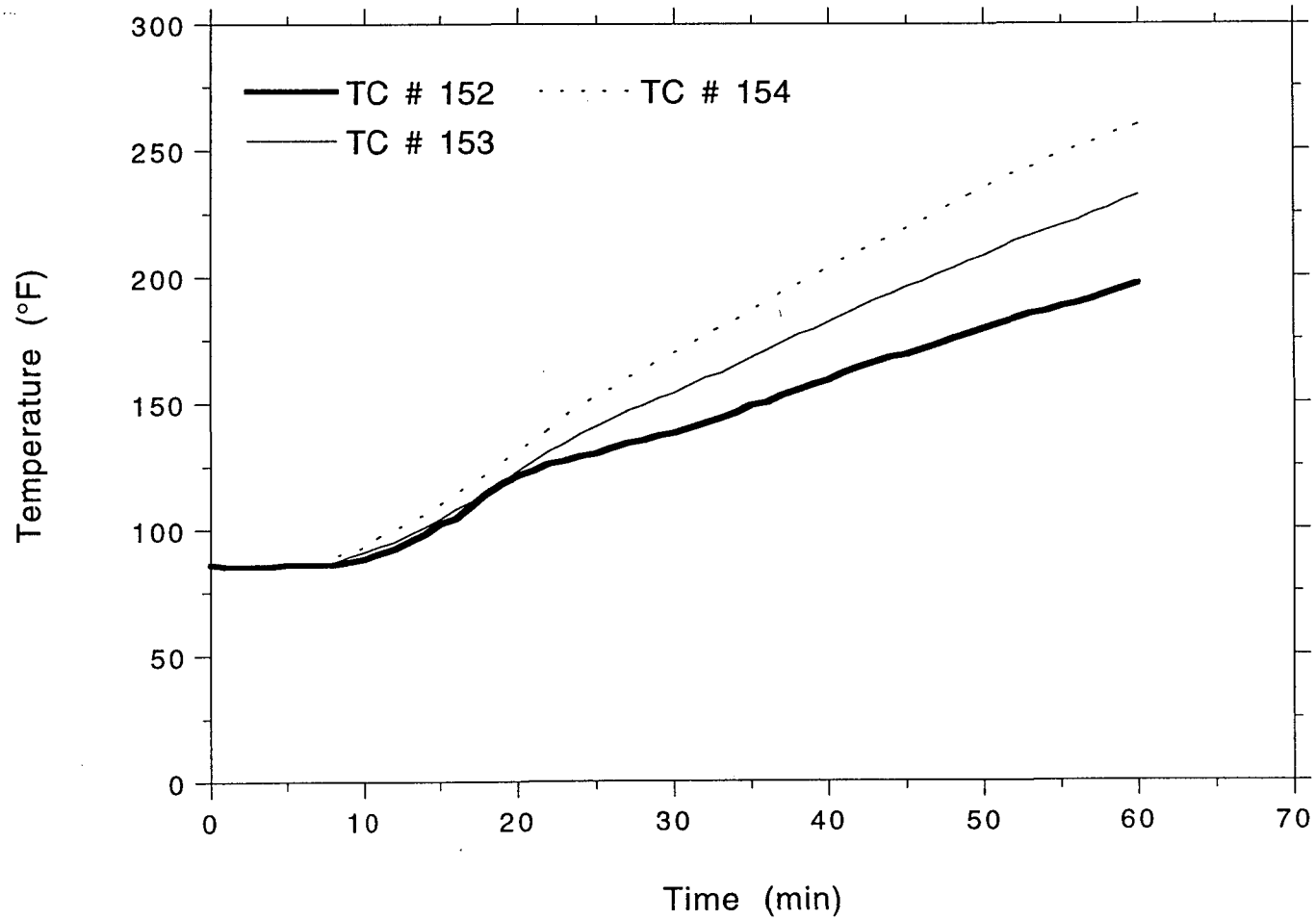
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 on Cables



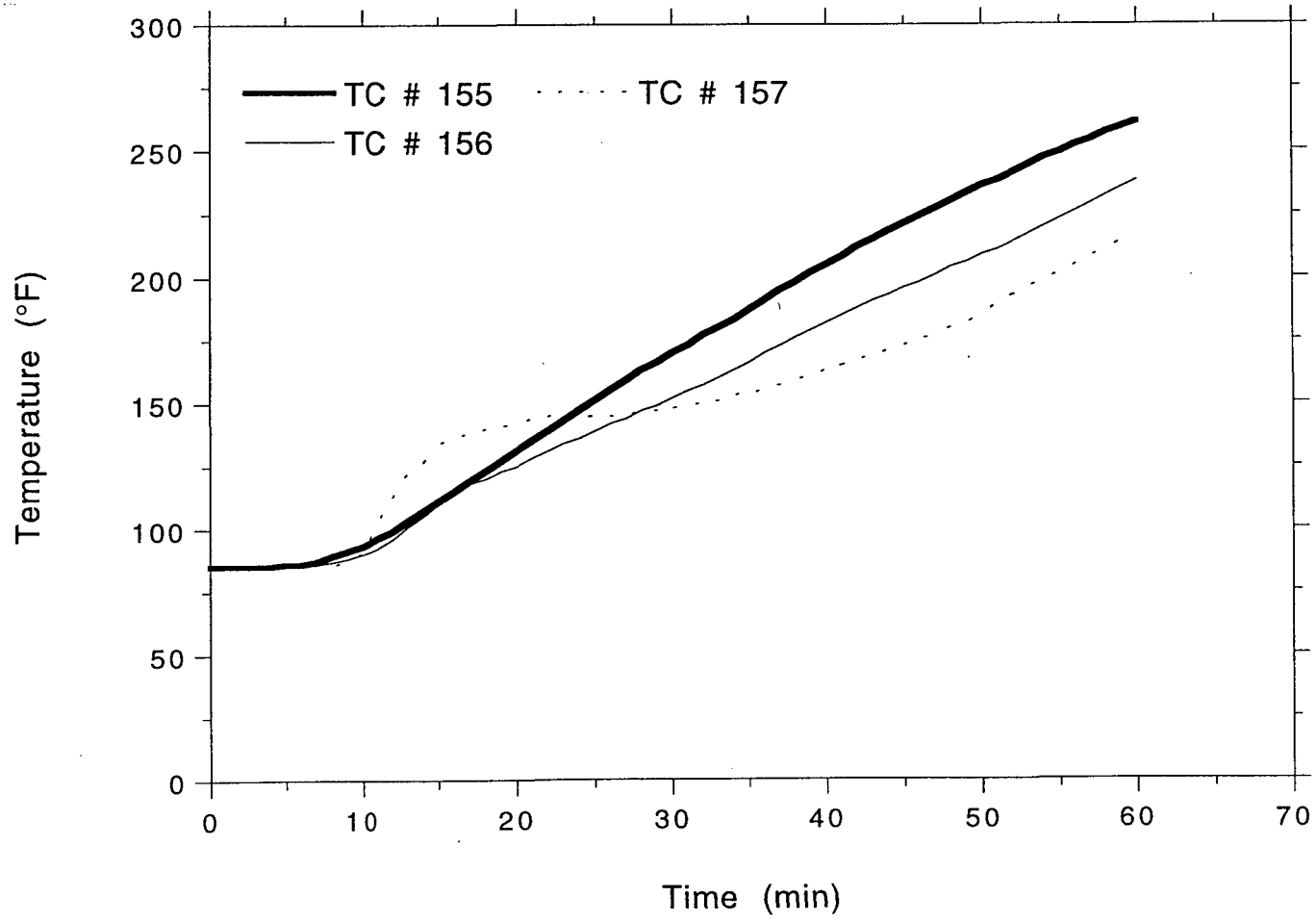
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 on Cables



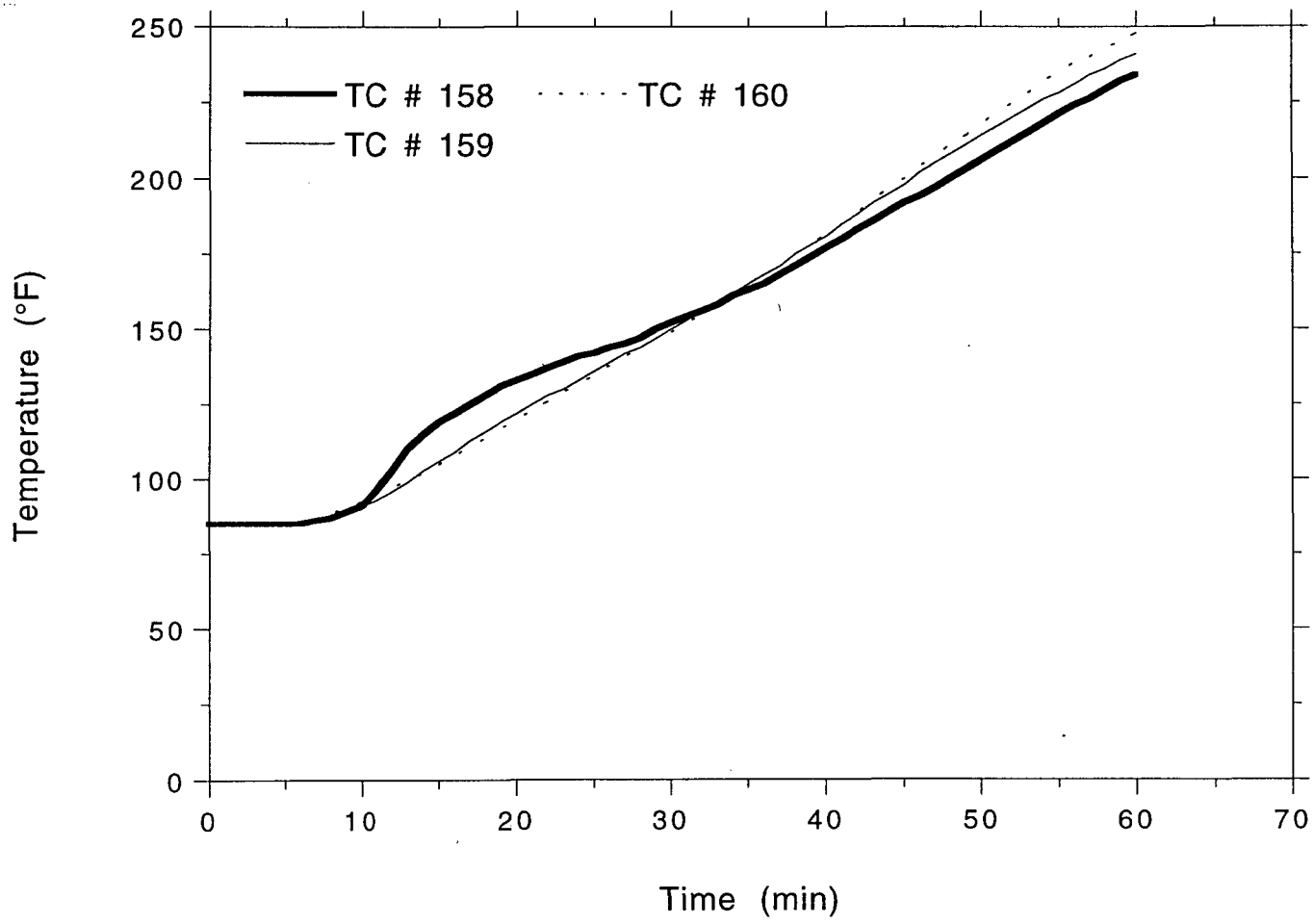
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 on Cables



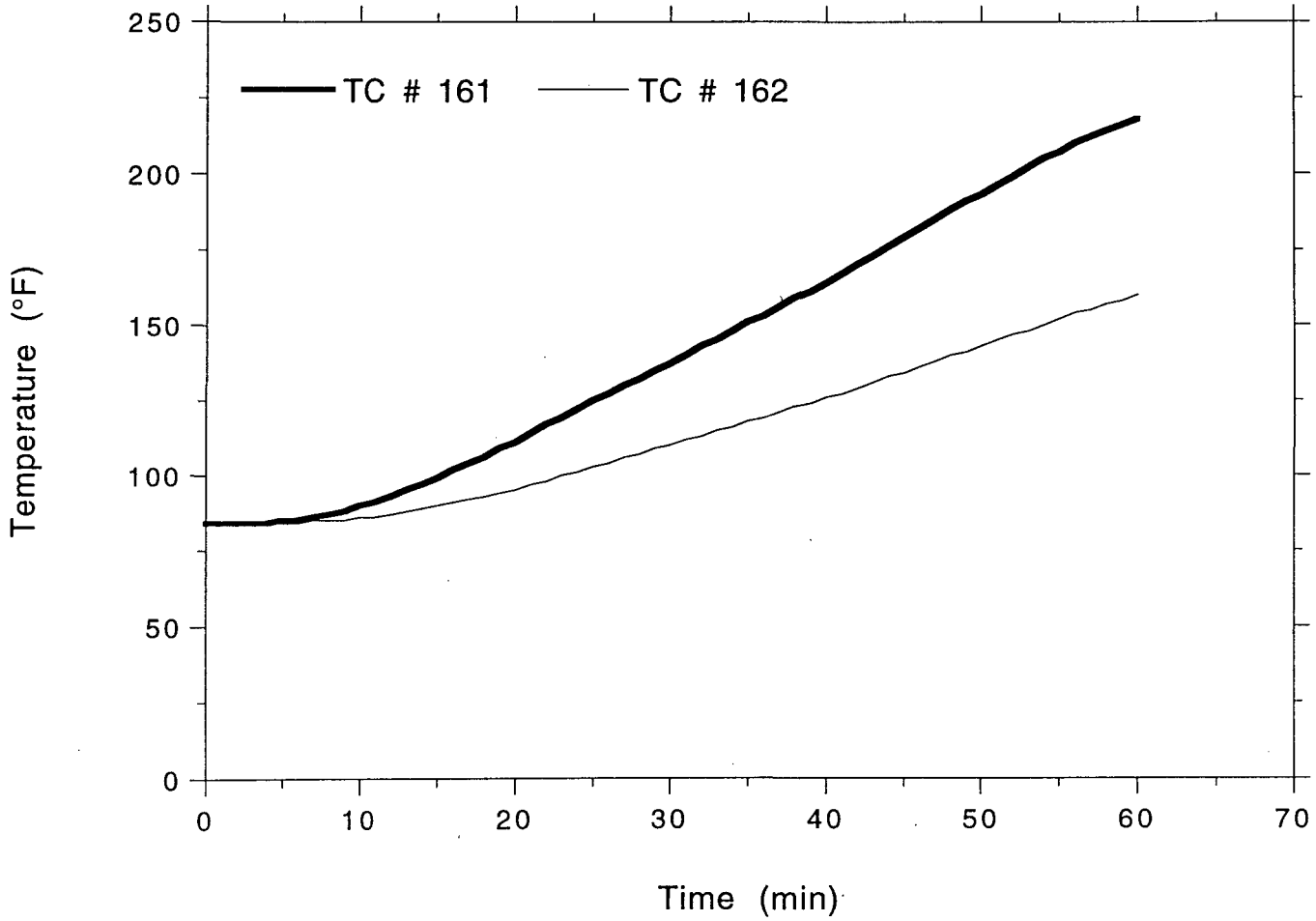
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 on Cables

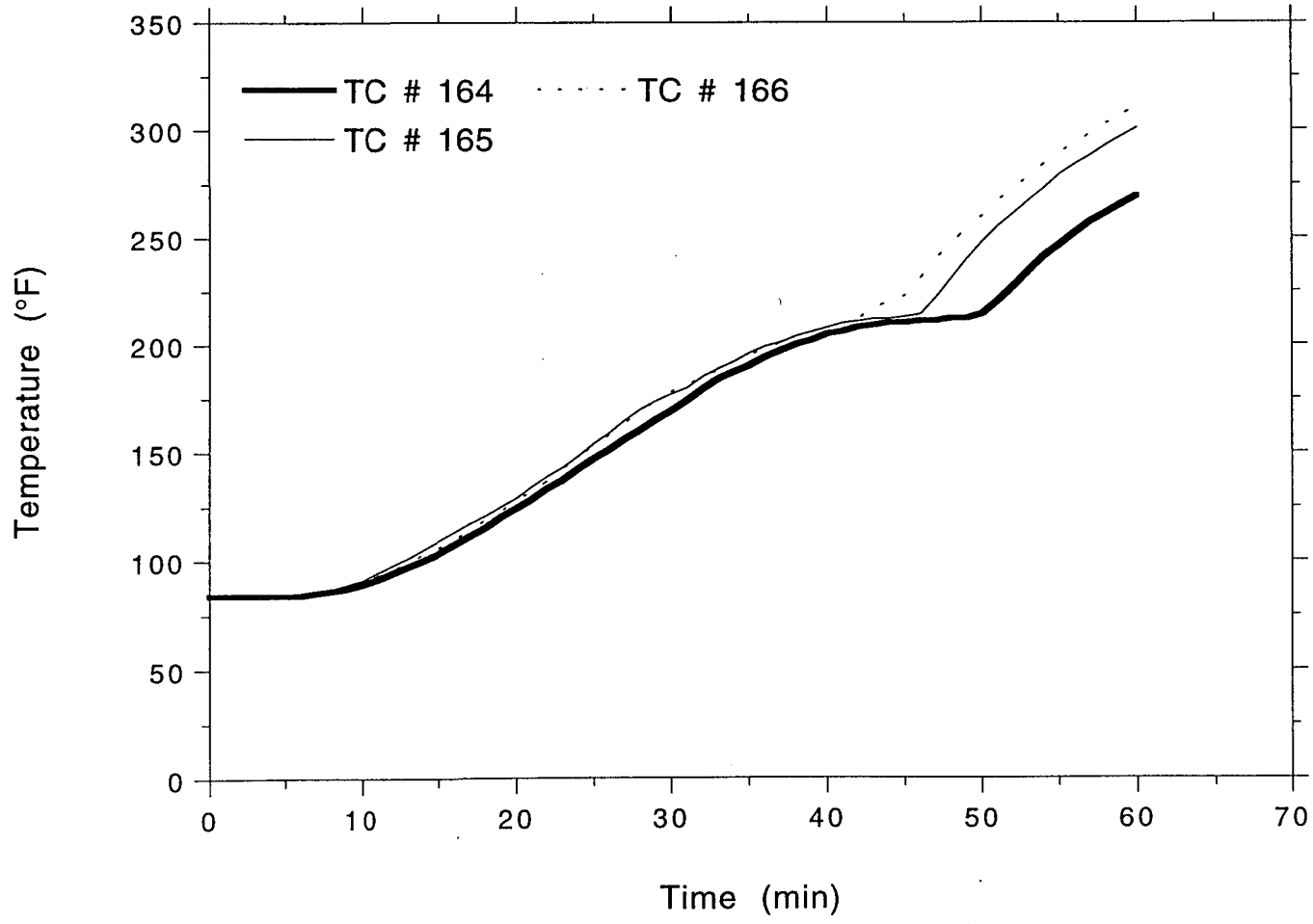


OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Left Tray, #8 on Cables

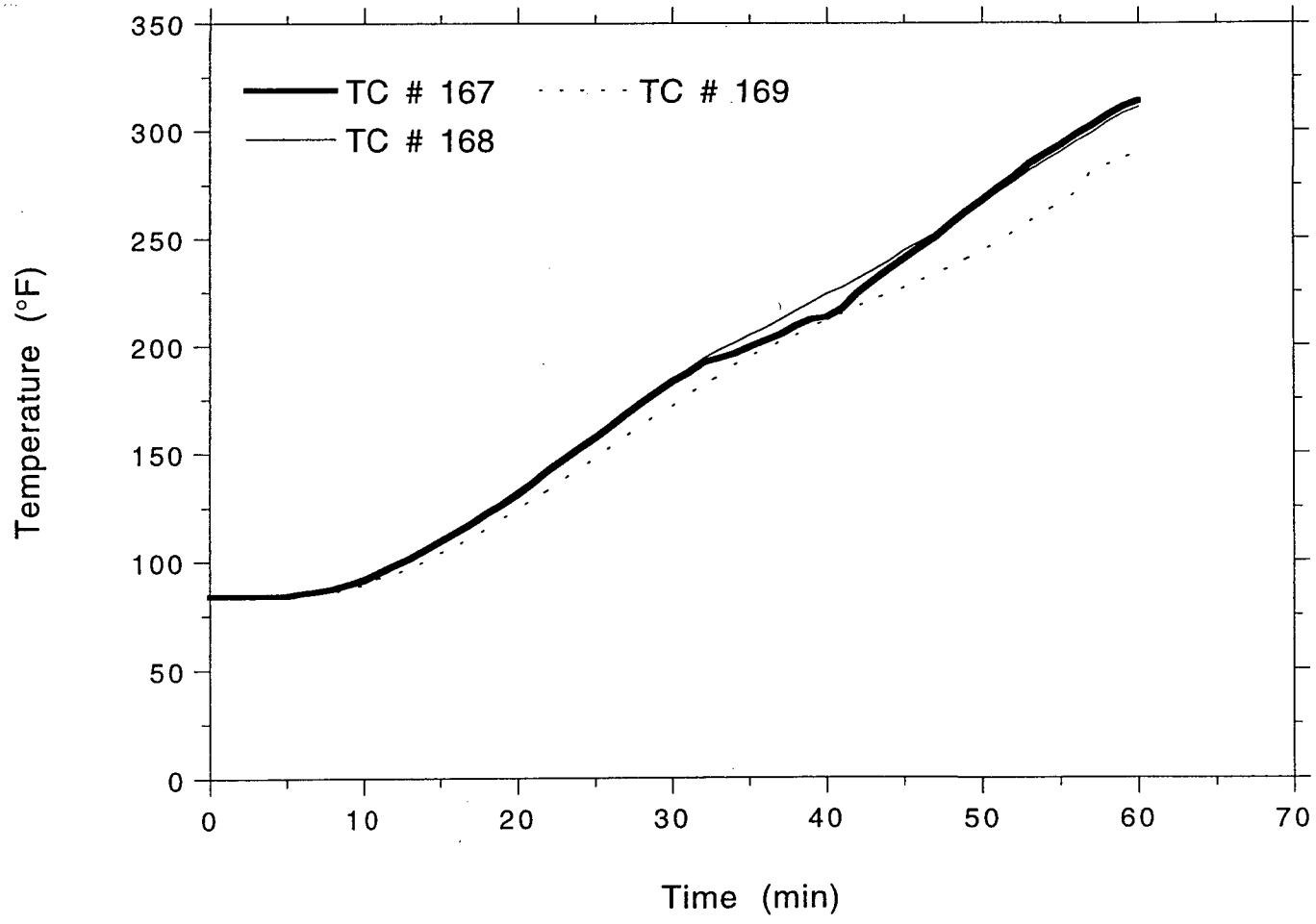


TSI/TVA
Project No. 11960-97185
Center Tray, #8 under Rungs



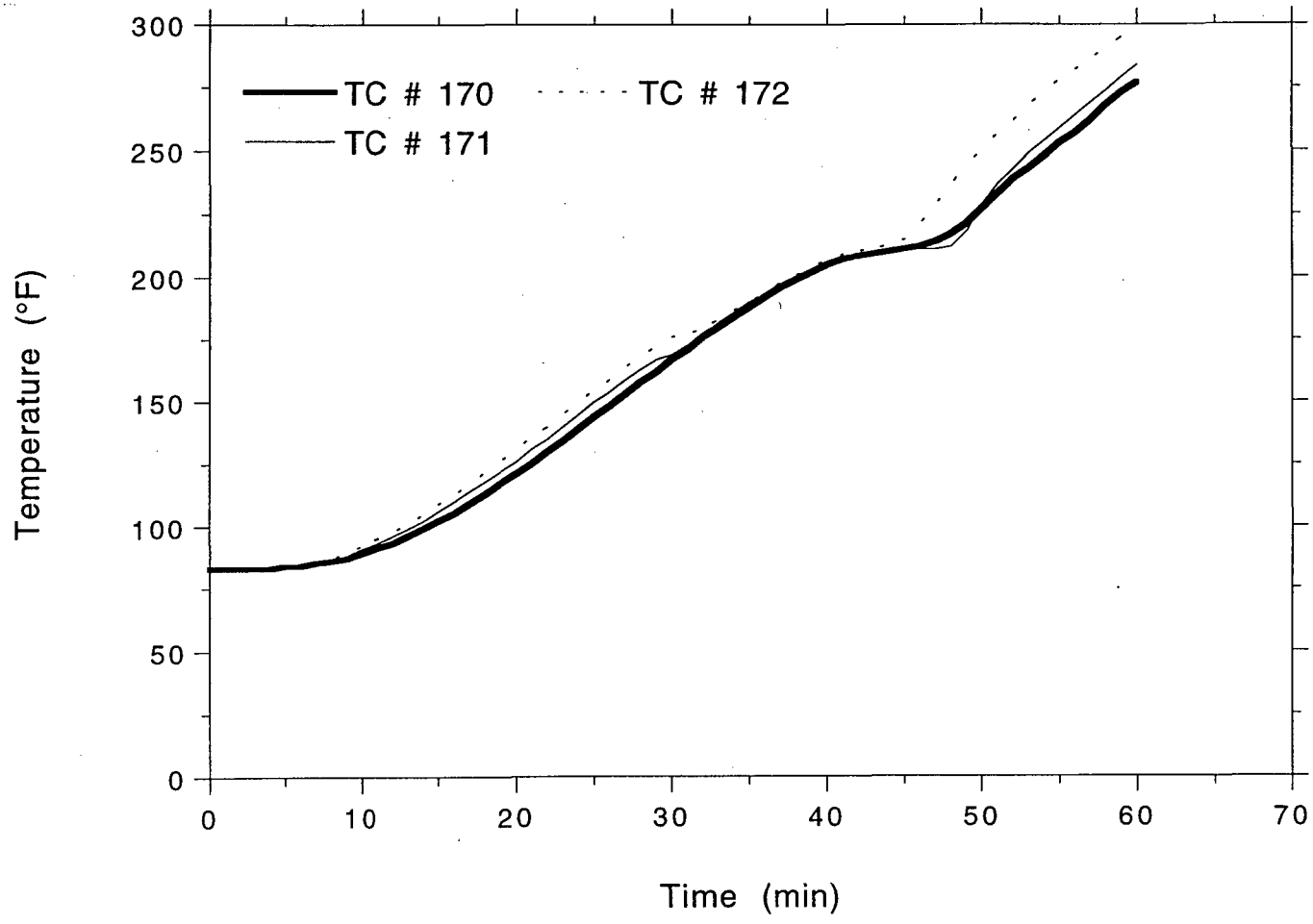
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 under Rungs



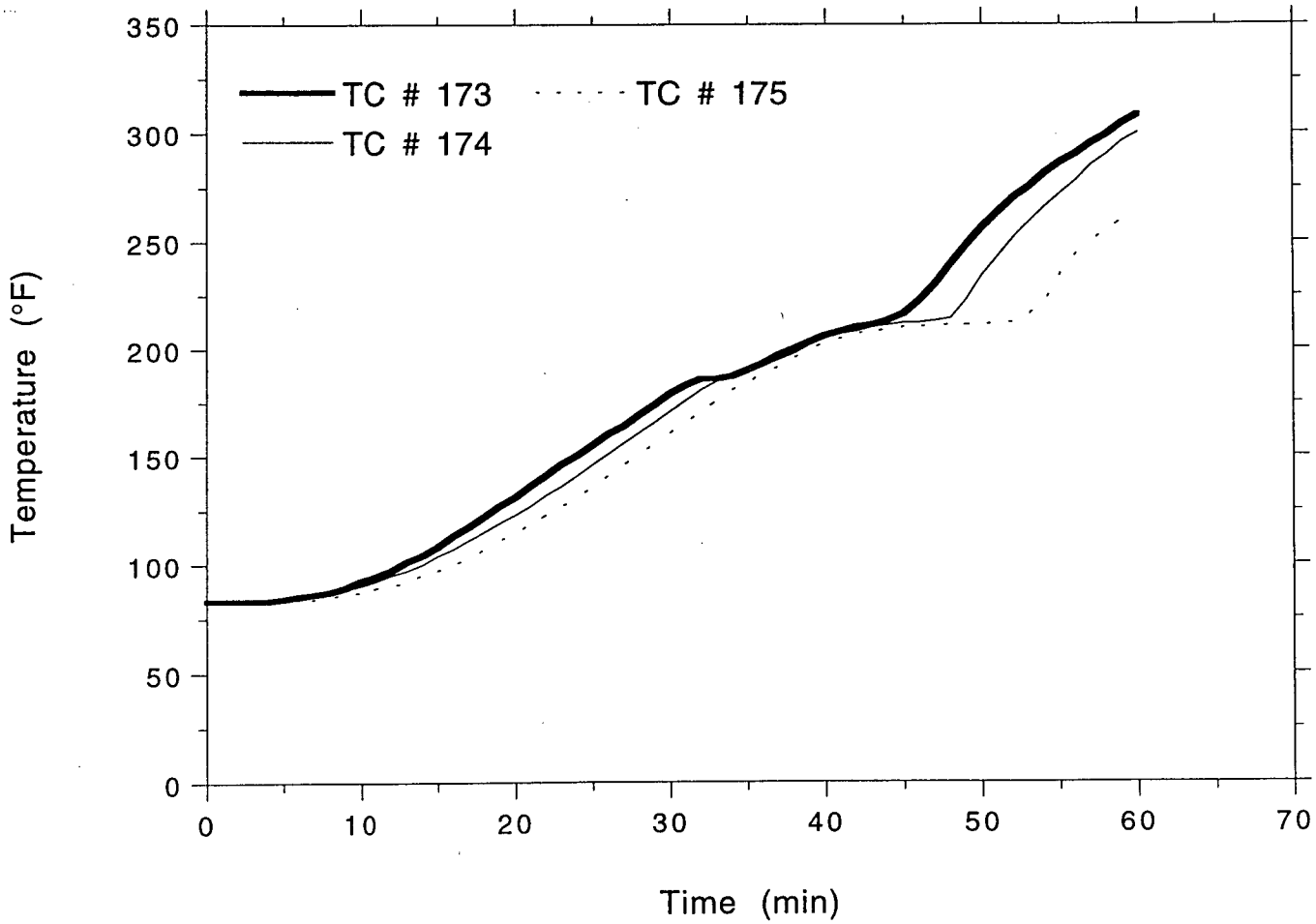
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 under Rungs



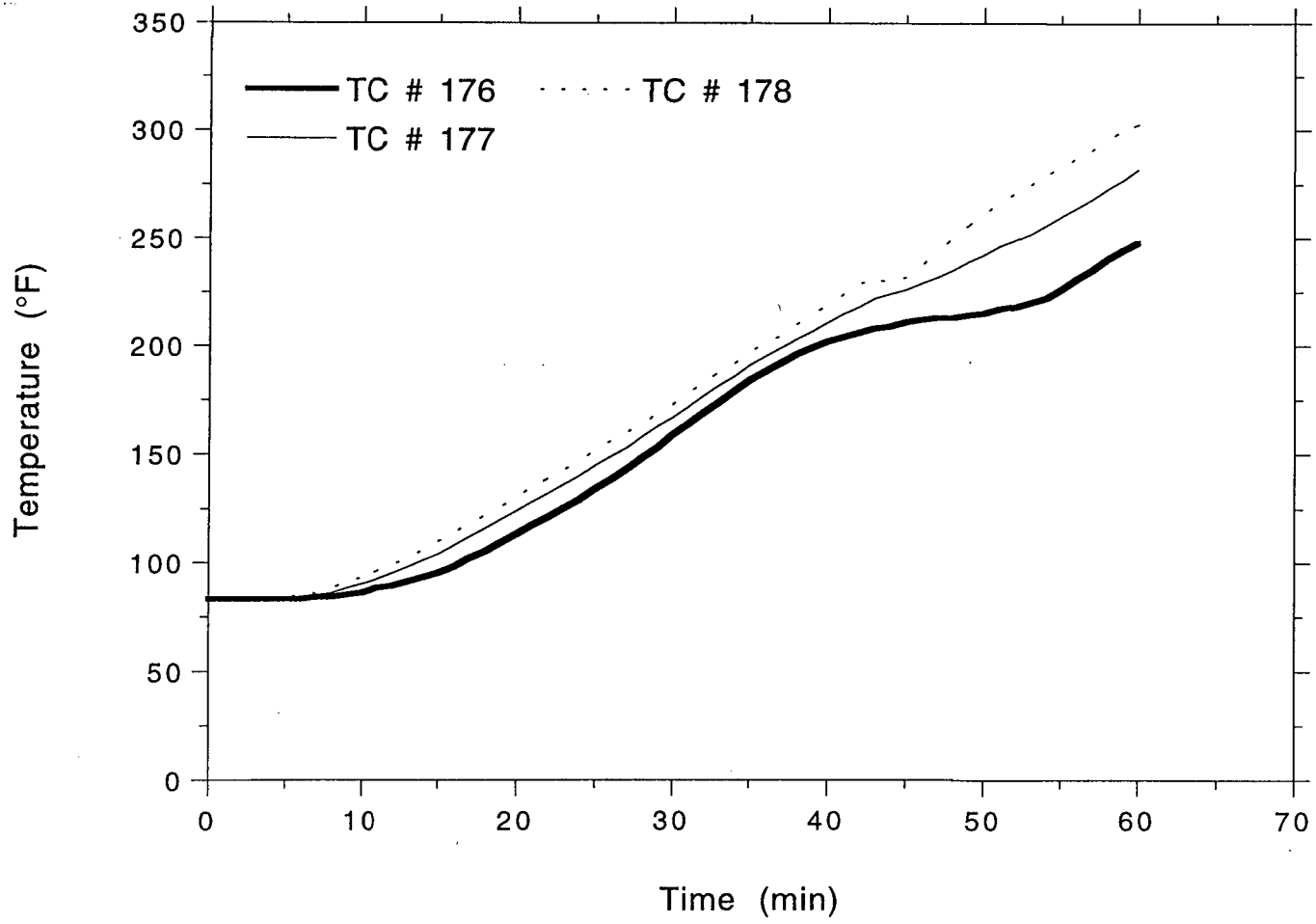
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 under Rungs



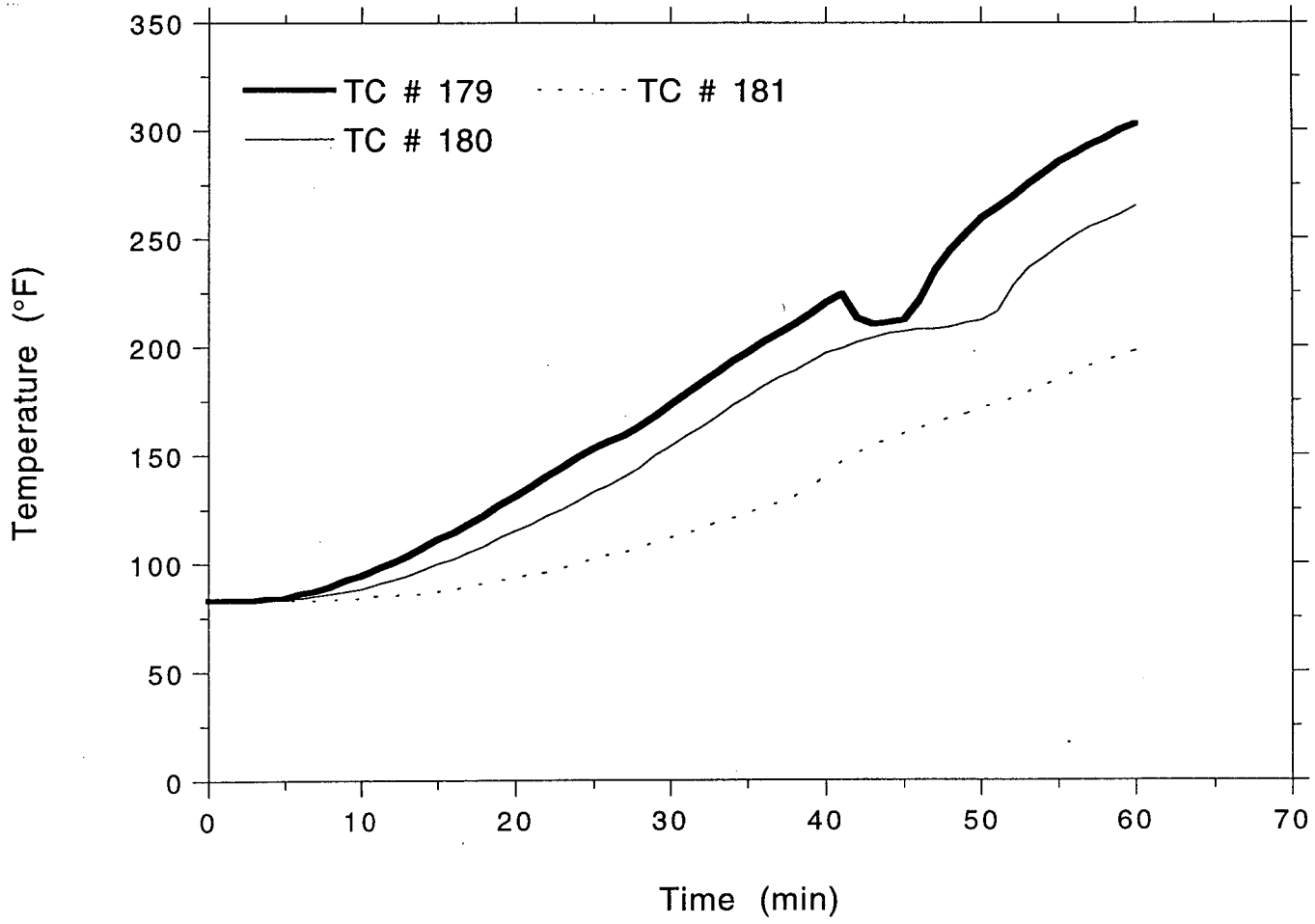
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 under Rungs



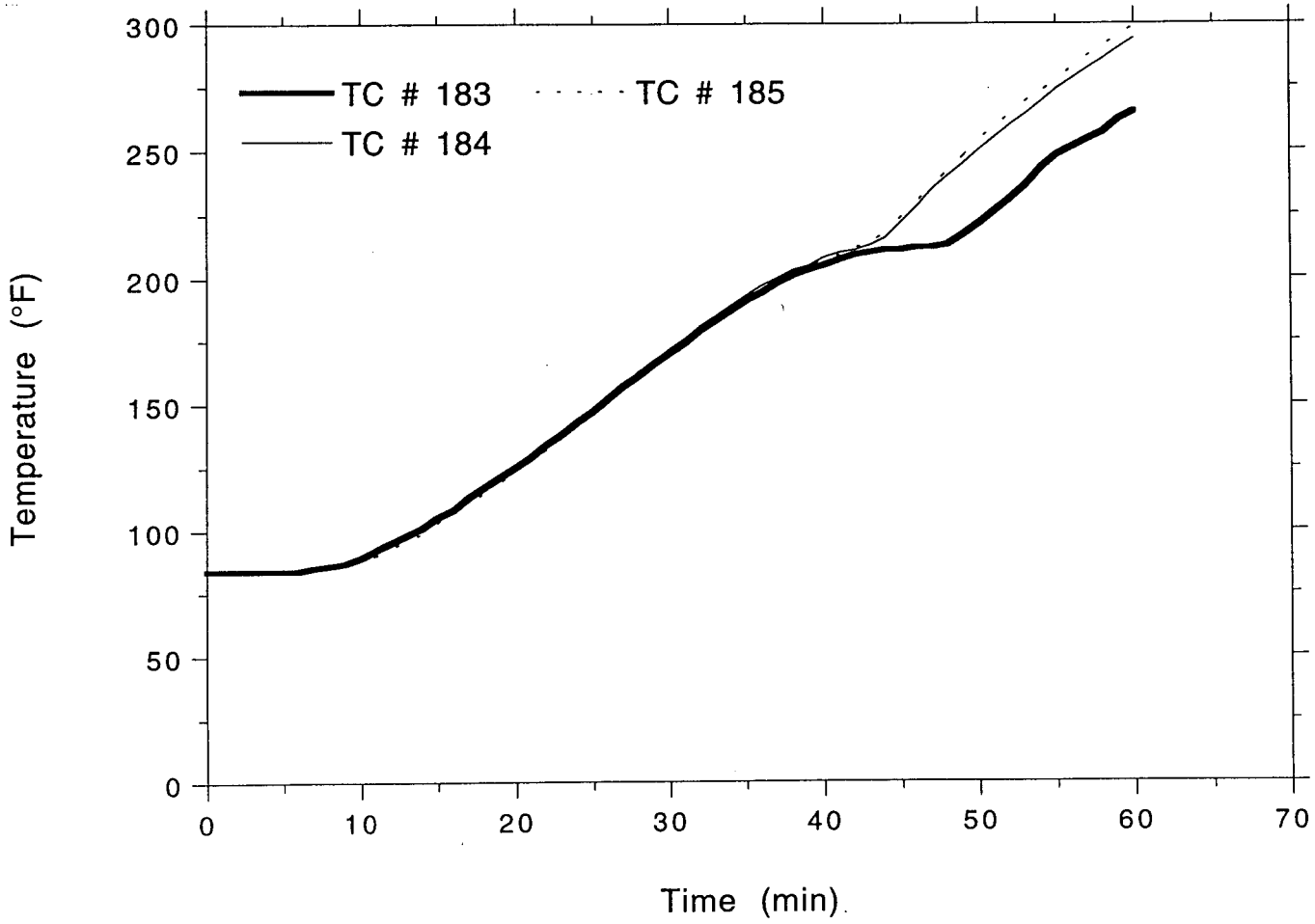
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 under Rungs



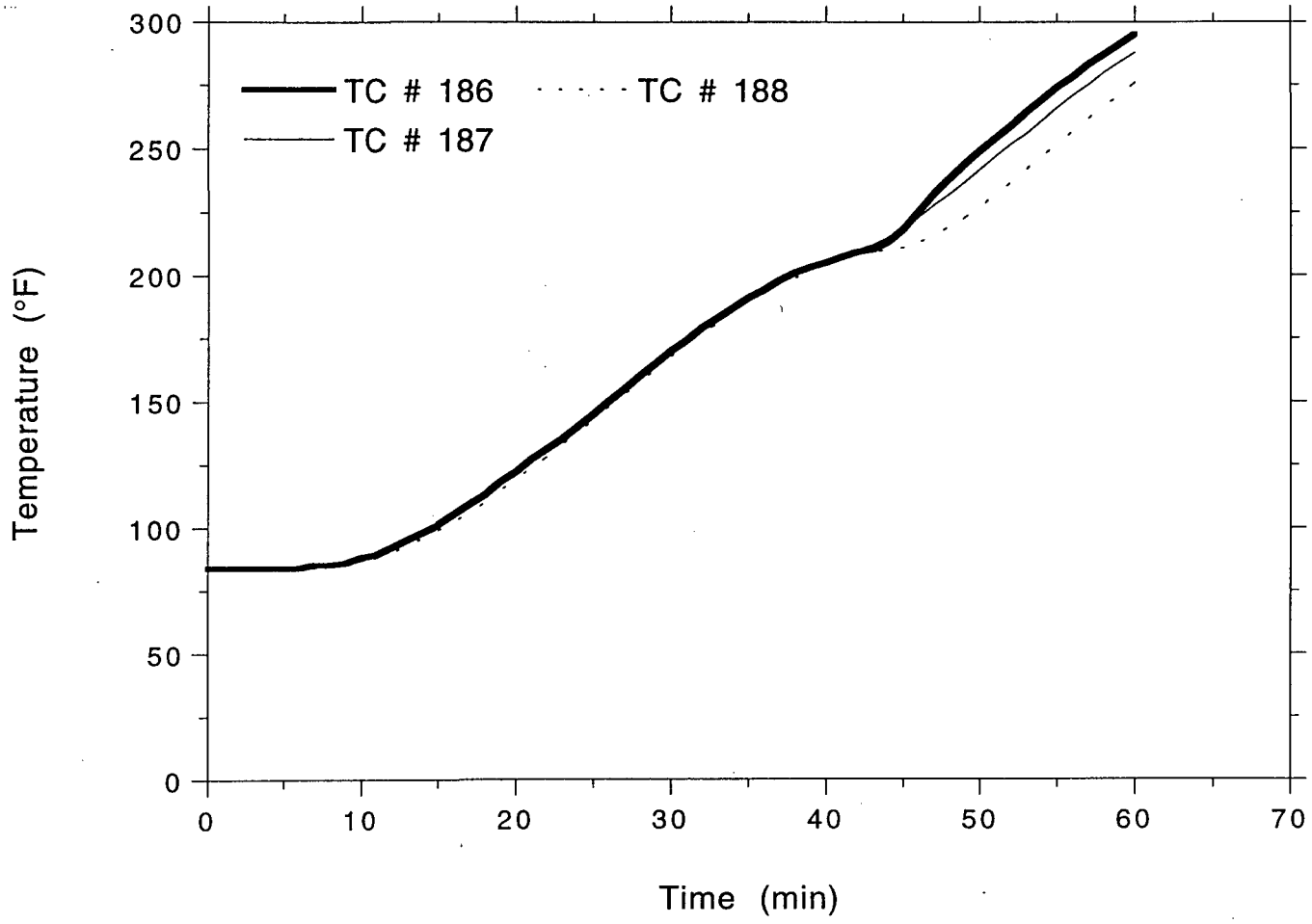
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 on Cables



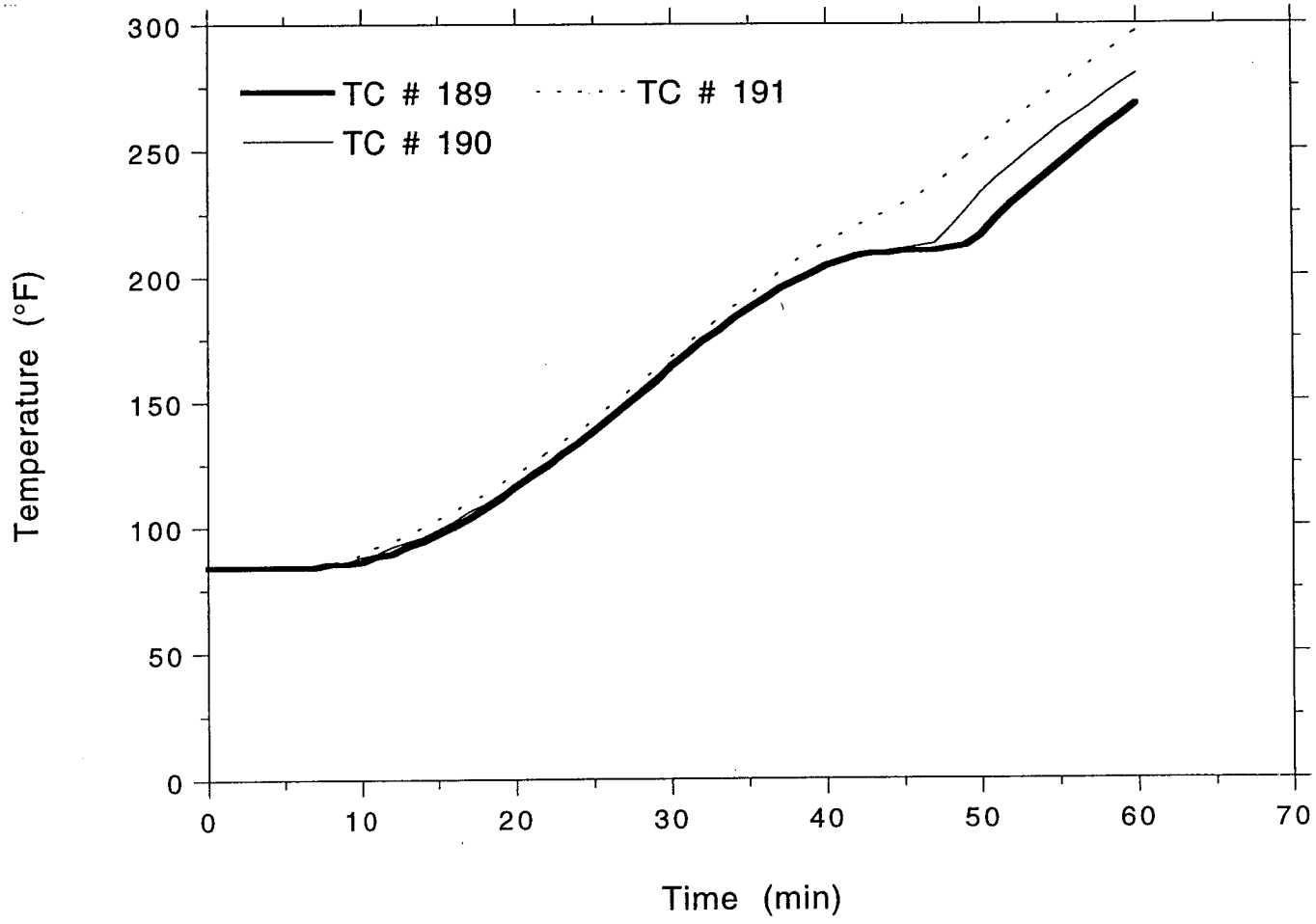
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 on Cables



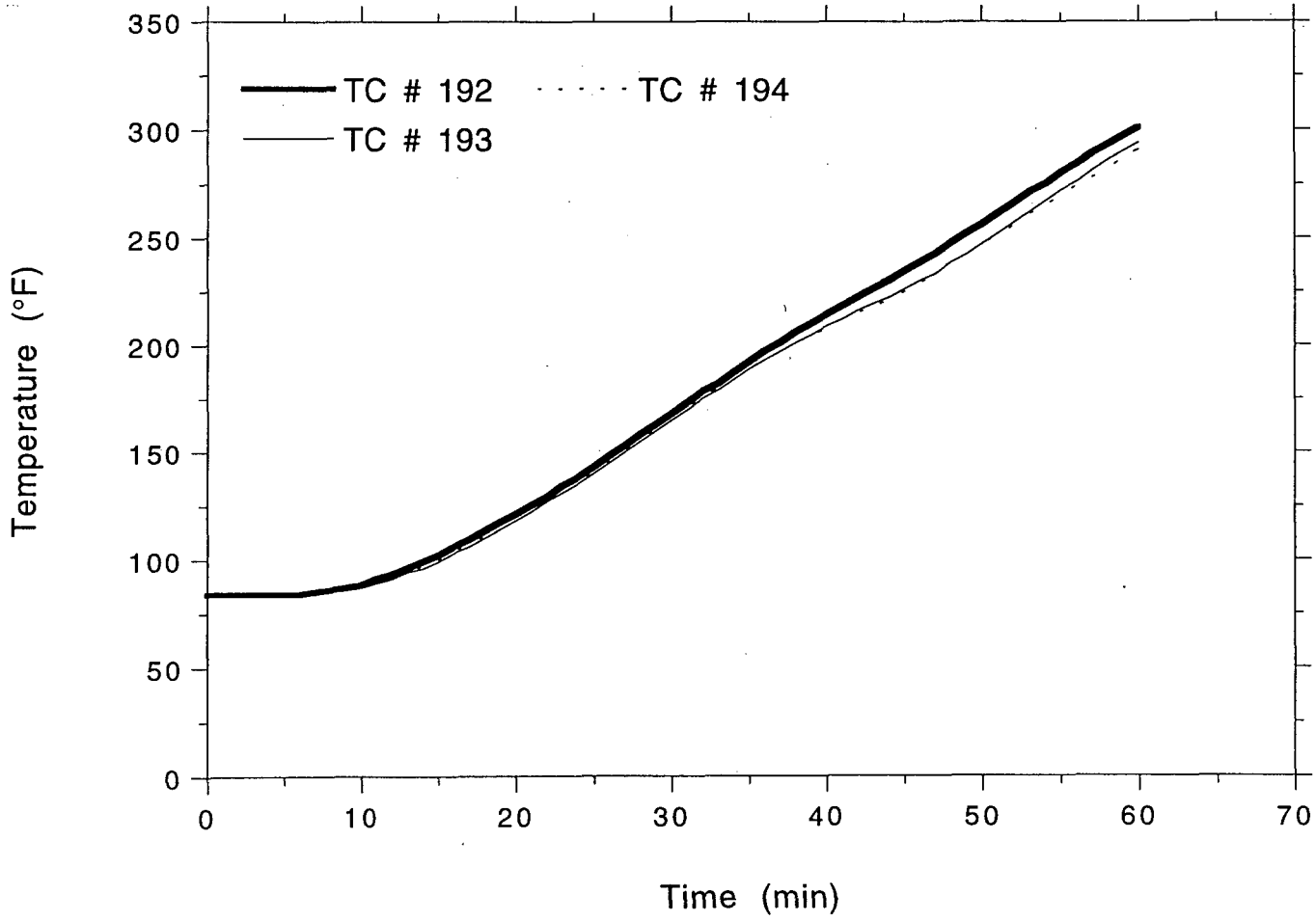
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 on Cables

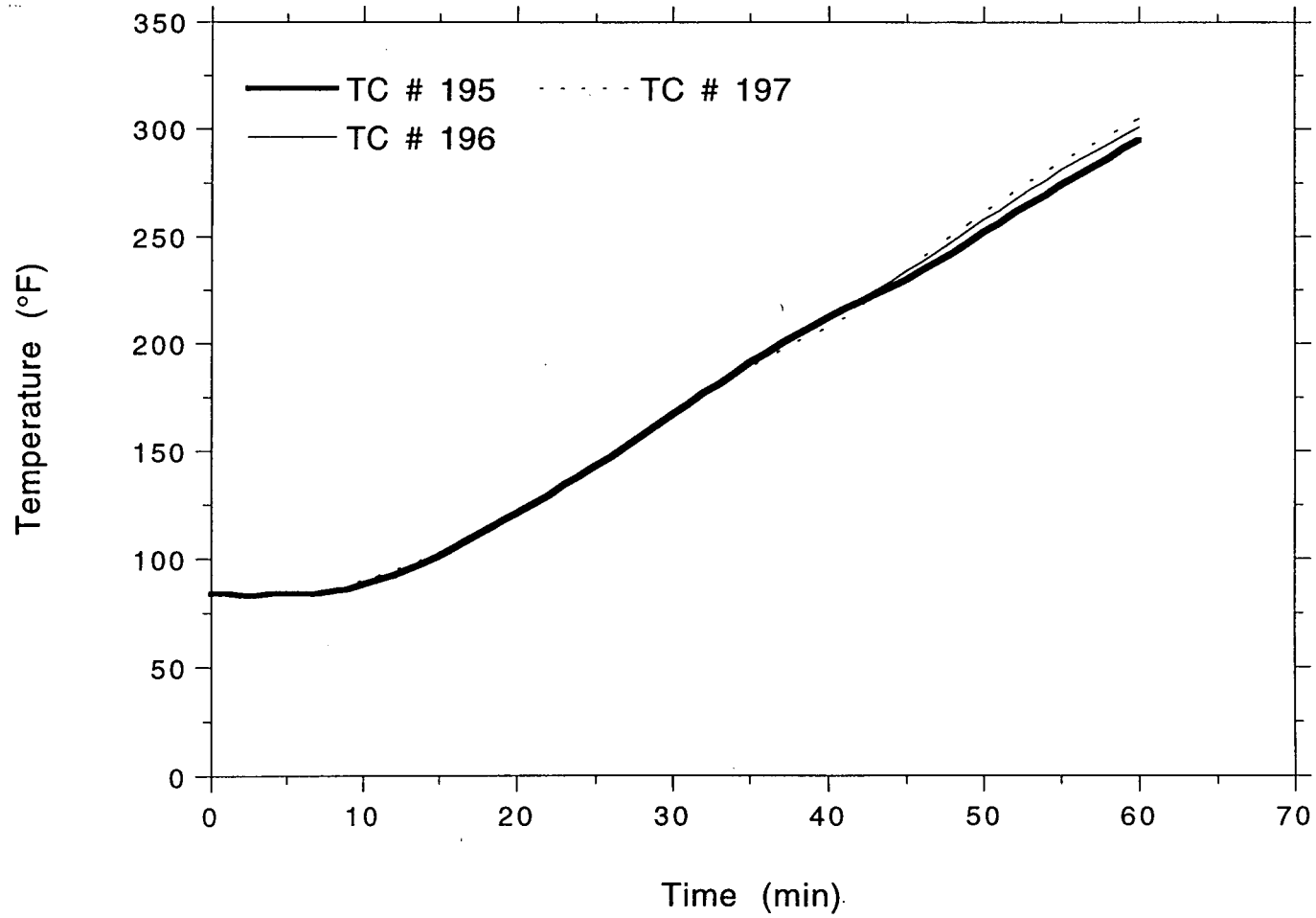


OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 on Cables

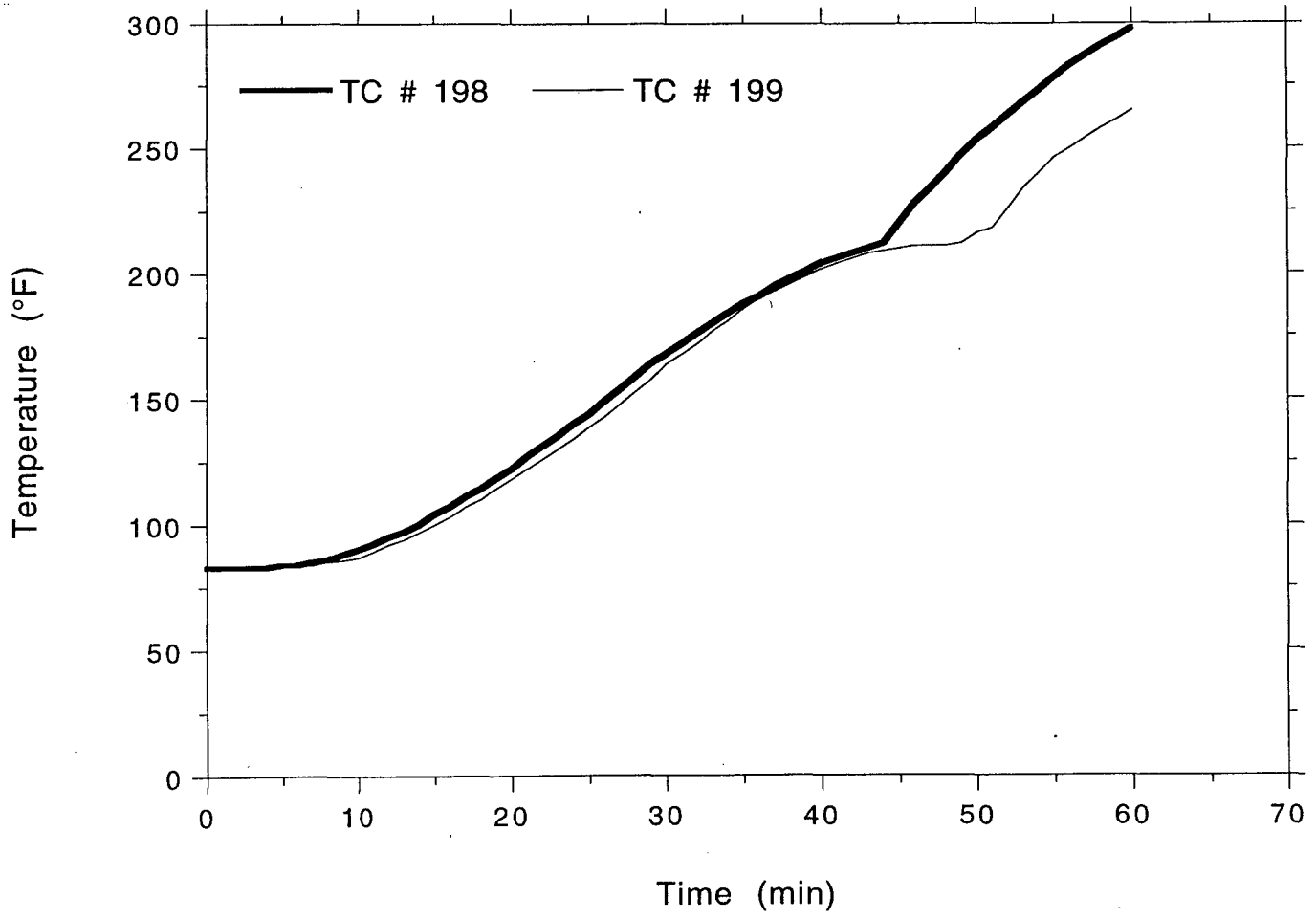


TSI/TVA
Project No. 11960-97185
Center Tray, #8 on Cables



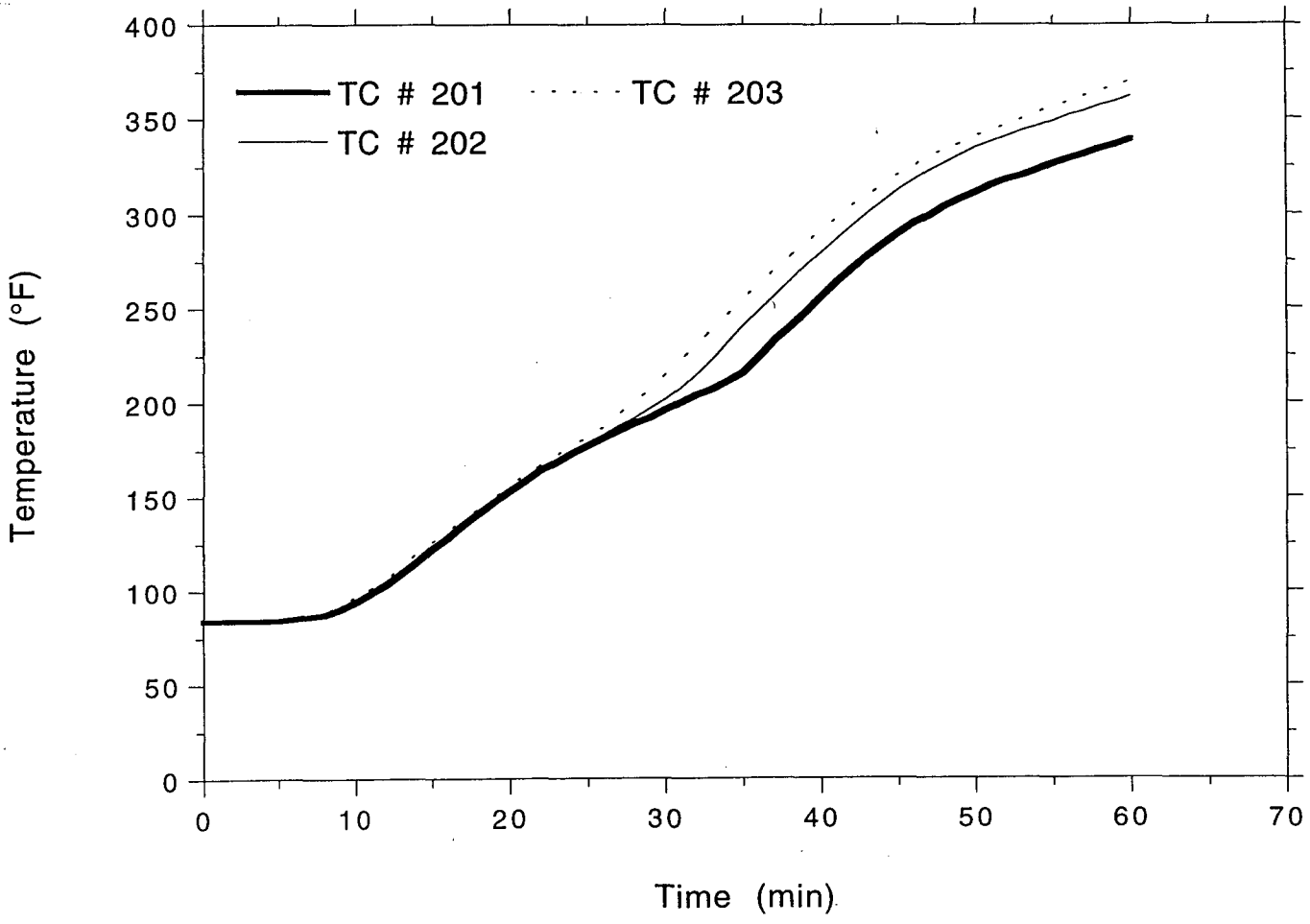
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Center Tray, #8 on Cables



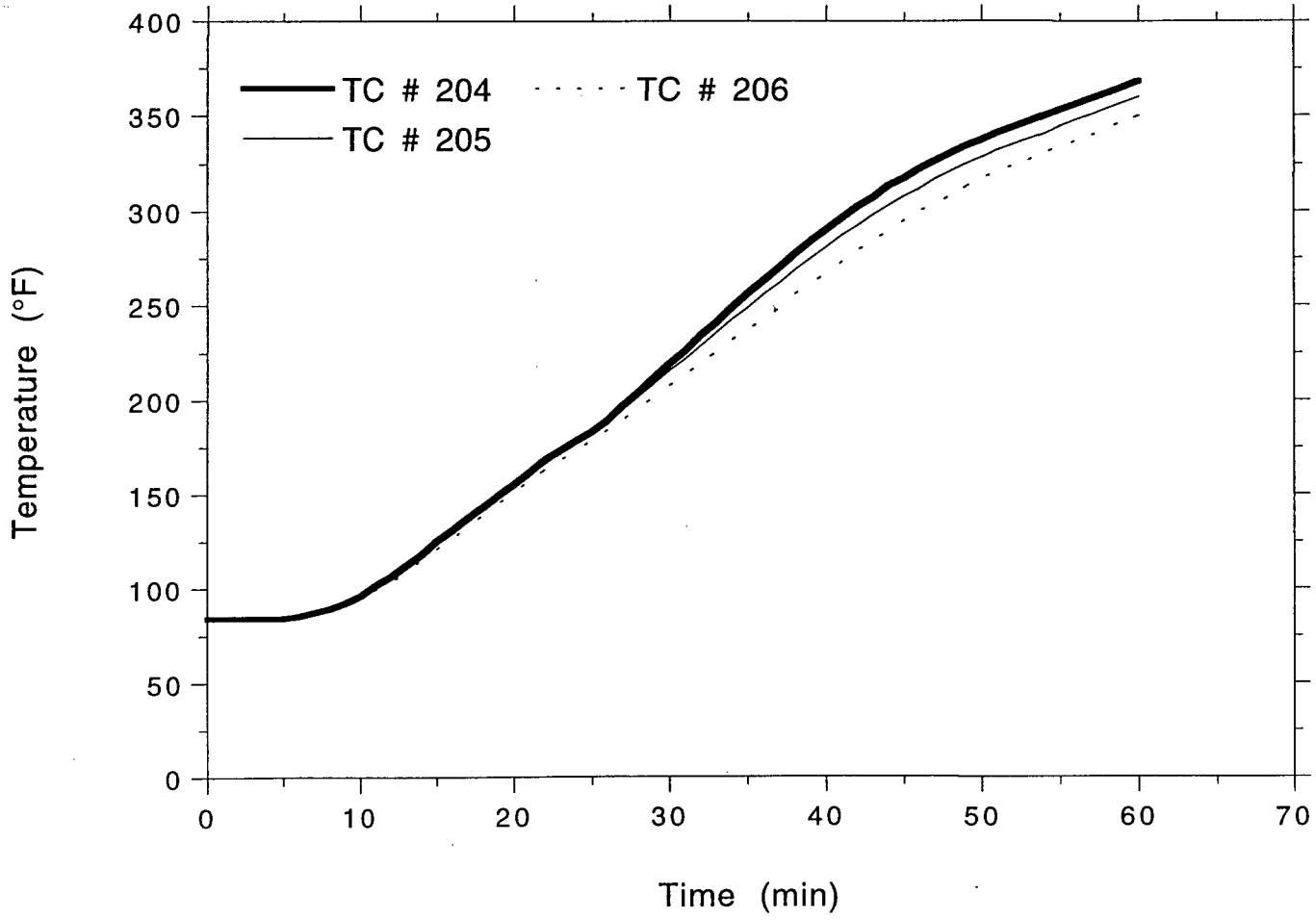
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, #8 on Rungs



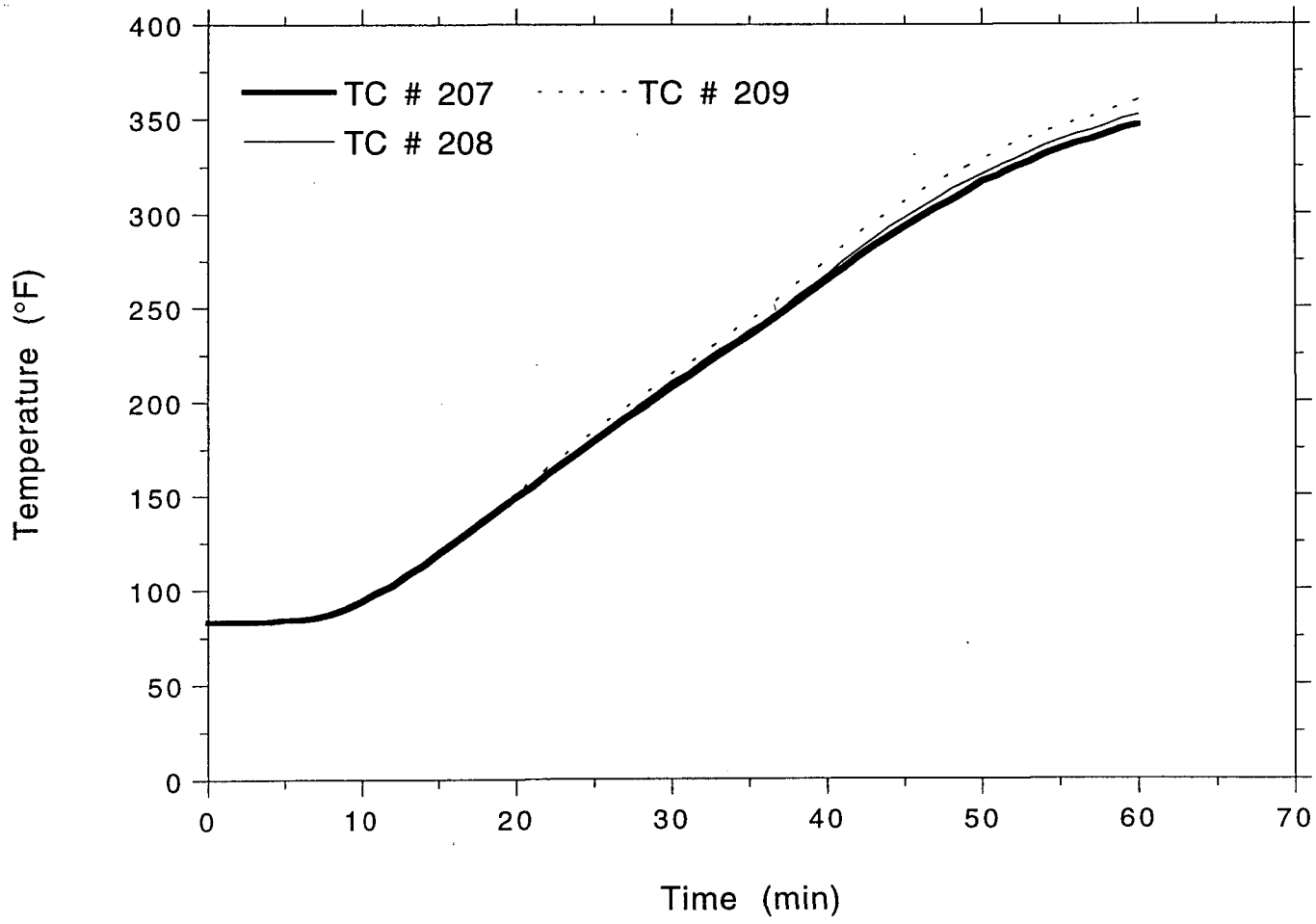
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, #8 on Rungs



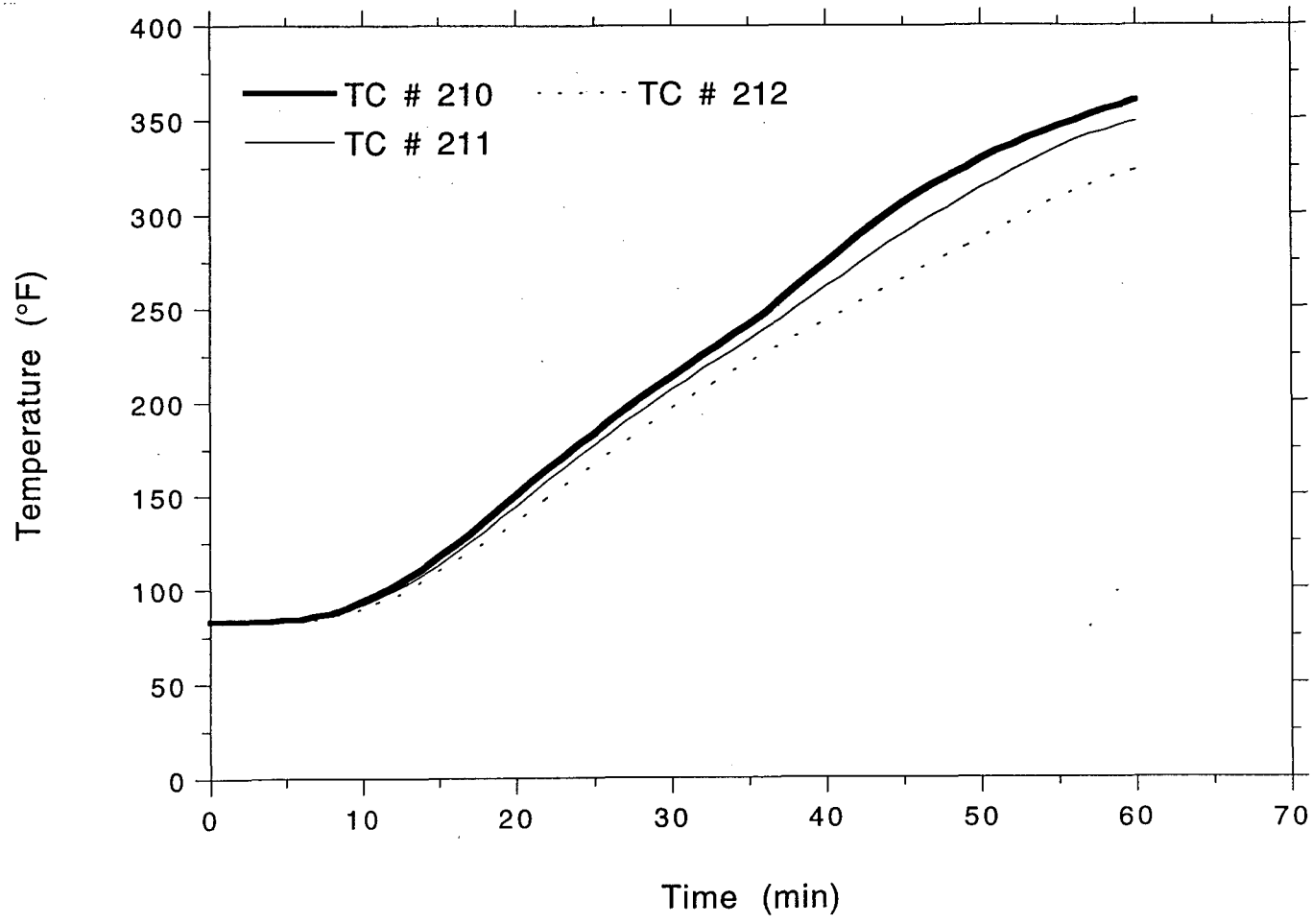
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, #8 on Rungs



OMEGA POINT LABORATORIES

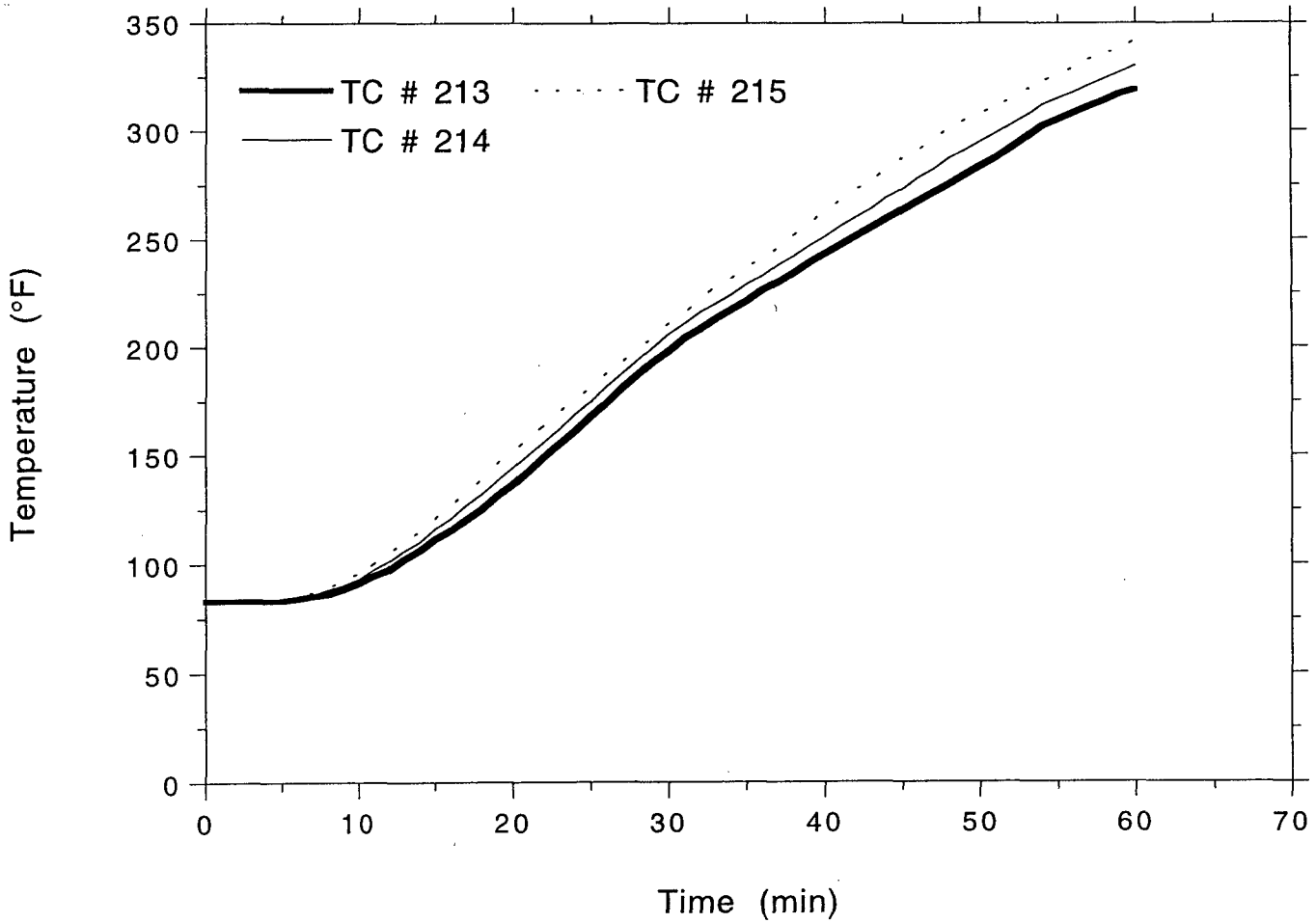
TSI/TVA
Project No. 11960-97185
Right Tray, #8 on Rungs



OMEGA POINT LABORATORIES

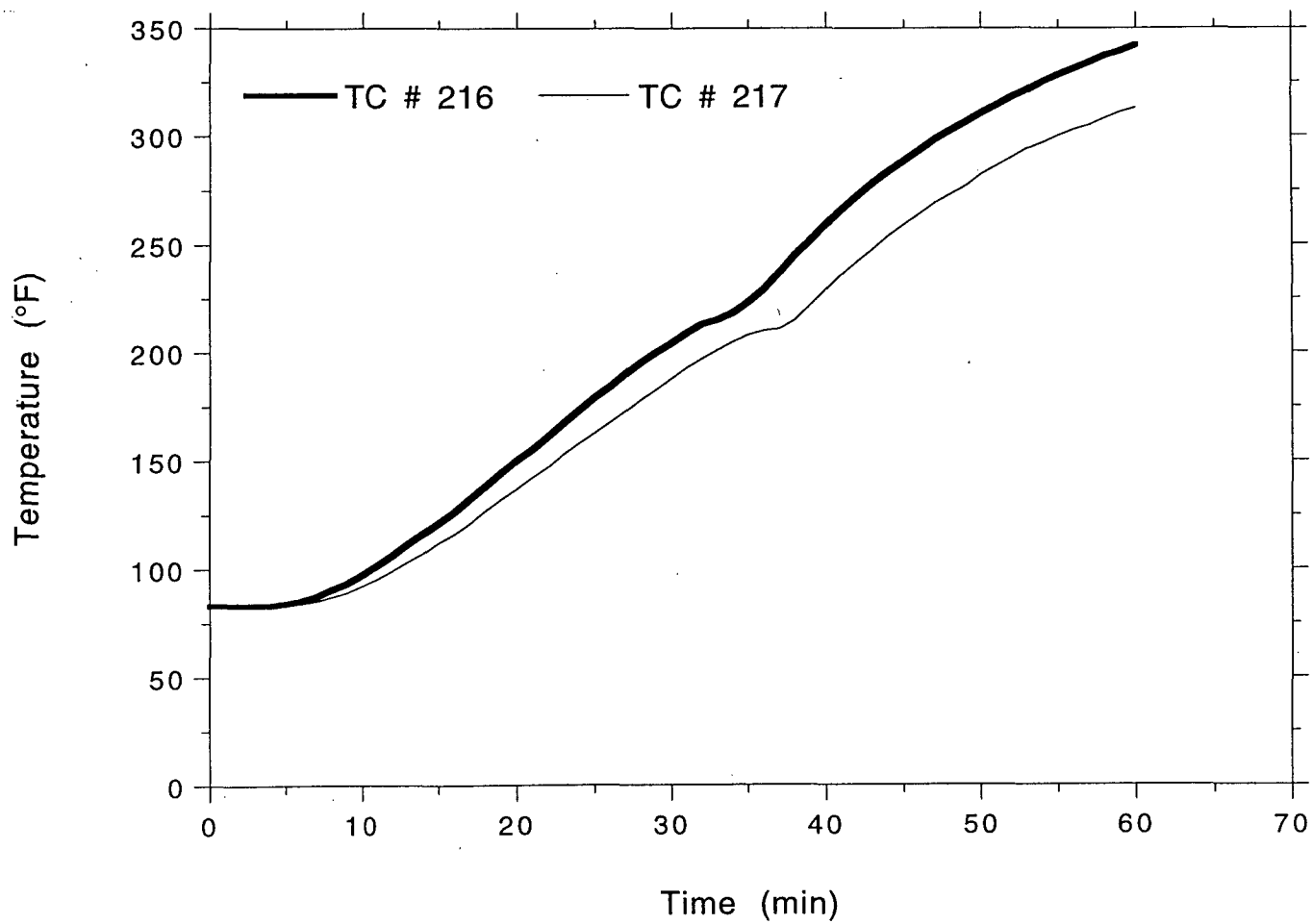
007

TSI/TVA
Project No. 11960-97185
Right Tray, #8 on Rungs



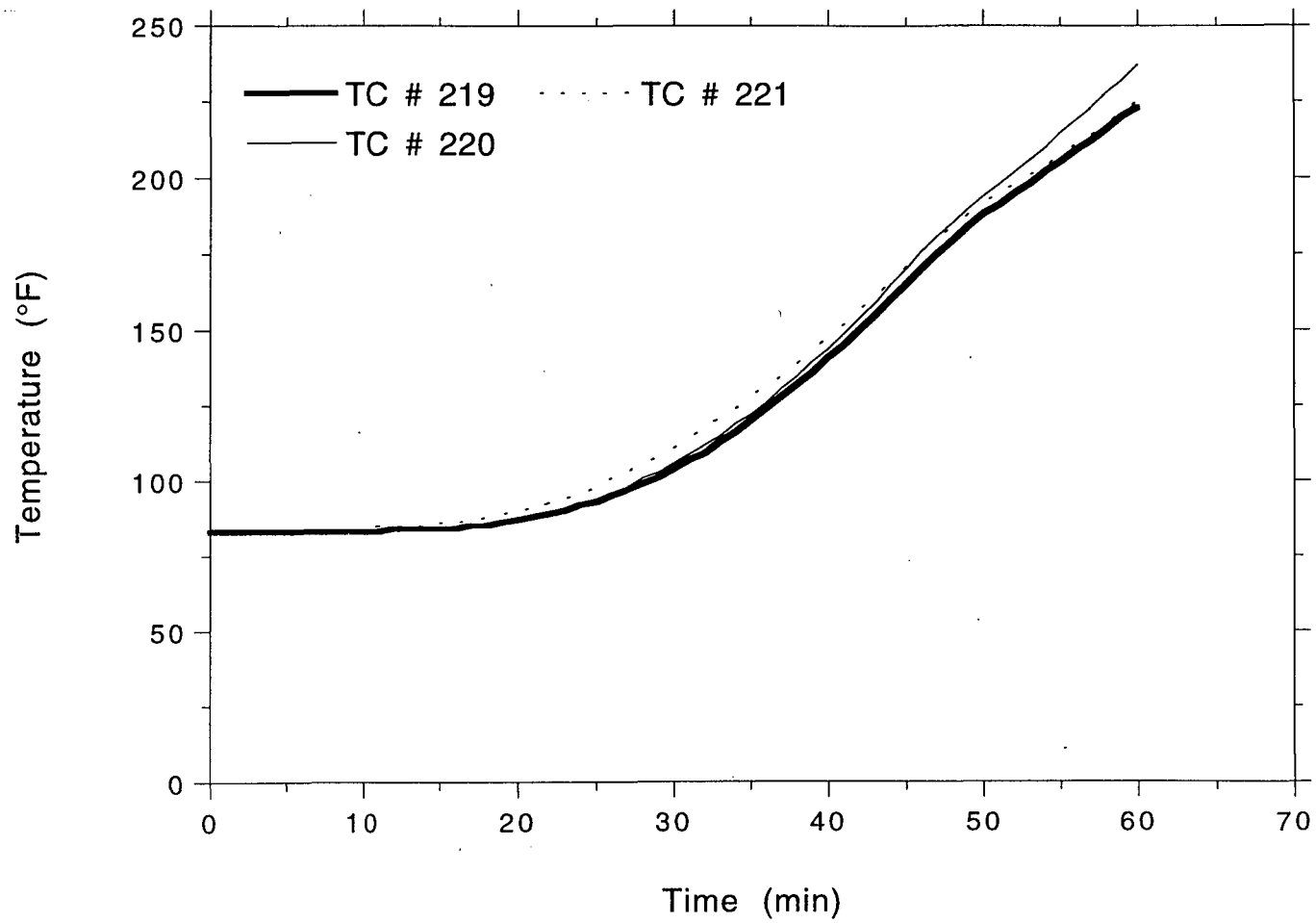
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Right Tray, #8 on Rungs



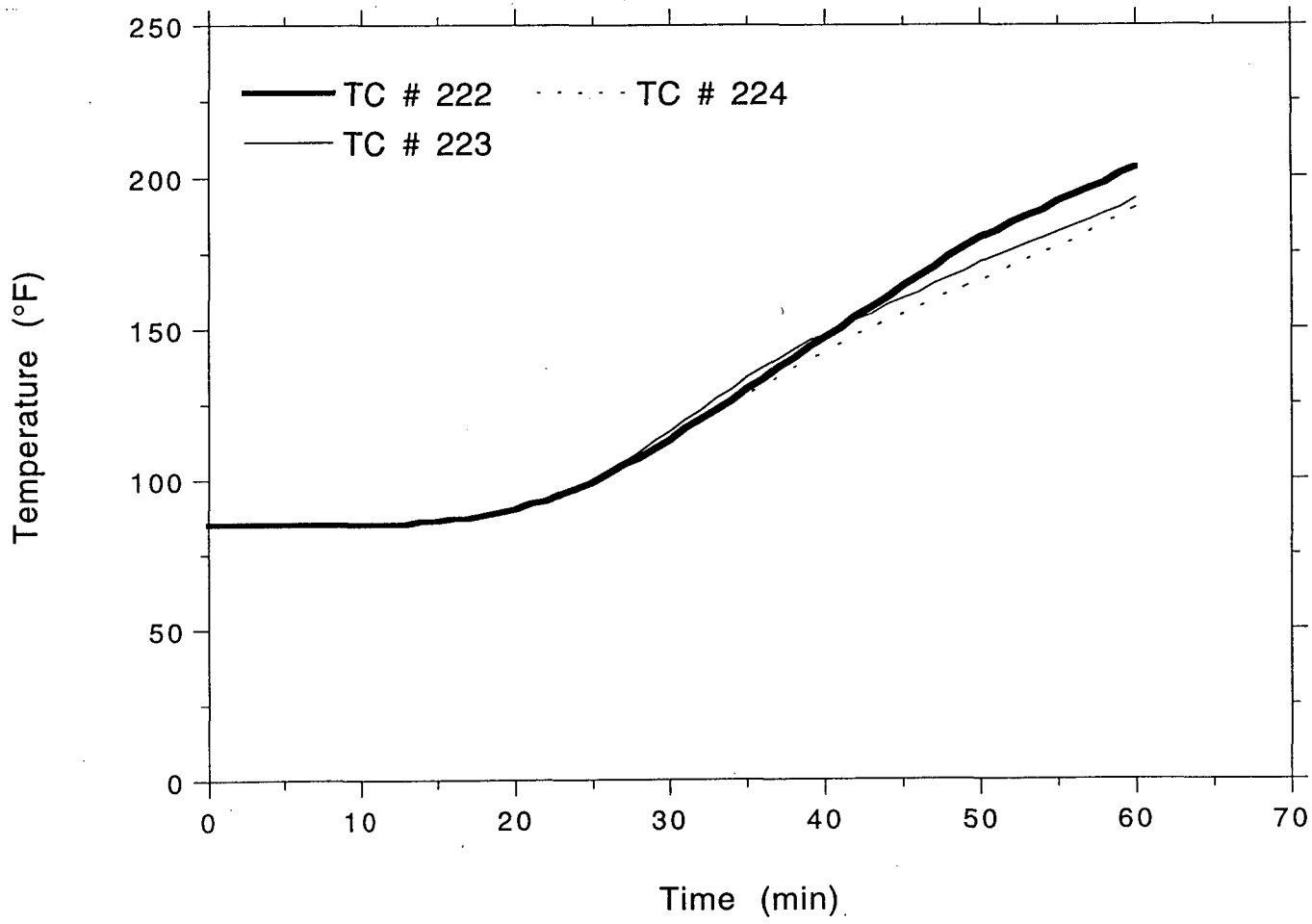
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
3" Conduit, #8



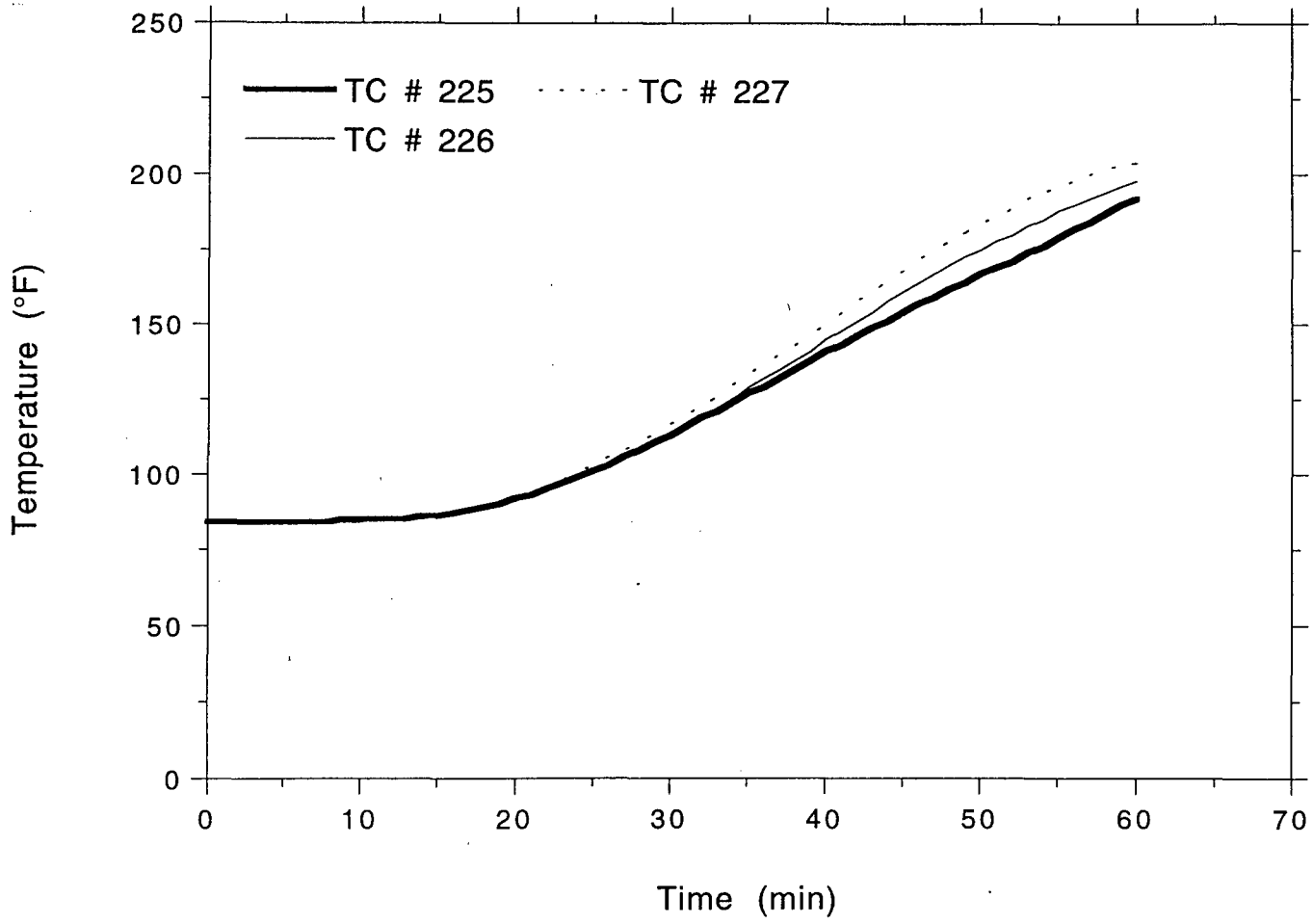
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
3" Conduit, #8



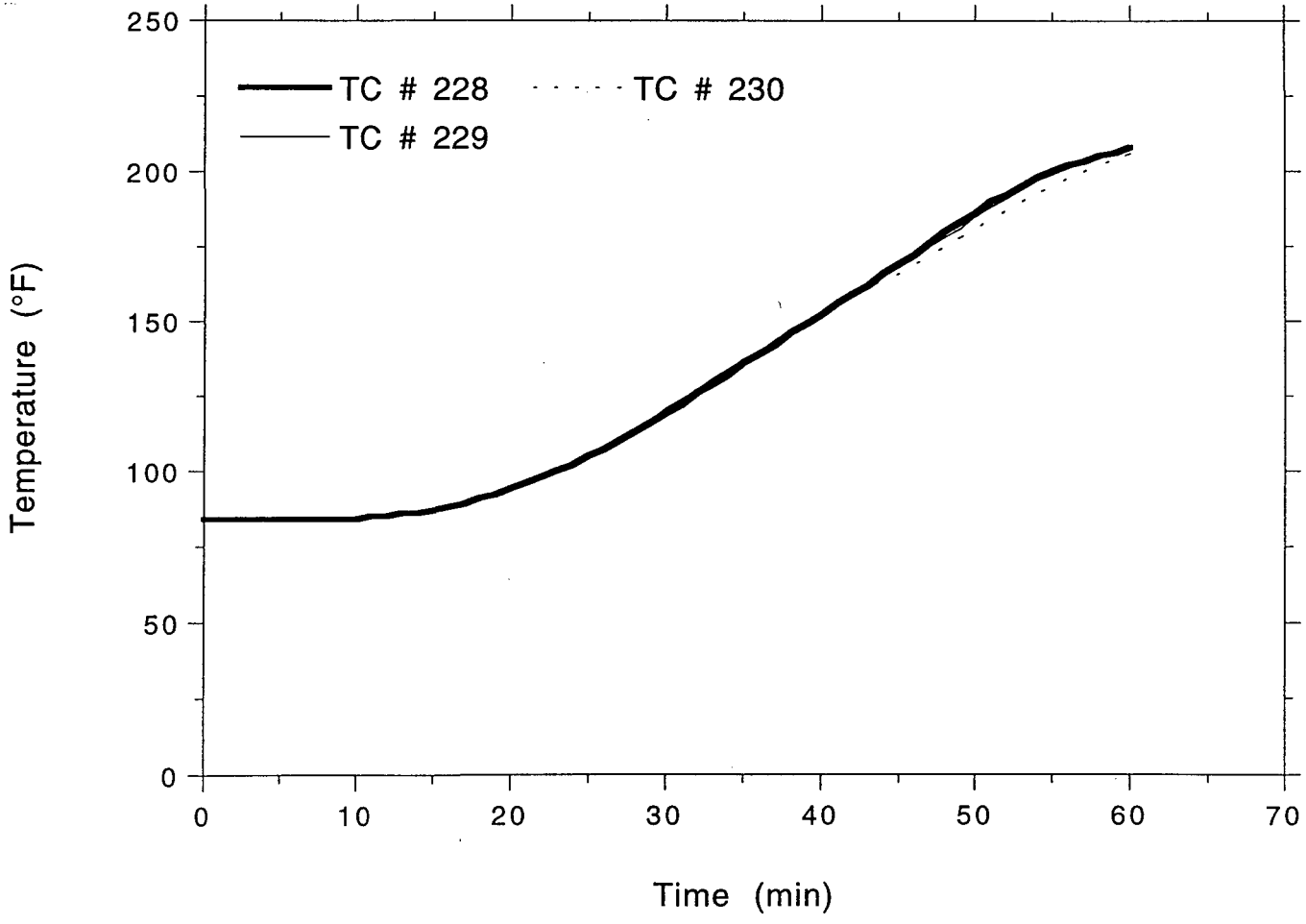
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
3" Conduit, #8



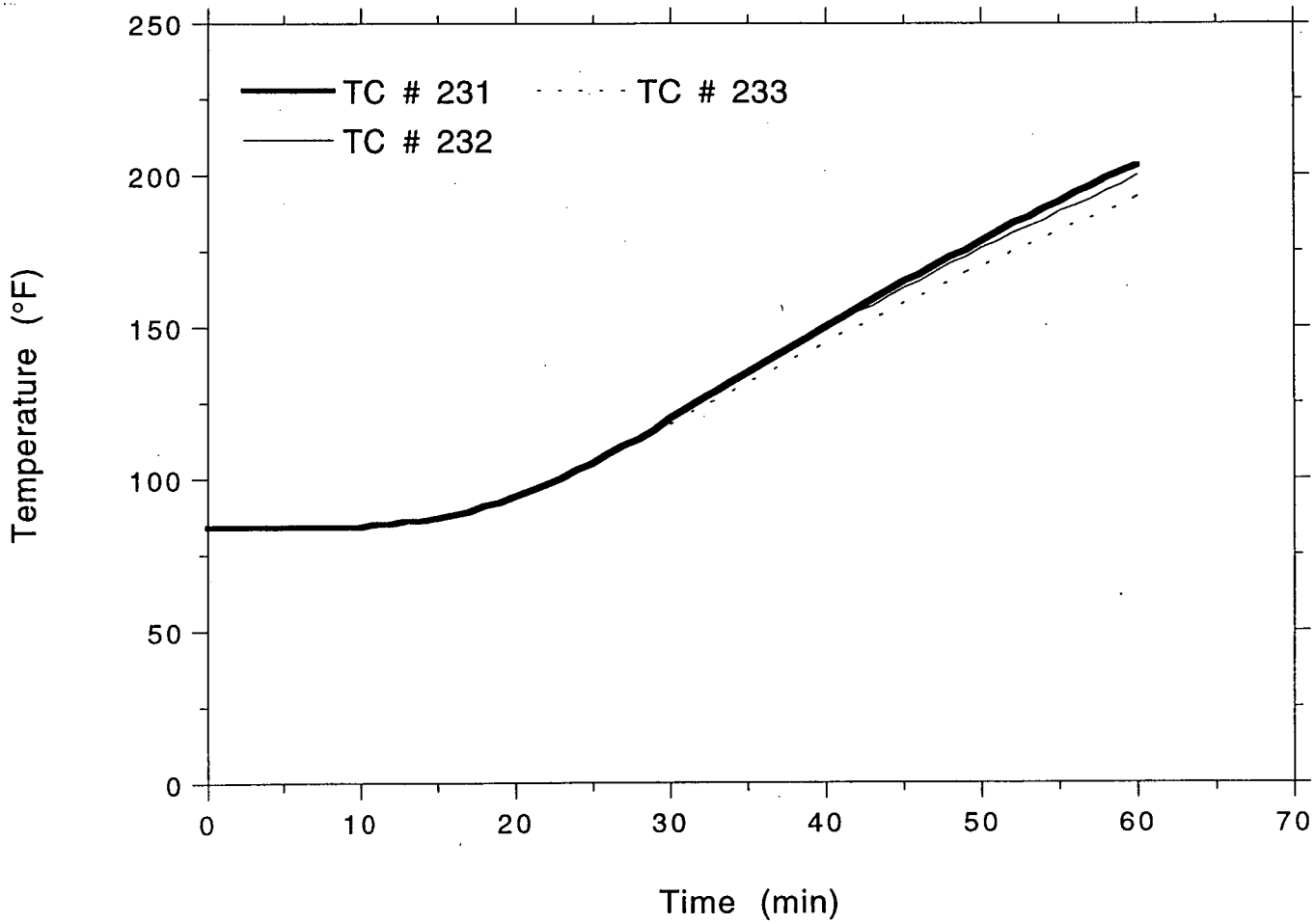
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
3" Conduit, #8



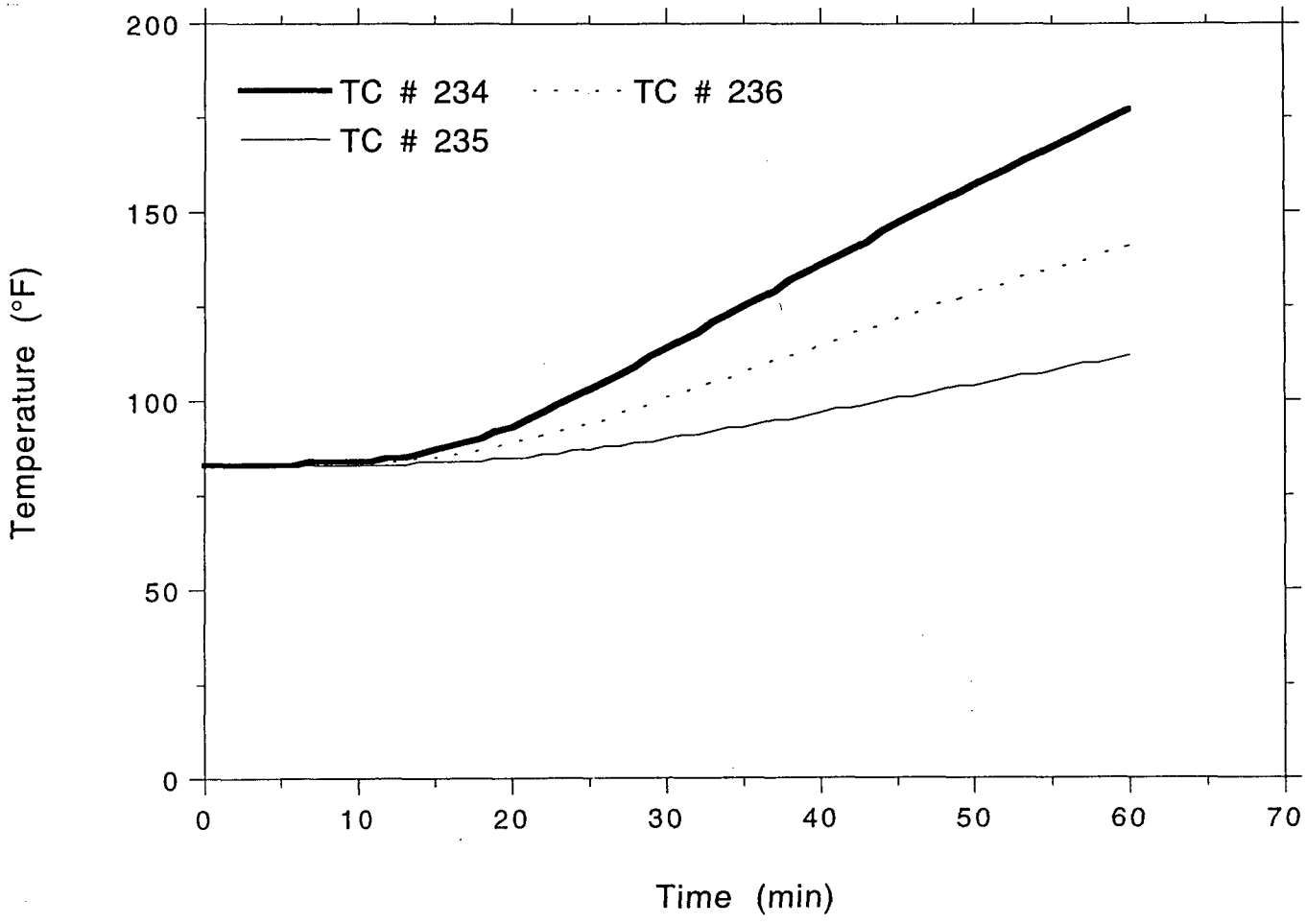
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
3" Conduit, #8



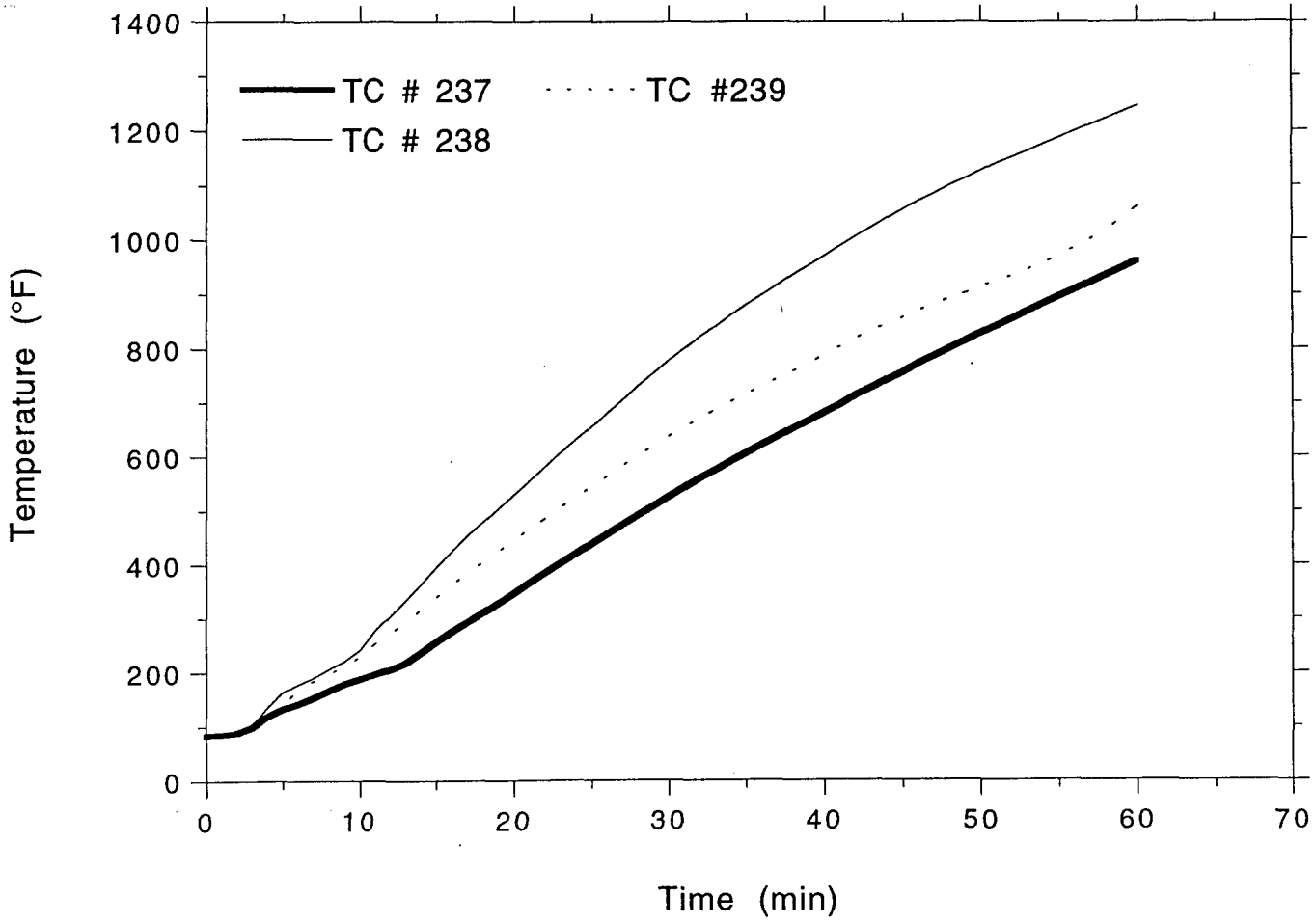
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
3" Conduit, #8



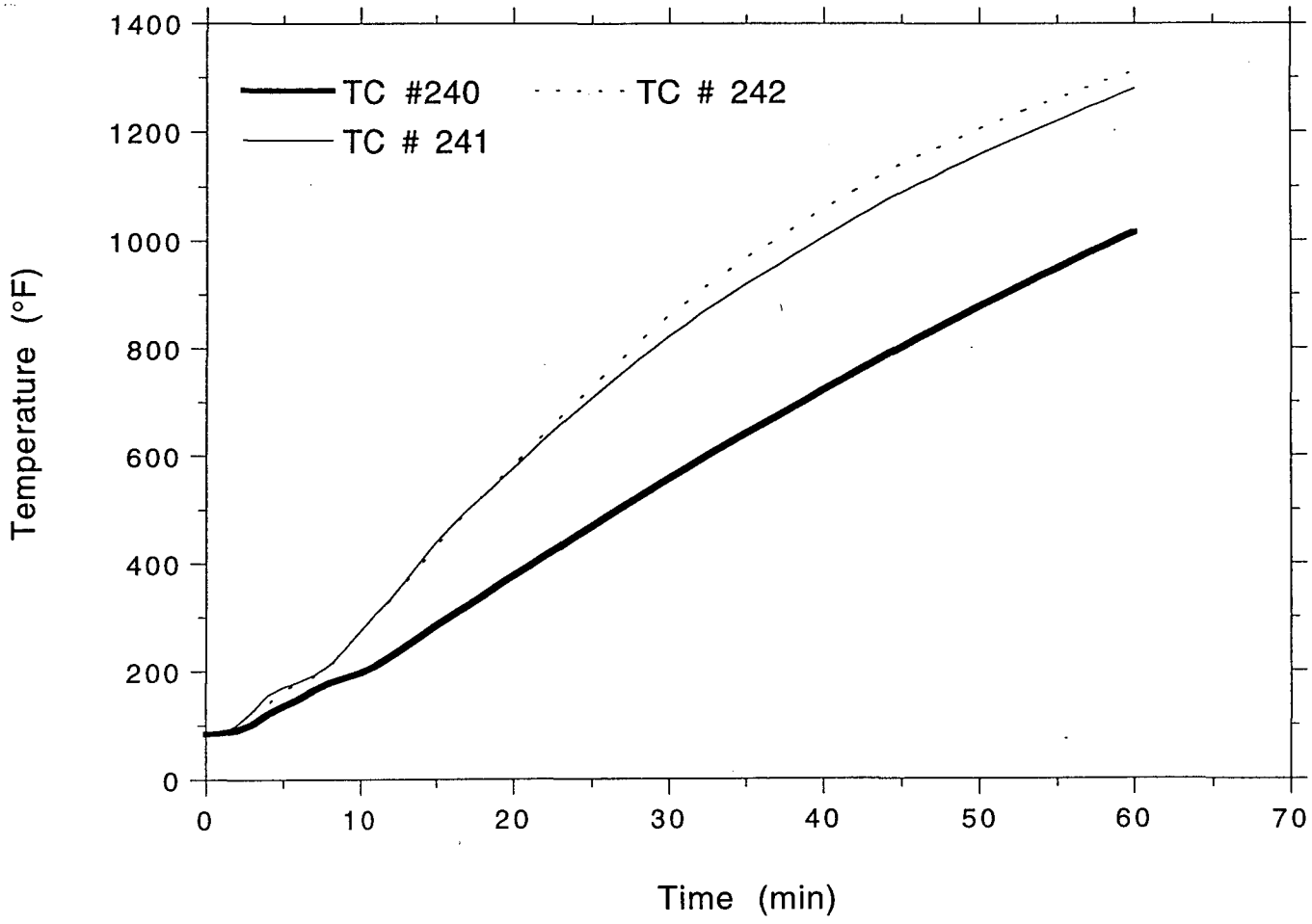
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



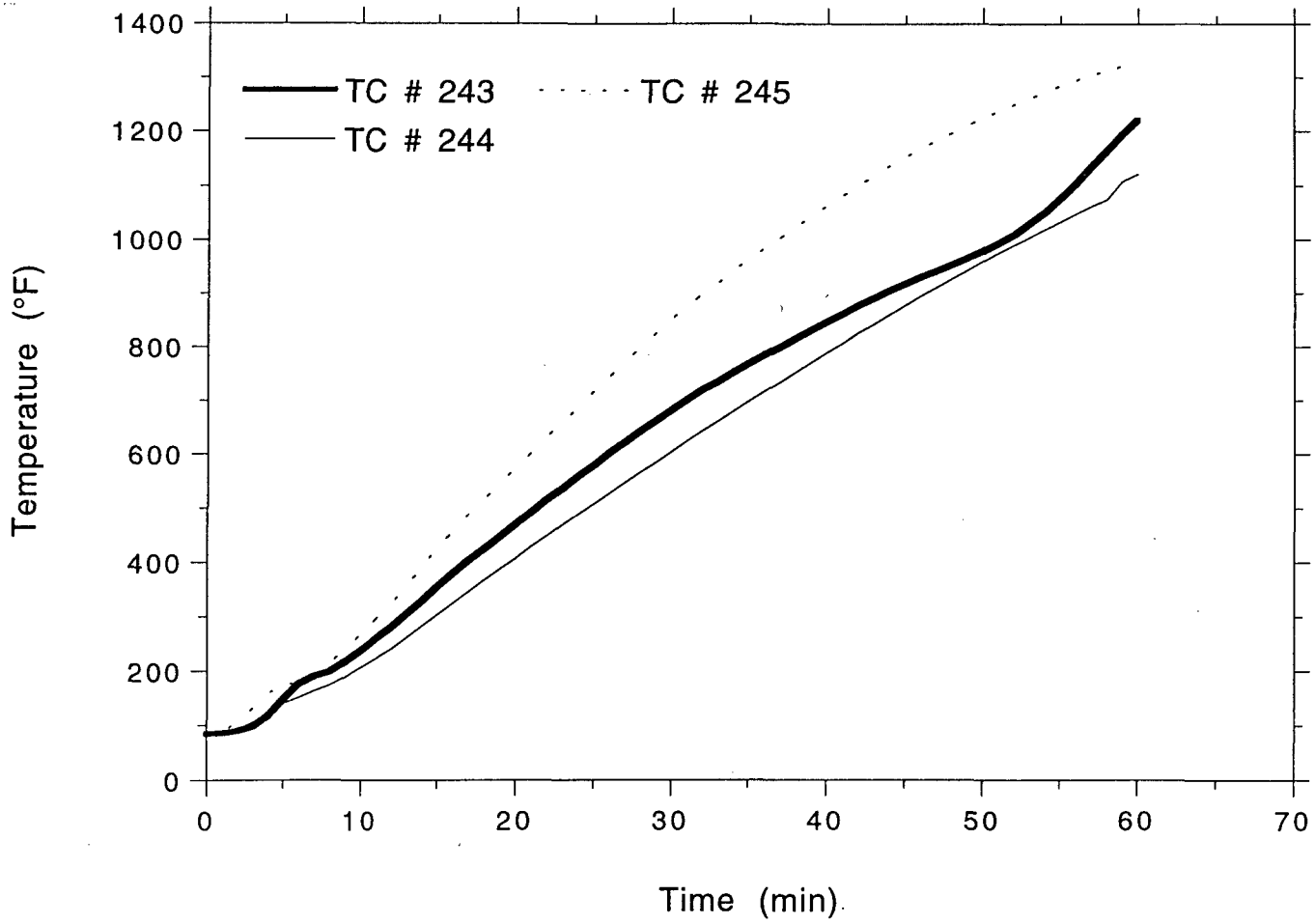
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



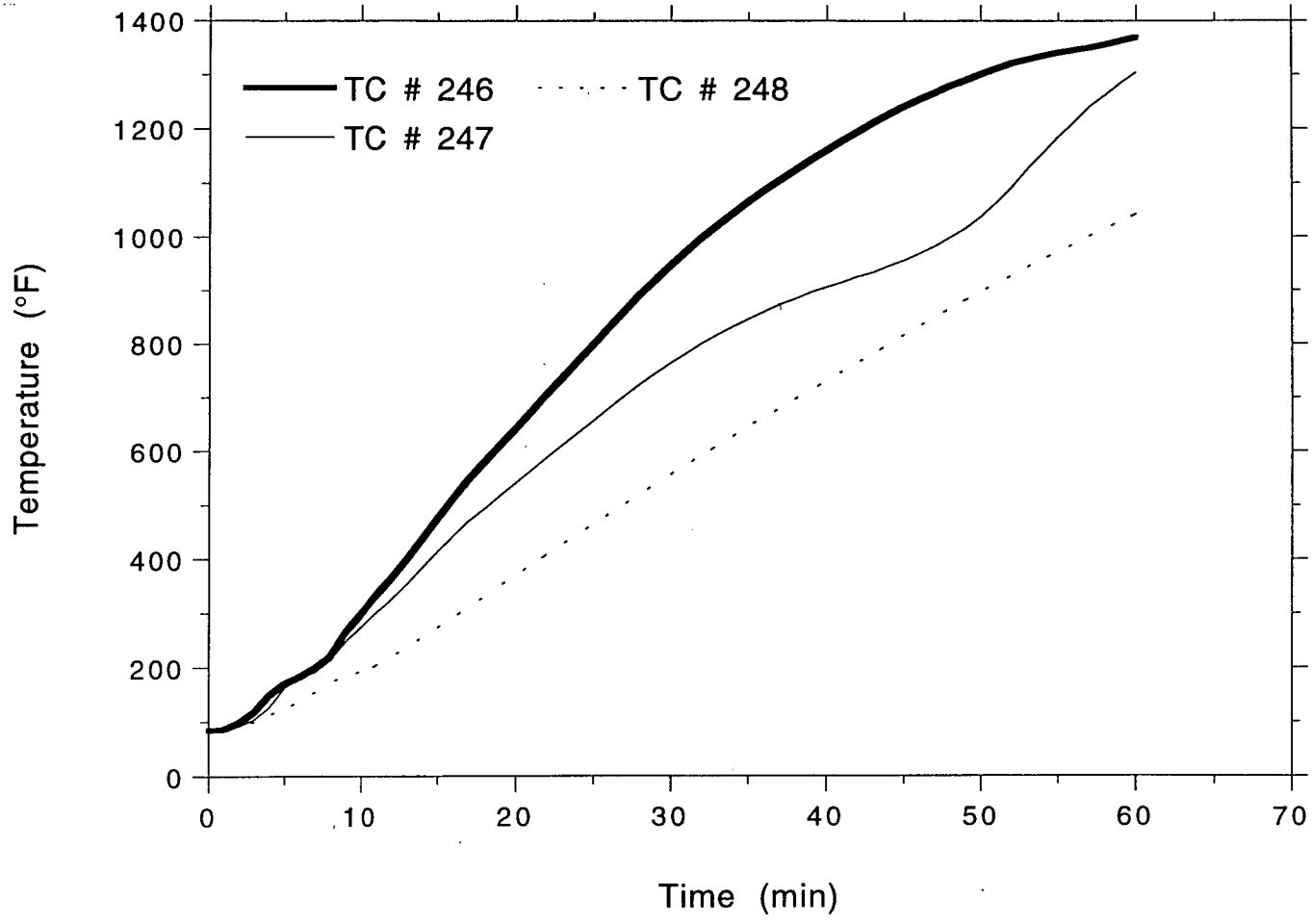
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



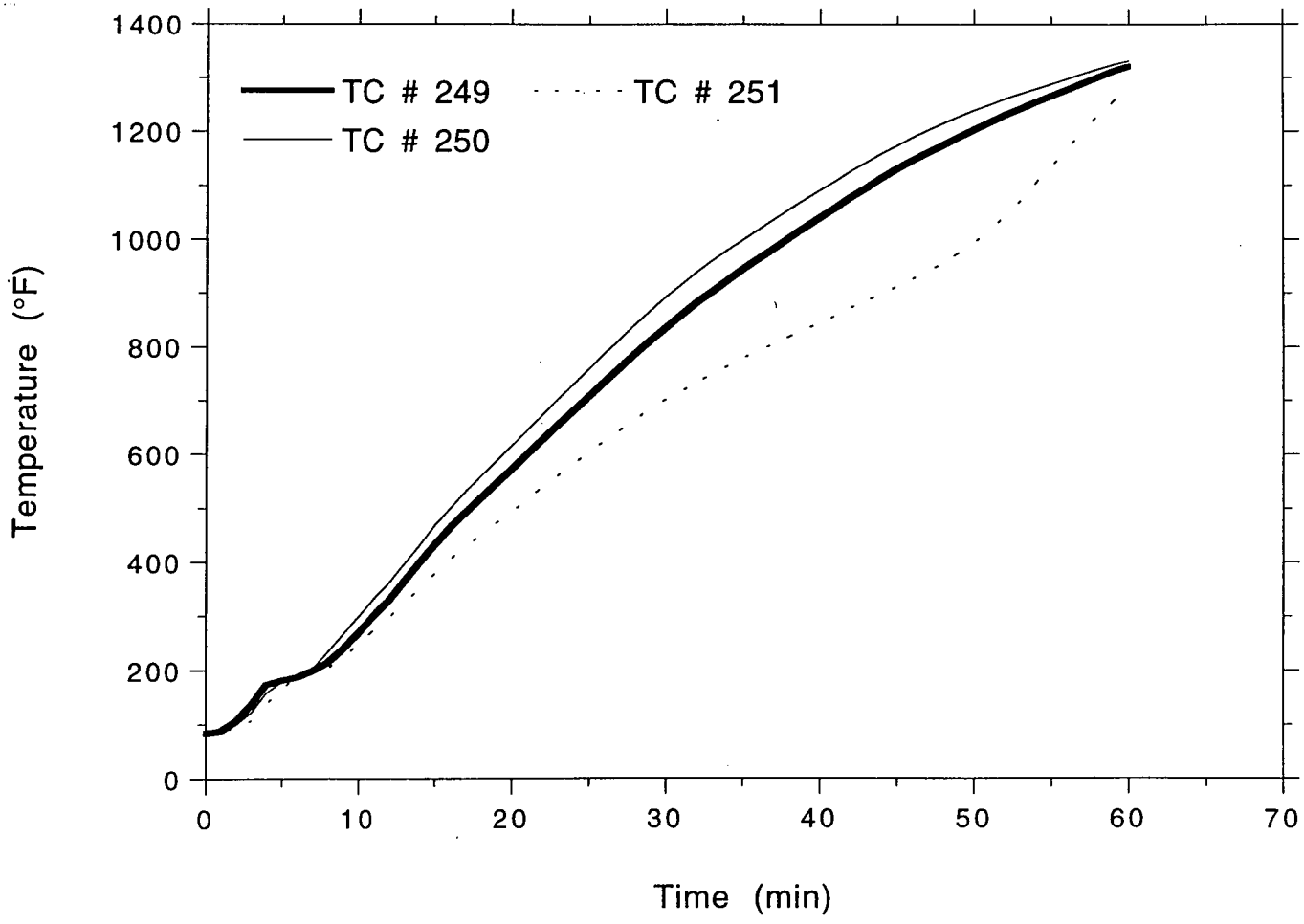
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



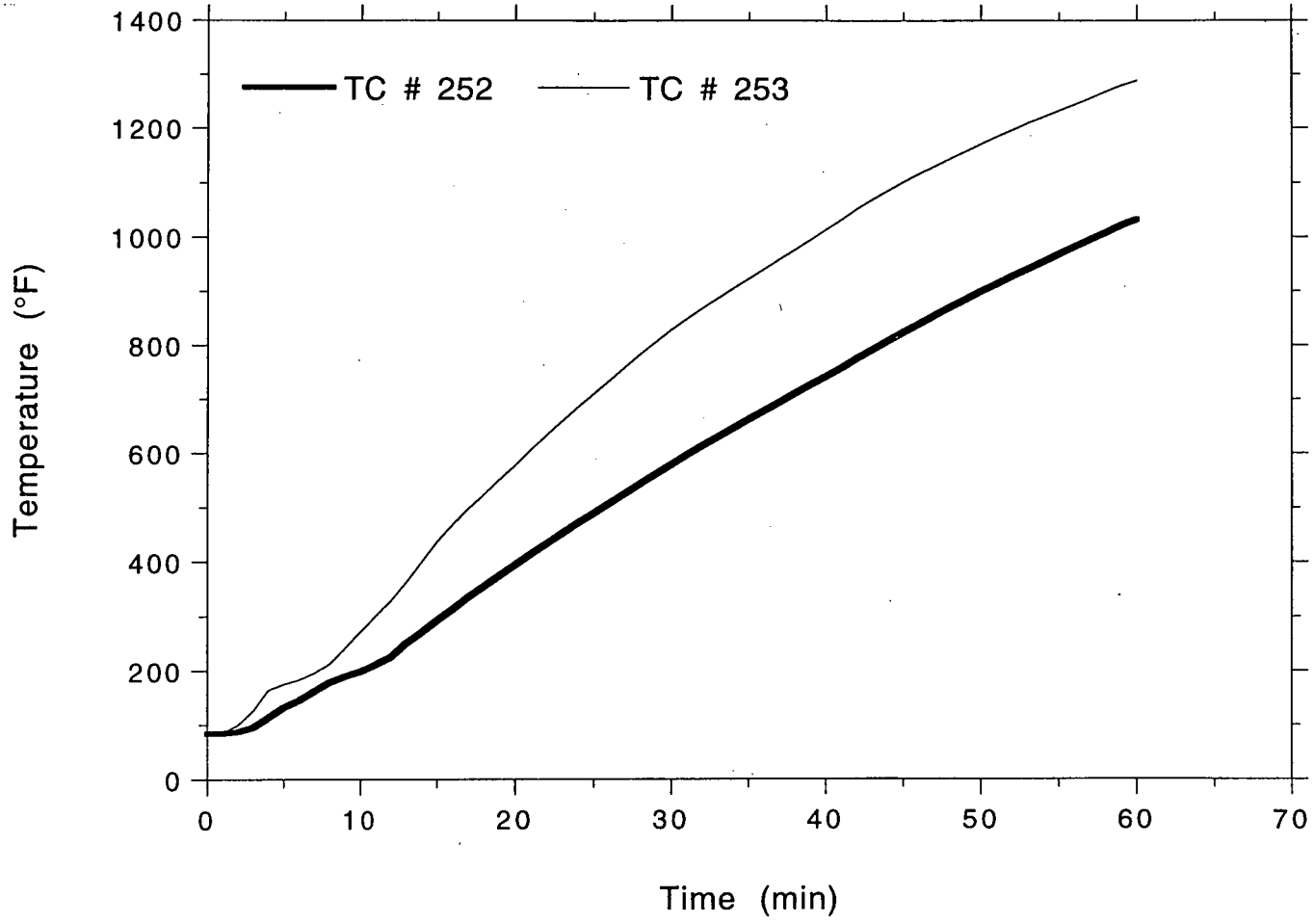
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



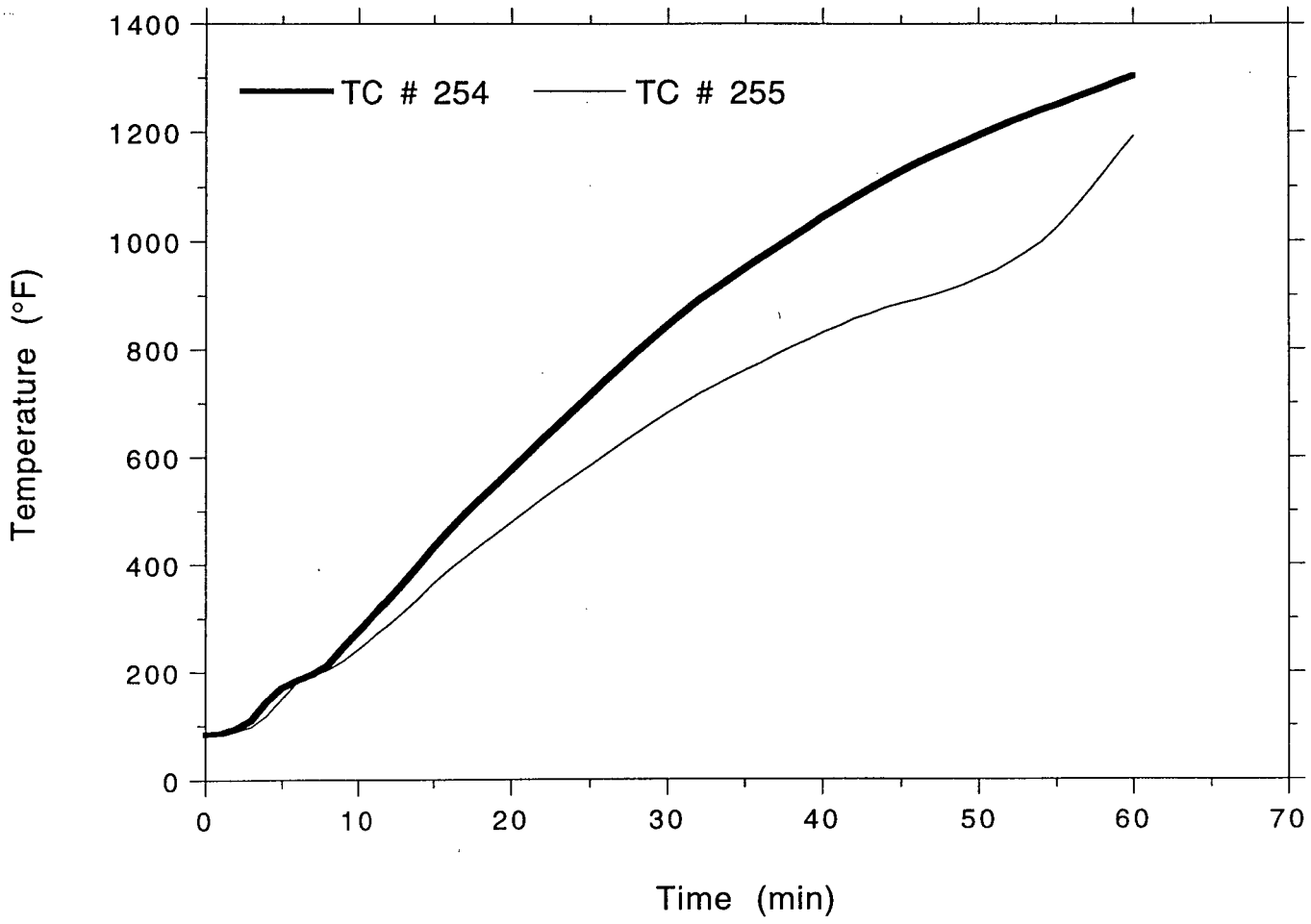
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97185
Support Steel



OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	Left 18" Tray Left Side Rail Max Temp (°F)	Left 18" Tray Left Side Rail Avg Temp (°F)	Left 18" Tray Bare #8 Under Rungs Max Temp (°F)	Left 18" Tray Bare #8 Under Rungs Avg Temp (°F)
0	85	84	85	84
1	85	84	85	84
2	85	84	85	84
3	84	84	85	84
4	84	84	85	84
5	85	84	85	84
6	85	84	85	85
7	85	85	86	85
8	85	85	88	86
9	86	86	89	88
10	88	86	92	89
11	89	88	94	91
12	91	89	97	93
13	93	90	101	96
14	96	92	105	99
15	99	94	109	102
16	103	97	113	105
17	106	99	118	108
18	109	102	123	112
19	111	105	128	115
20	114	108	133	119
21	118	111	138	123
22	121	114	142	126
23	124	117	146	130
24	128	120	150	133
25	131	123	154	137
26	135	126	158	140
27	138	130	161	144
28	141	133	165	147
29	145	136	168	150
30	148	139	171	153
31	151	142	175	156
32	154	145	178	159
33	156	147	182	162
34	159	150	186	164
35	162	153	190	167
36	165	156	194	170
37	168	158	198	173
38	171	161	202	176
39	175	163	205	178

Time (min)	Left 18" Tray Left Side Rail Max Temp (°F)	Left 18" Tray Left Side Rail Avg Temp (°F)	Left 18" Tray Bare #8 Under Rungs Max Temp (°F)	Left 18" Tray Bare #8 Under Rungs Avg Temp (°F)
40	178	166	209	181
41	182	168	213	184
42	186	171	217	187
43	190	173	221	189
44	196	176	224	192
45	210	180	228	195
46	210	184	231	197
47	211	188	235	200
48	211	190	238	203
49	211	193	242	206
50	211	195	245	208
51	211	196	248	211
52	211	198	251	213
53	211	199	254	216
54	212	201	257	218
55	212	202	259	220
56	212	203	262	223
57	212	204	265	225
58	212	205	267	227
59	212	206	270	229
60	212	207	272	231
Max Temp:	212	207	272	231
Max Allowed:	410	334	410	334

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	Left 18" Tray Bare #8 Over Cables Max Temp (°F)	Left 18" Tray Bare #8 Over Cables Avg Temp (°F)	Left 18" Tray Right Side Rail Max Temp (°F)	Left 18" Tray Right Side Rail Avg Temp (°F)
0	86	85	85	84
1	85	85	85	84
2	85	85	85	84
3	85	85	85	84
4	85	85	85	84
5	86	85	85	84
6	86	85	85	85
7	87	86	85	85
8	89	87	86	85
9	91	88	87	86
10	93	90	89	87
11	102	93	91	89
12	113	96	94	91
13	123	99	101	94
14	127	102	108	97
15	134	105	114	100
16	137	108	120	103
17	138	111	125	106
18	140	114	130	110
19	141	117	134	114
20	142	120	138	118
21	144	122	142	122
22	145	125	146	126
23	146	128	149	130
24	149	131	152	134
25	153	133	155	138
26	156	136	158	142
27	160	138	160	146
28	163	141	162	151
29	167	143	168	155
30	170	146	177	159
31	173	148	183	162
32	177	151	189	166
33	180	153	193	170
34	183	156	196	174
35	187	159	200	177
36	191	161	203	181
37	195	164	208	184
38	198	167	209	187
39	202	170	210	190

Time (min)	Left 18" Tray Bare #8 Over Cables Max Temp (°F)	Left 18" Tray Bare #8 Over Cables Avg Temp (°F)	Left 18" Tray Right Side Rail Max Temp (°F)	Left 18" Tray Right Side Rail Avg Temp (°F)
40	205	172	211	192
41	208	175	211	194
42	212	178	211	196
43	215	181	212	198
44	218	183	212	200
45	221	186	212	201
46	224	189	212	203
47	227	191	212	204
48	230	194	213	205
49	233	197	214	206
50	236	199	216	207
51	238	202	217	208
52	241	205	219	209
53	244	208	220	210
54	247	210	222	211
55	249	213	224	212
56	252	215	226	213
57	254	217	228	214
58	257	220	231	215
59	259	222	234	217
60	261	224	238	218
Max Temp:	261	224	238	218
Max Allowed:	411	335	410	334

Time (min)	Center 18" Tray Left Side Rail Max Temp (°F)	Center 18" Tray Left Side Rail Avg Temp (°F)	Center 18" Tray Bare #8 Under Rungs Max Temp (°F)	Center 18" Tray Bare #8 Under Rungs Avg Temp (°F)
0	84	84	84	83
1	85	84	84	83
2	84	84	84	83
3	85	84	84	83
4	85	84	84	84
5	85	84	84	84
6	85	84	86	84
7	86	85	87	85
8	87	86	89	86
9	89	87	92	88
10	92	89	94	90
11	95	91	97	92
12	99	94	100	95
13	102	97	103	98
14	107	101	107	101
15	111	105	111	104
16	116	109	114	108
17	121	114	118	111
18	126	119	123	115
19	131	124	128	119
20	137	129	133	123
21	142	134	138	128
22	148	139	143	132
23	154	144	148	136
24	159	149	154	141
25	165	154	159	145
26	170	159	164	150
27	176	165	169	154
28	181	170	174	159
29	186	175	179	164
30	192	180	184	168
31	197	185	189	172
32	204	190	194	177
33	209	195	198	181
34	211	199	201	184
35	212	202	205	188
36	213	205	208	191
37	214	208	212	195
38	216	210	216	198
39	218	212	220	202

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	Center 18" Tray Left Side Rail Max Temp (°F)	Center 18" Tray Left Side Rail Avg Temp (°F)	Center 18" Tray Bare #8 Under Rungs Max Temp (°F)	Center 18" Tray Bare #8 Under Rungs Avg Temp (°F)
40	221	213	224	205
41	224	215	227	208
42	227	216	231	210
43	231	218	235	212
44	235	220	239	214
45	239	223	244	215
46	243	225	248	219
47	248	228	252	223
48	253	231	257	227
49	259	234	262	232
50	264	238	267	237
51	270	241	273	242
52	276	245	278	248
53	283	249	284	253
54	289	253	289	258
55	296	257	293	263
56	302	262	298	268
57	309	266	302	273
58	315	270	307	277
59	322	275	311	281
60	328	280	314	285
Max Temp:	328	280	314	285
Max Allowed:	409	334	409	333

OMEGA POINT LABORATORIES

Time (min)	Center 18" Tray Bare #8 Over Cables Max Temp (°F)	Center 18" Tray Bare #8 Over Cables Avg Temp (°F)	Center 18" Tray Right Side Rail Max Temp (°F)	Center 18" Tray Right Side Rail Avg Temp (°F)
0	84	84	85	84
1	84	84	85	84
2	84	84	85	84
3	84	84	85	84
4	84	84	85	84
5	84	84	85	84
6	84	84	85	84
7	85	85	86	85
8	86	85	87	85
9	88	86	88	87
10	90	88	90	88
11	92	90	93	91
12	95	93	97	93
13	98	95	101	97
14	101	98	105	100
15	105	101	110	104
16	109	105	115	109
17	113	109	120	113
18	117	113	126	118
19	121	117	131	123
20	126	121	137	127
21	130	125	142	133
22	135	129	148	138
23	139	134	153	143
24	144	138	159	148
25	148	143	165	153
26	153	148	170	158
27	158	153	176	163
28	163	158	182	168
29	167	163	189	173
30	172	168	195	178
31	176	172	201	183
32	181	177	207	188
33	185	181	210	192
34	189	186	211	196
35	193	190	211	200
36	197	194	212	204
37	202	198	213	207
38	206	201	216	210
39	210	204	219	212

Time (min)	Center 18" Tray Bare #8 Over Cables Max Temp (°F)	Center 18" Tray Bare #8 Over Cables Avg Temp (°F)	Center 18" Tray Right Side Rail Max Temp (°F)	Center 18" Tray Right Side Rail Avg Temp (°F)
40	214	207	221	214
41	218	210	225	215
42	222	213	228	217
43	226	215	232	219
44	230	218	237	221
45	234	222	241	223
46	240	225	245	226
47	245	229	250	228
48	251	234	255	231
49	256	238	260	234
50	261	243	264	237
51	266	248	269	240
52	271	253	274	243
53	276	258	279	247
54	280	263	285	250
55	285	268	290	254
56	289	272	296	258
57	293	277	302	262
58	297	281	307	265
59	301	285	313	269
60	305	289	319	273
Max Temp:	305	289	319	273
Max Allowed:	409	334	410	334

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	Right 18" Tray Left Side Rail Max Temp (°F)	Right 18" Tray Left Side Rail Avg Temp (°F)	Right 18" Tray Bare #8 Over Rungs Max Temp (°F)	Right 18" Tray Bare #8 Over Rungs Avg Temp (°F)
0	84	84	84	83
1	84	84	84	83
2	84	83	84	83
3	84	84	84	83
4	84	84	84	84
5	84	84	84	84
6	84	84	85	85
7	86	85	87	86
8	87	86	90	88
9	90	88	93	91
10	93	90	97	94
11	97	94	101	98
12	101	97	106	102
13	106	102	113	108
14	113	107	120	113
15	120	112	126	119
16	126	118	132	124
17	133	124	138	130
18	139	130	144	136
19	146	136	150	142
20	151	142	156	148
21	157	149	162	154
22	163	155	168	160
23	168	161	173	166
24	173	166	178	172
25	179	172	185	178
26	185	178	191	183
27	191	183	197	189
28	198	188	204	195
29	204	193	212	201
30	208	198	219	207
31	210	202	226	212
32	211	205	234	218
33	213	208	241	223
34	215	211	249	229
35	217	213	256	234
36	220	215	263	240
37	224	217	271	246
38	229	219	278	252
39	233	221	285	259

OMEGA POINT LABORATORIES

Time (min)	Right 18" Tray Left Side Rail Max Temp (°F)	Right 18" Tray Left Side Rail Avg Temp (°F)	Right 18" Tray Bare #8 Over Rungs Max Temp (°F)	Right 18" Tray Bare #8 Over Rungs Avg Temp (°F)
40	237	223	292	265
41	241	226	298	271
42	245	228	305	277
43	250	231	310	282
44	254	234	316	288
45	259	238	321	293
46	264	241	325	297
47	269	245	330	302
48	274	249	334	306
49	280	253	337	310
50	286	257	341	314
51	292	261	344	318
52	299	266	347	322
53	305	270	350	325
54	312	275	353	329
55	318	280	356	332
56	324	285	359	335
57	331	290	362	338
58	337	295	365	341
59	344	301	367	344
60	349	306	370	346
Max Temp:	349	306	370	346
Max Allowed:	409	334	409	333

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	Right 18" Tray Right Side Rail Max Temp (°F)	Right 18" Tray Right Side Rail Avg Temp (°F)	3" Conduit Surface Max Temp (°F)	3" Conduit Surface Avg Temp (°F)	3" Conduit Bare #8 Max Temp (°F)
0	84	84	85	84	85
1	84	84	85	84	85
2	84	84	85	84	85
3	84	84	85	84	85
4	85	84	85	84	85
5	85	84	85	84	85
6	86	84	85	84	85
7	87	85	85	84	85
8	89	86	85	84	85
9	92	88	85	85	85
10	95	90	86	85	85
11	100	93	87	86	85
12	104	97	88	87	85
13	110	101	89	88	86
14	116	106	93	89	86
15	123	111	100	91	87
16	129	116	112	93	88
17	136	122	117	95	90
18	142	128	120	97	91
19	149	134	122	99	93
20	155	141	122	101	95
21	162	147	122	104	97
22	168	153	124	106	99
23	173	159	127	109	101
24	179	165	129	112	104
25	184	171	132	114	106
26	190	176	135	117	109
27	196	181	137	121	111
28	206	187	140	124	114
29	211	191	142	127	117
30	211	195	145	131	121
31	212	199	147	134	124
32	213	203	152	137	127
33	217	206	157	140	131
34	220	209	162	144	134
35	222	211	169	147	137
36	225	213	175	150	140
37	229	215	181	153	144
38	232	217	187	157	147
39	236	219	193	160	150

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	Right 18" Tray Right Side Rail Max Temp (°F)	Right 18" Tray Right Side Rail Avg Temp (°F)	3" Conduit Surface Max Temp (°F)	3" Conduit Surface Avg Temp (°F)	3" Conduit Bare #8 Max Temp (°F)
40	240	221	198	163	153
41	244	223	201	166	156
42	249	225	205	169	159
43	254	228	208	173	162
44	259	230	209	176	166
45	265	233	210	179	171
46	270	236	210	182	176
47	276	238	211	184	181
48	283	242	212	187	185
49	289	245	214	189	190
50	296	248	217	191	194
51	303	252	220	193	198
52	310	255	225	195	202
53	317	259	230	197	206
54	324	263	235	200	210
55	331	267	241	202	215
56	337	271	247	204	219
57	343	276	253	206	223
58	349	280	259	209	228
59	353	285	266	211	232
60	358	290	273	214	237
Max Temp:	358	290	273	214	237
Max Allowed:	409	334	410	334	410

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	3" Conduit Bare #8 Avg Temp (°F)	Clad Support Steel Max Temp (°F)	Clad Support Steel Avg Temp (°F)	TC # 1 (°F)	TC # 2 (°F)	TC # 3 (°F)	TC # 4 (°F)	TC # 5 (°F)
0	84	86	84	84	84	85	85	85
1	84	153	96	84	84	84	84	85
2	84	273	120	84	84	85	84	84
3	84	485	166	84	84	84	84	84
4	84	1009	276	84	84	84	84	84
5	84	1418	409	84	84	85	85	85
6	84	1505	502	84	84	85	85	85
7	84	1406	538	84	85	85	85	85
8	84	1440	553	85	85	85	85	85
9	84	1451	565	85	86	86	86	85
10	84	1426	572	86	86	86	86	86
11	84	1425	591	87	88	87	87	86
12	85	1521	639	89	89	89	89	87
13	85	1602	680	90	90	90	90	88
14	85	1618	707	92	92	92	92	90
15	86	1611	720	94	94	94	94	91
16	87	1571	727	96	96	96	96	93
17	88	1529	737	98	99	98	99	95
18	89	1528	756	101	101	101	101	97
19	90	1558	780	103	104	103	104	99
20	91	1589	805	106	107	106	107	102
21	93	1613	828	109	110	109	110	104
22	95	1625	849	112	113	113	114	107
23	96	1647	869	115	117	116	117	110
24	98	1653	889	118	120	120	121	113
25	100	1667	907	121	124	123	124	116
26	103	1671	926	125	127	126	127	119
27	105	1685	945	128	131	129	131	122
28	107	1686	960	131	134	132	134	125
29	110	1688	971	135	137	134	136	127
30	113	1689	982	138	140	136	139	129
31	116	1682	993	141	144	139	142	132
32	118	1671	1004	144	147	142	145	134
33	121	1667	1016	147	149	145	148	136
34	124	1667	1030	150	152	147	151	139
35	127	1671	1043	153	155	149	153	142
36	130	1676	1060	155	158	152	156	144
37	133	1692	1076	158	161	154	158	146
38	136	1706	1092	161	163	156	161	148
39	139	1719	1109	163	166	159	163	150

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	3" Conduit Bare #8 Avg Temp (°F)	Clad Support Steel Max Temp (°F)	Clad Support Steel Avg Temp (°F)	TC # 1 (°F)	TC # 2 (°F)	TC # 3 (°F)	TC # 4 (°F)	TC # 5 (°F)
40	142	1724	1122	166	168	161	165	152
41	145	1730	1135	169	171	163	168	154
42	148	1742	1148	171	173	166	170	156
43	151	1747	1161	174	176	168	172	157
44	154	1742	1169	176	178	171	174	159
45	157	1730	1175	179	180	173	175	161
46	160	1729	1183	181	182	175	177	163
47	163	1731	1194	183	184	178	179	165
48	166	1729	1205	185	184	180	180	168
49	169	1734	1216	187	185	182	182	170
50	171	1742	1227	189	186	185	185	173
51	174	1742	1236	191	188	190	185	175
52	176	1740	1246	192	190	193	187	178
53	179	1745	1256	194	193	196	190	180
54	181	1751	1268	195	195	199	192	182
55	184	1759	1282	198	196	203	194	185
56	186	1775	1296	200	197	205	196	187
57	188	1794	1309	202	199	207	199	190
58	191	1793	1319	203	201	209	203	192
59	193	1788	1330	205	203	210	205	194
60	195	1787	1339	206	204	211	206	196
Max Temp:	195	1794	1339	206	204	211	206	196
Max Allowed:	334			409	409	410	410	410

OMEGA POINT LABORATORIES

Time (min)	TC # 6 (°F)	TC # 7 (°F)	TC # 8 (°F)	TC # 9 (°F)	TC # 10 (°F)	TC # 11 (°F)	TC # 12 (°F)	TC # 13 (°F)
0	84	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84	84
5	84	84	84	84	84	84	84	84
6	84	84	84	84	85	84	84	84
7	84	84	85	85	85	85	85	85
8	85	85	85	85	85	85	85	85
9	85	85	85	86	86	85	86	86
10	85	85	86	87	87	86	87	86
11	86	85	87	88	88	87	88	88
12	87	86	88	90	90	89	89	89
13	88	87	89	92	92	90	91	90
14	89	87	91	94	94	92	93	92
15	90	88	93	97	97	95	95	94
16	92	90	95	101	100	98	97	96
17	94	91	98	104	103	101	99	98
18	96	93	100	108	106	103	102	100
19	98	95	103	111	109	106	105	103
20	101	97	106	114	112	109	108	106
21	103	99	110	118	115	112	111	108
22	106	102	113	121	118	115	114	111
23	109	104	116	124	121	118	117	114
24	111	107	119	128	124	122	121	117
25	114	109	123	131	127	125	124	120
26	117	112	126	135	130	128	127	123
27	120	115	130	138	133	132	132	126
28	123	117	133	141	137	135	136	129
29	125	120	136	145	140	138	139	132
30	128	123	139	148	143	141	141	135
31	131	126	142	151	145	144	144	138
32	133	129	145	154	148	147	146	141
33	136	131	148	156	151	150	149	144
34	138	134	150	159	155	152	152	148
35	139	136	153	162	158	155	155	151
36	141	138	156	165	161	157	157	154
37	143	141	158	168	163	160	160	157
38	145	143	161	171	166	163	163	161
39	146	145	164	175	170	165	167	164

OMEGA POINT LABORATORIES

Time (min)	TC # 6 (°F)	TC # 7 (°F)	TC # 8 (°F)	TC # 9 (°F)	TC # 10 (°F)	TC # 11 (°F)	TC # 12 (°F)	TC # 13 (°F)
40	148	147	166	178	173	168	170	167
41	150	149	168	182	176	171	173	170
42	151	151	171	186	179	174	176	172
43	153	153	173	190	183	177	179	175
44	154	155	176	196	187	180	182	178
45	156	157	184	210	192	184	185	180
46	158	159	190	210	198	193	191	183
47	159	161	196	211	204	206	196	185
48	161	163	199	211	208	210	205	188
49	163	165	202	211	210	210	209	191
50	165	167	203	211	210	211	210	195
51	168	169	205	211	211	211	211	198
52	170	171	206	211	211	211	211	202
53	172	173	207	211	211	211	211	205
54	174	175	208	211	211	212	212	207
55	176	177	209	212	211	212	212	209
56	178	179	209	212	211	212	212	209
57	180	181	210	212	211	212	212	210
58	181	183	210	212	212	212	212	210
59	183	185	210	212	212	212	212	211
60	185	186	210	212	212	212	212	211
Max Temp:	185	186	210	212	212	212	212	211
Max Allowed:	409	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 14 (°F)	TC # 15 (°F)	TC # 16 (°F)	TC # 17 (°F)	TC # 18 (°F)	TC # 19 (°F)	TC # 20 (°F)	TC # 21 (°F)
0	84	84	84	84	deleted	84	84	85
1	84	84	84	84	deleted	84	84	85
2	84	84	84	84	deleted	84	84	85
3	84	84	84	84	deleted	84	84	85
4	84	84	84	84	deleted	84	84	85
5	84	84	84	84	deleted	84	84	85
6	84	84	84	84	deleted	84	85	85
7	85	85	85	85	deleted	84	85	85
8	85	85	85	85	deleted	85	86	85
9	86	86	86	86	deleted	85	86	86
10	87	87	88	88	deleted	86	88	87
11	88	89	89	89	deleted	87	89	88
12	89	91	91	91	deleted	89	91	90
13	91	93	93	93	deleted	90	93	91
14	93	95	96	96	deleted	92	95	93
15	96	97	98	99	deleted	94	97	96
16	98	100	101	103	deleted	96	100	98
17	101	103	104	106	deleted	99	103	101
18	104	106	108	109	deleted	102	106	104
19	107	110	111	111	deleted	105	110	107
20	110	113	114	114	deleted	108	114	111
21	113	116	118	117	deleted	112	118	115
22	116	120	121	120	deleted	115	122	119
23	119	123	124	123	deleted	119	126	122
24	122	127	127	126	deleted	122	130	127
25	125	130	130	129	deleted	125	134	131
26	128	134	133	132	deleted	129	137	136
27	131	137	136	135	deleted	132	141	141
28	134	140	140	138	deleted	136	144	145
29	138	143	143	141	deleted	140	148	149
30	141	147	146	145	deleted	143	152	153
31	144	150	149	148	deleted	147	156	156
32	147	153	152	151	deleted	151	160	160
33	150	155	155	154	deleted	154	164	164
34	154	158	159	156	deleted	158	168	168
35	157	161	162	159	deleted	162	172	170
36	160	164	165	161	deleted	165	175	174
37	162	166	168	164	deleted	169	178	177
38	165	169	170	166	deleted	172	182	180
39	167	172	173	168	deleted	176	185	182

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 14 (°F)	TC # 15 (°F)	TC # 16 (°F)	TC # 17 (°F)	TC # 18 (°F)	TC # 19 (°F)	TC # 20 (°F)	TC # 21 (°F)
40	170	174	176	170	deleted	179	187	185
41	172	177	178	172	deleted	183	190	188
42	174	179	181	174	deleted	186	194	190
43	177	181	184	177	deleted	190	196	193
44	179	184	186	179	deleted	193	200	195
45	182	186	189	181	deleted	195	200	198
46	185	206	192	184	deleted	198	200	201
47	190	211	195	187	deleted	200	202	204
48	195	211	198	190	deleted	202	203	206
49	200	211	201	192	deleted	203	205	208
50	205	211	204	195	deleted	204	207	209
51	209	211	205	198	deleted	204	209	210
52	211	211	206	201	deleted	205	209	211
53	211	211	207	204	deleted	205	210	211
54	211	211	208	207	deleted	206	208	212
55	211	211	209	209	deleted	206	209	212
56	211	211	210	210	deleted	207	209	212
57	211	211	210	211	deleted	207	210	213
58	211	211	211	211	deleted	207	210	213
59	211	211	211	212	deleted	208	210	213
60	212	212	212	212	deleted	208	210	214
Max Temp:	212	212	212	212		208	210	214
Max Allowed:	409	409	409	409		409	409	410

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 22 (°F)	TC # 23 (°F)	TC # 24 (°F)	TC # 25 (°F)	TC # 26 (°F)	TC # 27 (°F)	TC # 28 (°F)	TC # 29 (°F)
0	85	85	84	84	84	84	84	84
1	85	85	84	84	84	84	84	84
2	85	85	84	84	84	84	84	84
3	85	85	84	84	84	84	84	84
4	85	85	84	84	84	84	84	84
5	85	85	84	84	84	84	84	84
6	85	85	85	84	84	85	85	84
7	85	85	85	84	85	85	85	85
8	86	85	85	85	85	86	86	86
9	87	86	85	85	86	87	87	87
10	88	87	86	86	87	89	88	88
11	90	88	89	88	89	91	90	90
12	91	90	94	90	91	93	92	92
13	94	92	101	93	94	95	94	94
14	96	95	108	96	97	98	97	96
15	98	98	114	99	100	101	100	99
16	101	102	120	102	103	105	104	103
17	104	105	125	105	106	108	108	106
18	107	109	130	109	110	112	112	110
19	111	113	134	112	113	116	116	114
20	114	117	138	117	117	121	121	118
21	117	121	142	122	121	125	125	122
22	121	125	146	126	125	129	130	127
23	125	129	149	130	129	134	135	131
24	129	133	152	133	133	139	139	135
25	133	137	155	136	137	144	144	140
26	137	141	158	139	142	150	149	144
27	141	145	160	141	148	156	154	149
28	145	149	162	143	157	161	158	153
29	149	153	164	146	168	166	163	158
30	153	156	164	148	177	170	167	163
31	155	159	165	150	183	174	172	169
32	159	162	165	153	189	178	176	175
33	163	165	166	155	193	182	182	182
34	167	168	167	158	196	186	188	193
35	171	171	169	160	198	190	195	200
36	175	173	170	162	201	194	202	203
37	178	176	171	165	203	198	207	208
38	181	178	172	167	205	202	209	209
39	183	181	174	170	207	206	210	210

OMEGA POINT LABORATORIES

Time (min)	TC # 22 (°F)	TC # 23 (°F)	TC # 24 (°F)	TC # 25 (°F)	TC # 26 (°F)	TC # 27 (°F)	TC # 28 (°F)	TC # 29 (°F)
40	186	183	175	173	208	208	210	211
41	188	186	176	176	209	210	211	211
42	189	188	178	178	209	210	211	211
43	191	191	179	182	210	211	211	212
44	193	193	181	185	210	211	211	212
45	194	195	182	188	210	211	211	212
46	196	197	183	191	210	211	211	212
47	198	199	185	193	211	211	211	212
48	199	200	187	196	211	211	211	212
49	200	202	188	198	211	211	212	212
50	202	203	190	200	211	211	212	212
51	203	205	192	201	211	211	212	213
52	204	206	195	202	211	212	213	213
53	206	207	197	204	211	212	213	214
54	208	207	199	205	211	213	214	215
55	209	208	201	206	211	214	215	216
56	211	209	202	207	211	215	217	217
57	212	209	204	207	212	217	219	219
58	214	210	205	208	212	219	221	222
59	215	210	206	209	212	221	224	224
60	217	211	207	209	212	224	226	227
Max Temp:	217	211	207	209	212	224	226	227
Max Allowed:	410	410	409	409	409	409	409	409

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 30 (°F)	TC # 31 (°F)	TC # 32 (°F)	TC # 33 (°F)	TC # 34 (°F)	TC # 35 (°F)	TC # 36 (°F)	TC # 37 (°F)
0	84	84	84	84	84	84	deleted	84
1	84	84	84	84	84	84	deleted	84
2	84	84	84	84	84	84	deleted	84
3	84	84	84	84	84	84	deleted	84
4	84	84	84	84	84	84	deleted	84
5	84	85	84	84	84	84	deleted	84
6	85	85	84	84	84	84	deleted	84
7	85	85	85	85	85	84	deleted	85
8	85	85	85	86	85	85	deleted	86
9	86	86	86	87	87	86	deleted	87
10	87	87	87	89	88	87	deleted	89
11	89	88	89	91	90	89	deleted	92
12	91	90	91	93	93	90	deleted	95
13	93	92	93	96	95	92	deleted	99
14	95	95	95	99	99	95	deleted	103
15	98	98	98	102	102	98	deleted	107
16	101	102	101	105	106	100	deleted	112
17	105	106	104	109	111	103	deleted	116
18	108	110	107	113	115	106	deleted	121
19	112	114	110	117	119	110	deleted	127
20	116	118	114	122	124	113	deleted	133
21	120	123	117	126	128	116	deleted	139
22	124	127	121	130	133	119	deleted	144
23	129	132	125	134	138	123	deleted	150
24	133	136	129	138	142	127	deleted	156
25	137	141	133	142	147	131	deleted	162
26	142	145	137	147	152	136	deleted	168
27	147	148	140	151	156	140	deleted	174
28	151	152	144	155	161	144	deleted	180
29	156	155	148	158	165	147	deleted	186
30	160	159	151	162	169	151	deleted	191
31	163	162	155	166	172	154	deleted	197
32	167	164	158	169	176	158	deleted	202
33	171	167	161	173	181	161	deleted	206
34	174	169	165	176	185	165	deleted	208
35	178	172	168	180	190	168	deleted	209
36	183	174	171	183	195	171	deleted	210
37	190	177	174	187	201	175	deleted	211
38	197	180	177	190	205	178	deleted	211
39	202	182	179	194	207	181	deleted	211

OMEGA POINT LABORATORIES

Time (min)	TC # 30 (°F)	TC # 31 (°F)	TC # 32 (°F)	TC # 33 (°F)	TC # 34 (°F)	TC # 35 (°F)	TC # 36 (°F)	TC # 37 (°F)
40	206	185	182	197	209	184	deleted	212
41	207	188	185	201	209	188	deleted	212
42	208	191	188	205	209	191	deleted	212
43	209	194	191	208	210	194	deleted	213
44	209	197	195	210	210	195	deleted	213
45	210	199	199	210	211	198	deleted	214
46	210	201	203	211	211	200	deleted	215
47	210	203	207	211	212	202	deleted	216
48	210	205	209	212	213	204	deleted	218
49	210	206	211	212	214	205	deleted	219
50	210	208	212	212	216	206	deleted	221
51	210	209	212	213	217	207	deleted	223
52	211	210	213	213	219	208	deleted	225
53	210	211	213	215	220	209	deleted	227
54	211	212	214	216	222	210	deleted	229
55	212	212	214	219	224	211	deleted	231
56	214	213	215	222	226	212	deleted	233
57	215	213	216	225	228	213	deleted	236
58	217	214	217	228	231	214	deleted	240
59	219	214	218	231	234	217	deleted	245
60	221	215	220	235	238	220	deleted	249
Max Temp:	221	215	220	235	238	220		249
Max Allowed:	409	409	409	409	409	409		409

OMEGA POINT LABORATORIES

Time (min)	TC # 38 (°F)	TC # 39 (°F)	TC # 40 (°F)	TC # 41 (°F)	TC # 42 (°F)	TC # 43 (°F)	TC # 44 (°F)	TC # 45 (°F)
0	84	84	84	84	84	84	84	84
1	84	84	84	85	84	84	84	84
2	84	84	84	84	84	84	84	84
3	84	84	84	85	84	84	84	84
4	84	84	84	85	84	84	84	84
5	84	84	84	85	84	84	84	84
6	85	85	85	85	84	84	84	84
7	85	85	85	85	85	84	85	85
8	86	86	86	85	85	85	86	86
9	87	87	87	86	85	85	87	88
10	89	89	89	87	86	86	89	90
11	91	91	91	89	87	87	91	92
12	95	94	94	91	89	88	94	95
13	99	98	97	94	91	90	98	99
14	103	102	100	97	93	93	102	103
15	108	106	104	101	96	95	106	108
16	113	111	109	105	100	98	110	113
17	118	116	113	109	104	102	114	117
18	124	121	118	114	109	106	119	122
19	131	127	123	119	113	110	124	127
20	137	132	128	124	118	115	128	132
21	142	137	133	129	124	119	133	137
22	148	142	138	133	129	124	138	142
23	154	148	143	138	135	129	143	147
24	159	154	148	143	140	135	148	152
25	164	159	154	148	145	140	153	157
26	169	164	159	153	149	146	158	162
27	174	169	164	158	154	152	163	167
28	179	174	169	163	159	157	168	171
29	185	178	174	168	164	162	173	176
30	189	183	178	173	169	167	178	181
31	193	187	183	177	174	172	183	186
32	197	192	187	182	178	177	188	191
33	201	196	192	186	182	182	193	195
34	204	199	196	190	187	186	197	201
35	207	202	200	194	190	190	202	206
36	209	204	203	198	194	194	206	211
37	210	207	207	202	198	198	210	214
38	211	209	210	206	201	201	213	215
39	212	211	212	209	204	205	215	216

Time (min)	TC # 38 (°F)	TC # 39 (°F)	TC # 40 (°F)	TC # 41 (°F)	TC # 42 (°F)	TC # 43 (°F)	TC # 44 (°F)	TC # 45 (°F)
40	213	212	215	212	206	207	216	217
41	213	213	217	214	208	209	218	219
42	213	214	215	216	209	210	219	221
43	213	215	217	218	211	212	221	224
44	214	216	218	220	212	213	223	226
45	215	218	222	222	213	213	225	229
46	216	221	227	225	213	214	227	232
47	217	225	231	227	214	215	229	235
48	220	231	235	230	214	215	232	239
49	224	236	239	233	215	216	235	243
50	229	242	243	236	216	217	238	247
51	235	248	248	239	217	218	242	251
52	241	253	253	243	218	219	246	256
53	247	259	257	247	220	220	250	261
54	253	264	262	251	222	221	253	266
55	258	269	267	255	224	223	258	271
56	263	274	272	259	226	225	262	276
57	269	279	277	264	229	227	266	282
58	274	284	282	268	232	230	271	287
59	280	289	287	273	235	233	275	293
60	285	294	292	278	238	236	280	299
Max Temp:	285	294	292	278	238	236	280	299
Max Allowed:	409	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 46 (°F)	TC # 47 (°F)	TC # 48 (°F)	TC # 49 (°F)	TC # 50 (°F)	TC # 51 (°F)	TC # 52 (°F)	TC # 53 (°F)
0	84	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84	84
5	84	84	84	84	84	84	84	84
6	84	84	84	84	84	85	85	84
7	85	85	85	85	85	85	86	85
8	86	85	85	85	86	87	87	86
9	87	86	87	86	87	88	89	88
10	88	87	88	87	89	91	92	90
11	91	89	91	89	92	94	95	93
12	94	92	93	92	95	97	99	96
13	97	95	97	95	98	101	102	99
14	101	99	101	99	102	106	107	103
15	105	103	106	103	106	110	111	107
16	110	107	111	107	111	115	116	111
17	115	111	117	111	115	120	121	116
18	120	116	121	116	120	125	126	121
19	125	121	126	121	125	130	131	125
20	130	126	131	126	129	135	136	130
21	135	131	135	130	134	141	142	135
22	140	135	140	135	139	146	148	140
23	144	140	144	140	144	151	154	145
24	149	145	149	144	149	157	159	150
25	154	149	153	149	154	162	165	155
26	159	154	158	153	159	168	170	160
27	164	158	163	158	165	174	176	166
28	169	163	168	162	170	179	181	172
29	174	167	173	167	175	185	186	177
30	179	172	178	172	181	191	192	182
31	184	176	183	177	187	197	197	187
32	188	180	188	181	194	204	203	192
33	207	184	192	185	201	209	208	197
34	211	188	197	190	206	209	211	201
35	212	191	202	195	209	211	211	204
36	212	195	207	200	210	213	212	206
37	212	199	209	206	211	214	213	208
38	213	203	211	211	212	216	215	211
39	213	209	211	213	212	218	218	211

OMEGA POINT LABORATORIES

Time (min)	TC # 46 (°F)	TC # 47 (°F)	TC # 48 (°F)	TC # 49 (°F)	TC # 50 (°F)	TC # 51 (°F)	TC # 52 (°F)	TC # 53 (°F)
40	214	212	211	213	213	221	221	211
41	215	213	212	214	215	224	224	213
42	217	214	214	215	217	227	227	215
43	219	215	217	216	220	231	231	219
44	222	216	220	217	223	235	235	222
45	225	218	223	219	226	239	239	224
46	229	219	226	221	230	243	243	227
47	232	221	229	223	233	248	248	230
48	236	223	232	225	237	253	253	233
49	240	225	235	227	241	258	259	236
50	244	227	238	230	245	263	264	239
51	248	229	242	233	250	268	270	243
52	252	232	246	236	254	274	276	247
53	256	235	250	239	259	279	283	251
54	261	238	254	242	263	285	289	255
55	265	241	258	245	268	290	296	259
56	270	244	263	248	272	296	302	262
57	274	248	268	252	276	302	309	266
58	279	251	272	255	280	307	315	270
59	283	255	277	258	284	313	322	273
60	288	258	282	261	288	319	328	278
Max Temp:	288	258	282	261	288	319	328	278
Max Allowed:	409	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 54 (°F)	TC # 55 (°F)	TC # 56 (°F)	TC # 57 (°F)	TC # 58 (°F)	TC # 59 (°F)	TC # 60 (°F)	TC # 61 (°F)
0	deleted	84	85	85	85	85	84	83
1	deleted	84	85	85	85	84	84	83
2	deleted	84	85	85	85	84	84	83
3	deleted	84	85	85	85	84	84	83
4	deleted	84	85	85	85	84	84	83
5	deleted	85	85	85	85	85	84	83
6	deleted	85	85	85	85	85	84	84
7	deleted	85	85	86	85	85	85	84
8	deleted	86	86	87	86	86	85	85
9	deleted	87	87	88	87	87	86	86
10	deleted	88	89	90	89	88	87	87
11	deleted	91	91	92	91	90	88	88
12	deleted	93	94	95	93	92	90	90
13	deleted	97	97	98	96	95	92	92
14	deleted	100	101	102	99	98	94	94
15	deleted	105	105	106	103	102	98	97
16	deleted	109	109	110	107	106	102	100
17	deleted	113	113	114	111	111	107	104
18	deleted	118	118	119	116	117	111	108
19	deleted	123	123	123	121	122	117	113
20	deleted	128	128	128	126	127	122	117
21	deleted	133	134	133	132	133	128	123
22	deleted	139	140	138	137	138	133	128
23	deleted	144	145	143	143	143	139	133
24	deleted	150	150	148	148	148	144	138
25	deleted	156	155	153	153	153	149	143
26	deleted	162	160	158	158	158	155	149
27	deleted	168	164	162	163	163	160	155
28	deleted	173	168	167	168	167	166	160
29	deleted	179	174	172	173	172	171	167
30	deleted	184	180	177	178	176	176	173
31	deleted	191	185	182	182	181	182	178
32	deleted	197	190	187	187	185	185	183
33	deleted	200	194	192	191	190	189	187
34	deleted	203	198	197	196	194	194	191
35	deleted	206	201	201	200	198	198	195
36	deleted	208	204	205	203	202	201	198
37	deleted	210	206	208	206	205	203	202
38	deleted	212	209	210	209	208	205	205
39	deleted	212	211	212	212	211	207	208

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 54 (°F)	TC # 55 (°F)	TC # 56 (°F)	TC # 57 (°F)	TC # 58 (°F)	TC # 59 (°F)	TC # 60 (°F)	TC # 61 (°F)
40	deleted	213	212	214	214	213	210	210
41	deleted	212	212	216	217	215	211	211
42	deleted	213	215	219	218	217	211	212
43	deleted	214	219	221	220	219	212	212
44	deleted	216	223	224	222	221	213	213
45	deleted	217	226	226	224	223	213	213
46	deleted	219	230	229	226	226	214	214
47	deleted	221	234	233	228	228	215	215
48	deleted	223	237	236	231	231	216	215
49	deleted	226	241	240	233	234	218	216
50	deleted	228	245	244	236	237	219	218
51	deleted	231	249	247	239	241	221	219
52	deleted	235	253	251	243	245	223	220
53	deleted	238	257	255	246	248	225	222
54	deleted	242	261	259	250	252	228	223
55	deleted	245	265	263	253	257	230	225
56	deleted	248	269	267	257	261	233	227
57	deleted	252	272	270	261	265	236	230
58	deleted	255	276	274	265	269	239	232
59	deleted	259	280	278	269	273	242	234
60	deleted	263	283	281	273	278	246	237
Max Temp:		263	283	281	273	278	246	237
Max Allowed:		409	410	410	410	410	409	408

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 62 (°F)	TC # 63 (°F)	TC # 64 (°F)	TC # 65 (°F)	TC # 66 (°F)	TC # 67 (°F)	TC # 68 (°F)	TC # 69 (°F)
0	83	83	83	83	83	83	83	83
1	83	83	83	83	83	83	83	83
2	83	83	83	83	83	83	83	83
3	83	83	83	83	83	83	83	83
4	83	83	83	83	83	83	83	83
5	83	83	83	83	83	83	83	83
6	84	84	84	84	84	83	83	83
7	84	84	84	84	84	84	84	84
8	85	86	85	85	85	84	85	85
9	86	87	87	87	86	85	86	86
10	88	89	89	89	88	86	88	89
11	90	92	92	91	91	89	90	91
12	93	95	95	94	94	91	93	95
13	96	98	98	97	98	94	97	98
14	99	102	102	101	102	98	101	102
15	103	106	106	105	105	102	105	107
16	107	111	111	110	110	106	109	111
17	111	115	115	114	114	111	114	116
18	115	120	120	119	118	115	118	120
19	120	124	124	124	123	120	122	125
20	124	129	129	128	128	125	127	129
21	129	134	134	133	133	130	132	134
22	133	138	139	138	138	135	136	139
23	138	143	144	142	142	140	140	145
24	143	148	148	146	147	145	145	150
25	148	153	153	151	152	149	149	156
26	152	158	158	156	156	154	154	162
27	157	162	162	160	160	158	158	167
28	162	167	167	165	165	162	163	173
29	167	172	172	169	169	167	167	178
30	172	176	177	174	173	171	172	183
31	176	181	181	178	177	176	176	189
32	181	185	186	183	181	181	180	194
33	186	190	190	188	186	184	184	199
34	190	195	194	193	190	188	189	203
35	195	199	199	198	194	192	194	207
36	199	204	204	204	199	195	201	209
37	204	210	209	209	207	199	206	211
38	207	211	211	211	210	205	209	213
39	211	212	212	212	211	210	211	215

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 62 (°F)	TC # 63 (°F)	TC # 64 (°F)	TC # 65 (°F)	TC # 66 (°F)	TC # 67 (°F)	TC # 68 (°F)	TC # 69 (°F)
40	212	214	214	212	212	211	212	217
41	213	216	215	213	213	211	214	219
42	215	219	217	215	214	212	215	221
43	216	221	220	217	214	212	217	224
44	218	224	222	218	215	213	219	227
45	220	226	225	220	216	216	222	230
46	222	229	227	222	217	219	224	234
47	224	231	230	224	219	221	227	237
48	226	234	234	227	220	223	229	241
49	228	238	237	229	222	226	232	245
50	231	241	241	232	223	228	235	249
51	234	245	244	234	225	231	239	253
52	237	248	248	237	227	233	242	258
53	240	252	252	240	230	236	246	262
54	243	256	256	244	232	239	249	266
55	246	260	260	247	235	243	253	271
56	250	264	265	251	237	246	257	275
57	253	268	269	254	240	250	261	279
58	257	272	274	258	243	253	265	283
59	261	276	278	262	247	257	269	287
60	265	281	283	267	251	260	273	292
Max Temp:	265	281	283	267	251	260	273	292
Max Allowed:	408	408	408	408	408	408	408	408

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 70 (°F)	TC # 71 (°F)	TC # 72 (°F)	TC # 73 (°F)	TC # 74 (°F)	TC # 75 (°F)	TC # 76 (°F)	TC # 77 (°F)
0	83	83	deleted	84	84	84	84	84
1	83	83	deleted	84	84	84	84	84
2	83	83	deleted	84	84	84	84	84
3	83	83	deleted	84	84	84	84	84
4	83	83	deleted	84	84	84	84	84
5	83	83	deleted	84	84	84	84	84
6	84	84	deleted	84	84	84	84	84
7	85	84	deleted	85	85	85	85	86
8	86	86	deleted	86	86	86	86	87
9	88	87	deleted	89	88	88	88	89
10	90	90	deleted	91	90	91	91	92
11	93	93	deleted	95	93	94	94	95
12	97	96	deleted	99	97	98	99	100
13	101	100	deleted	104	102	103	104	106
14	105	104	deleted	110	107	109	110	113
15	110	109	deleted	116	113	116	117	120
16	115	113	deleted	122	119	122	124	126
17	120	118	deleted	129	126	129	131	133
18	126	123	deleted	135	132	136	138	139
19	131	128	deleted	141	139	142	145	146
20	137	133	deleted	148	145	148	151	151
21	142	138	deleted	154	151	154	157	157
22	148	144	deleted	159	157	160	163	163
23	153	150	deleted	165	162	166	168	168
24	159	155	deleted	169	168	171	173	172
25	165	161	deleted	174	173	175	178	176
26	170	166	deleted	178	177	180	182	181
27	176	172	deleted	183	181	185	187	185
28	182	178	deleted	187	186	190	191	190
29	189	185	deleted	191	190	195	196	195
30	195	191	deleted	194	193	200	201	199
31	201	197	deleted	198	197	206	205	203
32	207	204	deleted	201	201	210	208	206
33	209	210	deleted	204	204	213	212	209
34	211	211	deleted	207	208	215	214	212
35	211	211	deleted	209	210	216	217	215
36	212	212	deleted	212	213	218	219	220
37	213	213	deleted	213	215	219	222	224
38	216	214	deleted	213	216	222	225	229
39	219	216	deleted	214	217	224	229	233

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 70 (°F)	TC # 71 (°F)	TC # 72 (°F)	TC # 73 (°F)	TC # 74 (°F)	TC # 75 (°F)	TC # 76 (°F)	TC # 77 (°F)
40	221	218	deleted	214	218	227	233	237
41	225	221	deleted	214	220	230	237	241
42	228	224	deleted	214	223	234	241	245
43	232	227	deleted	215	225	238	246	250
44	237	230	deleted	215	228	242	251	254
45	241	234	deleted	215	231	246	257	259
46	245	237	deleted	216	235	251	262	264
47	250	241	deleted	216	238	256	268	269
48	255	245	deleted	216	242	260	274	274
49	260	249	deleted	218	245	266	280	279
50	264	254	deleted	219	248	271	286	285
51	269	258	deleted	220	252	277	292	290
52	274	262	deleted	222	256	284	299	296
53	279	266	deleted	223	259	290	305	301
54	285	270	deleted	227	262	296	312	308
55	290	274	deleted	233	266	302	318	313
56	296	278	deleted	240	269	309	324	320
57	302	283	deleted	246	272	315	330	325
58	307	288	deleted	251	276	320	336	331
59	313	292	deleted	256	279	326	341	336
60	319	297	deleted	260	282	331	345	342
Max Temp:	319	297		260	282	331	345	342
Max Allowed:	408	408		409	409	409	409	409

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 78 (°F)	TC # 79 (°F)	TC # 80 (°F)	TC # 81 (°F)	TC # 82 (°F)	TC # 83 (°F)	TC # 84 (°F)	TC # 85 (°F)
0	83	83	83	84	84	84	83	83
1	83	83	83	84	84	84	84	83
2	83	83	83	84	84	84	83	83
3	83	83	83	84	84	84	84	84
4	83	83	83	84	84	84	84	84
5	83	83	83	84	84	84	84	84
6	84	83	84	84	84	84	84	84
7	84	84	84	85	85	85	85	85
8	85	84	86	87	86	86	86	86
9	87	85	88	90	88	88	88	87
10	89	87	91	93	91	90	90	89
11	91	89	94	97	95	94	93	92
12	94	91	99	101	99	98	97	95
13	97	94	103	106	104	102	101	99
14	101	98	109	112	109	107	106	103
15	106	102	114	117	114	113	111	107
16	112	107	120	123	120	118	117	112
17	119	113	125	129	126	124	123	118
18	126	119	131	135	131	130	129	123
19	133	126	138	141	137	136	135	129
20	140	134	144	147	143	142	141	135
21	147	141	150	153	149	148	147	141
22	154	149	157	160	155	154	153	147
23	160	156	163	166	162	160	159	153
24	166	162	169	172	168	166	165	160
25	172	167	174	179	174	172	171	166
26	176	173	180	185	180	178	177	172
27	181	177	185	191	186	183	183	178
28	185	182	190	198	192	189	188	183
29	189	186	196	204	198	194	194	187
30	193	190	202	208	204	199	200	191
31	196	194	208	210	208	204	205	195
32	199	197	210	211	210	209	208	199
33	202	200	210	212	212	212	210	202
34	205	203	210	214	213	214	211	206
35	207	205	213	217	215	217	212	210
36	210	207	216	219	217	219	212	213
37	211	209	220	221	219	222	213	215
38	213	210	223	225	222	224	215	216
39	214	212	226	227	225	228	218	218

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 78 (°F)	TC # 79 (°F)	TC # 80 (°F)	TC # 81 (°F)	TC # 82 (°F)	TC # 83 (°F)	TC # 84 (°F)	TC # 85 (°F)
40	216	213	229	231	228	231	221	219
41	217	215	232	235	232	234	224	221
42	220	216	235	239	235	238	226	222
43	222	217	238	243	239	242	230	224
44	225	219	241	248	244	246	233	225
45	228	220	245	253	248	250	237	227
46	232	222	248	259	253	255	240	230
47	235	224	252	264	258	259	244	232
48	239	226	257	270	262	264	249	234
49	242	229	261	276	268	268	252	237
50	246	231	265	283	274	272	256	240
51	250	233	270	290	280	276	259	243
52	254	235	275	297	285	280	263	245
53	258	238	280	304	290	284	266	248
54	262	241	285	310	295	287	269	251
55	266	244	290	317	300	291	273	254
56	270	247	296	324	305	295	276	258
57	275	250	303	331	311	298	279	261
58	280	254	309	337	317	302	283	265
59	284	258	316	344	323	307	287	268
60	289	262	323	349	329	312	291	272
Max Temp:	289	262	323	349	329	312	291	272
Max Allowed:	408	408	408	409	409	409	408	408

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 86 (°F)	TC # 87 (°F)	TC # 88 (°F)	TC # 89 (°F)	TC # 90 (°F)	TC # 91 (°F)	TC # 92 (°F)	TC # 93 (°F)
0	83	83	83	83	deleted	84	84	84
1	83	83	83	83	deleted	84	84	84
2	83	83	83	83	deleted	84	84	84
3	84	83	83	84	deleted	84	84	84
4	83	83	83	84	deleted	84	84	85
5	84	84	84	84	deleted	84	85	85
6	84	84	84	84	deleted	85	85	86
7	84	85	85	85	deleted	85	85	87
8	85	86	86	86	deleted	86	86	88
9	87	88	88	88	deleted	88	88	91
10	89	91	91	91	deleted	90	90	94
11	91	94	94	94	deleted	93	93	97
12	95	98	98	98	deleted	97	96	102
13	98	102	103	103	deleted	101	101	106
14	103	107	108	107	deleted	107	106	112
15	107	111	113	112	deleted	113	112	118
16	112	116	119	117	deleted	119	118	124
17	117	122	125	123	deleted	125	124	130
18	123	127	130	128	deleted	132	131	137
19	128	132	137	133	deleted	138	138	143
20	134	138	142	139	deleted	145	144	150
21	140	143	149	144	deleted	151	150	156
22	147	149	155	150	deleted	157	157	162
23	153	155	161	156	deleted	162	162	167
24	159	161	168	162	deleted	167	168	173
25	166	167	175	168	deleted	172	173	178
26	172	174	181	174	deleted	177	177	183
27	178	180	187	181	deleted	181	182	190
28	183	186	193	187	deleted	185	186	196
29	187	192	198	192	deleted	189	190	203
30	191	198	203	197	deleted	193	195	208
31	195	205	207	201	deleted	196	199	211
32	200	209	210	205	deleted	199	201	212
33	204	212	212	208	deleted	201	204	213
34	210	214	213	211	deleted	204	206	214
35	212	215	214	213	deleted	205	208	214
36	214	216	216	215	deleted	207	211	215
37	215	217	217	217	deleted	209	213	217
38	216	218	218	218	deleted	210	215	219
39	217	219	220	220	deleted	212	217	223

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 86 (°F)	TC # 87 (°F)	TC # 88 (°F)	TC # 89 (°F)	TC # 90 (°F)	TC # 91 (°F)	TC # 92 (°F)	TC # 93 (°F)
40	218	221	221	222	deleted	215	220	227
41	220	222	222	224	deleted	218	223	231
42	221	224	224	227	deleted	222	226	235
43	223	226	226	230	deleted	226	229	239
44	224	228	228	232	deleted	228	231	243
45	226	230	231	236	deleted	233	234	248
46	229	232	234	239	deleted	237	237	252
47	231	235	237	243	deleted	241	240	257
48	233	238	240	247	deleted	244	243	262
49	236	241	244	251	deleted	247	245	267
50	239	245	249	256	deleted	250	248	273
51	242	249	253	261	deleted	253	251	279
52	246	254	258	266	deleted	256	254	285
53	250	259	263	272	deleted	259	257	292
54	254	265	269	278	deleted	262	260	299
55	259	271	275	284	deleted	265	263	306
56	264	277	281	290	deleted	268	267	313
57	269	284	287	297	deleted	271	270	320
58	275	291	293	304	deleted	274	274	327
59	280	298	300	311	deleted	277	278	333
60	286	305	307	318	deleted	280	282	338
Max Temp:	286	305	307	318		280	282	338
Max Allowed:	408	408	408	408		409	409	409

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 94 (°F)	TC # 95 (°F)	TC # 96 (°F)	TC # 97 (°F)	TC # 98 (°F)	TC # 99 (°F)	TC # 100 (°F)	TC # 101 (°F)
0	84	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84	84
5	85	85	84	84	84	84	84	84
6	86	85	84	84	84	84	84	84
7	87	86	85	84	84	85	85	84
8	89	88	86	85	85	86	86	85
9	92	90	88	85	87	87	87	87
10	95	93	90	86	89	89	89	89
11	100	97	92	88	92	93	92	92
12	104	101	95	91	95	96	96	95
13	110	106	99	94	99	100	100	99
14	116	112	103	98	104	105	104	104
15	123	118	107	104	109	110	109	109
16	129	124	113	110	114	115	114	114
17	136	131	119	116	120	121	120	119
18	142	137	126	122	126	127	125	125
19	149	144	134	129	133	133	131	131
20	155	150	142	136	139	139	138	137
21	162	156	150	143	146	146	144	143
22	168	162	157	150	152	152	151	149
23	173	167	164	156	159	159	157	156
24	179	172	170	163	165	165	163	162
25	184	177	175	168	170	170	170	168
26	190	181	180	174	175	175	175	173
27	196	186	184	179	180	180	179	178
28	206	190	188	183	184	184	184	183
29	211	195	192	188	188	188	188	187
30	211	200	195	191	192	192	191	190
31	212	208	198	195	196	195	195	194
32	213	211	201	198	198	199	199	198
33	217	212	203	201	201	203	203	203
34	220	214	206	203	204	207	208	208
35	222	215	208	205	206	211	212	212
36	225	216	210	207	210	214	213	214
37	229	218	211	209	214	217	215	216
38	232	220	212	210	217	219	217	218
39	236	222	213	212	219	222	219	220

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 94 (°F)	TC # 95 (°F)	TC # 96 (°F)	TC # 97 (°F)	TC # 98 (°F)	TC # 99 (°F)	TC # 100 (°F)	TC # 101 (°F)
40	240	225	214	213	221	224	222	223
41	244	228	214	214	223	227	225	225
42	249	231	215	215	225	230	228	227
43	254	234	216	216	227	232	231	230
44	259	237	218	217	229	235	233	233
45	265	240	219	219	231	238	237	235
46	270	244	221	220	233	240	240	238
47	276	248	223	222	236	243	243	240
48	283	252	225	224	238	246	246	243
49	289	256	227	227	240	249	249	246
50	296	261	230	229	243	252	252	249
51	303	265	232	231	246	255	256	252
52	310	271	235	233	249	258	259	255
53	317	276	238	235	252	261	261	258
54	324	281	241	238	254	264	263	260
55	331	287	244	240	258	267	266	263
56	337	294	248	242	261	270	270	266
57	343	300	251	245	264	273	273	269
58	349	307	255	248	267	277	277	271
59	353	314	259	250	270	280	281	274
60	358	321	263	253	274	284	285	278
Max Temp:	358	321	263	253	274	284	285	278
Max Allowed:	409	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 102 (°F)	TC # 103 (°F)	TC # 104 (°F)	TC # 105 (°F)	TC # 106 (°F)	TC # 107 (°F)	TC # 108 (°F)
0	84	83	83	83	83	83	deleted
1	84	84	83	83	83	83	deleted
2	84	83	83	83	83	83	deleted
3	84	83	83	83	83	83	deleted
4	84	83	83	83	83	83	deleted
5	84	84	84	84	84	84	deleted
6	84	84	84	84	84	84	deleted
7	84	84	85	85	85	85	deleted
8	85	85	86	87	86	87	deleted
9	86	86	87	89	88	89	deleted
10	88	88	90	92	91	92	deleted
11	91	91	92	95	94	96	deleted
12	94	94	96	99	98	100	deleted
13	97	97	99	103	102	104	deleted
14	101	101	104	108	107	109	deleted
15	106	105	108	112	112	114	deleted
16	110	110	113	117	116	119	deleted
17	116	115	118	123	121	124	deleted
18	121	120	124	128	127	129	deleted
19	127	126	130	133	132	135	deleted
20	133	131	135	139	137	140	deleted
21	140	137	141	144	143	146	deleted
22	146	143	147	150	148	151	deleted
23	153	150	153	156	154	157	deleted
24	159	156	159	162	159	163	deleted
25	166	163	165	167	165	170	deleted
26	171	169	171	173	171	177	deleted
27	177	175	176	178	176	186	deleted
28	181	180	181	183	181	194	deleted
29	185	185	186	187	187	201	deleted
30	189	190	191	192	194	206	deleted
31	193	194	199	198	200	208	deleted
32	196	199	204	202	206	210	deleted
33	200	203	208	207	209	212	deleted
34	203	206	210	210	212	213	deleted
35	207	209	211	212	214	214	deleted
36	211	211	212	214	216	214	deleted
37	214	213	213	215	217	216	deleted
38	216	214	214	216	219	217	deleted
39	218	215	215	218	220	218	deleted

OMEGA POINT LABORATORIES

Time (min)	TC # 102 (°F)	TC # 103 (°F)	TC # 104 (°F)	TC # 105 (°F)	TC # 106 (°F)	TC # 107 (°F)	TC # 108 (°F)
40	219	217	216	220	221	220	deleted
41	221	218	217	221	223	221	deleted
42	223	219	218	223	225	223	deleted
43	224	220	219	225	227	225	deleted
44	226	221	220	227	229	227	deleted
45	227	222	222	229	231	229	deleted
46	229	223	223	232	234	232	deleted
47	231	224	225	234	237	235	deleted
48	233	225	227	237	240	238	deleted
49	235	226	229	241	244	241	deleted
50	237	227	231	244	248	245	deleted
51	239	229	234	248	252	250	deleted
52	242	231	237	253	257	255	deleted
53	244	233	240	258	262	260	deleted
54	246	235	244	264	268	266	deleted
55	248	237	248	270	274	272	deleted
56	250	239	252	276	281	278	deleted
57	253	242	257	284	288	286	deleted
58	255	245	261	291	296	293	deleted
59	257	247	266	299	305	302	deleted
60	260	251	272	308	314	310	deleted
Max Temp:	260	251	272	308	314	310	
Max Allowed:	409	408	408	408	408	408	

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI. September 7, 1994

Time (min)	TC # 109 (°F)	TC # 110 (°F)	TC # 111 (°F)	TC # 112 (°F)	TC # 113 (°F)	TC # 114 (°F)	TC # 115 (°F)
0	deleted	84	84	85	85	85	85
1	deleted	84	84	85	85	85	84
2	deleted	84	84	85	85	85	85
3	deleted	84	84	85	85	85	85
4	deleted	84	84	85	85	85	84
5	deleted	84	84	85	85	85	84
6	deleted	84	84	85	85	85	85
7	deleted	84	84	85	85	85	85
8	deleted	84	84	85	85	85	85
9	deleted	84	84	85	85	85	85
10	deleted	84	84	86	86	85	85
11	deleted	84	85	86	86	86	85
12	deleted	84	85	87	87	86	86
13	deleted	85	85	88	87	87	87
14	deleted	85	86	93	88	88	88
15	deleted	86	87	100	90	90	89
16	deleted	86	88	112	91	91	90
17	deleted	87	89	117	92	92	91
18	deleted	88	90	120	94	94	93
19	deleted	89	92	122	96	96	95
20	deleted	91	94	122	98	98	97
21	deleted	92	96	122	100	100	99
22	deleted	94	98	124	102	102	101
23	deleted	96	101	127	105	104	103
24	deleted	98	103	129	108	107	106
25	deleted	100	106	132	110	109	108
26	deleted	103	109	135	113	112	111
27	deleted	107	113	137	116	116	113
28	deleted	110	117	140	119	119	116
29	deleted	115	120	142	122	124	118
30	deleted	121	124	145	125	128	121
31	deleted	127	127	147	128	132	124
32	deleted	131	131	150	132	136	127
33	deleted	137	135	152	135	140	130
34	deleted	141	139	155	138	143	132
35	deleted	146	143	158	141	147	135
36	deleted	151	147	161	144	150	138
37	deleted	155	152	164	147	153	141
38	deleted	160	157	167	150	155	143
39	deleted	166	163	170	153	158	146

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 109 (°F)	TC # 110 (°F)	TC # 111 (°F)	TC # 112 (°F)	TC # 113 (°F)	TC # 114 (°F)	TC # 115 (°F)
40	deleted	171	169	174	156	160	149
41	deleted	177	175	178	159	162	151
42	deleted	183	182	181	161	164	154
43	deleted	189	189	185	164	166	156
44	deleted	196	196	189	166	168	158
45	deleted	202	202	194	168	169	161
46	deleted	207	207	197	171	171	163
47	deleted	211	210	201	173	173	165
48	deleted	212	212	203	175	175	167
49	deleted	212	214	204	178	177	169
50	deleted	214	217	204	180	179	171
51	deleted	216	220	204	182	181	173
52	deleted	218	225	205	184	183	175
53	deleted	221	230	206	186	184	177
54	deleted	226	235	207	188	186	180
55	deleted	232	241	208	190	188	182
56	deleted	238	247	209	191	189	186
57	deleted	245	253	210	193	191	189
58	deleted	252	259	211	195	193	192
59	deleted	259	266	213	197	195	195
60	deleted	267	273	215	198	197	197
Max Temp:		267	273	215	198	197	197
Max Allowed:		409	409	410	410	410	410

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 116 (°F)	TC # 117 (°F)	TC # 118 (°F)	TC # 119 (°F)	TC # 120 (°F)	TC # 121 (°F)	TC # 122 (°F)
0	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84
5	84	84	84	84	84	84	84
6	84	84	84	84	84	84	84
7	84	84	84	84	84	84	84
8	84	85	84	85	85	84	84
9	85	85	85	85	85	85	85
10	85	86	85	86	86	85	85
11	85	86	86	87	87	86	86
12	86	87	86	88	88	87	87
13	87	88	87	89	89	89	88
14	88	90	89	91	91	90	90
15	89	91	91	93	93	92	91
16	91	92	93	94	95	94	93
17	93	94	95	97	97	96	95
18	95	96	97	99	100	98	98
19	97	98	100	101	102	101	100
20	99	100	102	104	105	103	102
21	101	103	105	107	108	106	105
22	103	105	108	109	111	109	108
23	106	107	111	112	114	112	110
24	108	110	115	115	117	115	113
25	111	113	120	118	120	118	117
26	113	115	124	121	124	122	120
27	115	118	128	125	127	126	123
28	118	121	133	128	131	130	126
29	120	124	138	131	135	134	130
30	123	127	143	134	138	138	133
31	126	130	147	138	142	142	136
32	129	132	152	141	145	146	140
33	131	135	157	144	149	149	143
34	134	139	162	147	152	152	146
35	137	141	169	151	155	155	149
36	139	144	175	154	158	157	152
37	141	147	181	157	161	160	154
38	143	150	187	161	163	163	157
39	146	153	193	164	166	165	160

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 116 (°F)	TC # 117 (°F)	TC # 118 (°F)	TC # 119 (°F)	TC # 120 (°F)	TC # 121 (°F)	TC # 122 (°F)
40	148	155	198	167	169	167	163
41	150	158	201	171	172	170	165
42	153	161	205	174	175	172	168
43	155	163	208	178	177	175	170
44	157	166	209	182	181	177	173
45	160	168	210	187	183	180	175
46	162	171	210	194	186	183	178
47	164	174	210	201	190	186	180
48	166	176	210	207	194	189	183
49	168	178	210	208	200	192	185
50	171	181	210	209	205	196	188
51	173	183	210	210	208	199	190
52	175	186	211	211	210	202	193
53	178	188	212	212	211	204	196
54	182	191	212	212	212	206	199
55	185	193	212	213	213	208	201
56	188	196	213	213	213	209	204
57	190	198	213	213	213	210	207
58	193	200	213	214	214	211	209
59	195	203	213	214	214	212	210
60	197	205	214	214	214	212	212
Max Temp:	197	205	214	214	214	212	212
Max Allowed:	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 123 (°F)	TC # 124 (°F)	TC # 125 (°F)	TC # 126 (°F)	TC # 127 (°F)	TC # 128 (°F)	TC # 129 (°F)
0	84	83	83	83	84	84	85
1	84	83	83	83	84	85	85
2	84	83	83	83	84	85	85
3	84	83	83	83	84	85	85
4	84	83	83	83	84	85	85
5	84	83	83	83	84	85	85
6	84	83	83	83	85	85	85
7	84	84	83	83	85	86	86
8	84	84	84	83	86	87	87
9	85	84	84	84	88	88	88
10	85	85	85	84	90	90	90
11	86	86	86	85	92	93	92
12	88	87	87	86	94	95	94
13	89	89	88	87	97	98	97
14	91	90	90	88	100	102	100
15	93	92	92	89	104	105	104
16	95	94	94	91	107	109	107
17	97	96	96	92	111	113	111
18	99	99	98	94	114	117	115
19	102	101	101	96	118	121	119
20	104	104	103	97	122	125	124
21	107	107	106	99	126	130	128
22	110	110	108	101	130	134	132
23	113	113	111	104	134	139	137
24	116	116	114	106	138	143	141
25	119	119	117	108	142	148	146
26	122	123	120	110	147	152	150
27	125	126	123	112	151	157	154
28	128	129	126	115	155	161	158
29	131	132	128	117	159	165	163
30	134	135	131	119	164	170	167
31	138	138	134	122	168	174	171
32	141	141	137	124	171	178	174
33	144	144	139	126	175	182	178
34	147	147	142	128	179	186	182
35	150	150	145	131	183	190	186
36	152	153	147	133	186	194	189
37	155	156	150	135	190	198	193
38	158	159	152	137	194	202	197
39	161	161	155	139	197	205	200

Time (min)	TC # 123 (°F)	TC # 124 (°F)	TC # 125 (°F)	TC # 126 (°F)	TC # 127 (°F)	TC # 128 (°F)	TC # 129 (°F)
40	163	164	157	142	201	209	204
41	166	167	160	144	205	213	208
42	169	170	163	146	208	217	211
43	171	173	165	148	212	221	215
44	174	176	168	150	216	224	218
45	176	178	171	152	219	228	222
46	179	181	173	154	223	231	225
47	181	183	176	156	226	235	229
48	183	186	179	158	230	238	232
49	186	188	181	160	233	242	235
50	188	190	183	162	236	245	238
51	190	193	186	164	239	248	241
52	192	195	188	165	242	251	244
53	195	197	190	167	245	254	247
54	197	199	192	169	248	257	250
55	199	201	194	171	251	259	253
56	201	204	196	172	253	262	255
57	204	206	199	174	256	265	258
58	206	208	203	176	258	267	261
59	209	210	207	178	261	270	263
60	211	211	209	187	263	272	266
Max Temp:	211	211	209	187	263	272	266
Max Allowed:	409	408	408	408	409	409	410

OMEGA POINT LABORATORIES

Time (min)	TC # 130 (°F)	TC # 131 (°F)	TC # 132 (°F)	TC # 133 (°F)	TC # 134 (°F)	TC # 135 (°F)	TC # 136 (°F)
0	85	85	85	84	84	84	84
1	85	85	85	84	84	84	84
2	85	85	85	84	84	84	84
3	85	85	85	84	84	84	84
4	85	85	85	85	84	84	84
5	85	85	85	85	84	85	85
6	85	85	85	85	85	85	85
7	86	86	85	85	85	86	86
8	87	87	86	86	86	87	88
9	88	88	87	87	87	89	89
10	90	89	88	88	89	91	92
11	92	91	90	89	90	94	94
12	95	93	92	91	93	97	97
13	97	96	94	94	95	100	101
14	101	98	96	96	98	104	105
15	104	101	99	99	101	108	109
16	107	104	102	102	104	112	113
17	111	108	105	105	108	116	118
18	115	111	109	109	112	121	123
19	119	115	113	112	116	126	128
20	123	119	116	116	120	130	133
21	127	123	120	119	124	134	138
22	132	127	124	123	127	138	142
23	136	132	128	127	131	143	146
24	140	136	132	130	135	146	150
25	144	140	136	134	139	150	154
26	148	144	140	138	142	154	158
27	152	148	143	141	146	157	161
28	156	151	147	144	149	160	165
29	160	155	150	148	152	163	168
30	164	159	154	151	155	166	171
31	167	162	157	153	158	170	175
32	171	165	160	156	161	173	178
33	174	169	163	156	162	176	182
34	178	172	165	156	161	179	185
35	181	175	168	160	165	182	189
36	185	178	170	163	169	185	192
37	188	181	173	166	172	188	195
38	191	184	176	169	174	191	197
39	195	187	179	171	176	194	200

OMEGA POINT LABORATORIES

Time (min)	TC # 130 (°F)	TC # 131 (°F)	TC # 132 (°F)	TC # 133 (°F)	TC # 134 (°F)	TC # 135 (°F)	TC # 136 (°F)
40	198	190	181	173	178	198	202
41	201	193	184	175	180	201	205
42	204	196	186	177	182	204	209
43	208	199	189	179	184	208	212
44	211	202	191	181	186	211	215
45	214	205	194	183	188	214	219
46	217	208	197	185	190	217	222
47	220	211	199	187	193	220	225
48	223	213	202	189	195	223	228
49	226	216	205	192	197	225	232
50	229	219	207	194	199	228	235
51	232	222	210	195	201	230	238
52	235	224	212	197	203	233	241
53	237	226	214	199	204	235	244
54	240	229	217	201	206	238	247
55	242	231	219	203	208	240	250
56	245	234	221	205	210	242	254
57	247	236	224	207	212	244	256
58	250	238	226	208	213	245	258
59	252	241	228	210	214	246	260
60	255	243	230	212	215	246	262
Max Temp:	255	243	230	212	215	246	262
Max Allowed:	410	410	410	409	409	409	409

Time (min)	TC # 137 (°F)	TC # 138 (°F)	TC # 139 (°F)	TC # 140 (°F)	TC # 141 (°F)	TC # 142 (°F)	TC # 143 (°F)
0	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84
5	84	84	84	84	84	84	84
6	85	85	84	85	85	85	84
7	86	85	85	85	85	85	85
8	87	86	85	86	86	87	86
9	88	87	86	87	88	88	87
10	90	89	87	89	90	90	89
11	92	91	88	90	92	92	91
12	95	93	89	92	95	94	93
13	98	96	91	95	97	97	95
14	101	98	93	97	100	100	97
15	105	101	95	100	104	103	100
16	108	105	97	103	107	106	103
17	113	108	99	106	110	109	105
18	117	112	102	109	113	112	107
19	121	115	105	112	117	115	109
20	126	119	107	115	120	118	112
21	130	123	110	119	123	122	114
22	134	126	113	122	127	125	116
23	138	130	116	125	130	128	118
24	142	133	119	129	133	131	121
25	145	136	122	132	136	134	123
26	149	139	125	134	139	136	125
27	152	142	127	137	142	139	127
28	155	145	130	140	145	142	130
29	158	148	133	142	147	144	132
30	162	150	135	145	150	147	134
31	165	153	137	147	153	150	136
32	168	156	140	150	156	152	138
33	171	159	143	153	158	155	140
34	175	162	145	156	161	158	142
35	178	164	148	159	164	160	144
36	180	167	151	161	167	163	146
37	182	169	154	164	170	165	148
38	184	171	156	167	173	167	150
39	187	173	159	170	175	170	152

OMEGA POINT LABORATORIES

Time (min)	TC # 137 (°F)	TC # 138 (°F)	TC # 139 (°F)	TC # 140 (°F)	TC # 141 (°F)	TC # 142 (°F)	TC # 143 (°F)
40	189	175	161	172	178	172	154
41	192	178	164	175	181	175	156
42	194	181	167	177	183	177	158
43	197	183	170	180	186	180	160
44	200	186	172	183	189	182	161
45	204	189	175	185	192	185	163
46	207	192	178	188	194	187	165
47	210	194	180	191	197	189	167
48	213	197	182	193	200	192	169
49	216	200	185	196	203	195	170
50	219	202	187	198	206	197	172
51	221	205	189	201	208	200	175
52	224	207	191	203	211	202	177
53	227	210	193	206	214	205	179
54	230	212	195	209	217	208	181
55	232	214	197	211	220	211	183
56	235	217	199	214	223	213	185
57	238	219	202	217	226	216	188
58	240	221	203	219	228	218	190
59	242	223	205	221	231	221	192
60	244	224	207	223	233	223	194
Max Temp:	244	224	207	223	233	223	194
Max Allowed:	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 144 (°F)	TC # 145 (°F)	TC # 146 (°F)	TC # 147 (°F)	TC # 148 (°F)	TC # 149 (°F)	TC # 150 (°F)
0	84	deleted	84	85	85	85	85
1	84	deleted	84	84	85	85	85
2	84	deleted	84	84	85	85	85
3	84	deleted	84	84	85	85	85
4	84	deleted	84	85	85	85	85
5	84	deleted	84	85	85	85	85
6	84	deleted	85	85	85	86	85
7	84	deleted	85	86	86	87	86
8	85	deleted	86	87	87	88	86
9	85	deleted	87	88	89	89	87
10	86	deleted	88	89	90	91	88
11	87	deleted	90	91	92	93	89
12	88	deleted	92	93	94	96	91
13	89	deleted	94	95	97	98	93
14	90	deleted	96	98	99	101	94
15	92	deleted	98	100	102	104	97
16	93	deleted	100	103	105	107	99
17	94	deleted	103	105	108	110	101
18	96	deleted	105	108	111	114	104
19	97	deleted	108	111	114	117	107
20	98	deleted	110	114	117	120	110
21	99	deleted	112	116	121	124	112
22	101	deleted	115	119	124	127	115
23	102	deleted	118	122	127	131	118
24	103	deleted	120	125	130	134	121
25	105	deleted	123	128	134	137	124
26	106	deleted	125	131	137	141	127
27	107	deleted	128	134	140	144	129
28	108	deleted	131	137	143	147	132
29	110	deleted	134	140	146	150	135
30	111	deleted	136	143	149	153	137
31	112	deleted	139	146	152	156	140
32	113	deleted	142	148	155	159	143
33	115	deleted	144	151	158	162	145
34	116	deleted	147	154	161	165	148
35	117	deleted	150	157	163	168	150
36	119	deleted	152	160	166	171	153
37	120	deleted	155	163	169	173	155
38	121	deleted	158	165	172	176	157
39	122	deleted	160	168	175	179	160

Time (min)	TC # 144 (°F)	TC # 145 (°F)	TC # 146 (°F)	TC # 147 (°F)	TC # 148 (°F)	TC # 149 (°F)	TC # 150 (°F)
40	124	deleted	163	171	178	182	162
41	125	deleted	166	174	181	185	164
42	126	deleted	168	178	184	187	166
43	127	deleted	171	181	187	190	168
44	128	deleted	174	184	190	193	171
45	129	deleted	176	187	193	196	173
46	130	deleted	179	190	196	199	175
47	131	deleted	182	193	199	202	177
48	133	deleted	185	196	202	205	180
49	134	deleted	188	199	205	207	182
50	135	deleted	190	203	208	210	184
51	136	deleted	193	206	211	213	187
52	138	deleted	196	208	214	216	189
53	139	deleted	199	211	217	218	191
54	140	deleted	201	214	220	221	193
55	142	deleted	204	217	222	223	195
56	143	deleted	207	220	225	226	198
57	145	deleted	209	222	227	228	200
58	146	deleted	212	225	230	231	202
59	148	deleted	214	228	233	233	204
60	149	deleted	217	230	235	235	206
Max Temp:	149		217	230	235	235	206
Max Allowed:	409		409	410	410	410	410

OMEGA POINT LABORATORIES

Time (min)	TC # 151 (°F)	TC # 152 (°F)	TC # 153 (°F)	TC # 154 (°F)	TC # 155 (°F)	TC # 156 (°F)	TC # 157 (°F)
0	86	86	85	85	85	85	85
1	85	85	85	85	85	85	85
2	85	85	85	85	85	85	85
3	85	85	85	85	85	85	85
4	85	85	85	85	85	85	85
5	86	86	86	86	86	85	85
6	85	86	86	86	86	85	85
7	86	86	86	87	87	86	86
8	86	86	87	89	89	87	86
9	86	87	89	91	91	88	87
10	87	88	91	93	93	90	91
11	88	90	93	97	96	92	102
12	89	92	95	100	99	96	113
13	91	95	98	103	103	101	123
14	92	98	101	106	107	105	127
15	94	102	104	110	111	110	134
16	96	104	108	114	115	114	137
17	99	109	111	118	119	118	138
18	101	114	115	122	123	120	140
19	103	118	119	127	127	123	141
20	106	121	123	131	131	125	142
21	108	123	127	135	135	128	144
22	111	126	131	140	139	131	145
23	113	127	134	145	143	134	146
24	115	129	138	149	147	136	145
25	117	130	141	153	151	139	145
26	119	132	144	156	155	142	145
27	121	134	147	160	159	144	145
28	124	135	149	163	163	147	147
29	126	137	152	167	166	149	147
30	128	138	154	170	170	152	148
31	130	140	157	173	173	155	149
32	132	142	160	177	177	157	150
33	133	144	162	180	180	160	151
34	136	146	165	183	183	163	153
35	138	149	168	187	187	166	154
36	140	150	171	190	191	170	155
37	142	153	174	194	195	173	157
38	144	155	177	197	198	176	159
39	146	157	179	200	202	179	161

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 151 (°F)	TC # 152 (°F)	TC # 153 (°F)	TC # 154 (°F)	TC # 155 (°F)	TC # 156 (°F)	TC # 157 (°F)
40	148	159	182	204	205	182	163
41	150	162	185	207	208	185	165
42	152	164	188	210	212	188	167
43	154	166	191	213	215	191	169
44	156	168	193	216	218	193	171
45	158	169	196	219	221	196	173
46	160	171	198	222	224	198	175
47	162	173	201	225	227	201	177
48	164	175	203	229	230	204	180
49	166	177	206	232	233	206	182
50	168	179	208	235	236	209	185
51	170	181	211	238	238	211	190
52	172	183	214	241	241	214	193
53	174	185	216	243	244	217	196
54	176	186	218	246	247	220	199
55	177	188	220	249	249	223	202
56	179	189	222	251	252	226	205
57	181	191	225	253	254	229	208
58	183	193	227	256	257	232	211
59	184	195	230	258	259	235	214
60	186	197	232	260	261	238	217
Max Temp:	186	197	232	260	261	238	217
Max Allowed:	411	411	410	410	410	410	410

OMEGA POINT LABORATORIES

Time (min)	TC # 158 (°F)	TC # 159 (°F)	TC # 160 (°F)	TC # 161 (°F)	TC # 162 (°F)	TC # 163 (°F)	TC # 164 (°F)
0	85	85	85	84	84	deleted	84
1	85	85	85	84	84	deleted	84
2	85	85	85	84	84	deleted	84
3	85	85	85	84	84	deleted	84
4	85	85	85	84	84	deleted	84
5	85	85	85	85	84	deleted	84
6	85	86	86	85	84	deleted	84
7	86	86	87	86	85	deleted	85
8	87	88	89	87	85	deleted	86
9	89	89	90	88	85	deleted	87
10	91	91	93	90	86	deleted	89
11	96	93	95	91	86	deleted	91
12	103	96	97	93	87	deleted	94
13	110	99	100	95	88	deleted	97
14	115	103	102	97	89	deleted	100
15	119	106	105	99	90	deleted	103
16	122	109	108	102	91	deleted	107
17	125	113	111	104	92	deleted	111
18	128	116	114	106	93	deleted	115
19	131	119	117	109	94	deleted	120
20	133	122	120	111	95	deleted	124
21	135	125	123	114	97	deleted	128
22	137	128	126	117	98	deleted	133
23	139	130	129	119	100	deleted	137
24	141	133	132	122	101	deleted	142
25	142	136	135	125	103	deleted	147
26	144	139	138	127	104	deleted	151
27	145	142	141	130	106	deleted	156
28	147	144	144	132	107	deleted	160
29	150	147	147	135	109	deleted	165
30	152	150	149	137	110	deleted	169
31	154	153	152	140	112	deleted	174
32	156	156	155	143	113	deleted	179
33	158	159	158	145	115	deleted	184
34	161	162	162	148	116	deleted	187
35	163	165	165	151	118	deleted	190
36	165	168	168	153	119	deleted	194
37	168	171	171	156	121	deleted	197
38	171	175	175	159	123	deleted	200
39	174	178	178	161	124	deleted	202

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 158 (°F)	TC # 159 (°F)	TC # 160 (°F)	TC # 161 (°F)	TC # 162 (°F)	TC # 163 (°F)	TC # 164 (°F)
40	177	181	182	164	126	deleted	205
41	180	185	185	167	127	deleted	206
42	183	188	189	170	129	deleted	208
43	186	192	193	173	131	deleted	209
44	189	195	197	176	133	deleted	210
45	192	198	200	179	134	deleted	210
46	194	202	204	182	136	deleted	211
47	197	205	207	185	138	deleted	211
48	200	208	211	188	140	deleted	212
49	203	211	214	191	141	deleted	212
50	206	214	218	193	143	deleted	214
51	209	217	221	196	145	deleted	220
52	212	220	225	199	147	deleted	227
53	215	223	228	202	148	deleted	234
54	218	226	232	205	150	deleted	241
55	221	228	235	207	152	deleted	246
56	224	231	238	210	154	deleted	252
57	226	234	240	212	155	deleted	257
58	229	236	243	214	157	deleted	261
59	232	239	245	216	158	deleted	265
60	234	241	248	218	160	deleted	269
Max Temp:	234	241	248	218	160		269
Max Allowed:	410	410	410	409	409		409

OMEGA POINT LABORATORIES

Time (min)	TC # 165 (°F)	TC # 166 (°F)	TC # 167 (°F)	TC # 168 (°F)	TC # 169 (°F)	TC # 170 (°F)	TC # 171 (°F)
0	84	84	84	84	84	83	83
1	84	84	84	84	84	83	83
2	84	84	84	84	84	83	83
3	84	84	84	84	84	83	83
4	84	84	84	84	84	83	84
5	84	84	84	84	84	84	84
6	85	85	85	85	84	84	84
7	85	85	86	86	85	85	85
8	87	86	87	88	86	86	87
9	89	88	89	90	87	87	88
10	91	90	91	93	89	89	91
11	94	93	94	96	92	91	93
12	98	96	98	99	94	93	96
13	101	99	101	102	97	96	99
14	105	103	105	106	100	99	102
15	109	106	109	110	104	102	106
16	113	110	113	114	107	105	110
17	117	114	117	118	111	109	114
18	121	119	122	123	115	113	118
19	125	123	126	128	120	117	122
20	129	128	131	133	124	121	126
21	134	132	136	138	129	125	131
22	139	137	142	143	133	130	135
23	143	142	147	148	138	134	140
24	148	148	152	154	143	139	145
25	154	153	157	159	148	144	150
26	159	158	162	164	153	148	154
27	165	164	168	169	158	153	159
28	170	169	173	174	163	158	163
29	174	174	178	179	168	162	167
30	177	178	183	184	172	167	169
31	180	181	187	189	177	171	173
32	185	185	192	194	182	176	177
33	189	188	194	198	186	180	182
34	192	192	196	201	191	184	186
35	196	195	199	205	195	188	190
36	199	198	202	208	198	192	193
37	201	201	205	212	202	196	197
38	204	204	209	216	205	199	200
39	206	206	212	220	209	202	203

OMEGA POINT LABORATORIES

Time (min)	TC # 165 (°F)	TC # 166 (°F)	TC # 167 (°F)	TC # 168 (°F)	TC # 169 (°F)	TC # 170 (°F)	TC # 171 (°F)
40	208	208	213	224	212	205	205
41	210	210	217	227	215	207	207
42	211	212	224	231	218	208	208
43	212	217	230	235	221	209	209
44	212	220	235	239	224	210	210
45	213	223	240	244	227	211	211
46	214	231	245	248	230	212	211
47	222	240	250	252	233	214	211
48	231	247	256	257	236	217	212
49	240	254	262	262	240	221	218
50	248	260	267	266	244	227	229
51	255	267	273	271	248	233	237
52	261	273	278	276	253	239	243
53	267	278	284	281	258	243	249
54	273	284	289	286	262	248	254
55	279	289	293	290	267	253	259
56	284	294	298	295	271	257	264
57	288	298	302	299	281	262	269
58	293	303	307	304	284	268	274
59	297	307	311	308	287	273	279
60	301	311	314	311	290	277	284
Max Temp:	301	311	314	311	290	277	284
Max Allowed:	409	409	409	409	409	408	408

OMEGA POINT LABORATORIES

Time (min)	TC # 172 (°F)	TC # 173 (°F)	TC # 174 (°F)	TC # 175 (°F)	TC # 176 (°F)	TC # 177 (°F)	TC # 178 (°F)
0	83	83	83	83	83	83	83
1	83	83	83	83	83	83	83
2	83	83	83	83	83	83	83
3	83	83	83	83	83	83	83
4	84	83	83	83	83	83	83
5	84	84	84	83	83	83	84
6	85	85	84	84	83	84	85
7	86	86	85	84	84	85	86
8	87	87	87	85	84	86	88
9	90	89	88	86	85	88	91
10	92	92	90	87	86	90	93
11	95	94	92	89	88	92	96
12	98	97	95	90	89	95	99
13	101	101	97	92	91	98	102
14	105	104	100	95	93	101	106
15	109	108	104	97	95	104	110
16	113	113	107	100	98	108	114
17	117	117	111	103	102	112	118
18	122	122	115	107	105	116	122
19	126	127	119	111	109	120	126
20	131	131	123	114	113	124	130
21	136	136	127	119	117	128	135
22	140	141	132	123	121	132	139
23	145	146	136	127	125	136	143
24	150	150	141	131	129	140	147
25	155	155	146	136	134	145	152
26	159	160	151	141	138	149	156
27	164	164	156	146	143	153	160
28	168	169	161	151	148	158	164
29	173	174	166	156	153	163	169
30	176	179	171	161	159	167	173
31	177	183	176	166	164	172	178
32	180	186	181	171	169	177	183
33	183	186	185	176	174	182	188
34	187	187	188	181	179	186	192
35	190	190	189	184	184	191	197
36	194	193	192	189	188	195	201
37	198	197	195	192	192	199	205
38	201	200	198	196	196	203	210
39	204	203	202	200	199	207	215

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 172 (°F)	TC # 173 (°F)	TC # 174 (°F)	TC # 175 (°F)	TC # 176 (°F)	TC # 177 (°F)	TC # 178 (°F)
40	207	206	205	203	202	211	219
41	209	208	207	205	204	215	224
42	210	210	208	207	206	218	229
43	211	211	210	208	208	222	231
44	213	213	211	209	209	224	230
45	215	216	212	210	211	226	232
46	221	222	212	210	212	229	237
47	229	230	213	211	213	232	244
48	237	239	214	211	213	235	250
49	244	248	223	211	214	239	256
50	250	256	234	211	215	242	261
51	257	263	243	212	217	246	266
52	262	270	252	212	218	249	271
53	268	275	259	216	220	252	275
54	273	281	266	222	222	256	279
55	278	286	272	235	226	260	283
56	282	290	278	244	231	264	287
57	286	295	285	250	235	268	291
58	291	299	290	255	240	273	296
59	295	304	296	260	244	277	300
60	299	308	300	264	248	282	303
Max Temp:	299	308	300	264	248	282	303
Max Allowed:	408	408	408	408	408	408	408

OMEGA POINT LABORATORIES

Time (min)	TC # 179 (°F)	TC # 180 (°F)	TC # 181 (°F)	TC # 182 (°F)	TC # 183 (°F)	TC # 184 (°F)	TC # 185 (°F)
0	83	83	83	deleted	84	84	84
1	83	83	83	deleted	84	84	84
2	83	83	83	deleted	84	84	84
3	83	83	83	deleted	84	84	84
4	84	83	83	deleted	84	84	84
5	84	84	83	deleted	84	84	84
6	86	84	83	deleted	84	84	84
7	87	85	83	deleted	85	85	85
8	89	86	83	deleted	86	86	85
9	92	87	84	deleted	87	87	87
10	94	88	84	deleted	89	89	88
11	97	90	85	deleted	92	91	90
12	100	92	85	deleted	95	94	93
13	103	94	86	deleted	98	98	96
14	107	97	86	deleted	101	101	99
15	111	100	87	deleted	105	105	103
16	114	102	88	deleted	108	109	107
17	118	105	89	deleted	113	113	111
18	122	108	91	deleted	117	117	115
19	127	112	92	deleted	121	121	119
20	131	115	93	deleted	125	126	123
21	135	118	95	deleted	129	130	128
22	140	122	96	deleted	134	135	132
23	144	125	98	deleted	138	139	137
24	149	129	100	deleted	143	144	141
25	153	133	102	deleted	147	148	146
26	156	136	104	deleted	152	153	151
27	159	140	105	deleted	157	158	156
28	163	144	107	deleted	161	163	161
29	168	150	110	deleted	166	167	166
30	173	154	112	deleted	170	172	171
31	178	159	114	deleted	174	176	175
32	183	163	116	deleted	179	181	180
33	188	168	119	deleted	183	185	184
34	193	173	121	deleted	187	189	189
35	197	177	123	deleted	191	193	192
36	202	182	126	deleted	194	197	196
37	206	186	128	deleted	198	200	199
38	210	189	131	deleted	201	203	202
39	215	193	135	deleted	203	205	205

OMEGA POINT LABORATORIES

Time (min)	TC # 179 (°F)	TC # 180 (°F)	TC # 181 (°F)	TC # 182 (°F)	TC # 183 (°F)	TC # 184 (°F)	TC # 185 (°F)
40	220	197	141	deleted	205	208	207
41	224	199	147	deleted	207	210	209
42	213	202	151	deleted	209	211	212
43	210	204	155	deleted	210	213	214
44	211	206	157	deleted	211	216	218
45	212	207	160	deleted	211	222	224
46	221	208	162	deleted	212	228	230
47	235	208	165	deleted	212	235	236
48	244	209	167	deleted	213	240	242
49	252	211	169	deleted	217	245	248
50	259	212	172	deleted	221	250	254
51	264	216	174	deleted	226	255	259
52	269	228	176	deleted	231	260	264
53	275	236	179	deleted	236	264	269
54	280	241	182	deleted	243	269	273
55	285	246	185	deleted	248	274	278
56	289	251	188	deleted	251	278	282
57	293	255	191	deleted	254	282	287
58	296	258	193	deleted	257	286	291
59	300	261	196	deleted	262	290	295
60	303	265	198	deleted	265	294	299
Max Temp:	303	265	198		265	294	299
Max Allowed:	408	408	408		409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 186 (°F)	TC # 187 (°F)	TC # 188 (°F)	TC # 189 (°F)	TC # 190 (°F)	TC # 191 (°F)	TC # 192 (°F)
0	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84
5	84	84	84	84	84	84	84
6	84	84	84	84	84	84	84
7	85	85	84	84	84	85	85
8	85	85	85	85	85	86	86
9	86	86	85	85	86	87	87
10	88	87	87	86	88	89	88
11	89	89	88	88	89	92	91
12	92	92	90	89	92	94	93
13	95	95	93	92	94	97	96
14	98	98	96	94	96	100	99
15	101	101	99	97	99	103	102
16	105	105	102	100	102	106	106
17	109	109	106	103	106	110	109
18	113	113	110	107	109	113	113
19	118	118	115	111	113	117	117
20	122	122	119	116	117	121	121
21	127	126	124	120	122	125	125
22	131	131	128	124	126	130	129
23	135	135	133	129	130	134	134
24	140	140	138	133	134	138	138
25	145	145	143	138	139	143	143
26	150	150	148	143	144	148	148
27	155	155	153	148	149	153	153
28	160	160	158	153	155	158	158
29	165	165	163	158	160	163	163
30	170	169	168	164	165	168	168
31	174	174	173	169	170	173	173
32	179	178	177	174	175	178	178
33	183	183	181	178	179	183	182
34	187	187	186	183	184	188	187
35	191	191	190	187	188	192	192
36	194	194	193	191	192	197	197
37	198	198	197	195	196	202	201
38	201	201	199	198	199	206	206
39	203	204	202	201	202	210	210

OMEGA POINT LABORATORIES

Project No. 97185 TVA / TSI September 7, 1994

Time (min)	TC # 186 (°F)	TC # 187 (°F)	TC # 188 (°F)	TC # 189 (°F)	TC # 190 (°F)	TC # 191 (°F)	TC # 192 (°F)
40	205	206	204	204	205	214	214
41	207	208	206	206	207	217	218
42	209	210	208	208	208	220	222
43	210	212	209	209	209	223	226
44	213	215	210	209	210	226	230
45	218	219	211	210	211	229	234
46	225	223	213	210	212	232	238
47	232	228	216	210	213	236	242
48	238	232	219	211	219	241	247
49	244	237	223	212	226	247	252
50	249	242	227	216	233	252	256
51	254	247	232	223	239	257	261
52	259	252	237	229	244	262	266
53	264	256	242	234	249	266	271
54	269	261	247	239	254	271	275
55	274	266	252	244	259	275	280
56	278	271	257	249	263	280	284
57	283	275	262	254	267	284	289
58	287	280	267	259	272	288	293
59	291	284	271	263	276	293	297
60	295	288	276	268	280	297	301
Max Temp:	295	288	276	268	280	297	301
Max Allowed:	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 193 (°F)	TC # 194 (°F)	TC # 195 (°F)	TC # 196 (°F)	TC # 197 (°F)	TC # 198 (°F)	TC # 199 (°F)
0	84	84	84	83	83	83	83
1	84	84	84	83	83	83	83
2	84	84	83	83	83	83	83
3	84	84	83	83	83	83	83
4	84	84	84	84	83	83	83
5	84	84	84	84	84	84	84
6	84	84	84	84	84	84	84
7	84	84	84	85	85	85	84
8	85	85	85	86	86	86	85
9	86	86	86	87	88	88	86
10	87	87	88	89	90	90	87
11	89	89	90	91	92	92	89
12	91	91	92	93	95	95	92
13	94	94	95	96	97	97	94
14	96	97	98	99	100	100	97
15	99	100	101	102	103	104	100
16	103	104	105	105	107	107	103
17	106	107	109	109	110	111	107
18	110	111	113	113	114	114	110
19	114	116	117	117	118	118	114
20	118	120	121	121	122	122	118
21	122	124	125	126	126	127	122
22	127	128	129	130	131	131	126
23	131	133	134	134	135	135	130
24	135	137	138	139	140	140	134
25	140	141	143	144	144	144	139
26	145	146	147	149	149	149	143
27	150	151	152	153	154	154	148
28	155	156	157	158	158	159	153
29	160	161	162	163	163	164	158
30	165	167	167	168	168	168	164
31	170	171	172	173	173	172	168
32	175	176	177	178	177	176	172
33	179	180	181	182	182	180	177
34	184	184	186	187	186	184	181
35	189	189	191	192	189	188	186
36	193	193	195	196	193	191	190
37	197	197	200	201	197	195	193
38	201	201	204	205	201	198	196
39	205	205	208	209	204	201	199

OMEGA POINT LABORATORIES

Time (min)	TC # 193 (°F)	TC # 194 (°F)	TC # 195 (°F)	TC # 196 (°F)	TC # 197 (°F)	TC # 198 (°F)	TC # 199 (°F)
40	209	208	212	213	208	204	202
41	212	212	216	217	212	206	204
42	216	215	219	221	217	208	206
43	219	218	223	225	223	210	208
44	222	221	226	229	228	212	209
45	226	225	230	234	234	220	210
46	230	229	234	238	240	228	211
47	233	233	238	243	245	234	211
48	238	238	242	248	251	240	211
49	242	242	247	253	256	247	212
50	247	247	252	258	261	253	216
51	252	251	256	262	266	258	218
52	257	256	261	267	271	263	226
53	262	261	265	272	276	268	234
54	267	265	269	276	280	273	240
55	272	270	274	281	285	278	246
56	276	274	278	285	289	283	250
57	281	278	282	289	293	287	254
58	286	282	286	293	297	291	258
59	290	287	291	297	301	294	261
60	294	291	295	301	305	298	265
Max Temp:	294	291	295	301	305	298	265
Max Allowed:	409	409	409	408	408	408	408

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	E119 Std (°F)	Furnace Avg (°F)	TC # 201 (°F)	TC # 202 (°F)	TC # 203 (°F)	TC # 204 (°F)	TC # 205 (°F)
0	68	83	84	84	84	84	84
1	254	116	84	84	84	84	84
2	440	174	84	84	84	84	84
3	627	281	84	84	84	84	84
4	813	562	84	84	84	84	84
5	1000	920	84	84	84	84	84
6	1060	1172	85	85	85	85	85
7	1120	1256	86	86	86	87	87
8	1180	1271	87	88	89	89	90
9	1240	1262	90	91	92	92	93
10	1300	1238	94	95	97	96	97
11	1327	1252	98	100	101	101	101
12	1346	1351	103	105	106	106	106
13	1364	1423	109	111	113	112	112
14	1380	1448	115	117	120	118	118
15	1395	1432	122	124	126	125	125
16	1410	1401	128	130	132	131	131
17	1423	1382	135	137	138	137	137
18	1436	1393	141	143	144	143	143
19	1448	1422	147	149	150	149	148
20	1459	1451	153	154	156	155	154
21	1470	1472	158	160	162	161	160
22	1480	1490	164	165	167	168	166
23	1490	1505	168	170	172	173	172
24	1499	1519	173	175	177	178	177
25	1508	1531	177	179	182	183	182
26	1517	1543	181	183	187	189	188
27	1525	1557	185	188	194	197	195
28	1533	1558	189	192	201	204	202
29	1541	1550	192	197	207	212	209
30	1548	1543	196	202	215	219	216
31	1555	1537	200	208	223	226	222
32	1562	1530	204	215	231	234	229
33	1569	1532	207	223	239	241	236
34	1576	1541	211	232	247	249	243
35	1582	1548	216	241	255	256	249
36	1588	1566	224	249	263	263	256
37	1594	1582	233	257	271	270	262
38	1600	1597	240	265	278	277	269
39	1606	1616	248	273	285	284	275
40	1612	1625	256	280	292	290	281
41	1617	1634	264	287	298	296	287

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	E119 Std (°F)	Furnace Avg (°F)	TC # 201 (°F)	TC # 202 (°F)	TC # 203 (°F)	TC # 204 (°F)	TC # 205 (°F)
42	1622	1640	271	294	305	302	292
43	1627	1651	278	301	310	307	298
44	1633	1646	284	307	316	313	303
45	1638	1634	290	313	321	317	308
46	1642	1632	295	318	325	322	312
47	1647	1640	299	323	330	326	317
48	1652	1647	304	327	334	330	321
49	1656	1653	308	331	337	334	325
50	1661	1658	311	335	341	337	328
51	1665	1658	315	338	344	341	332
52	1669	1661	318	341	347	344	335
53	1674	1663	320	344	350	347	338
54	1678	1670	323	346	353	350	341
55	1682	1684	326	349	356	353	345
56	1686	1695	329	352	359	356	348
57	1690	1704	331	354	362	359	351
58	1693	1706	334	357	365	362	354
59	1697	1708	336	359	367	365	357
60	1701	1709	339	362	370	368	360
Max Temp:			339	362	370	368	360
Max Allowed:			409	409	409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 206 (°F)	TC # 207 (°F)	TC # 208 (°F)	TC # 209 (°F)	TC # 210 (°F)	TC # 211 (°F)	TC # 212 (°F)
0	83	83	83	83	83	83	83
1	84	83	83	83	83	83	83
2	83	83	83	83	83	83	83
3	83	83	83	83	83	83	83
4	84	83	83	83	83	83	83
5	84	84	84	84	84	84	83
6	85	84	84	84	84	84	84
7	86	85	85	86	86	85	84
8	88	87	87	88	87	87	86
9	91	90	90	90	90	89	87
10	95	94	94	94	94	92	90
11	99	98	98	98	97	95	93
12	103	102	103	102	101	99	96
13	109	108	107	107	106	103	100
14	115	113	113	112	111	108	105
15	121	119	118	118	117	113	110
16	127	125	124	124	123	119	115
17	133	131	130	131	129	125	120
18	139	137	136	138	136	131	125
19	145	143	143	145	143	138	130
20	151	149	149	151	150	144	136
21	157	154	155	158	157	151	142
22	163	161	162	165	164	158	149
23	168	167	168	171	170	164	155
24	173	173	175	178	177	171	161
25	179	179	181	185	183	177	167
26	184	185	187	191	190	183	173
27	190	191	193	197	196	190	179
28	196	196	199	203	202	195	185
29	202	202	205	209	208	201	191
30	208	208	211	215	213	207	197
31	214	213	216	220	219	212	202
32	220	219	222	226	225	218	207
33	226	225	228	232	230	223	212
34	232	230	232	238	236	228	217
35	237	235	238	243	241	233	221
36	243	241	243	249	247	239	226
37	249	247	249	256	254	244	230
38	256	253	256	263	261	250	235
39	262	259	262	269	268	256	239
40	267	265	268	276	274	262	244
41	273	271	275	283	281	267	248

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 206 (°F)	TC # 207 (°F)	TC # 208 (°F)	TC # 209 (°F)	TC # 210 (°F)	TC # 211 (°F)	TC # 212 (°F)
42	279	277	281	290	288	273	253
43	284	283	287	296	294	279	257
44	290	288	293	301	300	285	262
45	295	293	298	307	306	290	266
46	300	298	303	312	311	295	271
47	304	303	308	317	316	300	275
48	308	307	313	321	320	304	279
49	313	312	317	325	324	309	283
50	317	317	321	329	329	314	287
51	321	320	325	333	333	318	292
52	324	324	328	337	336	323	296
53	327	327	332	340	340	327	300
54	331	331	336	343	343	331	305
55	334	334	339	346	346	335	309
56	337	337	342	349	349	339	312
57	340	339	344	351	352	342	315
58	344	342	347	354	355	344	318
59	347	345	350	357	357	347	321
60	350	347	352	360	360	349	323
Max Temp:	350	347	352	360	360	349	323
Max Allowed:	408	408	408	408	408	408	408

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 213 (°F)	TC # 214 (°F)	TC # 215 (°F)	TC # 216 (°F)	TC # 217 (°F)	TC # 218 (°F)	TC # 219 (°F)
0	83	83	83	83	83	deleted	83
1	83	83	83	83	83	deleted	83
2	83	83	83	83	83	deleted	83
3	83	83	83	83	83	deleted	83
4	83	83	84	83	84	deleted	83
5	83	84	84	84	84	deleted	83
6	84	85	85	85	84	deleted	83
7	85	86	87	87	85	deleted	83
8	86	88	89	90	87	deleted	83
9	88	90	92	93	89	deleted	83
10	91	93	96	97	92	deleted	83
11	94	97	100	101	95	deleted	83
12	97	101	105	106	99	deleted	84
13	102	106	110	111	103	deleted	84
14	106	110	115	116	107	deleted	84
15	111	116	121	121	112	deleted	84
16	115	121	127	126	116	deleted	84
17	120	127	133	132	121	deleted	85
18	125	132	139	138	127	deleted	85
19	131	138	146	144	132	deleted	86
20	136	144	152	150	137	deleted	87
21	142	150	158	155	142	deleted	88
22	149	156	164	161	147	deleted	89
23	155	162	170	167	153	deleted	90
24	161	169	176	173	158	deleted	92
25	168	175	182	179	163	deleted	93
26	174	182	188	184	168	deleted	95
27	181	188	193	190	173	deleted	97
28	187	194	199	195	178	deleted	99
29	193	200	205	200	183	deleted	101
30	198	206	211	204	188	deleted	104
31	204	211	216	209	193	deleted	107
32	208	216	222	213	197	deleted	109
33	213	220	228	215	201	deleted	113
34	217	224	232	218	205	deleted	116
35	221	229	237	223	208	deleted	120
36	226	233	241	229	210	deleted	124
37	230	238	246	237	211	deleted	128
38	234	242	252	245	215	deleted	132
39	239	247	257	252	222	deleted	136
40	243	251	263	259	229	deleted	141
41	247	256	268	266	236	deleted	145

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 213 (°F)	TC # 214 (°F)	TC # 215 (°F)	TC # 216 (°F)	TC # 217 (°F)	TC # 218 (°F)	TC # 219 (°F)
42	251	260	273	272	242	deleted	150
43	255	264	277	278	248	deleted	155
44	259	269	282	283	254	deleted	160
45	263	273	287	288	259	deleted	165
46	267	278	291	293	264	deleted	170
47	271	282	296	298	269	deleted	175
48	275	287	301	302	273	deleted	179
49	279	291	305	306	277	deleted	184
50	283	295	308	310	282	deleted	188
51	287	299	311	314	286	deleted	191
52	292	303	315	318	290	deleted	195
53	297	307	319	321	294	deleted	198
54	302	312	323	325	297	deleted	202
55	305	315	326	328	300	deleted	205
56	308	318	329	331	303	deleted	209
57	311	321	333	334	305	deleted	212
58	314	324	336	337	308	deleted	216
59	317	327	338	339	311	deleted	220
60	319	330	342	342	313	deleted	223
Max Temp:	319	330	342	342	313		223
Max Allowed:	408	408	408	408	408		408

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 220 (°F)	TC # 221 (°F)	TC # 222 (°F)	TC # 223 (°F)	TC # 224 (°F)	TC # 225 (°F)	TC # 226 (°F)
0	84	84	85	85	85	84	84
1	84	84	85	85	85	84	84
2	84	84	85	85	85	84	84
3	84	84	85	85	85	84	84
4	84	84	85	85	85	84	84
5	84	84	85	85	85	84	84
6	84	84	85	85	85	84	84
7	84	84	85	85	85	84	84
8	84	84	85	85	85	84	84
9	84	84	85	85	85	85	84
10	84	84	85	85	85	85	84
11	84	85	85	85	85	85	85
12	84	85	85	85	85	85	85
13	84	85	85	85	85	85	85
14	84	85	86	86	85	86	85
15	84	86	86	86	86	86	86
16	85	86	87	87	86	87	87
17	85	87	87	87	87	88	88
18	86	88	88	88	88	89	89
19	87	89	89	89	89	90	90
20	88	90	90	91	90	92	91
21	89	91	92	92	92	93	93
22	90	93	93	94	94	95	95
23	91	94	95	96	95	97	97
24	93	96	97	98	97	99	99
25	94	98	99	100	100	101	101
26	96	101	102	103	102	103	103
27	98	103	105	106	104	106	106
28	101	106	107	109	107	108	108
29	103	108	110	113	110	111	111
30	106	111	113	116	113	113	114
31	109	114	117	120	116	116	117
32	112	118	120	123	119	119	120
33	115	121	123	127	122	121	122
34	119	124	126	130	125	124	125
35	122	128	130	134	128	127	129
36	126	132	133	137	131	129	132
37	131	135	137	140	134	132	135
38	135	139	140	143	137	135	138
39	140	144	144	146	140	138	141
40	144	148	147	148	142	141	145
41	149	152	150	151	145	143	148

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 220 (°F)	TC # 221 (°F)	TC # 222 (°F)	TC # 223 (°F)	TC # 224 (°F)	TC # 225 (°F)	TC # 226 (°F)
42	154	157	154	153	148	146	151
43	159	161	157	155	150	149	154
44	165	166	160	158	153	151	158
45	170	171	164	160	155	154	161
46	176	176	167	162	157	157	164
47	181	180	170	165	160	159	167
48	185	184	174	167	162	162	170
49	190	188	177	169	164	164	173
50	194	192	180	172	166	167	175
51	198	195	182	174	168	169	178
52	202	198	185	176	171	171	180
53	206	201	187	178	173	174	183
54	210	204	189	180	175	176	185
55	215	208	192	182	177	179	188
56	219	211	194	184	179	182	190
57	223	214	196	186	182	184	192
58	228	218	198	188	185	187	194
59	232	222	201	190	187	190	196
60	237	225	203	193	190	192	198
Max Temp:	237	225	203	193	190	192	198
Max Allowed:	409	409	410	410	410	409	409

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 227 (°F)	TC # 228 (°F)	TC # 229 (°F)	TC # 230 (°F)	TC # 231 (°F)	TC # 232 (°F)	TC # 233 (°F)
0	84	84	84	84	84	84	84
1	84	84	84	84	84	84	84
2	84	84	84	84	84	84	84
3	84	84	84	84	84	84	84
4	84	84	84	84	84	84	84
5	84	84	84	84	84	84	84
6	84	84	84	84	84	84	84
7	84	84	84	84	84	84	84
8	84	84	84	84	84	84	84
9	84	84	84	84	84	84	84
10	84	84	84	84	84	84	84
11	85	85	85	85	85	85	84
12	85	85	85	85	85	85	85
13	85	86	86	86	86	86	85
14	86	86	86	86	86	86	86
15	87	87	87	87	87	87	87
16	87	88	88	88	88	88	88
17	88	89	89	89	89	90	90
18	90	91	91	91	91	91	91
19	91	92	92	92	92	93	93
20	93	94	94	94	94	95	95
21	94	96	96	96	96	97	96
22	96	98	98	98	98	99	99
23	98	100	101	100	100	101	101
24	101	102	103	103	103	104	103
25	103	105	106	105	105	106	105
26	106	107	108	108	108	109	108
27	108	110	111	111	111	111	110
28	111	113	114	114	113	114	113
29	114	116	117	117	116	117	116
30	117	119	121	120	120	120	118
31	120	122	124	123	123	123	121
32	123	126	127	127	126	126	124
33	126	129	131	130	129	129	126
34	130	132	134	133	132	132	129
35	133	136	137	136	135	135	132
36	137	139	140	140	138	138	134
37	140	142	144	143	141	140	137
38	143	146	147	146	144	143	140
39	147	149	150	149	147	146	142
40	150	152	153	152	150	149	145
41	154	156	156	155	153	152	148

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 227 (°F)	TC # 228 (°F)	TC # 229 (°F)	TC # 230 (°F)	TC # 231 (°F)	TC # 232 (°F)	TC # 233 (°F)
42	158	159	159	158	156	155	150
43	161	162	162	161	159	157	153
44	165	166	165	164	162	160	155
45	168	169	168	166	165	163	158
46	172	172	172	169	167	165	160
47	175	176	175	172	170	168	163
48	178	180	178	175	173	171	165
49	181	183	181	178	175	173	168
50	184	186	185	181	178	176	170
51	186	190	188	184	181	178	172
52	189	192	191	187	184	181	175
53	192	195	194	190	186	183	177
54	194	198	197	193	189	185	179
55	196	200	199	195	191	188	182
56	198	202	201	198	194	190	184
57	200	203	203	200	196	192	186
58	202	205	205	202	199	195	188
59	203	206	206	204	201	197	190
60	204	208	208	206	203	200	193
Max Temp:	204	208	208	206	203	200	193
Max Allowed:	409	409	409	409	409	409	409

OMEGA POINT LABORATORIES

Time (min)	TC # 234 (°F)	TC # 235 (°F)	TC # 236 (°F)	TC # 237 (°F)	TC # 238 (°F)	TC #2 39 (°F)	TC #240 (°F)
0	83	83	83	84	85	85	84
1	83	83	83	85	85	85	85
2	83	83	83	88	91	89	90
3	83	83	83	98	104	97	101
4	83	83	83	118	136	115	120
5	83	83	83	132	165	142	135
6	83	83	83	142	178	169	148
7	84	83	83	153	191	185	165
8	84	83	83	166	206	197	178
9	84	83	83	178	221	211	187
10	84	83	83	187	242	229	196
11	84	83	84	195	274	252	208
12	85	83	84	205	304	272	226
13	85	83	84	216	333	294	245
14	86	84	85	236	364	317	264
15	87	84	85	255	395	340	283
16	88	84	86	274	425	363	302
17	89	84	86	292	453	385	320
18	90	84	87	310	479	406	338
19	92	85	88	328	504	425	357
20	93	85	89	346	529	445	375
21	95	85	90	365	555	465	393
22	97	86	91	383	581	486	412
23	99	86	92	401	606	505	430
24	101	87	93	419	631	525	449
25	103	87	94	437	656	544	467
26	105	88	95	455	681	564	486
27	107	88	97	473	706	583	504
28	109	89	98	490	731	601	521
29	112	89	99	508	755	620	539
30	114	90	101	525	778	637	557
31	116	91	102	542	800	655	574
32	118	91	104	559	822	672	591
33	121	92	105	574	842	687	608
34	123	93	106	590	862	702	624
35	125	93	108	605	880	716	641
36	127	94	109	621	899	731	657
37	129	95	111	636	917	745	673
38	132	95	112	651	935	759	689
39	134	96	113	666	952	774	705
40	136	97	115	681	970	788	722
41	138	98	116	696	988	803	738

Time (min)	TC # 234 (°F)	TC # 235 (°F)	TC # 236 (°F)	TC # 237 (°F)	TC # 238 (°F)	TC #2 39 (°F)	TC #240 (°F)
42	140	98	118	712	1006	818	754
43	142	99	119	726	1022	833	770
44	145	100	120	741	1039	844	786
45	147	101	122	756	1055	857	801
46	149	101	123	771	1071	869	817
47	151	102	125	785	1085	881	832
48	153	103	126	799	1099	892	847
49	155	104	127	813	1112	901	862
50	157	104	129	827	1126	912	877
51	159	105	130	840	1139	924	891
52	161	106	131	854	1151	933	906
53	163	107	133	867	1163	945	920
54	165	107	134	881	1175	956	934
55	167	108	135	894	1187	971	947
56	169	109	136	907	1199	985	961
57	171	110	137	920	1210	1000	975
58	173	110	139	933	1222	1018	988
59	175	111	140	946	1233	1038	1002
60	177	112	141	959	1245	1060	1015
Max Temp:	177	112	141	959	1245	1060	1015
Max Allowed:	408	408	408				

OMEGA POINT LABORATORIES

Time (min)	TC # 241 (°F)	TC # 242 (°F)	TC # 243 (°F)	TC # 244 (°F)	TC # 245 (°F)	TC # 246 (°F)	TC # 247 (°F)
0	84	84	84	84	84	84	84
1	86	85	85	86	87	86	85
2	100	93	89	92	105	97	91
3	126	108	97	105	131	116	103
4	156	138	116	124	159	147	126
5	170	163	147	140	172	169	162
6	181	179	175	151	181	182	182
7	193	191	190	163	193	197	191
8	212	209	198	174	213	218	213
9	242	243	216	188	241	263	247
10	274	275	237	207	268	298	275
11	303	303	257	222	294	330	299
12	333	331	279	241	323	363	325
13	367	363	303	261	356	398	353
14	404	397	328	282	390	435	383
15	438	432	354	303	425	473	414
16	470	465	379	325	457	511	442
17	498	495	402	346	488	546	469
18	524	525	424	367	517	579	493
19	550	553	445	387	545	610	517
20	576	582	468	407	574	641	540
21	603	611	490	428	602	672	564
22	631	642	514	448	632	704	588
23	657	670	535	468	660	735	611
24	682	699	558	488	688	767	634
25	707	727	579	508	717	798	657
26	731	756	601	527	744	829	680
27	755	783	622	547	772	860	702
28	779	811	643	567	799	890	724
29	801	836	663	586	826	918	745
30	823	861	682	605	851	946	764
31	843	884	701	625	876	972	783
32	864	907	719	644	900	997	801
33	882	927	735	662	921	1020	817
34	901	948	752	681	943	1042	832
35	919	967	768	699	964	1064	846
36	936	986	784	717	984	1084	860
37	954	1004	799	735	1004	1104	873
38	972	1023	815	753	1024	1122	884
39	989	1041	831	771	1044	1141	896
40	1007	1059	846	789	1063	1159	906
41	1024	1076	861	807	1082	1177	915

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 241 (°F)	TC # 242 (°F)	TC # 243 (°F)	TC # 244 (°F)	TC # 245 (°F)	TC # 246 (°F)	TC # 247 (°F)
42	1041	1093	876	826	1101	1194	925
43	1057	1109	890	843	1119	1210	933
44	1074	1126	904	860	1136	1225	944
45	1089	1141	917	878	1153	1240	955
46	1104	1155	930	895	1168	1253	967
47	1117	1167	941	911	1183	1266	981
48	1132	1180	952	928	1197	1278	997
49	1145	1193	965	943	1211	1289	1015
50	1159	1206	978	959	1225	1300	1036
51	1172	1217	993	975	1238	1310	1062
52	1184	1229	1009	990	1251	1320	1093
53	1196	1240	1029	1004	1262	1328	1125
54	1208	1251	1050	1019	1274	1335	1156
55	1220	1261	1075	1033	1285	1340	1185
56	1232	1272	1103	1047	1295	1345	1211
57	1245	1282	1133	1061	1305	1350	1240
58	1256	1293	1164	1074	1314	1355	1262
59	1268	1302	1194	1107	1322	1362	1284
60	1279	1311	1221	1121	1329	1369	1304
Max Temp:	1279	1311	1221	1121	1329	1369	1304
Max Allowed:							

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 248 (°F)	TC # 249 (°F)	TC # 250 (°F)	TC # 251 (°F)	TC # 252 (°F)	TC # 253 (°F)	TC # 254 (°F)
0	84	84	84	84	84	84	84
1	86	88	86	86	84	85	85
2	91	105	99	93	87	99	93
3	99	136	122	107	95	126	109
4	112	173	158	137	112	163	144
5	123	180	178	168	131	175	170
6	137	186	188	185	144	183	184
7	155	197	202	192	161	195	195
8	171	213	232	202	177	212	212
9	184	238	265	221	189	242	245
10	193	268	299	249	198	272	275
11	202	297	330	272	209	299	303
12	220	328	361	296	224	329	333
13	238	362	395	322	249	362	364
14	255	398	431	350	270	400	397
15	273	431	467	378	292	436	431
16	292	463	500	404	313	468	463
17	312	491	530	428	334	497	493
18	331	518	559	450	354	524	521
19	350	544	587	472	373	551	548
20	369	571	615	494	393	578	575
21	388	598	644	516	412	606	603
22	408	627	674	539	432	634	632
23	426	653	702	560	450	659	658
24	445	680	730	582	469	685	686
25	464	707	759	603	488	710	714
26	482	734	787	624	507	735	741
27	501	760	814	645	525	760	766
28	520	786	841	665	543	784	794
29	538	811	868	684	561	807	820
30	557	835	893	702	579	829	844
31	575	859	916	718	597	849	867
32	593	881	939	735	614	869	890
33	611	902	960	750	630	887	910
34	628	923	980	765	646	905	930
35	646	943	999	779	662	923	949
36	663	963	1018	793	678	941	968
37	680	982	1037	806	694	959	987
38	697	1002	1055	820	710	977	1006
39	714	1021	1074	833	726	995	1024
40	731	1039	1091	845	742	1014	1043
41	748	1058	1109	859	758	1032	1060

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 248 (°F)	TC # 249 (°F)	TC # 250 (°F)	TC # 251 (°F)	TC # 252 (°F)	TC # 253 (°F)	TC # 254 (°F)
42	766	1077	1127	873	775	1051	1078
43	782	1095	1143	886	791	1068	1095
44	799	1113	1159	900	807	1085	1111
45	816	1130	1174	912	823	1101	1127
46	833	1145	1189	926	838	1115	1141
47	849	1160	1202	940	854	1129	1155
48	865	1174	1215	956	869	1143	1168
49	881	1189	1227	974	883	1157	1181
50	897	1203	1239	993	898	1171	1194
51	913	1216	1250	1017	912	1184	1206
52	928	1230	1261	1043	927	1197	1218
53	943	1242	1270	1071	940	1209	1229
54	958	1254	1280	1105	954	1221	1240
55	972	1266	1289	1136	967	1232	1250
56	986	1277	1298	1169	981	1244	1261
57	1001	1289	1307	1198	994	1256	1271
58	1015	1300	1316	1230	1007	1268	1282
59	1028	1311	1324	1256	1020	1279	1293
60	1042	1320	1331	1279	1032	1289	1303
Max Temp:	1042	1320	1331	1279	1032	1289	1303
Max Allowed:							

OMEGA POINT LABORATORIES

Time (min)	TC # 255 (°F)	Ambient (°F)	Furnace #1 (°F)	Furnace #2 (°F)	Furnace #3 (°F)	Furnace #4 (°F)	Furnace #5 (°F)	Furnace #6 (°F)
0	84	86	83	83	84	not used	84	84
1	85	86	98	113	117	not used	115	104
2	89	86	127	163	169	not used	172	145
3	98	86	184	252	251	not used	286	228
4	119	86	381	576	478	not used	571	446
5	151	86	767	1041	865	not used	931	776
6	180	87	1088	1286	1165	not used	1229	1091
7	193	87	1167	1324	1296	not used	1383	1262
8	203	87	1178	1314	1326	not used	1440	1332
9	221	87	1164	1290	1317	not used	1451	1378
10	243	86	1142	1267	1296	not used	1426	1369
11	264	87	1152	1264	1321	not used	1425	1363
12	287	86	1228	1335	1403	not used	1521	1440
13	311	87	1299	1390	1492	not used	1602	1517
14	338	87	1332	1422	1533	not used	1618	1541
15	365	87	1330	1423	1515	not used	1611	1512
16	390	87	1312	1405	1480	not used	1571	1485
17	413	87	1297	1391	1467	not used	1529	1470
18	435	87	1302	1395	1494	not used	1528	1475
19	456	87	1323	1417	1528	not used	1558	1499
20	478	87	1346	1445	1559	not used	1589	1524
21	500	87	1364	1466	1576	not used	1613	1544
22	522	87	1382	1484	1591	not used	1625	1556
23	543	87	1398	1496	1602	not used	1647	1567
24	564	87	1415	1507	1610	not used	1653	1584
25	585	87	1432	1518	1621	not used	1667	1592
26	605	88	1448	1529	1628	not used	1671	1605
27	625	88	1463	1540	1636	not used	1685	1619
28	645	88	1475	1534	1634	not used	1686	1618
29	665	88	1471	1533	1635	not used	1688	1606
30	683	88	1464	1530	1632	not used	1689	1599
31	700	88	1458	1528	1627	not used	1682	1596
32	717	88	1453	1521	1621	not used	1671	1590
33	732	88	1453	1524	1623	not used	1667	1593
34	747	88	1459	1533	1628	not used	1667	1600
35	761	88	1468	1535	1631	not used	1671	1603
36	775	88	1484	1553	1641	not used	1676	1625
37	790	88	1501	1564	1652	not used	1692	1638
38	804	88	1522	1570	1662	not used	1706	1659
39	817	88	1540	1582	1686	not used	1719	1683
40	831	88	1553	1593	1685	not used	1724	1688
41	843	88	1565	1600	1690	not used	1730	1696

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	TC # 255 (°F)	Ambient (°F)	Furnace #1 (°F)	Furnace #2 (°F)	Furnace #3 (°F)	Furnace #4 (°F)	Furnace #5 (°F)	Furnace #6 (°F)
42	856	89	1569	1612	1693	not used	1742	1698
43	865	89	1582	1622	1698	not used	1747	1716
44	876	89	1580	1618	1695	not used	1742	1710
45	885	89	1574	1606	1682	not used	1730	1698
46	892	89	1573	1602	1672	not used	1729	1700
47	900	89	1574	1620	1688	not used	1731	1705
48	909	89	1579	1635	1698	not used	1729	1711
49	920	89	1584	1639	1703	not used	1734	1718
50	932	89	1590	1637	1699	not used	1742	1722
51	945	89	1591	1646	1692	not used	1742	1722
52	962	89	1593	1657	1700	not used	1740	1724
53	979	89	1595	1660	1701	not used	1739	1723
54	999	89	1602	1669	1705	not used	1743	1727
55	1024	90	1613	1687	1728	not used	1753	1738
56	1055	89	1624	1691	1734	not used	1762	1751
57	1088	90	1629	1705	1744	not used	1771	1761
58	1123	90	1630	1703	1753	not used	1780	1764
59	1159	89	1633	1704	1776	not used	1784	1762
60	1194	90	1636	1703	1787	not used	1787	1764

Max Temp: 1194
Max Allowed:

OMEGA POINT LABORATORIES

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	Furnace #7 (°F)	Furnace #8 (°F)	Furnace #9 (°F)	Furnace #10 (°F)	Furnace #11 (°F)
0	84	84	83	83	83
1	109	105	153	131	112
2	154	147	273	225	170
3	231	236	485	378	276
4	385	465	1009	816	497
5	618	802	1418	1220	768
6	867	1118	1505	1363	1007
7	1030	1259	1406	1321	1107
8	1100	1316	1315	1263	1124
9	1125	1339	1241	1201	1110
10	1127	1340	1173	1149	1089
11	1164	1351	1185	1169	1132
12	1273	1419	1310	1297	1288
13	1351	1492	1370	1359	1361
14	1393	1515	1371	1371	1386
15	1401	1499	1334	1342	1355
16	1383	1473	1288	1299	1313
17	1367	1476	1263	1277	1286
18	1378	1494	1274	1287	1301
19	1406	1513	1307	1324	1342
20	1438	1532	1342	1359	1382
21	1464	1544	1363	1380	1410
22	1483	1558	1383	1406	1435
23	1500	1569	1398	1423	1451
24	1513	1587	1416	1439	1467
25	1525	1592	1430	1451	1481
26	1536	1601	1449	1469	1499
27	1549	1618	1464	1483	1511
28	1552	1612	1468	1485	1511
29	1548	1598	1451	1475	1499
30	1542	1589	1437	1460	1485
31	1537	1589	1426	1450	1476
32	1530	1585	1422	1443	1468
33	1529	1589	1425	1448	1473
34	1537	1601	1436	1463	1485
35	1545	1602	1449	1475	1497
36	1560	1629	1472	1502	1519
37	1578	1640	1495	1519	1540
38	1588	1660	1516	1534	1557
39	1603	1679	1538	1552	1574
40	1613	1685	1549	1569	1587
41	1623	1692	1557	1582	1601

Project No. 97185 TVA/ TSI September 7, 1994

Time (min)	Furnace #7 (°F)	Furnace #8 (°F)	Furnace #9 (°F)	Furnace #10 (°F)	Furnace #11 (°F)
42	1630	1695	1562	1591	1606
43	1639	1715	1576	1606	1614
44	1639	1711	1569	1596	1605
45	1633	1693	1556	1581	1590
46	1628	1700	1553	1582	1583
47	1632	1714	1557	1590	1591
48	1636	1720	1565	1599	1601
49	1643	1724	1570	1605	1606
50	1647	1735	1577	1614	1614
51	1650	1730	1580	1611	1613
52	1653	1739	1581	1612	1616
53	1655	1745	1581	1615	1616
54	1661	1751	1590	1627	1626
55	1674	1759	1605	1644	1643
56	1683	1775	1618	1658	1654
57	1691	1794	1625	1664	1660
58	1693	1793	1623	1659	1659
59	1696	1788	1621	1661	1656
60	1697	1784	1619	1659	1656

Max Temp:
Max Allowed:

OMEGA POINT LABORATORIES

Appendix E

QUALITY ASSURANCE

Quality Assurance Statement

Omega Point Laboratories, Inc. is an independent, wholly owned company incorporated in the state of Texas, devoted to engineering, inspection, quality assurance and testing of building materials, products and assemblies. The company has developed and implemented a Quality Assurance Program designed to provide its clients with a planned procedure of order and document processing for inspection and testing services it provides to assure conformity to requirements, codes, standards and specifications. The Program is designed to meet the intent of ANSI 45.2 Quality Assurance Program Requirements for Nuclear Power Plants, and complies with the requirements of the ASME Code, SPPE, Military Standards and other less stringent programs. It is the Laboratory's intention to adhere strictly to this Program, to assure that the services offered to its clients remains of the highest quality and accuracy possible.

The overall responsibility of the supervision, operation and coordination of this Quality Assurance Program is that of the Quality Assurance Manager, a person not involved with the performance of the inspection or testing services, and who is under the full time employ of the Laboratory. This individual is responsible for implementing and enforcing all procedures presented in the Quality Assurance Manual and the Procedures Manual. All personnel involved with activities which fall under the scope of this Program are required to cooperate with the letter and intent of this Program.

All QA Surveillance documents remain on file at the Laboratory, and are available for inspection by authorized personnel in the performance of an on-site QA Audit. All materials, services and supplies used herein were obtained with appropriate QA Certifications of Compliance, which may be found in the following pages.

OMEGA POINT LABORATORIES

ACCEPTABILITY DOCUMENTATION

TEST DECK #1: PROJECT NO. 97185

The following signatures attest to the review and acceptance of each attribute listed regarding the above-noted test article:

I. CABLE TRAY/CONDUIT ASSEMBLY

C Humphrey — Omega Point Laboratories, Inc. — 7/8/94 Date

J.J. Pierce — TVA / TSI — 7/18/94 Date

II. ELECTRICAL CABLE INSTALLATION

C Humphrey — Omega Point Laboratories, Inc. — 7/15/94 Date

J.J. Pierce — TVA / TSI — 7/18/94 Date

III. THERMOCOUPLE INSTALLATION

C Humphrey — Omega Point Laboratories, Inc. — 7/15/94 Date

J.J. Pierce — TVA / TSI — 7/18/94 Date

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112-9784
210-635-8100 / FAX: 210-635-8101
800-966-5253

IV. FIRE PROTECTION BARRIER

C Humphrey — 9/6/94
Omega Point Laboratories, Inc. — Date

J J Pierce — 9/7/94
TVA / TSI — Date

V. FINAL PRE-BURN INSPECTION

C Humphrey — 9/6/94
Omega Point Laboratories, Inc. — Date

J J Pierce — 9/7/94
TVA / TSI — Date

Event Log

50-390 TVA WATTS BAR 1

PHASE 2 THERMO-LAG FIRE BARRIER
QUALIFICATION FIRE TEST RESULTS

REC'D W/LTR DTD 12/23/94....9501120202

EVENT LOG

TSI / TVA

Client # 11960

PROJECT NUMBERS:

97185
97186
97187

OMEGA POINT LABORATORIES, INC.
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112
1-800-966-5253

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Revision 0 of Test plan received from TVA.	6/27/94	CH
Material ordered for test deck construction by OPL.	6/27	CH
Construction begins on test deck #1, project 97185, by OPL technicians.	6/29	CH
Cable trays are installed in Test Deck #1 by OPL technicians.	7/7/94	CH.
Shipment of Thermolag material is received from TSI.	7/8/94	CH
Thermocouples are installed on cable tray rails on Test Deck #1.	7/8	CH
Test Deck #2 construction begins.	7/8	CH
Cable loading begins in Test Deck #1.	7/11	CH
Thermocouple placement is verified on tray rails on Test Deck #1.	7/11	CH
Thermocouples are installed by OPL technicians in Test Deck #2.	7/11	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Construction is started on the test deck by OPL welders for Test Deck # 3.	7/12/94	CH
Revision 1 of test plan received from TVA.	7/13	CH
Quality Control verifies test deck dimensions on project #97186, Test Deck #2.	7/13	CH
Conduit drop for thermocouples on Test deck #2 is installed.	7/15	CH
Verification of thermocouples on Test Deck # 2 is completed by OPL QA/QC personnel.	7/15	CH
Cable cable loading and thermocouple installation and verification by QA is completed on Test Deck #1. Cable fill on left tray has been changed to a total of 289, 4/C 16AWG cables.	7/15/94	CH
Purchase order received for the release of construction on the next four test decks. Another event log will be used to record these tests.	7/18/94	CH
J.J. Pierce and crew arrive	7/18	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
at Omega Point to begin the installation process.	7/18/94	CH
Construction of the test article continues and the thermocouple installation begins on Test Deck #3.	7/18/94	CH
Cutting and dry fitting of the Thermo Lag K Rib panels is started on Test Deck #1 by Steve Treadway and Jimmy Starnes, the TVA installers on site.	7/19	CH
Trowel grade Thermo Lag 330-1 is applied to the Thermo Lag panels on the side rails of the cable trays on Test Deck #1 by TVA installers. This trowel grade Thermo Lag will be pre-buttered onto the panels at all surfaces where it lays against the metal tray rails, and all butt joints and seams. Panels are held in place with stainless steel tie wire. The outside edge of the 90° bend on the cable	7/20	CH
	7/20	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Trays are stitched with stainless steel wire at 3" or less intervals on Test Deck #1 cable trays.	7/20/94	CH
All insulation is done according to the TVA installation procedures. Stress skin overlapping patch is applied to butt joints and fastened with 1/2" staples on Test Deck #1.	7/20	CH
Cable tray fill continues on Test Deck #3 by OPL technicians.	7/21	CH
Test Deck #1 Cable tray with 289 cables (full tray on left side of test deck) is fitted with a transition piece to accomodate excess fill at inside 90° angle on cable tray. This piece is made with a 2" stress skin overlap field with staples. Detailed on TVA data sheet dated 7/21/94.	7/21	CH
3" Conduit section of Test Deck	7/22/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
#1 is covered with the first layer of preshaped Thermo Lag sections. The score and fold method of applying Thermo Lag to the 90° elbow is used. Sections are held with the stainless steel tie wire.	7/22/94	CH
Thermo Lag wrap using the Vribbed board and the 18" cable trays is completed on all three trays of Test Deck #1 by TVA installers.	7/22	CH
Cable fill is completed on Test Deck #3 by OPL technicians.	7/23	CH
Second layer of pre-shaped Thermo Lag conduit sections are applied to the 3" conduit on Test Deck #1.	7/25	CH
Trowel grade Thermo-Lag is applied over trays and conduit of Test Deck #1 before finish stainless steel tie wires are applied	7/25	CH
Amarjit Singh, USNRC on site	7/25/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
over the cable trays on Test Deck #1.	7/25/94	CH
Two more TVA installers arrive at Omega Point Labs. Gary Cole Arnold Wright	7/26	CH
TVA installers begin the installation of the cable tray supports, (called T-Rag Supports) between the cable trays on Test Deck #3.	7/26	CH
TVA installers measured, cut and installed T-Rag supports on Test Deck #2.	7/26	CH
Final skim coat put on Test Deck #1, 3-M insulation material applied over 3" conduit in 5 layers. A collar over the 3M-Thermo Rag joint is installed using the 3-M material overlapping 3" on each side with 2 layers. Stainless steel tie wire holds over the taped edges on Test Deck #1.		
Omega Point Technicians	7/26/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
install the cable tray cover over the filled 18" cable tray.	7/26/94	CH
OPL technicians complete the thermocouples placed on the cable tray cover of Test Deck #3. TVA installers begin the cutting and dry fitting of Thermo Lag 330-1 panels to the cable trays on Test Deck #3. Thermocouple verification is completed on this deck by OPL QA/QC.	7/27/94	CH
	7/27	CH
Installation of the V ribbed Thermo-Lag panels proceeds on Test Deck #2 using the all-thread rods with washers and tie wire to support the bottom panels.	7/28	CH
Thermo-Lag V ribbed panels are cut and dry-fitted to Test Deck #3 using the score & fold method by TVA installers.	7/28	CH
Installation of panels using the trowel grade	7/29	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Thermo-Lag proceeds on both Test Deck #2 and #3 by TVA installers. Panels are held in place using stainless steel tie wire.	7/29/94	CH
Supports on Test Deck #2 are insulated using the 18" rule.	7/29	CH
Some V-ribs on the Thermo-Lag pieces are hammered flat on both Test Deck #2 and #3 to achieve a tight fit.	7/29	CH
The 2" conduit was insulated on Test Deck #2. This conduit was installed only as a means to get thermocouple wires from deck. There is no instrumentation on the conduit.	7/29	CH
Stress skin is applied to supports and tray on Test Deck #2. Skim coat of Thermo-Lag trowel grade is applied over the stress skin.	7/30/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Bottom curved section of Test Deck #3 was fitted with a 2" overlap of stress skin which was attached to bottom tray with tie wire every 6". Used 4" conduit sections to fit the 5" conduit using a filler strip, cut to fit.	7/30/94	CH
The end thermocouple on the 1" airdrop is attached to the inside of the cable bundle. This TC is no. 392 on Test Deck #3. The end TC for the 5" airdrop is attached to the horizontal cable section TC number 385.	7/30	CH
Top and bottom surfaces of Test Deck #2 are covered with stress skin and held with staples.	8/1	CH
Rich Johnson with TSI on site to witness installation.	8/1	CH
Pat Madden, USNRC on site.	8/1	CH
Stress skin overlap is	8/1	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
stitched every 3"-5" on Test Deck #2.	8/1/94	CH
5" air drop on Test Deck #3 was filled with scrap Therm-Lag pieces and the trowel grade Therm-Lag material. This method was taken out to try another ~~application~~ installation method.	8/2/94	CH
The new installation procedure determined by TVA for the 5" air drops on Test Deck #3 involves using a bundle of cables (40% fill with a count of 44 cables) inside the Therm-Lag conduit sections.	8/2/94	CH
It has been decided by D. Pierce TVA Proj. Mgr. that the moisture readings will not be required due to the amount of steel stress skin wire used which affects readings,	8/2/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
and TVA's intent to wait a full 30 days to cure the trowel grade material.	8/2/94	CH
The insulation continues on Test Deck #3 with the application of stress skin stapled over the Thermo-Lag 330-1 panels.	8/2	CH
Attached 6" wide flat panel pieces over the seams on the top & bottom of the double tray intersection. Threaded bolts are cut off flush with the nuts. Thermo-Lag putty covers the bolts and nuts and is held in place by a 6" square of stress skin stapled to panel on Test Deck #2. A final coat of trowel grade is applied over the entire assembly.	8/2	CH
The 1" diameter airdrop is covered with two layers of the preformed Thermo-Lag	8/3/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
conduit sections with stress-skin reinforcing at curved radius between layers on Test Deck #3.	8/3/94	CH
Assembly surfaces smoothed and tie wires installed on Test Deck #2. This deck is completed except for 3M material to be applied to plates on supports.	8/3	CH
Deck #3 continues with the application of stress skin & the skim coat of trowel grade material.	8/4	CH
Biff Bradley from NEI has released one bucket of the Thermo Lag 330-1 trowel grade material (batch no. 94-05093 expiration date Jan '95) to be used on this project. This bucket will be replaced by future shipment of material to TVA from TSI).	8/4	CH
Final polish and skim of Test Deck #3 is done by TVA installers and Deck #3 is completed.	8/5	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
TVA installers return to continue insulation of Test # 7 and repair is done to completed test decks.	8/23/96	CH
This repair consists of adding Therms-Lag Trowel grade material to shrinkage cracks pounding in any protruding staples and adding trowel grade skim coat to cover these staple heads or any stress skin wire showing.	8/23	CH
Twelve buckets of NET Therms-Lag Trowel grade material have been transferred to the TVA stock by an authorization letter from Biff Bradley. This material is from batch number 93-1649 with the expiration date extended to January 1995 by TSI.	8/23	CH
The TVA installers on site are: John H. Stewart, Sr. ~~Gary Cole~~ CH Ben Loveless		

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Arnold Wright Bernard McQueen	8/23/94	CH
Daniele Dadinot, USNRC is on site to witness installation of Thermo-Lag, arriving 8/22.	8/23	CH
Mark Talley, TVA Proj. Mgr. on site to coordinate efforts.	8/23	CH
Test Deck #1 has one layer of M-20-A MAT manufactured by 3M applied to the bare sections of the structural support steel above the 18" Therms-Lag wrap. Thermo-couples were attached to the metal before wrapping to give informational only readings (not a test requirement). Deck #1 is complete.	9/1/94	CH
Test Deck #2 has two layers of the 3M M-20-A MAT wraps applied over the structural steel supports after the thermocouples were added. Test Deck #2 is completed.	9/1/94	CH
Test Deck #3 has three	9/1/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
layers of the same 3M product applied over the steel supports after thermocouples were added. All 3M wrap is secured with the foil tape and stainless steel tie wires on decks #1, #2 and #3.	9/1/94	CH
Omega Point technicians begin pouring foam seal fire stops around cable trays and conduits at the penetration points through the test decks on decks #1, #2 and #3.	9/1/94	CH
Foam fire stops are completed on test decks #1, #2 & #3 by OPL technicians	9/2/94	CH
DJ Pierce and Bill Baker of TVA arrive at Omega Point to inspect test decks ready for testing.	9/6/94	CH
Pat Madden, USNRC on site. Richy Lohman, TSI, and Mark Talley, TVA	9/6/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
arrive at Omega Point to witness tomorrows test.	9/6/94	CH
Thermocouple extensions are added to Test Deck #1 due to programming problems with the new data acquisition system. all TC extensions are verified by QA/QC.	9/6	CH
Test Deck #1 has been inspected by TVA and OPL QA/QC and is approved for testing. Final pre burn inspection process is verified by Herb Stansberry OPL Project manager.	9/7/94	CH
Test Deck #1 has been placed on the test furnace.	9/7	CH
On site at Omega Point to witness the first test of Test Deck #1 are; Dee Priest Omega Point Labs Connie Humphrey " " " Kerry Hitchcock " " " Richard Beasley " " " Herb Stansberry " " "	9/7/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Laudencio Castanon Omega Point Labs	9/7/94	CH
Cleda Patton " " "		
J.D. Pierce TVA		
Bill Baber TVA		
Mark Talley TVA		
Pat Madden USNRC		
Rich Johnson TSI		
Ben Loveless TVA (Installer)		
Bernard McQueen " "		
Temperature at time of test start of Test Deck #1 is 85°F with the relative humidity at 63%. The one hour test of deck #1 began at 9:47 am and is completed by 10:47 am. The fire test is followed by the hose stream test after the test deck is removed from the furnace. The hose stream uses the fog nozzle (OPL equipment #92LE003) with a pressure of 15 psi and a 30° spray from a distance of five feet for five minutes.	9/7/94	CH
	9/7/94	CH (#92LE003)
	9/7/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
After the hose stream test of deck #1 the assembly was dismantled by OPL technicians with the condition of the Thermo-Lag, electrical cables and thermocouple wire documented by Herb Stansberry and OPL QA/QC personnel.	9/7/94	CH
Thermocouple extensions are added to Test Deck #2 in preparation of tomorrow's test.	9/7	CH
Verification of thermocouple extensions on Test Deck #2 is verified by OPL QA/QC.	9/8/94	CH
Test Deck #2 has been mounted on the test furnace and all thermocouples are attached to the data acquisition equipment. Herb Stansberry OPL Proj. Mgr. has completed the preburn checklist.	9/8	CH
On site at Omega Point to	9/8	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
witness the fire test of Test Deck # 2 are:	9/8/94	CH
Dee Priest Omega Point Labs		
Cledy Patton " " "		
Herb Stansberry " " "		
Connie Humphrey " " "		
Kerry Hitchcock " " "		
Richard Beasley " " "		
Laudencio Castaneda " " "		
Pat Madden US NRC		
Rich Johnson TSI		
J. Pierce TVA		
Bill Baker "		
Mark Talley "		
The fire test of Test Deck #2 is started at 9:27 am. The temperature is 82°F with the relative humidity at 75%. The test is completed after one hour and is followed by the hose stream test using the fog nozzle (PSI gauge 92LE003) with a 30° spray pattern and a pressure of 75 psi.	9/8/94 9/8	CH CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
The hose is held at a distance of five feet for a five minute duration.	9/8/94	CH
Following the test of Test deck #2, the Therm-Tex material was stripped away and the condition of the materials was documented by the OPG staff.	9/8	CH
Deck #3 is given the final preburn inspection by TVA and OPG staff and is approved for testing. The test article is placed on the test furnace and the thermocouples are attached to the data acquisition system.	9/19	CH
Final preburn inspection is performed by Steve Stansberry, OPG Project manager.	9/20	CH
On site to witness the fire test of Test deck #3 are: Rubin Feldman TSI	9/20	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
Edward Connell USNRC	9/20/94	CH
JJ Pierce TVA		
Mark Talley "		
Peg Priest Omega Point Labs		
Connie Humphrey " " "		
Cleda Patton " " "		
Herb Stansberry " " "		
Kerry Hitchcock " " "		
Richard Beasley " " "		
Laudencio Castanon " " "		
Ben Loveless TVA (installer)		
Bernard McQueen " "		
Temperature at time of test start was 73° with the relative humidity at 73%. The test of deck #3 began at 9:56 am and was completed in one hour. This test was followed by the hose stream test. The hose stream test uses the 30° spray fog nozzle (OPL Equipment 92LE.003 pressure gage) with a pressure of 75 psi from a distance of 50 feet for 5 minutes	9/20	CH
	9/20	CH
	9/20/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
This Log is to be used to document the date and item for each step during the completion of test projects referenced below. The assigned project numbers and description for each of the test assemblies are:

97185 #1 (3) 18" L- shaped steel tray with (1) 3" L - shaped steel conduit
97186 #2 Double 18" steel tray intersection
97187 #3 (1) 18" U - shaped steel tray with cover and (3) nested 18" U - shaped steel trays

ITEM	DATE	INITIALS
After the hose stream test, the test article was dismantled and examined by OPL personnel.	9/20/94	CH
- end -		

Installation Details

ATTACHMENT 1

DATA SHEET

RACEWAY ID 18" CABLE TRAY (Empty) WP/WR NO. 97185 TEST DECK #1
F94-02012, F94-03-12 (Panels)

LOT/CONTRACT NO. 94-05093 (Trowel) EXPIRATION DATE DEC 94

CRAFTSMAN JP Pierce DATE 7/19/94

QC INSPECTOR Cleda Patton DATE 7-19-94

TYPICAL DRAWING NO. 47W243-4

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING		
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE		
CIRCUMFERENCE		
SURFACE APPEARANCE		
MESH OVERLAPS		

REMARKS: Nominal 5/8" thick panels - Max thickness 3/4", Min thickness 1/2". One bucket trowel spread out to dry & make putty.

ATTACHMENT 1

DATA SHEET

RACEWAY ID CABLE TRAYS WP/WR NO. 97185 TEST DECK #1
* Panels See Remarks
LOT/CONTRACT NO. 94-05093 (TROWEL) EXPIRATION DATE DEC 94
CRAFTSMAN JJ Pierce DATE 7/20/94
QC INSPECTOR Cleda Patton DATE 7-20-94
TYPICAL DRAWING NO. 97W293-4

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	6"	
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE		
CIRCUMFERENCE		
SURFACE APPEARANCE		
MESH OVERLAPS		

REMARKS: Nominal 5/8" panels. Max thickness 3/4", MIN thickness 1/2"
Lot # 94-03018 & 94-03047.
Stress skin patch on joints.
Stitch outside bottom edge at adjustable 90°.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Cable Trays WP/WR NO. 97185 TEST DECK #1

LOT/CONTRACT NO. SEE REMARKS EXPIRATION DATE DEC 94

CRAFTSMAN J.P. Pierce DATE 7/21/94

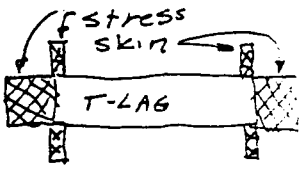
QC INSPECTOR Cleda Patton DATE 7-21-94

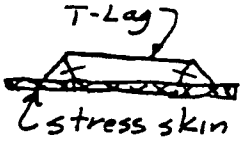
TYPICAL DRAWING NO. 47W293-4

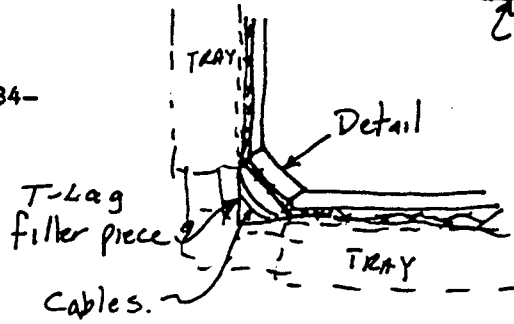
MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	6" TIE WIRE	
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE		
CIRCUMFERENCE	N/A	
SURFACE APPEARANCE	N/A	
MESH OVERLAPS	Joints	

REMARKS: F94-03098 & 94-03047 Panel Lot #s
94-05093 TROWEL GRADE
Stitch outside seam of 90° Elbow.
Fill seams with putty & trowel grade.
Cut piece to transition from horizontal to vertical on full tray (see sketch below). Put transition piece on first (~2" stress skin overlap). Staple stress skin overlap to edges & side of rail side pieces. Removed stress skin between tray side rails.







ATTACHMENT 1

DATA SHEET

RACEWAY ID Cable Trays & Conduit Panels - See Remarks WP/WR NO. 97185 TEST DECK #1

LOT/CONTRACT NO. 94-05093 (TROWEL) EXPIRATION DATE DEC 94

CRAFTSMAN Jeff Pierce DATE 7/22/94

QC INSPECTOR Oleda Patton DATE 7-22-94

TYPICAL DRAWING NO. 47W243-4

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	6" OC.	
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE		
CIRCUMFERENCE		
SURFACE APPEARANCE		
MESH OVERLAPS	YES	

REMARKS: Nominal 5/8" panels: Max thickness 3/4", Min thickness 1/2". Lot # 94-03018 & 94-03047.
Nominal 3/8" thick first layer 3" conduit, Lot 94-02053
Score & fold conduit sections around 90° Elbow.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Cable Tray & Conduit WP/WR NO. 97185 TEST DECK 1

LOT/CONTRACT NO. TROWEL 94-05093 EXPIRATION DATE DEC 94

CRAFTSMAN J.J. Pierce DATE 7/23/94

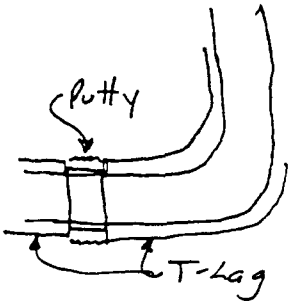
QC INSPECTOR C Patton DATE 7-23-94

TYPICAL DRAWING NO. 47W243-4

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	6"	
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE	YES	
CIRCUMFERENCE	OK	
SURFACE APPEARANCE	OK	
MESH OVERLAPS	YES	

REMARKS: Installed stainless steel stress skin over cable trays and installed preformed on the conduit. Preformed Lot 92-10009 & 94-02053. Preformed pieces butted against conduit connectors and space between pieces filled with putty/trowel.



ATTACHMENT 1

DATA SHEET

RACEWAY ID Conduit & Cable Tray WP/WR NO. 97185-Test Deck 1

LOT/CONTRACT NO. TROWEL 94-05093 EXPIRATION DATE DEC 94

CRAFTSMAN JJ Pierce DATE 7/25/94

QC INSPECTOR C Humphrey DATE 7/25/94

TYPICAL DRAWING NO. _____

MONITORING POINTS	3" Conduit FIRST LAYER	3" Conduit SECOND LAYER
FASTENER SPACING	ok	6" max
SEAMS OFFSET	NA	YES
JOINTS OFFSET	NA	YES
18" RULE	YES	YES
CIRCUMFERENCE	14⅞" to 15½"	Measure tomorrow after dry
SURFACE APPEARANCE	ok	N/A
MESH OVERLAPS		On bend.

REMARKS: May Circum in the bend section.
Conduit Section Lot # 93-06008 (Second layer)
Attached 2nd layer on 3" conduit.
Applied skim coat over stress skin on trays.
Smoothed down with wet Scotch Brite pads.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Conduit & Cable Trays WP/WR NO. 97185 Test Deck 1

LOT/CONTRACT NO. Trowel 94-05093 EXPIRATION DATE Dec 94

CRAFTSMAN JJ Price DATE 7/26/94

QC INSPECTOR C Humphrey DATE 7/26/94

TYPICAL DRAWING NO. _____

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING		6" (4" on curve)
SEAMS OFFSET	NA	✓
JOINTS OFFSET	NA	✓
18" RULE		✓
CIRCUMFERENCE	JJP 7/26/94	
SURFACE APPEARANCE		✓
MESH OVERLAPS		✓

REMARKS: Find skim coat and smooth down with wet Scotch-Brite pads on conduit. Attach permanent tie wires to trays and conduit. Install 5 layers 3M. * Deck complete.

* Collar over the 3M-TSI interface is two layers thick and overlaps the interface 3" on each side.

ATTACHMENT 1

DATA SHEET

RACEWAY ID _____ WP/WR NO. _____

LOT/CONTRACT NO. 93-11049 Trowel Grade EXPIRATION DATE JAN. 95

CRAFTSMAN [signature] DATE 8/23/94

QC INSPECTOR C Humphrey DATE 8/23/94

TYPICAL DRAWING NO. _____

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	-SEE Note*	—
SEAMS OFFSET	NA	—
JOINTS OFFSET	NA	—
18" RULE	NA	—
CIRCUMFERENCE	NA	—
SURFACE APPEARANCE	See remarks -	—
MESH OVERLAPS	—	—

REMARKS: During curing the decks experienced small cracks where trowel grade material cured. Additionally 1-2 small areas (< 2 sq.in.), you could visually see stress skin under the cured Thermo-Lag. Per G-98 these areas would have been re-skimed. (Note, add these requirements to G-98.) Decks worked are #3: 97187, #2: 97186, #1: 97185

*Note: Deck #3 does not have final tie WBEP - 7197A wire installed yet.

SUBJECT Thermo-Lag Testing PROJECT

COMPUTED BY [signature] DATE 8/23/94 CHECKED BY C Humphreys DATE 8/23/94

Notes to Add to G-98

1) The ERFBS shall be considered operational after the QA sign-off and before the completion of the 30 day cure time. After the 30 day cure time the ERFBS shall be reinspected and work orders written for any small shrinkage cracks or visable stress skin. These small shrinkage cracks or visable stress skin does not make the ERFBS in-operable. The work order shall be processed as soon as possible but in no case longer than 30 days.

2) For air drops the inside stress skin shall be inspected to ensure there are no stray strands of wire before installing on the cable.

Sheet 1 of 2

ATTACHMENT 1

DATA SHEET

RACEWAY ID 97185 WP/WR NO. Test Deck #1

LOT/CONTRACT NO. _____ EXPIRATION DATE _____

CRAFTSMAN [signature] DATE 9/1/94

QC INSPECTOR Cleda Patton DATE 9-1-94

TYPICAL DRAWING NO. _____

MONITORING POINTS

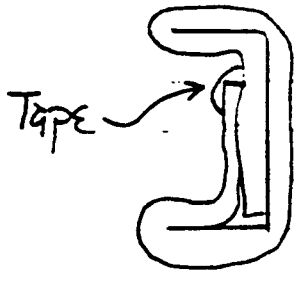
	FIRST LAYER	SECOND LAYER
FASTENER SPACING		
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE	NA	NA
CIRCUMFERENCE		
SURFACE APPEARANCE		
MESH OVERLAPS		

REMARKS: Test deck had one Layer M-20-A MAT (manufactured by 3M) applied to the Structural Support Steel above the 18" of Thermo-Lag protecting the raceway. The purpose will be to see the thermal Protection provided to the support steel & Thermo-Lag / 3M Interam by one (1) Layer of M-20A. (See Next sheet) This deck is complete and ready for test.

SUBJECT 97185 PROJECT Test Deck #1

COMPUTED BY [signature] DATE 9/1/94 CHECKED BY [signature] DATE 9/1/94

Thermo-Lag / 3M Interface

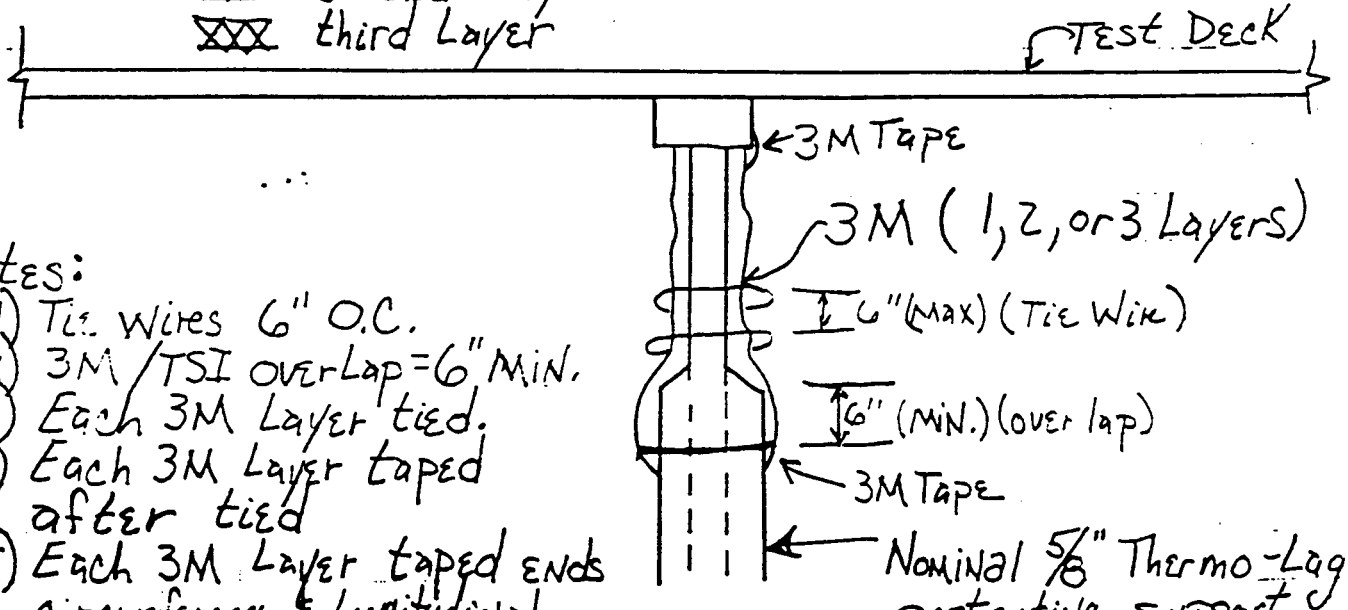


Deck #1

(1-Layer 3M)

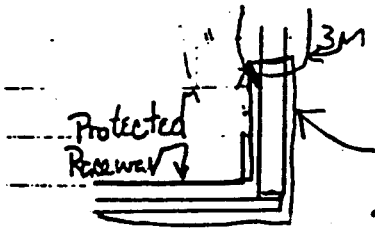
Plan View

Legend
= first Layer
III Second Layer
XXX third Layer



Notes:
1) Tie Wires 6" O.C.
2) 3M/TSI overLap = 6" MIN.
3) Each 3M Layer tied.
4) Each 3M Layer taped after tied
5) Each 3M Layer taped ends Circumferonce & Longitudinal

Elevation



Thermolag 18" on steel from protected raceway.

Certifications of Calibration and Conformance

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97332-38
RECEIVED FROM PMC
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1416 - 11960
DATE RECEIVED 8-16-94
DATE INSPECTED 8-16-94
INSPECTED BY: CBatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
TC Plug	11400	200	200	0	T-1 Plug	Y	Y	Good	None	X			
TC Jack	11400	200	200	0	T-2 Jack	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Janice Welch
PMC Corporation
57 Harvey Road

Londonderry NH 03053

PO Number: 1140-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Cleda Patton Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/15/94	UPS Red Label		8-16-94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	T-1 Plug	100		
2.	T-2 Jack	100		

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-15-94

Special Instructions

Shipment Must Include Certificate of Conformance on Materials.

Ordered By: Cleda Patton

Project #: TSI/TVA AMPACITY

Total	
Shipping	
Tax	
Invoice Total	

PMC CORPORATION
1170 N. GILBERT STREET, ANAHEIM, CA. 92801 • FAX (800) 753-5595 • PHONE (714) 563-0332

SPECIALIZING IN WIRE, CABLE & TEMPERATURE SENSORS

SOLD TO

OMEGA POINT LABS
16015 SHADY FALLS RD.
ELMENDORF, TX 78112

SHIP TO

OMEGA POINT LABS
16015 SHADY FALLS RD.
ELMENDORF, TX 78112
ATTN: CLETA

DATE RECEIVED	CUSTOMER NO.	PMC JOB NO.
8-15-94		TC-6229

REQUESTED SHIP	CUSTOMER P.O. NUMBER	SHIP VIA	TERMS
8-15-94	11400	UPS/RED	NET 15

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QTY. BACK ORDERED	QTY. SHIPPED
1	100	T-1 PLUG	0	100
2	100	T-2 JACK	0	100

SPECIAL INSTRUCTIONS:

2850

DATE SHIPPED	BILL OF LADING NO.	NO. OF PACKAGES	WEIGHT	PPD	COL.	PARTIAL	COMPLETE	PACKED BY
8-15-94	UPS	1	9#	X			X	JP

White - Anaheim Office • Goldenrod - New Hampshire Office • Canary - Packing Slip 22

PMC

CERTIFICATE OF CONFORMANCE

TO Omega Point Labs
16015 Shady Falls Rd.
Elmendorf, TX 78112

DATE 8-15-94
CUSTOMER PO# 1140Q
JOB # TC-6229

PMC P/N	QUANTITY	CUSTOMER P/N	SPEC
T-1 (Plug)	100		
T-2 (Jack)	100		

ADDITIONAL INFORMATION (IF REQUIRED):

This is to certify the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review.

Quality Assurance Inspector 8/15/94

Manny Moreno
Quality Assurance Manager

1170 N. GILBERT STREET
ANAHEIM, CA.
92801
(714) 563-0332
FAX (800) 753-5595

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-87; 97257-260
RECEIVED FROM PMC
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1417 - 11960
DATE RECEIVED 8-22-94
DATE INSPECTED 8-22-94
INSPECTED BY: CBatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	CONID MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
TC Wire	11230	40K	37K	0	KK-TA/TA-24	Y	Y	Good	None	X			LOT#'s: 105966-972; 106460; 106837-839 Order is considered complete within 10% of original amount CY

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Janice Welch
PMC Corporation
57 Harvey Road

Londonderry NH 03053

PO Number: 1123-Q

Invoice, correspondence, all shipping papers, and packages *must reference P.O. number.*

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Constance A. Humphrey Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
6/28/94	UPS Blue Label	MS-1123Q-97185	7-11-94	30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Teflon Coated Thermocouple Wire KK-TA/TA-24	40,000		
2.	Calibration data	1		

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Humphrey
Date 6/25/94

Special Instructions

Include Certificates of Conformance to ASTM E230-93 Special Limits of Error and Calibration data required to 200°F, 400°F, 600°F, 800°F and 1000°F traceable to NIST

Ordered By: Constance A. Humphrey

Project #: ~~OPL Equipment~~ CH
TVA/TSI
Proj # 97185

Total	
Shipping	
Tax	
Invoice Total	

Recd 8/22/94 12,550ft
8/23/94 6,175ft.
Recd 9/8/94 5,000ft
9/20/94 13,856

OMEGA POINT LABORATORIES
MATERIAL PURCHASING SPECIFICATIONS

SPECIFICATION NUMBER: MS--1230-97185

VENDOR: PMC

VENDOR PRODUCT NUMBER: KK-TA/TA-24

PRODUCT DESCRIPTION: Teflon Coated Thermocouple Wire

Material as defined above shall be provided in accordance with the Critical Characteristics as listed below:

TEST	DESCRIPTION	SPECIFICATION RANGES MINIMUM	MAXIMUM
ASTM E230-93	Std. Temperature-EMF Tables for Standardized Thermocouples	Temp. Range +32°F to +545°F Special Limits of Error ±2°F	

QUALITY ASSURANCE REQUIREMENTS

1.0 QUALITY PROGRAM

Seller shall furnish this item in accordance with Quality Program approved by Omega Point Laboratories. Material specified herein is to be produced and tested in accordance with vendor quality standards, methods, guidelines and manufacturing instructions as defined in that Quality Program.

2.0 QUALITY VERIFICATION

Receiving Inspection - Buyer shall inspect items upon receipt to verify compliance with purchase order requirements. Rejected items shall be returned at seller's expense.

Document Review - Final acceptance shall be based on satisfactory review of required certifications and/or supporting documents.

3.0 CERTIFICATIONS

3.1 Certification that supplied materials comply with this material specification and listing Critical Characteristics shall be provided. This certificates shall reference Omega Point Labs purchase order number and specification number for all material furnished under this specification. This Certification shall be signed by the appropriate vendor representative.

3.2 The material furnished under this specification shall be a product that complies with the following:

3.2.1 Has been tested and passed all tests specified herein.

3.2.2 Manufacturing methods for this material have not changed. Vendor will advise Omega Point in writing of any changes in the manufacturing prior to material manufacture.

3.2.3 Raw materials used in the manufacture of this material meet Vendor specifications.

4.0 AUDITS/RIGHTS OF ACCESS

Omega Point Labs reserves the right to audit your facility to verify compliance with the purchase order and specification requirements with a minimum ten (10) day notice.

5.0 IDENTIFICATION

Seller shall identify each item with a unique traceability number by physical marking or tagging. These identification numbers shall be traceable to certifications and packing lists.

6.0 PACKING/SHIPPING

All materials shall be packaged in air tight, moisture free containers and shall be free of foreign substances such as dirt, oil, grease or other deleterious materials.

All materials shall be suitably crated, boxed or otherwise prepared for shipment to prevent damage during handling and shipping.

QUALITY ASSURANCE APPROVAL

C Humphrey

Title Quality Assurance Mgr.

Date 6/28/94

CH

AVL Verification

Class: B

OMEGA POINT LABORATORIES

339

OMEGA POINT LABORATORIES
COMMERCIAL GRADE DEDICATION

PURCHASING SPEC. NO: MS-1123Q-97185

PRODUCT: Thermocouple Wire

MANUFACTURER: PMC Corporation
57 Harvey Road
Londonderry, NH 03053

SUPPLIER: (same)
ADDRESS:
CITY:
STATE/ZIP:
PHONE: (603) 432-9473

TECHNICAL EVALUATION

DESCRIPTION: Teflon Coated Thermocouple Wire

DOES IT PERFORM SAFETY FUNCTION? YES:

Material testing and equipment calibration

DOES ITEM MEET CRITERIA OF CGI DEFINITION? Yes

Item meets all three criteria of CGI listed below:

a) not subject to design or specification requirements that are unique to nuclear facilities; and

b) used in applications other than nuclear facilities; and

c) is ordered from manufacturer or supplier on the basis of specifications set forth in the manufacturers published product description.

TECHNICAL EVALUATION PERFORMED BY:

Project Manager
Date 6/28/94

VERIFIED BY:

C Humphrey
Q/A Manager
Date 6/28/94

PRODUCT: Teflon Coated Thermocouple Wire

SPEC NO: KK-TA/TA-24

IDENTIFICATION OF CRITICAL CHARACTERISTICS:

TEST	DESCRIPTION	SPECIFICATION RANGES MINIMUM	MAXIMUM
ASTM E230-93	Std. Temperature-EMF Tables for Standardized Thermocouples	Temp. Range +32°F to +545°F Special Limits of Error ±2°F	

IDENTIFICATION OF CRITICAL CHARACTERISTICS PERFORMED BY:

PROJECT MANAGER
DATE 6/28/94

VERIFIED BY:

C. Humphrey
Q/A MANAGER
DATE 6/28/94

PRODUCT: KK-TA/TA-24 Thermocouple Wire

SPEC NO: MS-1123Q-97185

ACCEPTANCE METHOD:

METHOD

Source Verification

Performance Record

Purchase order to vendor includes the Omega Point Material Specification listing critical characteristics of CGI material.

All shipments to include appropriate Certification documents listing all critical characteristics.

Material receiving shall include verification of Compliance Report with prescribed critical characteristics. Copies of Compliance Report and verification to be attached to the receiving report.

ACCEPTANCE METHOD DETERMINATION BY:

C Humphrey

DATE: 6/28/94

PFA Insulated Thermocouple Wire

PRODUCT CODE: TA/TA

Our customers have grown to expect only the highest quality products from PMC. We are continuously committed to meet the specific needs of industry and our customers. This construction includes Teflon* PFA insulataion extruded on the single conductors which are then laid parallel and jacketed with Teflon PFA.

Teflon PFA (perfluoroalkoxy) was released in 1972 by Dupont. It possesses similar properties of the other Teflon products such as outstanding electrical characteristics, resistance to virtually all chemicals and excellent flame resistance.

PFA is a true thermoplastic material extrudable by conventional means, and available in long continuous lengths. This construction provides flexibility and toughness with stress crack resistance, resistance to weather, non-aging characterisics, and low coefficient of friction for ease of pulling through conduit.

Like TFE, suggested upper continuous temperature is 500°F (260°C), however, it does not have TFE's solder iron resistance.

The thermocouple grade products shown are used to form temperature sensors and the extension grade products become the interconnecting link in the temperature sensing system.

You will find our qualified sales and engineering staff eager to assist in selecting a design to meet the requirements of your specific application. Variations of this construction are available upon request, including aluminum Mylar* to reduce noise problems found in so many of today's plants.

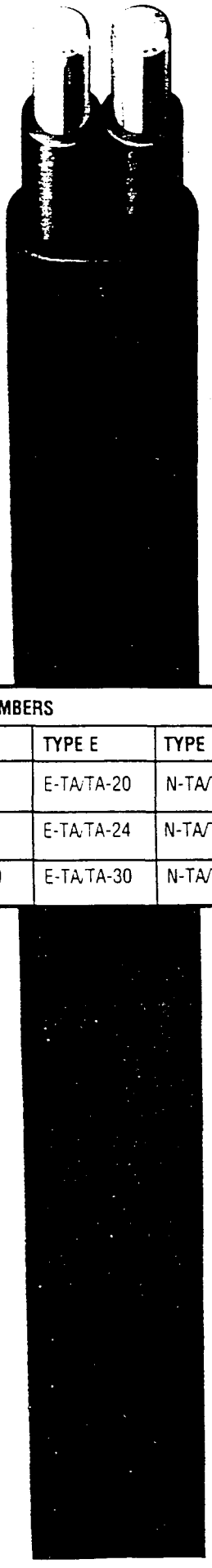
Typical applications include aircraft and automotive engine testing, rapid transit cables, and down hole cable in the oil industry.

*Registered trademark of E.I. DuPont Inc.

Calibrated conductors for high system accuracy

500°F (260°C) PFA insulation for improved electrical properties and high temperature applications

500°F (260°C) PFA jacket for chemical inertness to solvents, acids and oils



GRADE OF WIRE	GAUGE SIZE	WIRE TYPE	PART NUMBERS				
			TYPE J	TYPE K	TYPE T	TYPE E	TYPE N
THERMOCOUPLE	20	SOLID	J-TA/TA-20	K-TA/TA-20	T-TA/TA-20	E-TA/TA-20	N-TA/TA-20
THERMOCOUPLE	24	SOLID	J-TA/TA-24	K-TA/TA-24	T-TA/TA-24	E-TA/TA-24	N-TA/TA-24
THERMOCOUPLE	30	SOLID	J-TA/TA-30	K-TA/TA-30	T-TA/TA-30	E-TA/TA-30	N-TA/TA-30

The above part numbers represent the more popular constructions. However, other designs are available upon request.

PMC CORPORATION
57 Harvey Road
Londonderry, NH
03053

Tel. (603) 432-9473
FAX (603) 432-0435

Color code & initial calibration tolerances for thermocouple wire

THERMOCOUPLE TYPE		COLOR CODE		INITIAL CALIBRATION TOLERANCES		
WIRE ALLOYS	ANSI SYMBOL	+/- INDIVIDUAL	JACKET	TEMPERATURE RANGE	STANDARD LIMITS	SPECIAL LIMITS
*Iron (+) vs. Constantan™ (-)	J	WHITE/RED	BROWN	+ 32°F (0°C) to +545°F (+285°C) +545°F (+285°C) to +1400°F (+750°C)	± 4°F (2.2°C) ± .75%	± 2°F (1.1°C) ± .4%
Chromel™ (+) vs. *Alumel™ (-)	K	YELLOW/RED	BROWN	-330°F (-200°C) to -165°F (-110°C) -165°F (-110°C) to +32°F (0°C) +32°F (0°C) to +545°F (+285°C) +545°F (+285°C) to +2300°F (+1250°C)	± 2% ± 4°F (2.2°C) ± 4°F (2.2°C) ± .75%	± 2°F (1.1°C) ± .4%
Copper (+) vs. Constantan™ (-)	T	BLUE/RED	BROWN	- 330°F (-200°C) to -85°F (-65°C) -85°F (-65°C) to +270°F (+130°C) +270°F (+130°C) to +660°F (+350°C)	± 1.5% ±1.8°F (1°C) ± .75%	± .8% ± .9°F (.5°C) ± .4%
Chromel ™ (+) vs. Constantan ™ (-)	E	PURPLE/RED	BROWN	-330°F (-200°C) to -270°F (-170°C) -270°F (-170°C) to +480°F (+250°C) +480°F (+250°C) to +640°F (+340°C) +640°F (+340°C) to +1600°F (+900°C)	±1% ±3°F (1.7°C) ±3°F (1.7°C) ± .5%	± 1.8 °F (1°C) ± 1.8° F (1°C) ± .4% ± .4%
Nicrosil™ (+) vs. Nisil™ (-)	N	ORANGE/RED	BROWN	+ 32°F (0°C) to +545°F (+285°C) +545°F (+285°C) to +2300°F (+1250°C)	± 4°F (2.2°C) ± .75%	± 2° F(1.1°C) ± .4%

Color code and initial calibration tolerances for extension wire

*Iron vs. Constantan™	JX	WHITE/RED	BLACK	+ 32°F (0°C) to +400°F (+200°C)	± 4°F (2.2°C)	± 2°F (1.1°C)
Chromel™ vs. *Alumel™	KX	YELLOW/RED	YELLOW	+32°F (0°C) to +400°F (+200°C)	± 4°F (2.2°C)	± 2°F (1.1°C)
Copper vs. Constantan™	TX	BLUE/RED	BLUE	-75°F (-60°C) to +210°F (+100°C)	± 2°F (1.1° C)	± 1°F (.5°C)
Chromel™ vs. Constantan™	EX	PURPLE/RED	PURPLE	+32°F (0°C) to +400°F (+200°C)	± 3°F (1.7°C)	± 2°F (1.1°C)
Nicrosil™ vs. Nisil™	NX	ORANGE/RED	ORANGE	+32°F (0°C) to +400°F (+200°C)	± 4°F (2.2°C)	± 2°F (1.1°C)
Copper vs. Copper Alloy	SX RX	BLACK/RED	GREEN	+75°F (+25°C) to +400°F (+200°C)	± 12°F (7°C)	

* Magnetic
™Trade Mark, Hoskins Mfg. Co.

NOTE – Percent limits apply directly to temperatures in °C units, but for °F equivalents are applied to the numbers of °F above or below the ice point (+32°F).
I.e., Limit (°F) = (Temp. °F – 32°F) X Percentage)

Thermocouple wire cannot be expected to meet the limits of error at temperatures below the ice point unless specified at time of purchase.

TA/TA physical properties

INSULATION CHARACTERISTICS	INSULATION	JACKET
SPECIFIC GRAVITY	2.15	2.15
DUROMETER HARDNESS	55	55
TENSILE STRENGTH p.s.i. (min.)	4000 p.s.i.	4000 p.s.i.
ELONGATION %(min.)	300%	300%
MINIMUM BEND RADIUS	5 X O.D.	10 X O.D.
ABRASION RESISTANCE	VERY GOOD	VERY GOOD
CUT THROUGH RESISTANCE	GOOD	GOOD
MOISTURE RESISTANCE	EXCELLENT	EXCELLENT
SOLDER IRON RESISTANCE	VERY GOOD	VERY GOOD
SERVICE TEMPERATURE	500°F(260°C) CONTINUOUS 550°F(288°C) SINGLE EXPOSURE	500°F(260°C) CONTINUOUS 550°F(288°C) SINGLE EXPOSURE
FLAME TEST	NON-FLAMMABLE	NON-FLAMMABLE

GAUGE SIZE	NOMINAL INSULATION WALL (INCHES)	NOMINAL JACKET WALL (INCHES)	NOMINAL DIAMETER (INCHES)	APPROX. SHIP. WEIGHT LBS. PER 1000 FT
20	.008	.010	.068 X .116	12
24	.008	.010	.056 X .092	7
30	.004	.006	.030 X .048	2

PRICING POLICY > Shipments will be invoiced at PMC's prices in effect at time of shipment. Quotations are given with an escalation clause and prices, terms, and conditions are subject to change without prior notice. PMC will, however, make every attempt to hold to current quoted prices. All prices quoted are in United States currency, and shall be subject to correction for errors. Unless otherwise stated in writing to PMC.

REELS, SPOOLS & COILS > All shipments, unless specified otherwise by PMC, are made on non-returnable reels, spools or coils in one continuous length.

HANDLING & RETURNS > All claims for shortage or incorrect material must be made within 10 days after receipt of the goods to which such claim pertains. Goods may only be returned for credit within 1 month of the date of authorization. Goods that are special in any way shall not be returned to PMC. Material returned for any reason, without written authorization will be refused and returned at shipper's expense. A return request must be processed through our Londonderry, N.H. sales office.

TOLERANCES > Due to allowances in manufacturing processes for wire, cable and similar products, PMC reserves the right to ship a variation of ± 10% from the quantity of such goods ordered. Physical tolerances shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating only. These weights can vary substantially due to different types of spools, reels and/or conductors.

PMC CORPORATION
57 HARVEY ROAD, LONDONDERRY, N.H. 03053 • (603) 432-WIRE

SPECIALIZING IN WIRE, CABLES & TEMPERATURE

SOLD TO

OMEGA POINT LABS. INC.
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

SHIP TO

OMEGA POINT LABS. INC.
16015 SHADY FALLS RD.
ELMENDORF, TX 78112

78238

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
7/27/94	OMEG001	60	50	60	18794

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP	CODE
11330			1. MFT 5. METERS 2. CFT 6. FEET 3. POUNDS 7. LOT 4. EACH NET 8. OTHER

SHIP VIA	F.O.B.	TERMS
UPS BLUE	LONDONDERRY, NH	

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QUANTITY SHIPPED
1	20000.00	KK-TA/TA-24 REF. MS11330-97185 SCHED. SHIP 8/5/94	18,705'
2	20000.00	KK-TA/TA-24 REF. MS11330-97188 SCHED. SHIP 8/31/94	
3	1.00	CALIBRATION AT 200, 400, 600, 800 AND 1000°F (7) CAL DATA REQUIRED	

UNIT PRICES ARE BASED ON COPPER AT $ /lb., SILVER AT $ /TROY OZ. HOWEVER UNIT PRICES INVOICED WILL BE BASED ON MATERIAL COST ON DATE OF SHIPMENT.

SPECIAL INSTRUCTIONS:

UPS SDA

DATE SHIPPED	BILL OF LADING NO.	NO. OF PACKAGES	WEIGHT	PPD	COL.	PARTIAL	COMPLETE	PACKED BY
8/16/94	———	4	129#	✓		✓		

PACKING SLIP

PMC

PMC CORPORATION
57 HARVEY ROAD, LONDONDERRY, N.H. 03053 • (603) 432-WIRE
SPECIALIZING IN WIRE, CABLES & TEMPERATURE

SOLD TO

OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

78239

SHIP TO

OMEGA POINT LABS, INC
16015 SHADY FALLS ROAD
ELMENDORF, TX 781..

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
7/27/94	OMEG001	60	60	00	1879A

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP
11230		

SHIP VIA	F.O.B.	TERMS
UPS BLUE	LONDONDERRY, NH	NET 15

CODE	
1. MFT	5. METERS
2. CFT	6. FEET
3. POUNDS	7. LOT
4. EACH NET	8. OTHER

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QUANTITY SHIPPED
2	20000.00	KK-TA-T4-24 REF. MC11230-27195 SCHED. SHIP 8/31/94	5000
?	1.00	CALIBRATION AT 200, 400, 600, 800 AND 1000°F T/C CAL DATA REQUIRED	

UNIT PRICES ARE BASED ON COPPER AT $ /lb., SILVER AT $ /TROY OZ. HOWEVER UNIT PRICES INVOICED WILL BE BAS[ED] ON MATERIAL COST ON DATE OF SHIPMENT.

SPECIAL INSTRUCTIONS: UPS blue

DATE SHIPPED	BILL OF LADING NO.	NO. OF PACKAGES	WEIGHT	PPD	COL.	PARTIAL	COMPLETE	PACKED BY
8-21-94		1	34	✓		✓		[illegible]

PACKING SLIP

340

PMC CORPORATION
57 HARVEY ROAD, LONDONDERRY, N.H. 03053 • (603) 432-WIRE
SPECIALIZING IN WIRE, CABLES & TEMPERATURE

SOLD TO

OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

78238

SHIP TO

OMEGA POINT LABS, Inc
16015 SHADY FALLS RD.
ELMENDORF, TX 781

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
7/27/94	OMEG001	50	50	50	13794

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP	CODE
11230			1. MFT 5 METERS 2. CFT 6 FEET 3. POUNDS 7. LOT 4. EACH NET 8. OTHER

SHIP VIA	F.O.B.	TERMS
UPS BLUE	LONDONDERRY, NH	NET 15

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QUANTITY SHIPPED
1	15000.00	KK-TA/TA-24 REF. MS1130-97195	13856
2	1.00	CALIBRATION AT 200, 400, 600, 800 AND 1000°F I/C CAL DATA REQUIRED	1

UNIT PRICES ARE BASED ON COPPER AT $ /lb., SILVER AT $ /TROY OZ. HOWEVER UNIT PRICES INVOICED WILL BE BASED ON MATERIAL COST ON DATE OF SHIPMENT.

SPECIAL INSTRUCTIONS:

UPS Blue

DATE SHIPPED	BILL OF LADING NO.	NO. OF PACKAGES	WEIGHT	PPD	COL.	PARTIAL	COMPLETE	PACKED BY
7/29/94	—	2	93	✓			✓	

PACKING SLIP

PMC

CERTIFICATE OF CONFORMANCE

TO OMEGA POINT LABS INC.
16015 SHADY FALLS RD.
ELMENDORF, TX 78112

DATE 8/15/94
CUSTOMER PO# 11230
JOB # 18794

PMC P/N	QUANTITY	CUSTOMER P/N	SPEC
KK-TA/TA-24	18,705'		MS11230-97185

THE FOLLOWING WIRE SPOOLS HAVE BEEN MANUFACTURED FROM BARE WIRE SPOOL #105966, REEL NOS. 20752, 20753; SPOOL NOS. 105967, 105968, 105969, 105970, 105971 AND 105972, REEL NOS. 18242, 17623.

ADDITIONAL INFORMATION (IF REQUIRED):

SPOOL NO.	IN ERROR 200°F	IN ERROR 400°F	IN ERROR 600°F	IN ERROR 800°F	IN ERROR 1000°F
105966 - INSIDE	-0.5	+0.4	-1.9	-2.2	-0.8
105966 - OUTSIDE	+0.1	+1.1	-1.0	-1.1	+0.4
105967 - INSIDE	-0.2	0	-2.2	-2.0	+0.4
105968					
105969					
105970					
105971					
105972 - OUTSIDE	+0.1	+0.7	-1.2	-0.9	+1.4

ALL SPOOLS ARE TAKEN FROM LARGE MASTER SPOOLS IN ROTATION. CALIBRATION SHOWS BEGINNING OF FIRST SPOOL AND END OF LAST SPOOL.
CALIBRATION RESULTS ARE TRACEABLE TO NIST AND MEET SPECIAL LIMITS OF ERROR AS DEFINED IN ASTM-E-230 AND COMPLY TO MIL STD. 45662.

This is to certify the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review.

Quality Assurance Inspector

Quality Assurance Manager

57 HARVEY ROAD
LONDONDERRY, NH
03053
(603) 432-WIRE
FAX (603) 432-0435

PMC

CERTIFICATE OF CONFORMANCE

TO OMEGA POINT LABS INC. DATE 8/31/94

16015 SHADY FALLS ROAD CUSTOMER PO# 11230

ELMENDORF, TX 78112 JOB # 18794-2

PMC P/N	QUANTITY	CUSTOMER P/N	SPEC
KK-TA/TA-24	5000'		MS-1123Q-97185

THE FOLLOWING WIRE SPOOL HAS BEEN MANUFACTURED FROM BARE WIRE REEL NOS. (POS.) 18554 AND (NEG.) 18555

ADDITIONAL INFORMATION (IF REQUIRED):

SPOOL NO.	IN ERROR 200°	IN ERROR 400°	IN ERROR 600°	IN ERROR 800°	IN ERROR 1000°
106460 - INSIDE	+1.0	-0.1	-2.1	-2.2	+0.2
106460 - OUTSIDE	+1.0	-0.2	-2.0	-2.0	+0.3

CALIBRATION SHOWS THE BEGINNING AND END ON SPOOL 106460.

CALIBRATION RESULTS ARE TRACEABLE TO NIST AND MEET SPECIAL LIMITS OF ERROR AS DEFINED IN ASTM-E-230 AND COMPLY TO MIL STD 45662.

This is to certify the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review.

John Robinson
Quality Assurance Inspector

Thomas M. Coffey
Quality Assurance Manager

57 HARVEY ROAD
LONDONDERRY, NH
03053
(603) 432-WIRE
FAX (603) 432-0435

PMC

CERTIFICATE OF CONFORMANCE

TO OMEGA POINT LABS
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

DATE 9/15/94
CUSTOMER PO# 11230
JOB # 18794-2

PMC P/N	QUANTITY	CUSTOMER P/N	SPEC
KK-TA/TA-24	13,856'		MS11230-97185

THE FOLLOWING WIRE SPOOLS 106837, 106838 AND 106839 HAVE BEEN MANUFACTURED FROM BARE WIRE REELS 18554 (POSITIVE) AND 18555 (NEGATIVE).

ADDITIONAL INFORMATION (IF REQUIRED):

SPOOL NOS.	IN ERROR 200°F	IN ERROR 400°F	IN ERROR 600°F	IN ERROR 800°F	IN ERROR 1000°F
106837	+0.3	-0.5	-2.4	-2.3	-0.1
106838					
106839	+0.1	-0.4	-2.3	-1.9	-0.4

ALL SPOOLS ARE TAKEN FROM LARGE MASTER SPOOLS IN ROTATION. CALIBRATION SHOWS THE BEGINNING OF FIRST SPOOL AND END OF LAST SPOOL. CALIBRATION RESULTS ARE TRACEABLE TO NIST AND MEET SPECIAL LIMITS OF ERROR AS DEFINED IN ASTM-E-230 AND COMPLY TO MIL STD-45662.

This is to certify the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review.

John Robinson
Quality Assurance Inspector

Quality Assurance Manager

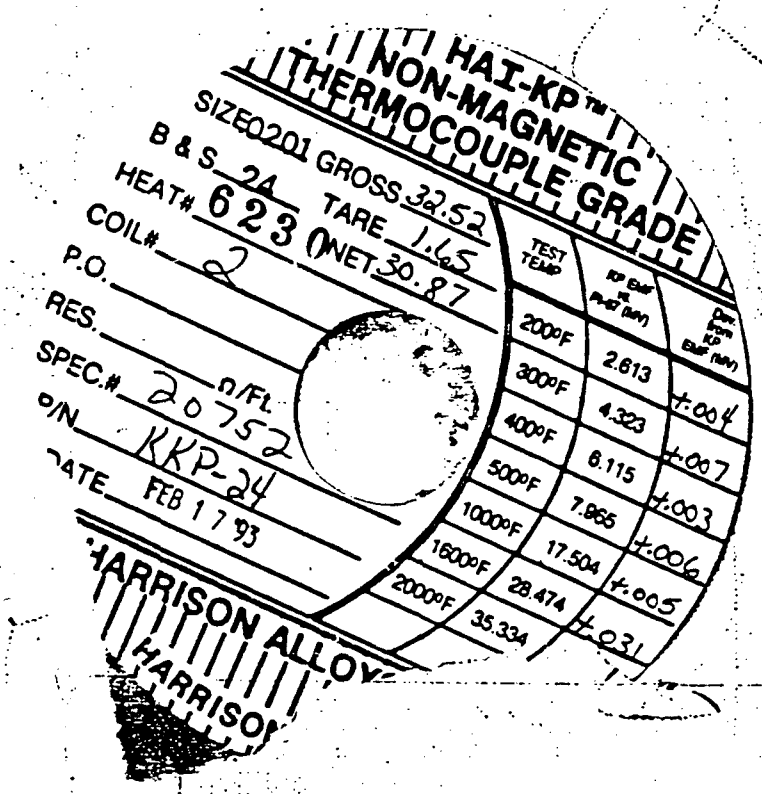
57 HARVEY ROAD
LONDONDERRY, NH
03053
(603) 432-WIRE
FAX (603) 432-0435

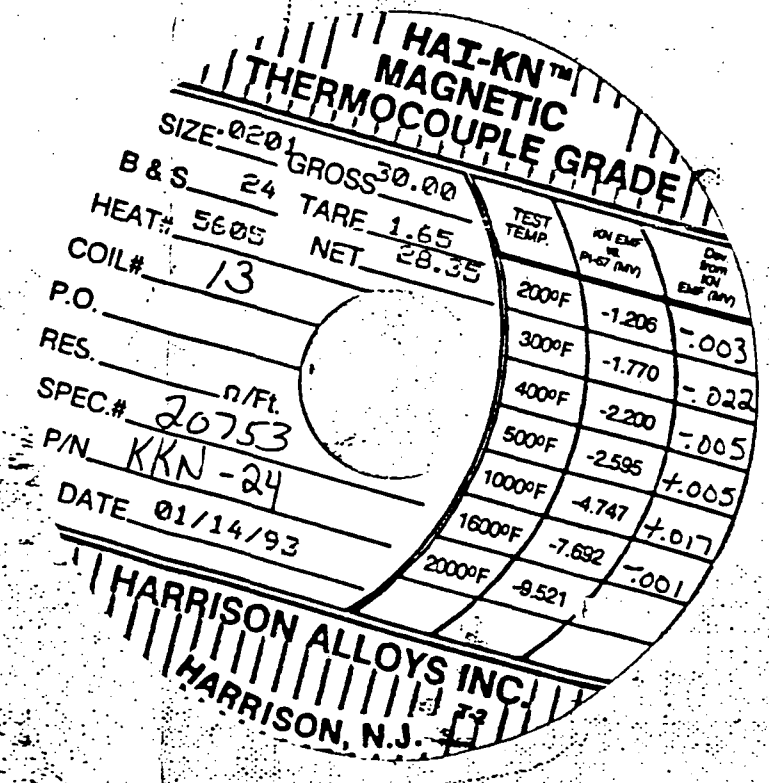
Good KK material to Special Limitson

Run # 6518

1-13-94

Wire used for Spool 105-946.





Bare Wire Reel # 18242 used on Spool #s 351

105-967, 105-968, 105-969, 105-970, 105-971 & 105-972

HAI-KP™
NON-MAGNETIC
THERMOCOUPLE GRADE

SIZE 020 GROSS 32.46
B & S 24 TARE 1.65
HEAT# 7737 NET 30.81
COIL#
P.O. 11338
RES. Ω/Ft
SPEC.# 18242
P/N KKP-24
DATE 06/17/94

TEST TEMP	KP EMF in mV	Dev. from EMF (mV)
200°F	2.613	+.015
300°F	4.323	+.025
400°F	6.115	+.027
500°F	7.965	+.032
1000°F	17.504	+.070
1600°F	28.474	+.091
2000°F	35.334	

2.678

HARRISON ALLOYS INC.
HARRISON, N.J.

352

Bare Wire Reel # 17623 Used
on Spool #'s 105967, 105968, 105969
105970, 105971 & 105-972

HAI-KN™
MAGNETIC
THERMOCOUPLE GRADE

SIZE 0201 GROSS 33.31
B & S 24 TARE 1.65
NET 31.66
HEAT# 5605
COIL# 14
P.O.
RES. Ω/Ft.
SPEC.# 17623
P/N KKN-24
DATE 01/14/93

TEST TEMP.	KN EMF vs. Pt-40 (MV)	Dev. from KN EMF (MV)
200°F	-1.206	-.003
300°F	-1.770	-.015
400°F	-2.200	+.002
500°F	-2.595	+.014
1000°F	-4.747	+.018
1600°F	-7.692	-.008
2000°F	-9.521	

HARRISON ALLOYS INC.
HARRISON, N.J.

These Two Rolls were used in The Manufacture of Spool # 106460

T.C

HAI-KP™
NON-MAGNETIC
THERMOCOUPLE GRADE

SIZE .020 GROSS 32.64
B & S 24 TARE 1.65
HEAT# 6748 NET 30.99
COIL# 6
P.O. P11338REPL
RES. _____ Ω/Ft.
SPEC.# 18554
P/N KKP-24
DATE 07/27/94

TEST TEMP	KP EMF vs Pt-67 (MV)	Dev. from KP EMF (MV)
200°F	2.613	-.001
300°F	4.323	-.003
400°F	6.115	-.005
500°F	7.965	-.013
1000°F	17.504	-.026
1600°F	28.474	-.002
2000°F	35.334	-.125

HARRISON ALLOYS INC.
HARRISON, N.J.

HAI-KN™
MAGNETIC
THERMOCOUPLE GRADE

SIZE .020 GROSS 31.64
B & S 24 TARE 1.65
HEAT# 2975 NET 29.99
COIL# 2
P.O. P11338 REPL
RES. _____ Ω/Ft.
SPEC.# 18555
P/N KKN-24
DATE 05/15/94

TEST TEMP.	KN EMF vs Pt-67 (MV)	Dev. from KN EMF (MV)
200°F	-1.206	-.003
300°F	-1.770	-.013
400°F	-2.200	-.062
500°F	-2.595	+.002
1000°F	-4.747	-.036
1600°F	-7.692	-.101
2000°F	-9.521	-.180

HARRISON ALLOYS INC.
HARRISON, N.J.

HAI-KP™
NON-MAGNETIC
THERMOCOUPLE GRADE

SIZE .020 GROSS 32.64
B & S 24 TARE 1.65
HEAT# 6748 NET 30.99
COIL# 6
P.O. P11338REPL
RES. _____ Ω/Ft.
SPEC.# 18554
P/N KKP-24
DATE 07/27/94

TEST TEMP	KP EMF vs. Pt-67 (MV)	Dev. from KP EMF (MV)
200°F	2.613	-.001
300°F	4.323	-.003
400°F	6.115	-.005
500°F	7.965	-.013
1000°F	17.504	-.026
1600°F	28.474	-.002
2000°F	35.334	-.125

HARRISON ALLOYS INC.
HARRISON, N.J.
T-1

HAI-KN™
MAGNETIC
THERMOCOUPLE GRADE

SIZE .020 GROSS 31.64
B & S 24 TARE 1.65
HEAT# 2975 NET 29.99
COIL# 2
P.O. P11338 RFPL
RES. _____ Ω/Ft.
SPEC.# 18555
P/N KKN-24
DATE 05/15/94

TEST TEMP.	KN EMF vs. Pt-67 (MV)	Dev. from KN EMF (MV)
200°F	-1.206	-.003
300°F	-1.770	-.013
400°F	-2.200	-.062
500°F	-2.595	+.002
1000°F	-4.747	-.036
1600°F	-7.692	-.101
2000°F	-9.521	-.180

HARRISON ALLOYS INC.
HARRISON, N.J.
T-3

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97257-97260
RECEIVED FROM PMC
PROJECT LOCATION Omega Point Labs

REPORT NUMBER M35 - 11960
DATE RECEIVED 9-7-94
DATE INSPECTED 9-8-94
INSPECTED BY: D Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Te Wire	1139Q	12K	12K	0	KK-TA/TA-24	Y	Y	Good	None	X			Spool #'s 106461 - inside, 106462 and 106463 - outside.

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Janice Welch
PMC Corporation
57 Harvey Road

Londonderry NH 03053

PO Number: 1139-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Cleda Patton Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/5/94	UPS Ground	MS-1139Q-11960	8/26/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	KK-TA/TA-24	12,000		
2.	Calibration Data	1		

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-5-94

Special Instructions

Include Certificates of Conformance to ASTM E230-93 Special Limits of Error and Calibration data required to 200°F, 400°F, 600°F, 800°F and 1000°F traceable to NIST

Ordered By: Cleda Patton

Project #: 11960

Total	
Shipping	
Tax	
Invoice Total	

357

PMC

PMC CORPORATION
57 HARVEY ROAD, LONDONDERRY, N.H. 03053 • (603) 432-WIRE
SPECIALIZING IN WIRE, CABLES & TEMPERATURE

SOLD TO	SHIP TO
OMEGA POINT LABS. INC. 16015 SHADY FALLS ROAD ELMENDORF, TX 78112 78238	OMEGA POINT LABS. I[illegible] 16015 SHADY FALLS [illegible] ELMENDORF, TX 78[illegible]

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
8/11/94	OME3001	60	30	20	[illegible]

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP
11390	8/31/94	8/31/94

SHIP VIA	F.O.B.	TERMS
UPS	LONDONDERRY NH	NET [illegible]

CODE

1. MFT
2. CFT
3. POUNDS
4. EACH NET
5. METERS
6. FEET
7. LOT
8. OTHER

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QUANTITY SHIPPED
1	12000.00	KK-TR/TA-24 REF. MS11390-11960	12285
2	1.00	CALIBRATION AT 200, 400, 600, 800 AND 1000°F T.C CAL DATA REQUIRED	1

UNIT PRICES ARE BASED ON COPPER AT $ lb., SILVER AT $ /TROY OZ. HOWEVER UNIT PRICES INVOICED WILL BE BASED ON MATERIAL COST ON DATE OF SHIPMENT.

SPECIAL INSTRUCTIONS:

DATE SHIPPED	BILL OF LADING NO.	NO. OF PACKAGES	WEIGHT	PPD	COL.	PARTIAL	COMPLETE	PACKED BY
8-31-94	—	2	83	✓			✓	[illegible]

PACKING SLIP

PMC

CERTIFICATE OF CONFORMANCE

TO OMEGA POINT LABORATORIES INC. DATE 8/31/94

16015 SHADY FALLS ROAD CUSTOMER PO# 1139-Q

ELMENDORF, TX 78112-9784 JOB # 18959

PMC P/N	QUANTITY	CUSTOMER P/N	SPEC
KK-TA/TA-24	12,285'		MS-11390-11960

ALL OF THE FOLLOWING WIRE SPOOLS HAVE BEEN MANUFACTURED FROM BARE WIRE REEL NOS. (POS.) 18578 AND (NEG.) 18579

ADDITIONAL INFORMATION (IF REQUIRED):

SPOOL NOS.	IN ERROR 200°	IN ERROR 400°	IN ERROR 600°	IN ERROR 800°	IN ERROR 1000°
106461 - INSIDE	+0.5	-0.2	-2.4	-2.6	-0.3
106462					
106463 - OUTSIDE	+0.6	-0.1	-2.1	-2.3	-0.1

ALL SPOOLS ARE TAKEN FROM LARGE MASTER SPOOLS IN ROTATION. CALIBRATION SHOWS BEGINNING OF FIRST SPOOL AND END OF LAST SPOOL.
CALIBRATION RESULTS ARE TRACEABLE TO NIST AND MEET SPECIAL LIMITS OF ERROR AS DEFINED IN ASTM-E-230 AND COMPLIES TO MIL STD 45662.

This is to certify the materials furnished on this shipment are in conformance with the requirements, specifications, and drawings of the above referenced customer purchase order. Inspection and test records are on file and available for customer review.

John Robinson
Quality Assurance Inspector

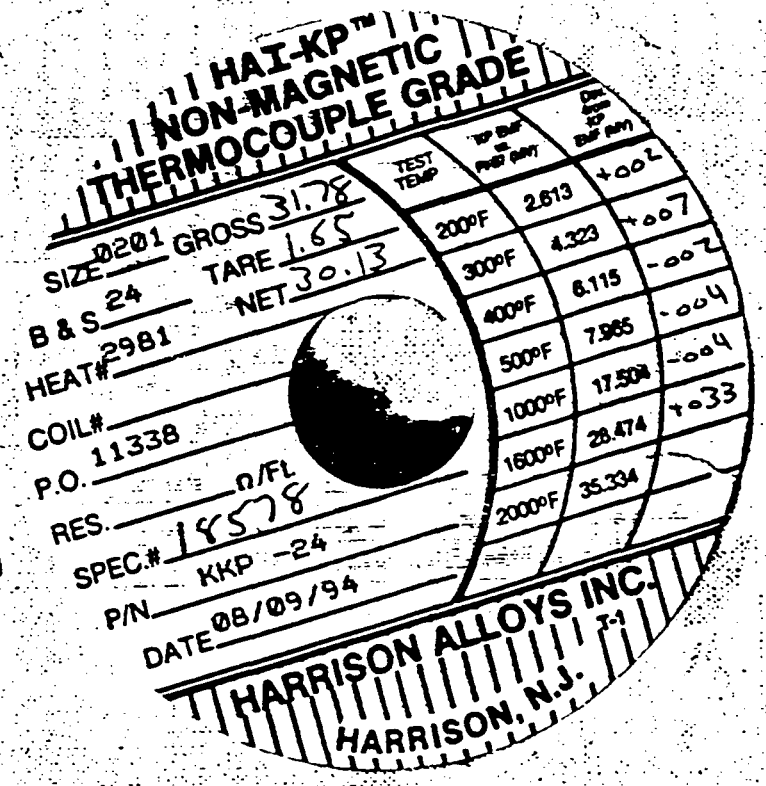
Thomas M. Coffey
Quality Assurance Manager

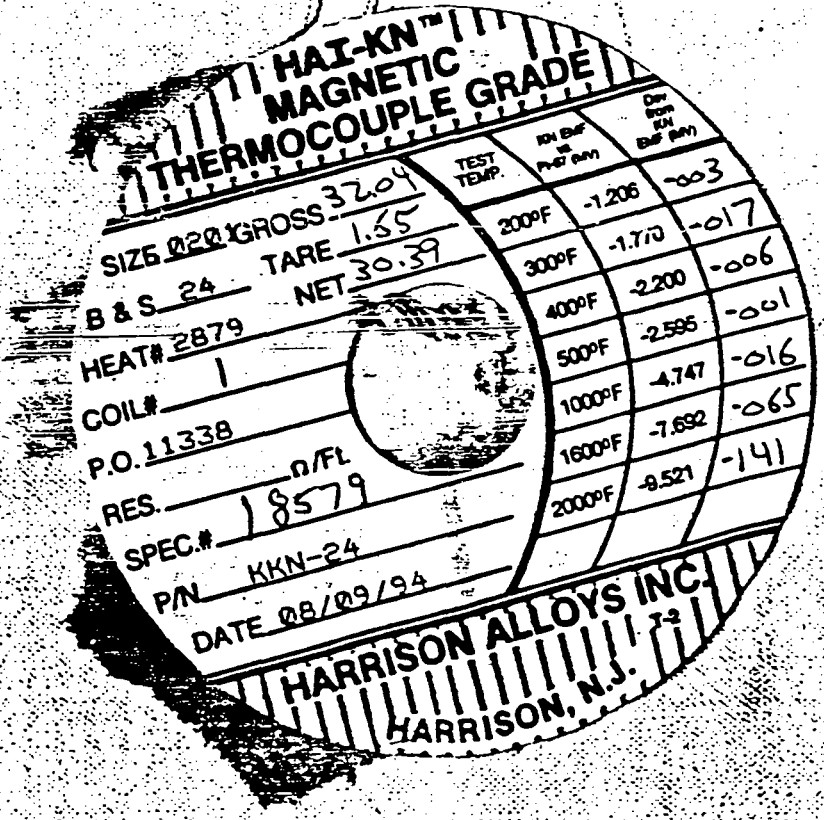
57 HARVEY ROAD
LONDONDERRY, NH
03053
(603) 432-WIRE
FAX (603) 432-0435

These Two Rolls were used To Manufacture Job No. 18959

T.C.

good KK.
Special Limits.
8-16-94





360

OMEGA POINT LABORATORIES
COMMERCIAL GRADE DEDICATION

PURCHASING SPEC. NO: MS- 11392-11960

PRODUCT: Thermocouple Wire

MANUFACTURER: PMC Corporation
57 Harvey Road
Londonderry, NH 03053

SUPPLIER: (same)
ADDRESS:
CITY:
STATE/ZIP:
PHONE: (603) 432-9473

****

TECHNICAL EVALUATION

DESCRIPTION: Teflon Coated Thermocouple Wire

DOES IT PERFORM SAFETY FUNCTION? YES:
Material testing and equipment calibration

DOES ITEM MEET CRITERIA OF CGI DEFINITION? Yes

Item meets all three criteria of CGI listed below:

a) not subject to design or specification requirements that are unique to nuclear facilities; and

b) used in applications other than nuclear facilities; and

c) is ordered from manufacturer or supplier on the basis of specifications set forth in the manufacturers published product description.

TECHNICAL EVALUATION PERFORMED BY:

Project Manager
Date 8/5/94

VERIFIED BY:

C Humphrey
Q/A Manager
Date 8/5/94

PRODUCT: Teflon Coated Thermocouple Wire

SPEC NO: KK-TA/TA-24
MS-1139Q-11960

IDENTIFICATION OF CRITICAL CHARACTERISTICS:

TEST	DESCRIPTION	SPECIFICATION RANGES MINIMUM	MAXIMUM
ASTM E230-93	Std. Temperature-EMF Tables for Standardized Thermocouples	Temp. Range +32°F to +545°F Special Limits of Error ±2°F	

IDENTIFICATION OF CRITICAL CHARACTERISTICS PERFORMED BY:

PROJECT MANAGER
DATE 8/5/94

VERIFIED BY:

C Humphrey
Q/A MANAGER
DATE 8/5/94

PRODUCT: KK-TA/TA-24 Thermocouple Wire

SPEC NO: MS- 11390-11960

ACCEPTANCE METHOD:

METHOD

Source Verification

Performance Record

Purchase order to vendor includes the Omega Point Material Specification listing critical characteristics of CGI material.

All shipments to include appropriate Certification documents listing all critical characteristics.

Material receiving shall include verification of Compliance Report with prescribed critical characteristics. Copies of Compliance Report and verification to be attached to the receiving report.

ACCEPTANCE METHOD DETERMINATION BY:

C Humphreys

DATE: 8/5/94

OMEGA POINT LABORATORIES
MATERIAL PURCHASING SPECIFICATIONS

SPECIFICATION NUMBER: MS-11390-11960

VENDOR: PMC

VENDOR PRODUCT NUMBER: KK-TA/TA-24

PRODUCT DESCRIPTION: Teflon Coated Thermocouple Wire

Material as defined above shall be provided in accordance with the Critical Characteristics as listed below:

TEST	DESCRIPTION	SPECIFICATION RANGES MINIMUM	MAXIMUM
ASTM E230-93	Std. Temperature-EMF Tables for Standardized Thermocouples	Temp. Range +32°F to +545°F Special Limits of Error ±2°F	

QUALITY ASSURANCE REQUIREMENTS

1.0 QUALITY PROGRAM

Seller shall furnish this item in accordance with Quality Program approved by Omega Point Laboratories. Material specified herein is to be produced and tested in accordance with vendor quality standards, methods, guidelines and manufacturing instructions as defined in that Quality Program.

2.0 QUALITY VERIFICATION

Receiving Inspection - Buyer shall inspect items upon receipt to verify compliance with purchase order requirements. Rejected items shall be returned at seller's expense.

Document Review - Final acceptance shall be based on satisfactory review of required certifications and/or supporting documents.

3.0 CERTIFICATIONS

3.1 Certification that supplied materials comply with this material specification and listing Critical Characteristics shall be provided. This certificates shall reference Omega Point Labs purchase order number and specification number for all material furnished under this specification. This Certification shall be signed by the appropriate vendor representative.

3.2 The material furnished under this specification shall be a product that complies with the following:

3.2.1 Has been tested and passed all tests specified herein.

3.2.2 Manufacturing methods for this material have not changed. Vendor will advise Omega Point in writing of any changes in the manufacturing prior to material manufacture.

3.2.3 Raw materials used in the manufacture of this material meet Vendor specifications.

4.0 AUDITS/RIGHTS OF ACCESS

Omega Point Labs reserves the right to audit your facility to verify compliance with the purchase order and specification requirements with a minimum ten (10) day notice.

5.0 IDENTIFICATION

Seller shall identify each item with a unique traceability number by physical marking or tagging. These identification numbers shall be traceable to certifications and packing lists.

6.0 PACKING/SHIPPING

All materials shall be packaged in air tight, moisture free containers and shall be free of foreign substances such as dirt, oil, grease or other deleterious materials.

All materials shall be suitably crated, boxed or otherwise prepared for shipment to prevent damage during handling and shipping.

QUALITY ASSURANCE APPROVAL

C Humphrey

Title Quality Assurance Mgr.

Date 8/5/94

CH

AVL Verification

Class: B

OMEGA POINT LABORATORIES

PFA Insulated Thermocouple Wire

PRODUCT CODE: TA/TA

Our customers have grown to expect only the highest quality products from PMC. We are continuously committed to meet the specific needs of industry and our customers. This construction includes Teflon* PFA insulataion extruded on the single conductors which are then laid parallel and jacketed with Teflon PFA.

Teflon PFA (perfluoroalkoxy) was released in 1972 by Dupont. It possesses similar properties of the other Teflon products such as outstanding electrical characteristics, resistance to virtually all chemicals and excellent flame resistance.

PFA is a true thermoplastic material extrudable by conventional means, and available in long continuous lengths. This construction provides flexibility and toughness with stress crack resistance, resistance to weather, non-aging characterisics, and low coefficient of friction for ease of pulling through conduit.

Like TFE, suggested upper continuous temperature is 500°F (260°C), however, it does not have TFE's solder iron resistance.

The thermocouple grade products shown are used to form temperature sensors and the extension grade products become the interconnecting link in the temperature sensing system.

You will find our qualified sales and engineering staff eager to assist in selecting a design to meet the requirements of your specific application. Variations of this construction are available upon request, including aluminum Mylar* to reduce noise problems found in so many of today's plants.

Typical applications include aircraft and automotive engine testing, rapid transit cables, and down hole cable in the oil industry.

*Registered trademark of E.I. DuPont Inc.

Calibrated conductors for high system accuracy

500°F (260°C) PFA insulation for improved electrical properties and high temperature applications

500°F (260°C) PFA jacket for chemical inertness to solvents, acids and oils

GRADE OF WIRE	GAUGE SIZE	WIRE TYPE	PART NUMBERS				
			TYPE J	TYPE K	TYPE T	TYPE E	TYPE N
THERMOCOUPLE	20	SOLID	J-TA/TA-20	K-TA/TA-20	T-TA/TA-20	E-TA/TA-20	N-TA/TA-20
THERMOCOUPLE	24	SOLID	J-TA/TA-24	K-TA/TA-24	T-TA/TA-24	E-TA/TA-24	N-TA/TA-24
THERMOCOUPLE	30	SOLID	J-TA/TA-30	K-TA/TA-30	T-TA/TA-30	E-TA/TA-30	N-TA/TA-30

The above part numbers represent the more popular constructions. However, other designs are available upon request.

PMC CORPORATION
57 Harvey Road
Londonderry, NH
03053

Tel. (603) 432-9473
FAX (603) 432-0435

Color code & initial calibration tolerances for thermocouple wire

THERMOCOUPLE TYPE		COLOR CODE		INITIAL CALIBRATION TOLERANCES		
WIRE ALLOYS	ANSI SYMBOL	+/- INDIVIDUAL	JACKET	TEMPERATURE RANGE	STANDARD LIMITS	SPECIAL LIMITS
*Iron (+) vs. Constantan™ (-)	J	WHITE/RED	BROWN	+ 32°F (0°C) to +545°F (+285°C) +545°F (+285°C) to +1400°F (+750°C)	± 4°F (2.2°C) ± .75%	± 2°F (1.1°C) ± .4%
Chromel™ (+) vs. *Alumel™ (-)	K	YELLOW/RED	BROWN	-330°F (-200°C) to -165°F (-110°C) -165°F (-110°C) to +32°F (0°C) +32°F (0°C) to +545°F (+285°C) +545°F (+285°C) to +2300°F (+1250°C)	± 2% ± 4°F (2.2°C) ± 4°F (2.2°C) ± .75%	 ± 2°F (1.1°C) ± .4%
Copper (+) vs. Constantan™ (-)	T	BLUE/RED	BROWN	- 330°F (-200°C) to -85°F (-65°C) -85°F (-65°C) to +270°F (+130°C) +270°F (+130°C) to +660°F (+350°C)	± 1.5% ±1.8°F (1°C) ± .75%	± .8% ± .9°F (.5°C) ± .4%
Chromel ™ (+) vs. Constantan ™ (-)	E	PURPLE/RED	BROWN	-330°F (-200°C) to -270°F (-170°C) -270°F (-170°C) to +480°F (+250°C) +480°F (+250°C) to +640°F (+340°C) +640°F (+340°C) to +1600°F (+900°C)	±1% ±3°F (1.7°C) ±3°F (1.7°C) ± .5%	± 1.8 °F (1°C) ± 1.8° F (1°C) ± .4% ± .4%
Nicrosil™ (+) vs. Nisil™ (-)	N	ORANGE/RED	BROWN	+ 32°F (0°C) to +545°F (+285°C) +545°F (+285°C) to +2300°F (+1250°C)	± 4°F (2.2°C) ± .75%	± 2° F(1.1°C) ± .4%

Color code and initial calibration tolerances for extension wire

*Iron vs. Constantan™	JX	WHITE/RED	BLACK	+ 32°F (0°C) to +400°F (+200°C)	± 4°F (2.2°C)	± 2°F (1.1°C)
Chromel™ vs. *Alumel™	KX	YELLOW/RED	YELLOW	+32°F (0°C) to +400°F (+200°C)	± 4°F (2.2°C)	± 2°F (1.1°C)
Copper vs. Constantan™	TX	BLUE/RED	BLUE	-75°F (-60°C) to +210°F (+100°C)	± 2°F (1.1° C)	± 1°F (.5°C)
Chromel™ vs. Constantan™	EX	PURPLE/RED	PURPLE	+32°F (0°C) to +400°F (+200°C)	± 3°F (1.7°C)	± 2°F (1.1°C)
Nicrosil™ vs. Nisil™	NX	ORANGE/RED	ORANGE	+32°F (0°C) to +400°F (+200°C)	± 4°F (2.2°C)	± 2°F (1.1°C)
Copper vs. Copper Alloy	SX RX	BLACK/RED	GREEN	+75°F (+25°C) to +400°F (+200°C)	± 12°F (7°C)	

* Magnetic
™Trade Mark, Hoskins Mfg. Co.

NOTE – Percent limits apply directly to temperatures in °C units, but for °F equivalents are applied to the numbers of °F above or below the ice point (+32°F). (i.e., Limit (°F) = (Temp. °F – 32°F) X Percentage)

Thermocouple wire cannot be expected to meet the limits of error at temperatures below the ice point unless specified at time of purchase.

TA/TA physical properties

INSULATION CHARACTERISTICS	INSULATION	JACKET
SPECIFIC GRAVITY	2.15	2.15
DUROMETER HARDNESS	55	55
TENSILE STRENGTH p.s.i. (min.)	4000 p.s.i.	4000 p.s.i.
ELONGATION %(min.)	300%	300%
MINIMUM BEND RADIUS	5 X O.D.	10 X O.D.
ABRASION RESISTANCE	VERY GOOD	VERY GOOD
CUT THROUGH RESISTANCE	GOOD	GOOD
MOISTURE RESISTANCE	EXCELLENT	EXCELLENT
SOLDER IRON RESISTANCE	VERY GOOD	VERY GOOD
SERVICE TEMPERATURE	500°F(260°C) CONTINUOUS 550°F(288°C) SINGLE EXPOSURE	500°F(260°C) CONTINUOUS 550°F(288°C) SINGLE EXPOSURE
FLAME TEST	NON-FLAMMABLE	NON-FLAMMABLE

GAUGE SIZE	NOMINAL INSULATION WALL(INCHES)	NOMINAL JACKET WALL(INCHES)	NOMINAL DIAMETER (INCHES)	APPROX. SHIP. WEIGHT LBS. PER 1000 FT
20	.008	.010	.068 X .116	12
24	.008	.010	.056 X .092	7
30	.004	.006	.030 X .048	2

PRICING POLICY > Shipments will be invoiced at PMC's prices in effect at time of shipment. Quotations are given with an escalation clause and prices, terms, and conditions are subject to change without prior notice. PMC will, however, make every attempt to hold to current quoted prices. All prices quoted are in United States currency, and shall be subject to correction for errors. Unless otherwise stated in writing to PMC.

REELS, SPOOLS & COILS > All shipments, unless specified otherwise by PMC, are made on non-returnable reels, spools or coils in one continuous length.

HOW TO MAKE CLAIMS & RETURNS > All claims for shortage or incorrect material must be made within 10 days after receipt of the goods to which such claim pertains. Goods may only be returned for credit within 1 month of the date of authorization. Goods that are special in any way shall not be returned to PMC. Material returned for any reason, without written authorization will be refused and returned at shipper's expense. A return request must be processed through our Londonderry, N.H. sales office.

TOLERANCES > Due to allowances in manufacturing processes for wire, cable and similar products, PMC reserves the right to ship a variation of ± 10% from the quantity of such goods ordered. Physical tolerances shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating only. These weights can vary substantially due to different types of spools, reels and/or conductors.

Omega Point Laboratories, Inc.

16015 Shady Falls Rd..
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Calibration

Certification No.:	92021
Calibration Date:	5-23-94
Recalibration Date:	11-23-94
Manufacturer:	Omega Point Laboratories, Inc.
Model No.:	200 Channel DAU
Serial No.:	1042
Equipment Description:	200 Channel Data Acquisition System with Fluke Computer Front End and Extender Chassis
Calibration Sources:	Digicator Digital Calibrator, Model #CL-466, Serial #703297

PERFORMANCE:

Better than -0.49 / +0.84 on all 200 channels

Cailibration Performed/Approved by:

Herbert W. Stansberry II,
Fire Test Technologist

OMEGA POINT LABORATORIES

Omega Point Laboratories, Inc.

16015 Shady Falls Rd..
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Calibration

Certification No.:	92022
Calibration Date:	5-28-94
Recalibration Date:	11-28-94
Manufacturer:	Omega Point Laboratories, Inc.
Model No.:	100 Channel DAU
Serial No.:	1041
Equipment Description:	100 Channel Data Acquisition System with Fluke Computer Front End
Calibration Sources:	Digicator Digital Calibrator, Model #CL-466, Serial #703297

PERFORMANCE:

Better than -0.62 / +1.49 on all 100 channels

Cailibration Performed/Approved by:

Herbert W. Stansberry II,
Fire Test Technologist

OMEGA POINT LABORATORIES

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Omega Point Labs
CLIENT/PROJECT NUMBER OPL Equipment
RECEIVED FROM Rothe
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1411 - OPL
DATE RECEIVED 8-1-94
DATE INSPECTED 8-1-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Digital Temp. Calibr	1131-0	1	1	0	serial NO 703297	Y	Y	Good	None	X			Calibration Service - arrived in specs at Rothe.

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Rothe Development
4614 Sinclair Road

San Antonio TX 78222

PO Number: 1131-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Cleda Patton Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
7/19/94	Their Truck		8-2-94	30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Digital Calibrator SN# 703297 - Calibration Service	1	$60.00	$60.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 7-19-94

Special Instructions

Please include Certificate of Calibration and Calibration Data Sheets

Ordered By: Cleda Patton

Project #: OPL Equipment

Total	$60.00
Shipping	
Tax	
Invoice Total	$60.00

EQUIPMENT DELIVERY RECEIPT

Rothe Development, Inc.
Metrology Services Division
[redacted] Sinclair Rd.
San Antonio, TX 78222-2099
(210)648-3131

Date: 08/01/94
Control: 556

Company: Omega Point Laboratories
Contact: Ms. Connie Humphrey
Address: 16015 Shady Falls Road
City: Elmendorf, TX 78112-9784
Phone: 635-8100

Item	W.O. #	Customer P.O.	Mfgr.	Model	Serial No.	Description
1	44184	1131-Q	Omega	CL-466-L-1	703297	Digital Temp Calibrator

Received by:

Date:

Rothe Development, Inc.

4614 SINCLAIR RD. SAN ANTONIO, TEXAS 78222-2099

210-648-3131 FAX: 210-648-4091

METROLOGY SERVICES DIVISION
PRECISION MEASUREMENT EQUIPMENT LABORATORY
TRACEABLE TO NIST

372

CHARGE # 107 CONTROL # 556 - 8477

WORK ORDER # 44184

RECEIVED FROM	Omega Point Laboratories	DATE	07/20/94
ADDRESS	16015 Shady Falls Road Elmendorf, TX 78112-9784	PHONE#	635-8100
CONTACT (NAME)	Ms. Connie Humphrey	FAX#	
PURCHASE ORDER #	1131-Q		
CUSTOMER COMMENTS	TAXABLE 8.25%		

ITEM

MFG	Omega
MODEL	CL-466-L-1
SERIAL #	703297
TYPE	Digital Temp Calibrator
ACCES. RCVD.	Power cord Probe Handle

- [ ] REPAIR
- [ ] OPERATIONAL CHECK
- [x] CALIBRATION

CALIBRATION DATE 29 July 94

DATE DUE 29 Jan 95

CALIBRATION INTERVAL 6 mo.

- [x] RECEIVED IN SPECS.
- [ ] RECEIVED INOPERATIVE
- [ ] RECEIVED OUT OF SPECS.

CKT REF #	QTY.	MFG PART #	DESCRIPTION	COST

ROTHE TECH.	OUR P.O. #
WW	
REPAIR LABOR HRS.	SERVICE CODE
	J

PARTS TOTAL		
REPAIR LABOR		
SHIPPING		
TEAR DOWN CHARGE		
CALIBRATION	160.00	
TAX	12	40
TOTAL	172	40

TR #'s 20,30,208,150

COMMENTS CAL DATA PROVIDED

WORK PERFORMED:

Cal'd

TEM. 74 °F

R.H. 34 %

SPECS: (MFG) RDI

PROCEDURE: (MFG) RDI OTHER

RDI 2002

SHIP VIA: _____ DATE: _____

RECEIVED BY: _____

Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

\# 35555

CAL DATE: 07/29/94

DUE DATE: 01/29/95

ISSUED TO: Omega Point Laboratories
16015 Shady Falls Road
Elmendorf, TX 78112-9784
635-8100

CONTROL: 556 - 8477

SPECIFICATIONS: MFG
PROCEDURE: MFG
WORK ORDER #: 44184
CUSTOMER PO #: 1131-Q

MFG Omega

MODEL CL-466-L-1

SERIAL # 703297

TYPE Digital Temp Calibrator

RECEIVED IN-SPECS [x]
OUT-OF-SPECS [ ]

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 74oF , Relative Humidity 34% .

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfgr	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	05/25/94	3	08/25/94
TR 30	3458A	HP	2823A01926	DMM	05/25/94	3	08/25/94
TR 208	PT138P	Logan	9424-3	TEMPERATURE PROBE	06/14/94	12	06/14/95
TR 150	TRC-III	OMEGA	41007	ICE POINT REFERENCE	11/02/93	12	11/02/94

Test Report Numbers

DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
NIST TEST# 250839
NIST TEST# 251316
Hz WWVB Transmission

INSPECTED BY Jose A Mendoza
COMMENTS:

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA : OMEGA CL-466

CUSTOMER: Omega Point Laboratories DATE: 29 July 94

WORK ORDER: 44184 TECH: 11

SERIAL: 703297 INST NO: 8477

CAL DATA TAKEN — INCOMING ✓ OUTGOING ✓

CONDITION — IN TOLERANCE ✓ OUT OF TOLERANCE

TYPE J	DEG F	READING	TOL
-5.760	-200	-199.7	+/- .6
-3.492	-100	-99.8	+/- .6
0.000	32	32.1	+/- .6
1.942	100	100.1	+/- .6
7.947	300	300.0	+/- .6
14.108	500	500.0	+/- .6
21.785	750	750.0	+/- .6
29.515	1000	1000.0	+/- .6
37.688	1250	1250.0	+/- .6
46.503	1500	1500.0	+/- .6
53.525	1700	1700.0	+/- .6

	DEG C	READING	TOL
-4.632	-100	-99.8	+/- .5
0.000	0	.0	+/- .5
5.268	100	100.0	+/- .5
16.325	300	299.9	+/- .5
33.096	600	599.9	+/- .5
51.875	900	900.0	+/- .5

TYPE K	DEG F	READING	TOL
-2.699	-100	-100.0	+/- 1.2
0.000	32	32.0	+/- .8
1.520	100	100.0	+/- .8
6.092	300	299.9	+/- .8
10.560	500	499.8	+/- .8
16.349	750	749.7	+/- .8
22.251	1000	999.7	+/- .8
28.148	1250	1249.8	+/- .8
33.913	1500	1499.9	+/- .8
39.485	1750	1750.0	+/- .8
44.856	2000	2000.1	+/- .8
49.996	2250	2250.2	+/- .8
54.845	2500	2500.3	+/- .8

TYPE K	DEG C	READING	TOL
-3.553	-100	-99.6	+/- .8
0.000	0	.0	+/- .5
4.095	100	100.0	+/- .5
12.207	300	299.9	+/- .5
20.640	500	499.8	+/- .5
31.214	750	749.9	+/- .5
41.269	1000	1000.0	+/- .5
50.633	1250	1250.1	+/- .5
54.125	1350	1350.2	+/- .5

TYPE T	DEG F	READING	TOL
-5.341	-300	-300.3	+/- 1.5
-4.149	-200	-200.3	+/- 1.5
-2.581	-100	-100.3	+/- 1.5
0.000	32	31.8	+/- .6
1.518	100	99.7	+/- .6
6.647	300	299.7	+/- .6
12.572	500	499.8	+/- .6
19.095	700	699.9	+/- .6

	DEG C	READING	TOL
-5.439	-190	-190.3	+/- 1.0
-3.378	-100	-100.2	+/- 1.0
0.000	0	-.1	+/- .4
4.277	100	99.8	+/- .4
9.286	200	199.8	+/- .4
14.860	300	299.9	+/- .4
20.252	390	389.9	+/- .4

TYPE E	DEG F	READING	TOL
-8.404	-300	-299.8	+/- .7
-6.471	-200	-200.1	+/- .7
-3.976	-100	-100.1	+/- .7
0.000	32	31.9	+/- .7
2.281	100	99.8	+/- .7
9.708	300	299.7	+/- .7
17.942	500	499.8	+/- .7
28.854	750	749.8	+/- .7
40.056	1000	999.8	+/- .7
51.246	1250	1250.0	+/- .7
62.240	1500	1500.0	+/- .7
75.024	1800	1800.1	+/- .7

	DEG C	READING	TOL
-5.237	-100	-99.8	+/- .4
0.000	0	.0	+/- .4
6.317	100	99.9	+/- .4
21.033	300	299.9	+/- .4
36.999	500	499.8	+/- .4
53.110	700	699.9	+/- .4
68.783	900	900.0	+/- .4
76.358	1000	1000.0	+/- .4

MV INPUT	READING	TOL
-10	-9.99	.01% OF
0	0.00	RDG+/-2CT
10	9.99	
30	29.99	
50	49.99	
75	75.00	
100	100.00	

MA INPUT	READING	TOL
0	.000	.01% OF
5	4.999	RDG+/-2CT
10	10.000	
15	15.000	
20	20.001	

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Omega Point Labs
CLIENT/PROJECT NUMBER OPL Equipment
RECEIVED FROM Rothe Development
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1377 . OPL
DATE RECEIVED 2-28-94
DATE INSPECTED 2-28-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Digital Calibrater	11129	1	1	—	SN# 703297	Y	Y	good	None	X			Calibration services only
Delmhorst Moisture													
Detector	11129	1	1	—	model BD-8 SN# 5855	Y	Y	good	None	X			

FORM
1/29/93

ORIGINAL

377

OMEGA POINT LABORATORIES
CALIBRATION DATA SHEET

DIGITAL CALIBRATOR
OMEGA ENGINEERING MODEL CL 466-L
SN# 703297

Calibration Date 2/24/94 Next Cal. Due on or before: 8/24/94

Calibration Frequency: Every six months.

Equipment to be returned to qualified facility for recalibration against suitable NBS / Mil. Std.45662 / 10 CFR 50 standards.

Sent to (for Calibration): Rothe Development
4614 Sinclair Rd.
San Antonio, TX
78222

Ship Date: 2/14/94

Return Date: 2/28/94

P.O. #: 1112Q

Attach calibration label to the Digital Calibrator and any supporting documentation ("As Returned" specifications) to this form.

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Rothe Development
4614 Sinclair Road

San Antonio TX 78222

PO Number: 1112-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Constance A. Humphrey Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	F.O.B.	Date Required	Terms
2/14/94	Their Truck			30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Digital Calibrater SN# 703297 - Calibration Service	1	~~$60.00~~ 160.00	~~$60.00~~ 173.20 incl. Tax
2.	Delmhorst Moisture Detector Model BD-8, SN# 5855 Calibration Service	1	~~$160.00~~ 40.00	~~$160.00~~ 43.30

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 2-14-94

Special Instructions

Certificates of Calibration traceable to NIST

Ordered By: Constance A. Humphrey

Project #: OPL Equipment

Total	~~$220.00~~
Shipping	216.50
Tax	
Invoice Total	~~$220.00~~ 216.50

EQUIPMENT DELIVERY RECEIPT

380

Rothe Development, Inc.
Metrology Services Division
[redacted] Sinclair Rd.
[redacted]Antonio, TX 78222-2099
(210)648-3131

Date: 02/25/94
Control: 556

Company: Omega Point Laboratories
Contact: Ms. Connie Humphrey
Address: 16015 Shady Falls Road
City: Elmendorf, TX 78112-9784
Phone: 635-8100

Item	W.O. #	Customer P.O.	Mfgr.	Model	Serial No.	Description
1	42180	1112-Q	Omega	CL-466-L-1	703297	Digital Temp Calibrator
2	42181	1112-Q	Delmhorst	BD-8	5855	Moisture Detector

[redacted]ived by:

Date:

RDI 3003

Rothe Development, Inc.

4614 SINCLAIR RD. SAN ANTONIO, TEXAS 78222-2099

210-648-3131 FAX: 210-648-4091

METROLOGY SERVICES DIVISION
PRECISION MEASUREMENT EQUIPMENT LABORATORY
TRACEABLE TO NIST

381

CHARGE # 107 CONTROL # 556 - 8477

WORK ORDER # 42180

RECEIVED FROM Omega Point Laboratories DATE 02/14/94

ADDRESS 16015 Shady Falls Road
Elmendorf, TX 78112-9784 PHONE# 635-8100

CONTACT (NAME) Ms. Connie Humphrey FAX#

PURCHASE ORDER # 1112-Q

CUSTOMER COMMENTS TAXABLE 8.25% Before + After DATA Required

ITEM

MFG Omega

MODEL CL-466-L-1

SERIAL # 703297

TYPE Digital Temp Calibrator

ACCES. RCVD. Probe handle

- [ ] REPAIR
- [x] OPERATIONAL CHECK
- [x] CALIBRATION

CALIBRATION DATE 24FEB94

DATE DUE 24AUG94

CALIBRATION INTERVAL 6 mo.

- [x] RECEIVED IN SPECS.
- [ ] RECEIVED INOPERATIVE
- [ ] RECEIVED OUT OF SPECS.

CKT REF #	QTY.	MFG PART #	DESCRIPTION	COST

ROTHE TECH.	OUR P.O. #
WW	
REPAIR LABOR HRS.	SERVICE CODE
	J

PARTS TOTAL		
REPAIR LABOR		
SHIPPING		
TEAR DOWN CHARGE		
CALIBRATION	160.00	
TAX	13	20
TOTAL	173	20

R #'s 20, 30, 150, 243

COMMENTS CAL DATA PROVIDED

WORK PERFORMED: Optimized mV + mA functions.

Cal'd

EM 72 °F

H. 27 %

SPECS: (MFG) RDI

PROCEDURE: (MFG) RDI OTHER

RDI 2002

SHIP VIA: _____ DATE: _____ RECEIVED BY: _____

Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

33929

CAL DATE: 02/24/94

DUE DATE: 08/24/94

ISSUED TO: Omega Point Laboratories
16015 Shady Falls Road
Elmendorf, TX 78112-9784
635-8100

CONTROL: 556 - 8477

SPECIFICATIONS: MFG
PROCEDURE: MFG
WORK ORDER #: 42180
CUSTOMER PO #: 1112-Q

MFG Omega

MODEL CL-466-L-1

SERIAL # 703297

TYPE Digital Temp Calibrator

RECEIVED IN-SPECS [x]
OUT-OF-SPECS [ ]

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 72oF , Relative Humidity 27% .

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfgr	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	11/26/93	3	02/26/94
TR 30	3458A	HP	2823A01926	DMM	11/26/93	3	02/26/94
TR 150	TRC-III	OMEGA	41007	ICE POINT REFERENCE	11/02/93	12	11/02/94
TR 243	138P	LOGAN	9350-1	TEMPERATURE PROBE	12/21/93	12	12/21/94

Test Report Numbers

DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
[redacted] NIST TEST# 250839
[redacted] NIST TEST# 251316
Hz WWVB Transmission

INSPECTED BY Jose A Mendoza
COMMENTS:

RDI 1001

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA : OMEGA CL-466

WORK ORDER # 42180

CUSTOMER Omega Point Labs.

SERIAL 703297

DATE 24FEB94

TECH # 11

RECEIVED IN SPECS ✓ RECEIVED OUT OF SPECS _____

RECEIVED INOPERATIVE _____

TYPE J	DEG F	INCOMING	OUTGOING	TOL
-5.760	-200	-200.0	-200.0	+/- .6
-3.492	-100	-100.0	-100.0	+/- .6
0.000	32	32.0	32.0	+/- .6
1.942	100	99.9	99.9	+/- .6
7.947	300	299.8	299.8	+/- .6
14.108	500	499.8	499.8	+/- .6
21.785	750	749.8	749.8	+/- .6
29.515	1000	999.8	999.8	+/- .6
37.688	1250	1249.8	1249.8	+/- .6
46.503	1500	1500.0	1500.0	+/- .6
53.525	1700	1700.0	1700.0	+/- .6

	DEG C	INCOMING	OUTGOING	TOL
-4.632	-100	-100.0	-100.0	+/- .5
0.000	0	.0	.0	+/- .5
5.268	100	99.9	99.9	+/- .5
16.325	300	299.8	299.8	+/- .5
33.096	600	599.8	599.8	+/- .5
51.875	900	899.9	899.9	+/- .5

TYPE K	DEG F	INCOMING	OUTGOING	TOL
-2.699	-100	-100.0	-100.0	+/- 1.2
0.000	32	32.0	32.0	+/- .8
1.520	100	100.0	100.0	+/- .8
6.092	300	299.9	299.9	+/- .8
10.560	500	499.8	499.8	+/- .8
16.349	750	749.7	749.7	+/- .8
22.251	1000	999.7	999.7	+/- .8
28.148	1250	1249.7	1249.7	+/- .8
33.913	1500	1499.8	1499.8	+/- .8
39.485	1750	1749.8	1749.8	+/- .8
44.856	2000	2000.0	2000.0	+/- .8
49.996	2250	2250.0	2250.0	+/- .8
54.845	2500	2500.0	2500.0	+/- .8

TYPE K	DEG C	INCOMING	OUTGOING	TOL
-3.553	-100	-99.6	-99.6	+/- .8
0.000	0	.0	.0	+/- .5
4.095	100	99.9	99.9	+/- .5
12.207	300	299.9	299.9	+/- .5
20.640	500	499.8	499.8	+/- .5
31.214	750	749.8	749.8	+/- .5
41.269	1000	999.9	999.9	+/- .5
50.633	1250	1250.0	1250.0	+/- .5
54.125	1350	1350.0	1350.0	+/- .5

TYPE T	DEG F	INCOMING	OUTGOING	TOL
-5.341	-300	-300.4	-300.4	+/- 1.5
-4.149	-200	-200.3	-200.3	+/- 1.5
-2.581	-100	-100.2	-100.2	+/- 1.5
0.000	32	31.9	31.9	+/- .6
1.518	100	99.8	99.8	+/- .6
6.647	300	299.8	299.8	+/- .6
12.572	500	499.9	499.9	+/- .6
19.095	700	699.9	699.9	+/- .6

	DEG C	INCOMING	OUTGOING	TOL
-5.439	-190	-190.1	-190.1	+/- 1.0
-3.378	-100	-100.0	-100.0	+/- 1.0
0.000	0	-.0	-.0	+/- .4
4.277	100	99.8	99.8	+/- .4
9.286	200	199.9	199.9	+/- .4
14.860	300	299.9	299.9	+/- .4
20.252	390	389.9	389.9	+/- .4

TYPE E	DEG F	INCOMING	OUTGOING	TOL
-8.404	-300	-299.7	-299.7	+/- .7
-6.471	-200	-200.0	-200.0	+/- .7
-3.976	-100	-100.0	-100.0	+/- .7
0.000	32	32.0	32.0	+/- .7
2.281	100	99.8	99.8	+/- .7
9.708	300	299.6	299.6	+/- .7
17.942	500	499.7	499.7	+/- .7
28.854	750	749.8	749.8	+/- .7
40.056	1000	999.6	999.6	+/- .7
51.246	1250	1249.8	1249.8	+/- .7
62.240	1500	1499.8	1499.8	+/- .7
75.024	1800	1799.9	1799.9	+/- .7

	DEG C	INCOMING	OUTGOING	TOL
-5.237	-100	-99.9	-99.9	+/- .4
0.000	0	-.0	-.0	+/- .4
6.317	100	99.9	99.9	+/- .4
21.033	300	299.9	299.9	+/- .4
36.999	500	499.8	499.8	+/- .4
53.110	700	699.9	699.9	+/- .4
68.783	900	899.9	899.9	+/- .4
76.358	1000	999.9	999.9	+/- .4

MV INPUT	INCOMING	OUTGOING	TOL
-10	-9.99	-9.99	.01% OF
0	.00	.00	RDG+/-2CT
10	9.99	9.99	
30	29.99	29.99	
50	49.98	49.99	
75	74.98	74.99	
100	99.98	100.00	

MA INPUT	INCOMING	OUTGOING	TOL
0	.001	.000	.01% OF
5	4.997	4.999	RDG+/-2CT
10	9.997	9.999	
15	14.997	15.000	
20	19.996	20.000	

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Omega Point Labs
CLIENT/PROJECT NUMBER OPL Equip
RECEIVED FROM Metroplex Metrology
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1371 - OPL
DATE RECEIVED 2-2-94
DATE INSPECTED 2-2-94
INSPECTED BY: CPatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
0-100 PSI GAGE	1103Q	1	1	–	SN. 92LE003	Y	Y	Good	None	X			Calibration Services only
0-60 PSI Gage	1103Q	1	1	–	SN92LE002	Y	Y	good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Floyd Passmore
Metroplex Metrology Lab
2312 Municipal Parkway

Bedford TX 76021

PO Number: 1103-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Cleda Patton
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	F.O.B.	Date Required	Terms
1/13/94	UPS Ground			30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	0-100 psi Pressure gauge Model No. JD-GF Serial No. 92 LE 003	1	$25.00	$25.00
2.	0-60 psi Pressure gauge Model No. JC-GF Serial NO. 92 LE 002	1	$25.00	$25.00
	plus tax & shipping			

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 1-13-94

Special Instructions

Please include Certificates of Calibration and Calibration Data

Ordered By: Cleda Patton

Project #: OPL Equipment

Total	$50.00
Shipping	
Tax	
Invoice Total	**$50.00**

TEST Nº 424132

388

METROPLEX METROLOGY LABORATORY INCORPORATED

P.O. BOX 210249
BEDFORD, TEXAS 76095-7249

2312 MUNICIPAL PARKWAY
BEDFORD, TEXAS 76021-4642

METRO (817) 267-4999

Certificate of Calibration

We certify the accuracy of this Mc Daniel Controls, Inc. 0 to 100 Liquid Filled PSI Gage, Mod.# None, S/N 92LE003, subdivided in 1 lb. increments, property of Omega Point Laboratories, Inc., 16015 Shady Falls Road, Elmendorf, Texas. The accuracy of this instrument has been determined from **Reference Standards** which have been calibrated from **Master Standards** which were certified by **The National Institute of Standards and Technology.**

The accuracy of this pressure gage meets all the requirements of **Federal Specifications GGG-G-76E, GG-G-66-B** and **Instrument Calibration Procedure (I.C.P.) No. D25A and M20.** The calibration certification of this instrument is in compliance with **MIL-STD-45662A.** This instrument has been calibrated in an upright position at 72°F 45%RH.

Instrument used in calibration: Chandler Dead Weight Tester, S/N 20759 (Cal. 12/28/93 Due 12/28/94). **NIST Test #737/229495. Expires: 10-2-94.**
Received Condition: In Tolerance
Technician ID: #4

LABORATORY WEIGHT PRESSURE	DISPLAYED INDICATED PRESSURE OF PSI GAGE	DEVIATION OF PSI GAGE	LIMITS OF UNCERTAINTY
10	10	0	0
20	20	0	0
30	30	0	0
40	39.9	-.1	.1%
50	49.2	-.8	.1%
60	59.3	-.7	.1%
70	69.3	-.7	.1%
80	79.4	-.6	.1%
90	89.4	-.6	.1%
100	100.5	+.5	.1%

IN COMPLIANCE WITH GOVERNMENT REGULATIONS CALIBRATION TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

TEST IN COMPLIANCE WITH MIL-STD-45662A

President

Weta Passmore
Date Cal: 1-20-94
Date Due: 1-20-95

WP/kb

INVOICE

No. 42531 389

PHONE Metro (817) 267-4999
FAX (817) 540-1410

METROPLEX METROLOGY LABORATORY

Refer to above number in correspondence regarding this charge.

2312 MUNICIPAL PARKWAY

PLEASE REMIT TO P.O. BOX 210249
BEDFORD, TEXAS 76095-7249

BEDFORD, TEXAS 76021 February 1, 1994

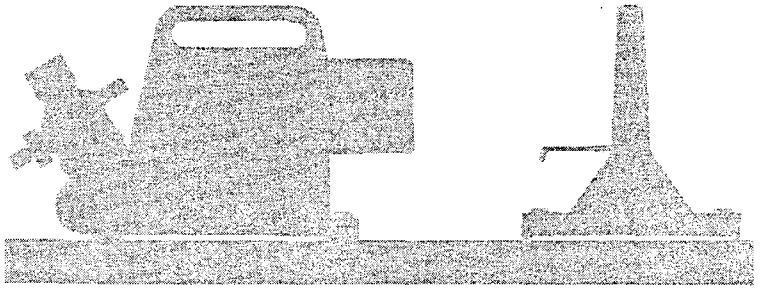
SOLD TO
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

SHIP TO
Same

(214) 635-8100

VIA UPS CUSTOMER P/O NO. 1103-Q TERMS *NET 30* F.O.B. BEDFORD, TEXAS

Item No.	Qty.	DESCRIPTION	Unit Price	Amount
1	1	McDaniel Controls, Inc. 0-100 Liquid Filled PSI Gage, S/N 92LE0003 Cal. & Cert.		
2	1	McDaniel Controls, Inc. 0-60 Liquid Filled PSI Gage, S/N 92LE002 Cal. & Cert.		



IF YOUR REMITTANCE IS POSTMARKED BY 2/16/94, YOU MAY DEDUCT $1.20 FROM THIS INVOICE. (DISCOUNT EXCLUDES TAX.)
OUR TERMS ARE NET 30 DAYS FROM THE DATE OF THIS INVOICE.

Parts	Tools	Calibration Certification	Repairs	Shipping & Handling	Tax	TOTAL	
		60.00		8.04	5.61		73.65

Cust.# 11549
bb
p

Masters at Repairs and Calibration of Precision Measuring Instruments

Please Pay ▲

PACKING SLIP

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES 17 PIECES GROSS WEIGHT 9440 LBS.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 158100 THERMO-LAG Preshaped Conduit Sections Thickness: 0.625" ± 0.125" Nom. Size: 1"	16 Pieces	F94-02053
Item 01	16 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 158400 THERMO-LAG Preshaped Conduit Sections Thickness: 0.625" ± 0.125" Nom. Size: 4"	5 Pieces	F9-105037
	3 Pieces	F92-09051
	10 Pieces	F92-11018
Item 02	10 Pieces	F94-03018
No Shelf Life On Conduit	28 Pieces (In 2 Cartons)	

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

392

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 238100 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 1"	16 Pieces	F94-04005
Item 03 No Shelf Life On Conduit	16 Pieces (In 1 Carton)	

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 338300 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 3"	8 Pieces	F94-02053
Item 04	8 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 438300 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 3"	3 Pieces 5 Pieces	F92-10009 F93-06008
Item 05	8 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 1384X6 - THERMO-	1 PANEL	F93-11048
LAG 330 RIBBED PANEL	4	F94-02012
NOMINAL 3/8" THICK, 4'x6½' NOM.	1	F94-03018
	1	F94-06051
ITEM 06	7 PANELS (ON 1 PALLET)	

NO SHELF LIFE LIFE ON PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O Bryant
David O Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 1584X6 - THERMO-LAG RIBBED PANEL, NOMINAL 5/8" 4' X 6½'	1	F93-11048
	9	F94-02012
	6	F94-02053
	9	F94-03018
	7	F94-03028
ITEM 07	14	F94-03047
	46 PANELS (ON 4 PALLETS)	

NO SHELF LIFE ON PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE ITEM 08 1 x 5 gallon pail containing temperature recorder EXP. DATE: DECEMBER 1994 SHELF LIFE SIX MONTHS FROM DATE OF SHIPMENT STORE ABOVE 32 F AND BELOW 100 F AT ALL TIMES	2000 LB. (40 x 50 Lb. Pails) (ON 2 PALLETS)	94-05093

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O Bryant
Manager Quality Control

398

21334

TSI

CERTIFICATE OF ANALYSIS

CUSTOMER

OMEGA POINT LABORATORY
%TENNESSEE VALLEY AUTHORITY
16015 SHADY FALLS RD
ELMENDORFF, TX 78112

DATE OF SHIPMENT: 30 JUNE 1994
PURCHASE ORDER NO: CONTRACT #TV 92362V
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-05093	2000 LB. (40 x 50 LB. PAILS	A-2	WT/GALLON	10.16	10.5 ± 1.5
		A-3	pH	8.5	8 +

ITEM 08

EXPIRATION DATE: DECEMBER 1994

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: Danielle Bryant DATE: 30 JUNE 1994

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
STRESS SKIN-ASTM E437 type 304 stainless steel, plain weave, 8 x 8 square mesh wire cloth, 0.017 dia. wire, or equal.	100 LB. (IN 1 CARTON)	F062494

Item 09

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O'Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
STAINLESS STEEL TIE WIRE 16 Gauge, Annealed type 304	100 LB. (3 ROLLS)	N/A
Item 10		
STAINLESS STEEL BANDING Type 304 Thickness: .0.020" x 0.5" x 200 Ft. Rolls	3 Rolls	070693
STAINLESS STEEL CLIPS SIZE. 1/2" WIDE X 0.020"	1 CARTON (1000 CLIPS)	112691
ITEM 11	(ALL ABOVE ITEMS IN 1 CARTON)	

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O Bryant
David O Bryant
Manager Quality Control

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 158340 THERMO-LAG Preshaped Conduit Sections Thickness: 0.625" ± 0.125" Nom. Size: 3/4"	10 Pieces	F94-02053
Item 12	10 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant
David O Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 238340 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 3/4"	2 Pieces	F92-02005
	1 Piece	F92-03029
	1 Piece	F94-02012
	6 Pieces	F94-04005
Item 13	10 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TUA
CLIENT/PROJECT NUMBER 11960-97185.8687)
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1393 - 11960
DATE RECEIVED 7-8-94
DATE INSPECTED 7-8-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Temp Recorder	NA	0	1	0	Recorder # 0301 Chart tape # 27	Y	N	Good	None	X			Receiving Verifications only. Temperature Recorder has been returned to TSI. CP
Thermo Lag 1" pre shaped conduit	NA	0	16	0	Part # 158100 F94-02053	Y	Y	Good	None	X			
Thermo Lag 4" pre shaped conduit	NA	0	5	0	Part # 158400 F9-105037	Y	Y	Good	None	X			
Thermo Lag 4" pre shape Conduit	NA	0	3	0	Part # 158400 F92-09051	Y	Y	Good	None	X			
Thermo Lag 4" pre shaped conduit	NA	0	10	0	Part # 158400 F92-11018	Y	Y	Good	None	X			
Thermo Lag 4" pre shaped Conduit	NA	0	10	0	Part # 158400 F94-03018	Y	Y	Good	None	X			
Thermo Lag 1" pre shaped conduit	NA	0	16	0	Part # 238100 F94-04005	Y	Y	Good	None	X			
Thermo Lag 3" pre shaped conduit	NA	0	8	0	Part # 338300 F94-02053	Y	X	Good	None	X			
Thermo Lag 3" pre shaped Conduit	NA	0	3	0	Part # 438300 F92-10009	Y	Y	Good	None	X			
Thermo Lag 3" pre shaped Conduit	NA	0	5	0	Part # 438300 F93-06008	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 3/8"	NA	0	1	0	Part # 1384X6 F93-11048	X	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 3/8"	NA	0	4	0	Part # 1384X6 F94-02012	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 3/8"	NA	0	1	0	Part # 1384X6 F94-03018	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 3/8"	NA	0	1	0	Part # 1384X6 F94-06057	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 5/8"	NA	0	1	0	Part # 1584X6 F93-11048	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 5/8"	NA	0	9	0	Part # 1584X6 F94-02012	Y	Y	Good	None	X			

FORM
1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185, 86887
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1393 - 11960
DATE RECEIVED 7-8-94
DATE INSPECTED 7-8-94
INSPECTED BY: C. Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Thermo Lag 330 Ribbed Panel 5/8"	NA	0	6	0	Part# 1584X6 F94-02053	Y	Y	Good	None	X			Receiving Verification Only. Expiration on trowel grade is December 1994
Thermo Lag 330 Ribbed Panel 5/8"	NA	0	9	0	Part# 1584X6 F94-03018	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 5/8"	NA	0	7	0	Part# 1584X6 F94-03028	Y	Y	Good	None	X			
Thermo Lag 330 Ribbed Panel 5/8"	NA	0	14	0	Part# 1584X6 F94-03047	X	Y	Good	None	X			
Thermo Lag 330-1 Trowel Grade	NA	0	40	0	94-05093	X	Y	Good	None	X			
Stress-Skin	NA	0	100lb	0	F062494	Y	Y	Good	None	X			
Stainless Steel Wire	NA	0	100lbs	0	16ga, Type 304	Y	Y	Good	None	X			
Stainless Steel Banding	NA	0	3rolls	0	070693	Y	Y	Good	None	X			
Stainless steel Clips	NA	0	1000	0	112691	Y	Y	Good	None	X			
Thermo Lag 3/4" pre shaped conduit	NA	0	10	0	Part# 158340 F94-02053	Y	Y	Good	None	X			
Thermo Lag 3/4" pre shaped conduit	NA	0	2	0	Part# 238340 F92-02005	Y	Y	Good	None	X			
Thermo Lag 3/4" pre shaped conduit	NA	0	1	0	Part# 238340 F92-03029	Y	Y	Good	None	X			
Thermo Lag 3/4" pre Shaped Conduit	NA	0	1	0	Part# 238340 F94-02012	Y	Y	Good	None	X			
Thermo Lag 3/4" pre Shaped Conduit	NA	0	6	0	Part# 238340 F94-04005	X	X	Good	None	X			

FORM
1/29/93

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES 17 PIECES GROSS WEIGHT 9440 LBS.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 158100 THERMO-LAG Preshaped Conduit Sections Thickness: 0.625" ± 0.125" Nom. Size: 1"	16 Pieces	F94-02053
Item 01	16 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

Daniel O'Bryant

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 158400 THERMO-LAG Preshaped Conduit Sections Thickness: 0.625" ± 0.125" Nom. Size: 4"	5 Pieces	F9-105037
	3 Pieces	F92-09051
	10 Pieces	F92-11018
Item 02	10 Pieces	F94-03018
No Shelf Life On Conduit	28 Pieces (In 2 Cartons)	

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 238100 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 1"	16 Pieces	F94-04005
Item 03 No Shelf Life On Conduit	16 Pieces (In 1 Carton)	

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 338300 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 3"	8 Pieces	F94-02053
Item 04	8 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 438300 THERMO-LAG Preshaped Conduit	3 Pieces	F92-10009
Sections Thickness: 0.375" ± 0.125" Nom. Size: 3"	5 Pieces	F93-06008
Item 05	8 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant
David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 1384X6 - THERMO-	1 PANEL	F93-11048 ✓
LAG 330 RIBBED PANEL	4	F94-02012 ✓
NOMINAL 3/8" THICK, 4'x6½' NOM.	1	F94-03018 ✓
	1	F94-06051 ✓
ITEM 06	7 PANELS (ON 1 PALLET)	

NO SHELF LIFE LIFE ON PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O'Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 1584X6 - THERMO-	1	F93-11048
LAG RIBBED PANEL, NOMINAL 5/8"	9	F94-02012
4' X 6½'	6	F94-02053
	9	F94-03018
	7	F94-03028
ITEM 07	14	F94-03047
	46 PANELS (ON 4 PALLETS)	

NO SHELF LIFE ON PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O'Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO-LAG 330-1 SUBLIMING COATING TROWEL GRADE ITEM 08 1 x 5 gallon pail containing temperature recorder EXP. DATE: DECEMBER 1994 SHELF LIFE SIX MONTHS FROM DATE OF SHIPMENT STORE ABOVE 32 F AND BELOW 100 F AT ALL TIMES	2000 LB. (40 x 50 Lb. Pails) (ON 2 PALLETS)	94-05093

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O'Bryant
David O'Bryant
Manager Quality Control

413

21334

TSI

CERTIFICATE OF ANALYSIS

CUSTOMER

OMEGA POINT LABORATORY
%TENNESSEE VALLEY AUTHORITY
16015 SHADY FALLS RD
ELMENDORFF, TX 78112

DATE OF SHIPMENT: 30 JUNE 1994
PURCHASE ORDER NO: CONTRACT #TV 92362V
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-05093	2000 LB. (40 x 50 LB. PAILS	A-2	WT/GALLON	10.16	10.5 ± 1.5
		A-3	pH	8.5	8 +

ITEM 08

EXPIRATION DATE: DECEMBER 1994

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: David O Bryant DATE: 30 JUNE 1994 PAGE NO. 1

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
STRESS SKIN-ASTM E437 type 304 stainless steel, plain weave, 8 x 8 square mesh wire cloth, 0.017 dia. wire, or equal.	100 LB. (IN 1 CARTON)	F062494

Item 09

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O'Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
STAINLESS STEEL TIE WIRE 16 Gauge, Annealed type 304	100 LB. (3 ROLLS)	N/A
Item 10		
STAINLESS STEEL BANDING Type 304 Thickness: .0.020" x 0.5" x 200 Ft. Rolls	3 Rolls	070693
STAINLESS STEEL CLIPS SIZE. 1/2" WIDE X 0.020"	1 CARTON (1000 CLIPS)	112691
ITEM 11	(ALL ABOVE ITEMS IN 1 CARTON)	

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 30 June 1994
BILL OF LADING: 21334
MODE: DYNAMIC TRANSIT PREPAID

David O'Bryant
David O'Bryant
Manager Quality Control

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 158340 THERMO-LAG Preshaped Conduit Sections Thickness: 0.625" ± 0.125" Nom. Size: 3/4"	10 Pieces	F94-02053
Item 12	10 Pieces (In 1 Carton)	

No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant

David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 30 JUNE 1994

TEMPERATURE RECORDER 030117 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA Part No. 238340 THERMO-LAG Preshaped Conduit Sections Thickness: 0.375" ± 0.125" Nom. Size: 3/4"	2 Pieces	F92-02005
	1 Piece	F92-03029
	1 Piece	F94-02012
	6 Pieces	F94-04005
Item 13	10 Pieces (In 1 Carton)	

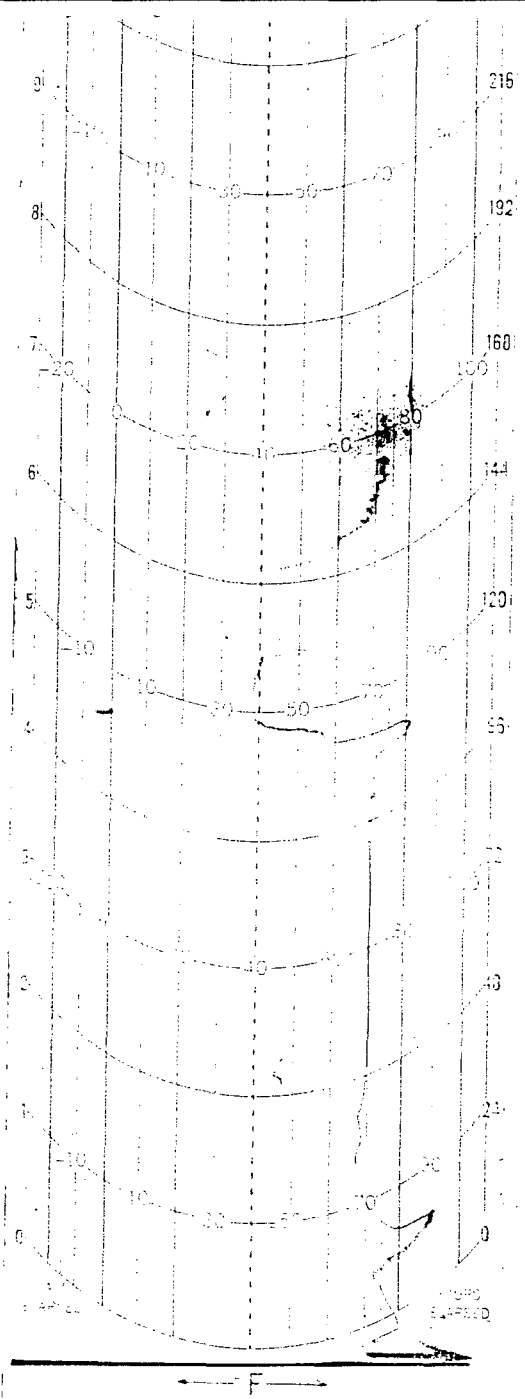
No Shelf Life On Conduit

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant

David O Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID


F
CAR No.
CITY: San Antonio / TX
CONSIGNEE: Omega Point
CAR CONT:
PER:
CITY: St. Louis
SHIPPER: T&T
DATE: 6-30-94 TIME: 1:30pm
INSTR. No.:
CHART 27
32 DAY (–30° + 110° F)
PART NO. 840-95
PARTLOW THERMA-GARD
NEW HARTFORD, N.Y. 13413
START

419

...subject to the classifications and tariffs in effect on the date of issue of this Original Bill of Lading,

SHORT FORM — ORIGINAL — NOT NEGOTIABLE

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment. Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

From THERMAL SCIENCE, INC.

At ST. LOUIS, MISSOURI 63026

CONTRACT ORDER TV 92362V

Carrier DYNAMIC TRUCK PREPAID PROTECTIVE SERVICE 6/8 30 19 94 Shipper's No. 21334

Consigned to OMEGA POINT LABORATORY % TVA CONTRACT TV 92362V Agent's No.

Destination 16015 SHADY FALLS ROAD (Mail or street address of consignee—For purposes of notification only)

Route ELMENDORFF, TEXAS 78112 State of County of

Delivering Carrier Vehicle or Car Initial No.

No. Packages	HM	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS	*Weight (Subject to Correction)	Class or Rate	Check Column
1	✓	CARTON TVA PART #I58100			
2	✓	16 PCS. 1" ITEM 01	100 lb.		
		CARTONS TVA PART NO. 158400			
1	✓	28 PCS. 4" ITEM 02	300		
		CARTON TVA PART NO. 238100			
1	✓	16 PCS. 1" ITEM 03	150		
		CARTON TVA PART NO. 338300			
1	✓	8 PCS. 3 INCH (UPGRADE) ITEM 04	90		
		CARTON TVA PART NO. 438300			
1	✓	8 PCS. 3" (UPGRADE)			
		PALLET TVA PART NO. 1384X6 ITEM 05	90		
	✓	7 EA. THERMO LAG 330 RIBBED PANEL			
4	✓	3/8" THICKNESS 4'x6½' NOM ITEM 06	700		
		PALLETS TVA PART NO. 1584X6			
		46 PANELS THERMO LAG 330 RIBBED PANEL			
2	✓	5/8" THICKNESS NOM 4'x6½' ITEM 7	5200 lb.		
	✓	PALLETS CONTAINING: 40 x 50 LB. PAILS			
	✓	THERMO LAG 330-1 SUBLIMING COATING	2400		
		TROWEL GRADE ITEM 08 TVA PART TG-330			
1	✓	1 x 5 gal. pail containng temp recorder			
		STORE ABOVE 32 F AND BELOW 100F AT ALL TIMES			
	✓	CARTON CONTAINING STRESS SKIN ASTM E437	120 lb.		
	✓	TYPE 304 SS Wire/plain weave 8x8 square			
	✓	mesh wire cloth 0.017" DIA Wire ITEM 09			
	✓	CARTON CONTAINING			
	✓	3 Rolls SS Banding ITEM 11	240 LB.		
	✓	3 Rolls (100 Lb.) SS TIE WIRE TYPE 304			
	✓	ITEM 10			
	✓	1 BOX OF 1000 SS CLIPS ITEM 11			
	✓	CARTON TVA PART NO. 158340			
	✓	3/4" 50 PCS. ITEM 12	50		
	✓	CARTON TVA PART NO. 238340			
		SIZE: 3/4 INCH UPGRADE ITEM 13 (10 PCS.)	100		

Subject to Section 7 conditions of applicable bill lading, if this shipment is to t delivered to the consignee without recourse on th consignor, the consignor sha sign the following statement: The carrier shall not mak delivery of this shipmen without payment of freight and all other lawful charges.

Per (Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

TO BE PREPAID

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per (The signature here acknowledges only the amount prepaid.)

Charges Advanced:

$

C. O. D. SHIPMENT

C. O. D. Amt.

Collection Fee

Total Charges

*Boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Rule 41, of the Consolidated Classification.

...certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.

...shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

...Imprint in lieu of stamp; not a part of Bill of Lading approved by the Department of Transportation.

...If the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

...The declared value of the property is hereby specifically stated by the shipper to be not exceeding

...CONTENT IS CORRECTLY DESCRIBED.

...WEIGHT ... LBS.

"This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation." NOTE: Prepared classifications complying with 49 CFR 173, 400 (a) in effect January 30, 1978, may be used through June 30, 1979.

Per Shipper

...MAL SCIENCE, INC.

Shipper, Per

...ost office address of shipper 2200 Cassens Dr. St. Louis, MO 63026

Agent, Per

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TUA
CLIENT/PROJECT NUMBER 11960-97185-87, 97257-60
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1413 . 11960
DATE RECEIVED 8-3-94
DATE INSPECTED 8-3-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Stress Skin	NA	0	1	0	SS-008-0170-36	Y	Y	good	None	X			1 roll - 100' x 36" - 8x8 mesh .017 wire Receiving Verification Only

FORM
1/29/93

PACKING LIST 421

SOLD TO
3500
Thermal Science
2200 Cassens Drive
St. Louis, MO

63026

SHIP TO
[redacted]
Omega Point Laboratories
16015 Shady Falls Road
Elmendorff, Texas

78112

CUSTOMER ORDER NO.	DATE SHIPPED
12492	8-2-94
DATE ORDER RECEIVED	SHIPPED VIA
8/2/94	UPS Next Day
OUR ORDER NO.	
12492	
RESALE NO./STATUS	
Interstate 0	
FREIGHT TERMS	

IG	INIT.	CONTACT
UPS-NEXT DAY AIR	Ken	Denise

314-349-1280

QUANTITY ORDERED*	DESCRIPTION						QUANTITY SHIPPED*
	PART NUMBER	MESH	WIRE	MATERIAL	WIDTH	CODE	
300.00	SS-008-0170-36 M016	8X8	.017	304SS	36"	A	300.00

Attn: Richard Lohman

1 ROLL 100'-0" X 36"

MATERIAL RECEIVED BY _____

*UNIT OF MEASURE IS SQ. FT. UNLESS OTHERWISE NOTED.

Q/A RECEIVING REPORT

OMEGA POINT LABORATORIES

CLIENT/PROJECT NAME TSI / TVA

CLIENT/PROJECT NUMBER 11960-97257-60+97332-38

RECEIVED FROM TSI

PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1430 - 11960

DATE RECEIVED ~~8-29~~ ~~8-31-94~~ 8/31/94 CH

DATE INSPECTED ~~8-29~~ ~~8-31-94~~ CH

INSPECTED BY: C Patton 8/31/94 CH

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	CONT'D MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Stress Skin	NA	O	2 rolls	O	SS-008-010-48	Y	N	Good	None	X			Receiving Verification Only
SS Tie Wire	NA	O	25 lbs	O	16 ga, annealed Type 304	Y	Y	GOOD	None	X			

FORM
1/29/93

426

PACKING LIST 423

SOLD TO
6573
Thermal Science
2200 Cassens Drive
St. Louis, MO

63026

SHIP TO
[redacted] Science
Omega Point Laboratories
C/O TVA, Attn: Mark Sallee
16015 Shady Falls Road
Elmendorff, Texas
78112

CUSTOMER ORDER NO.	DATE SHIPPED
12569	
DATE ORDER RECEIVED	**SHIPPED VIA**
8/26/94	UPS NxtDay Air
OUR ORDER NO.	
12569	
RESALE NO./STATUS	
Interstate 0	
FREIGHT TERMS	

NG	INIT.	CONTACT
UPS-NEXT DAY AIR	Ken	Denise 314-349-1288

QUANTITY ORDERED*	DESCRIPTION						QUANTITY SHIPPED*
	PART NUMBER	MESH	WIRE	MATERIAL	WIDTH	CODE	
600.00	SS-008-0170-48 I606	8X8	.017	304SS	48"	A	600.00

150'-0" x 48"

MATERIAL RECEIVED BY _____

*UNIT OF MEASURE IS SQ. FT. UNLESS OTHERWISE NOTED.

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 26 AUGUST 1994

TEMPERATURE RECORDER N/A CHART TAPE NO. N/A

TOTAL NO. OF PACKAGES 1 CARTON GROSS WEIGHT 30 LBS.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
STAINLESS STEEL TIE WIRE 16 Gauge, Annealed type 304	25 LBS.	N/A

Item 10

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112.

DATE: 26 AUGUST 1994
BILL OF LADING: 21416
MODE: UPS PREPAID

David O'Bryant
David O'Bryant
Manager Quality Control

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

8/3/94

Cal Banning
Vectra c/o Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112

Dear Sir:

The in-house retain sample of Thermo-Lag 330-1 Trowel Grade batch #93-11049, was examined and tested. The results were within our published quality control standards.

Based on these results, the expiration date could be extended to read January 1995. The new expiration date would not include the extension of the original written warranty or any implied warranty.

Note that the sample tested was not received from the storage facilities of Omega Point Laboratories.

Regards,

David O'Bryant
QC Manager

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. 1085-Q c/o #1 DATE: 10 Dec 1993

TEMPERATURE RECORDER 030128 CHART TAPE NO. 10

TOTAL NO. OF PACKAGES see pg 1 GROSS WEIGHT see pg 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
Thermo-Lag 330-1 Subliming Coating - Trowel Grade Mfg. Date Nov. 24, 1993 Item 9	70 X 50 Lb Pail (3500 Lbs)	93-11049
Shelf Life: Six (6) months from date of shipment Storage Conditions: Above 32°F and below 100°F		
Temperature Recorder Item 10	1 Recorder	N/A

This will certify that the above listed THERMO-LAG Materials, shipped under Purchase Order No. 1085-Q c/o #1, to Omega Point Laboratories San Antonio, TX, Meet the requirements of "Specifications for the Procurement of Fire Barrier Materials 0784-00001-S-01, Rivision 3" for Nuclear Management and Resources Council (NUMARC) 1776 Eye Street, N.W., Suite 300, Washington, D.C. The material meets the requirements of the purchase order. This material does not contain asbestos.

DATE: 10 Dec 1993
BILL OF LADING: 21069
MODE OF TRANSPORT: C.V. SOHN PREPAID

B.E. EVANS
MANAGER OF QUALITY CONTROL

CERTIFICATE OF ANALYSIS

CUSTOMER

Omega Point Laboratories
6868 Alamo Downs Parkway
San Antonio, TX 78238

DATE OF SHIPMENT: December 10, 1993
PURCHASE ORDER NO: 1085-Q c/o #1
RELEASE NO:
CUSTOMER PART NO: Item #9

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
93-11049	70 X 50 Lb. Pails	A-2	Wt/Gallon	10.13	10.5 ± 1.5
Mfg. Date: Nov. 24, 1993	(3500 Lbs)	A-3	pH	8.36	8 +

m #9

Temperature Recorder (1) with the shipment

Material Expiration Date: June 1994

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: B Elvain DATE: December 10, 1993

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: ThermoLag 330-1

DATE PRINTED.: 8/24/89
DATE REVISED: 7/7/89
By A. Thorpe

THERMAL SCIENCE INC
2200 Cassens Dr
Fenton , MO 63026
PHONE: (314) 349-1233
EMERGENCY PHONE: (314) 349-1267

HMIS HAZARD RATINGS

LEAST	0	HEALTH HAZARD	2*
SLIGHT	1	FLAMMABILITY HAZARD	0
MODERATE	2	REACTIVITY HAZARD	0
HIGH	3	MAXIMUM PERSONAL	
EXTREME	4	PROTECTION	B

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: Thermolag 330-1

PRODUCT CLASS : Latex Fire Resistive Coating

D.O.T. HAZARD CLASS: none
D.O.T. Shipping Name: Cold Water Paint
D.O.T. UN Number:

SECTION II - PHYSICAL DATA

APPEARANCE AND ODOR :Milky white pasty mastic, ammoniacal odor

BOILING POINT (at 760 mm Hg) : 220-240 F
VAPOR PRESSURE (at 20C or 68F): nil
EVAPORATION RATE (ether = 1) much slower
VAPOR DENSITY (air = 1) : 0.6
Volatile Organic Content (VOC) : < 0.1 lb/gal

SPECIFIC GRAVITY (water = 1): 1.3
WEIGHT PER GALLON (lbs.) : 10.6
PERCENT VOLATILES BY VOLUME: 45
SOLUBILITY IN WATER: Very

SECTION III - HAZARDOUS COMPONENTS

TRADE NAME	CAS #	PERCENT BY VOLUME	OCCUPATIONAL EXPOSURE LIMITS OSHA PEL	ACGIH TLV
Crystalline Silica (quartz) (total dust)	14808-60-7	1-5 %	30 mg/m^3 %SiO2 +2	
(respirable dust)			10 mg/m^3 %SiO2 +2	0.1 mg/m^3
Ammonia	1336-21-6	< 0.1 %	50 ppm	25 ppm
Fibrous glass,continuous filament (total dust)	65997-17-3	1-5 %	15 mg/m^3	10 mg/m^3
(respirable dust)			5 mg/m^3	

* Indicates toxic chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372
Carcinogenicity of Silica: NTP: No IARC: Yes Z List: Yes OSHA Reg: Not as carcinogen
Appears on Table Z-3 for Mineral Dusts in 29 CFR § 1910.1000
IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans(vol 42,1987) concludes that there is sufficient evidence for the carcinogenicity of crystalline silica to experimental animals, and there is limited evidence for the carcinogenicity of crystalline silica to humans. IARC Class 2A.
Carcinogenicity of fibrous glass: NTP: No IARC: Yes Z List: No OSHA Reg: No
IARC categorized fibrous glass as not classifiable with respect to human carcinogenicity.

MATERIAL SAFETY DATA SHEET PRODUCT NAME: ThermoLag 330-1

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION
OSHA : Non-combustible
DOT : Non-combustible

FLASH POINT : None
TEST METHOD:

FLAMMABILITY LIMITS LEL: NA UEL: NA

EXTINGUISHING MEDIA :

SPECIAL FIRE FIGHTING PROCEDURES :Wet Product will not burn but will smoke and spatter if exposed to flames. Firefighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS : Sealed containers may rupture if overheated. Cool with water spray.

HAZARDOUS DECOMPOSITION PRODUCTS : Thermal oxidative decomposition can produce toxic gases, including oxides of nitrogen and carbon monoxide.

SECTION V - REACTIVITY DATA

STABILITY	UNSTABLE STABLE	 X	CONDITIONS TO AVOID: Not applicable

INCOMPATIBILITY (MATERIALS TO AVOID) : Strong Oxidizers, Strong Bases

HAZARDOUS POLYMERIZATION	MAY OCCUR WILL NOT OCCUR X	CONDITIONS TO AVOID : Not applicable

SECTION VI - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: See HAZARDOUS COMPONENTS list in Section III.

EFFECTS OF OVEREXPOSURE :
Eyes: Direct contact with product may result in eye irritation.
Skin: Prolonged or repeated contact with product may cause skin irritation.
Breathing: Excessive inhalation can cause irritation of the mucous membranes of the nose, throat and respiratory tract, headache and nausea.
Swallowing:

FIRST AID PROCEDURES :
If in Eyes: Flush with flowing water immediately and continously for 15minutes. Consult medical personnel.
If on Skin: Thoroughly wash exposed area with soap and water. Remove and wash contaminated clothing before reuse. Destroy contaminated shoes. Consult medical personnel if swelling or reddening occurs.
If Swallowed: If conscious, give two glasses of water to drink. Get immediate medical attention.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED : Keep unnecessary people away. Contain spill with inert material (sand, earth, ect) and transfer the material to containers for recovery or disposal. Keep spill out of sewers and open bodies of water. Floors may be slippery, care should be exercized to avoid falls.

WASTE DISPOSAL METHOD : Burn in adaquate incinerator or bury in an approved landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION TYPE : Mechanical local exhaust at point of mist release is preferred.

RESPIRATORY PROTECTION : None required if good ventilation is maintained. Otherwise wear MSHA/NIOSH approved respirator suitable for vapor, mist or dust concentrations encountered.

PROTECTIVE GLOVES : Impervious, cotton lined rubber EYE PROTECTION : Safety glasses.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE : Use only with adaquate ventilation. Prevent prolonged breathing of vapor or mist. Prevent contact with eyes. Do not take internally. Keep out of the reach of children.

STORAGE TEMP. MAX 100 F MIN 32 F

OTHER PRECAUTIONS :

NUCLEAR ENERGY INSTITUTE

August 23, 1994

Ms. Connie Humphry
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Dear Connie:

This letter authorizes Omega Point to release up to twelve containers of trowel grade Thermo-Lag 330 material from NEI stock (batch number 93-11049) to Mark Salley of TVA, in exchange for an equal number of containers of trowel grade material from TVA stock to be delivered later this week.

Please contact me if you have any questions.

Sincerely,

Biff Bradley
Senior Project Manager

REB/

1776 I STREET, NW SUITE 400 WASHINGTON, DC 20006-3708 PHONE 202.739.8000 FAX 202.785.4019

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TUA
CLIENT/PROJECT NUMBER 11960-97185-87, 97258 thru 97260, 97332 thru 97338
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1421 - 11960
DATE RECEIVED 8-25-94
DATE INSPECTED 8-25-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Temperature Records	NA	0	1	0	Chart # 71 #40	Y	X	Good	None	X			Receiving Verification only
Thermo Lag 330-1 trowel grade	NA	0	15	0	94-05093	Y	Y	Good	None	X			
" "	NA	0	45	0	94-08008	Y	Y	Good	None	X			
Thermo Lag 330-1 Ribbed Panel	NA	0	1	0	158400 F94-02012	Y	X	Good	None	X			
" "	NA	0	1	0	158400 F94-03028	X	Y	Good	None	X			
" "	NA	0	4	0	158400 F94-03047	Y	Y	Good	None	X			
" "	NA	0	7	0	158400 F94-04005	Y	Y	Good	None	X			
" "	NA	0	16	0	158400 F94-07014	Y	Y	Good	None	X			
" "	NA	0	1	0	158400 F94-07023	Y	Y	Good	None	X			
4" Thermo Lag 330-1 Preshaped Conduit	NA	0	1	0	158400 F92-08038	X	Y	Good	None	X			
4" Thermo Lag Preshaped Conduit	NA	0	1	0	158400 F92-10031	Y	Y	Good	None	X			
" "	NA	0	4	0	158400 F94-06051	Y	Y	Good	None	X			
" "	NA	0	8	0	158400 F94-06082	Y	Y	Good	None	X			
" "	NA	0	15	0	158400 F94-07003	Y	Y	Good	None	X			
1" Thermo Lag 330-1 Preshaped Conduit	NA	0	7	0	238100 F94-07023								
" "	NA	0	3	0	238100 F94-08003								

FORM
1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960 97185-87 & 97332-38 97258-60
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1421 - 11960
DATE RECEIVED 8-25-94
DATE INSPECTED 8-25-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
3/4" Thermo Lag 330-1 Preshaped conduit	NA	0	4	0	158340 F94-02053	Y	Y	Good	None	X			Receiving Verification Only
" "	NA	0	6	0	158340 F94-03047	Y	Y	Good	None	X			
" "	NA	0	10	0	238340 F94-07014	Y	Y	Good	None	X			
1" Thermo Lag 330-1 Preshaped Conduit	NA	0	1	0	158100 F92-11009	X	Y	Good	None	X			
" "		0	5	0	158100 F93-09045	Y	Y	Good	None	X			
" "		0	3	0	158100 F93-09047	Y	Y	Good	None	X			
" "		0	1	0	158100 F94-06051	X	X	Good	None	X			
Stress Skin type 304	NA	0	1	0	TYPE 304 8x8 0.017dia	Y	Y	Good	None	X			

FORM
1/29/93

THIS SHIPPING ORDER

must be legibly filled in, in Ink, in Indelible Pencil, or by Permanent Carbonless Impression, and retained by the Agent.

434

:EIVE, subject to the classifications and tariffs in effect on the date of the issue of this Shipping Order,

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment. Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

or THERMAL SCIENCE, INC. TVA CONTRACT NO. TV92363V
t ST. LOUIS, MISSOURI 63026

8/18 19 94 Shipper's No. 21398

arrier DYNAMIC TRANSIT PREPAID Agent's No.

(Mail or street address of consignee—For purposes of notification only.)

onsigned to TENNESSEE VALLEY AUTHORITY c/o OMEGA POINT LABORATORIES

estination 16015 SHADY FALLS ROAD State of County of

oute ELMENDORFF, TX 78112

elivering Carrier Vehicle or Car Initial No.

No Packages	HM	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS	* Weight (Subject to Correction)	Class or Rate	Check Column
2		PALLETS CONTAINING: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE TVA PART NO. TG-330 60 x 50 LB. PAILS STORE ABOVE 32F AT ALL TIMES 1 x 5 Gal. Pail Containing Temp. Recorder	3250 LBS.		
3		PALLETS CONTAINING: THERMO LAG PREFABRICATED PANELS TVA PART NO. 1584X6 30 PANELS 5/8" NOMINAL 4' x 6'	3500 LBS.		
2		PALLETS CONTAINING: ✓ 8 CARTONS: TVA PART NO. 158400 29 PIECES 4"	200 LBS.		
		✓ 1 CARTON: TVA PART NO. 238340 10 PIECES 3/4"	90 LBS.		
		✓ 1 CARTON: TVA PART NO. 158340 10 PIECES 3/4"	90 LBS.		
		✓ 1 CARTON: TVA PART NO. 158100 10 PIECES 1"	80 LBS.		
		✓ 1 CARTON: TVA PART NO. 238100 10 PIECES 1"	90 LBS.		
		[redacted]	[redacted]		
		✓ 1 CARTON: STRESS SKIN ASTM E437 Type 304 ss-plain weave 8x8 square mesh wire cloth	50 LBS.		

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

Per
(Signature of Consignor)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per
(The signature here acknowledges only the amount prepaid.)

Charges Advanced:
$

The fibre boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Rule 41, of the Consolidated Freight Classification.

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.
If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."
Shipper's imprint in lieu of stamp; not a part of Bill of Lading approved by the Department of Transportation.
NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed of declared value of the property is hereby specifically stated by the shipper to be not exceeding

HIS NT IS CORRECTLY DESCRIBED.
CORRECT WEIGHT IS LBS.

"This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation." NOTE: Preprinted certificates complying with 49 CFR 173, 430 (3) in effect on June 30, 1976, may be used through June 30, 1979.

Per Shipper

C. O. D. SHIPMENT
C. O. D. Amt
Collection Fee
Total Charges

THERMAL SCIENCE, INC.

Shipper, Per

Agent must detach and retain this Shipping Order and must sign the Original Bill of Lading.

ermanent post office address of shipper 2200 Cassens Dr., St. Louis, MO 63026

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT NO. TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES 7 PALLETS GROSS WEIGHT 7350 LBS.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE	750 LBS. (15 x 50 LB. PAILS)	94-05093
EXP. DATE: FEBRUARY 1995 1 x 5 Gallon pail containing Temperature Recorder	2250 LBS. (45 x 50 LB. PAILS)	94-08008
SHELF LIFE SIX MONTHS FROM DATE OF SHIPMENT	3000 LBS. (60 x 50 LB. PAILS)	

STORE ABOVE 32F AND BELOW
100F AT ALL TIMES

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

430

21398

CERTIFICATE OF ANALYSIS

CUSTOMER

TENNESSEE VALLEY AUTHORITY
% OMEGA POINT LABORATORY
16015 SHADY FALLS RD.
ELMENDORF, TEXAS 78112

DATE OF SHIPMENT 18 AUGUST 1994
PURCHASE ORDER NO: TESTING/
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-05093	750 LB. (15 x 50 LB. PAILS	A-2	WT/GALLON	10.16	10.5 ± 1.5
		A-3	pH	8.5	8 +

EXP. DATE: FEB. 1995

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: David O Bryant DATE: 18 AUGUST 1994 PAGE NO. 1

21398

CERTIFICATE OF ANALYSIS

CUSTOMER

TENNESSEE VALLEY AUTHORITY
%OMEGA POINT LABORATORY
16015 SHADY FALLS RD.
ELMENDORF, TEXAS 78112

DATE OF SHIPMENT 18 AUGUST 1994
PURCHASE ORDER NO: TESTING/
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-08008	2250 LB. (45 x 50 LB. PAILS)	A-2	WT/GALLON	10.01	10.5 ± 1.5
		A-3	pH	8.31	8 +

EXP. DATE: FEB. 1995

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: Harold O'Bryant DATE: 18 AUGUST 1994 PAGE NO. 1

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 1584X6	1	F94-02012
THERMO LAG RIBBED PANEL	1	F94-03028
NOMINAL 5/8"	4	F94-03047
4' x 6½'	7	F94-04005
	16	F94-07014
	1	F94-07023
	30 PANELS (ON 3 PALLETS)	

NO SHELF LIFE ON PANELS

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 158400	1 PIECE	F92-08038
THERMO LAG PRESHAPED	1 PIECE	F92-10031
CONDUIT SECTIONS	4 PIECES	F94-06051
THICKNESS: 0.625" ± 0.125" NOMINAL	8 PIECES	F94-06082
SIZE: 4"	15 PIECES	F94-07003
	29 PIECES (IN 2 CARTONS)	

NO SHELF LIFE ON CONDUIT

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 238100 THERMO LAG PRESHAPED CONDUIT SECTIONS THICKNESS: 0.375" ± 0.125" NOMINAL SIZE: 1"	7 PIECES 3 PIECES 10 PIECES (IN 1 CARTON)	F94-07023 F94-08003

NO SHELF LIFE ON CONDUIT

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 158340 THERMO LAG PRESHAPED CONDUIT SECTIONS THICKNESS: 0.625" ± 0.125" NOMINAL SIZE: 3/4"	4 PIECES 6 PIECES 10 PIECES (IN 1 CARTON)	F94-02053 F94-03047

NO SHELF LIFE ON CONDUIT

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 238340 THERMO LAG PRESHAPED CONDUIT SECTIONS THICKNESS: 0.375" ± 0.125" NOMINAL SIZE: 3/4"	10 PIECES (IN 1 CARTON)	F94-07014

NO SHELF LIFE ON CONDUIT

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
TVA PART NO. 158100	1 PIECE	F92-11009
THERMO LAG PRESHAPED CONDUIT	5 PIECES	F93-09045
SECTIONS	3 PIECES	F93-09047
THICKNESS: 0.625" ± 0.125" NOMINAL	1 PIECES	F94-06051
SIZE: 1"	10 PIECES (IN 1 CARTON)	

NO SHELF LIFE ON CONDUIT

This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. TVA CONTRACT #TV92362V DATE: 18 AUGUST 1994

TEMPERATURE RECORDER 40 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
STRESS SKIN-ASTM E437 Type 304 stainless steel, plain weave 8x8 square mesh wire cloth 0.017 dia. wire	50 LBS. (IN 1 CARTON)	N/A

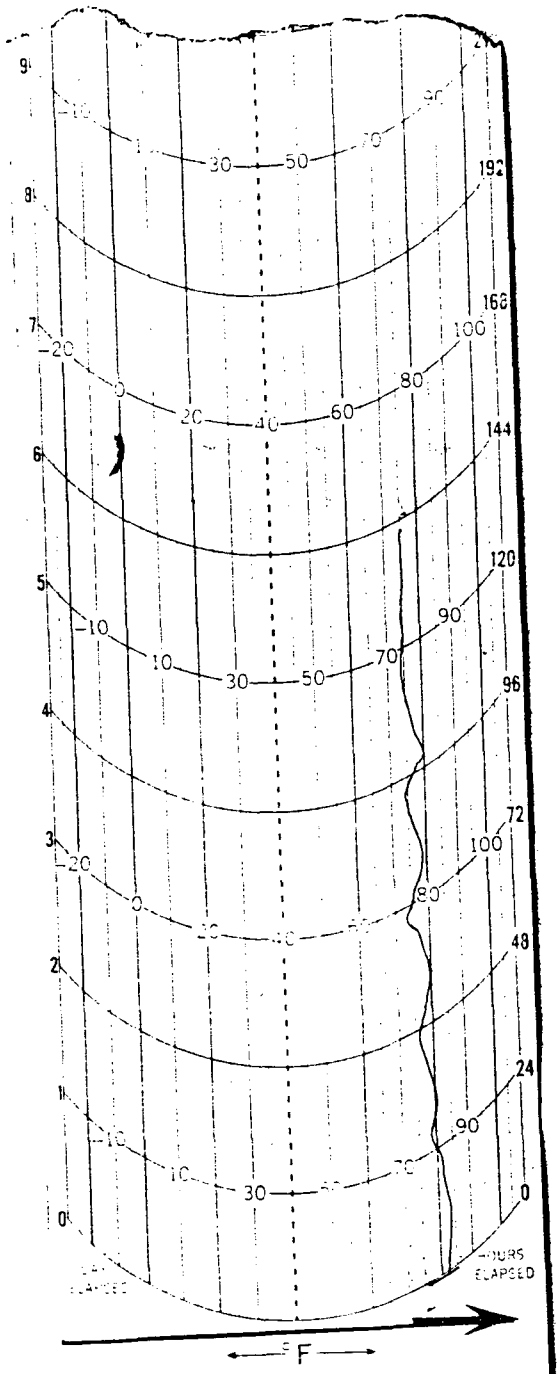
This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER QUALITY CONTROL

DATE: 18 AUGUST 1994
BILL OF LADING: 21398
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207



CAR NO.:
CITY: San Antonio, TX
CONSIGNEE: IVA/C/o Omega Point
CAR CONT.:
PER:
CITY: St. Louis
SHIPPER: TSI
DATE: 5/18/94 TIME: 9:50
INSTR. No.:

CHART 71

N DATA

AD CARTRIDGE - ADVANCE CHART

32 DAY (–30° + 110° F)

PART NO. 840-95

PARTLOW THERMA-GARD

NEW HARTFORD, N.Y. 13413

START

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1439 . 11960
DATE RECEIVED 9-26-94
DATE INSPECTED 9-26-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Thermo-Lag panel 1"X4'X6½'	NA	0	1	0	F94-08003	Y	N	Good	None	X			Thermo-Lag 330-1 trowel grade update 3/95
" "	NA	0	20	0	F94-08021	Y	Y	Good	None	X			
" "	NA	0	1	0	F94-08022	Y	Y	Good	None	X			
Thermo-Lag 770-1 Panels 3/8"X40"X94"	NA	0	11	0	F94-08026	Y	Y	Good	None	X			
" "	NA	0	19	0	F94-08030	Y	Y	Good	None	X			
Thermo-Lag, Panel 5/8"X4'X6½'	NA	0	1	0	F94-08003	Y	Y	Good	None	X			
" "	NA	0	2	0	F94-08022	Y	Y	Good	None	X			
" "	NA	0	14	0	F94-08044	Y	Y	Good	None	X			
Stainless steel Banding ½"X0.20"X200'	NA	0	8 Rolls	0	NA	Y	Y	Good	None	X			
Stainless Steel Clips ½"	NA	0	1K	0	NA	Y	Y	Good	None	X			
Stainless Steel tie wire 16 gauge	NA	0	1 Roll	0	NA	Y	Y	Good	None	X			
Stress Skin ASTM E437. 8X8 sq. mesh 0.017 dia	NA	0	1 Roll	0	NA	Y	Y	Good	None	X			
Thermo-Lag preshaped Conduit 5"	NA	0	5	0	F94-08003	Y	Y	Good	None	X			
" "	NA	0	11	0	F94-08021	Y	Y	Good	None	X			
Thermo-Lag 330-1 Trowel grade	NA	0	10	0	94-08008	Y	Y	Good	None	X			
Temp recorder	NA	0	1	0	#41	Y	Y	Good	None	X			

FORM
1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TUA
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1439 - 11960
DATE RECEIVED 9-26-94
DATE INSPECTED 9-26-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	CONTD MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Thermo-Lag 770-1 trowel grade	NA	0	20	0	94-09009	Y	Y	GOOD	None	X			Thermo-Lag 770-1 trowel grade expires 3/95

FORM
1/29/93

STRAIGHT BILL OF LADING — SHORT FORM — ORIGINAL — NOT NEGOTIABLE

448

ECEIVED, subject to the classifications and tariffs in effect on the date of issue of this Original Bill of Lading,

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry ~~to its usual place~~ of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment. Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Fr[illegible] **THERMAL SCIENCE, INC.**
At **ST. LOUIS, MISSOURI 63026**

CONTRACT ORDER NO. TV92362V
9/23 19 94 Shipper's No. 21467

Carrier DYNAMIC TRANSIT PREPAID Agent's No.

Consigned to OMEGA POINT LABORATORIES c/o TVA CONTACT NO. TV92362V
(Mail or street address of consignee—For purposes of notification only.)

Destination 16015 SHADY FALLS State of County of

Route ELMENDORFF, TX 78112

Delivering Carrier Vehicle or Car Initial No.

No. Packages	HM	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS	*Weight (Sub. to Correction)	Class or Rate	Check Column
3		PALLETS CONTAINING: THERMO LAG PANELS 22 PANELS NOMINAL 1" 4' x 6½' ITEM 01	4400#		
2		PALLETS CONTAINING: THERMO LAG PANELS 17 PANELS NOMINAL 5/8" 4'x6½' ITEM 02	1700#		
2		CARTONS CONTAINING: THERMO LAG PRESHAPED CONDUIT 16 PCS. 1.250" + 0.250" SIZE: 5" ITEM 03	200#		
2		PALLETS CONTAINING: THERMO LAG 770-1 PANELS 30 PANELS 3/8" NOM. 40"x94" NOM. ITEM 04	2250#		
		PALLETS CONTAINING: THERMO LAG 330-1 COATING-TROWEL GRADE 10 x 50 LB. PAILS ITEM 05 STORE ABOVE 32f AND BELOW 100F AT ALL TIMES	550#		
		PALLETS CONTAINING: THERMO LAG 770-1 COATING-TROWEL GRADE 20 x 50 LB. PAILS ITEM 06 STORE ABOVE 32f AND BELOW 100f AT ALL TIMES	1100#		
		STAINLESS STEEL BANDING ITEM 07 1/2" x 0.20" x 200 ft. 8 ROLLS	80#		
		STAINLESS STEEL CLIPS ½" ITEM 08 1000 clips (1 box)	10#		
		STAINLESS STEEL TIE WIRE ITEM 09 16 gauge 1 ROLL	10#		
		STRESS SKIN-ASTM E437 type 304 ITEM 10 stainless steel, plain weave 8 x 8 sq. mesh wire cloth 0.017 dia. wire 1 ROLL	25#		

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

Per
(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per
(The signature here acknowledges only the amount prepaid.)

Charges Advanced:
$

C. O. D. SHIPMENT
C. O. D. Amt.
Collection Fee
Total Charges

The fibre boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Rule 41, of the Consolidated Freight Classification.

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.
If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."
Shipper's imprint in lieu of stamp; not a part of Bill of Lading approved by the Department of Transportation.
NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed of declared value of the property is hereby specifically stated by the shipper to be not exceeding

HIS[illegible]ENT IS CORRECTLY DESCRIBED.
CORRECT WEIGHT IS LBS.

"This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation." NOTE: Preprinted certificates complying with 49 CFR 173, 430 (a) in effect on June 30, 1976, may be used through June 30, 1979.

Per Shipper

THERMAL SCIENCE, INC. Shipper, Per Agent, Per

Permanent post office address of shipper **2200 Cassens Dr., St. Louis, MO 63026**

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES _____ GROSS WEIGHT 10,300 LBS.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓THERMO LAG RIBBED PANEL NOMINAL 1 " 4' x 6½'	1 PANEL	F94-08003
	20 PANELS	F94-08021
	1 PANEL	F94-08022
	22 PANELS (on 3 pallets)	

ITEM 01

NO SHELF LIFE ON PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓ THERMO-LAG 770-1 PANELS 3/8" NOMINAL 40" x 94" NOMINAL	11 PANELS 19 PANELS 30 PANELS (on 2 pallets)	F94-08026 F94-08030

ITEM 04

NO SHELF LIFE ON PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG RIBBED PANEL NOMINAL 5/8" 4' x 6½' NOMINAL	1 PANEL 2 PANELS 14 PANELS	F94-08003 F94-08022 F94-08044
	17 PANELS (on 2 pallets)	
ITEM 02		

NO SHELF LIFE FOR PANELS

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓Stainless Steel Banding 1/2" x 0.20" x 200 ft. ITEM 07	8 ROLLS	N/A
✓Stainless steel clips 1/2" ITEM 08	1 BOX (1000 clips)	N/A
✓Stainless steel tie wire 16 gauge ITEM 09	1 ROLL	N/A

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓STRESS SKIN-ASTM E437 type 304 stainless steel, plain weave 8 x 8 square mesh wire cloth 0.017 dia. wire, or equal.	1 ROLL	N/A

ITEM 10

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓THERMO-LAG Preshaped Conduit Sections Thickness: 1.250" ± 0.250" Size: 5"	5 PIECES 11 PIECES 16 PIECES (in 2 cartons)	F94-08003 F94-08021

Item 03

NO SHELF LIFE ON CONDUIT

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE	500 LBS. (10 x 50 Lb. Pails)	94-08008

ITEM 05

EXP. DATE: MARCH 1995

✓1 x 5 Gal. Pail containing
Temperature recorder

SHELF LIFE SIX MONTHS
FROM DATE OF SHIPMENT

STORE ABOVE 32F AND BELOW 100F
AT ALL TIMES

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

CERTIFICATE OF ANALYSIS

CUSTOMER

OMEGA POINT LABORATORY
%TENNESSEE VALLEY AUTHORITY
16015 SHADY FALLS RD
ELMENDORFF, TX 78112

DATE OF SHIPMENT: 23 SEPTEMBER 1994
PURCHASE ORDER NO: CONTRACT #TV 92362V
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-08008	500 LBS. (10 x 50 Lb. Pails)	A-2	WT/GALLON	10.16	10.5 ± 1.5
		A-3	pH	8.5	8 +

EXPIRATION DATE:

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: David O Bryant DATE: 23 Sept 1994

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 23 SEPTEMBER 1994

TEMPERATURE RECORDER 41 CHART TAPE NO. 71

TOTAL NO. OF PACKAGES See Page 1 GROSS WEIGHT See Page 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
✓THERMO LAG 770-1 COATING TROWEL GRADE ITEM 06 EXP. DATE: MARCH 1995 1 x 5 Gal. Pail containing Temperature Recorder SHELF LIFE SIX MONTHS FROM DATE OF SHIPMENT STORE ABOVE 32F AND BELOW 100F AT ALL TIMES	1000 LBS. (20 x 50 Lb. Pails)	94-09009

This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

G. Furaus

G. Furaus
Quality Assurance Manager

DATE OF SHIPMENT: 23 September 1994
BILL OF LADING: 21467
MODE OF TRANPORT: Dynamic Transit Prepaid

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

CERTIFICATE OF ANALYSIS

CUSTOMER

OMEGA POINT LABORATORY
%TENNESSEE VALLEY AUTHORITY
16015 SHADY FALLS RD
ELMENDORFF, TX 78112

DATE OF SHIPMENT 23 SEPTEMBER 1994
PURCHASE ORDER NO: CONTRACT #TV 92362V
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

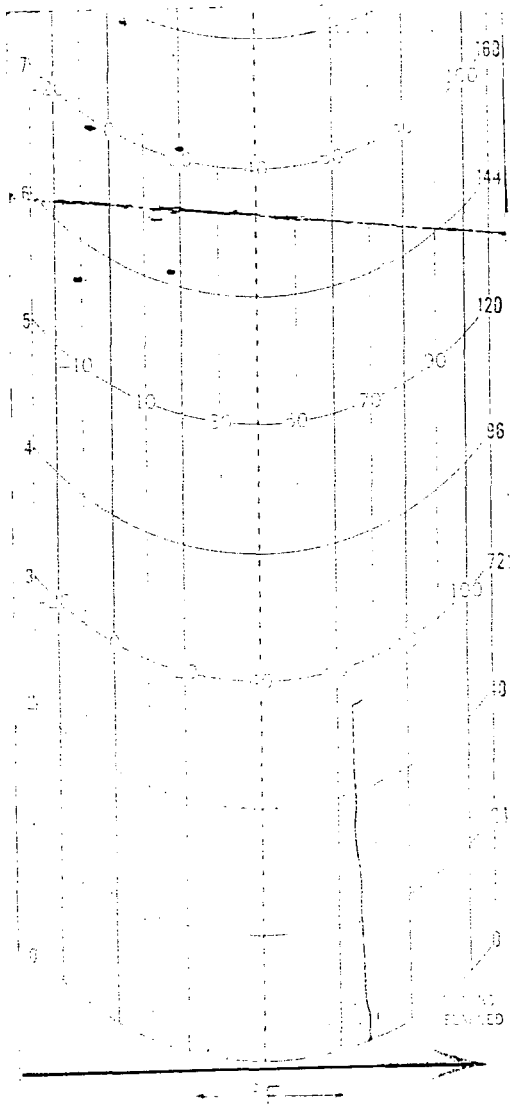
LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-09009	1000 LBS. (20 x 50 Lb. Pails)	A-2	WT/GALLON	10.16	10.5 ± 1.5
		A-3	pH	8.5	8 +

EXPIRATION DATE:

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: David O Bryant DATE: 23 Sept 1994



CER NO.
CITY San Antonio, Tx
CONSIGNEE TVA / Omega Pest
CAR CONT.
PER
CITY St. Louis
SHIPPER TSL
DATE 9-23-94 TIME 10:15 am
INSTR. NO.

CHART 71

ADVANCE CHART

90 DAY (-30° + 110° F)

PART NO. 840-95

PARTLOW THERMA-GARD

NEW HARTFORD, N.Y. 13413

START

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Thermo-Lag 770

DATE PRINTED: 9/24/92
DATE REVISED: 1/15/91
By A. Thorpe

THERMAL SCIENCE, INC.
2200 Cassens Dr.
Fenton , MO 63026

PHONE: (314) 349-1233
EMERGENCY PHONE: (314) 349-1267

HMIS HAZARD RATINGS

LEAST	0	HEALTH HAZARD	2
SLIGHT	1	FLAMMABILITY HAZARD	0
MODERATE	2	REACTIVITY HAZARD	0
HIGH	3	MAXIMUM PERSONAL	
EXTREME	4	PROTECTION	B

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME:	Thermo-Lag 770	D.O.T. HAZARD CLASS:	none
		D.O.T. Shipping Name:	Cold Water Paint
PRODUCT CLASS :	Latex Fire Resistive Coating	D.O.T. UN Number:	none

SECTION II - PHYSICAL DATA

APPEARANCE AND ODOR :Milky white, pasty mastic, no odor.

BOILING POINT (at 760 mm Hg) :	220-240 F	SPECIFIC GRAVITY (water = 1):	1.16
VAPOR PRESSURE (at 20°C or 68°F):	nil	WEIGHT PER GALLON (lbs.) :	9.7
EVAPORATION RATE (ether = 1) :	much slower	PERCENT VOLATILES BY VOLUME:	40
VAPOR DENSITY (air = 1) :	0.6	SOLUBILITY IN WATER:	Yes
Volatile Organic Content (VOC) :	0.18 lb/gal	pH	7–8

SECTION III - HAZARDOUS COMPONENTS

TRADE NAME	CAS #	PERCENT BY VOLUME	OCCUPATIONAL EXPOSURE LIMITS OSHA PEL	ACGIH TLV
Ethylene Glycol	107-21-1	1.2 %		50 ppm
* Vinyl Acetate	108-05-4	<0.15	10 ppm 20ppm STEL	10 ppm 20ppm SHORT
Fibrous glass,continuous filament (total dust) (respirable dust)	65997-17-3	2 %	 15 mg/m^3 5 mg/m^3	 10 mg/m^3

* Indicates toxic chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372
Carcinogenicity of fibrous glass: NTP: No IARC: Yes Z List: No OSHA Reg: No
IARC categorized fibrous glass as not classifiable with respect to human carcinogenicity.
Vinyl Acetate Monomer, a residual componet of this product, is a possible human cancer hazard based on tests with laboratory animals. Vinyl Acetate has not been identified as a carcinogen by NTP, IARC or OSHA. Total residual monomer does not exceed 0.15%.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION
OSHA : Non-combustible
DOT Non-combustible

FLASH POINT : None
TEST METHOD:

FLAMMABILITY LIMITS LEL: Not Applicable UEL: Not Applicable

EXTINGUISHING MEDIA : Non-flammable (aqueous emulsion).

SPECIAL FIRE FIGHTING PROCEDURES :Wet Product will not burn but will smoke and spatter if exposed to flames. Firefighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS : Sealed containers may rupture if overheated. Cool with water spray.

HAZARDOUS DECOMPOSITION PRODUCTS : Thermal oxidative decomposition can produce toxic gases, including oxides of nitrogen and carbon monoxide.

SECTION V - REACTIVITY DATA

STABILITY	UNSTABLE STABLE	 X	CONDITIONS TO AVOID: Not applicable

INCOMPATIBILITY (MATERIALS TO AVOID) : Strong Oxidizers, Strong Bases

HAZARDOUS POLYMERIZATION	MAY OCCUR WILL NOT OCCUR X	CONDITIONS TO AVOID : Not applicable

SECTION VI - HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE :
Eyes: Direct contact with product may result in eye irritation.
Skin: Prolonged or repeated contact with product may cause skin irritation.
Breathing: Excessive inhalation can cause irritation of the mucous membranes of the nose, throat and respiratory tract, headache and nausea.
Swallowing: Excessive exposure may cause central nervous system effects, cardio-pulmonary effects, and kidney failure.

FIRST AID PROCEDURES :
If in Eyes: Flush with flowing water immediately and continuously for 15 minutes. Consult medical personnel.
If on Skin: Thoroughly wash exposed area with soap and water. Remove and wash contaminated clothing before reuse. . Consult medical personnel if swelling or reddening occurs.
If Swallowed: If conscious, give two glasses of water to drink. Get immediate medical attention.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED : Keep unnecessary people away. Contain spill with inert material (sand, earth, etc.) and transfer the material to containers for recovery or disposal. Keep spill out of sewers and open bodies of water. Floors may be slippery, care should be exercised to avoid falls.

WASTE DISPOSAL METHOD : Burn in adequate incinerator or bury in an approved landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION TYPE : Mechanical local exhaust at point of mist release is preferred.

RESPIRATORY PROTECTION : None required if good ventilation is maintained. Otherwise wear MSHA/NIOSH approved respirator suitable for vapor, mist or dust concentrations encountered.

PROTECTIVE GLOVES: Impervious, cotton lined rubber EYE PROTECTION: Safety glasses.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE : Use only with adequate ventilation. Prevent prolonged breathing of vapor or mist. Prevent contact with eyes. Do not take internally. Keep out of the reach of children.

STORAGE TEMP. MAX 100 F MIN 32 F

OTHER PRECAUTIONS :

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Thermo-Lag 330-1

DATE PRINTED: 9/24/92
DATE REVISED: 7/7/89
By A. Thorpe

THERMAL SCIENCE, INC.
2200 Cassens Dr.
Fenton , MO 63026

PHONE: (314) 349-1233
EMERGENCY PHONE: (314) 349-1267

HMIS HAZARD RATINGS

LEAST	0	HEALTH HAZARD	2*
SLIGHT	1	FLAMMABILITY HAZARD	0
MODERATE	2	REACTIVITY HAZARD	0
HIGH	3	MAXIMUM PERSONAL	
EXTREME	4	PROTECTION	B

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: Thermo-Lag 330-1

PRODUCT CLASS : Latex Fire Resistive Coating

D.O.T. HAZARD CLASS: none
D.O.T. Shipping Name: Cold Water Paint
D.O.T. UN Number:

SECTION II - PHYSICAL DATA

APPEARANCE AND ODOR :Milky white pasty mastic, ammoniacal odor

BOILING POINT (at 760 mm Hg) :	220-240 F	SPECIFIC GRAVITY (water = 1):	1.3
VAPOR PRESSURE (at 20°C or 68°F):	nil	WEIGHT PER GALLON (lbs.) :	10.6
EVAPORATION RATE (ether = 1) :	much slower	PERCENT VOLATILES BY VOLUME:	45
VAPOR DENSITY (air = 1) :	0.6	SOLUBILITY IN WATER:	Very
Volatile Organic Content (VOC) :	< 0.1 lb/gal		

SECTION III - HAZARDOUS COMPONENTS

TRADE NAME	CAS #	PERCENT BY VOLUME	OCCUPATIONAL EXPOSURE LIMITS OSHA PEL	ACGIH TLV
Crystalline Silica (quartz) (total dust)	14808-60-7	1-5 %	30 mg/m^3 %SiO2 +2	
(respirable dust)			10 mg/m^3 %SiO2 +2	0.1 mg/m^3
Ammonia	1336-21-6	< 0.1 %	50 ppm	25 ppm
Fibrous glass,continuous filament (total dust)	65997-17-3	1-5 %	15 mg/m^3	10 mg/m^3
(respirable dust)			5 mg/m^3	

* Indicates toxic chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372
Carcinogenicity of Silica: NTP: No IARC: Yes Z List: Yes OSHA Reg: Not as carcinogen
Appears on Table Z-3 for Mineral Dusts in 29 CFR § 1910.1000
IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans(vol 42,1987) concludes that there is sufficient evidence for the carcinogenicity of crystalline silica to experimental animals, and there is limited evidence for the carcinogenicity of crystalline silica to humans. IARC Class 2A.
Carcinogenicity of fibrous glass: NTP: No IARC: Yes Z List: No OSHA Reg: No
IARC categorized fibrous glass as not classifiable with respect to human carcinogenicity.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION
OSHA : Non-combustible
DOT Non-combustible

FLASH POINT : None
TEST METHOD:

FLAMMABILITY LIMITS LEL: NA UEL: NA

EXTINGUISHING MEDIA : Non-flammable (aqueous emulsion).

SPECIAL FIRE FIGHTING PROCEDURES :Wet Product will not burn but will smoke and spatter if exposed to flames. Firefighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS : Sealed containers may rupture if overheated. Cool with water spray.

HAZARDOUS DECOMPOSITION PRODUCTS : Thermal oxidative decomposition can produce toxic gases, including oxides of nitrogen and carbon monoxide.

SECTION V - REACTIVITY DATA

STABILITY	UNSTABLE STABLE	X	CONDITIONS TO AVOID: Not applicable

INCOMPATIBILITY (MATERIALS TO AVOID) : Strong Oxidizers, Strong Bases

HAZARDOUS POLYMERIZATION	MAY OCCUR WILL NOT OCCUR X	CONDITIONS TO AVOID : Not applicable

SECTION VI - HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE :
Eyes: Direct contact with product may result in eye irritation.
Skin: Prolonged or repeated contact with product may cause skin irritation.
Breathing: Excessive inhalation can cause irritation of the mucous membranes of the nose, throat and respiratory tract, headache and nausea.
Swallowing: Excessive exposure may cause central nervous system effects, cardio-pulmonary effects, and kidney failure.

FIRST AID PROCEDURES :
If in Eyes: Flush with flowing water immediately and continuously for 15 minutes. Consult medical personnel.
If on Skin: Thoroughly wash exposed area with soap and water. Remove and wash contaminated clothing before reuse. Destroy contaminated shoes. Consult medical personnel if swelling or reddening occurs.
If Swallowed: If conscious, give two glasses of water to drink. Get immediate medical attention.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED : Keep unnecessary people away. Contain spill with inert material (sand, earth, etc.) and transfer the material to containers for recovery or disposal. Keep spill out of sewers and open bodies of water. Floors may be slippery, care should be exercised to avoid falls.

WASTE DISPOSAL METHOD : Burn in adequate incinerator or bury in an approved landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION TYPE : Mechanical local exhaust at point of mist release is preferred.

RESPIRATORY PROTECTION : None required if good ventilation is maintained. Otherwise wear MSHA/NIOSH approved respirator suitable for vapor, mist or dust concentrations encountered.

PROTECTIVE GLOVES: Impervious, cotton lined rubber EYE PROTECTION: Safety glasses.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE : Use only with adequate ventilation. Prevent prolonged breathing of vapor or mist. Prevent contact with eyes. Do not take internally. Keep out of the reach of children.

STORAGE TEMP. MAX 100 F MIN 32 F

OTHER PRECAUTIONS :

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1446.11960
DATE RECEIVED 10/11/94
DATE INSPECTED 10/11/94
INSPECTED BY: C Humphrey

ITEM NO.	ITEM DESCRIPTION	P.O. NO.	QUANTITY Ordered	QUANTITY Rec'd	QUANTITY B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS SEE	ACCEPTANCE Accept	ACCEPTANCE Hold	ACCEPTANCE Reject
1.	TEST ARTICLE 3 STEEL COLUMNS	N/A	0	3	0	SIZE 16" X 36"	N	N	GOOD	REMARKS NONE CH	X		
2.	TEST ARTICLE 1 STEEL COLUMN	N/A	0	1	0	SIZE 10" X 36"	N	N	"	"	X		
3.	TEST ARTICLE U SHAPE	N/A	0	1	0	CLADDED U-SHAPE	N	N	"	"	X		
4.	TEST ARTICLE CONDUIT 3"	N/A	0	1	0	3" X 10 FT CLADDED	N	N	"	"	X		
5.	TEST ARTICLE CONDUIT 1½"	N/A	0	1	0	1½" X 10 FT CLADDED	N	N	"	"	X		
6.	TEST ARTICLE 18" CABLE TRAY	N/A	0	1	0	18" X 12 FT. CLADDED	N	N	"	"	X		
7.	THERMO-LAG 1" 330-1 PANELS	N/A	0	7	0	lot NUMBERS F94-08021	Y	Y	"	NONE	X		
	"	N/A	0	1	0	F94-08022	Y	Y	"	"	X		
8.	THERMO-LAG 330-1 TROWEL GRADE	N/A	0	10	0	94-08008	Y	Y	"	"	X		
9.	THERMO-LAG 770-1 TROWEL GRADE	N/A	0	20	0	94-09009	Y	Y	"	"	X		
10.	TEMPERATURE CHART RECORDER	N/A	0	1	0	CHART #27	N	N	"	RETURNED TO TSI	X		
11.	1" THERMO-LAG 330 CONDUIT SECTIONS	N/A	0	3	0	lot No. F92-06031	Y	Y	"	NONE	X		
	"	N/A	0	6	0	F93-06008	Y	Y	"	"	X		
	"	N/A	0	3	0	F93-06046	Y	Y	"	"	X		
	"	N/A	0	4	0	F93-09045	Y	Y	"	"	X		
	"	N/A	0	1	0	F93-09069	Y	Y	"	"	X		

REMARKS: TEST ARTICLES (ITEMS 1-6) REC'D WITH THIS SHPMT, BUT ARE NOT PART OF PROJECTS #97553 THRU #97555, RECEIVING VERIFICATION ONLY. C4

FORM 1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1446.11960
DATE RECEIVED 10/11/94
DATE INSPECTED 10/11/94
INSPECTED BY: C. Humphrey

ITEM NO.	ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
11.	1" THERMO-LAG 330 CONDUIT SECTIONS	N/A	0	7	0	lot No. F94-08021	Y	Y	GOOD	NONE	X			CHART RECORDER RETURNED TO TSI. TEMPERATURES RECORDED ARE WITHIN ACCEPTABLE RANGE. RECEIVING VERIFICATION ONLY. CH
12.	2" THERMO-LAG 330 CONDUIT SECTIONS	N/A	0	3	0	F94-08021	Y	Y	"	"	X			
	"	N/A	0	13	0	F94-08022	Y	Y	"	"	X			
13.	THERMO-LAG HIGH TEMP FABRIC	N/A	0	1	0	440-75 42" X 60YD.	Y	Y	"	"	X			

FORM
1/29/93

STRAIGHT BILL OF LADING — SHORT FORM — ORIGINAL — NOT NEGOTIABLE

468

RECEIVED, subject to the classifications and tariffs in effect on the date of issue of this Original Bill of Lading,

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment. Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

From THERMAL SCIENCE, INC. TVA CONTRACT 92362V

At ST. LOUIS, MISSOURI 63026 10/7/94 19 Shipper's No. 21494

Carrier DYNAMIC TRUCK PREPAID Agent's No.

Consigned to TENNESSEE VALLEY AUTHORITY % OMEGA POINT LABORATORY
(Mail or street address of consignee—For purposes of notification only.)

Destination 16015 SHADY FALLS ROAD State of County of

Route

Delivering Carrier ELMENDORFF, TX 78112 Vehicle or Car Initial No.

No. Packages	HM	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS	*Weight (Sub. to Correction)	Class or Rate	Check Column
1		PALLET CONTAINING 3 COLUMNS 16 x 50 1 COLUMN 10 x 49 3 FT. LONG (ED TAYLOR)	800 Lb		
1		PALLET CONTAINING 3 INCH CONDUIT U SHAPE TEST ARTICLE	400 LB.		
1		PALLET CONTANING: 3 INCH CONDUIT 10 FT. STRAIGHT 1½ INCH CONDUIT 10 FT. STRAIGHT	100 LB		
1		PALLET CONTAINING: 18 INCH CABLE TRAY 12 FT	500 LB.		
		TVA ORDER/ 21494			
1		PALLET CONTAINING: 8 PANELS SIZE: 4' x 6½' NOMINAL THICKNESS: 1.25" + 0.250" ITEM 1	1800 LB.		
1		PALLET CONTANINING: 10 x 50 LB. PAILS THERMO LAG 330-1 SUBLIMING COATING ITEM 5 20 x 50 LB. PAILS THERMO LAG XXXX 770-1 COATING ITEM 6 1 x 5 gal. pail CONT. TEMP. RECORDER STORE ABOVE 32 F AND BELOW 100 F AT ALL TIMES	1750 LB.		
1		CARTONS OF THERMO LAG 330 PRESHAPED CONDUIT SIZE 1" x 250" 24 Pcs. (11)	125 lb.		
1		CARTON OF 2" x 1.250" 16 Pc. (12)	100 Lb.		
1		CARTON CONTAINING: 1 ROLL THERMO LAG 440-75 HI TEMP FABRIC SIZE: 42 INCH X 60 YDS. 30 LB.			

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

Per
(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

PPd

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per
(The signature here acknowledges only the amount prepaid.)

Charges Advanced:
$

C. O. D. SHIPMENT
C. O. D. Amt.
Collection Fee
Total Charges

The fibre boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Rule 41, of the Consolidated Freight Classification.

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.
If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."
Shipper's imprint in lieu of stamp; not a part of Bill of Lading approved by the Department of Transportation.
NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

THIS SHIPMENT IS CORRECTLY DESCRIBED.

CORRECT WEIGHT IS LBS.

"This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation." NOTE: Preprinted certificates complying with 49 CFR 173, 430 (a) in effect on June 30, 1978, may be used through June 30, 1979.

Per Shipper

THERMAL SCIENCE, INC.

Shipper, Per June Elizalde Agent, Per

Permanent post office address of shipper 2200 Cassens Dr., St. Louis, MO 63026

THERMAL SCIENCE INC.

PAGE 1 OF 1

PACKING LIST

SHIP TO:

OMEGA POINT LAB.
16015 SHADY FALLS RD
ELMENDORFF, TX 78112

P.O.# TEST ARTICLE
RELEASE NO:
DATE: 7 OCTOBER 1994
BILL OF LADING:
MODE: TRUCK LINE
CARRIER: DYNAMIC TRUCK PPD

TEMPERATURE RECORDER NO: NA
CHART TAPE NO: NA

TOTAL NO. OF PACKAGES: 3 PALLETS
GROSS WEIGHT: 1000 LBS

PRODUCT DESCRIPTION	NET QUANITY	BATCH LOT NUMBER	NUMBER OF ITEMS PER BATCH/LOT
TEST ARTICLES			
3 INCH CONDUIT U SHAPE (ON 1 PALLET	1	NA	1
3 INCH CONDUIT STRAIGHT 10 FT.	1	NA	1
1½ INCH CONDUIT STRAIGHT 10 FT. (ON 1 PALLET	1	NA	1
18 INCH CABLE TRAY 12 FT. (ON 1 PALLET	1	NA	1

Scott Pozanek
HEAD OF SHIPPING

THERMAL SCIENCE INC.

PAGE 2 OF 2

PACKING LIST

SHIP TO:

OMEGA POINT LAB.
16015 SHADY FALLS RD
ELMENDORFF, TX 78112

P.O.# TEST ARTICLE
RELEASE NO:
DATE: 7 OCTOBER 1994
BILL OF LADING:
MODE: TRUCK LINE
CARRIER: DYNAMIC TRUCK PPD

TEMPERATURE RECORDER NO: NA
CHART TAPE NO: NA

TOTAL NO. OF PACKAGES: 1 PALLET
GROSS WEIGHT: 800 LB. LBS

PRODUCT DESCRIPTION	NET QUANITY	BATCH LOT NUMBER	NUMBER OF ITEMS PER BATCH/LOT
COLUMNS 16 X 50	3	NA	3
10 X 49	1	NA	1
3 FOOT LONG/			
(ED TAYLOR)			

Scott Pozarek
HEAD OF SHIPPING

471

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 7 OCTOBER 1994

TEMPERATURE RECORDER 007763 CHART TAPE NO. 27

TOTAL NO. OF PACKAGES 5 PCS. GROSS WEIGHT 3805 LB.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330 PREFABRICATED PANELS SIZE: 4' x 6½' NOMINAL THICKNESS: 1.250" ± 0.250"	7 PANELS	F94-08021
	1	F94-08022
ITEM 1	8 PANELS (ON 1 PALLET)	

NO SHELF LIFE ON PANEL

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 7 OCTOBER 1994
BILL OF LADING: 21494
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 7 OCTOBER 1994

TEMPERATURE RECORDER SEE PAGE 1 CHART TAPE NO. SEE PAGE 1

TOTAL NO. OF PACKAGES SEE PAGE 1 GROSS WEIGHT SEE PAGE 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE ITEM 5 EXP. DATE: MARCH 1995 1 x 5 gal. pail containing temp. recorder SHELF LIFE SIX MONTHS FROM DATE OF SHIPMENT STORE ABOVE 32 F AND BELOW 100 F AT ALL TIMES	500 LB. (10 x 50 LB. PAILS)	94-08008

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 7 OCTOBER 1994
BILL OF LADING: 21494
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 7 OCTOBER 1994

TEMPERATURE RECORDER SEE PAGE 1 CHART TAPE NO. SEE PAGE 1

TOTAL NO. OF PACKAGES SEE PAGE 1 GROSS WEIGHT SEE PAGE 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 770-1 COATING	1000 LB.	94-09009
TROWEL GRADE	(20 x 50 LB. PAILS)	
ITEM 6		
EXP. DATE: MARCH 1995		
SHELF LIFE SIX MONTHS FROM DATE OF SHIPMENT		
STORE ABOVE 32 F AND BELOW 100 F AT ALL TIMES		

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 7 OCT. 1994
BILL OF LADING: 21494
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

474

21494

CERTIFICATE OF ANALYSIS

CUSTOMER

TENNESSEE VALLEY AUTHORITY
OMEGA POINT LABORATORY
16015 SHADY FALLS ROAD
ELMENDORFF, TX 78112

DATE OF SHIPMENT 7 OCTOBER 1994
PURCHASE ORDER NO: CONTRACT TV 92362V
RELEASE NO:
CUSTOMER PART NO:

PRODUCT DESCRIPTION: THERMO LAG 330-1 SUBLIMING COATING TROWEL GRADE

LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-08008	500 LB. (10 x 50 Lb. PAILS)	A-2	WT/GALLON	10.01	10.5 ± 1.5
		A-3	pH	8.31	8 +

EXP. DATE: MARCH 1995

ITEM 5

SHELF LIFE: SIX MONTHS FROM DATE OF SHIPMENT
STORE MATERIAL ABOVE 32°F AND BELOW 100°F AT ALL TIMES

THIS IS TO CERTIFY THAT THE ABOVE DESIGNATED MATERIAL HAS BEEN TESTED AND DID COMPLY WITH LISTED SPECIFICATIONS WHEN SUPPLIED. THE MATERIAL IS SUBJECT TO THE CONDITIONS LISTED ON TSI'S INVOICE. THE ABOVE IS A COPY OF INFORMATION ON FILE AND THE LOT ACCEPTANCE DATA IS AVAILABLE FOR EXAMINATION.

REVIEWED BY: David O Bryant DATE: 7 OCTOBER 1994 PAGE NO. 1

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 7 OCTOBER 1994

TEMPERATURE RECORDER SEE PAGE 1 CHART TAPE NO. SEE PAGE 1

TOTAL NO. OF PACKAGES SEE PAGE 1 GROSS WEIGHT SEE PAGE 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330 PRESHAPED CONDUIT SECTION	3 PCS.	F92-06031
	6	F93-06008
	3	F93-06046
SIZE: 1"	4	F93-09045
THICKNESS: 1.250" ± 0.250"	1	F93-09069
	7	F94-0802i
ITEM 11	24 PCS.	
NO SHELF LIFE ON CONDUIT	(IN 1 CARTON)	

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 7 OCTOBER 1994
BILL OF LADING: 21494
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 7 OCTOBER 1994

TEMPERATURE RECORDER SEE PAGE 1 CHART TAPE NO. SEE PAGE 1

TOTAL NO. OF PACKAGES SEE PAGE 1 GROSS WEIGHT SEE PAGE 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330 PRESHAPED CONDUIT SECTIONS	3 PIECES	F94-08021
	13	F94-08022
SIZE: 2" THICKNESS: 1.250" ± 0.250"	16 PCS. (IN 1 CARTON)	
NO SHELF LIFE ON CONDUIT		

ITEM 12

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 7 OCTOBER 1994
BILL OF LADING: 21494
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: 7 OCTOBER 1994

TEMPERATURE RECORDER SEE PAGE 1 CHART TAPE NO. SEE PAGE 1

TOTAL NO. OF PACKAGES SEE PAGE 1 GROSS WEIGHT SEE PAGE 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 440-75 HIGH TEMPERATURE FABRIC	1 ROLL	NA

SIZE: 42 INCH WIDE X 60 YDS.

ITEM 14

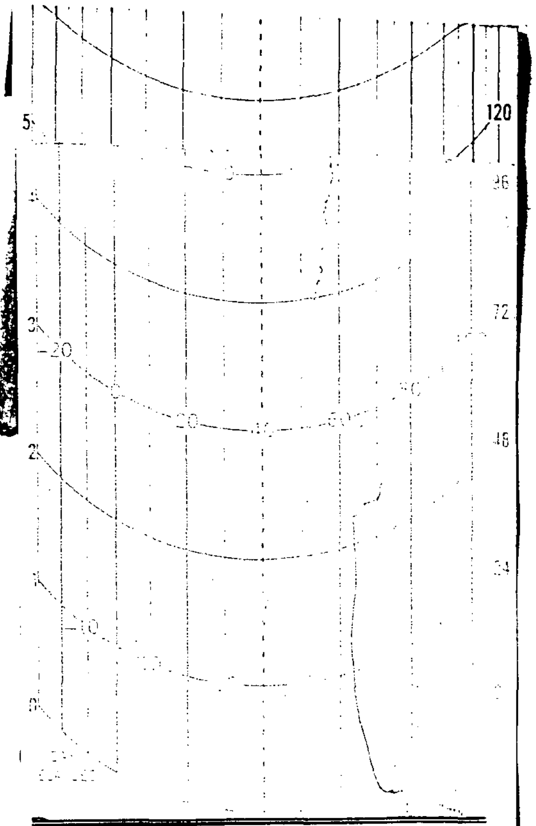
This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 7 OCTOBER 1994
BILL OF LADING: 21494
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207



CAR No. ______

CITY: San Antonio, TX.

CONSIGNEE: TVA - Omega-Bart

CAR CONT. ______

PER. ______

CITY: St. Louis

SHIPPER: TSI

DATE: 10-8-94 TIME: 8715

INSTR. No. ______

CHART 27

2. FILL IN DATA.

1. LOAD CARTRIDGE

32 DAY (-20° + 110° F)

PART NO. 640-95

PARTLOW THERMA-GARD

NEW HARTFORD, N.Y. 13413

START

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: ThermoLag 330-1

DATE PRINTED.: 8/24/89
DATE REVISED: 7/7/89
By A. Thorpe

THERMAL SCIENCE INC
2200 Cassens Dr
Fenton , MO 63026
PHONE: (314) 349-1233
EMERGENCY PHONE: (314) 349-1267

HMIS HAZARD RATINGS

LEAST	0	HEALTH HAZARD	2*
SLIGHT	1	FLAMMABILITY HAZARD	0
MODERATE	2	REACTIVITY HAZARD	0
HIGH	3	MAXIMUM PERSONAL	
EXTREME	4	PROTECTION	B

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: Thermolag 330-1

PRODUCT CLASS : Latex Fire Resistive Coating

D.O.T. HAZARD CLASS: none
D.O.T. Shipping Name: Cold Water Paint
D.O.T. UN Number:

SECTION II - PHYSICAL DATA

APPEARANCE AND ODOR :Milky white pasty mastic, ammoniacal odor

BOILING POINT (at 760 mm Hg) : 220-240 F
VAPOR PRESSURE (at 20C or 68F): nil
EVAPORATION RATE (ether = 1) much slower
VAPOR DENSITY (air = 1) : 0.6
Volatile Organic Content (VOC) : < 0.1 lb/gal

SPECIFIC GRAVITY (water = 1): 1.3
WEIGHT PER GALLON (lbs.) : 10.6
PERCENT VOLATILES BY VOLUME: 45
SOLUBILITY IN WATER: Very

SECTION III - HAZARDOUS COMPONENTS

TRADE NAME	CAS #	PERCENT BY VOLUME	OCCUPATIONAL EXPOSURE LIMITS OSHA PEL	ACGIH TLV
Crystalline Silica (quartz) (total dust)	14808-60-7	1-5 %	30 mg/m^3 %SiO2 +2	
(respirable dust)			10 mg/m^3 %SiO2 +2	0.1 mg/m^3
Ammonia	1336-21-6	< 0.1 %	50 ppm	25 ppm
Fibrous glass,continuous filament (total dust)	65997-17-3	1-5 %	15 mg/m^3	10 mg/m^3
(respirable dust)			5 mg/m^3	

* Indicates toxic chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372
Carcinogenicity of Silica: NTP: No IARC: Yes Z List: Yes OSHA Reg: Not as carcinogen
Appears on Table Z-3 for Mineral Dusts in 29 CFR § 1910.1000
IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans(vol 42,1987) concludes that there is sufficient evidence for the carcinogenicity of crystalline silica to experimental animals, and there is limited evidence for the carcinogenicity of crystalline silica to humans. IARC Class 2A.
Carcinogenicity of fibrous glass: NTP: No IARC: Yes Z List: No OSHA Reg: No
IARC categorized fibrous glass as not classifiable with respect to human carcinogenicity.

MATERIAL SAFETY DATA SHEET PRODUCT NAME: ThermoLag 330-1

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION
OSHA : Non-combustible
DOT : Non-combustible

FLASH POINT : None
TEST METHOD:

FLAMMABILITY LIMITS LEL: NA UEL: NA

EXTINGUISHING MEDIA :

SPECIAL FIRE FIGHTING PROCEDURES :Wet Product will not burn but will smoke and spatter if exposed to flames. Firefighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS : Sealed containers may rupture if overheated. Cool with water spray.

HAZARDOUS DECOMPOSITION PRODUCTS : Thermal oxidative decomposition can produce toxic gases, including oxides of nitrogen and carbon monoxide.

SECTION V - REACTIVITY DATA

STABILITY	UNSTABLE STABLE	 X	CONDITIONS TO AVOID: Not applicable

INCOMPATIBILITY (MATERIALS TO AVOID) : Strong Oxidizers, Strong Bases

HAZARDOUS POLYMERIZATION	MAY OCCUR WILL NOT OCCUR X	CONDITIONS TO AVOID : Not applicable

SECTION VI - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: See HAZARDOUS COMPONENTS list in Section III.

EFFECTS OF OVEREXPOSURE :
Eyes: Direct contact with product may result in eye irritation.
Skin: Prolonged or repeated contact with product may cause skin irritation.
Breathing: Excessive inhalation can cause irritation of the mucous membranes of the nose, throat and respiratory tract, headache and nausea.
Swallowing:

FIRST AID PROCEDURES :
If in Eyes: Flush with flowing water immediately and continously for 15minutes. Consult medical personnel.
If on Skin: Thoroughly wash exposed area with soap and water. Remove and wash contaminated clothing before reuse. Destroy contaminated shoes. Consult medical personnel if swelling or reddening occurs.
If Swallowed: If conscious, give two glasses of water to drink. Get immediate medical attention.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED : Keep unnecessary people away. Contain spill with inert material (sand, earth, ect) and transfer the material to containers for recovery or disposal. Keep spill out of sewers and open bodies of water. Floors may be slippery, care should be exercized to avoid falls.

WASTE DISPOSAL METHOD : Burn in adaquate incinerator or bury in an approved landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION TYPE : Mechanical local exhaust at point of mist release is preferred.

RESPIRATORY PROTECTION : None required if good ventilation is maintained. Otherwise wear MSHA/NIOSH approved respirator suitable for vapor, mist or dust concentrations encountered.

PROTECTIVE GLOVES : Impervious, cotton lined rubber EYE PROTECTION : Safety glasses.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE : Use only with adaquate ventilation. Prevent prolonged breathing of vapor or mist. Prevent contact with eyes. Do not take internally. Keep out of the reach of children.

STORAGE TEMP. MAX 100 F MIN 32 F

OTHER PRECAUTIONS :

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Thermo-Lag 770

DATE PRINTED: 9/24/92
DATE REVISED: 1/15/91
By A. Thorpe

THERMAL SCIENCE, INC.
2200 Cassens Dr.
Fenton , MO 63026

PHONE: (314) 349-1233
EMERGENCY PHONE: (314) 349-1267

HMIS HAZARD RATINGS

LEAST	0	HEALTH HAZARD	2
SLIGHT	1	FLAMMABILITY HAZARD	0
MODERATE	2	REACTIVITY HAZARD	0
HIGH	3	MAXIMUM PERSONAL	
EXTREME	4	PROTECTION	B

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME:	Thermo-Lag 770	D.O.T. HAZARD CLASS:	none
		D.O.T. Shipping Name:	Cold Water Paint
PRODUCT CLASS :	Latex Fire Resistive Coating	D.O.T. UN Number:	none

SECTION II - PHYSICAL DATA

APPEARANCE AND ODOR :Milky white, pasty mastic, no odor.

BOILING POINT (at 760 mm Hg) :	220-240 F	SPECIFIC GRAVITY (water = 1):	1.16
VAPOR PRESSURE (at 20°C or 68°F):	nil	WEIGHT PER GALLON (lbs.) :	9.7
EVAPORATION RATE (ether = 1) :	much slower	PERCENT VOLATILES BY VOLUME:	40
VAPOR DENSITY (air = 1) :	0.6	SOLUBILITY IN WATER:	Yes
Volatile Organic Content (VOC) :	0.18 lb/gal	pH	7–8

SECTION III - HAZARDOUS COMPONENTS

TRADE NAME	CAS #	PERCENT BY VOLUME	OCCUPATIONAL EXPOSURE LIMITS OSHA PEL	ACGIH TLV
Ethylene Glycol	107-21-1	1.2 %		50 ppm
* Vinyl Acetate	108-05-4	<0.15	10 ppm 20ppm STEL	10 ppm 20ppm SHORT
Fibrous glass,continuous filament (total dust) (respirable dust)	65997-17-3	2 %	 15 mg/m^3 5 mg/m^3	 10 mg/m^3

* Indicates toxic chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372
Carcinogenicity of fibrous glass: NTP: No IARC: Yes Z List: No OSHA Reg: No
IARC categorized fibrous glass as not classifiable with respect to human carcinogenicity.
Vinyl Acetate Monomer, a residual componet of this product, is a possible human cancer hazard based on tests with laboratory animals. Vinyl Acetate has not been identified as a carcinogen by NTP, IARC or OSHA. Total residual monomer does not exceed 0.15%.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION
OSHA : Non-combustible
DOT Non-combustible

FLASH POINT : None
TEST METHOD:

FLAMMABILITY LIMITS LEL: Not Applicable UEL: Not Applicable

EXTINGUISHING MEDIA : Non-flammable (aqueous emulsion).

SPECIAL FIRE FIGHTING PROCEDURES :Wet Product will not burn but will smoke and spatter if exposed to flames. Firefighters must use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS : Sealed containers may rupture if overheated. Cool with water spray.

HAZARDOUS DECOMPOSITION PRODUCTS : Thermal oxidative decomposition can produce toxic gases, including oxides of nitrogen and carbon monoxide.

SECTION V - REACTIVITY DATA

STABILITY	UNSTABLE STABLE	X	CONDITIONS TO AVOID: Not applicable

INCOMPATIBILITY (MATERIALS TO AVOID) : Strong Oxidizers, Strong Bases

HAZARDOUS POLYMERIZATION	MAY OCCUR WILL NOT OCCUR X	CONDITIONS TO AVOID : Not applicable

SECTION VI - HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE :
Eyes: Direct contact with product may result in eye irritation.
Skin: Prolonged or repeated contact with product may cause skin irritation.
Breathing: Excessive inhalation can cause irritation of the mucous membranes of the nose, throat and respiratory tract, headache and nausea.
Swallowing: Excessive exposure may cause central nervous system effects, cardio-pulmonary effects, and kidney failure.

FIRST AID PROCEDURES :
If in Eyes: Flush with flowing water immediately and continuously for 15 minutes. Consult medical personnel.
If on Skin: Thoroughly wash exposed area with soap and water. Remove and wash contaminated clothing before reuse. . Consult medical personnel if swelling or reddening occurs.
If Swallowed: If conscious, give two glasses of water to drink. Get immediate medical attention.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED : Keep unnecessary people away. Contain spill with inert material (sand, earth, etc.) and transfer the material to containers for recovery or disposal. Keep spill out of sewers and open bodies of water. Floors may be slippery, care should be exercised to avoid falls.

WASTE DISPOSAL METHOD : Burn in adequate incinerator or bury in an approved landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION TYPE : Mechanical local exhaust at point of mist release is preferred.

RESPIRATORY PROTECTION : None required if good ventilation is maintained. Otherwise wear MSHA/NIOSH approved respirator suitable for vapor, mist or dust concentrations encountered.

PROTECTIVE GLOVES: Impervious, cotton lined rubber EYE PROTECTION: Safety glasses.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE : Use only with adequate ventilation. Prevent prolonged breathing of vapor or mist. Prevent contact with eyes. Do not take internally. Keep out of the reach of children.

STORAGE TEMP. MAX 100 F MIN 32 F

OTHER PRECAUTIONS :

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97553-555
RECEIVED FROM TSI
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1448 . 11960
DATE RECEIVED 10-14-94
DATE INSPECTED 10-14-94
INSPECTED BY: Cleda Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Thermo Lag 770-1 Panels	NA	0	5	0	F94-08026	Y	Y	GOOD	None	X			Receiving verification only.
" "	"	0	40	0	F94-08030	Y	Y	GOOD	None	X			
" "	"	0	18	0	F94-09009	Y	Y	GOOD	None	X			
Thermo Lag Pre Shaped Conduit 4"	NA	0	8	0	F94-08021	Y	Y	GOOD	None	X			

FORM
1/29/93

THIS SHIPPING ORDER Impression, and retained by the Agent. 436

RECEIVE, subject to the classifications and tariffs in effect on the date of the issue of this Shipping Order,
the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment. Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

From **THERMAL SCIENCE, INC.** TVA CONTRACT [illegible]
A **ST. LOUIS, MISSOURI 63026** 10/12/ 19 94 Shipper's No. [illegible]
Carrier DYNAMIC TRUCK PREPAID Agent's No.

(Mail or street address of consignee—For purposes of notification only.)
Consigned to TENNESSEE VALLEY AUTHORITY % OMEGA POINT LAB
Destination 16015 SHADY FALLS RD State of County of
Route ELMENDORFF, TX 78112
Delivering Carrier Vehicle or Car Initial No.

No. Packages	HM	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS	*Weight (Sub. to Correction)	Class or Rate	Check Column
4		PALLETS CONTAINING:	4800 LB.		
		63 PANELS THERMO-LAG 770-1 panels			
		SIZE: 40 INCH X 94 INCH			
		THICKNESS: 3/8 INCH ITEM 4			
1		CARTON CONTAINING:			
		8 PCS. THERMO-LAG 330 PRESHAPED			
		CONDUIT SECTIONS			
		SIZE: 4 INCH			
		THICKNESS: 1.250" ± 0.250"			
		ITEM 13			
		DELIVER THURSDAY 10/13/94			
		SURE !!!!!!!			
		2			

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

Per ______
(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

Prepaid

Received $ ______ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier

Per ______
(The signature here acknowledges only the amount prepaid.)

Charges Advanced:
$ ______

†The fibre boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Rule 41, of the Consolidated Freight Classification.

†This is to certify that the above named articles are property classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.
*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."
†Shipper's imprint in lieu of stamp; not a part of Bill of Lading approved by the Department of Transportation.
NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed of declared value of the property is hereby specifically stated by the shipper to be not exceeding ______

C. O. D. SHIPMENT
C. O. D. Amt.
Collection Fee
Total Charges

THIS SHIPMENT IS CORRECTLY DESCRIBED.
CORRECT WEIGHT IS ______ LBS.

"This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation." NOTE: Preprinted certificates complying with 49 CFR 173, 430 (a) in effect on June 30, 1978, may be used through June 30, 1979.

Per [signature] Shipper

THERMAL SCIENCE, INC. Shipper, Per ______

Agent must detach and retain this Shipping Order and must sign the Original Bill of Lading.

Permanent post office address of shipper **2200 Cassens Dr., St. Louis, MO 63026**

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: OCTOBER 1994

TEMPERATURE RECORDER NA CHART TAPE NO. NA

TOTAL NO. OF PACKAGES 5 PIECES GROSS WEIGHT 5000 LB.

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 770-1 PANELS SIZE: 40 INCH X 94 INCH THICKNESS: 3/8 INCH	5 PANELS	F94-08026
	40	F94-08030
	18	F94-09009
	63 PANELS	

ITEM 4

NO SHELF LIFE ON PANEL

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 12 OCTOBER 1994
BILL OF LADING: 21499
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

TSI

PACKING LIST

AND

CERTIFICATE OF CONFORMANCE

PURCHASE ORDER NO. CONTRACT ORDER NO. TV92362V DATE: OCTOBER 1994

TEMPERATURE RECORDER NA CHART TAPE NO. NA

TOTAL NO. OF PACKAGES SEE PAGE 1 GROSS WEIGHT SEE PAGE 1

PRODUCT DESCRIPTION	QUANTITY	BATCH NUMBER
THERMO LAG 330 PRESHAPED CONDUIT SECTION	8 PCS.	F94-08021
SIZE: 4 INCH THICKNESS: 1.250" ± 0.250"	8 PCS. (IN 1 CARTON)	

ITEM 13

NO SHELF LIFE ON CONDUIT

This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 16015 Shady Falls Road, Elmendorff, TX 78112. This material does not contain asbestos.

David O'Bryant

DAVID O'BRYANT
MANAGER OF QUALITY CONTROL

DATE OF SHIPMENT: 12 OCTOBER 1994
BILL OF LADING: 21499
MODE OF TRANSPORT: DYNAMIC TRUCK PREPAID

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: 209901 (Answerback: TSI UR) • Telecopier (314) 349-1207

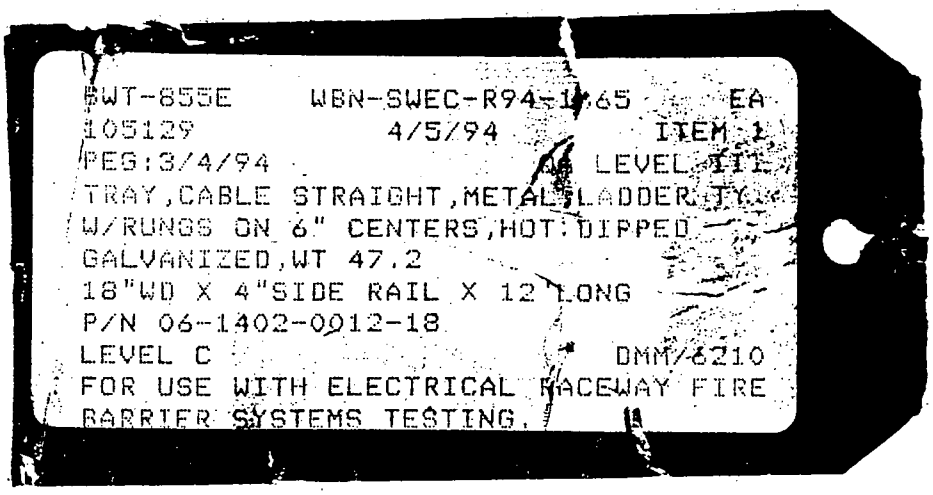
Q/A RECEIVING REPORT

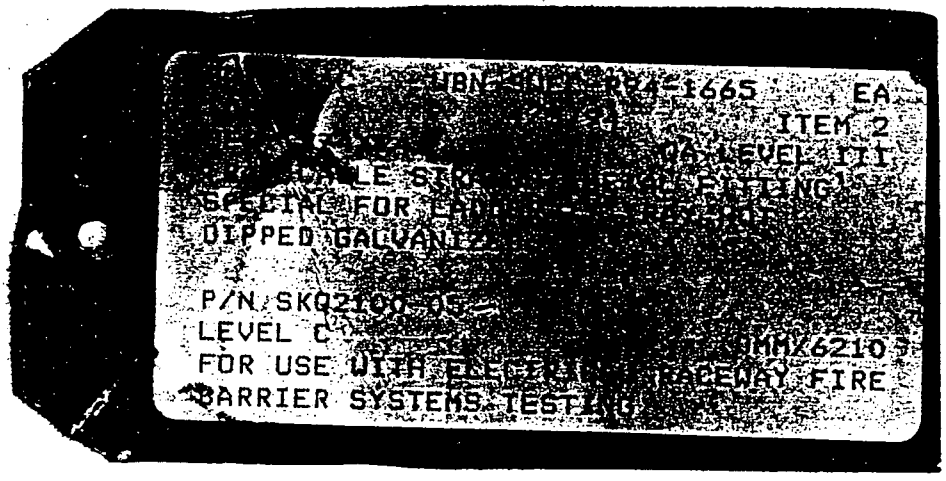
CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11210/TBD
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1384 - 11210
DATE RECEIVED 5-23-94
DATE INSPECTED 5-31-94
INSPECTED BY:

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
galv. Double Crosses	NA	0	6	0	SKQ2100-05	Y	N	Poor	None	X			Receiving Verification only; material was issued upon delivery, 6 pieces were damaged (4) double crosses and (2) ladders
galv. ladders	NA	0	5	0	06-1402-0012-18	Y	N	Poor	None	X			

FORM
1/29/93


SWT-855E WBN-SWEC-R94-1665 EA
105129 4/5/94 ITEM 1
PEG:3/4/94 QA LEVEL III
TRAY,CABLE STRAIGHT,METAL LADDER TY.
W/RUNGS ON 6" CENTERS,HOT DIPPED
GALVANIZED,WT 47.2
18"WD X 4"SIDE RAIL X 12'LONG
P/N 06-1402-0012-18
LEVEL C DMM/6210
FOR USE WITH ELECTRICAL RACEWAY FIRE
BARRIER SYSTEMS TESTING.


EA
ITEM 2
QA LEVEL III
DMM/6210

... SHADDY FALLS RD
ELMENDORF TX 78112
05916702

264/06 OVNT

FREIGHT BILL NUMBER 345 608 583

TENNESSEE VALLEY AUTHORITY 345 608
WATTS BAR NUCLEAR PLANT
SPRING CITY TN 37381
00994265

PO# NONE

20

OVERNITE PHONE NUMBER (210)662-0966

CITY RTE/BYD SCAC 2M

DEST SNT

PICK UP DATE 05/16/94

ORIG KNX

ADV CAR NONE

BL#

AD

OV 61.75

BD

Peggy

OVERNITE TRANSPORTATION COMPANY

345 608 583

COLLECT THIS AMOUNT $6

DRIVER COL

# PCS	HM	PT	DESCRIPTION OF ARTICLES AND SPECIAL MARKINGS	WEIGHT	NMFC	RATE	CHARGES
2		SK	2 HANDLING UNIT(S) CABLE TRAYS 58.00% DISCOUNT 80205	300	061220-02	49.01 LESS	147. 85.

OVERNITE

2 pcs Bent & Damage
Loose upon Del

2 TTL PCS

TTL WT 300

DELIVERY EXCEPTIONS

SIGNATURE	FIRM	ODOM	ARRIVE	DEPART	TOTAL CHARGES
[signature]	[signature]	009	9:16	9:45	61.75 C
		DATE 5-23-94	PCS 11 pcs	INITIALS ROW	

RECEIVED THE ABOVE PROPERTY IN GOOD CONDITION EXCEPT AS NOTED.

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185, 86687
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1396 - 11960
DATE RECEIVED 7-15-94
DATE INSPECTED 7-15-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
1" C-Clamps	NA	0	16	0	512	Y	N	Good	None	X			Receiving verification Only.
2" C-Clamps	NA	0	16	0	515	Y	N	good	None	X			
2.5" C-Clamps	NA	0	3	0	516	Y	N	good	None	X			
3" C-Clamps	NA	0	12	0	517	X	N	good	None	X			
4" C-Clamps	NA	0	53	0	519	Y	N	good	None	X			
5" C-Clamps	NA	0	3	0	520	X	N	good	None	X			
Junction Box	NA	0	2	0	A3L6043612LP	Y	N	good	None	X			
3/4" 90° Steel	NA	0	1	0	GAL34ELL	Y	N	good	None	X			
3/4" 90° Alum	NA	0	1	0	AL434ELL	X	N	good	None	X			
1" Cap	NA	0	2	0	PLG100R	Y	N	good	None	X			
2" Cap	NA	0	5	0	PLG200A	X	N	good	None	X			
3" Cap	NA	0	1	0	PLG300A	Y	N	good	None	X			
3/4" Alum Coupling	NA	0	2	0	NA	Y	N	good	None	X			
4" LB's (conduit outlets) w/covers & gaskets	NA	0	7	0	NA	Y	N	good	None	X			

FORM
1/29/93

TVA 144 (FD-5-70)

SHIPPING TICKET

No. 55694-00875

493

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR ATHENS, AL 35611 7/14 19 94

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER-MGR-M&PS-BFNP

SHIP TO
OMEGA POINT LAB
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112-9784

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1		CONDUIT, C-CLAMP, 1", #512		16	EA		
2		CONDUIT C-CLAMP, 2", #515		16	EA		
3		CONDUIT C-CLAMP, 2.5", #516		3	EA		
4		CONDUIT C-CLAMP, 3", #517		12	EA		
5		CONDUIT C-CLAMP, 4", #519		53	EA		
6		CONDUIT C-CLAMP, 5", 520		3	EA		
7		JUNCTION BOX, #A3L60H3612LP		2	EA		
8		ELBOW, 90 DEG, 3/4", STEEL, #GAL34ELL		1	EA		
9		ELBOW, 90 DEG, 3/4", ALUM, #ALU34ELL		1	EA		
10		ELBOW, 90 DEG, 4", STEEL, #GAL4ELL		7	EA		
11		CAP, 1", #PLG100R		2	EA		
12		CAP, 2", #PLG200A		5	EA		
		CAP, 3", #PLG300A		1	EA		
14		COUPLING, 3/4", ALUMINUM		2	EA		
15		CONDUIT OUTLET, 4"		7	EA		

QA-C

REF: 1023000

FOR THERMO-LAG FIRE TESTING

3 PALLETS @ 1056LB

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 7/14/19 94 G. B. L. No. TV N/A METHOD OF SHIPMENT FED EX

SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM

1677

COST
CARRIER'S CHARGE
DELIVERY CHARGES
TOTAL COST

MATERIAL RECEIVED 19
NAME OF CARRIER DTK
MATERIAL CHECKED IN BY
STORES LEDGER POSTED BY

4159M 0115008526

TRACKING NUMBER 0115008526

494

RECIPIENT'S COPY

1 Date 7-14-94

From (Your Name) Please Print: DANNY T. ROBINSON

Your Phone Number (Very Important): (205)729-4641

Company: TVA/BROWNS FERRY NUCLEAR PLT

Department/Floor No.:

Street Address: BROWNS FERRY ROAD

City: ATHENS

State: AL

ZIP Required: 35611

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice.)

2 To (Recipient's Name) Please Print:

Recipient's Phone Number (Very Important): ( )

Company: OMEGA POINT LAB

Department/Floor No.:

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.): 16015 SHADY FALLS ROAD

City: ELMENDORF

State: TX

ZIP Required: 78112-9784

3 PAYMENT
1 [X] Bill Sender 2 [ ] Bill Recipient's FedEx Acct. No. 3 [X] Bill 3rd Party FedEx Acct. No. 4 [ ] Bill Credit Card
5 [ ] Cash/Check

H IF HOLD AT FEDEX LOCATION, Print FEDEX Address Here
Street Address:
City: State: ZIP Required:

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business morning†)
11 [ ] OTHER PACKAGING
16 [ ] FEDEX LETTER*
12 [ ] FEDEX PAK*
13 [ ] FEDEX BOX
14 [ ] FEDEX TUBE

Standard Overnight (Delivery by next business afternoon. No Saturday delivery†)
51 [ ] OTHER PACKAGING
56 [ ] FEDEX LETTER*
52 [ ] FEDEX PAK*
53 [ ] FEDEX BOX
54 [ ] FEDEX TUBE

Economy Two-Day (Delivery by second business day †)
30 [ ] ECONOMY*
* Economy Letter Rate not available. Minimum charge: One pound Economy rate.

Government Overnight (Restricted for authorized users only)
46 [ ] GOVT LETTER
41 [ ] GOVT PACKAGE

Freight Service (for packages over 150 lbs.)
70 [ ] OVERNIGHT FREIGHT** (Confirmed reservation required)
80 [X] TWO-DAY FREIGHT**
† Delivery commitment may be later in some areas.
** Declared Value Limit $500. Call for delivery schedule.

5 DELIVERY AND SPECIAL HANDLING (Check services required)

Weekday Service
1 [X] HOLD AT FEDEX LOCATION WEEKDAY (Fill in Section H)
2 [X] DELIVER WEEKDAY

Saturday Service
31 [ ] HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
3 [ ] DELIVER SATURDAY (Extra charge) (Not available to all locations)
9 [ ] SATURDAY PICK-UP (Extra charge)

Special Handling
4 [ ] DANGEROUS GOODS (Extra charge)
6 [ ] DRY ICE, Dangerous Goods Shipper's Declaration not required
Dry Ice, 9, UN 1845 ____ x ____ kg. 904 (4)
[ ] DESCRIPTION
12 [ ] HOLIDAY DELIVERY (If offered) (Extra charge)

6

PACKAGES	WEIGHT in Pounds Only	YOUR DECLARED VALUE (See right)
1	223	
1	458	
1	375	
Total 3	Total 1056	Total

DIM SHIPMENT (Chargeable Weight)
[ ] ____ lbs.
L x W x H

Received At
1 [ ] Regular Stop 3 [ ] Drop Box
2 [X] On-Call Stop 4 [ ] B.S.C. 5 [ ] Station

7 Release Signature:

Emp. No. Date
[ ] Cash Received
[ ] Return Shipment
[ ] Third Party [ ] Chg. To Del. [ ] Chg. To Hold
Street Address
City State Zip
Received By: X
Date/Time Received FedEx Employee Number

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 3/94
PART #137204 FXEM 5/94
FORMAT #158
158

5/20/94

TO:

Omega Point Lab
16015 Shady Falls Road
Elmendorf, Texas
78112-9784

Sirs,

This Material is being supplied to you by the TVA Browns Ferry Nuclear Plant in support of the Thermolag Fire and Ampacity Testing your facility is working on.

If you have any questions or need additional information please contact D.P. Burrell at 205-729-7589.

R.P. Hyde
Lead Procurement Engineer
Browns Ferry Nuclear Plant

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185-87
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1388 - 11960
DATE RECEIVED 6-28-94
DATE INSPECTED 6-28-94
INSPECTED BY: A Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
12" Radial Bend	NA	–	1	–	06-1079-9112-12-4	Y	N	Good	None	X			Receiving Verification Only. (1) 18" cable tray is damaged; (1) 24" cable tray is damaged & (2) 18" covers are damaged on one end.
18" Radial Bend	NA	–	4	–	06-1079-9112-18-4	Y	N	"	"	X			
18" Radial Bend Cover	NA	–	1	–	40-2000-9112-18-2	Y	N	"	"	X			
24" Radial Bend	NA	–	2	–	06-1079-9112-24-4	Y	N	"	"	X			
12" Cable Tray	NA	–	3	–	06-1079-0012-12	Y	N	"	"	X			
18" Cable Tray	NA	–	10	–	06-1079-0012-18	Y	N	"	"	X			
24" Cable Tray	NA	–	5	–	06-1079-0012-24	Y	N	"	"	X			
18" Cable Tray Covers	NA	–	2	–	galv sheeting 4½" turned edges	X	N	"	"	X			
Splice plates	NA	–	49pr	–	1079-1302-02	Y	N	"	"	X			
Hinged Splice plts	NA	–	12pr	–	1079-1302-02	Y	N	"	"	X			
Cable 16AWG	NA	–	1reel	–	Reel #12963	Y	N	"	"	X			
Nuts/Bolts	NA	–	488	–	N/A	Y	N	"	"	X			

FORM
1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA / TSI
CLIENT/PROJECT NUMBER 11210 - TBD
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1386 - 11210
DATE RECEIVED 6-3-94
DATE INSPECTED 6-6-94
INSPECTED BY: C. Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
3/4" Alumm Conduit	NA	-	2	-	AVK-542K	Y	N	Good	None	X			Receiving verification only NON-SAFETY RELATED MATERIAL. CH
2" Alum Conduit	NA	-	5	-	AVK-543K	Y	N	"	"	X			
2.5" Alum Conduit	NA	-	1	-	BBN-621X	Y	N	"	"	X			
3" Alum Conduit	NA	-	2	-	BDF-089A	Y	N	"	"	X			
4" Alum Conduit	NA	-	22	-	BEV-087A	Y	N	"	"	X			
3/4" Steel Conduit	NA	-	2	-	AWD-014Y	Y	N	"	"	X			
1" Steel Conduit	NA	-	10	-	AWD-015W	Y	N	"	"	X			
3" Steel Conduit	NA	-	5	-	AWD-019L	Y	N	"	"	X			
4" Steel Conduit	NA	-	14	-	AWD-020F	Y	N	"	"	X			
5" Steel Conduit	NA	-	1	-	BBY-741J	Y	N	"	"	X			
3/4" Alum LB	NA	-	1	-	BTY-197J	Y	N	"	"	X			
2" Alum LB	NA	-	5	-	BTY-256W	Y	N	"	"	X			
2.5" Alum LB	NA	-	1	-	BTY-260H	Y	N	"	"	X			
3" Alum LB	NA	-	4	-	BTY-265V	Y	N	"	"	X			
3/4" Steel LB	NA	-	1	-	BTY-196L	Y	N	"	"	X			
1" Steel LB	NA	-	2	-	BTM-778C	Y	N	"	"	X			

FORM
1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TS1
CLIENT/PROJECT NUMBER 11210
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1386 . 11210
DATE RECEIVED 6-3-94
DATE INSPECTED 6-6-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
4" Steel LB	NA	-	5	-	BTY-191Y	Y	N	Good	None	X			Receiving Verification Only NON SAFETY-RELATED MATERIAL C&I
3/4" Steel Coupling	NA	-	2	-	BEV-325X	Y	N	"	"	X			
1" Steel Coupling	NA	-	4	-	BLD-538F	Y	N	"	"	X			
3" Steel Coupling	NA	-	3	-	BKR-844C	Y	N	"	"	X			
4" Steel Coupling	NA	-	15	-	BGD-652A	Y	N	"	"	X			
3/4" Alum Coupling	NA	-	2	-	BTY-644K	Y	N	"	"	X			
2" Alum Coupling	NA	-	5	-	BEV-326V	Y	N	"	"	X			
2.5" Alum Coupling	NA	-	1	-	BGW-557N	Y	N	"	"	X			
3" Alum Coupling	NA	-	4	-	BET-731P	Y	N	"	"	X			
4" Alum Coupling	NA	-	8	-	BET-732M	Y	N	"	"	X			

FORM
1/29/93

49 69

TVA 144 (FD-5-70)

SHIPPING TICKET

NO. 495

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR, ATHENS, AL. 35611 5-25- 94 19

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER, SUPV., M&PS

SHIP TO

OMEGA POINT LAB
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT 0005121

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1.	2	Conduit, 3/4" Aluminum	AVK-542M	2	PC		
2.	5	Conduit, 2" Aluminum	AVK-543K	5	PC		
3.	1	Conduit, 2.5" Aluminum	BBH-621X	1	PC		
4.	2	Conduit, 3" Aluminum	BDF-089A	2	PC		
5.	22	Conduit, 4" Aluminum	BEV-087A	22	PC		
6.	2	Conduit, 3/4" Stl (AWD-014Y)	AWD-014Y	2	PC		
7.	XX 10	Conduit, 1" Stl (AWD-015W)	AWD-015W	10	PC		
8.	5	Conduit, 3" Stl	AWD-019L	5	PC		
9.	14	Conduit, 4" Stl	AWD-020F	14	PC		
10.	1	Conduit, 5" Stl	BBY-741J	1	PC		
11.	1	Conduit LB, 3/4" aluminum	BTY-197J	1	EA		
12.	5	Conduit LB, 2" aluminum	BTY-256W	5	EA		
13.	1	Conduit LB, 2.5" aluminum	BTY-260H	1	EA		
14.	4	Conduit LB, 3" aluminum	BTY-265V	4	EA		
15.	1	Conduit LB, 3/4" Stl	BTY-196L	1	EA		
16.	X 2	Conduit LB, 1" Stl	BTY-778C	2	EA		
17.	7	Conduit LB, 4" Stl	BTY-191Y	7	EA		
18.	2	Conduit Coupling, 3/4" Stl	BEV-325X	2	EA		
19.	4	Conduit Coupling, 1" Stl	BLD-538F	4	EA		
20.	3	Conduit Coupling, 3" Stl	BKR-344G	3	EA		
21.	15	Conduit Coupling, 4" Stl	BGD-652A	15	EA		
22.	2	Conduit Coupling, 3/4" Aluminum	BTY-644K	2	EA		
23.	5	Conduit Coupling, 2" Aluminum	BEV-326V	5	EA		
24.	1	Conduit Coupling, 2.5" Aluminum	BGW-557N	1	EA		
25.	4	Conduit Coupling, 3" Aluminum	BET-731P	4	EA		
26.	8	Conduit Coupling, 4" Aluminum	XBET-732M	8	EA		

This material shipped per memo from Claudia Dyar of 5-25-94 for Thermolag Test

REFERENCE TRACKING #9400031847
QA III
SHIPPED BY OVERNITE PER INSTRUCTIONS FROM K. WRIGHT/F. PRIEST

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 5-25- 19 94 G. B. L. No. TV N/A METHOD OF SHIPMENT OVERNITE

SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM 1677

COST
CARRIER'S CHARGE
DELIVERY CHARGES
TOTAL COST

MATERIAL RECEIVED 19
NAME OF CARRIER W. BURT
MATERIAL CHECKED IN BY
STORES LEDGER POSTED BY

500

CONSIGNEE

CUSTOMER COPY (BLUE)

OMEGA POINT LAB

16015 SHADY FALLS RD
HENDORF TX 78112
6358100

INBOUND TRAILER
288858 OVNT

FREIGHT BILL NUMBER
391 634 025

CITY RTE/BYD SCAC: 2M
DEST: SNT

SHIPPER
TVA
NUCLEAR PLANT
BROWNS FERRY RD
ATHENS AL 35611
(205)729-2000

391 634 025

ADV CAR
02521271

PO# NONE

OVERNITE PHONE NUMBER
(210)662-0966

PICK UP DATE
05/25/94

ORIG
DCT

BL# 5569400740

AD OV BD

31

DELIVERY RECEIPT COPY: 1

COLLECT THIS AMOUNT
$.0
$.0

OVERNITE TRANSPORTATION COMPANY

391 634 025

# PCS	HM	PT	DESCRIPTION OF ARTICLES AND SPECIAL MARKINGS	WEIGHT	NMFC	RATE	CHARGES
4			4 HANDLING UNIT(S) SK CONDUIT & FITTING SECTION 7 SIGNED BILL TO: 00501491 80205	2567	050940-00		

OVERNITE

1-2"x10' 40 Conduit bent
Roger Young 6-2-94

4 ◀ TTL PCS

TTL WT ▶ 2567

DELIVERY EXCEPTIONS

SIGNATURE
Veda Patton

FIRM

RECEIVED THE ABOVE PROPERTY IN GOOD CONDITION EXCEPT AS NOTED

ODOM	ARRIVE	DEPART
DATE	PCS	INITIALS

TOTAL CHARGES

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA
CLIENT/PROJECT NUMBER 11210
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1383 - 11210
DATE RECEIVED 5-9-94
DATE INSPECTED 5-10-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
3" gal. conduit	NA	-	2	-	72009 2260 AWA-019L	Y	N	Good	None	X			Receiving Verification Only
3" 90 Elbow	NA	-	1	-	1008122 BLN-258A	Y	N	Good	None	X			
3" Pipe Strap Retaining	NA	-	3	-	42981B BJN-409R	Y	N	Good	None	X			

FORM
1/29/93

TVA 144 (FD-5-70)

SHIPPING TICKET

NO. [illegible] 502

SHIPPER MARK WILLIAMS

POINT OF ORIGIN SPRING CITY,TN 37381 4-28-94 19___

SHIPPING STOREROOM NUCLEAR STORES WBNP

AUTHORITY MARK WILLIAMS

SHIP TO
OMEGA POINT LABORATORIES,INC
16015 SHADY FALLS ROAD
ELMENDORF,TX 78112-9784

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)
DEBIT
RECORD ONLY

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
		THIS MATERIAL TO USED IN A FIRE TESTING PROGRAM SHIP PER J.J. PIERCE MAT BOUGT ON 575 NO 784401					
1	2	CONDUIT 3 in,galv. 720092260	AWD-0191	2	pc		
2	1	ELBOW 90 deg,3 in 1008122	ELB-258A	1	ea		
3	3	STRAP RETAINING 3 in PIPE 429818	BJH-409R	3	ea		
		ALL ITEMS QA 3					
		THIS MATERIAL CONTAINS NO RADIOACTIVITY					

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 4-28-94 19___ G. B. L. No. TV _____ METHOD OF SHIPMENT MOTOR

– SHIPPER'S COPY

RETAINED BY SHIPPER AS RECORD OF SHIPMENT.

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185.86.487
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1397 . 11960
DATE RECEIVED 7-18-94
DATE INSPECTED 7-18-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
3/4" Strap Clamp	NA	0	4	0	NA	Y	N	good	None	X			Receiving Verification Only
2.5" plug	NA	0	1	0	NA	Y	N	good	None	X			

FORM
1/29/93

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY
SHIPPING TICKET

No. 856-94-00877

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR ATHENS, AL. 35611 07/15 19 94

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER, SUPV. M&PS

SHIP TO

OMEGA POINT LAB
16015 SHADY FALLS RD.
ELSENDORF, TX. 78112

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT

000512L

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1		STRAP 3/4" MAL IRON		4	EA		
2		PLUG 2 1/2".		1	EA		
		THIS MATERIAL SHIPPED FOR THERMOLAG TEST.					
		REF : TRACKING # 9400031847					

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 07/15 19 94 G. B. L. No. TV _____ METHOD OF SHIPMENT FED EXP

5 – SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM

1677 _____

COST CARRIER'S CHARGE _____
DELIVERY CHARGES _____
TOTAL COST _____

MATERIAL RECEIVED JUDY 19 _____
NAME OF CARRIER _____
MATERIAL CHECKED IN BY _____
STORES LEDGER POSTED BY _____

FEDERAL EXPRESS

USE THIS AIRBILL FOR SHIPMENTS WITHIN THE CONTINENTAL U.S.A., ALASKA AND HAWAII.
USE THE INTERNATIONAL AIR WAYBILL FOR SHIPMENTS TO PUERTO RICO AND ALL NON U.S. LOCATIONS.
QUESTIONS? CALL 800-238-5355 TOLL FREE.

AIRBILL — PACKAGE TRACKING NUMBER 0115008530

41594 0115008530

RECIPIENT'S COPY

1 Date 7-15-94

From (Your Name) Please Print | Your Phone Number (Very Important) (205) 729-4641

Company: TVA/BROWNS FERRY NUCLEAR PLT | Department/Floor No.

Street Address: BROWNS FERRY ROAD

City: ATHENS | State: AL | ZIP Required: 3 5 6 1 1

2 To (Recipient's Name) Please Print | Recipient's Phone Number (Very Important) ( )

Company: Omega Point Lab | Department/Floor No.

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.): 16715 Shady Hill Rd

City: Elsewhere | State: TX | ZIP Required: 76111

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice.)

H IF HOLD AT FEDEX LOCATION, Print FEDEX Address Here
Street Address
City | State | ZIP Required

3 PAYMENT 1 ☐ Bill Sender 2 ☐ Bill Recipient's FedEx Acct. No. 3 ☐ Bill 3rd Party FedEx Acct. No. 4 ☐ Bill Credit Card 5 ☐ Cash/Check

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business morning†)	Standard Overnight (Delivery by next business afternoon. No Saturday delivery††)
11 ☑ OTHER PACKAGING*	51 ☐ OTHER PACKAGING
16 ☐ FEDEX LETTER*	56 ☐ FEDEX LETTER*
12 ☐ FEDEX PAK*	52 ☐ FEDEX PAK*
13 ☐ FEDEX BOX	53 ☐ FEDEX BOX
14 ☐ FEDEX TUBE	54 ☐ FEDEX TUBE
Economy Two-Day (Delivery by second business day ††)	**Government Overnight** (Restricted for authorized users only)
30 ☐ ECONOMY*	46 ☐ GOVT LETTER
	41 ☐ GOVT PACKAGE

* Economy Letter Rate not available. Minimum charge. One pound Economy rate.

Freight Service (for packages over 150 lbs.)
70 ☐ OVERNIGHT FREIGHT** (Confirmed reservation required)
80 ☐ TWO-DAY FREIGHT**
† Delivery commitment may be later in some areas
*Declared Value Limit $500
**Call for delivery schedule.

5 DELIVERY AND SPECIAL HANDLING (Check services required)

Weekday Service
1 ☐ HOLD AT FEDEX LOCATION WEEKDAY (Fill in Section H)
2 ☑ DELIVER WEEKDAY

Saturday Service
31 ☐ HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
9 ☐ SATURDAY PICK-UP (Extra charge)

Special Handling
4 ☐ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE Dangerous Goods Shipper's Declaration not required
Dry Ice, 9, UN1845 ____ X ____ kg, 904 III
☐ ____ X ____
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

6

PACKAGES	WEIGHT in Pounds Only	YOUR DECLARED VALUE (See right)
1		
Total	Total	Total

DIM SHIPMENT (Chargeable Weight) ☐ ____ ____ ____ lbs.
L x W x H

Received At
1 ☐ Regular Stop 3 ☐ Drop Box
2 ☑ On-Call Stop 4 ☐ B.S.C. 5 ☐ Station

7 Release Signature:

Emp. No. | Date
☐ Cash Received
☐ Return Shipment
☐ Third Party ☐ Chg. To Del. ☐ Chg. To Hold
Street Address
City | State | Zip
Received By: X
Date/Time Received | FedEx Employee Number

Federal Express
Base Charges
Declared Value Charge
Other *
Other 2
Total Charges

REVISION DATE 3-94
PART #107204 FXEM
FORMAT #158
158
PRINTED IN U.S.A.

OMEGA POINT LABORATORIES

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA

CLIENT/PROJECT NUMBER 11960-97185,86,87

RECEIVED FROM TVA

PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1392 . 11960

DATE RECEIVED 7-7-94

DATE INSPECTED 7-8-94

INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COMD MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
4" gal. conduit	NA	0	2	0	NA	Y	N	Good	None	X			Receiving Verification Only
1" gal. conduit	NA	0	3	0	NA	Y	N	Good	None	X			

FORM
1/29/93

500

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97257-60+97332-38
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1429 - 11960
DATE RECEIVED 8-29-94
DATE INSPECTED 8-29-94
INSPECTED BY: A Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
4" LB Cover	NA	0	5	0	BMB329W	Y	N	Good	None	X			Receiving Verification Only
4" gasket	NA	0	5	0	BMB330P	Y	N	Good	None	X			
1" LB Cover	NA	0	2	0	BPP177F	Y	N.	Good	None	X			
2½-3" LB Covers	NA	0	5	0	BBT792M	Y	N.	Good	None	X			
2½-3" gaskets	NA	0	5	0	BGP836C	X	N.	Good	None	X			
2" gasket	NA	0	5	0	BGK730D	Y	N..	Good	None	X			
1" gasket	NA	0	2	0	BPQ043N	Y	N.	Good	None	X			
2" LB Cover	NA	0	5	0	AQP157N	Y	N	Good	None	X			

FORM
1/29/93

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY
SHIPPING TICKET

No. 362-94-0974 508

SHIPPER J.M. WILLIAMS

POINT OF ORIGIN NEAR SPRING,CITY, TN 37381 8-26, 94

SHIPPING STOREROOM WATTS BAR NUCLEAR PLANT

AUTHORITY R.D. HALL PROJ MGR N.E.

TO
OMEGA POINT LABORATURIES, INC
16015 SHADY FALLS RD
ELMENDORF, TX 78112
ATTN: MARK SALLEY

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)
DEBIT
00014P9

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1		4 IN LB	EMB329W	5	EA		
2		4 IN GASKET	EMB330P	5	EA		
3		1 IN LG COVER	BPP177F	2	EA		
4		2-1/2 - 3 IN LB COVER	MBT792M	5	EA		
5		2-1/2 -3 IN LB GASKET	BGP636C	5	EA		
6		1 IN GASKET BPQ043N		2	EA		
7		2IN GASKET	BGK730W	5	EA		
8		2 IN LB COVER AQP157H		5	EA		
		QA LEVEL III					
		FOR TESTING					

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

GFC

DATE SHIPPED 8-26 19 94 G. B. L. No. TV

METHOD OF SHIPMENT UPS-NDA

INSPECTOR'S COPY

SHIPMENT TO TVA POINTS – TO CONSIGNEE UNDER SEPARATE COVER, CONSIGNEE RECORDS DATE SHIPMENT WAS RECEIVED, NOTES ANY EXCEPTIONS AND SIGNS CERTIFICATE. ALSO ATTACHES COPY OF FREIGHT OR EXPRESS ARRIVAL NOTICE AND FORWARDS TO ACCOUNTING OFFICE.
SHIPMENTS TO OUTSIDE POINTS – SHIPPER ENTERS AMOUNT OF TRANSPORTATION CHARGEABLE TO TVA WITH ACCOUNT NUMBER TO BE CHARGED AND FORWARDS TO ACCOUNTING OFFICE WITH THE ORIGINAL.

I CERTIFY THAT THE ARTICLES OR SERVICES LISTED ABOVE HAVE BEEN RECEIVED IN QUANTITY AND QUALITY SPECIFIED. EXCEPT AS NOTED.

RECEIVED _____ 19___ SIGNED _____

CARRIER _____ TITLE _____

Q/A RECEIVING REPORT

OMEGA POINT LABORATORIES

CLIENT/PROJECT NAME TSI/TVA

CLIENT/PROJECT NUMBER 11960-97185-87 & 97332-38 97257-60

RECEIVED FROM TVA

PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1425 - 11960

DATE RECEIVED 8-26-94

DATE INSPECTED 8-26-94

INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
1" galv Conduit	NA	0	100'	0	AWD-015W	Y	N	Good	None	X			Receiving Verification only

FORM
1/29/93

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY

SHIPPING TICKET

No. S5694-01057 510

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR, ATHENS, AL. 35611 8-24- 1994

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER, SUPV., M&PS

SHIP TO
OMEGA POINT LAB
16015 SHAVY FALLS ROAD
KLEINDORF, TX 78112

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)
DEBIT
0005131

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1.	100	Conduit, Metal, Rigid steel, Galv., 1.0 IN. Dia X 10 FT LG	AWD-015W	100	FT		
		Shipped per the attached letter. Thermolag Fire and Ampacity Testing.					
		QA III					

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 8-24 1994 G. B. L. No. TV N/A METHOD OF SHIPMENT FEDEX

SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM

1677

COST CARRIER'S CHARGE
DELIVERY CHARGES
TOTAL COST

MATERIAL RECEIVED 19
CARRIER
MATERIAL CHECKED IN BY
STORES LEDGER POSTED BY

5/20/94

TO:

Omega Point Lab
16015 Shady Falls Road
Elmendorf, Texas
78112-9784

Sirs,

This Material is being supplied to you by the TVA Browns Ferry Nuclear Plant in support of the Thermolag Fire and Ampacity Testing your facility is working on.

If you have any questions or need additional information please contact D.P. Burrell at 205-729-7589.

Claudia Hyde for

R.P. Hyde
Lead Procurement Engineer
Browns Ferry Nuclear Plant

FEDERAL EXPRESS

USE THIS AIRBILL FOR SHIPMENTS WITHIN THE CONTINENTAL U.S.A., ALASKA AND HAWAII.
USE THE INTERNATIONAL AIR WAYBILL FOR SHIPMENTS TO PUERTO RICO AND ALL NON U.S. LOCATIONS.
QUESTIONS? CALL 800-238-5355 TOLL FREE.

AIRBILL PACKAGE TRACKING NUMBER

4131M 9569284303

RECIPIENT'S COPY

1 Date

From (Your Name) Please Print † | Your Phone Number (Very Important) | 2 To (Recipient's Name) Please Print | Recipient's Phone Number (Very Important)

Company | Department/Floor No. | Company | Department/Floor No.

Street Address | Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.)

City | State | ZIP Required | City | State | ZIP

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice)

H IF HOLD AT FEDEX LOCATION, Print FEDEX Address Here
Street Address
City | State | ZIP Required

3 PAYMENT 1 ☐ Bill Sender 2 ☐ Bill Recipient's FedEx Acct. No. 3 ☐ Bill 3rd Party FedEx Acct. No. 4 ☐ Bill Credit Card
5 ☐ Cash/Check

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business afternoon)
11 ☐ OTHER PACKAGING
16 ☐ FEDEX LETTER*
12 ☐ FEDEX PAK*
13 ☐ FEDEX BOX
14 ☐ FEDEX TUBE

Standard Overnight (No Saturday Delivery)
51 ☐ OTHER PACKAGING
56 ☐ FEDEX LETTER*
52 ☐ FEDEX PAK*
53 ☐ FEDEX BOX
54 ☐ FEDEX TUBE

Economy Two-Day (Delivery by second business day †)
30 ☐ ECONOMY*
* Economy Letter Rate not available. Minimum charge: One pound Economy rate.

Government Overnight (Restricted for authorized users only)
46 ☐ GOVT LETTER
41 ☐ GOVT PACKAGE

Freight Service (for packages over 150 lbs.)
70 ☐ OVERNIGHT FREIGHT** (Confirmed reservation required)
80 ☐ TWO-DAY FREIGHT**
† Delivery commitment may be later in some areas.
*Declared Value Limit $500.
**Call for delivery schedule.

5 DELIVERY AND SPECIAL HANDLING (Check services required)

Weekday Service
☐ HOLD AT FEDEX LOCATION WEEKDAY (Fill in Section H)
2 ☒ DELIVER WEEKDAY

Saturday Service
31 ☐ HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
9 ☐ SATURDAY PICK-UP (Extra charge)

Special Handling
4 ☐ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE Dangerous Goods Shipper's Declaration not required
Dry Ice, 9, UN 1845, ____ X ____ kg, 904 III
☐ DESCRIPTION
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

6 For FedEx Use Only | YOUR DECLARED VALUE (See right)
Total | Total | Total

DIM SHIPMENT (Chargeable Weight)
☐ lbs.
L x W x H

Received At
1 ☐ Regular Stop | 3 ☐ Drop Box
2 ☐ On-Call Stop | 4 ☐ B.S.C | 5 ☐ Station

7 Release Signature:

Emp. No. | Date
☐ Cash Received
☐ Return Shipment
☐ Third Party ☐ Chg. To Del. ☐ Chg. To Hold
Street Address
State | Zip
Received By:
X
Date/Time Received | FedEx Employee Number

Federal Express Use
Base Charges
Other 1
Other 2
Total Charges

REVISION DATE 3/94
PART #137204 FXEM 4/94
FORMAT #158
158

Q/A RECEIVING REPORT

OMEGA POINT LABORATORIES

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960 - 97185-87+97257-60
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1414 - 11960
DATE RECEIVED 8-10-94
DATE INSPECTED 8-10-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
1" steel Conduit	NA	7	7	0	AWD-015W	Y	N	Good	None	X			Receiving Verification only; 10' lengths for a total 70 feet CP

FORM
1/29/93

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY
SHIPPING TICKET

No. S5694-01017

PER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR, ATHENS, AL. 35611 8-2- 19 94

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER, SUPV., M&PS

SHIP TO MR OMEGA POINT LABS
10815 SHADY FALLS ROAD
ELMENDORF, TX 78112

ACCT NO. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT 0005151 RECORD ONLY

BILL TO

CREDIT 0002065

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1	70	Conduit, metal rigid steel, Galv., Thickwall, 1.0 IN DIA X 10 FT LG.	AWD-015W	70	FT		
		SENT FOR FIRE TESTING PROGRAM					
		QA III					

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

E SHIPPED 8-6- 19 94 G. B. L. No. TV N/A METHOD OF SHIPMENT FEDEX (TWO DAY FRT)

5 – SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM 1677

COST
CARRIER'S CHARGE
DELIVERY CHARGES
TOTAL COST

MATERIAL RECEIVED 19
NAME OF CARRIER
MATERIAL CHECKED IN BY C. W. BURT
STORES LEDGER POSTED BY

USE THIS AIRBILL FOR SHIPMENTS WITHIN THE CONTINENTAL U.S.A., ALASKA AND HAWAII.
USE THE INTERNATIONAL AIR WAYBILL FOR SHIPMENTS TO PUERTO RICO AND ALL NON U.S. LOCATIONS.
QUESTIONS? CALL 800-238-5355 TOLL FREE.

PACKAGE TRACKING NUMBER

4159M 0115008830

RECIPIENT'S COPY

1 Date 8-9-4

From (Your Name) Please Print: W. Burt

Your Phone Number: (205-729-

Company: ...RNS ROBERT INOCULE... LT

Street Address:

City: ATHENS State: AL ZIP Required: 3 5 6

2 To (Recipient's Name) Please Print

Company: Omni...Lab

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes): 1601 ... Falls ...

City: Elmendorf State: TX ZIP Required: 78112

Department/Floor No.

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice.)

IF HOLD AT FEDEX LOCATION, Print FEDEX Address Here
Street Address
City State ZIP Required

3 PAYMENT 1 ☐ Bill Sender 2 ☐ Bill Recipient's FedEx Acct. No. 3 ☐ Bill 3rd Party FedEx Acct. No. 4 ☐ Bill Credit Card
5 ☐ Cash/Check

4 SERVICES (Check only one box)

5 DELIVERY AND SPECIAL HANDLING

6 PACKAGES | WEIGHT In Pounds Only | YOUR DECLARED VALUE

1 | 125

Total | Total 125 | Total

OTHER PACKAGING
FEDEX LETTER
FEDEX PAK
13 ☐ FEDEX BOX
14 ☐ FEDEX TUBE

51 ☐ OTHER PACKAGING (No Saturday Delivery)
52 ☐ FEDEX PAK
53 ☐ FEDEX BOX
54 ☐ FEDEX TUBE

Economy Two-Day (Second business day †)
30 ☐ ECONOMY*
* Economy Letter Rate not available. Minimum charge: One pound Economy rate.

Government Overnight (Restricted for authorized users only)
46 ☐ GOV'T LETTER
41 ☐ GOV'T PACKAGE

Freight Service (for packages over 150 lbs.)
70 ☒ OVERNIGHT FREIGHT** (Confirmed reservation required)
80 ☐ TWO-DAY FREIGHT

† Delivery commitment may be later in some areas.

HOLD AT FEDEX LOCATION WEEKDAY (Fill in Section H)
DELIVER WEEKDAY
Saturday Service
31 ☐ HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
9 ☐ SATURDAY PICK-UP (Extra charge)

Special Handling
4 ☐ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE Dangerous Goods Shipper's Declaration not required
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

DIM SHIPMENT (Chargeable Weight)
☐ lbs.
L x W x H

Received At
3 ☐ Drop Box
4 ☐ B.S.C.
5 ☐ Station

Emp. No. | Date
☐ Cash Received
☐ Return Shipment
☐ Third Party ☐ Chg. To Del. ☐ Chg. To Hold
Street
City State Zip

Received By:
X

Date/Time Received | FedEx Employee Number

7 Release Signature

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 3/94
PART #137204 FXEM 5/94
FORMAT #158

158

© 1994 FEDEX
PRINTED IN U.S.A.

Q/A RECEIVING REPORT

OMEGA POINT LABORATORIES

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-87 97257-60 + 97332-38
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1426-11960
DATE RECEIVED 8-26-94
DATE INSPECTED 8-26-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	ACCEPTANCE Hold	ACCEPTANCE Reject	REMARKS
Junction Box 1'x1'x5'	0	0	1	0	Ref # 94-5349	Y	N	Good	None	X			NOTE: CA Receiving Verification Only

FORM
1/29/93

520

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY

SHIPPING TICKET

No. G 578597

517

SHIPPER TVA - HORACE CROWDEN

POINT OF ORIGIN MUSCLE SHOALS, AL 8-24- 19 94

SHIPPING STOREROOM POWER SERVICE SHOPS

AUTHORITY 3FN-M-94-0071

TO

OMEGA POINT LAB
16015 Shady Falls Road
Elmendorf, Texas 78112
ATTN: W. D. Black

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT

Record Only

BILL TO

Same

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1		Junction box		1	ea		

Per: C. Allsbrooks
REF: 94-5349

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

7 – EXTRA COPY TO _____

TO DIVISION OF PURCHASING, CHATTANOOGA.

TO PURCHASING FOR ALL PERSONAL PROPERTY SHIPMENTS AUTHORIZED BY FORM 81, TRANSFER ORDER, OR USED AS EXTRA COPY AS REQUIRED.

5/20/94

TO: N. D. Black

Omega Point Lab
16015 Shady Falls Road
Elmendorf, Texas
78112-9784

Sirs,

This Material is being supplied to you by the TVA Browns Ferry Nuclear Plant in support of the Thermolag Fire and Ampacity Testing your facility is working on.

If you have any questions or need additional information please contact D.P. Burrell at 205-729-7589.

R.P. Hyde
Lead Procurement Engineer
Browns Ferry Nuclear Plant

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11960/97553-55
RECEIVED FROM TVA
PROJECT LOCATION OPL

REPORT NUMBER 1442, 11960
DATE RECEIVED 10/6/94
DATE INSPECTED 10/6/94
INSPECTED BY: C Humphrey

ITEM DESCRIPTION	P.O. NO. OR ORDER NO.	QUANTITY			I.D. NO.	CNTRL MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
5" STEEL CONDUIT	N/A	0	4	0	BBY-741J	Y	N	OK	NONE	X			Receiving Inspection only.
3" " "	"	0	2	0	AWD-019L	Y	N	OK	"	X			
2" " "	"	0	2	0	AWD-017Q	Y	N	OK	"	X			
3" IRON LB	"	0	1	0	BBM-589C	Y	N	OK	"	X			
3" LB COVER	"	0	1	0	BTX-383T	Y	N	OK	"	X			
3" LB GASKET	"	0	1	0	BTY-337W	Y	N	OK	"	X			
2" LB COVER	"	0	1	0	BTX-381Y	Y	N	OK	"	X			
2" LB GASKET	"	0	1	0	BTY-336Y	Y	N	OK	"	X			
1" IRON LB	"	0	2	0	BTM-778C	Y	N	OK	"	X			
1" LB COVER	"	0	2	0	BTX-375R	Y	N	OK	"	X			
1" LB GASKET	"	0	2	0	BTY-329V	Y	N	OK	"	X			

FORM
1/4/89

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY

SHIPPING TICKET

No. S5694-00010 520

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR, ATHENS, AL. 35611 10-4- 1994

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER, SUPV., M&PS

SHIP TO
OMEGA POINT LAB
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)
DEBIT
00035LG

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1.	40	5" Conduit	BBY-741J	40	FT		
2.	20	3" Conduit	AWD-019L	20	FT		
3.	20	2" Conduit	AWD-017Q	20	FT		
4.	1	3" Iron LB	BBM-589C	1	EA		
5.	1	3" LB Cover	BTX-383T	1	EA		
6.	1	3" LB Gasket	BTY-337W	1	EA		
7.	1	2"LB Cover	BTX-381Y	1	EA		
8.	1	2" LB Gasket	BTY-336Y	1	EA		
9.	2	1" Iron LB	BTM-778C	2	EA		
10.	2	1" LB Cover	BTX-375R	2	EA		
11.	2	1" LB Gasket	BTY-329V	2	EA		

This material supplied to support the Thermolag Fire and Ampacity Testing

QA III

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

USVA #74

DATE SHIPPED 10-4- 1994 G. B. L. No. TV N/A METHOD OF SHIPMENT FEDEX TWO-DAY FRT

SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM

1677

COST
CARRIER'S CHARGE
DELIVERY CHARGES
TOTAL COST

MATERIAL RECEIVED 19
NAME OF CARRIER C. W. BURT
MATERIAL CHECKED IN BY
STORES LEDGER POSTED BY

4230M— **2819333775** ...-800-238-5355 TOLL FREE. ...AND ALL NON U.S. LOCATIONS.

AIRBILL
PACKAGE
TRACKING NUMBER **2819333775**

521

RECIPIENT'S COPY

1 [redacted]

Date: 10-4-94

From (Your Name) Please Print: C. J. Burt

Your Phone Number (Very Important): (205) 729-4641

Company: TVA/BROWNS FERRY NUCLEAR PLT

Department/Floor No.

Street Address: BROWNS FERRY RD

City: ATHENS | State: AL | ZIP Required: 35612

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice.)

2 To (Recipient's Name) Please Print

Recipient's Phone Number (Very Important): ( )

Company: Omega Point Lab

Department/Floor No.

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.): 16015 Shady Falls Road

City: Elmendorf | State: TX | ZIP Required: 78112

3 PAYMENT
1 ☐ Bill Sender
2 ☐ Bill Recipient's FedEx Acct. No.
3 ☒ Bill 3rd Party FedEx Acct. No.
4 ☐ Bill Credit Card
5 ☐ Cash/Check

[redacted]

H IF HOLD AT FEDEX LOCATION, Print FEDEX Address Here
Street Address
City | State | ZIP Required

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business morning†)
11 ☐ OTHER PACKAGING
16 ☐ FEDEX LETTER*
12 ☐ FEDEX PAK*
13 ☐ FEDEX BOX
14 ☐ FEDEX TUBE

Standard Overnight (Delivery by next business afternoon. No Saturday delivery†)
51 ☐ OTHER PACKAGING
56 ☐ FEDEX LETTER*
52 ☐ FEDEX PAK*
53 ☐ FEDEX BOX
54 ☐ FEDEX TUBE

Economy Two-Day (Delivery by second business day †)
30 ☐ ECONOMY*
*Economy Letter Rate not available. Minimum charge: One pound Economy rate.

Government Overnight (Restricted for authorized users only)
46 ☐ GOVT LETTER
41 ☐ GOVT PACKAGE

Freight Service (for packages over 150 lbs.)
70 ☐ OVERNIGHT FREIGHT** (Confirmed reservation required)
80 ☒ TWO-DAY FREIGHT**

† Delivery commitment may be later in some areas.
*Declared Value Limit $500.
**Call for delivery schedule.

5 DELIVERY AND SPECIAL HANDLING (Check services required)

Weekday Service
1 ☐ HOLD AT FEDEX LOCATION WEEKDAY (Fill in Section H)
2 ☒ DELIVER WEEKDAY

Saturday Service
31 ☐ HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
9 ☐ SATURDAY PICK-UP (Extra charge)

Special Handling
4 ☐ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE
Dangerous Goods Shipper's Declaration not required
Dry Ice, 9, UN 1845, ______ x ______ kg. 904 III
☐ DESCRIPTION
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

6

PACKAGES	WEIGHT In Pounds Only	YOUR DECLARED VALUE (See right)
1	300	
1	827	
Total 1	Total 1300	Total

DIM SHIPMENT (Chargeable Weight) 336 lbs.

120 x 048 x 042

Received At
1 ☐ Regular Stop
2 ☒ On-Call Stop
3 ☐ Drop Box
4 ☐ B.S.C.
5 ☐ Station

Emp. No. | Date
☐ Cash Received
☐ Return Shipment
☐ Third Party ☐ Chg. To Del. ☐ Chg. To Hold
Street Address
City | State | Zip
Received By:
X
Date/Time Received | FedEx Employee Number

7 Release Signature:

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 4/94
PART #145412 FXEM 5/94
FORMAT #160

160

© 1993-94 FEDEX
PRINTED IN U.S.A.

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TS1
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1447-11960
DATE RECEIVED 10/12/94
DATE INSPECTED 10/12/94
INSPECTED BY: C Humphrey

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
5" CONDUIT STRAP	N/A	0	6	0	P2558-50	Y	N	GOOD	NONE	X			RECEIVING VERIFICATION ONLY CK
2" " "	"	0	3	0	N2558-20EG	Y	N	"	"	X			
1" " "	"	0	6	0	N2558-10EG	Y	N	"	"	X			

FORM
1/29/93

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY

SHIPPING TICKET

No. 858-15485 528

SHIPPER L. J. Wheeler POINT OF ORIGIN Soddy Daisy, Tn 10-11 19 94

SHIPPING STOREROOM Sequoyah Nuclear Stores AUTHORITY L. J. Wheeler

TO

Omega Point Laboratories
16015 Shady Falls Rd
Elmendorf, Texas 78112
ATTN: Kent Brown

ACCT NO. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT

00014PG

BILL TO

CREDIT

ITEM	QUANTITY ORDERED	DESCRIPTION	PSC – ITEM No. BIN No.	QUANTITY DELIVERED	UNIT	UNIT PRICE	AMOUNT
1	6	5" two Hole conduit strap P|N P2558-50 RD 964707 it 11 3-13-85	BLT-609G	6	EA		
2	3	2" two hole conduit strap P|N N2558-20EG Lot C0350 1008070 it 2 2-18--94	Bla-296W	3	EA		
3	6	1" two hole conduit straps P|N N2558-10EG lot C0149 RD 331168 Item 5 4-6-93	AWM-628T	6	Ea		

Shipped per WBN Peg package T49941008800
and memo from Larry Mays to P. Truss

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 10-11 19 94 B. L. No. TV _____ METHOD OF SHIPMENT Fed Ex

SHIPPING NOTICE

TO BE ENCLOSED WITH MATERIAL WHEN NO OTHER PACKING SLIP IS USED: OTHERWISE, TO CONSIGNEE UNDER SEPARATE COVER.

TO BE FILLED IN BY RECEIVING OFFICE

SERIAL NO. OF FORM

1677 _____

COST _____
CARRIER'S CHARGE _____
DELIVERY CHARGES _____
TOTAL COST _____

MATERIAL RECEIVED _____ 19 _____
NAME OF CARRIER _____
MATERIAL CHECKED IN BY _____
STORES LEDGER POSTED BY _____

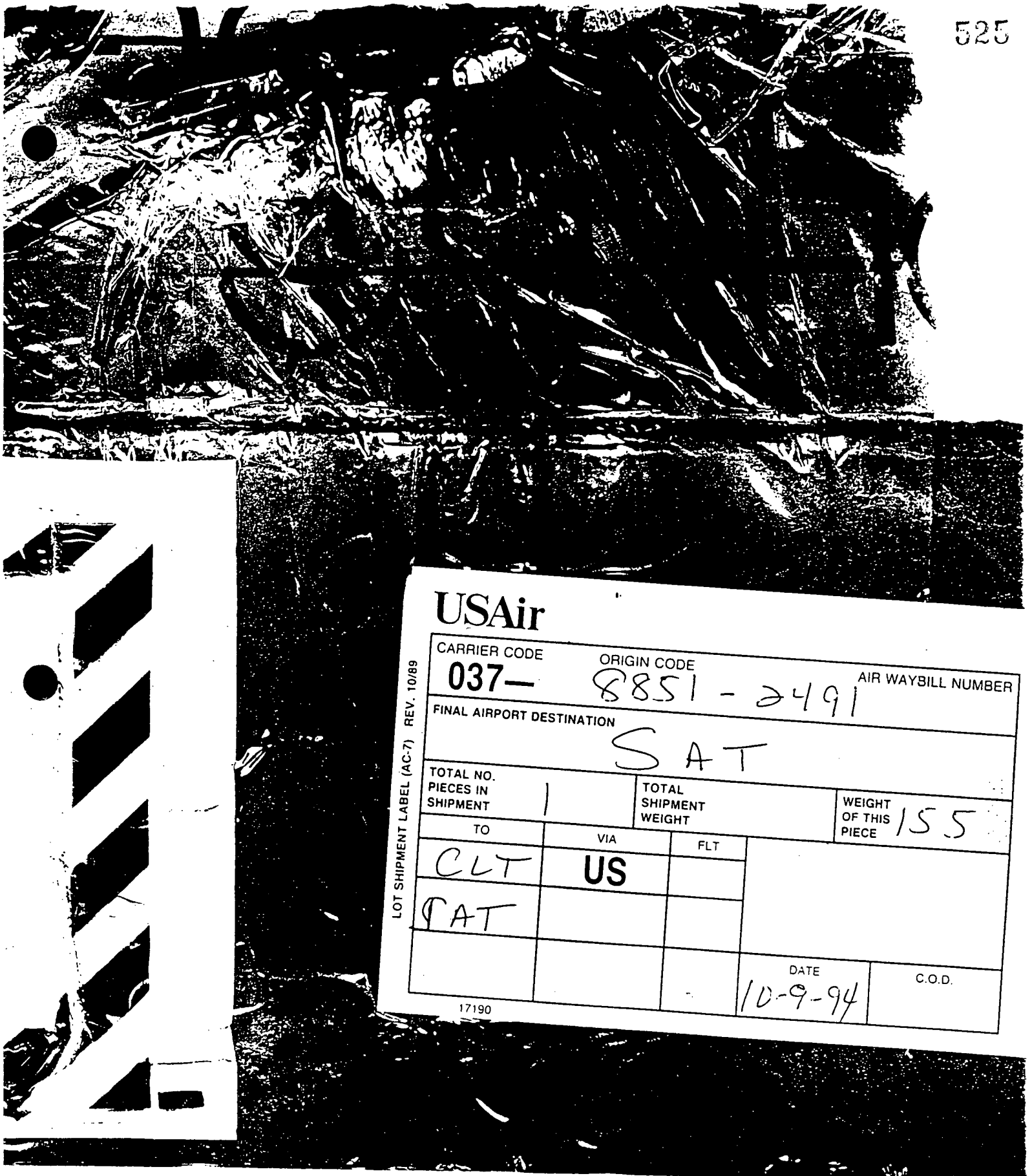
Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1445.11960
DATE RECEIVED 10/10/94
DATE INSPECTED 10/10/94
INSPECTED BY: C Humphrey

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
5" LB WITH COVERS + GASKETS	N/A	0	2	0	LB500-M	Y	N	Good	None	X			RECEIVING VERIFICATION ONLY. NO MATERIAL CERTS RECEIVED. NO PACKING LIST RECEIVED. CH
2" LB	N/A	0	1	0	LB200-M	Y	N	"	"	X			

FORM
1/29/93



USAir

LOT SHIPMENT LABEL (AC-7) REV. 10/89

CARRIER CODE	ORIGIN CODE	AIR WAYBILL NUMBER
037—	8851 - 2491	

FINAL AIRPORT DESTINATION: SAT

TOTAL NO. PIECES IN SHIPMENT	TOTAL SHIPMENT WEIGHT	WEIGHT OF THIS PIECE
1		155

TO	VIA	FLT
CLT	US	
SAT		

DATE: 10-9-94

C.O.D.

17190

☐ REGULAR
☐ PREPAID
☐ COLLECT

CAMPBELL DELIVERY SERVICE, INC.
P.O. BOX 460289
SAN ANTONIO, TEXAS 78246-0289
PHONE (210) 826-8110
RRC NO. 4756

526

№ 1274

CARRIER Sonic

SHIPPER

ADDRESS

CITY

DATE

AIRBILL NO. TEH 31453

CONSIGNEE Omega Point Labs

ADDRESS 16015 Shady Falls Rd

CITY Elmendorf TX 78112

NO PIECES	DESCRIPTION	WEIGHT		
1	Omega Point Labs			
	REFERENCE NO.			
	US 885-2491	155		

Carrier & liability not more than $50.00 unless a greater value is declared. Carrier is not responsible for concealed damage nor for freight claims after 48 hours. Shipment is accepted in apparent good order except as noted

DRIVER

DRIVER

SHIPPERS SIG

DRIVER

DRIVER

RECEIVED GOOD ORDER

TIME

DATE

TIME

DATE

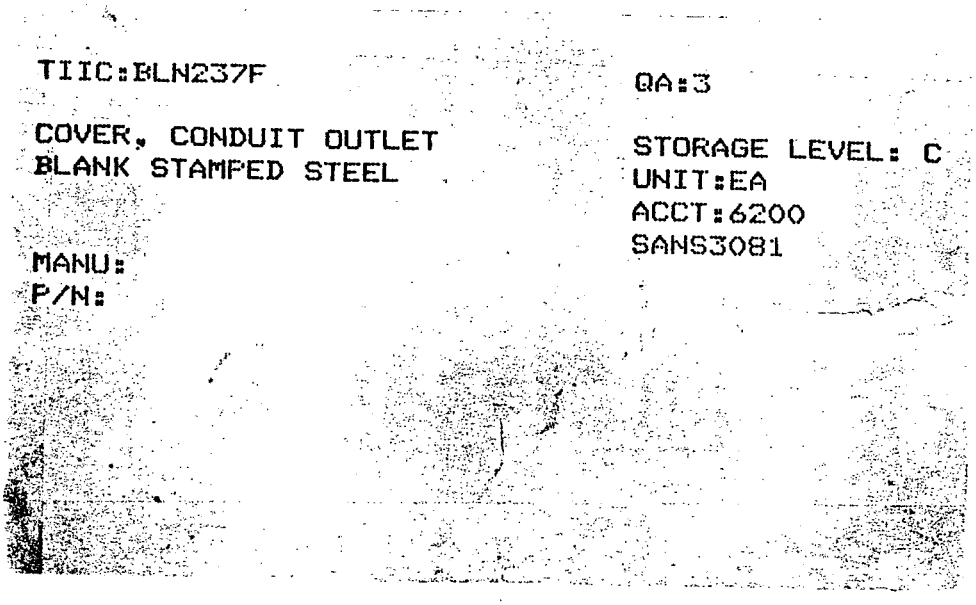
C.O.D. AMOUNT →

BUS/AIRLINE CHARGES →

TOTAL →

BTY259N WBN-SWEC-R93-7273 EA
1006841 12-28-93 IT# 2
QA LEVEL III PEG DATE: 12-9-93
CONDUIT OUTLET,ELEC,MI,2",
THD RIGID HUB,TYPE LB,
P/N: LB-200-M
STORAGE LEVEL C MED/6230

BLN236H WBN EA.
44286B-01 03-12-90
QA. LEVEL III STORAGE LEVEL C
COND. OUTLET,ELECT. TYPE LB,FORM 35
PN:LB500-M
MFG:APPLETON ELECT.
SANE3606 NS/6200 RDR



Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185, 86+87
RECEIVED FROM Foltec
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1390 - 11960
DATE RECEIVED 7-6-94
DATE INSPECTED 7-6-94
INSPECTED BY: CPatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Channel	1125Q	10	10	—	CHN3X4.1#X20	Y	Y	GOOD	NONE	X			
3"X4.1#Channel X20													
ANGLE IRON 4"X4"X½X20	1125Q	1	1	—	ANG 4X C07	Y	Y	GOOD	NONE	X			

FORM
1/29/93

5220

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Toltec Steel Products, Inc
5390 Dietrich Road

San Antonio TX 78219

PO Number: 1125-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Cleda Patton
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
7/5/94	Their Truck		7-6-94	30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Channel 3"x4.1	10	$23.58	$235.80
2.	Angle Iron 4"x4"x1/2" 20 ft. sections	1	$66.05	$66.05

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 7-5-94

Special Instructions

Please include MTR's (Material Test Reports)

Ordered By: Cleda Patton
Project #: 11960 - 97185

Total	$301.85
Shipping	
Tax	
Invoice Total	**$301.85**

* * * * * * * * * * * * * * * * *
* S A L E S O R D E R 28564 *
* * * * * * * * * * * * * * * * *

TOLTEC STEEL PRODUCTS, INC.
5390 DIETRICH
SAN ANTONIO, TX 78219

DELIVER PICKING TICKET

M+R's attached

BILL TO: 000477
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 78112

SHIP TO:
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 781120000

PURCHASE ORDER: 1125-Q
PLACED BY: CLEDA
TELEPHONE #: (512) 635-8100
SHIP VIA:
COMMENTS:

ORDER DATE: 7/05/94
REQUEST DATE: 7/05/94
SALESMAN: CASEY HARMS

LINE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
1	[redacted]	10	CHN 3X4.1#X20	3" X 4.1# CHANNEL X 20	820	28.75	235.75
2	[redacted]	1	ANG 4XC07	4 X 4 X 1/2 X 20	256	25.80	66.05

TOTAL WEIGHT: 1076 LBS

RECEIVED BY: Richard Reasby

NET BEFORE TAX	301.80
TAX.....	23.39
GRAND TOTAL...	325.19

STRUCTURAL METALS, INC.
POST OFFICE BOX 911, SEGUIN, TEXAS 78156-0911
512-372-8200

CERTIFIED TEST REPORT

The following tests conform to the requirements of the specifications listed.

WE HEREBY CERTIFY THAT THE FOLLOWING DATA IS A TRUE COPY FROM TESTS PERFORMED IN OUR LABORATORY.

DAN SCHACHT
QUALITY CONTROL MANAGER

12/ 8/92

SIN# S76813
BOL NO B9374105

INV NO V145995
INV DATE 12/07/92

S 768400
O TOL TEC PRODUCTS
L 5390 DIETRICH
D SAN ANTONIO TX
T 78219
O

S 8000
H TOL TEC
I P/U @ MILL
P TX
T
O

HEAT NO	SECTION	SPECIFICATION	T #	YIELD PSI	TENSILE PSI	ELONG %	ELONG IN	R.A. %	BEND TEST DIAM	BEND TEST RSL	DATE ROLLED	LB/F
01099	F 4X1/2	ASTM A36-89	1	49000	73500	31.0	8				060492	4.7
01109	F 5X3/8	ASTM A36-89	1	50500	70200	32.0	8				060492	6.3
01415	L 3X2X1/4	ASTM A36-89	1	53800	77700	29.0	8				062392	4.0
02376	L 2.5X2.5X1/4	ASTM A36-89	1	55000	76500	28.5	8				081792	3.9
02888	L 4X4X1/2	ASTM A36-89	1	51200	75500	29.0	8				091592	12.6
02973	SQ 1	ASTM A36-89	1	50000	72000	21.0	8				091992	3.3
03369	L 1.25X1.25X1/8	A36 MODIFIED	1	56900	85900	21.0	8				102292	0.9
03559	RD 1	ASTM A36-89	1	53500	75200	23.0	8				102992	2.6

HEAT NO	C	MN	P	S	SI	CU	CR	NI	MO	CB	V	AL	CE		BHN
01099	.16	0.79	.012	.035	.21	.49	0.18	0.24	.051	.001	.0020	.002	.00		
01109	.17	0.70	.007	.030	.19	.38	0.09	0.13	.046	.001	.0020	.001	.00		
01415	.17	0.77	.015	.041	.18	.52	0.19	0.17	.047	.000	.0020	.001	.00		
02376	.20	0.74	.009	.025	.21	.55	0.08	0.19	.045	.000	.0010	.003	.00		
02888	.20	0.63	.010	.038	.19	.60	0.14	0.15	.041	.000	.0110	.001	.00		
02973	.19	0.65	.008	.024	.16	.43	0.08	0.14	.042	.000	.0010	.001	.00		
03369	.21	0.79	.018	.027	.18	.55	0.20	0.18	.043	.000	.0040	.001	.00		
03559	.19	0.68	.011	.031	.16	.39	0.10	0.15	.041	.000	.0010	.001	.00		

REMARKS: THIS STEEL IS MELTED AND MANUFACTURED IN THE USA AND IS FREE FROM MERCURY CONTAMINATION IN THE PROCE

FOR ADDITIONAL COPIES
CALL ACCOUNTING
(512) 372-8225.

53

STRUCTURAL METALS, INC.
BOX [redacted], SEGUIN, TEXAS 78156-0911
210-372-8200

CERTIFIED TEST REPORT

The following tests conform to the requirements of the specifications listed.

IS A TRUE COPY FROM TESTS PERFORMED IN OUR LABORATORY.

DAN SCHACHT
QUALITY CONTROL MANAGER

4/29/94

N\	S115812	S	768400	S	8000
L NO	B9418932	O	TOL TEC PRODUCTS	H	TOL TEC
		L	5390 DIETRICH	I	P/U ^ MILL
		D	SAN ANTONIO TX	F	SEGUIN TX
V NO	V183809	T	78219	T	
/ DATE	04/28/94	O		O	

AT O	SECTION		SPECIFICATION	T #	YIELD PSI	TENSILE PSI	ELONG %	IN	R.A. %	BEND TEST DIAM	RSL	DATE ROLLED	LB/FT
281	C 3X4.1	20	ASTM A36-91	1	52500	75600	31.0	8				110293	4.100
245	F 3X3/8	20	ASTM A36-91	1	51800	75000	27.0	8				122093	3.720
489	L 3X3X3/16	20	ASTM A36-91	1	54200	75300	31.0	8				010394	3.670
433	L 4X4X1/4	20	ASTM A36-91	1	54200	77000	31.0	8				021894	6.600
394	\4 REBAR	20	ASTM A615-93 GRADE 60 AASHTO M31	1	66000	103000	13.0	8		1.750	OK	042394	0.640
395	\4 REBAR	20	ASTM A615-93 GRADE 60 AASHTO M31	1	65500	102000	12.6	8		1.750	OK	042394	0.640
572	L 4X3X3/8	20	ASTM A36-93a	1	52100	76300	32.5	8				040994	8.500
651	L 4X3X1/4	20	ASTM A36-93a	1	53100	73900	30.0	8				041094	5.750

AT O	C	MN	P	S	SI	CU	CR	NI	MO	CB	V	AL	CE		BHN	
281	.17	0.74	.012	.034	.21	.39	0.17	0.18	.052	.000	.0010	.002	.00			517
245	.16	0.71	.011	.035	.23	.45	0.13	0.16	.051	.000	.0010	.002	.00			517
489	.17	0.77	.011	.031	.24	.39	0.09	0.16	.064	.001	.0030	.003	.00			517
433	.17	0.70	.007	.020	.20	.39	0.12	0.18	.061	.000	.0010	.001	.00			517
394	.35	0.96	.012	.036	.25	.38	0.12	0.16	.046	.001	.0020	.002	.00			517
395	.37	0.96	.014	.040	.24	.46	0.10	0.15	.038	.001	.0030	.002	.00			517
572	.15	0.86	.009	.022	.22	.44	0.17	0.21	.044	.000	.0020	.000	.00			517
651	.15	0.77	.012	.027	.23	.43	0.25	0.20	.056	.002	.0030	.001	.00			517

MKS: 100% MELTED AND MANUFACTURED IN THE USA AND FREE FROM MERCURY CONTAMINATION IN THE PROCESS

FOR ADDITIONAL COPIES
CALL ACCOUNTING
(210) 372-8225.

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185, 97260, & 97338
RECEIVED FROM Toltec
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1422 . 11960
DATE RECEIVED 8-23-94
DATE INSPECTED 8-23-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O . NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
6"X6"X1/2X40' Tubing	11440	40'	40'	0	TUB6X6C09X40	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Toltec Steel Products, Inc
5390 Dietrich Road

San Antonio TX 78219

PO Number: 1144-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Cleda Patton
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/23/94	Their Truck		8/24/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Tubing-6" x 6" x 1/2"	40'		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-23-94

Special Instructions

Please include MTR's

Ordered By: Cleda Patton

Project #: TSI/TVA

Total	$0.00
Shipping	
Tax	
Invoice Total	**$0.00**

* * * * * * * * * * * * * * * * *
* S A L E S O R D E R 89830 *
* * * * * * * * * * * * * * * * *

TOLTEC STEEL PRODUCTS, INC.
5390 DIETRICH
SAN ANTONIO, TX 78219

DELIVER PICKING TICKET

BILL TO: 000477
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 78112

SHIP TO:
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 781120000

PURCHASE ORDER: 1144 0
PLACED BY: KERRY
SHIP VIA:
COMMENTS:

TELEPHONE #: (512) 635-8100

ORDER DATE: 8/23/94
SALESMAN: CASEY HARMS

REQUEST DATE: 8/23/94

LNE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
01	1	1	TUB 6X6X40	6 X 6 X 300 X 40	1410	1999.00	799.60
02	0	0		MUST HAVE MTR **	0	.00	.00
03	2	2	ANG 2X2X.25ALUM	2 X 2 X 1/4 X 25 ALUMINUM	56	255.00	141.53

WEIGHT: 1466 LBS

RECEIVED BY:

NET BEFORE TAX	941.13
TAX.....	72.94
GRAND TOTAL...	1014.07

P.01

TO 6358101 FROM TOLTEC STEEL 6614672 08/25/1994 09:42

TOTAL P.01
PAGE.001

666 8402

AUG 25 '94 11:02

NOM DE L'USINE PRODUCTRICE - NAME AND ADDRESS OF PRODUCER'S PLANT
FIRMA UN... NSCHRIFT DES HERSTELLERWERKS

V A L E ...
USINE DE ... EL
57480 RETTEL FRANCE

PAGE-SHEET-S... 1

CERTIFICAT DE RECEPTION
INSPECTION CERTIFICATE - ABNAHMEPRUFZEUGNIS
MODELE 3.1.B (A49.001) DIN 50049

ACHETEUR - PURCHASER - BESTELLER	NO.COMMANDE ACHETEUR / PURCHASER'S ORDER N° / BESTELLUNG NR
FRANCOSTEEL CORPORATION SALES HOUSTON UNITED STATES	FNY 553 - 8190 Q

NO COMMANDE USINE / PLANT ORDER NUMBER / WERKSBESTELL NUMMER	AVIS D'EXPEDITION N° / DISPATCH NOTE N° / VERSANDANZEIGE NR
3-M -20227	8 -130487

POSTE / ITEM / POST	DIMENSIONS EN POUCES / DIMENSIONS / ABMESSUNGEN	QUANTITE TOTALE-TOTAL QUANTITY-GESAMTMENGE: NOMBRE-NUMBER / ANZAHL	LONGUEUR (FEET): LENGTH-LANGE	MASSE (LBS) / MASS - MASSE
2	6" X 6" X ,500"			
3	7" X 7" X 3/8"	8	320,01	11221
6	8" X 8" X ,500"	5	200,00	6569
11	12" X 2" X ,250"	2	79,98	3946
12	12" X 4" X ,250"	10	400,00	9016
		6	239,93	6239

NUANCE D'ACIER - STEEL GRADE - STAHLSORTE

ASTM A 500 GRADE B ERW

NORME OU SPECIFICATION DU PRODUIT
PRODUCT STANDARD OR SPECIFICATION
PRODUKTNORM BZW.- SPEZIFIKATION

STRUCTURAL SQUARE AND RECTANGULAR TUBES
ERW ASTM A 500 GRADE B (WITH MIN. PSI YIELD 46000)

ANALYSE SUR TUBES EN % - PIPES ANALYSIS - ROHREANALYSE

POSTE / ITEM / POST	NO DE LA COULEE / NUMBER OF CAST / NUMMER DES GUSSES	C	MN	P	S	SI	AL	BO	CR	MO	V	CU	TI	NI	NB	SN
2	14836															
2	24904	0,126	1,440	0,012	0,007											
3	26255	0,160	1,450	0,018	0,008											
6	15158	0,131	1,400	0,016	0,009											
11	15158	0,158	1,430	0,013	0,007											
12	26401	0,158	1,430	0,013	0,007											
		0,169	1,510	0,020	0,007											

TRACTION - TENSILE TEST - ZUGVERSUCH
EPROUVETTE - TEST PIECE - PROBE

VALEURS GARANTIES - GUARANTEED VALUES - GEWAHRLEISTETE WERTE

POSTE / ITEM / POST	RE (PSI)	RM (PSI)	A %	RM(A-2)
2	68455	74691	25,2	
2	71936	77592	25,2	
3	62073	71936	28,6	
6	69905	75562	28,5	
11	61348	71791	32,9	
12	63669	75997	32,2	

POSTE / ITEM / POST	ESSAI HYDRAULIQUE / HYDRAULIC TEST / WASSERPRUFDRUCK	
2	S	BAR
2	S	BAR
3	S	BAR
6	S	BAR
11	S	BAR
12	S	BAR

NOUS ATTESTONS QUE LES PRODUITS SONT CONFORMES AUX STIPULATIONS DE LA COMMANDE
WE CERTIFY THAT THE DELIVRED PRODUCTS COMPLY WITH THE REQUIREMENTS OF THE ORDER.
ES WIRD BESTATIGT, DAS DIE GELIEFERTEN-ERZEUGNISSE DEN BESTIMMUNGEN DER BESTELLUNG ENTSPRECHEN.

RESPONSABLE SECTEUR QUALITE : PRODUCTEUR / PRODUCER / HERSTELLER

M. SZKOLNIK

DATE DATUM : 29/11/93

To: Kerry
From: B.T.
6X6X500
Sq Tube

XT 77444

0236

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-87 & 97332-38 / 97257-60
RECEIVED FROM Deltec
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1427 - 11960
DATE RECEIVED 8-25-94
DATE INSPECTED 8-25-94
INSPECTED BY: C Humphrey

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Angle Iron	11460	1	1	0	ANG-3½x2½x⅜x20	Y	Y	Good	None	X			
3½" x 2½" x ⅜" x 20'													

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Toltec Steel Products, Inc
5390 Dietrich Road

San Antonio TX 78219

PO Number: 1146-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Kerry M. Hitchcock
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/25/94	Their Truck		8-25-94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	3-1/2"x2-1/2"x3/8" angle iron	1	$44.57	$44.57

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements"
QA Approval C Patton
Date 8-25-94

Special Instructions

Please include MTR's.

Ordered By: Kerry Hitchcock

Project #: TSI/TVA

Total	$44.57
Shipping	
Tax	$3.45
Invoice Total	$48.02

* * * * * * * * * * * * * * * * *
*S A L E S   O R D E R 29259 *
* * * * * * * * * * * * * * * * *

TOLTEC STEEL PRODUCTS, INC.
5390 DIETRICH
SAN ANTONIO, TX 78219

DELIVER PICKING TICKET

BILL TO: 000477
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 78112

SHIP TO:
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 781120000

PURCHASE ORDER: 11460
PLACED BY:
TELEPHONE #: (210) 635-8100
SHIP VIA:
COMMENTS:

ORDER DATE: 8/25/94
REQUEST DATE: 8/25/94
SALESMAN: CASEY HARMS

NE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
1	1	1	ANG 3-1/2X2-1/2X005	3-1/2 X 2-1/2 X 3/8 X 20	144	30.95	44.57

TL EIGHT: 144 LBS

RECEIVED BY: ________________

NET BEFORE TAX	44.57
TAX...........	3.45
GRAND TOTAL...	48.02

CO·STEEL LASCO
A Division of Co-Steel Inc.
Hopkins St. South, Whitby, Ontario, Canada L1N 5T1
TEL: WHITBY 905-668-8811 • TORONTO 416-364-6138
FAX: 905-668-6469 DUNS 20-183-2094

MATERIAL LISTED BELOW WAS SHIPPED ON BILL OF LADING AND LOADING REPORT NUMBER

TESTING LABORATORY REPORT
COMPTE RENDU DU LABORATOIRE D'ESSAI

- PHYSICAL PROPERTIES • PROPRIÉTÉS PHYSIQUES
- CHEMICAL ANALYSIS • ANALYSE CHIMIQUE

JUL. 18, 1994 20:25

097068

32364

O'NEAL STEEL
108 BOGGSTOWN RD.
SHELBYVILLE, INDIANA
U.S.A.
46176

ATTENTION--

CUST ORDER NUMBERS / N° DE COMM DU CLIENT: SEE * BELOW

PAGE # 01

MATERIAL TESTED / MATÉRIAU ÉPROUVÉ | HEAT NO. / N° DE CHALEUR | YIELD STRENGTH / LIMITE D'ÉLASTICITÉ | TENSILE STRENGTH / RÉSISTANCE DE TRACTION | ELONGATION / GAUGE LENGTH | BEND TEST / ESSAI DE PLIAGE | GRADE / NUANCE

CHANNELS
7 @ 14.75 C6255 58995 PSI 78671 PSI 25.0% IN ASTM-A36-91 SA-36 ASTM A709 GR36

MATERIAL SPECS: 33081 PART #: PART NAME:
* B-31613

C	MN	P	S	SI
0.1700	0.6700	0.0050	0.0160	0.1500

ANGLES - STRUCTURAL
3 1/2 X 2 1/2 X 1/2 C3387 50240 PSI 75932 PSI 29.0% IN 8 IN ASTM-A36-91 SA-36 ASTM 709 GR36

MATERIAL SPECS: 0105961 PART #: PART NAME:
* B-07177

C	MN	P	S	SI
0.1900	0.7600	0.0040	0.0150	0.1860

ANGLES - STRUCTURAL
4 X 4 X 5/16 C6904 52263 PSI 78902 PSI 28.0% IN 8 IN ASTM-A36-91 SA-36 ASTM 709 GR36

MATERIAL SPECS: 01 10841 PART #: PART NAME:
* F-04643

C	MN	P	S	SI
0.2100	0.8500	0.0070	0.0200	0.2080

ROUND BARS-NON-ALLOY
1 1/8 INCH DIAM C6745 49536 PSI 73057 PSI 30.0% IN 8 IN ASTM-A36-91 SA-36 ASTM 709 GR36

MATERIAL SPECS: 03 15951 PART #: PART NAME:
* X-23757

C	MN	P	S	SI
0.1900	0.7300	0.0050	0.0240	0.1900

CO·STEEL LASCO A DIVISION OF CO-STEEL INC. CERTIFIES THAT THE ABOVE RESULTS ARE A TRUE AND CORRECT COPY OF THE

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 1960-97185-87, 97257-60
RECEIVED FROM Joltec Steel
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1404 - 11960
DATE RECEIVED 7-21-94
DATE INSPECTED 7-21-94
INSPECTED BY: D Batton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Plate ½"x12"x20'	11320	1	1	0	FLT ½X12	Y		Good	None	X			
Sq tubing 4"x4"x¼"x20'	11320	1	1	0	TUB4X4X¼X20	X		Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Toltec Steel Products, Inc
5390 Dietrich Road

San Antonio TX 78219

PO Number: 1132-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Cleda Patton Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
7/20/94	Their Truck		7/21/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	1/2"x 12"x20' Plate	1	$126.40	$126.40
2.	4"x4"x1/4" x24' Square Tubing	1	$103.22	$103.22

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 7-20-94

Special Instructions

Please include MTR's (Material Test Reports)

Ordered By: Cleda Patton

Project #: TSI/TVA-Deck 7

Total	$229.62
Shipping	
Tax	$17.80
Invoice Total	$247.42

****
* SALES ORDER 28761 *
****

TOLTEC STEEL PRODUCTS, INC.
5390 DIETRICH
SAN ANTONIO, TX 78219

DELIVER PICKING TICKET

BILL TO: 000477
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 78112

SHIP TO:
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 781120000

PURCHASE ORDER: 11329
PLACED BY: CLETA
SHIP VIA:
COMMENTS:

TELEPHONE #: (512) 635-8100

ORDER DATE: 7/20/94
SALESMAN: CASEY HARMS

REQUEST DATE: 7/20/94

INE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
01	[redacted]	1	FLT 1/2X12	1/2 X 12 X 20	408	30.95	126.40
02	1	1	TUB 4XC06X20	4 X 4 X 250 X 20	244	516.10	103.22

[redacted]EIGHT: 652 LBS

RECEIVED BY: Jane Elizalde

NET BEFORE TAX	229.62
TAX.....	17.80
GRAND TOTAL...	247.42

B/L # 72969

NUCOR STEEL
A Division of Nucor Corporation
JEWETT, TEXAS 75846 PH (903) 626-4461

Date 12/94

TOLTEC STEEL PRODUCTS, INC.
5390 DIETRICH RD.
SAN ANTONIO, TX 78219

CERTIFIED MILL TEST REPORT

43579

SOLD TO: TOLTEC
5390 DETRICH RD.
SAN ANTONIO TX 78219

SHIP TO: TOLTEC
5390 DETRICH RD

SIZE / GRADE	HEAT NUMBER	CUSTOMER PO NUMBER	TENSILE PSI	YIELD PSI	8 INCH SCALE ELONG %	C	Mn	Si	S	P	V	Nb	Cu	Cr	Ni	Mo
1/2 X 12 ASTM A36-93/ASME SA36-89	345-0467	#534	73600	50000	27	.17	.74	.26	.03	.02	.000	.000	.48	.09	.11	.033
3/4 X 12 ASTM A36-93/ASME SA36-89	334-2690	#534	73700	49100	23	.13	.72	.21	.03	.01	.000	.000	.26	.14	.10	.031
1/2 X 10 ASTM A529-92 GD 50	343-0813	#534	81800	56400	21	.23	.90	.26	.04	.02	.000	.000	.40	.16	.12	.040
3/8 X 8 ASTM A36-93/ASME SA36-89	343-0790	#534	65500	47700	25	.16	.75	.22	.04	.02	.000	.000	.38	.10	.12	.038
2 X 1 X 1/8 ASTM A36-93/ASME SA36-89	332-2362	#534	80000	59500	28	.15	.82	.24	.04	.02	.000	.000	.37	.20	.16	.049
2 X 2 X 1/4 ASTM A36-93/ASME SA36-89	341-1165	#534	70500	50400	30	.15	.75	.22	.04	.02	.000	.000	.48	.17	.17	.057
4 X 3 X 3/8 ASTM A36-93/ASME SA36-89	342-0736	#534	63700	43800	27	.13	.71	.16	.03	.02	.000	.000	.33	.10	.10	.024
3 X 4.1 ASTM A36-93/ASME SA36-89	341-1085	#534	70500	49800	25	.12	.82	.25	.03	.01	.000	.000	.60	.13	.11	.034
6 X 8.2 ASTM A36-93/ASME SA36-89	343-0661	#534	72300	54400	24	.20	.85	.25	.04	.02	.000	.000	.55	.15	.13	.057

MELTED AND MANUFACTURED IN U.S.A.

CHIEF METALLURGIST

HANNA

HANNA NO. | DATE | PAGE

Certification

391000 5/12/94 515

pped Hanna Steel Corporation
Tube Division
3600 Avenue C
P.O. Box 558
Fairfield AL 35064

Cust P.O.: 8731
Date Shipped: 5/11/94
Load Tally 3-44104
Invoice # 394103

TOLTEC STEEL PRODUCTS, INC.
5390 DIETRICH RD.
SAN ANTONIO, TX 78219

RECEIVED
MAY 16 1994

1 Sunbelt Metal Service Inc

P O Box 43839
Austin TX 78745

Ship To:

Sunbelt Metal Service Inc

South Loop 4
Buda TX 78610

Item	Heat #	ASTM Grade	Description	Yield	Tensile	Elong	Rockwell
7150712			2X3 RECT 3/16 HRA500 20.000FT				
TINUED							
3179	01403	A500 B		66,000	76,000	26.0	B84
3179	45472	A500 B		68,500	76,500	27.0	B86
3184	51226	A500 B		62,000	73,000	28.0	B82

Total Weight 7,826

Heat #	C	MN	P	S	SI
01403	.170	.790	.012	.007	.020
45472	.170	.780	.017	.009	.030
51226	.160	.740	.015	.013	.020

4600412		5 SQ 1/4	HRA500 40.000FT				
5060	1304854	A500 B		65,000	75,500	31.0	B84

Total Weight 5,616

Heat #	C	MN	P	S	SI
1304854	.170	.720	.011	.012	.005

4301112		2 SQ 11GA	HRA500 20.000FT				
3223	C85226	A500 B		55,000	69,000	30.0	B80
3224	C85226	A500 B		55,000	69,000	30.0	B80

Total Weight 6,100

Heat #	C	MN	P	S	SI
C85226	.180	.750	.013	.009	.017

na Steel Corporation
2 Commerce Avenue
Box 558
field, Alabama 35064
) 780-1111
IS No. 00-402-9294

SUBJECT TO TERMS AND CONDITIONS ON BACK

Milton Stewart
Metallurgist

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97257
RECEIVED FROM Toltec
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1440 . 11960
DATE RECEIVED 9-23-94
DATE INSPECTED 9-26-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Angleiron 1½"x1½"x⅛"x20	11549	4	4	0	ANG1-½X01	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Toltec Steel Products, Inc
5390 Dietrich Road

San Antonio TX 78219

PO Number: 1154-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Kerry M. Hitchcock
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
9/17/94	Their Truck		9/21/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	1-1/2"x1-1/2"x1/8"x20' Angle Iron ANG 1-1/2xCO1	4	$6.51	$26.03

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 9-17-94

Special Instructions

Please include MTR's.

Ordered By: Kerry Hitchcock

Project #: TSI/TVA

Total	$26.03
Shipping	
Tax	$2.02
Invoice Total	$28.05

* * * * * * * * * * * * * * * * *
* S A L E S O R D E R 24589 *
* * * * * * * * * * * * * * * * *

TOLTEC STEEL PRODUCTS, INC.
3898 DIETRICH
SAN ANTONIO, TX 78219

DELIVER PICKING TICKET

BILL TO: 000477
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 78112

SHIP TO:
OMEGA POINT LABORATORIES

16015 SHADY FALLS
ELMENDORF, TEXAS 78112-0000

PURCHASE ORDER: 1154 G
SALES REP: MURRAY
SHIP VIA:
COMMENTS:

TELEPHONE #: (210) 635-8100

ENTER DATE: 8/01/94
SALESMAN: CASEY MARVIE

REQUES. DATE: 7 8, 94

LINE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
1	[redacted]	4	ANG 1-1 [illegible]	1-1/2 X 1-1/2 X 1/8 X 20	98	26.65	26.03
2	0	0		****MILL CERTS REQUIRED	0	.00	.00

TOTAL WEIGHT: 98 LBS

NET BEFORE TAX 26.03
TAX..... 0.00
GRAND TOTAL... 26.03

RECEIVED BY: Richard L Beasley

STRUCTURAL METALS, INC.
BO[illegible]911, SEGUIN, TEXAS 78156-0911
51[illegible]2-8200

CERTIFIED TEST REPORT

The following tests conform to the requirements of the specifications listed.

IS A TRUE COPY FROM TESTS PERFORMED IN OUR LABORATORY.

QUALITY CONTROL MANAGER
DAN SCHMITT 3/ 2/93

IN# SB2439
DL NO B9379472

S 170000 TOLTECO STEEL PRODUCTS, INC.
O [illegible] RD.
L P O BOX [illegible] SAN ANTONIO, TX 78219
D HOUSTON TX
T 77241
O

S 8001 [illegible] STEEL PRODUCTS, INC.
H
I P/U @ THE MILL [illegible] RD.
P SEGUIN SAN ANTONIO, TX 78219
T TX
O

HEAT NO	SECTION	SPECIFICATION	T #	YIELD PSI	TENSILE PSI	ELONG %	ELONG IN	R.A. %	BEND TEST DIAM	BEND TEST BSL	DATE ROLLED	LB/FT
2360	L 2.5X2.5X3/16	ASTM A36-89	1	53300	75000	31.5	8				081692	2.99
3396	L 1.5X1.5X1/8	ASTM A36-89	1	55700	75200	23.0	8				101992	1.20
4032	L 2X2X1/4	ASTM A36-89	1	52200	74600	27.5	8				113092	3.09
4885	L 3X2X3/16	ASTM A36-91	1	55400	77800	29.0	8				011393	3.02
			2	55400	77200	29.0						
5193	L 3X3X1/2	ASTM A36-91	1	60000	79900	25.0	8				012793	9.40
0496	L 3.5X3.5X1/4	ASTM A36-89	1	55600	77000	35.0	8				040792	5.74

HEAT NO	C	MN	P	S	SI	CU	CR	NI	MO	CB	V	AL	CE		BHN	
2360	.16	0.81	.009	.031	.21	.52	0.10	0.18	.048	.000	.0020	.003	.00			1145
3396	.19	0.65	.007	.031	.20	.34	0.11	0.11	.034	.000	.0010	.001	.00			1145
4032	.19	0.61	.011	.035	.17	.43	0.09	0.16	.046	.000	.0010	.002	.00			1145
4885	.20	0.63	.006	.028	.21	.41	0.10	0.16	.041	.000	.0010	.002	.00			1145
5193	.20	0.76	.007	.021	.21	.28	0.13	0.17	.069	.000	.0170	.003	.00			1145
0496	.18	0.72	.010	.030	.20	.48	0.11	0.14	.032	.000	.0020	.000	.00			1145

MARKS:

THIS STEEL IS MELTED AND MANUFACTURED IN THE USA AND IS FREE FROM MERCURY CONTAMINATION IN THE PROCES

FOR ADDITIONAL COPIES
CALL ACCOUNTING
(512) 372-8225.

CT

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
REPORT NUMBER B99 . 11960
CLIENT/PROJECT NUMBER 11960-97185, 86+87, 9725-60
DATE RECEIVED 7-7-94
RECEIVED FROM Summers
DATE INSPECTED 7-7-94
PROJECT LOCATION Omega Point Labs
INSPECTED BY: A. Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
7 Strand Bare #8	1121Q	1K	1K	0	BASTR7SD8	Y	Y	Good	None	X			
Copper Wire													

FORM
1/29/93

C5
01
0

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Summers Electric
2400 Brockton

San Antonio TX 78217

PO Number: 1121-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Cleda Patton
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
6/27/94	Their Truck		6/30/94	30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	7 Strand Bare #8 Copper Wire BARE8STR	1000	$0.69	$690.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 6-27-94

Special Instructions

Please include all Certificates of Conformance to Catalog Specifications

Ordered By: Cleda Patton

Project #: 11960

Total	$690.00
Shipping	
Tax	
Invoice Total	**$690.00**

552

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

ORIGINAL

PACKING SLIP

NUMBER	PAGE
0800300601	1

FROM: 2400 BROCKTON
SAN ANTONIO, TX 78217

06-JUL-1994, 11:26

SOLD TO: 09543800
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ATTN: ACCOUNTS PAYABLE DEPT.
ELMENDORF, TX 78112

SHIP TO:
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

243

4hr SMALL

TCI-8:30

CUSTOMER PO NUMBER	JOB NAME	CONTACT	TYPE
1121-Q		KERRY	DEL

ORDER DATE	SHIP DATE	SHIP VIA	FR	SCHED		
28-JUN-1994	03-JUL-1994	Our Truck	PC	243	000	10th, Not 20th

LINE	ORDERED	BO QTY	QTY SHIP	PART NUMBER / DESCRIPTION	BIN LOCATION / STOCK CAT	ST	UNIT PRICE	UOM	EXTENDED PRICE
002	10000	0	1000	CUP BARE-8 STR SOFT DRAWN BARE C	33500	Y	140.00	M	140.00
	3000	0	3000	3M 06228 STD CABLE TIE	19-E-5 06228		20.48	C	614.40

Freight, if applicable, to be billed later

SUB TOTAL	:	754.40
FREIGHT	:	.00
TAX	:	58.46
TOTAL	:	812.86

MASTER FORM #2350

PICKED BY: [signature] CHECKED BY: [signature] DATE: [signature] CUSTOMER SIGNATURE: [signature]

SERVICE WIRE CO.

MANUFACTURER

CULLODEN, WV (304)743-8600 PITTSBURGH, PA (412)325-1666 HOUSTON, TX (713)674-6666

553

THIS MATERIAL IS MADE TO APPROPRIATE UL. ASTM. OR CUSTOMER STANDARDS AS SPECIFIED BY THE ORDER.

MADE BY:

SHIP TO:

SUMMERS-SAN ANTONIO
2400 BROCKTON
PO BOX 17747
SAN ANTONIO TX 78217

ORDER NO: 355686

SHIP/SPECIAL INSTRUCTIONS:

PP/ADD FOB ORIGIN
MARK PO # 510026009
510026009

#74 TX 779-675

66287011695

MFG DATE

BASTR7SD8
8 AWG 7STR
BARE CU STRAND SD

CUTTING

DRAWING

STRANDING

CABLING

ARMOR

JACKET

INSULATION

TESTING

GROSS TARE NET 1000 FEET

554

SUMMERS ELECTRIC

June 18, 1992

To Whom It May concern:

I hereby certify that on 7-3-94 we, Summers Electric, provided the material called for on your Purchase Order # 1121-Q on our Bill of Lading (shipping document) # 080330601, in accordance with all applicable requirements for shipment. I further certify that the supplies that were provided are of the quality specified and are in all respects in conformance with purchase order requirements.

Date: 7-20-94
Signature: John Hanks
Title: INSIDE SALES

2400 BROCKTON
P.O. BOX 17747
SAN ANTONIO, TEXAS 78217
512/824-1451

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-187 + 97257 to 97260
RECEIVED FROM Siemmers
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1406 - 11960
DATE RECEIVED 7-22-94
DATE INSPECTED 7-22-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Galv Cond Strap	11340	7	7	0	KINC105-4	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

John Harnett
Summers Electric
2400 Brockton

San Antonio TX 78217

PO Number: 1134-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Kerry M. Hitchcock Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
7/22/94	Pick up		7/22/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Galv Cond Strap-KIN C105-4	7	$2.36	$16.49

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 7-22-94

Special Instructions

Please include Certificate of Conformance

Ordered By: Kerry Hitchcock

Project #: 11960 -group 1

Total	$16.49
Shipping	
Tax	$1.27
Invoice Total	$17.76

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

CONTROL

PACKING SLIP 557

NUMBER	PAGE
080764101	1

22-JUL-1994, 08:53

FROM: 2400 BROCKTON
SAN ANTONIO, TX 78217

TYA.

SOLD TO: 08643800
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ATTN: ACCOUNTS PAYABLE DEPT.
ELMENDORF, TX 78112

SHIP TO:
OMEGA POINT LABORATORIES
2400 BROCKTON
SAN ANTONIO, TX 78217

CUSTOMER PO NUMBER	JOB NAME	CONTACT	TYPE
340			WC

ORDER DATE	SHIP DATE	SHIP VIA	FRT	SLS	TAX	TERMS
-JUL-1994	22-JUL-1994	Will Call	PC	236	000	10th, Net 20th

NE	QTY. ORD.	QTY. B.O.	QTY. SHP.	PART NUMBER / DESCRIPTION	BIN LOC. / UPC	NST	UNIT PRICE	UM	EXTENDED PRICE
1	7	0	7	KIN C105-4 GALV COND STRAP	24-A-2 75951		235.63	C	16.49

SUB TOTAL	:	16.49
FREIGHT	:	.00
TAX	:	1.27
TOTAL	:	17.76

MASTER FORM #2250

PICKED BY [MC] CHECKED BY [ ] DATE [ ] CUSTOMER SIGNATURE [Kerry Hutchins]

SUMMERS ELECTRIC

June 18, 1992

To Whom It May concern:

I hereby certify that on 7-22-94 we, Summers Electric, provided the material called for on your Purchase Order # 11340 on our Bill of Lading (shipping document) # 0807641O1, in accordance with all applicable requirements for shipment. I further certify that the supplies that were provided are of the quality specified and are in all respects in conformance with purchase order requirements.

Date: 7-26-94
Signature: John Harris
Title: INSIDE SALES

2400 BROCKTON
P.O. BOX 17747
SAN ANTONIO, TEXAS 78217
512/824-1451

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TUA
REPORT NUMBER 1418 . 11960
CLIENT/PROJECT NUMBER 11960-97185-87697257-60
DATE RECEIVED 8-23-94
RECEIVED FROM Summers Electric
DATE INSPECTED 8-23-94
PROJECT LOCATION Omega Point Labs
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Junction box	11410	1	1	0	MS? 12x12x6D	Y	Y	GOOD	None	X			
12ga. flat cover Welded ends													

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Summers Electric
2400 Brockton

San Antonio TX 78217

PO Number: 1141-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Kerry M. Hitchcock
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/18/94			8-22-94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Junction Box 12ga 12"x12"x60"	1	$186.00	$186.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval cPatton
Date 8-19-94

Special Instructions

Must meet NEMA 1 specifications.

Ordered By: Kerry Hitchcock

Project #: TVA/TSI
Proj# 97259
Test deck #6

Total	$186.00
Shipping	
Tax	$14.42
Invoice Total	$200.42

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

CUSTOMER

PACKING SLIP 561

PACKING SLIP NUMBER	PAGE
081251801	1

FROM: 2400 BROCKTON
SAN ANTONIO, TX 78217

18-AUG-1994, 10:43

SOLD TO: 08643800
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ATTN: ACCOUNTS PAYABLE DEPT.
ELMENDORF, TX 78112

SHIP TO:
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

CUSTOMER PO NUMBER	JOB NAME	CONTACT	TYPE
410		KERRY	DEL

ORDER DATE	SHIP DATE	SHIP VIA	FRT	SLS	TAX	TERMS
-AUG-1994	18-AUG-1994	Our Truck	PC	236	000	10th, Net 20th

NE	QTY. ORD.	QTY. B.O.	QTY. SHP.	PART NUMBER / DESCRIPTION	BIN LOC. / UPC	NST	UNIT PRICE	UM	EXTENDED PRICE
1	1	0	1	MS? 12X12X60		Y	186.00	E	186.00

WELDED ENDS 12X60 FLAT COVER 12 GA. NEMA 1
PAD

Freight, if applicable, to be billed later

SUB TOTAL	:	186.00
FREIGHT	:	.00
TAX	:	14.42
TOTAL	:	200.42

Deliver today 8-23 please code CD

Joe Trevino CD

MASTER FORM #2250

PICKED BY | CHECKED BY | DATE 8/23 | CUSTOMER SIGNATURE Richard D. Beasley 1:00

582

SUMMERS ELECTRIC

June 18, 1992

To Whom It May concern:

I hereby certify that on 8-18-94 we, Summers Electric, provided the material called for on your Purchase Order # 1141Q on our Bill of Lading (shipping document) # 08125180 1, in accordance with all applicable requirements for shipment. I further certify that the supplies that were provided are of the quality specified and are in all respects in conformance with purchase order requirements.

Date: 9-27-94
Signature: John Downs
Title: INSIDE SALES

2400 BROCKTON
P.O. BOX 17747
SAN ANTONIO, TEXAS 78217
512/824-1451

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-97187 +97332-97267-97260 97338
RECEIVED FROM Summers Electric
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1420 - 11960
DATE RECEIVED 8-24+25-94
DATE INSPECTED 8-24+25-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
4" steel locknut	11450	4	4	0	KPT 110	X	X	Good	None	X			
4" gal Cond Strap	11450	25	25	0	KIN-C105-4	Y	X	Good	None	X			
3" gal Cond Strap	11450	15	15	0	KIN-C105-3	Y	Y	Good	None	X			
2½" gal cond strap	11450	5	5	0	KIN-C105-2½	Y	Y	Good	None	X			
2" gal Cond Strap	11450	20	20	0	KIN-C105-2	X	Y	Good	None	X			
3" sq Head Plugs	11450	3	3	0	RPP PLG300S	X	Y	Good	None	X			
1" gal Cond Strap	11450	10	10	0	KIN C105-1	X	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Summers Electric
2400 Brockton

San Antonio TX 78217

PO Number: 1145-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Kerry M. Hitchcock
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/24/94	Their Truck			

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	4" Steel Locknut - BPT 110	4	$1.65	$6.60
2.	Galv Cond Strap - KIN C105-4	25	$2.36	$59.00
3.	Galv Cond Strap - KIN C105-3	15	$1.71	$25.65
4.	Galv Cond Strap - KIN C105-2-1/2	5	$1.58	$7.90
5.	Galv Cond Strap - KIN C105-2	20	$1.31	$26.20
6.	Galv Cond Strap - KIN C105-1	10	$0.95	$9.50
7.	3" SQ Head Plug - APP PLG300S	3	$12.73	$38.19

Special Instructions

Please include Certificate of Conformance.

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-24-94

Ordered By: Kerry Hitchcock

Project #: TSI/TVA

Total	$173.04
Shipping	
Tax	$13.42
Invoice Total	$186.46

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

CUSTOMER

PACKING SLIP 365

NUMBER	PAGE
178378001	1

24-AUG-1994, 12:15

FROM: 318 W. JOSEPHINE
SAN ANTONIO, TX 78212

SOLD TO: 08643800
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ATTN: ACCOUNTS PAYABLE DEPT.
ELMENDORF, TX 78112

SHIP TO: OMEGA POINT LABORATORIES
318 W JOSEPHINE
SAN ANTONIO, TX 78212

CUSTOMER PO NUMBER	JOB NAME	CONTACT	TYPE
1450		KERRY	WC

ORDER DATE	SHIP DATE	SHIP VIA	FRT	SLS	TAX	TERMS
4-AUG-1994	24-AUG-1994	Will Call	PC	226	000	10th, Net 20th

LINE	QTY. ORD.	QTY. B.O.	QTY. SHP.	PART NUMBER / DESCRIPTION	BIN LOC. / UPC	INST	UNIT PRICE	UM	EXTENDED PRICE
01	4	0	4	BPT 110 4-IN STEEL LOCKNUT	11-B-3 00110		165.00	C	6.60
02	25	0	25	KIN C105-4 GALV COND STRAP	17-A-1 75951		235.63	C	58.91
03	15	0	15	KIN C105-3 GALV COND STRAP	17-A-1 75945		171.22	C	25.68
04	5	0	5	KIN C105-2-1/2 GALV COND STRAP	17-A-1 75942		158.45	C	7.92
05	20	0	20	KIN C105-2 GALV COND STRAP	17-A-1 75939		131.00	C	26.20
06	10	0	10	KIN C105-1 GALV COND STRAP	17-A-1 75930		95.05	C	9.51

SUB TOTAL	:	134.82
FREIGHT	:	.00
TAX	:	10.46
TOTAL	:	145.28

REV. 8/94

MASTER FORM #2263 SE-TX

PICKED BY 231 CHECKED BY 231 DATE 8/24/94 RECEIVED BY Kerry Hollis

560

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

CUSTOMER

PACKING SLIP

PACKING SLIP NUMBER	PAGE
081360401	1

FROM: 2400 BROCKTON
SAN ANTONIO, TX 78217

24-AUG-1994, 12:16

SOLD TO: 08643800
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ATTN: ACCOUNTS PAYABLE DEPT.
ELMENDORF, TX 78112

SHIP TO:
OMEGA POINT LABORATORIES
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

CUSTOMER PO NUMBER	JOB NAME	CONTACT	TYPE
1450		KERRY	DEL

ORDER DATE	SHIP DATE	SHIP VIA	FRT	SLS	TAX	TERMS
4-AUG-1994	24-AUG-1994	Our Truck	PC	236	000	10th, Net 20th

LINE	QTY. ORD.	QTY. B.O.	QTY. SHP.	PART NUMBER / DESCRIPTION	BIN LOC. / UPC	INST	UNIT PRICE	UM	EXTENDED PRICE
02	3	0	3	APP PLG300S 3-IN SQ HEAD PLUG	27-C-3 65260		12.73	E	38.19

DELIVER TOMORROW IS OK

SUB TOTAL	:	38.19
FREIGHT	:	.00
TAX	:	2.96
TOTAL	:	41.15

MASTER FORM #2250

PICKED BY [ ] CHECKED BY [ ] DATE 8/24/94 CUSTOMER SIGNATURE [Richard Z Beasley]

SUMMERS ELECTRIC

June 18, 1992

To Whom It May concern:

I hereby certify that on 8-24-94 we, Summers Electric, provided the material called for on your Purchase Order # 11450 on our Bill of Lading (shipping document) # 0813604O1, in accordance with all applicable requirements for shipment. I further certify that the supplies that were provided are of the quality specified and are in all respects in conformance with purchase order requirements.

Date: 9-27-94
Signature: John Harris
Title: INSIDE SALES

2400 BROCKTON
P.O. BOX 17747
SAN ANTONIO, TEXAS 78217
512/824-1451

588

SUMMERS ELECTRIC

June 18, 1992

To Whom It May concern:

I hereby certify that on 8-24-94 we, Summers Electric, provided the material called for on your Purchase Order # 1145Q on our Bill of Lading (shipping document) # 178378001, in accordance with all applicable requirements for shipment. I further certify that the supplies that were provided are of the quality specified and are in all respects in conformance with purchase order requirements.

Date: 9-27-94
Signature: John Hamm
Title: INSIDE SALES

2400 BROCKTON
P.O. BOX 17747
SAN ANTONIO, TEXAS 78217
512/824-1451

Q/A RECEIVING REPORT

OMEGA POINT LABORATORIES

CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11960/97553-55
RECEIVED FROM B-Line Systems
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1443-11960
DATE RECEIVED 10/5/94
DATE INSPECTED 10/11/94
INSPECTED BY: C Humphrey

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	CONF'D MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
12" steel cable tray	1157Q	2	2	0	248P-09-12-144	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Sue Messerlie
B-Line Systems
509 West Monroe

Highland IL 62249

PO Number: 1157-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Constance A. Humphrey
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
9/28/94	UPS Red Label			

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	12" steel cable tray 248P-09-12-144	2		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 9-28-94

Special Instructions

See attached purchasing specifications and Quality Assurance Requirements.

Ordered By: Constance A. Humphrey

Project #: TSI-97553-55

Total	$0.00
Shipping	
Tax	
Invoice Total	**$0.00**

VENDOR PURCHASING SPECIFICATION AND QUALITY ASSURANCE REQUIREMENTS

Vendor B-Line

Purchase Order No. 11570

Any or all of the following Quality Assurance requirements shall be incorporated as conditions to this procurement when corresponding box is marked. Failure to comply with any requirement specified herein may result in rejection and/or return of shipment at seller's expense.

1.0 QUALITY PROGRAM

☒ Seller shall furnish all items on this Purchase Order in accordance with Quality Program approved by Buyer.

2.0 QUALITY VERIFICATION

When additional quality verification activities are required as a condition to this procurement, invoices will not be paid until satisfactory completion of such activities. Excessive rejection rates may result in removal from buyer's Approved Vendors List.

☒ Receiving Inspection - Buyer shall inspect items upon receipt to verify compliance with purchase order requirements. Rejected items shall be returned at seller's expense.

☐ Independent Laboratory Tests - Samples of materials furnished shall be tested independently for conformance to specification requirements proir to final acceptance. Rejected materials shall be returned at seller's expense.

☐ Document Review - Final acceptance shall be based on satisfactory review of required certifications and other supporting documents.

3.0 CERTIFICATIONS

When certifications are required as a condition to this procurement, the seller shall furnish one reproducible copy either with or prior to each shipment. Shipments will not be accepted and invoices will not be paid until certifications are in buyer's possession.

PURCHASING SPECIFICATIONS
PAGE 2 OF 3

VENDOR B-Line
PURCHASE ORDER NO. 11570

☒ Certificate of Compliance/Conformance Required - Certification that materials and/or services comply with purchase order requirements. Certification shall reference purchase order number and traceability numbers (when applicable).

☐ Certified Test Report Required - Certification that material complies with applicable material specification(s) and the purchase order. Include actual results of required tests.

☐ Certificate of Calibration Required - Certification shall be traceable to National Bureau of Standards. (Renamed NIST, Nat. Institute of Science & Technology)

4.0 AUDITS/RIGHT OF ACCESS

☐ The buyer reserves the right to audit your facility to verify compliance with purchase order, code and specification requirements with minimum of ten (10) days notice.

☒ Shipments shall only originate from facilities approved by the buyer.

☐ Buyer reserves the right to inspect any or all work included in this order at seller's facility with as early notice as practicable.

5.0 IDENTIFICATION

☒ Seller shall identify each item with a unique traceability number by physical marking or tagging. Traceability numbers shall be traceable to certifications and packing lists.

☐ Seller shall identify each container with a unique identification number. The identification number shall be traceable to certifications and packing lists.

6.0 10 CFR, PART 21

☒ The material, equipment and/or services to be furnished under the provisions of this purchase order are involved in the testing of basic components of a Nuclear Regulatory Commission (NCR) licensed facility. Accordingly, the seller is subject to the provisions of 10 CFR, Part 21 (Reporting of Defects and Non-compliance)

PURCHASING SPECIFICATIONS
PAGE 3 OF 3

VENDOR B-Line
PURCHASE ORDER NO. 11570

7.0 PACKING/SHIPPING

☐ All materials shall be packaged in air tight, moisture free containers and shall be free from all foreign substances such as dirt, oil, grease or other deleterious material.

☒ All materials and equipment shall be suitably crated, boxed or otherwise prepared for shipment to prevent damage during handling and shipping. Wherever practical, equipment shall be palletized for ease of unloading and storage at destination. each container shall be clearly marked with buyer's purchase order number.

QUALITY ASSURANCE APPROVAL C Humphrey DATE 9/28/94

FORM
3/93

SHIPPING ORDER

15:56:40

S

B-LINE® SYSTEMS, INC.
509 West Monroe Street
Highland, Illinois 62249-0326
Phone: 618-654-2184

SHIPPING ORDER NO.: RS1 8942-9261 SYM

DATE: 9/29/94

0026073

SOLD TO:

OMEGA POINT LABORATORY
16015 SHADDY FALLS RD

ELMENDORF TX 78112

Belmar 9-30-94

SHIP TO:

OMEGA POINT LABORATORY
16015 SHADDY FALLS RD

ELMENDORF TX 78112

PAGE NO. 1 OF 1 TERMS - NET 30 DAYS

1-CTN=6

8942926 1

CUST. ORDER NO.	DATE RECEIVED	LAST SHIPPED	SHIPPING DATE	VIA	COL	PPD	CHG	ALL
11570	9/29/94		10/03/94	AE		X	X	

DIV.	SALESMAN	SHIP FROM	F.O.B.	DATE SHIPPED	B/L	WEIGHT
7	8800 E	TROY	TROY	10-3-94	35f077	79#

TOM FENOGLIO

1 of 2 - 73

ORDERED	DUE	SHIPPED	BACK ORDER	UNIT	*	PART NUMBER	DESCRIPTION
3	2	2	—	PC		248P09-12-144	STR SECTION ITM 1
							____ BUNDLE(S) OF ____ PC(S) EA.
		S/O	1126-34200	9/29/94		WGT. 36.1600	971-3204 ML
2	2	2	—	PR		9ZN-8004	SPLICE PLATE ITM 2
							LOCATION: I002 H05-2
							____ CARTON(S) OF ____ PR(S) EA.
							WGT. 2.4000 703-0000 ML

FREIGHT CHARGES FROM TROY TO FOLLOW

TOTAL WEIGHT 77.1200

ANY SHORTAGE OR DAMAGE CLAIM MUST BE REPORTED IN WRITING TO ADDRESS SHOWN ABOVE, WITHIN TEN (10) DAYS FROM DATE OF SHIPMENT.

FORM 102 A

[redacted]

575

CERTIFICATE OF CONFORMANCE

P. O. No.: 11570 REV. —

SPECIFICATION: CATALOG CT3 REV. —

PRIME VENDOR: B-LINE SYSTEMS, INC.

SUPPLIER: SAME

ADDRESS: 509 WEST MONROE ST., HIGHLAND, ILLINOIS 62249

DESCRIPTION OF EQUIPMENT: 248P09-12-144, 92N-8004

IDENTIFICATION: ON ATTACHED SHIPPING ORDER 8942 - 9261

APPROVED EXCEPTIONS: NONE

M.T.R.'S ATTACHED: NONE

SUPPLIERS CERTIFICATION

This is to certify that the products identified herein have been manufactured/supplied under B-Line Systems approved quality assurance program and are in comformance with the procurement quality requirements including applicable codes, standards, and specifications as identified in the above referenced documents. Any supporting documentation will be forwarded or retained in accordance with purchase order requirements.

Nick Cain
Signature

10/11/94
Date

QUALITY ASSURANCE INSPECTOR
Title

B-LINE SYSTEMS, INC.
Organization

B-LINE ® SYSTEMS, INC.
509 West Monroe Street
Highland, IL 62249, U.S.A
Phone: 618/654-2184

AF AMERICAN Freightways®

800-826-3875

PAGE 01 OF 01

P. O. Box 840, Harrison, Arkansas 72602-0840 (ARFW)

FREIGHT BILL NUMBER
Refer To This Number

014 6371503 RO

CONSIGNEE
02215441
OMEGA POINT LABORATORY

16015 SHADDY FALLS RD
ELMENDORF TX 78112

SHIPPER
00950456 P3067
B LINE SYSTEMS

EXIT ARFW DOCK
SAINT LOUIS MO 63147

DATE 10/03/94

ORIGIN STL
DEST. SAT

BL# 0035 8077

CONSIGNEE COPY

PCS	HM	DESCRIPTION	WT (LBS)	NMFC	CLASS	RATE	TOTAL CHARGES
		PO1#: 11570					
1		BRACES BRACKETS NOI O OR S 3/16" OR THICKER	6	104600-00	050		
1		CABLE RACKS TRAYS TROUGHS OR CABLE WAY STL 16 GA OR THICKER SECTION 7 SIGNED	73	061220-01	060		
2			79			PPD	② 4:20

RECEIVED IN GOOD CONDITION EXCEPT AS NOTED
FIRM:

BY: June Elizalde

DELIVERED BY: R Krigen

DATE: 10-5-94

580

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME T51/TVA
CLIENT/PROJECT NUMBER 11960-97257-60+97332-38
RECEIVED FROM U.S. Sales
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1428.11960
DATE RECEIVED 8-26-94
DATE INSPECTED 8-29-94
INSPECTED BY: Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	CONtD MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Pipe Clamps 1"	11420	10	10	–	P-2558-10	Y		Good	None	X			Complete Shipment
Pipe Clamps 4"	11420	40	40	–	P-2558-40	Y		Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Johnny Boyd
U.S. Sales Company, Inc.
318 W. Melrose Place

San Antonio TX 78212

PO Number: 1142-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Constance A. Humphrey Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/19/94	Their Truck		8/22/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	P1000 Channel	20'		$0.00
2.	P1001 Channel	40'		$0.00
3.	P2558-40 4" pipe straps	40		$0.00
4.	P2558-10 1" pipe straps	10		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-19-94

Special Instructions

Please include all Certificates of Conformance to Catalog Specifications

Ordered By: Constance A. Humphrey

Project #: TVA/TS

Total	$0.00
Shipping	
Tax	
Invoice Total	$0.00

U. S. SALES COMPANY, INC.

CONTRACTORS SPECIALTIES
"SINCE 1948"
318 W. MELROSE PLACE
SAN ANTONIO, TEXAS 78212

PHONE 829-7044

Sold To: Omega Point Labs

Date: 8/26/94

Invoice: 21630

YOUR ORDER NO.	JOB NAME	Terms: 2% – 10 days, Net 30 days
1142 G		

QUANTITY	DESCRIPTION	LIST	UNIT	DISCOUNT	AMOUNT
10	D-255E-10 1 Pipe Clamps C C				
30	D-255S-40 4 " " "				
	Back Ordered 10 D-255S-40				

TAX

TOTAL

Received By C Humphreys

☐ Tax Exempt

U. S. SALES COMPANY, INC.

CONTRACTORS SPECIALTIES
"SINCE 1948"
318 W. MELROSE PLACE
SAN ANTONIO, TEXAS 78212

PHONE 829-7044

Sold To: Omega Point Labs Date: 9/30/[illegible]

Invoice: 21664

YOUR ORDER NO.	JOB NAME	Terms: 2% – 10 days, Net 30 days
1142 Q		

QUANTITY	DESCRIPTION	LIST	UNIT	DISCOUNT	AMOUNT
10	P-2559-40 4 Hold-Down Studs				

TAX

TOTAL

Received By Jane Clifford

☐ Tax Exempt

U.S. Sales Co., Inc.

318 W. Melrose Place
San Antonio, Texas 78212
(210) 829-7044

August 30, 1994

CERTIFICATION OF COMPLIANCE

Omega Point Labs
16015 Shady Falls Rd.
Elmendorf, Texas 78112-9784

Attn: Cleda

Customer Order No. 1142 Q

Material: 20' P-1000 (PS-200)
40' P-1001 (PS-200 2T3)
10 P-2558-10
40 P-2558-40

This is to certify that the materials shipped to fill the above order have been manufactured in accordance with standard manufacturing procedures and specifications for these products.

U. S. SALES CO.

Johnny Boyd

Johnny Boyd, President

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960- 97185-87, 97257-60, 97832-38
RECEIVED FROM U.S. Sales
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1419 - 11960
DATE RECEIVED 8-23.
DATE INSPECTED 8-25
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Channel	1142Q	20'	20'	0	P-1008 (PS-200)	Y		Good	None	X			partial shipment
Channel	1142Q	40'	40'	0	P-1001 (PS-200 2T3)	X		Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Johnny Boyd
U.S. Sales Company, Inc.
318 W. Melrose Place

San Antonio TX 78212

PO Number: **1142-Q**

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Constance A. Humphrey
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/19/94	Their Truck		8/22/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	P1000 Channel	20'		$0.00
2.	P1001 Channel	40'		$0.00
3.	P2558-40 4" pipe straps	40		$0.00
4.	P2558-10 1" pipe straps	10		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-19-94

Special Instructions

Please include all Certificates of Conformance to Catalog Specifications

Ordered By: Constance A. Humphrey

Project #: TVA/TS1

Total	$0.00
Shipping	
Tax	
Invoice Total	$0.00

U. S. SALES COMPANY, INC.

CONTRACTORS SPECIALTIES
"SINCE 1948"
318 W. MELROSE PLACE
SAN ANTONIO, TEXAS 78212

PHONE 829-7044

Sold To: Omega Pa... Labs

Date: 8/23/84

Invoice: 21596

YOUR ORDER NO.	JOB NAME	Terms: 2% — 10 days, Net 30 days
1142 Q		

QUANTITY	DESCRIPTION	LIST	UNIT	DISCOUNT	AMOUNT
20	P-1000 Channel [illegible] ([illegible])				
40	P-1001 " " " ([illegible])				
				TAX	
				TOTAL	

Received By: Richard D. Beasley

☐ Tax Exempt

U.S. Sales Co., Inc.

318 W. Melrose Place
San Antonio, Texas 78212
(210) 829-7044

August 30, 1994

CERTIFICATION OF COMPLIANCE

Omega Point Labs
16015 Shady Falls Rd.
Elmendorf, Texas 78112-9784

Attn: Cleda

Customer Order No. 1142 Q

Material: 20' P-1000 (PS-200)
40' P-1001 (PS-200 2T3)
10 P-2558-10
40 P-2558-40

This is to certify that the materials shipped to fill the above order have been manufactured in accordance with standard manufacturing procedures and specifications for these products.

U. S. SALES CO.

Johnny Boyd

Johnny Boyd, President

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185-87, 97267-60, 97332-38
RECEIVED FROM Hilti, Inc
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1431 - 11960
DATE RECEIVED 8-30-94
DATE INSPECTED 8-30-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	CONTD MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Kwik Bolt	11480	200	200	0	00045360S	Y	Y	Good	None	X			
1/2" x 2 1/4"													

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Hilti, Inc.
853 Isom Road

San Antonio TX 78216

PO Number: 1148-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Cleda Patton Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/29/94	Their Truck		8/30/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Hilti Bolt 1/4" x 2-1/4"	200		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 8-29-94

Special Instructions

Please include Certificate of Conformance.

Ordered By: Cleda Patton

Project #: TSI/TVA

Total	$0.00
Shipping	
Tax	
Invoice Total	**$0.00**

HILTI®

No. 459353-01

* *FIRST ORIGINAL* * * *FIRST ORIGIN

13635 STEMMONS FREEWAY
FARMERS BRANCH, TX 75234

OMEGA POINT LABORATORIES
16015 SHADY FALL ROAD

ELMENDORF TX 79112

NOTES:
CLETA 0 - -

CUST. PO #
11480

RDER DATE	ORDER #	SLS #	SLS NAME	SHIP LOC.	X-REF# = Y
8/29/94	459353-01	1750	RICHARD CARPENTER	51	08/29/94-16:16:33

CCT. #	ACCT. NAME AND CUSTOMER PURCHASE ORDER NO.	DDAATT
9989177	OMEGA POINT LABORATORIES 11480	58-07-01

HANK YOU FOR CALLING HILTI CUSTOMER SERVICE 1-800-879-8000
ICK DAVITO EXT 6109

JE	ITEM #	ITEM DESCRIPTION	DUE	SHIP	B/O	BIN-LOC
1	000453605	KWIK BOLT II 14-214(100/BX)	2	2		R5
		* * * END OF SHIPPER * * *				
		HILTI IS CLASSIFIED AS A LARGE BUSINESS				

SHIPMENT MODE
☐ LOCAL ☐ BUS
☐ TRUCK ☐ AIR
☐ UPS ☐ WAL IN

CARRIER

BILL OF LADING #

FREIGHT COST

CHARGE TO CUSTOME
☐ YES ☐ NO

NO. OF PACKAGES

WEIGHT
_____LBS_____OZ

DATE SHIPPED

PICKED BY
GG

CHECKED BY

CEIVED BY

DATE RECEIVED

PACKED BY

LE

02-6 (1-92) 000964502

PACKING SLIP

SUBJECT TO TERMS AND CONDITIONS ON REVERSE SIDE

589

HILTI®

No. 459353-01

* *FIRST ORIGINAL* *
13635 STEMMONS FREEWAY
FARMERS BRANCH, TX 75234

OMEGA POINT LABORATORIES
16015 SHADY FALL ROAD

ELMENDORF TX 78112

NOTES:
CLETA 0 - -

CUST. PO # 1148Q

HILTI®

No. 459353-01

* *FIRST ORIGINAL* *
13635 STEMMONS FREEWAY
FARMERS BRANCH, TX 75234

SHIP TO

OMEGA POINT LABORATORIES
16015 SHADY FALL ROAD

ELMENDORF TX 78112

NOTES:
CLETA 0 - -

CUST. PO # 1148Q

ORDER DATE	ORDER #	SLS #	SLS NAME	SHIP LOC.	X-REF# = Y
8/29/94	459353-01	1750	RICHARD CARPENTER	51	08/29/94-16:16:23

CCT. #	ACCT. NAME AND CUSTOMER PURCHASE ORDER NO.	DDAATT
9999177	OMEGA POINT LABORATORIES 1148Q	58-07-01

HANK YOU FOR CALLING HILTI CUSTOMER SERVICE 1-800-879-8000
ICK DAVITO EXT 6109

NE	ITEM #	ITEM DESCRIPTION	DUE	SHIP	B/O	BIN-LOC
1	000453605	KWIK BOLT II 14-214(100/BX)	2	2		R5
		* * * END OF SHIPPER * * *				
		HILTI IS CLASSIFIED AS A LARGE BUSINESS				

SHIPMENT MODE
☐ LOCAL ☐ BUS
☐ TRUCK ☐ AIR
☐ UPS ☐ WAL IN

CARRIER

BILL OF LADING #

FREIGHT COST

CHARGE TO CUST
☐ YES ☐

NO. OF PACK

WEIGHT
_____LBS.

DATE SHI

PICKED

CHEC
2

ECEIVED BY

DATE RECEIVED

PACI
2

TLE

202-6 (1-92) 000964502

COPY

SUBJECT TO TERMS AND CONDITIONS ON REVE

590

5400 South 122nd East Ave.
P.O. Box 21148
Tulsa, OK 74121
Phone (918) 252-6000
Telex No. 6866124
Fax No. (918) 252-6558

Date: September 13, 1994

Customer: Omega Point Laboratories

Customer P.O.: 1148-Q

Subject: **Certificate of Conformance**

Quantity: 2 Boxes 1/4 x 2 1/4 HKBII(Item #000453605)

To Whom it May Concern:

This is to certify that Hilti Kwik-Bolt II is manufactured in compliance with our standard specifications which state the following:

A. **Stud bolt material** is **AISI 1038** except for the following bolt sizes which are **AISI 11L41: 3/8 x 7, 3/4 x 12 and all 1" diameter bolts.** The **AISI 1038** bolt material meets the chemical requirements for **ASTM Specification A510** while the **AISI 11L41** material meets the chemical requirements for **ASTM Specification A108.**

B. The expansion **wedges** are made from **AISI 1010** steel except for the 3/4" x 12" and all 1" diameter which are made of AISI 304 Stainless Steel.

C. **Hex Nuts** are of commercial manufacture, meeting **ASTM A563, Gr. A,** and ANSI B18.2.2.

D. **Washers** are fabricated from SAE standard material in accordance with ASA Standard #B27.2-1965 SAE 1005/1020, superseded by **ANSI B18.22.1 1965 (R-1975).**

E. **Kwik-Bolts** conform to the description provided in Federal Specification **FF-S-325, Group II Type 4 Class I, Interim Amendment-3, dated July 16, 1965.**

F. **Bolts, Nuts and Washers** are **zinc plated** in accordance with **ASTM B633-85, Type III, SC1.**

The above products were manufactured in Tulsa, Oklahoma and supplied in accordance with Hilti's QA program, BHB-NQP-101 Rev. I, dated 01/94, 10CFR part 21 and 10 CFR 50 Appendix B. Additionally, they meet the requirements of the above referenced purchase order number.

Sincerely,

J. Metcalf
Quality/Environmental Engineer

JM
coc2a

OMEGA POINT LABORATORIES

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI - TVA
CLIENT/PROJECT NUMBER 11960-97258 #5
RECEIVED FROM Hilti
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1432 . 11960
DATE RECEIVED 8-30-94
DATE INSPECTED 8-30-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
KWIK BOLT II 3/8" X 3 3/4"	1151Q	200	200	0	000453647	Y		Good	None	X			
KWIK BOLT II 1/2" X 7"	1151Q	100	100	0	000453795	Y		Good	None	X			
DRILL BIT 6" X 1/2"	1151Q	1	1	0	000280370	Y		Good	None	X			

FORM
1/29/93

558

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Hilti, Inc.
853 Isom Road

San Antonio TX 78216

PO Number: 1151-Q

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Kerry M. Hitchcock
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
8/31/94	Their Truck		8/31/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Kwik Bolt II 3/8"x3-3/4" 000453647	200		$0.00
2.	Drill Bit 1/2"x6" 000280370	1		$0.00
3.	Kwik Bolt II 1/2"x7" 000453795	100		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Tatton
Date 8-31-94

Special Instructions

Please include Certificate of Conformance.

Ordered By: Kerry Hitchcock

Project #: TSI/TVA

Total	$0.00
Shipping	
Tax	
Invoice Total	$0.00

CUSTOMER COPY

598

HILTI®

Tulsa, Oklahoma 74146
Phone (918) 252-6000

T/S NO.	T/S NAME	STORE NO.	ASSIGNED F.O. NO.	X REFERENCE NO.

☐ N. ☐-NEW ACC'T. ☐ ADDRESS/NAME CHANGE

ACCOUNT NUMBER 6 9 1 E 1 1 1 7 7

CUSTOMER PHONE NUMBER ( ) —

PURCHASE ORDER NUMBER 1151Q

BILL TO
NAME Omega Fluid
STREET
P.O. BOX
CITY STATE ZIP

SHIP TO
CITY STATE ZIP

MARKET CODES

MARKET	☐1 = Trans. ☐2 = Util. ☐3 = Telecom ☐4 = Non-Res. ☐5 = Res.
NATURE	☐1 = Maint. ☐2 = Renov. ☐3 = New Const. ☐4 = OEM ☐5 = Manufacturing ☐6 = Resale ☐7 = Export
SOLD TO GOV AGENCY	☐1 = Local ☐2 = State. ☐3 = Fed. ☐4 = Not Sold to Gov. Agency
SOLD FOR GOV PROJECT	☐1 = Local ☐2 = State. ☐3 = Fed. ☐4 = Not Sold to Gov. Project
POINT OF SALE:	☐1 = Office ☐2 = Job Site
KEY JOB SITE:	YES NO IF YES KEY JOB SITE #

TAX STATUS T E

COMPLETE ONLY IF APPLICABLE
① Ship to T/S For Delivery ② Confirms Prior Whse. Shipmt.

IF TAX EXEMPT FORWARD CERTIFICATE TO TULSA

APPROVAL #
CUSTOMER SITE
PROMO
CONTRACT #

LINE NO.	CAT. NO.	DATED MAT. *	DESCRIPTION/NOTES	TOTAL QTY. ORDERED	DELIVERED QTY. VAN	DELIVERED QTY. STORE	TO BE SHIPPED QTY. STORE	TO BE SHIPPED QTY. WHSE	UNIT PRICE	$ AMOUNT
			XB 3/8 3 3/4	2		2				
			XB 1/2 7	1		1				
			Tec 1/2 6	1		1				

NOTES/SHIPPING INSTRUCTIONS

TOTAL ORDER
$
TAX
FREIGHT
NET ORDER $
SHIP C.O.D. $
APPROVED BY
DATE ENTERED TIME
S.E. OPERATOR

DELIVERY: ☐ COMPLETE ☐ PARTIAL AS SHOWN BALANCE TO BE SHIPPED.

CASH ☐ CHECK # AMT. REC'D. $

DRIVER'S LICENSE # STATE EXP. DATE

PHONED IN ORDER ☐ NAME

LINE NO.	TOOL MODEL	PRODUCT SERIAL NO.

ITEMS INDICATED BY (*) HAVE LIMITED SHELF LIFE. RETURNS FOR CREDIT MORE THAN (30) THIRTY DAYS PAST INVOICE DATE WILL NOT BE ACCEPTED.

CUSTOMER'S INITIALS X K M H

Salesmen are not authorized to make warranties regarding specific applications –

CUSTOMER'S SIGNATURE X

DATE 8-30-94 TITLE Tech

SUBJECT TO TERMS AND CONDITIONS ON REVERSE SIDE.

594

5400 South 122nd East Ave.
P.O. Box 21148
Tulsa, OK 74121
Phone (918) 252-6000
Telex No. 6866124
Fax No. (918) 252-6558

Date: September 13, 1994

Customer: Omega Point Laboratories

Customer P.O.: 1151-Q

Subject: **Certificate of Conformance**

Quantity: 2 Boxes 3/8 x 3 3/4 HKBII(Item #000453647)
1 Box 1/2 x 7 HKBII(Item #000453795)

To Whom it May Concern:

This is to certify that Hilti Kwik-Bolt II is manufactured in compliance with our standard specifications which state the following:

A. **Stud bolt material** is **AISI 1038** except for the following bolt sizes which are **AISI 11L41: 3/8 x 7, 3/4 x 12 and all 1" diameter bolts.** The **AISI 1038** bolt material meets the chemical requirements for **ASTM Specification A510** while the **AISI 11L41** material meets the chemical requirements for **ASTM Specification A108.**

B. The expansion **wedges** are made from **AISI 1010** steel except for the 3/4" x 12" and all 1" diameter which are made of AISI 304 Stainless Steel.

C. **Hex Nuts** are of commercial manufacture, meeting **ASTM A563, Gr. A,** and ANSI B18.2.2.

D. **Washers** are fabricated from SAE standard material in accordance with ASA Standard #B27.2-1965 SAE 1005/1020, superseded by **ANSI B18.22.1 1965 (R-1975).**

E. **Kwik-Bolts** conform to the description provided in Federal Specification **FF-S-325, Group II Type 4 Class I, Interim Amendment-3, dated July 16, 1965.**

F. **Bolts, Nuts and Washers** are **zinc plated** in accordance with **ASTM B633-85, Type III, SC1.**

The above products were manufactured in Tulsa, Oklahoma and supplied in accordance with Hilti's QA program, BHB-NQP-101 Rev. I, dated 01/94, 10CFR part 21 and 10 CFR 50 Appendix B. Additionally, they meet the requirements of the above referenced purchase order number.

Sincerely,

J. Metcalf
Quality/Environmental Engineer

JM
coc2a

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97553-55+
RECEIVED FROM Hilti 97257
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1441 - 11960
DATE RECEIVED 9/30/94
DATE INSPECTED 9/30/94
INSPECTED BY: CPatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Hilti quick Bolt II 2¼"x¼"	1159Q	200	200	0	KB¼-2¼	Y	Y	Good	None	X			
Hilti Quick Bolt II ¼"x4½"	1159Q	100	100	0	KB¼-4½	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Steve Hood
Hilti, Inc.
853 Isom Road

San Antonio TX 78216

PO Number: **1159-Q**

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:	Ship To:
Accounts Payable Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784	Cleda Patton Omega Point Laboratories, Inc. 16015 Shady Falls Road Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
9/29/94	Pick up		9/30/94	

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	Hilti Quick Bolt II 1/4"x 2-1/4"	200		$0.00
2.	Hilti Quick Bolt II 1/4"x4 1/2" CK	100		$0.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 9/29/94

Special Instructions

Certificate of Compliance/conformance

Ordered By: Cleda Patton

Project #: TSI/TVA

Total	$0.00
Shipping	
Tax	
Invoice Total	**$0.00**

HILTI®

CUSTOMER COPY

537

Tulsa, Oklahoma 74146
Phone (918) 252-6000

T/S NO.	T/S NAME	STORE NO.	ASSIGNED F.O. NO.	X REFERENCE NO.

☐-NEW ACC'T. ☐ ADDRESS/NAME CHANGE

ACCOUNT NUMBER 898177

CUSTOMER PHONE NUMBER ( ) -

PURCHASE ORDER NUMBER 11590

BILL TO
NAME
STREET
P.O. BOX
CITY | STATE | ZIP

SHIP TO
CITY | STATE | ZIP

MARKET CODES

MARKET	☐1 = Trans. ☐2 = Util. ☐3 = Telecom ☐4 = Non-Res. ☐5 = Res.
NATURE	☐1 = Maint. ☐2 = Renov. ☐3 = New Const. ☐4 = OEM ☐5 = Manufacturing ☐6 = Resale ☐7 = Export
SOLD TO GOV AGENCY	☐1 = Local ☐2 = State. ☐3 = Fed. ☐4 = Not Sold to Gov. Agency
SOLD FOR GOV PROJECT	☐1 = Local ☐2 = State. ☐3 = Fed. ☐4 = Not Sold to Gov. Project
POINT OF SALE:	☐1 = Office ☐2 = Job Site
KEY JOB SITE:	YES NO IF YES KEY JOB SITE #

TAX STATUS T E

COMPLETE ONLY IF APPLICABLE
① Ship to T/S For Delivery ② Confirms Prior Whse. Shipmt.

IF TAX EXEMPT FORWARD CERTIFICATE TO TULSA

APPROVAL #
CUSTOMER SITE
PROMO
CONTRACT #

LINE NO.	CAT. NO.	DATED MAT. *	DESCRIPTION/NOTES	TOTAL QTY. ORDERED	DELIVERED QTY. VAN	DELIVERED QTY. STORE	TO BE SHIPPED QTY. STORE	TO BE SHIPPED QTY. WHSE	UNIT PRICE	$ AMOUNT
1			KB 1/4-3 1/4	2		2				
2			KB 1/4-4 1/2	1		1				

NOTES/SHIPPING INSTRUCTIONS

TOTAL ORDER
$

DELIVERY; ☐ COMPLETE ☐ PARTIAL AS SHOWN BALANCE TO BE SHIPPED.

CASH ☐ CHECK #

AMT. REC'D. $

DRIVER'S LICENSE # STATE EXP. DATE

PHONED IN ORDER ☐ NAME

TAX
FREIGHT
NET ORDER $

LINE NO.	TOOL MODEL	PRODUCT SERIAL NO.

ITEMS INDICATED BY (*) HAVE LIMITED SHELF LIFE. RETURNS FOR CREDIT MORE THAN (30) THIRTY DAYS PAST INVOICE DATE WILL NOT BE ACCEPTED.

CUSTOMER'S INITIALS
X

SHIP C.O.D. $

APPROVED BY

DATE ENTERED | TIME

S.E. OPERATOR

Salesmen are not authorized to make warranties regarding specific applications –

CUSTOMER'S SIGNATURE X

DATE 9/30 | TITLE

SUBJECT TO TERMS AND CONDITIONS ON REVERSE SIDE.

598

5400 South 122nd East Ave.
P.O. Box 21148
Tulsa, OK 74121
Phone (918) 252-6000
Telex No. 6866124
Fax No. (918) 252-6558

Date: October 13, 1994

Customer: Omega Point Laboratories Inc.

Customer P.O.: 1159-Q

Subject: **Certificate of Conformance**

Quantity: 2 Boxes 1/4 x 2 1/4 HKBII(Item #000453605)
1 Box 1/4 x 4 1/2 HKBII(Item #000453787)

To Whom it May Concern:

This is to certify that Hilti Kwik-Bolt II is manufactured in compliance with our standard specifications which state the following:

A. **Stud bolt material** is **AISI 1038** except for the following bolt sizes which are **AISI 11L41: 3/8 x 7, 3/4 x 12 and all 1" diameter bolts.** The **AISI 1038** bolt material meets the chemical requirements for **ASTM Specification A510** while the **AISI 11L41** material meets the chemical requirements for **ASTM Specification A108.**

B. The expansion **wedges** are made from **AISI 1010** steel except for the 3/4" x 12" and all 1" diameter which are made of AISI 304 Stainless Steel.

C. **Hex Nuts** are of commercial manufacture, meeting **ASTM A563, Gr. A,** and ANSI B18.2.2.

D. **Washers** are fabricated from SAE standard material in accordance with ASA Standard #B27.2-1965 SAE 1005/1020, superseded by **ANSI B18.22.1 1965 (R-1975).**

E. **Kwik-Bolts** conform to the description provided in Federal Specification **FF-S-325, Group II Type 4 Class I, Interim Amendment-3, dated July 16, 1965.**

F. **Bolts, Nuts and Washers** are **zinc plated** in accordance with **ASTM B633-85, Type III, SC1.**

The above products were manufactured in Tulsa, Oklahoma and supplied in accordance with Hilti's QA program, BHB-NQP-101 Rev. I, dated 01/94.

Sincerely,

J. Metcalf
Quality/Environmental Engineer

JM
coc2a

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-874 97257-60
RECEIVED FROM Ramsey Electric Supply Co.
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1407 - 11960
DATE RECEIVED 7-26-94
DATE INSPECTED 7-26-94
INSPECTED BY: C. Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
4"X12'X24" ladders	NA	0	5	0	06-1079-0012-24	Y	N	Good	NONE	X			Receiving Verification Only
24" flngd stl Cover	NA	0	1	0	2000-0012-24	Y	N						
Adj. Riser Conn. Pair	NA	0	2	0	06-1079-1307-02	Y	N	Good	None	X			
Cover Conn 1"flg 3" Gap	NA	0	50	0	06-1079-1895-30	Y	N	Good	None	X			

FORM
1/29/93

WESTERN, INC. Manufacturers

623 OLYMPIC BLVD. P.O. BOX 1399
MONTEBELLO, CALIFORNIA 90640-1399
TELEPHONE (213) 723-8919
FAX (213) 728-5023

INVOICE NO. 14739

SOLD TO

Ramsey Electric Supply Co.
2310 Rossville Blvd.
Chattanooga, TN 37401

SHIP TO

Omega Point Lab
16015 Shady Falls Rd.
Elmendorf, TX 78112

Attn: Jim TVA Field Eng.
MARK: 1029342

DATE OF INVOICE	DATE OF ORDER	CUSTOMER ORDER NO.	SALESMAN
7/25/94	7/22/94	0020056	PROF L @

SHIP VIA	PART. DEL.	COMPLETE DELIVERY
Emery Air Frt ACCT# 541-015-053 3rd Party Billing		

ITEM NO.	CATALOG NUMBER	DESCRIPTION	QUANTITY TOTAL ORDER	PREV. SHIPPED	THIS SHIP'T	BACK ORDERED
1	06-1D79-0012-24	4" Stl Ladder 12'L 24"W	5	0	5	
2	2000-0012-24	Flngd Stl Cover; Str 24"W	1	0	1	
3	06-1D79-1307-02	Adj. Riser Conn. Pair	2	0	2	
4	06-1D79-1895-30	Cover Conn. 1"Flg 3" Gap	50	0	50	

PLEASE PAY FROM THIS INVOICE - NO OTHER STATEMENT WILL BE SENT. THANK YOU. NO ADJUSTMENTS WILL BE MADE ON SHORTAGE OR DEFECTIVE MERCHANDISE UNLESS CLAIM IS MADE WITHIN 30 DAYS FROM RECEIPT OF SHIPMENT. MERCHANDISE IS NOT SUBJECT TO RETURN FOR CREDIT UNLESS AUTHORIZED BY THIS COMPANY.
INTEREST AT A RATE OF 1½% PER MONTH WILL BE CHARGED ON ALL PAST DUE INVOICE.

TERMS: NO GOODS TO BE RETURNED OR CREDITED WITHOUT OUR CONSENT. GOODS COVERED BY THIS INVOICE WERE PRODUCED IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF THE FAIR LABOR STANDARDS ACT OF 1938, AS AMENDED. PRICES ARE IN ACCORDANCE WITH GOVERNMENTAL REGULATIONS. WHILE PRICES SHOWN ARE THE CURRENT PRICES, ORDER WILL BE BILLED AT PREVAILING PRICES AT TIME OF SHIPMENT.

PACKING LIST

THANK YOU

STOP!

READ THIS NOTICE

THIS SHIPMENT IS YOUR PROPERTY

The carrier accepted responsibility for safe delivery when he accepted and signed for your merchandise. When it arrives:

- Check tray, fittings and miscellaneous details including hardware for external damage.
- Check part count and make sure you received everything that is shown on the packing list.

IF THERE IS A PROBLEM:

1. Make a note of the damage on the face of the shipping receipt. Example: "2 damaged 12' Trays - Feb 25 - John Doe." You may now accept the shipment and you can keep the damaged material or let the carrier keep it. Do not ship it back to P-W and do not throw it away. If you let the carrier keep it, make a note of that on the receipt too. Don't assume that the carrier or yourself will remember what happened to the items later. If you lose the damaged material the claim is dead. If the carrier loses it, it's his problem.
2. Make a detailed note for yourself, like "Bent Rungs, two 1C31-0012-12, returned to Terminal." The part numbers are on a sticker attached to the part. You'll need this to reorder and it could come in handy later.
3. Call the carrier's Claims department and they will fax you a damage claim form. They may send an inspector to look at the part(s). When they pay you, they probably will want the damaged parts for possible salvage value.
4. Call your Distributor and reorder whatever is damaged. The sooner you do, the sooner you will have your replacement parts.

THE CARRIER OWES YOU:

- The value of whatever was damaged, and:
- The costs for re-shipping.

For instance, in the above example, you are owed the value of the two pieces of tray and whatever it costs to ship the two replacement pieces.

Many carriers will ship the replacement pieces free to save themselves the hassle of processing the claim for the freight. Notify your Distributor of any such arrangement because in order to get your free shipment, the carrier will usually require the shipper to note on the bill of lading something like "Ship Free - See Joe, Seattle Terminal." If this is not on the bill of lading you'll get charged for the shipment and then you'll have to file a claim for that.

IN SHORT:

- **NOTE IRREGULARITIES ON THE SHIPPING RECEIPT**
- **FILE YOUR CLAIM RIGHT AWAY**
- **GET YOUR REPLACEMENT PARTS STARTED IMMEDIATELY**
- **DON'T LOSE TRACK OF YOUR DAMAGED PARTS!**

The carrier wants your, and our, business. Satisfy his needs for documentation and verification and he'll be happy to pay your claim.

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185-87, 97257-
RECEIVED FROM Southwestern Wire Cloth CO
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1403 - 11960
DATE RECEIVED 7-20-94
DATE INSPECTED 7-20-94
INSPECTED BY: A Dalton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Tie Wire .062"	NA	0	100#	0	30455.062"	Y	N	Good	None	X			Receiving Verification Only

FORM
1/29/93

603

Southwestern Wire Cloth

P.O. BOX 35608
TULSA, OKLAHOMA 74153
(918) 251-2679
FAX (918) 251-0375

1831 W. SAM HOUSTON PARKWAY N.
HOUSTON, TEXAS 77043
(713) 973-2959
FAX (713) 973-1857

ORDER NO:
PAGE:
DATE:
REQ. SHIP DATE:

SOLD TO

SHIP TO

F.

CUSTOMER P. O.	ORDER DATE	SLSP	TERMS	SHIPPED FROM	SHIPPED VIA	FREIGHT

QUANTITY ORDERED	QUANTITY SHIPPED	QUANTITY B.O.	PART NUMBER	DESCRIPTION	U/M
	100				

Sherry #6

SEE REVERSE SIDE FOR ADDITIONAL TERMS AND CONDITIONS OF SALE

PACKING LIST

This Memorandum is an acknowledgement that a Bill of Lading has been issued and is not the Original Bill of Lading, nor a copy or duplicate, covering the property named herein, and is intended solely for filing or record.

SMC #5183
ICC-MC 190566

604
58098

CTI W/B NO. ______

CTI CONTROL NO. ______

DATE 7-20-94

Cannonball Trucking, Inc.

P.O. Box 262523, Houston, Texas 77207-2523 • 644-7300
Fax # (713) 644-9431

SHIPPERS B/L NO. ______

S… RS ORDER NO. ______

CONSIGNEES ORDER NO. ______

RELEASE NO. ______

INTRASTATE ☐ ICC ☐ LOCAL ☐

FROM: SHIPPER	TO: CONSIGNEE
Southwestern Wire Cloth	Omega Paint Laboratory
STREET ADDRESS: 1631 W Belt North	STREET ADDRESS: 14013 Shady Pass St. [illegible]
CITY / STATE / ZIP: Deu, TX	CITY / STATE / ZIP: Elmendorf, TX 78112
LOCATION / DOCK / SHIP	LOCATION / DOCK / SHIP
LEASE / RIG. / WELL NO.	LEASE / RIG. / WELL NO.

DRIVER	TRUCK NO.	TRAILER NO.	EQUIPMENT USED	LENGTH	WIDTH	HEIGHT
Sherry	#6		20			

BILL TO:	TARIFF MILEAGE	REGULATED BY	TARIFF

SPECIAL INSTRUCTIONS:	PLUS MILEAGE	ITEM NO.	COLUMN NO.

# PCS.	COMMODITY OR SERVICE RENDERED	HRS/WEIGHT	RATE	AMOUNT
2	Rolls Wire	100#		
☐	FUEL SURCHARGE			
☐	EXTRA STOPS			
☐	EXCLUSIVE USE OF VEHICLE REQUESTED			
☐	EXPEDITED SERVICE REQUESTED			
	TOTAL →			

C.O.D. CHARGE TO BE PAID BY { SHIPPER ☐ CONSIGNEE ☐

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement.
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges

______ (Signature of Shipper)

If charges are to be prepaid, write or stamp here. "To be Prepaid."

If charges are to be C.O.D. the carrier accepts no such responsibility, unless amount is here specified and this section signed by consignor.

$ ______ C.O.D. Amount

______ Signature of Shipper

Received $ ______ to apply in prepayment of the charges on the property described hereon.

______ Agent or Cashier

Per ______ (The signature here acknowledges only the amount prepaid.)

$ ______ Charges Advanced

PICK-UP RECORD (To be completed at Shipper's location)

SHIPPER NOTIFIED OF ARRIVAL		LOADING BEGAN		LOADING COMPLETED		UNIT RELEASED	
Date	Time	Date	Time	Date	Time	Date	Time

REASON FOR DELAY IN LOADING (IF ANY)
I hereby certify that the dates and time shown above are correct.
SHIPPER CO. NAME ______ BY ______ SHIPPER'S AGENT TITLE ______

DELIVERY RECORD AND RECEIPT (to be completed at Delivery location)

CONSIGNEE NOTIFIED OF ARRIVAL		UNLOADING BEGAN		UNLOADING COMPLETED		UNIT RELEASED	
Date	Time	Date	Time	Date	Time	Date	Time

REASON FOR DELAY IN UNLOADING (IF ANY)
I hereby certify that the dates and time shown above are correct.
CONSIGNEE CO. NAME ______ BY ______ CONSIGNEE'S AGENT TITLE ______

RECEIVE, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER'S NAME: [illegible]		RECEIVER'S NAME RECEIVED ABOVE ARTICLES IN GOOD ORDER	CONSIGNEE
BY	DATE	BY [illegible signature]	DATE 7-20-94

…nt moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is carrier's or shipper's weight.
…ere the rate is dependent on value, shippers are required to state in writing the agreed … value of property hereby specifically stated by the shipper to be not exceeding: $ ______ per ______
"It is understood and agreed that payment in full for work authorized hereunder shall be due seven (7) days after date hereof and if not paid in full within thirty (30) days, all amounts due shall carry interest at the rate of eighteen (18%) per cent per annum, in the event the claim is referred to an attorney for handling, the defendent shall bear full responsibility for all legal fees and any interest expense subsuquent thereto."

CANNONBALL TRUCKING, INC. CARRIER
P.O.BOX 262523
Houston, Texas 77207-2523
Permanent post office address of carrier

I hereby certify that the dates and time shown is correct.
CARRIER **CANNONBALL TRUCKING,INC.** DATE 7-20-94
DRIVER Sherry #6

All Amounts due under this waybill are due and payable in Houston, Harris County, Texas

CONSIGNEE COPY

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/IUA
CLIENT/PROJECT NUMBER 11960-97185.86+87
RECEIVED FROM Alamo Bolt + Screw
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1394 - 11960
DATE RECEIVED 7-11-94
DATE INSPECTED 7-12-94
INSPECTED BY: CPatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	COMD MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
1/2" Medium Lock Washers	11260	1K	1K	0	1/2" Lock Washers	Y	Y	Good	None	X			
1/2" nuts	11260	1K	1K	0	1/2" Finished Hex Nuts	Y	Y	Good	None	X			

FORM
1/29/93

PURCHASE ORDER

Omega Point Laboratories, Inc.
16015 Shady Falls Road, Elmendorf, TX 78112-9784
(210) 635-8100 FAX: (210) 635-8101

Vendor:

Randy
Alamo Bolt & Screw, Inc.
10101 Jones Maltsberger

San Antonio TX 78216

PO Number: **1126-Q**

Invoice, correspondence, all shipping papers, and packages must reference P.O. number.

Bill To:

Accounts Payable
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Ship To:

Cleda Patton
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

Order Date	Ship Via	P.O. Spec. No.	Date Required	Terms
7/11/94	Their Truck		7-12-94	30

Item No.	Description	Quantity Ordered	Unit Price	Extended Amount
1.	1/2" Medium Lock Washers	1000	$0.02	$23.00
2.	1/2" Finished Hex Nuts	1000	$0.04	$40.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval C Patton
Date 7-11-94

Special Instructions

Please include Certification of Conformance.

Ordered By: Cleda Patton

Project #: TSI/TVA

Total	$63.00
Shipping	
Tax	$4.88
Invoice Total	$67.88

ALAMO Bolt and Screw, Inc.

INVOICE NO.: 029240

10101 JONES MALTSBERGER
SAN ANTONIO, TX. 78216
512-342-9544

TO:
OMEGA POINT LABORATORIES
16015 SHADY FALLS RD.
ELMENDORF, TX. 78112

SHIP TO:
OMEGA POINT LABORATORIES
16015 SHADY FALLS RD.
ELMENDORF, TX. 78112

ACCOUNT NO.	SALESMAN NO.	PURCHASE ORDER NO.	SHIP VIA	COL	PPD	DATE SHIPPED	TERMS	INVOICE DATE	PAGE
073664	QYD	11260	DEL AM				JET 10	07/11/94	1

QTY. ORDERED	QTY. SHIPPED	QTY. BACK ORDERED	PROD. LINE	PART NO.	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1000	1000		SLW	1/2	MEDIUM LOCK WASHERS ZINC	2.30	23.00
1000	1000		HNC	1/2	FINISHED HEX NUTS NC ZINC	4.00	40.00

2 BOXS

WE APPRECIATE YOUR BUSINESS.

THANK YOU

SALE AMOUNT	63.00
SALES TAX	4.88
TOTAL	67.88

RECEIVED BY: [signature]

IVAN

608

ALAMO
Bolt and Screw, Inc.
10101 JONES MALTSBERGER
SAN ANTONIO, TEXAS 78216
PHONE: 342-9544
AREA CODE 210
FAX: (210) 342-9594

June 18, 1992

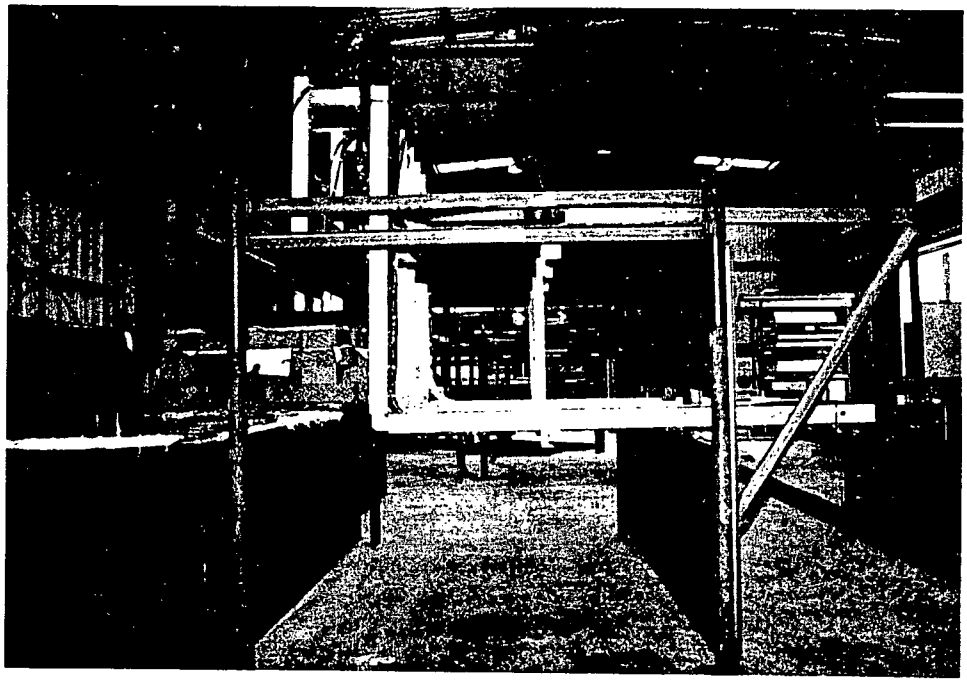
To Whom It May concern:

I hereby certify that on 7/11/94 we, ALAMO Bolt & Screw provided the material called for on your Purchase Order # 1126-Q on our Bill of Lading (shipping document) # 279340 in accordance with all applicable requirements for shipment. I further certify that the supplies that were provided are of the quality specified and are in all respects in conformance with purchase order requirements.

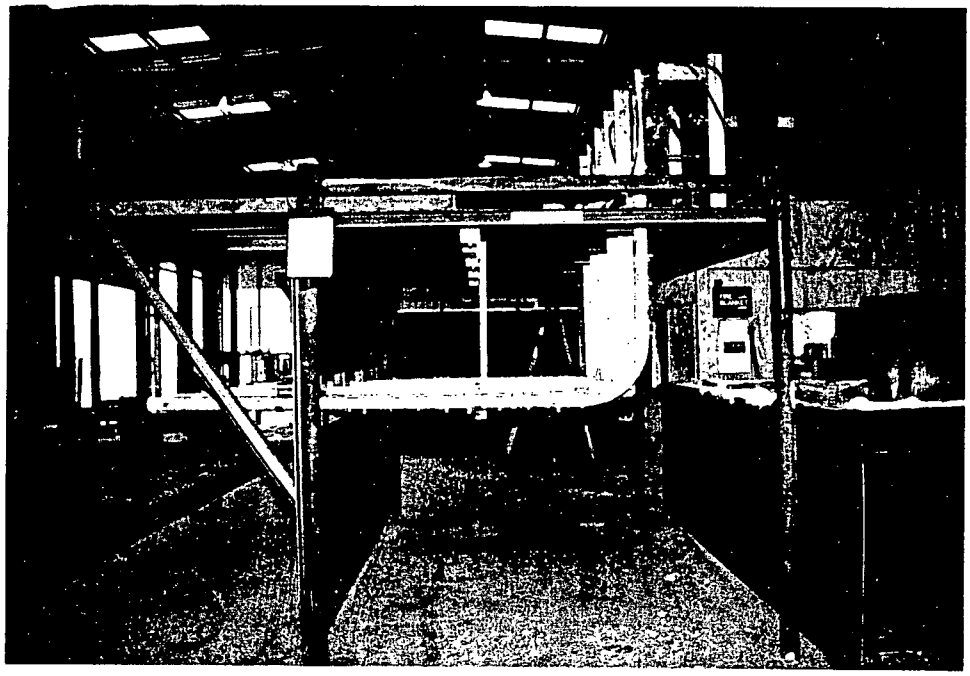
Date: 7/25/94
Signature: Laura H. DeBord
Title: Office Manager

Appendix F

PHOTOGRAPHS

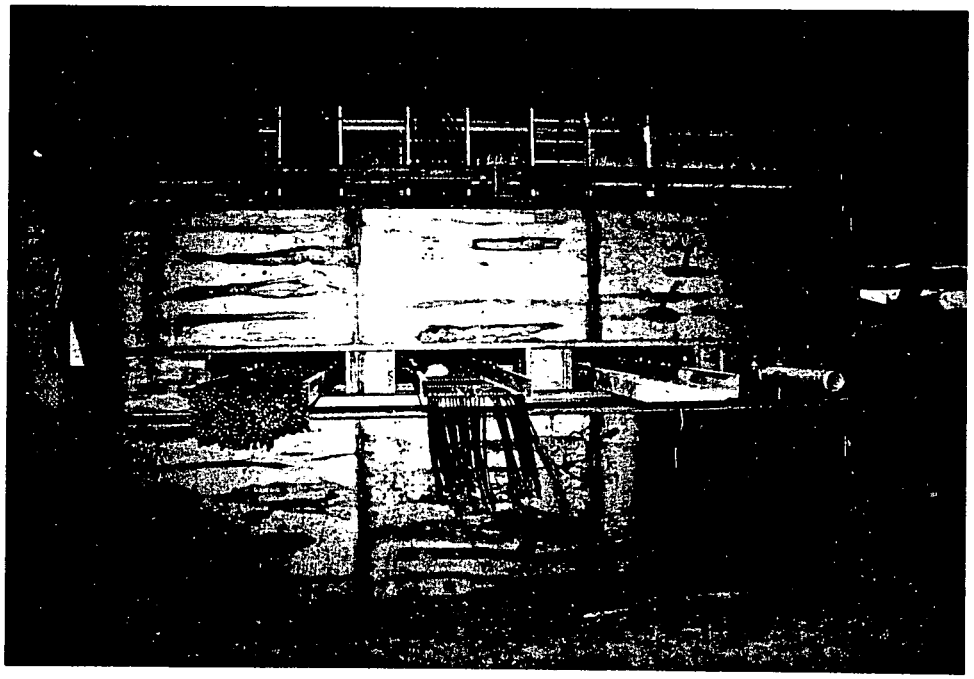


Left end view of assembled test deck.

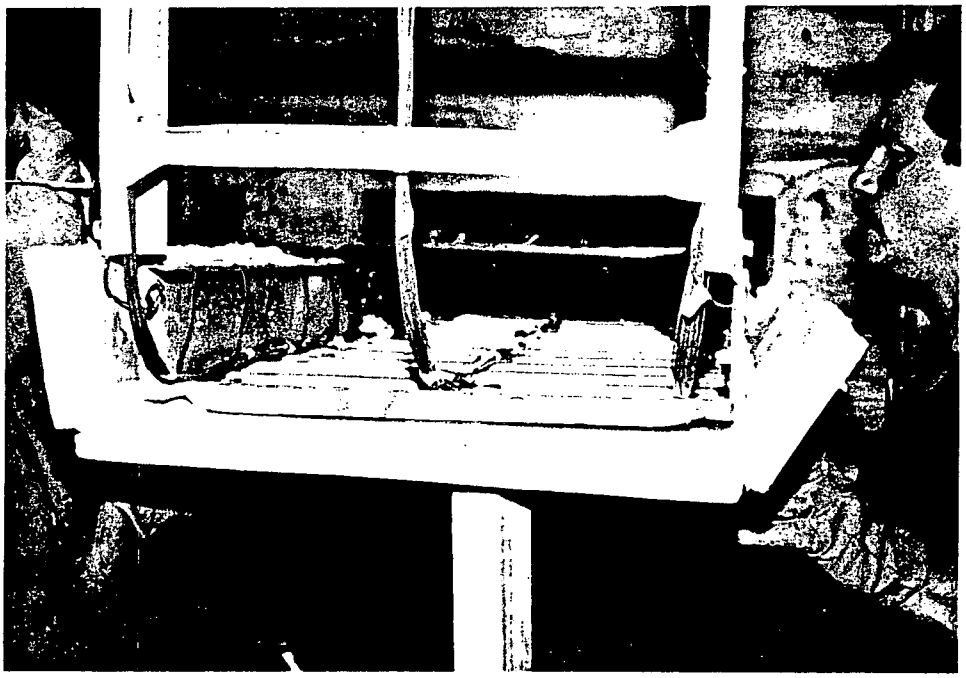


Right end view of assembled test deck.

Cables installed into left and center trays (note bundle height in bend area).

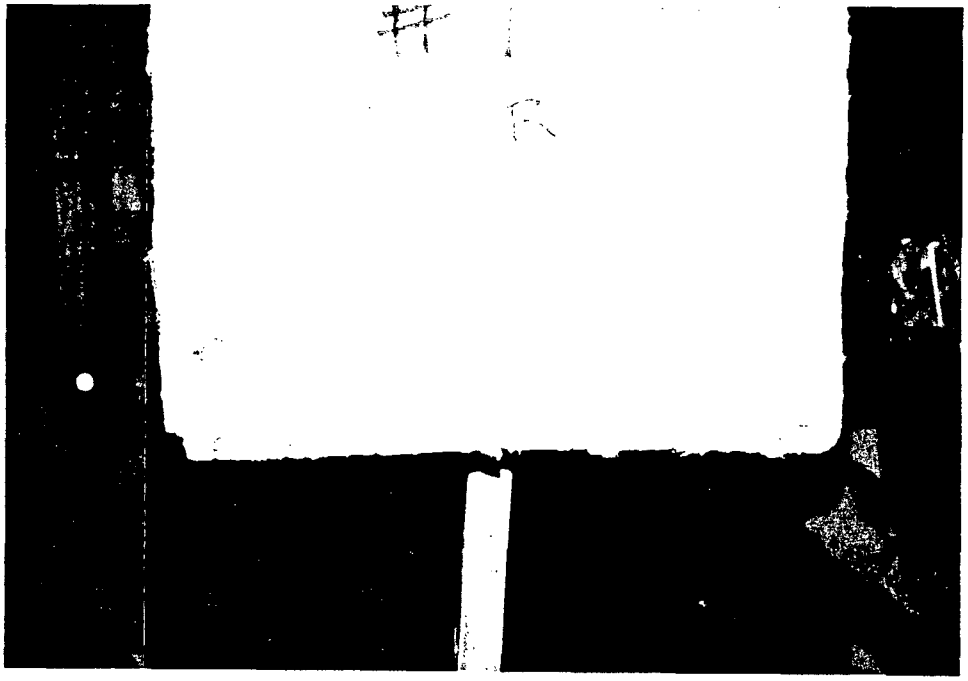


Front view of assembled test deck.

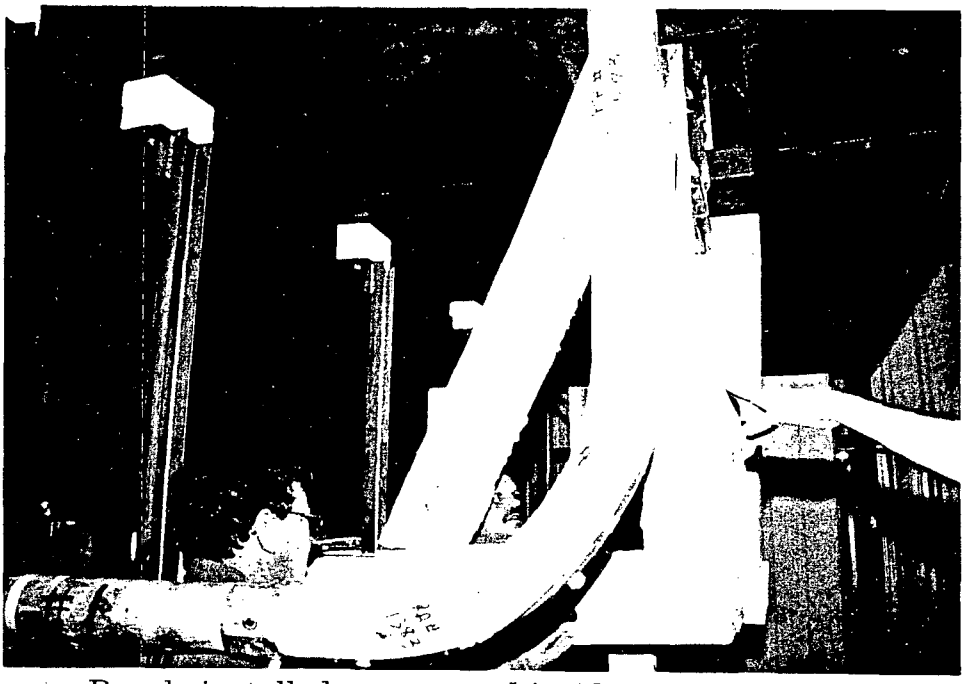


Scored panels installed on bottom and sides of tray assemblies.

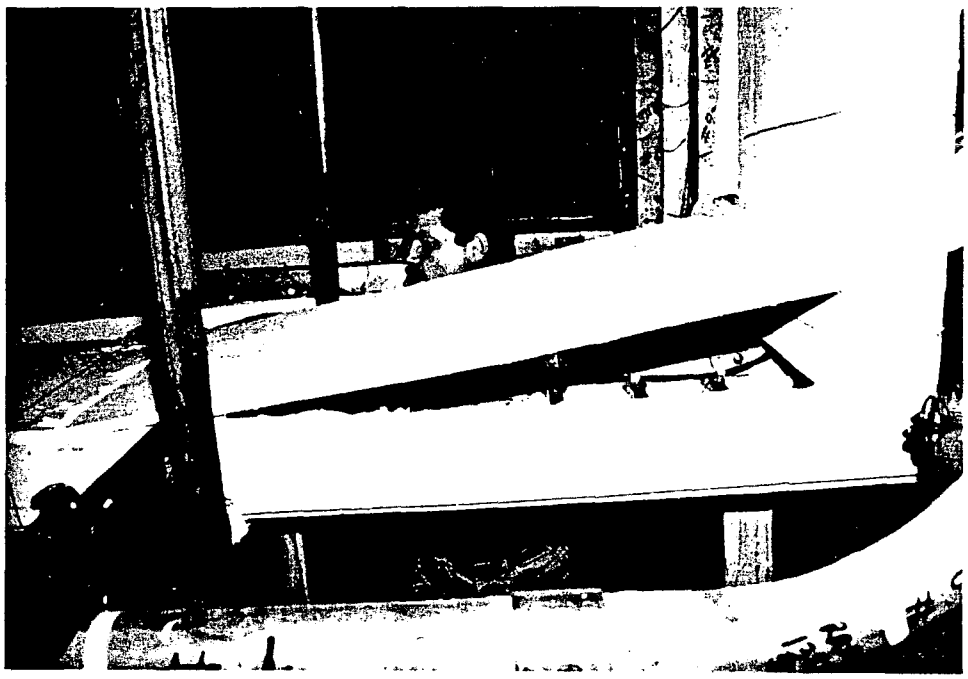
Scored panels installed on bottom and sides of tray assemblies.



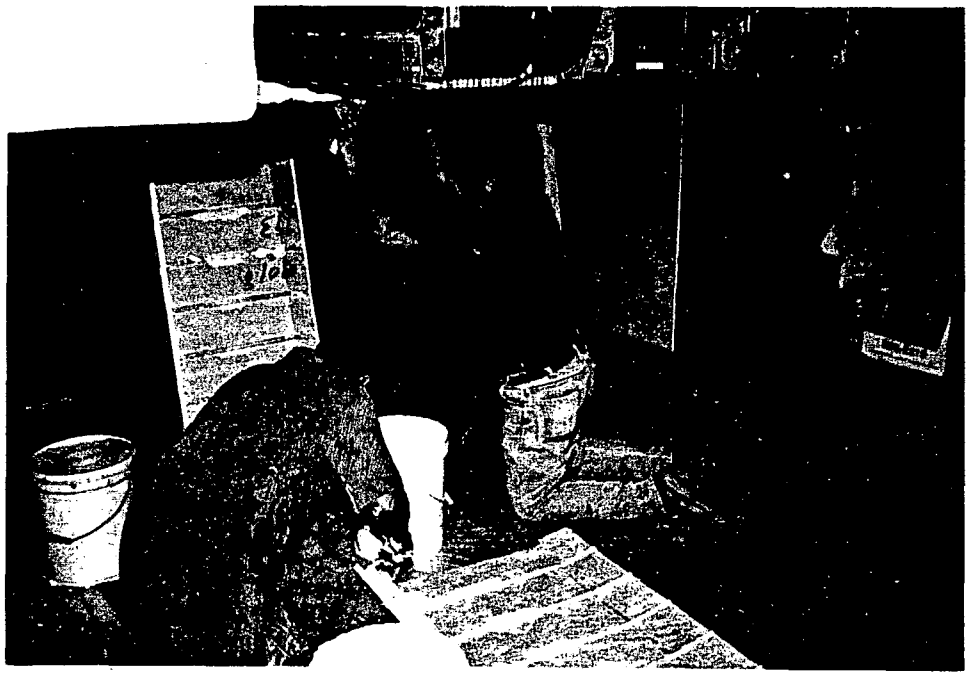
Tie wire stitches used to reinforce the corner joint at the bend location.



Panels installed on tops and inside vertical surfaces.

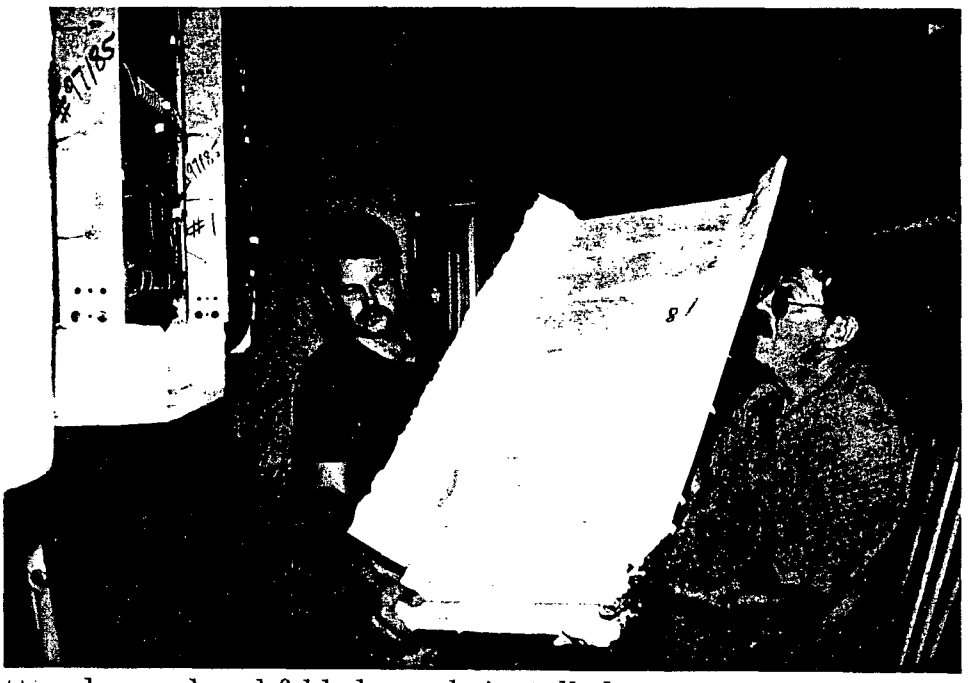


Panels installed on tops and inside vertical surfaces.

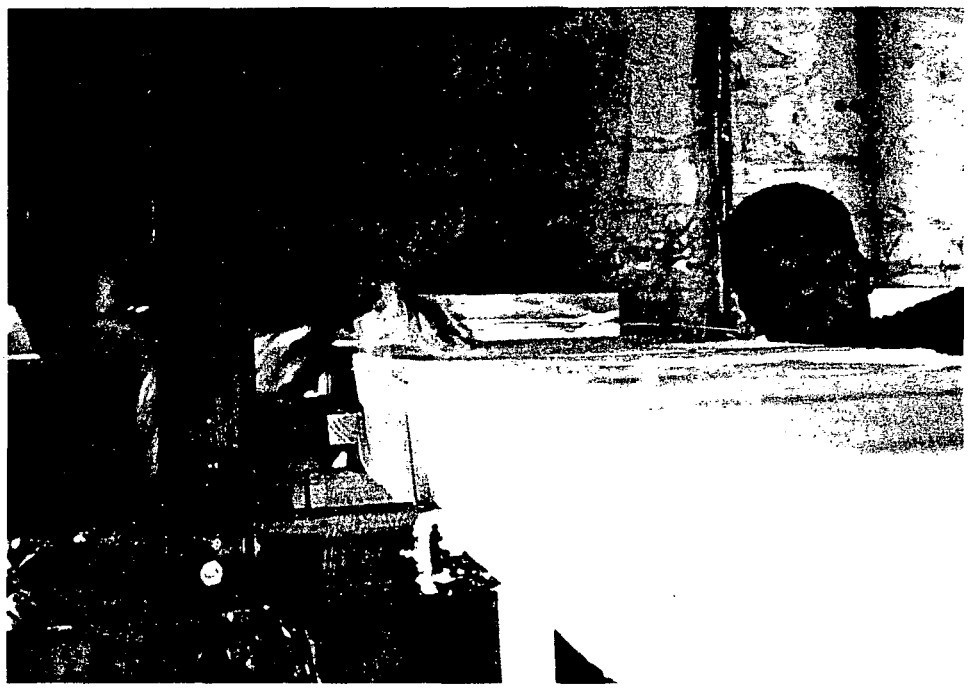


Panels pre-buttered with trowel grade material prior to installation.

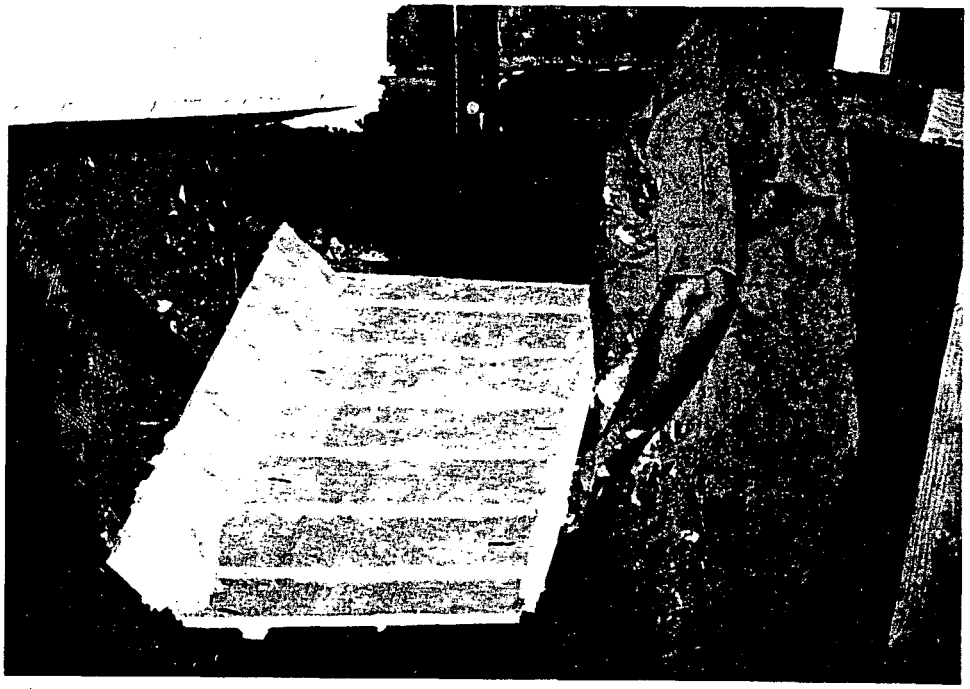
Pre-buttered scored and folded panels installed onto tray bottom and sides.



Pre-buttered scored and folded panels installed onto outside vertical section.



Panels installed onto tray tops and secured with stainless steel tie wires.

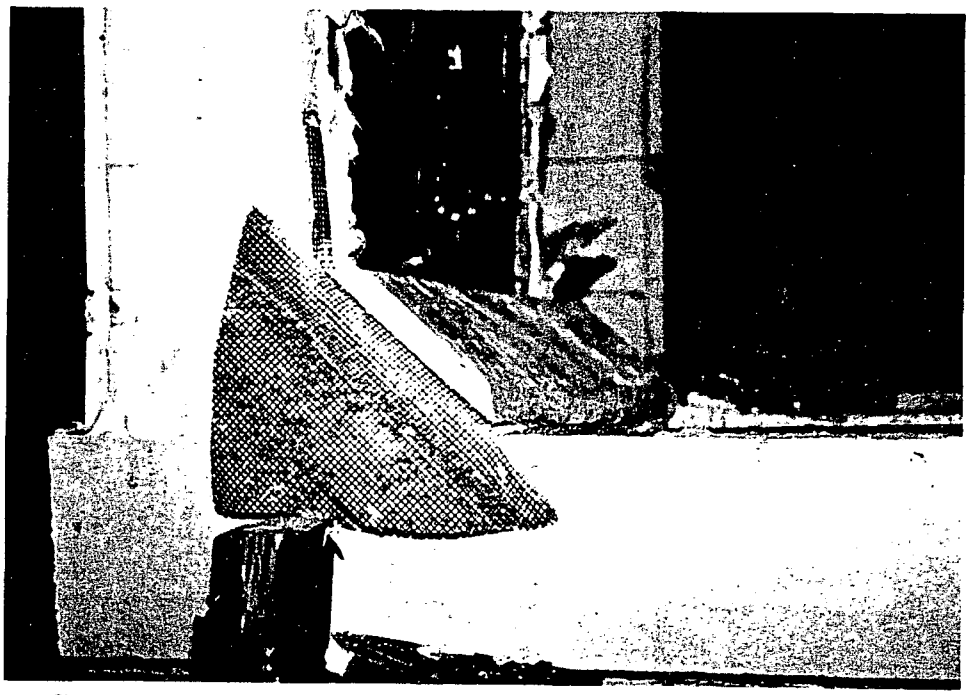


Pre-buttered scored and folded panel to be installed onto bottom of left tray.

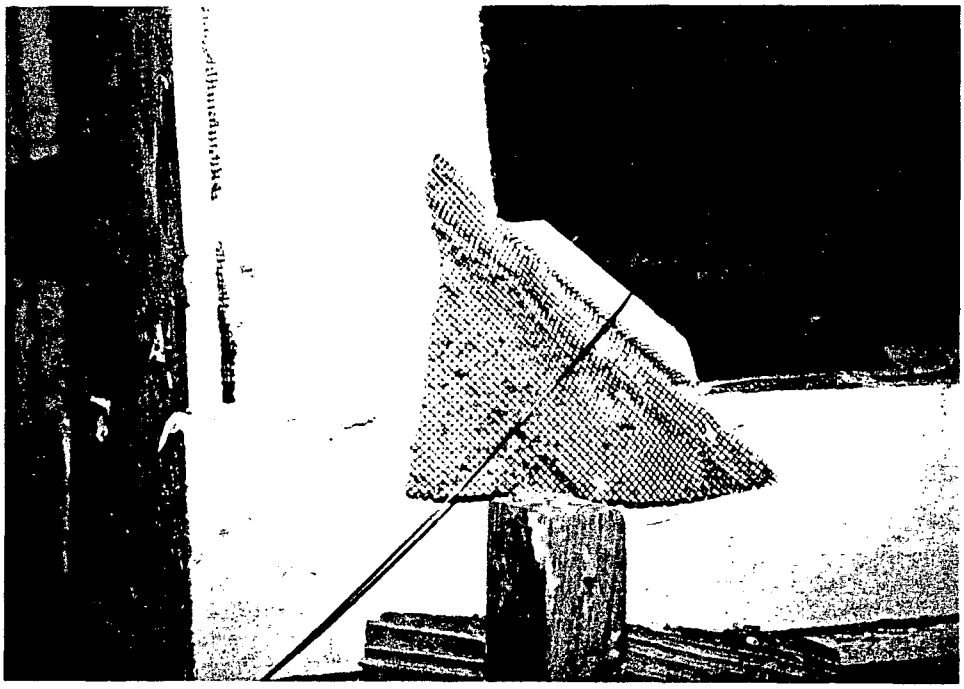
Panels installed onto top of left tray.

Triangular spacers used to accommodate extra cable height in bend area.

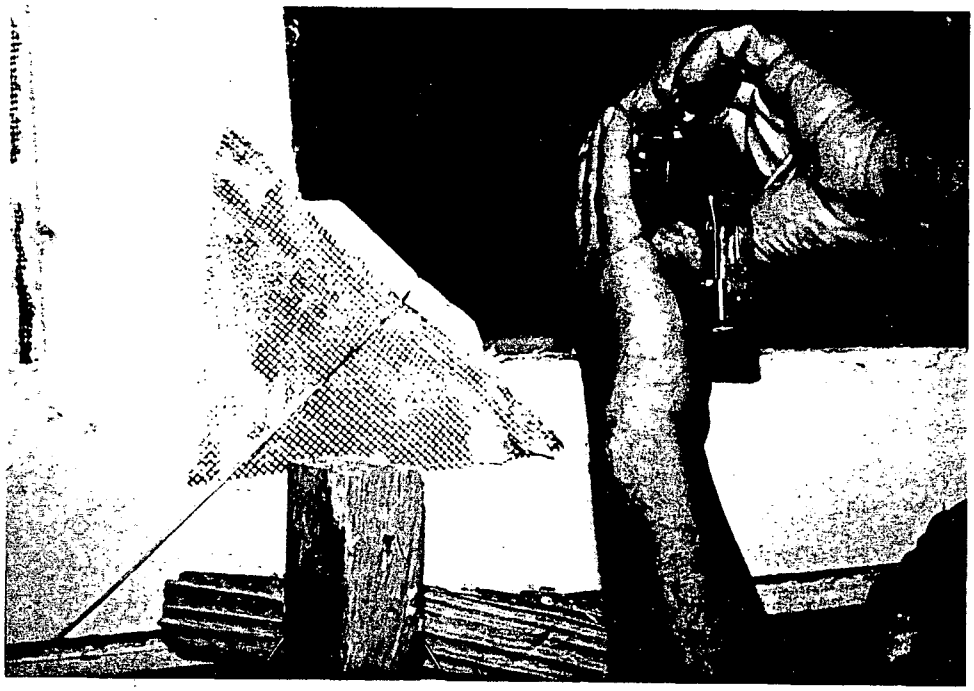
Section of panel to be installed over raised cables in bend area.



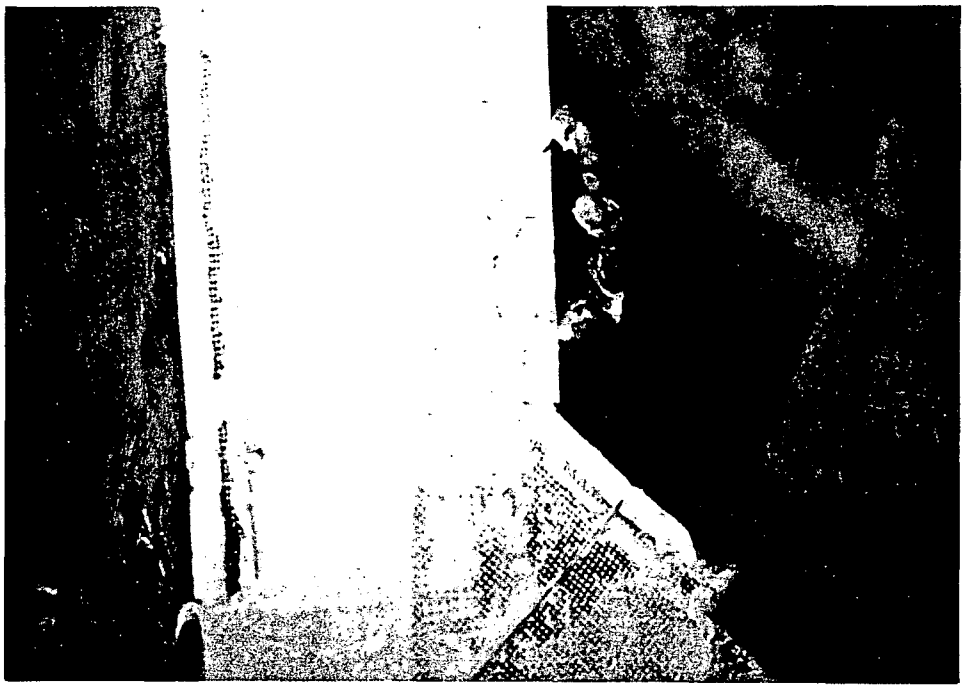
Section of panel installed over raised cables in bend area.



Panel secured to tray assembly with stainless steel tie wire.



Stress skin flap secured with staples.

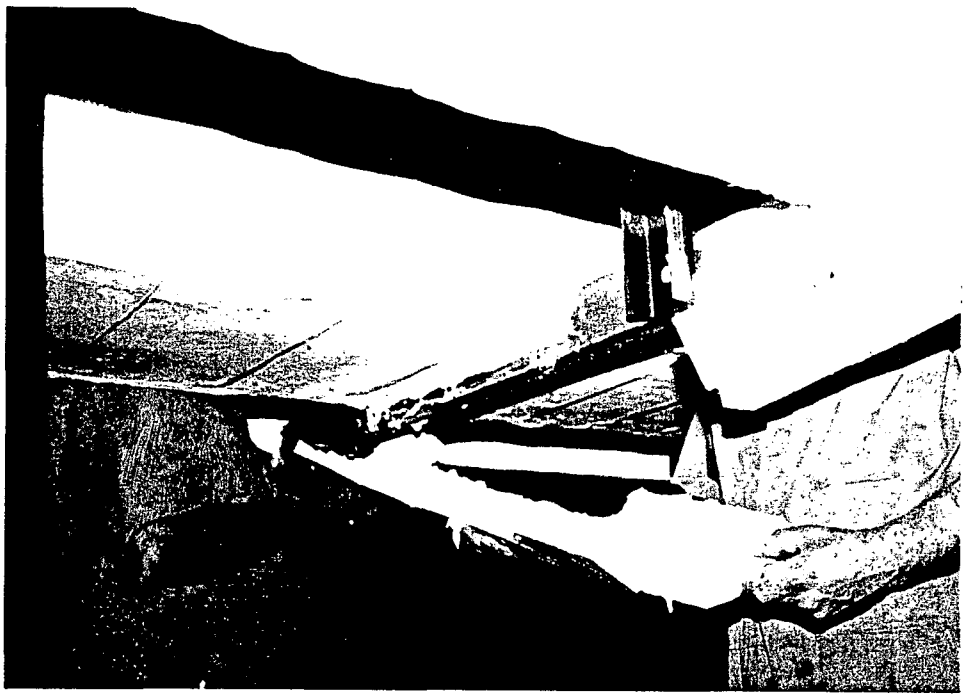


Panel installed on inside vertical section of left tray.

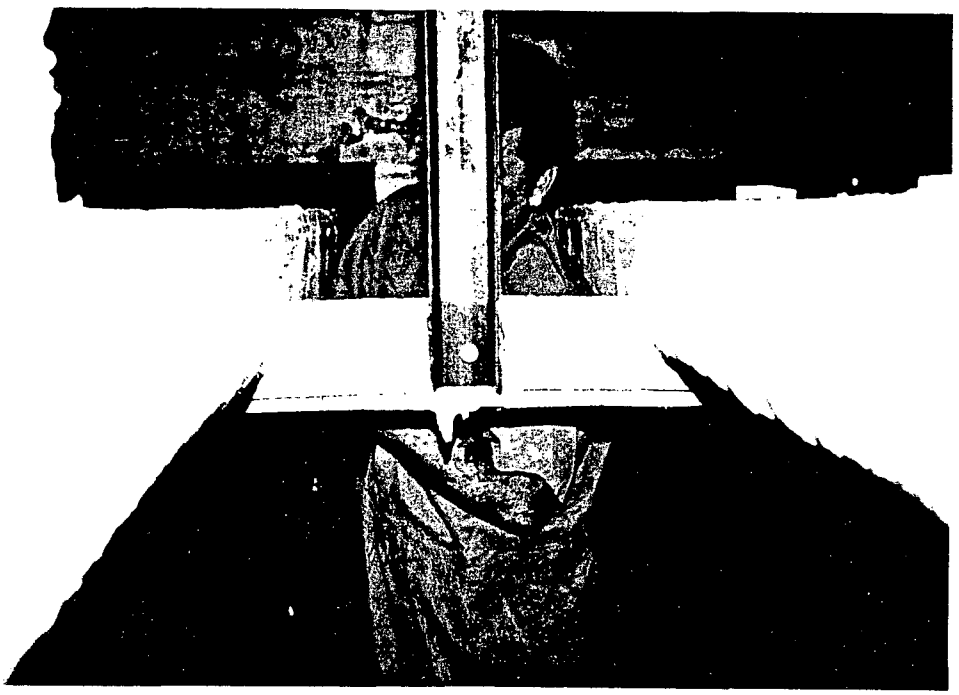
Trowel grade material applied to all joints and seams in enclosures.

Panels used to box in support members.

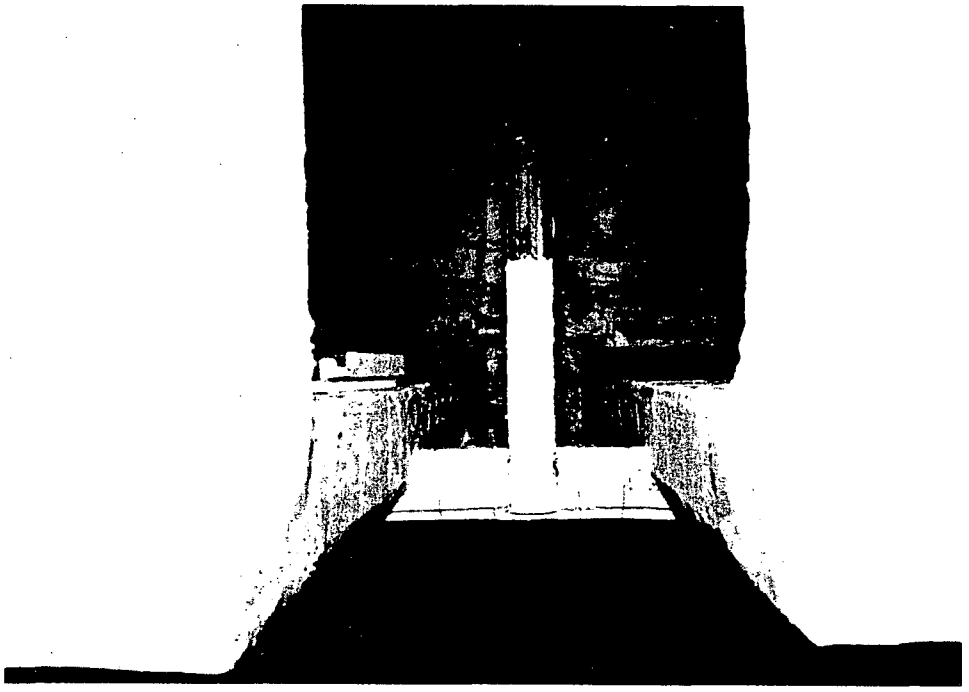
Panels used to box in support members.



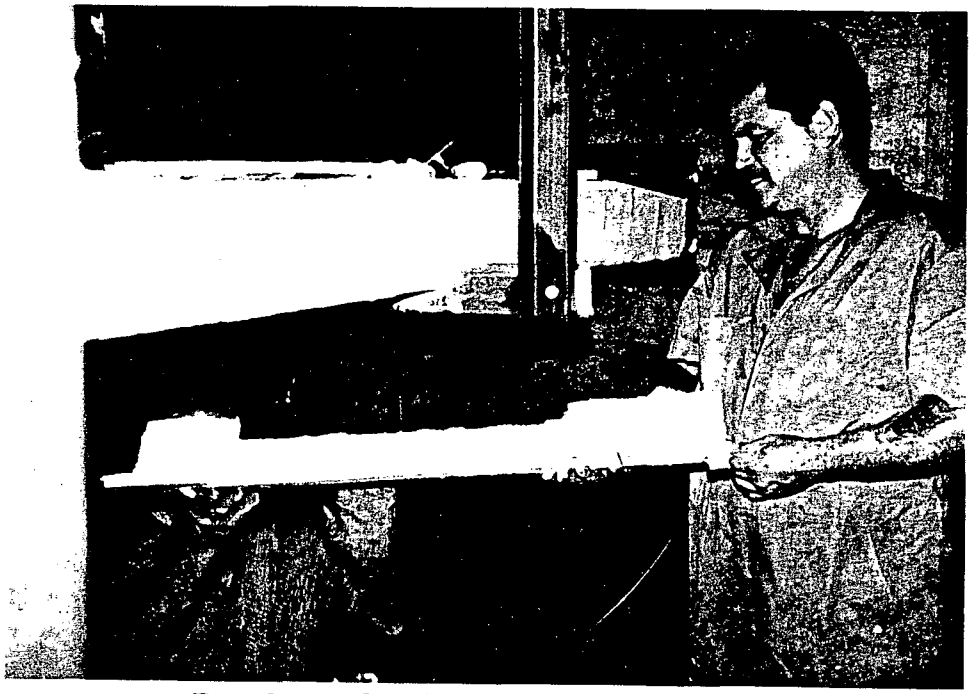
Panels used to box in support members.



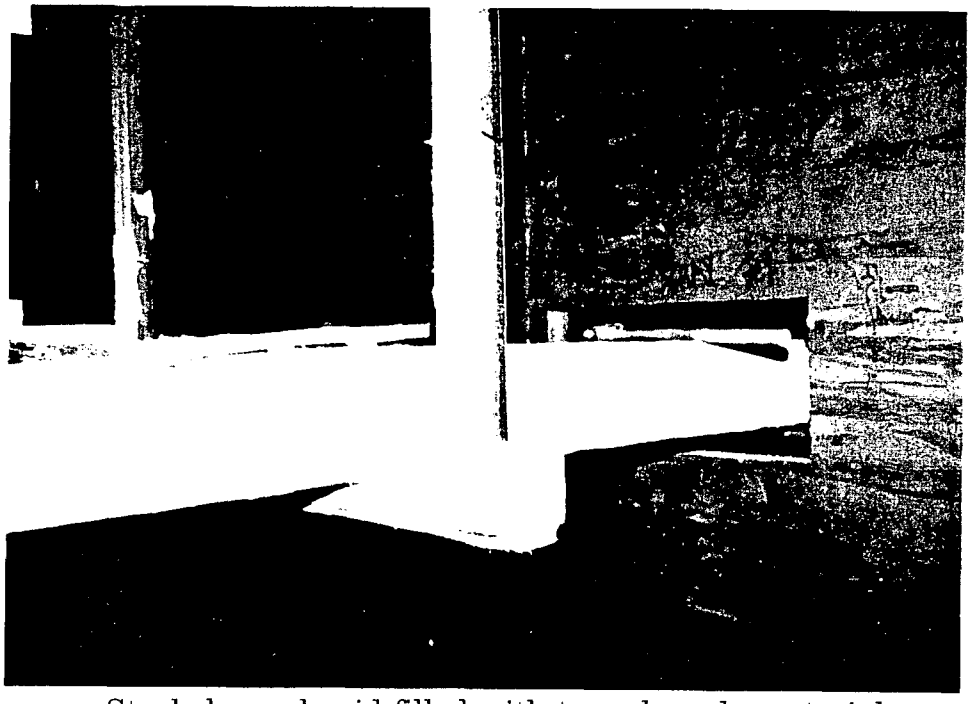
Panels secured with stainless steel tie wires.



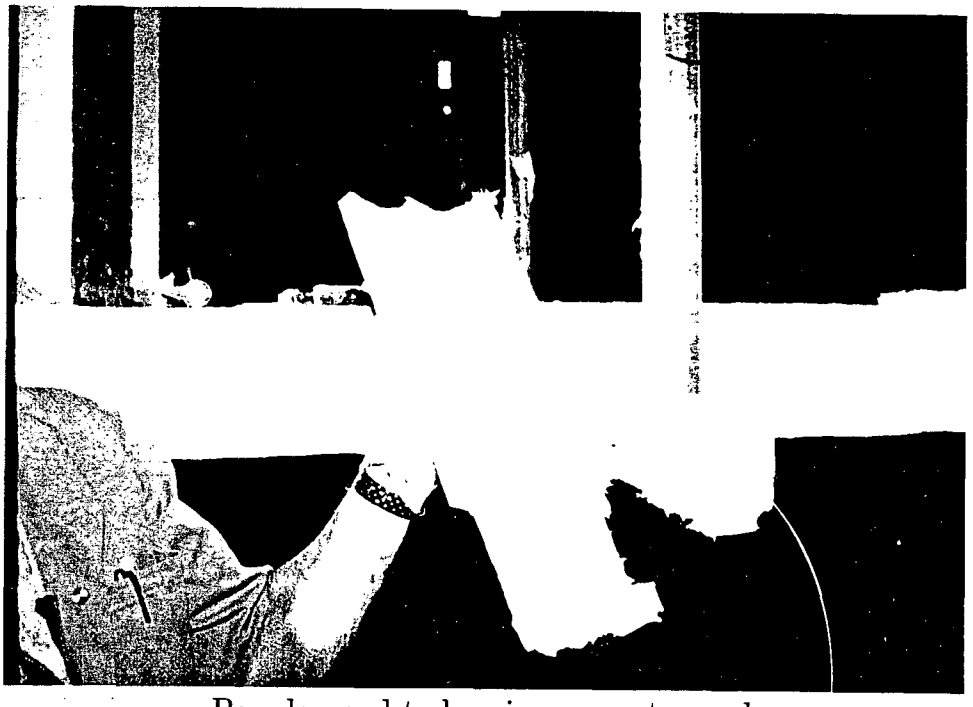
Steel channel voids filled with trowel grade material.



Panels used to box in support members.

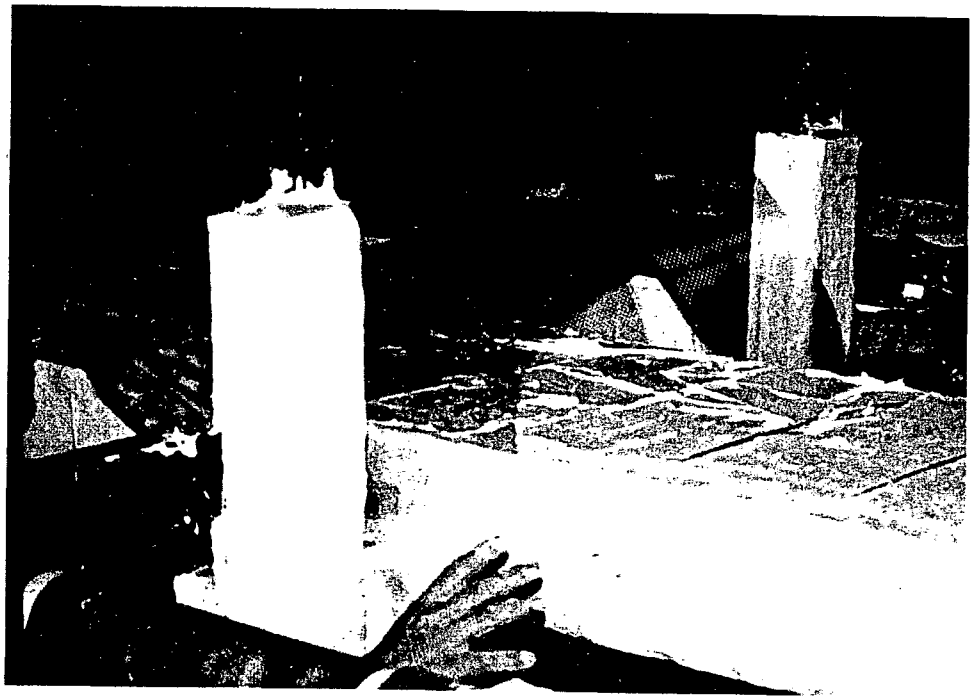


Steel channel void filled with trowel grade material.



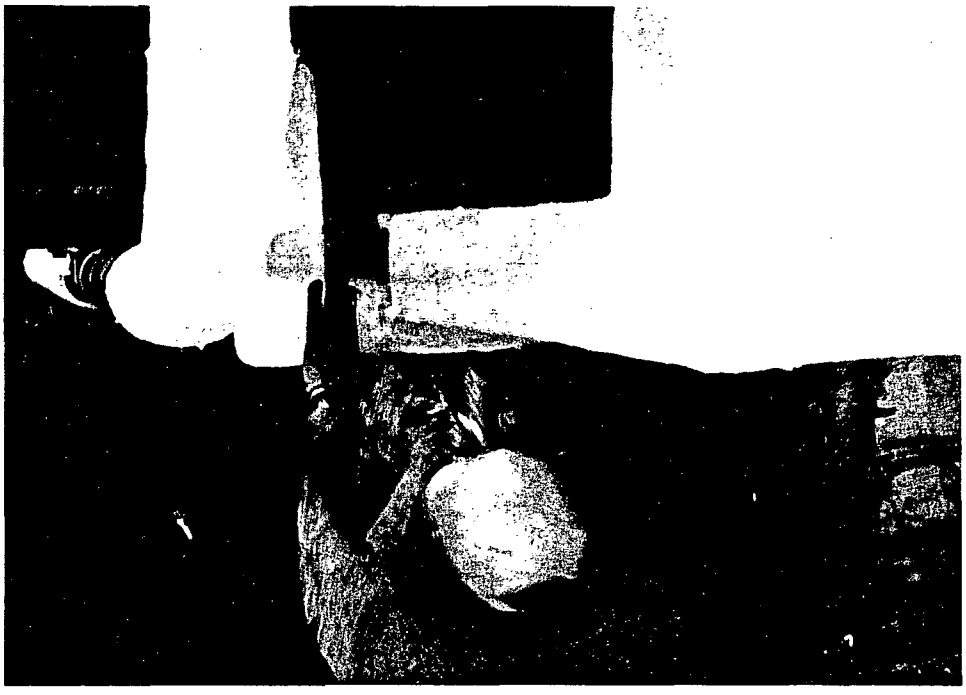
Panels used to box in support members.

Panels secured with stainless steel tie wires.



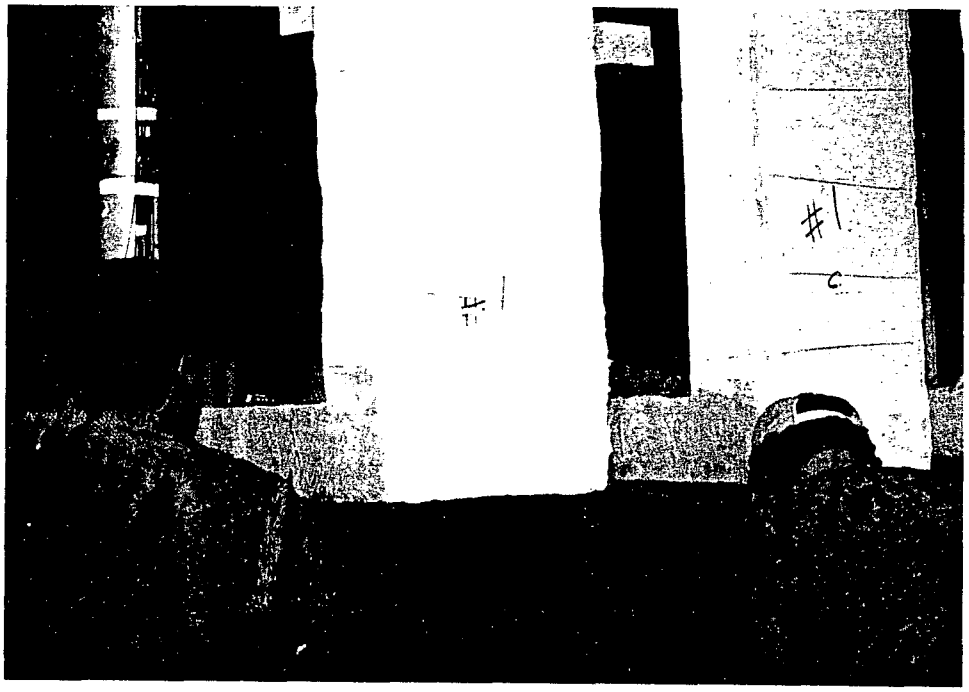
External stress skin layer installed over box enclosures.

External stress skin fitted around tray to support interfaces.

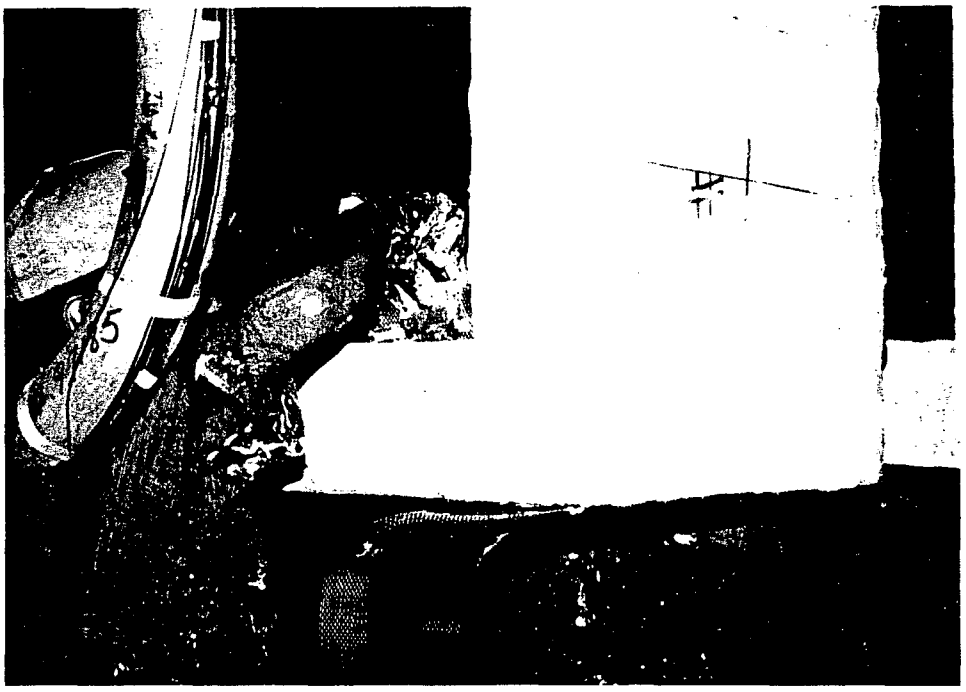


External stress skin fitted around tray to support interfaces.

External stress skin secured to enclosures with staples.



External stress skin installed over tray enclosures.

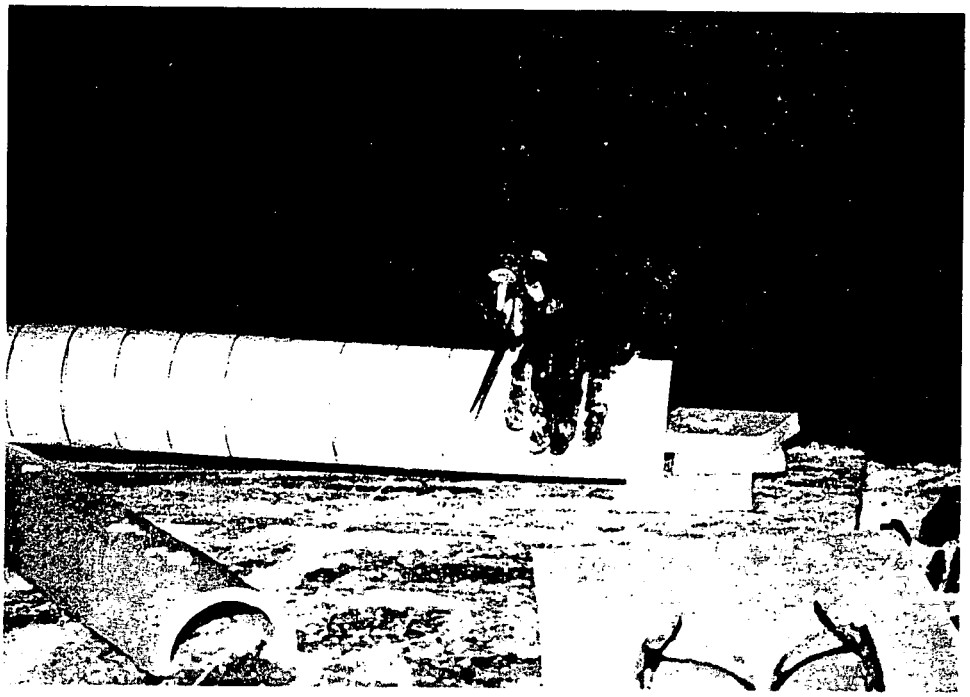


External stress skin fitted into place in tray bend area.

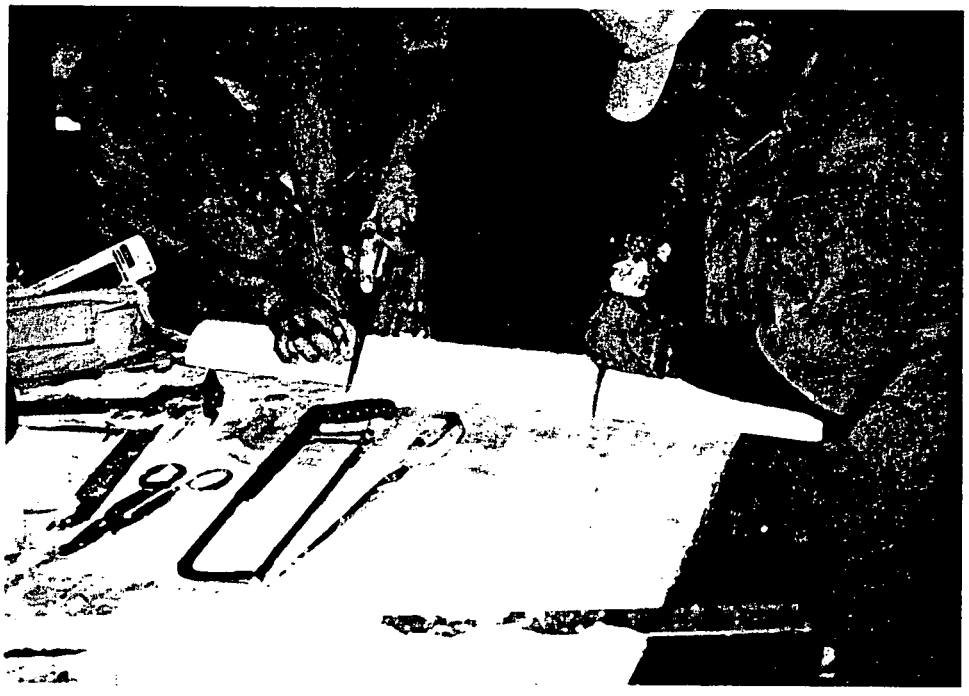
External stress skin stapled to vertical tray section.

External stress skin stapled to vertical tray section.

External stress skin overlaps reinforced with stainless steel tie wire stitches.

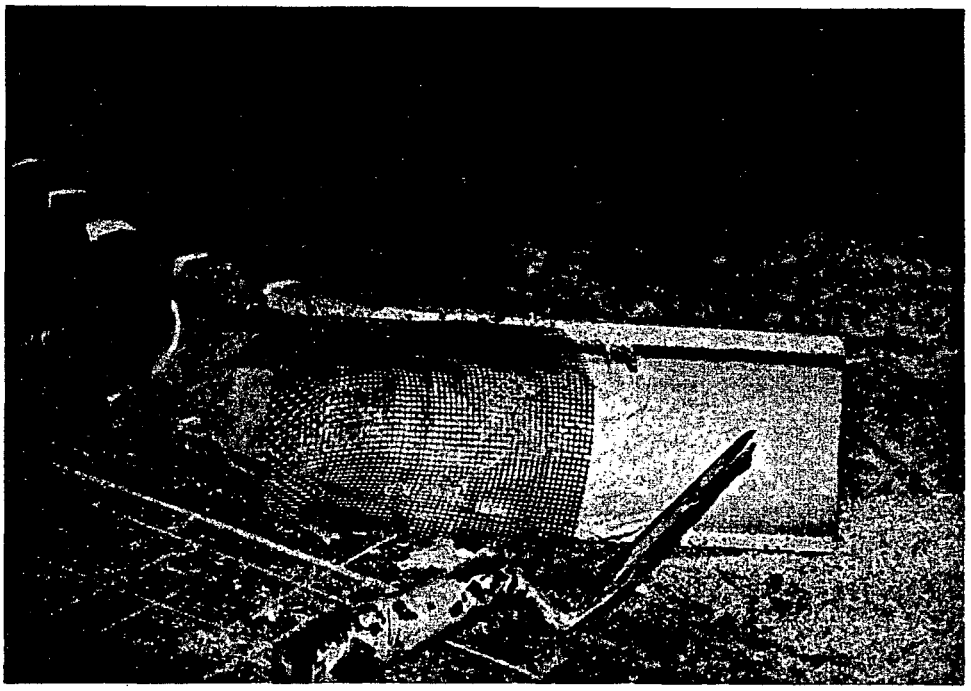


Section of material to be installed onto conduit radial bend is notched.

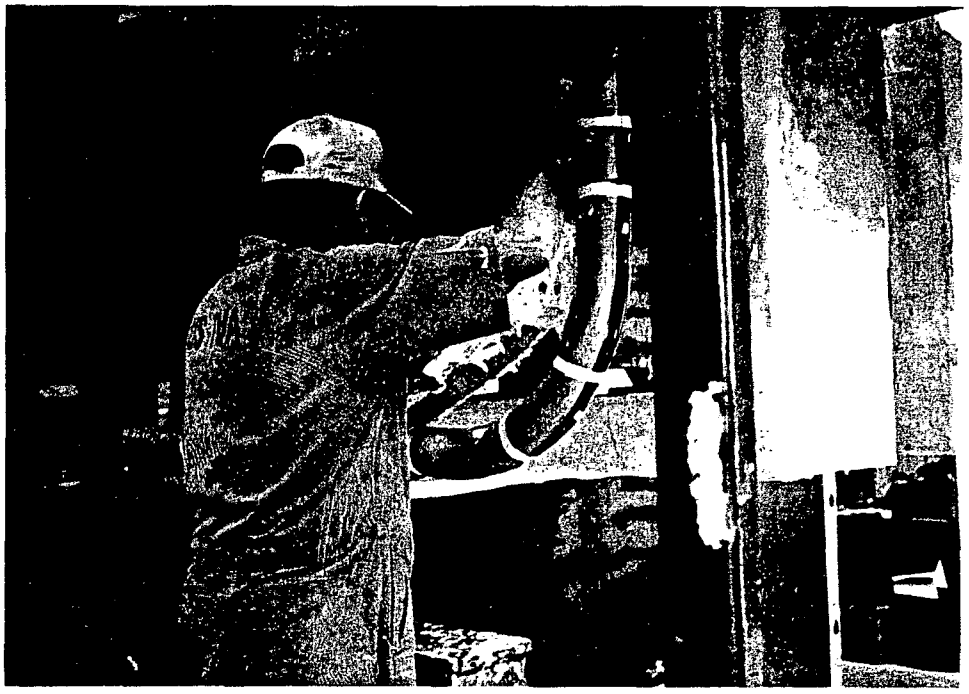


Section of material to be installed onto conduit radial bend is notched.

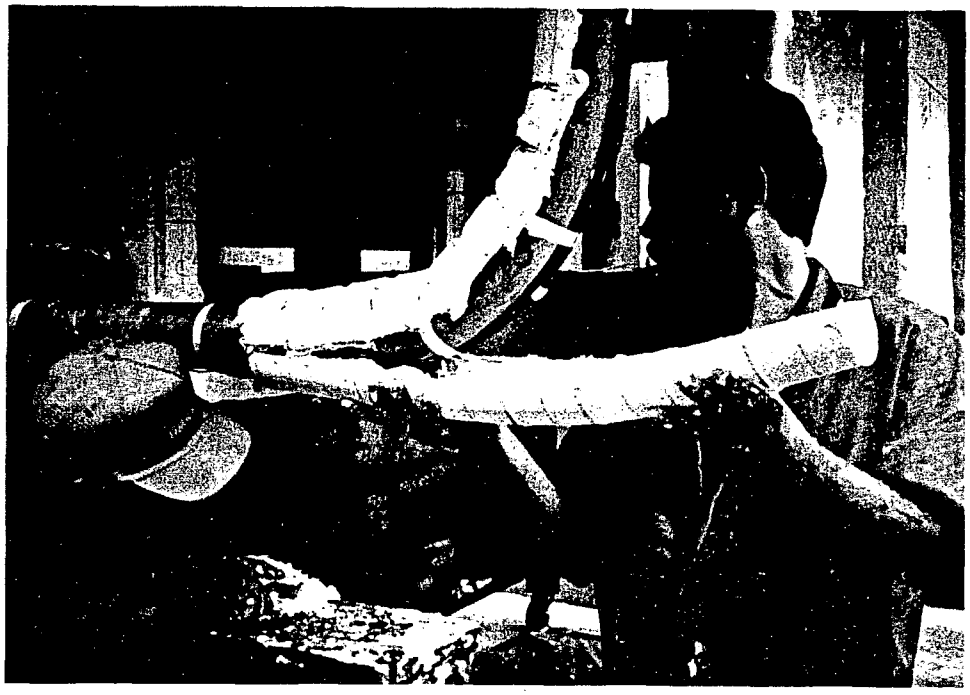
Notched pre-shaped conduit section bent into rough shape.



External stress skin patches installed on interior of pre-shaped bent section to repair torn stress skin.



Pre-buttered notched section installed onto conduit radial bend.

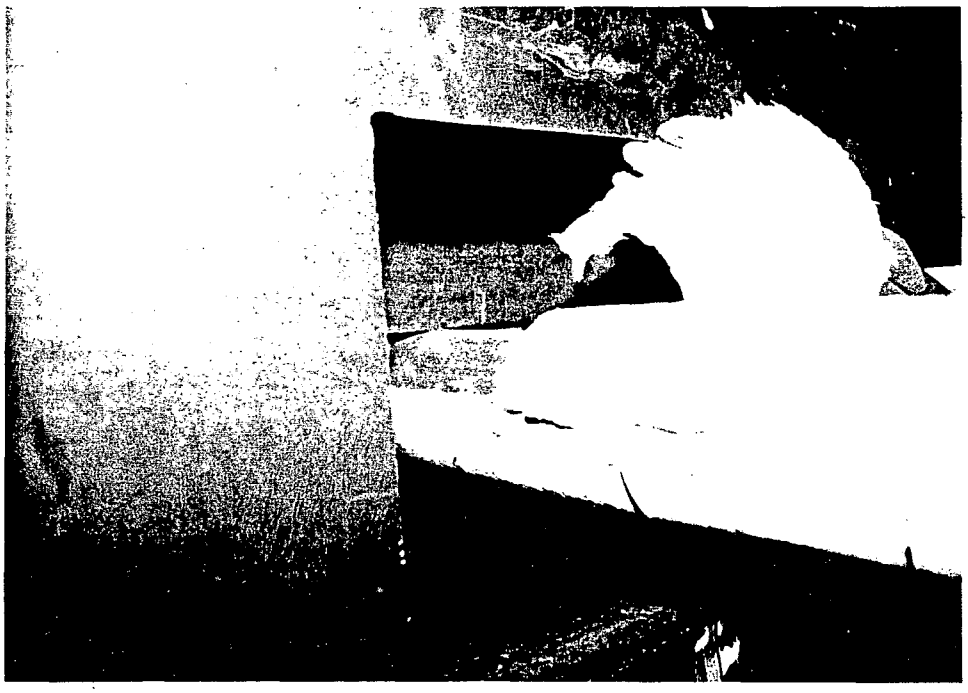


Pre-buttered notched section installed onto conduit radial bend.

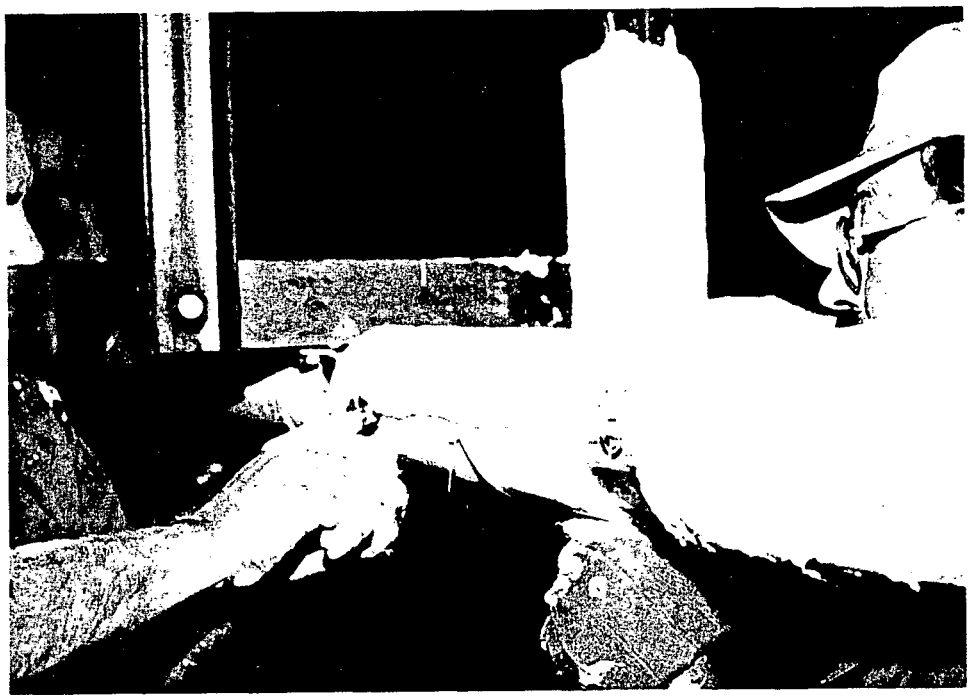
Pre-shaped conduit section secured with stainless steel tie wires.

Pre-Buttered, pre-shaped conduit sections installed onto conduit horizontal run.

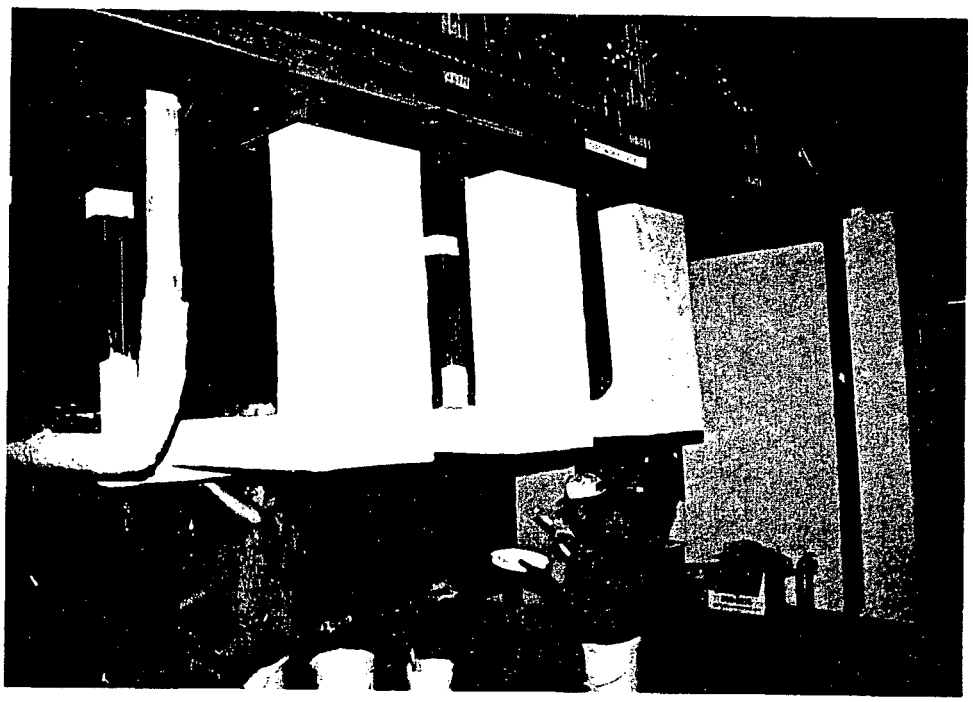
Pre-Buttered, pre-shaped conduit sections installed onto conduit horizontal run.



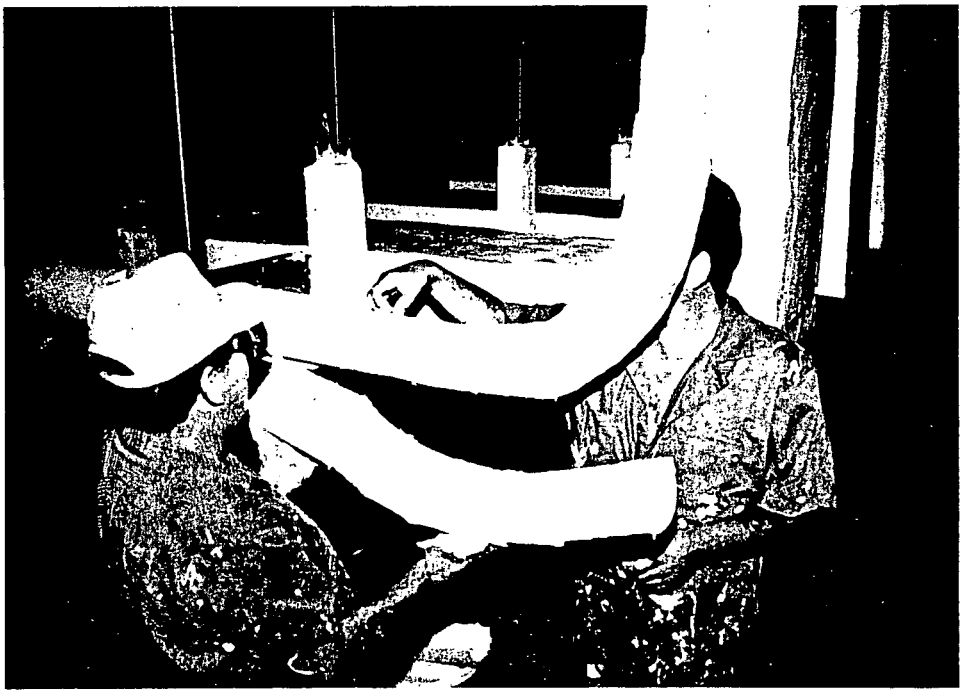
Pre-shaped conduit sections secured with stainless steel tie wires.



Pre-shaped conduit sections secured with stainless steel tie wires.

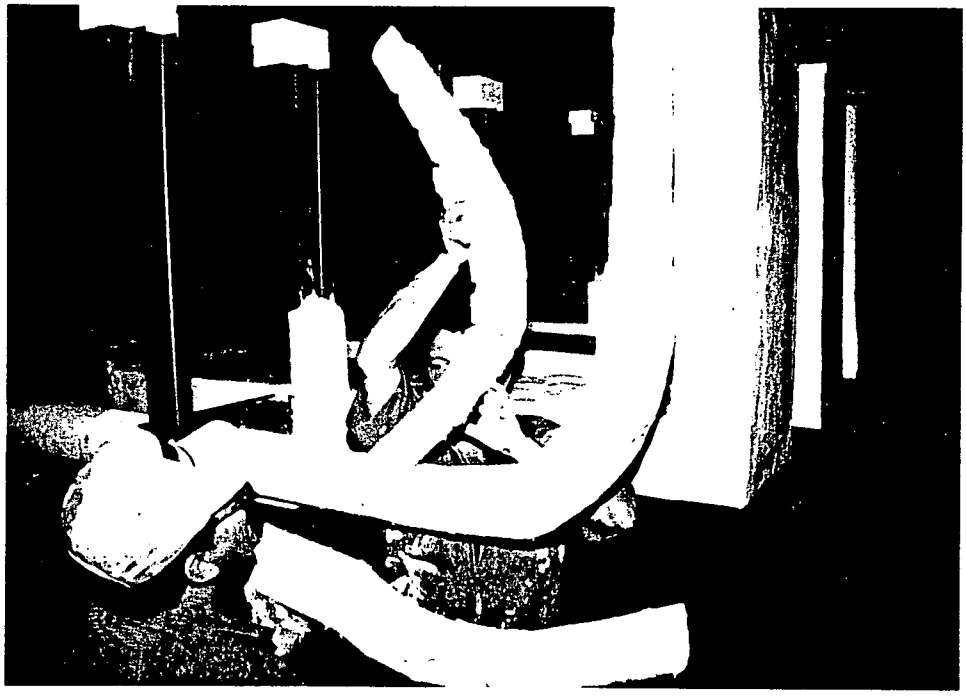


Trowel grade material applied over external stress skin overlay on cable trays.



Second layer of pre-shaped conduit sections installed onto conduit.

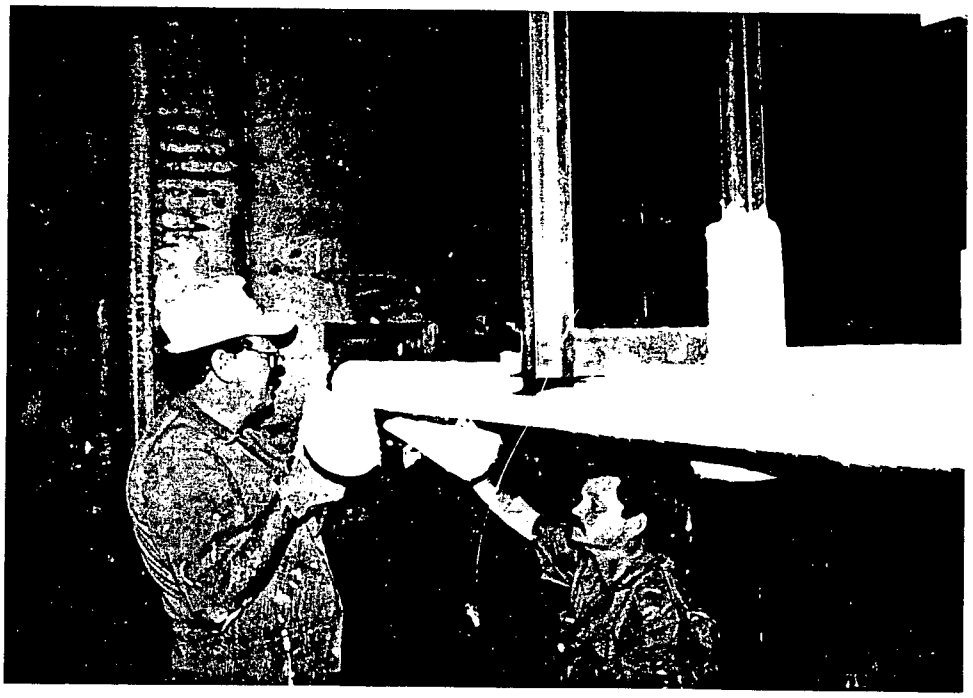
Bent pre-shaped conduit section pre-buttered prior to installation.



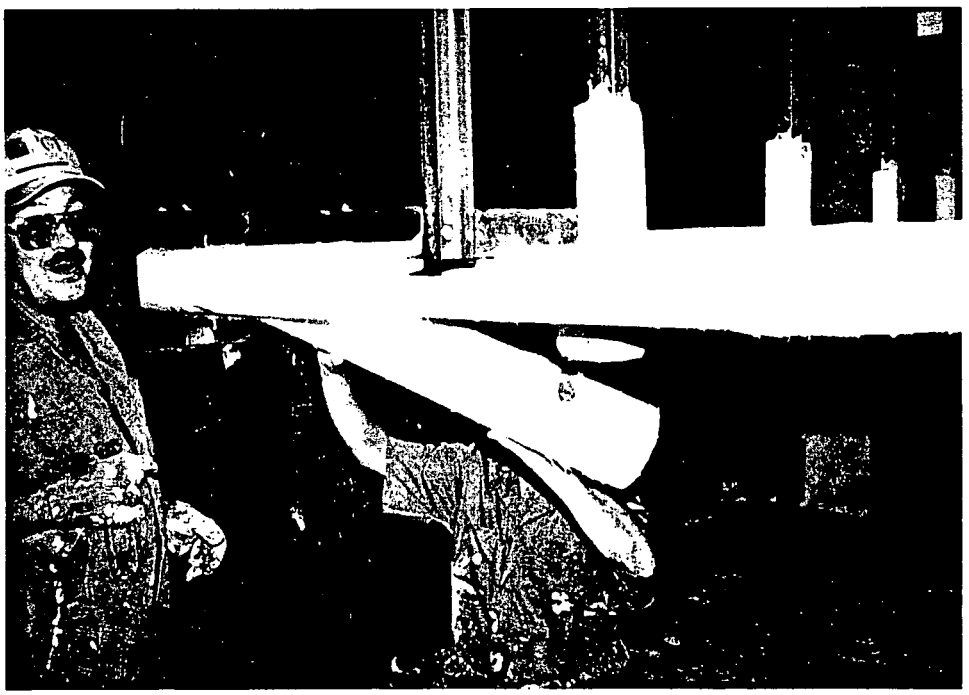
Second layer of pre-shaped conduit sections installed onto radial bend.

Overlay material secured with stainless steel tie wires.

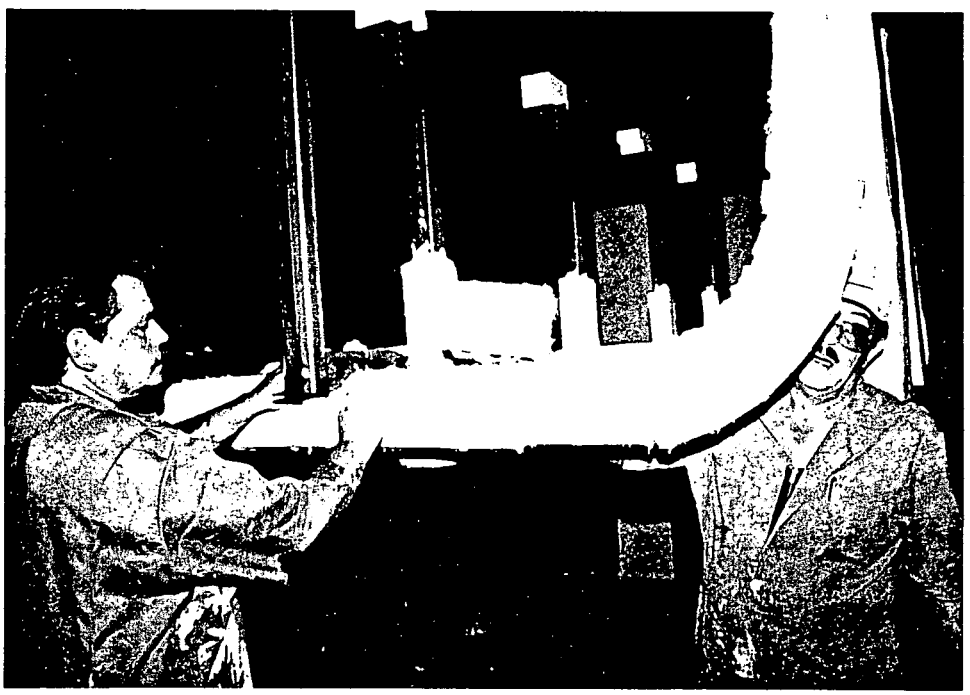
Second layer of pre-shaped conduit sections installed to horizontal run.



Second layer of pre-shaped conduit sections installed to horizontal run.

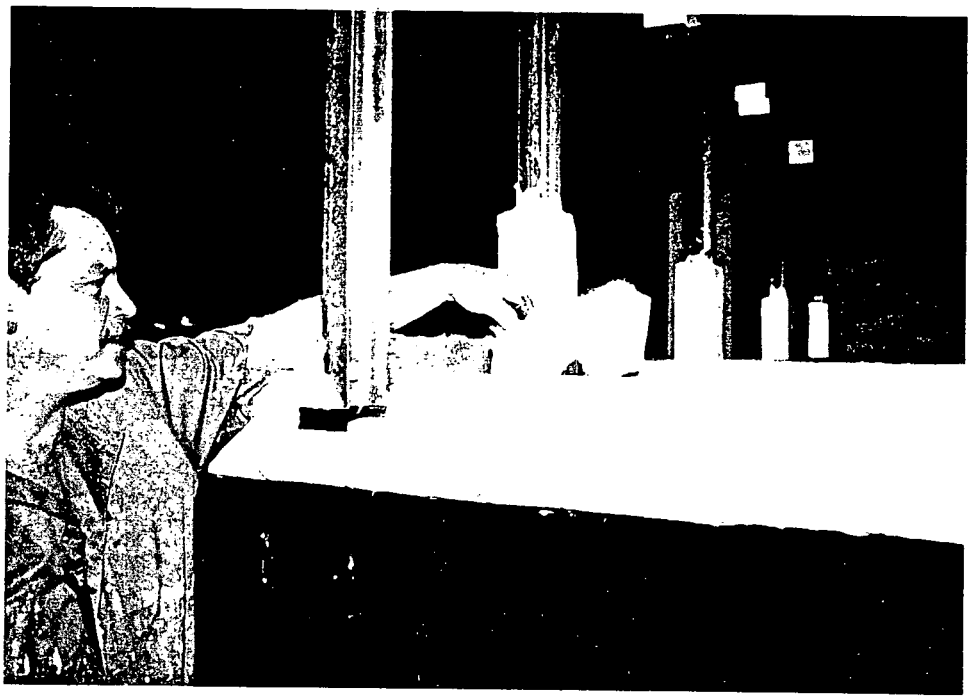


Second layer of pre-shaped conduit sections installed to horizontal run.



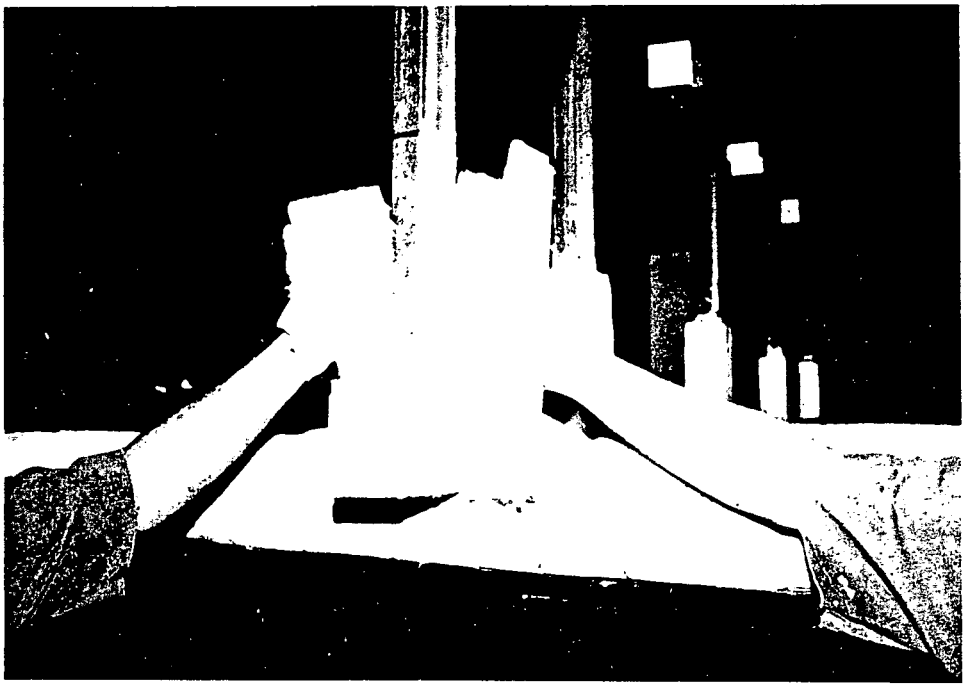
Second layer of pre-shaped conduit sections installed to horizontal run.

Panels used to enclose conduit support member.



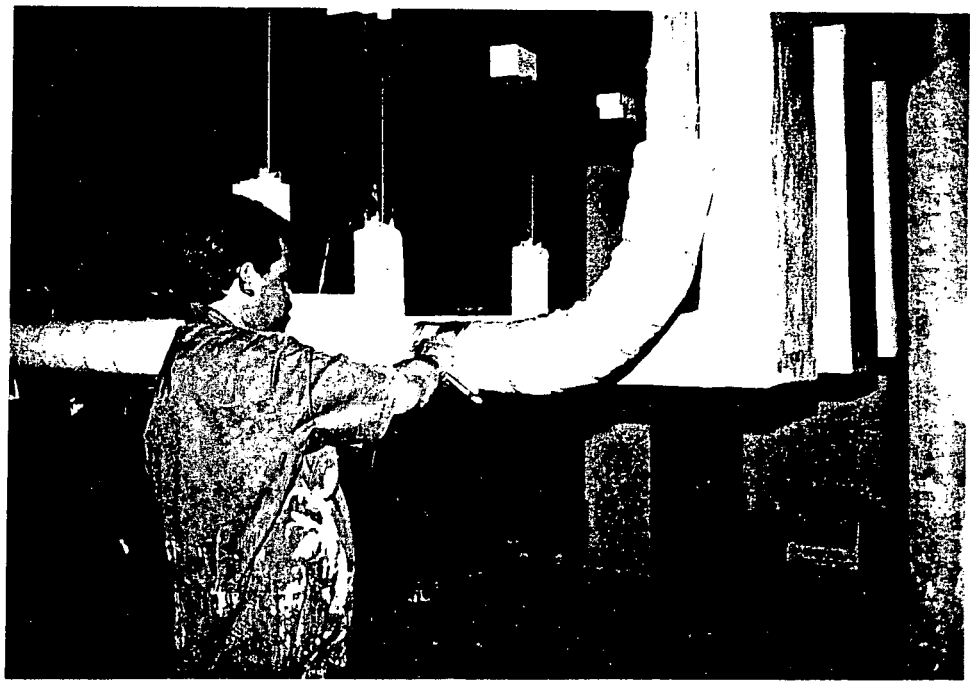
Panels used to enclose conduit support member.

Panels used to enclose conduit support member.

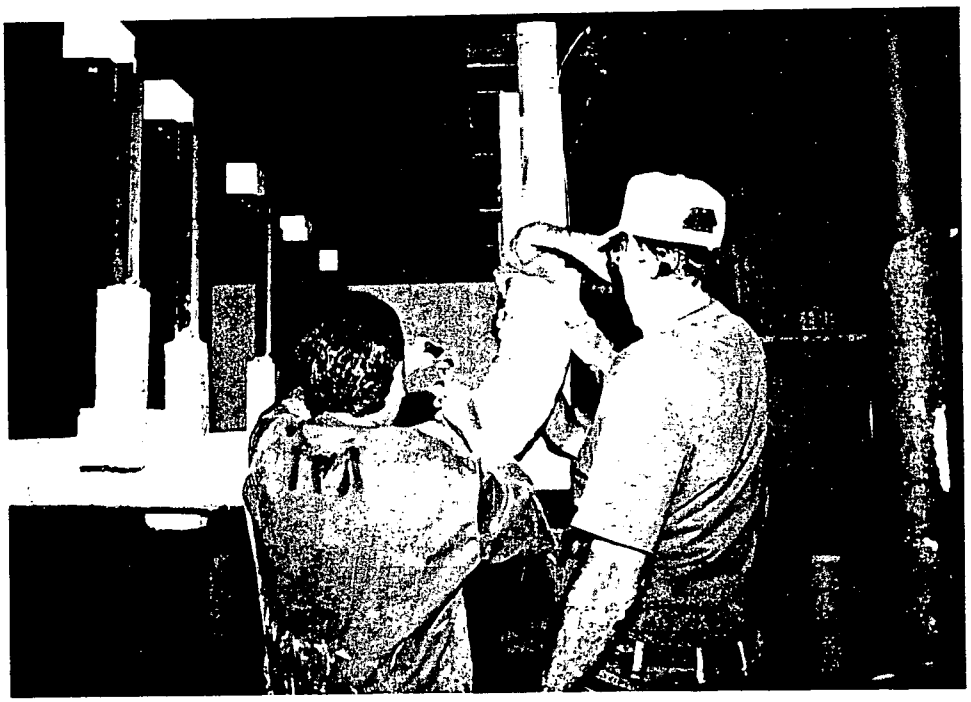


Panels used to enclose conduit support member.

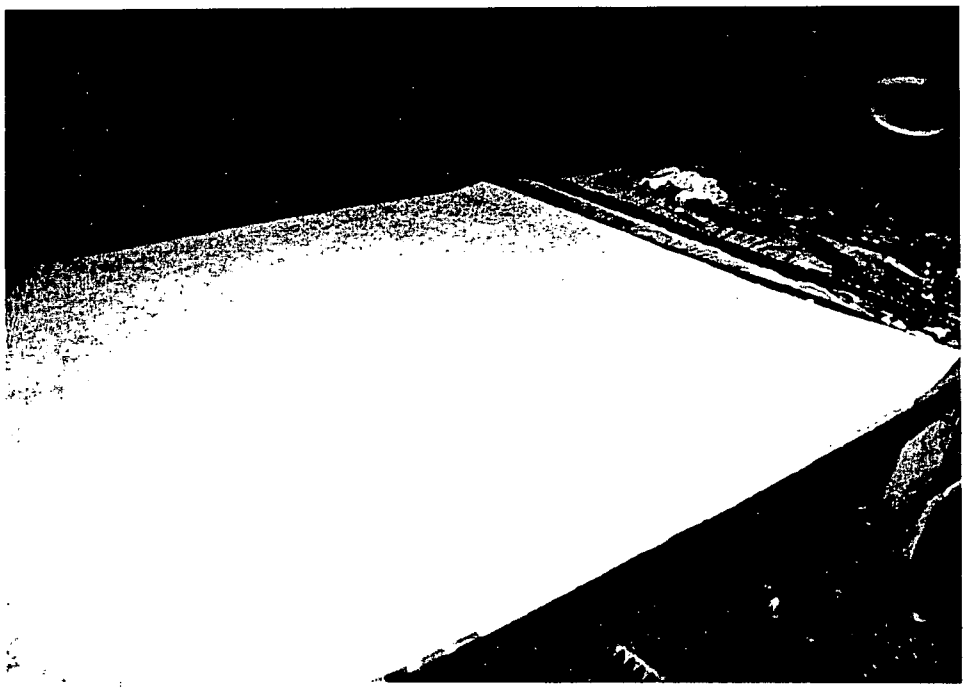
External stress skin wrap installed at joints in conduit run.



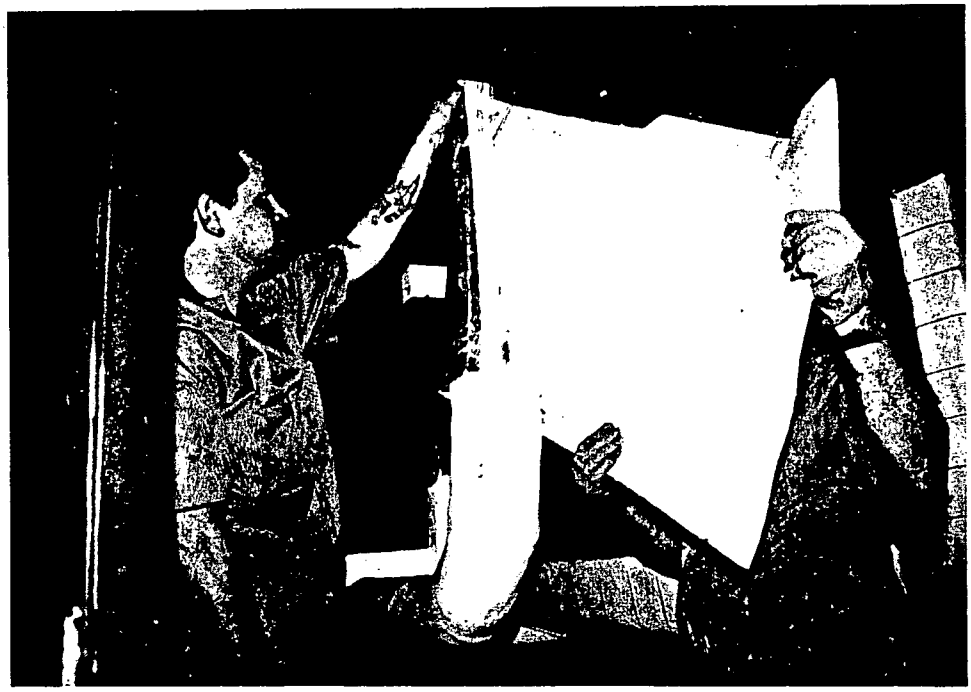
External stress skin wrap installed over conduit radial bend.



External stress skin secured with stainless steel tie wires.



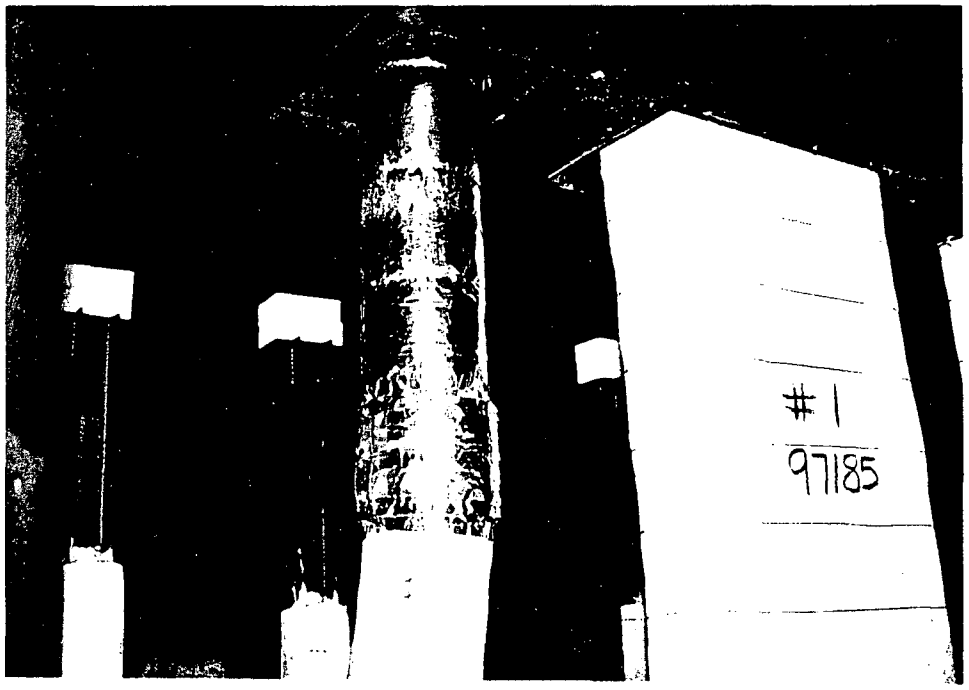
Sheet of 3M mat to be installed onto vertical section of conduit.



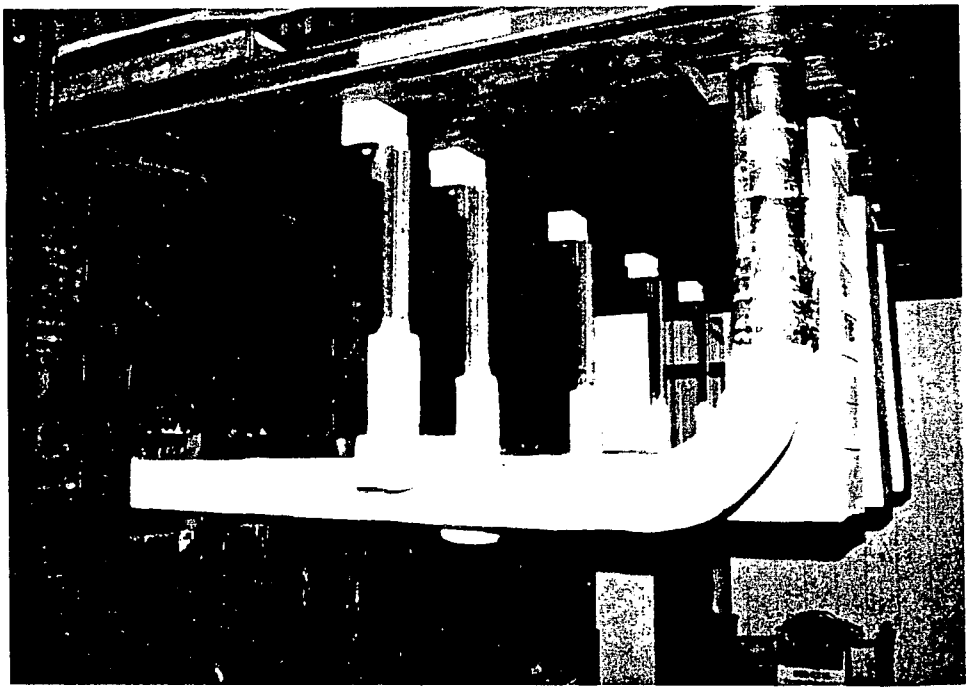
Material wrapped around vertical section of conduit.

Material secured with foil tape.

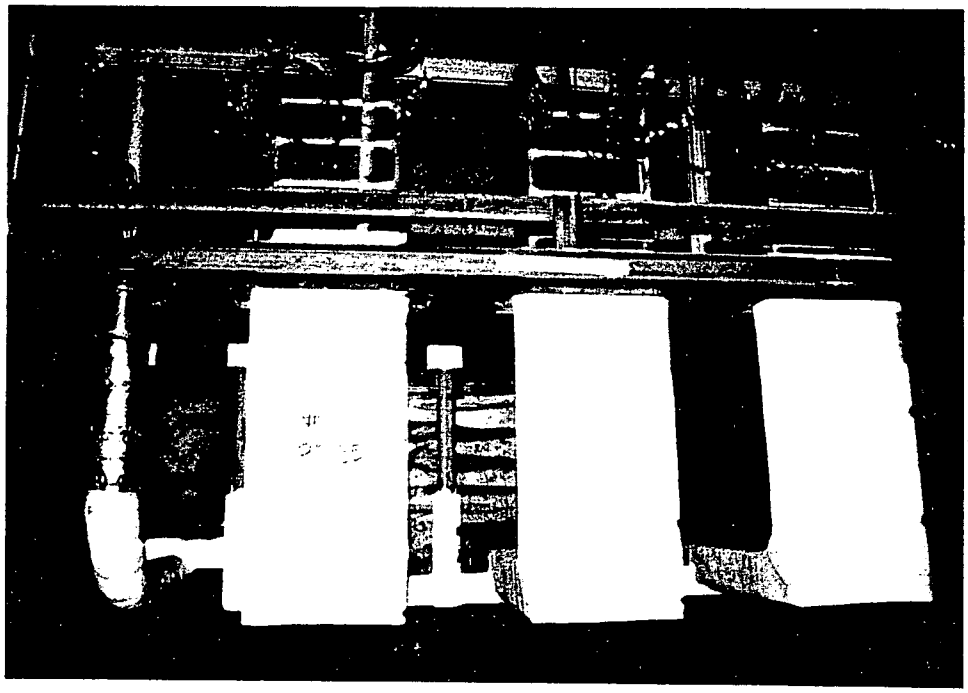
Collar of 3M material installed at interface with Thermo-Lag® materials.



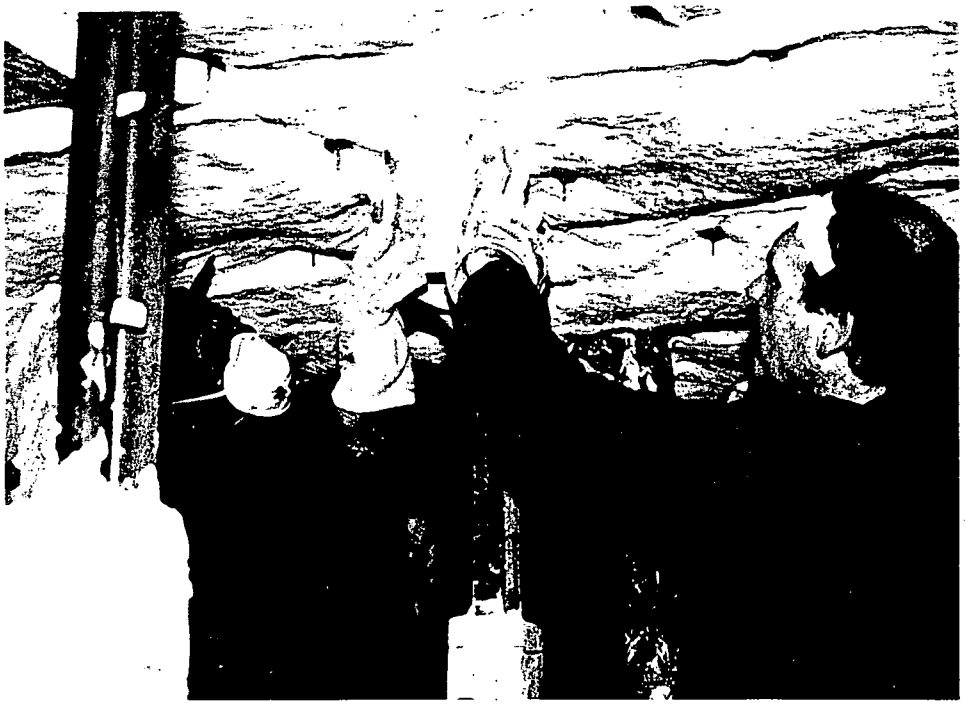
Wrapped material secured with stainless steel tie wires.



Right end view of raceway enclosures.



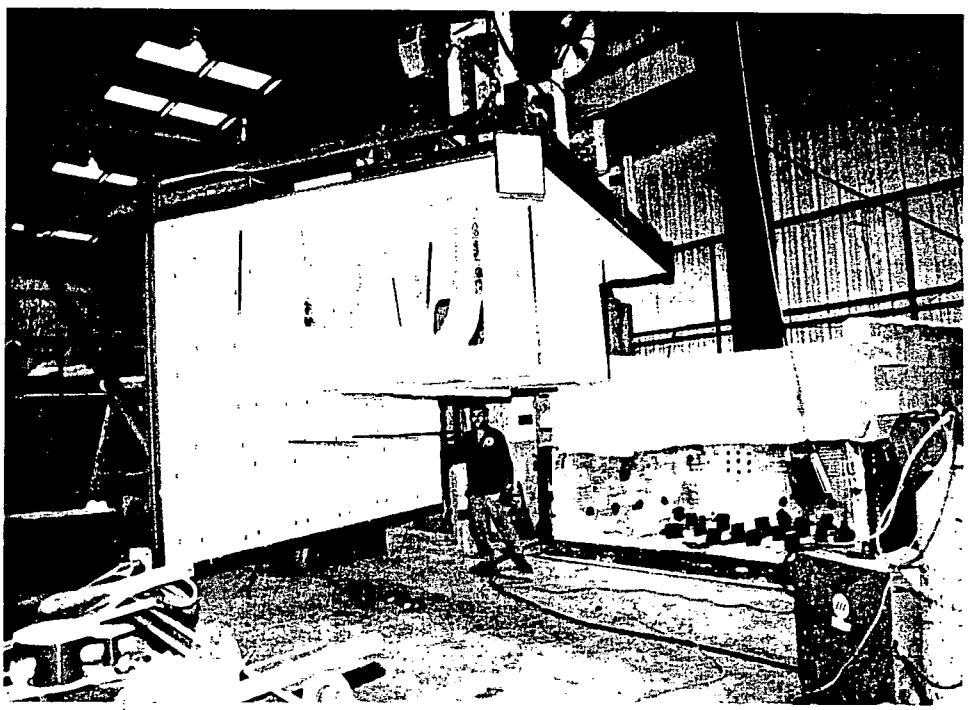
Rear view of raceway enclosures.



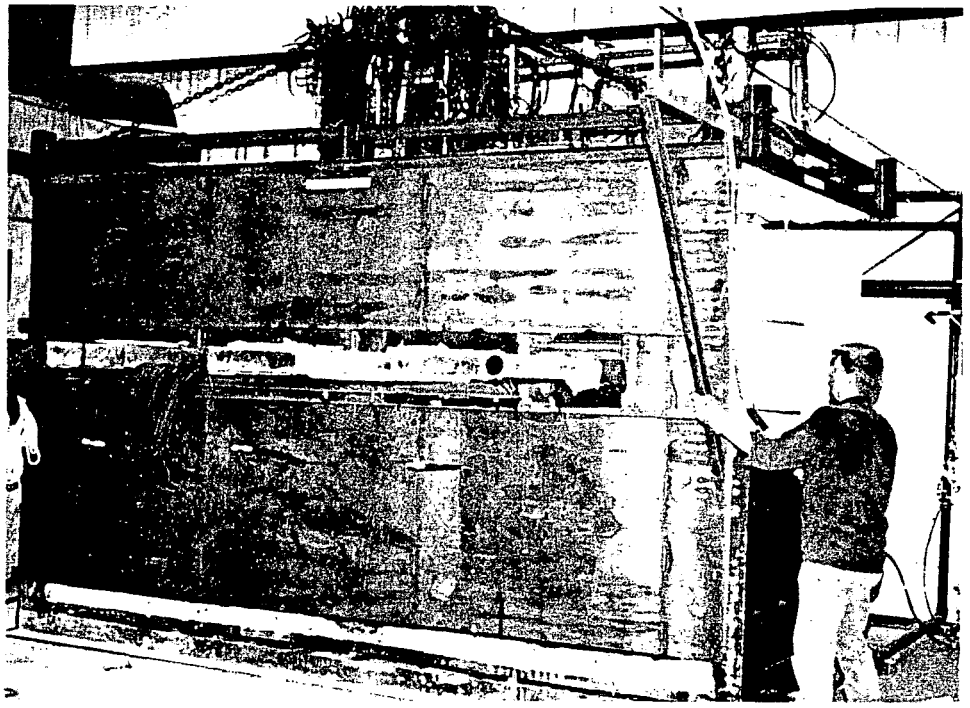
3M material installed onto exposed sections of support steel.

3M material installed onto exposed sections of support steel.

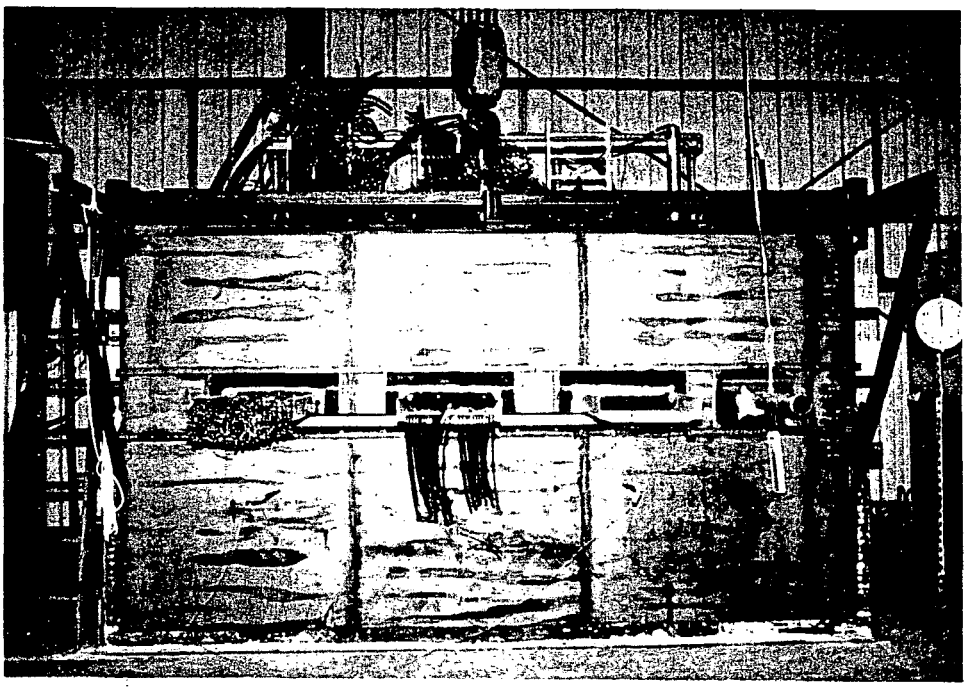
Single layer of 3M material wrapped around vertical support members.



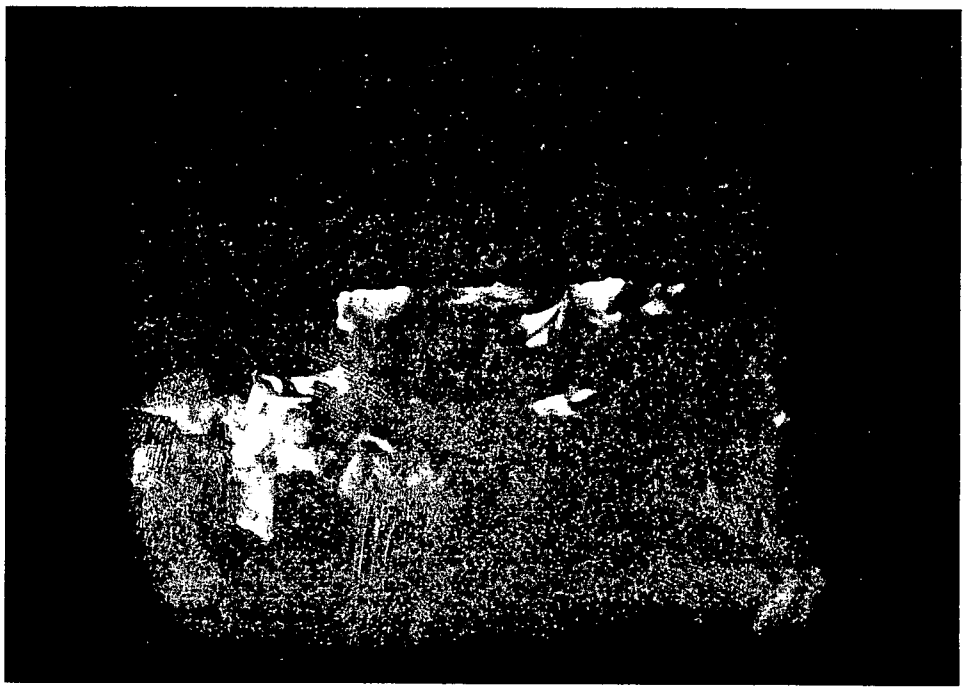
Completed test deck to be installed onto test furnace.



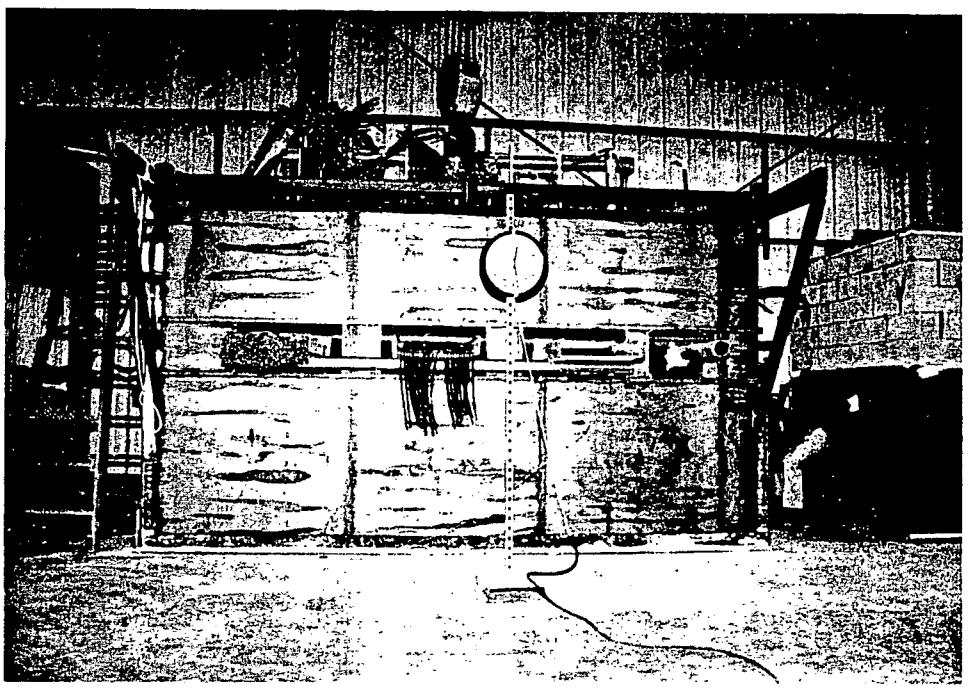
Test deck installed onto furnace.



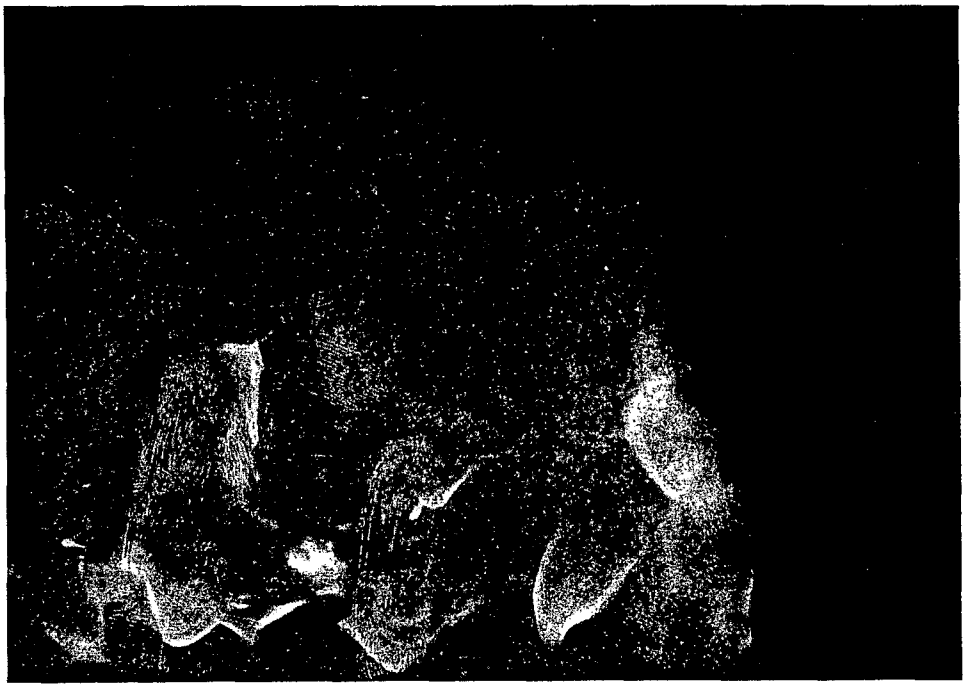
View of test furnace prior to start of fire exposure.



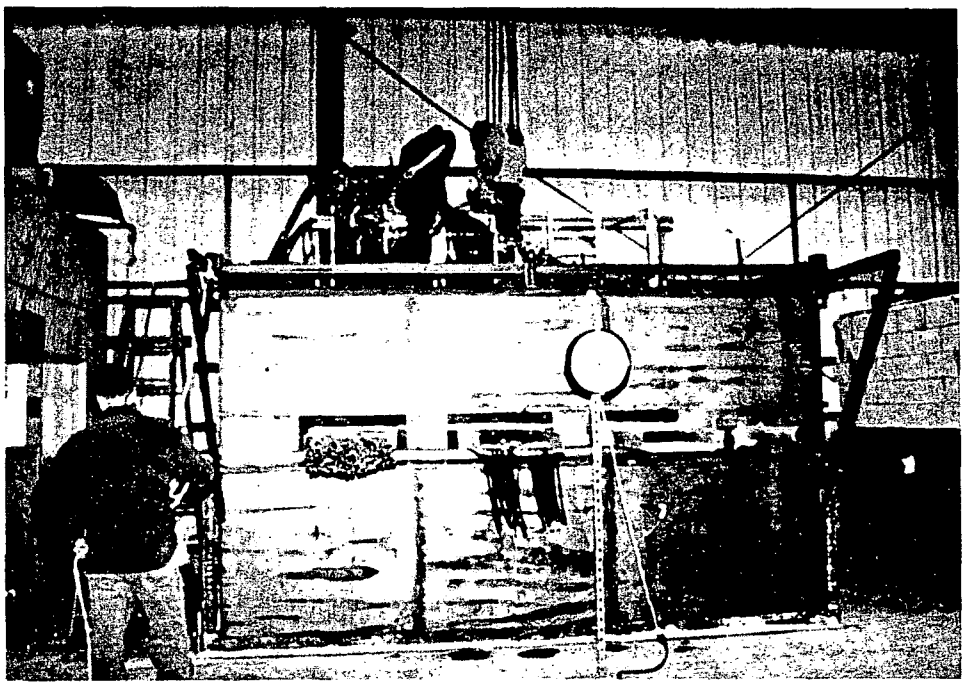
Furnace interior during fire exposure.



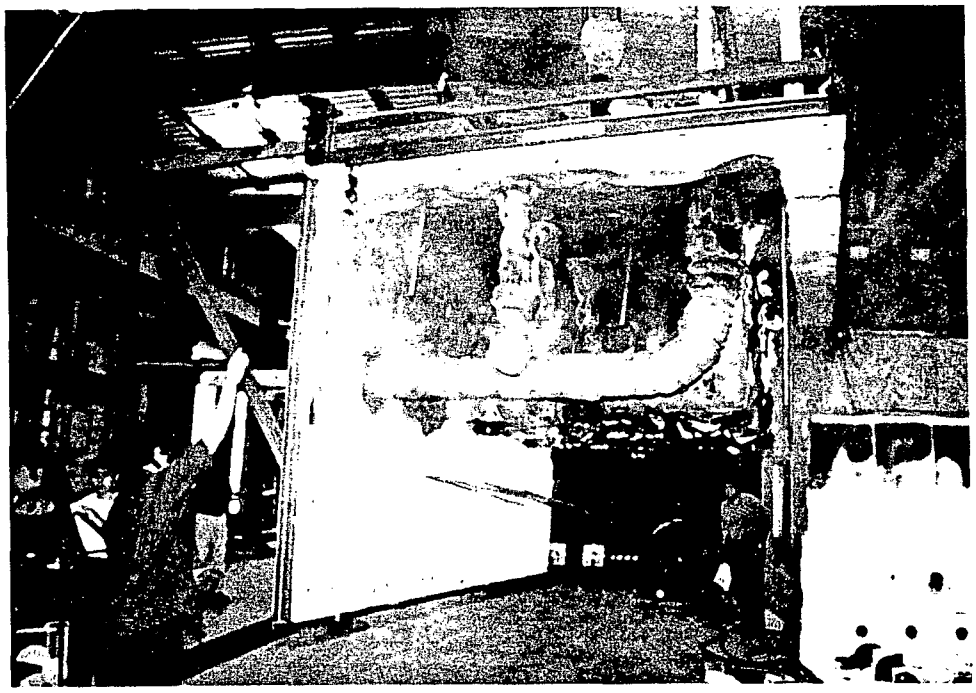
Test furnace at approximately thirty minutes.



Furnace interior during fire exposure.

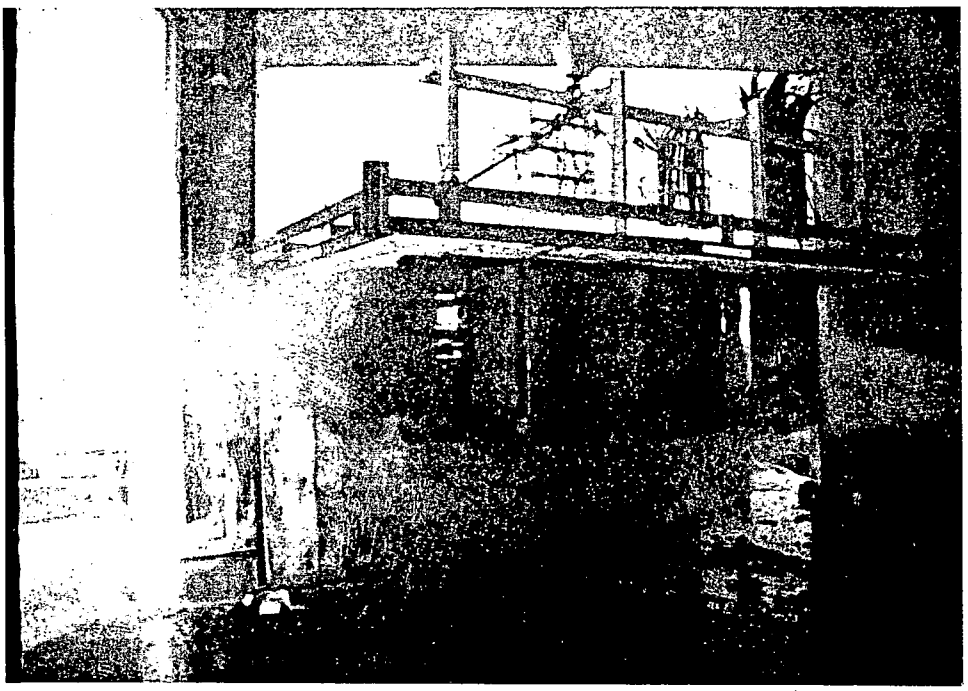


Test furnace at end of fire exposure (one hour).

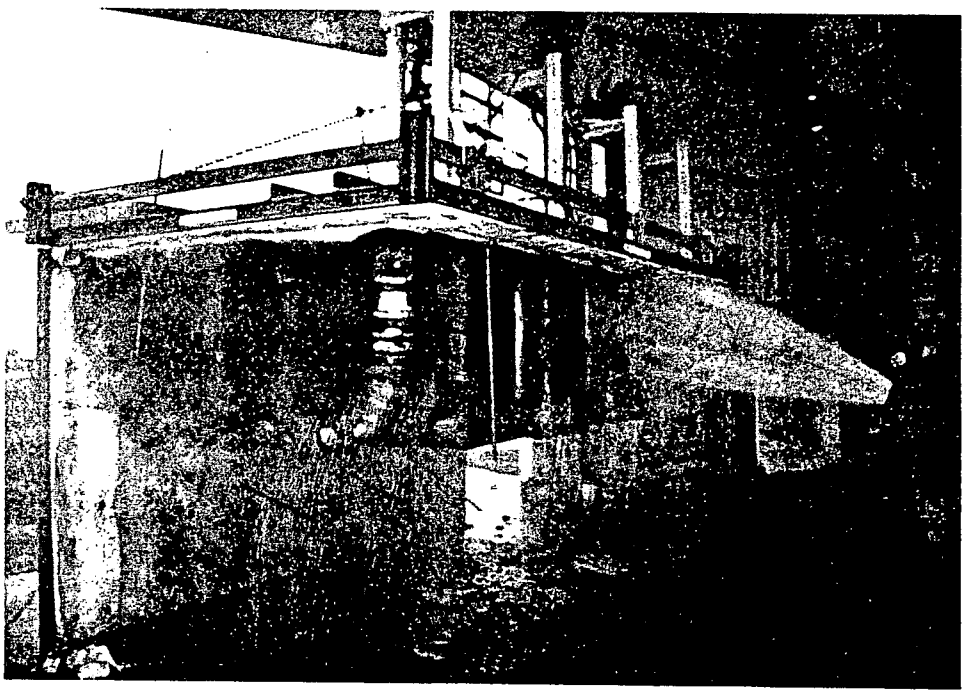


Test deck removed from furnace.

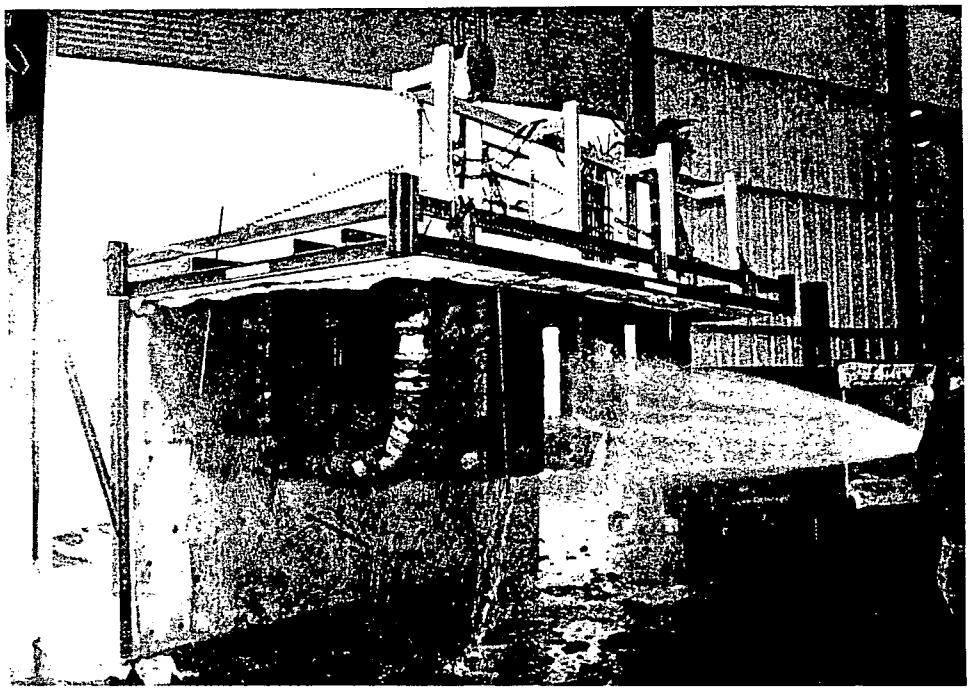
Test deck transported for hose stream test.



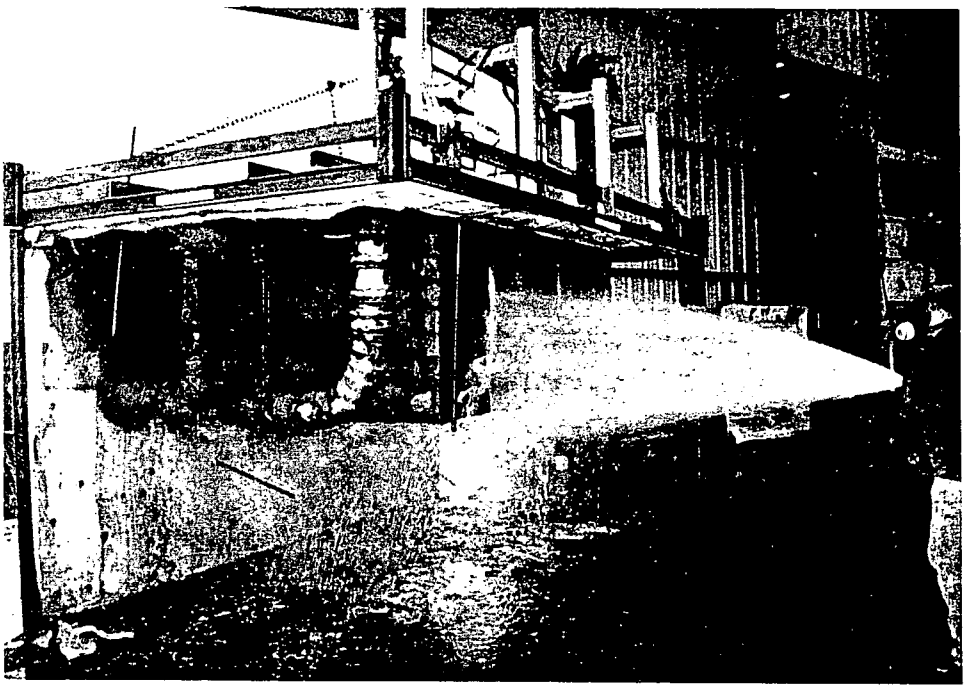
Rear view of test deck immediately prior to hose stream test.



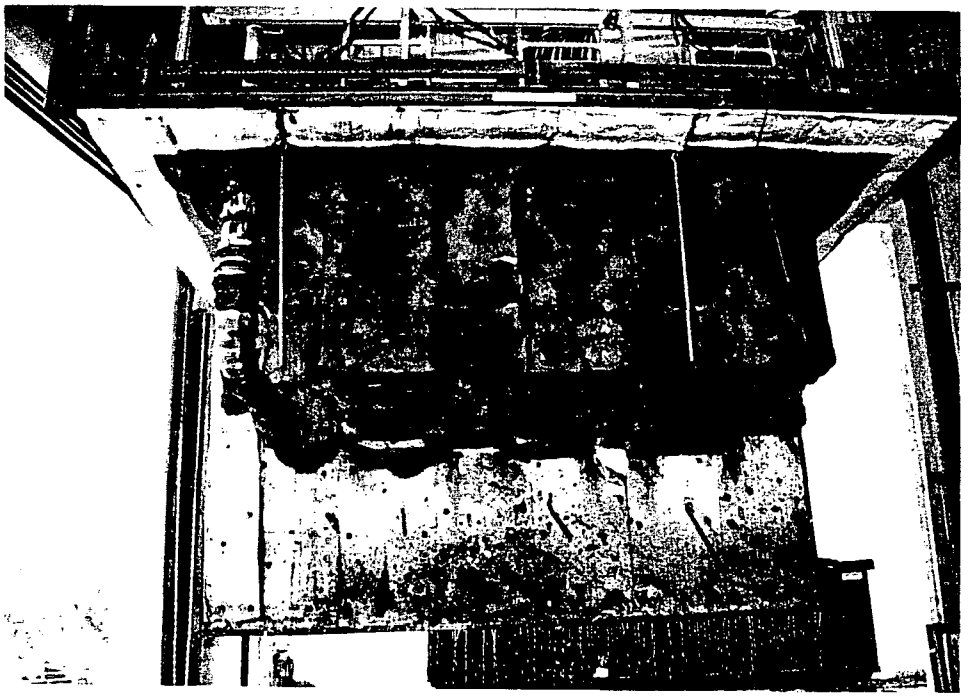
Water hose stream test.



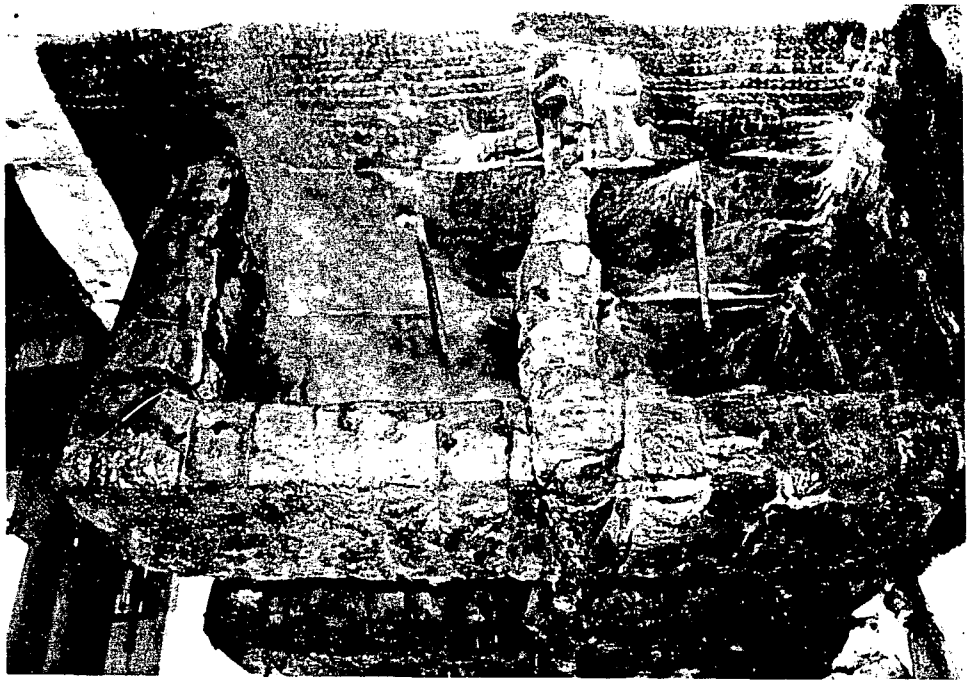
Water hose stream test.



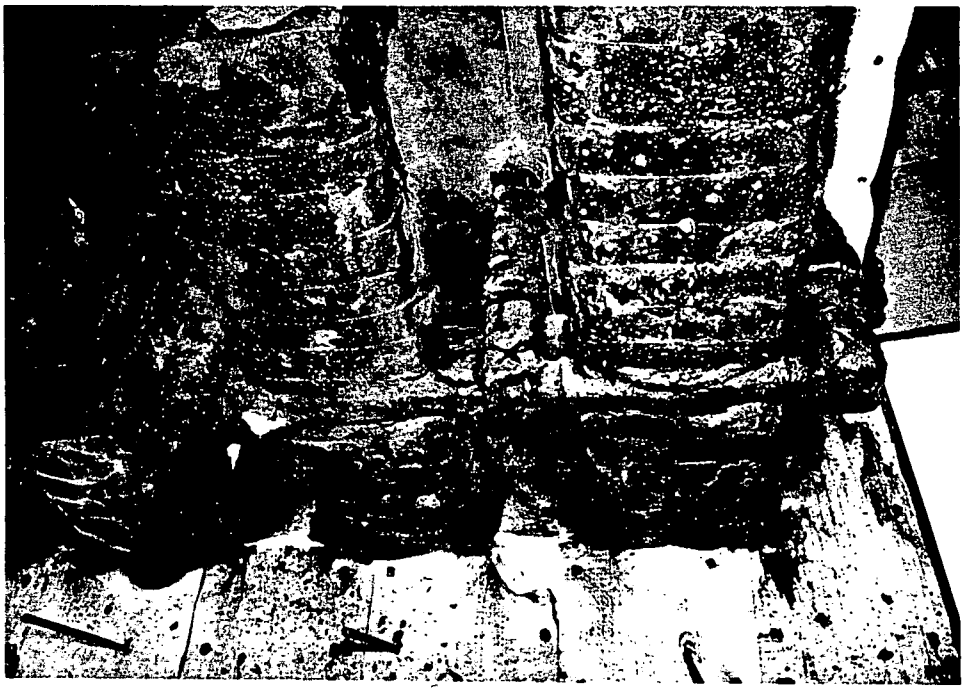
Water hose stream test.



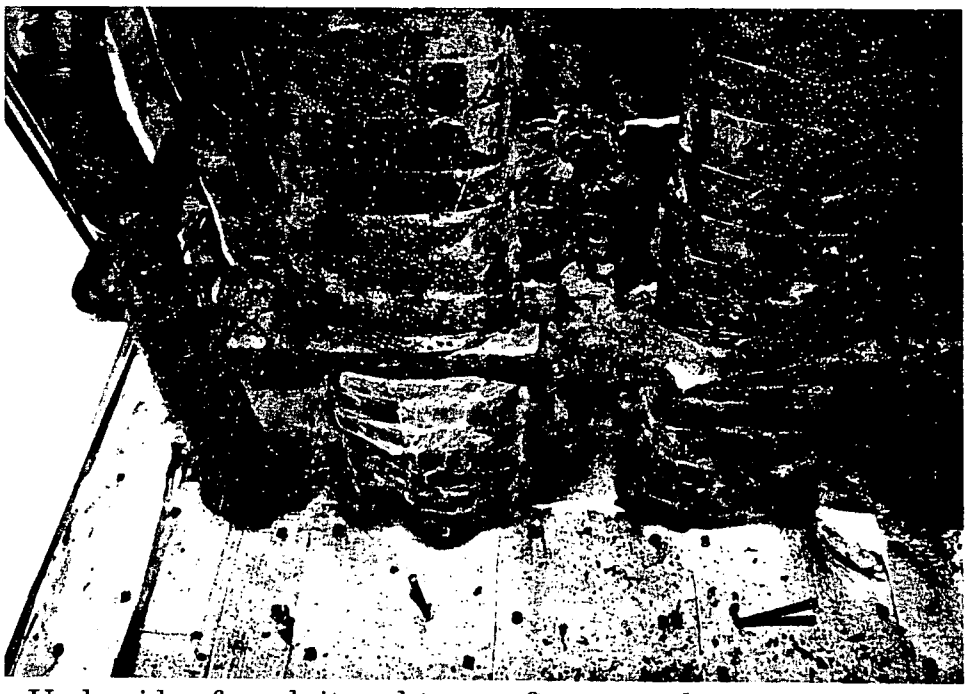
Underside of test deck after water hose stream test.



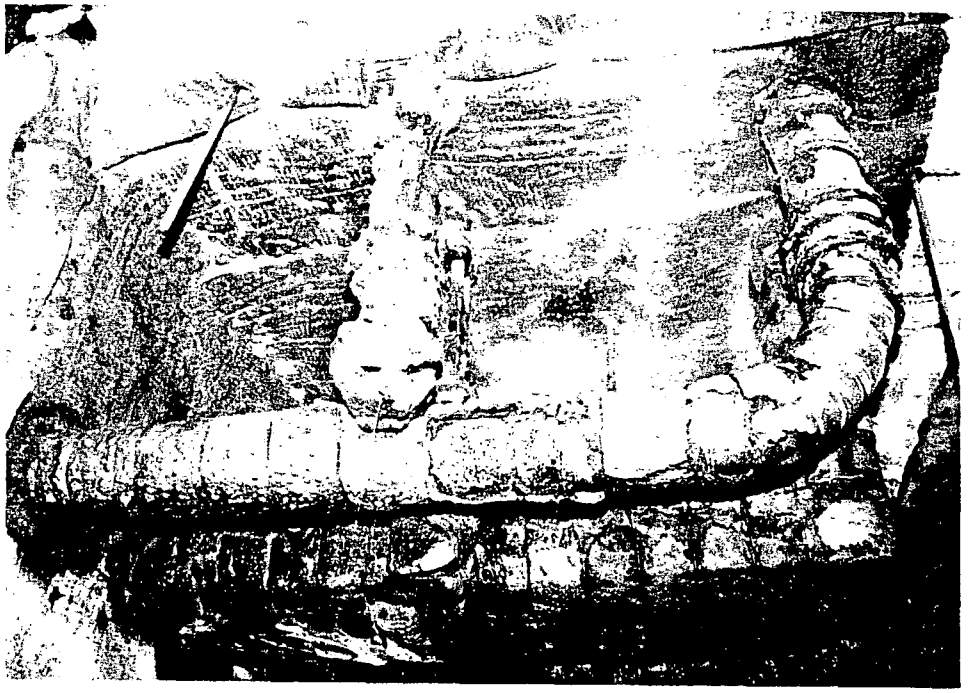
Left cable tray after water hose stream test.



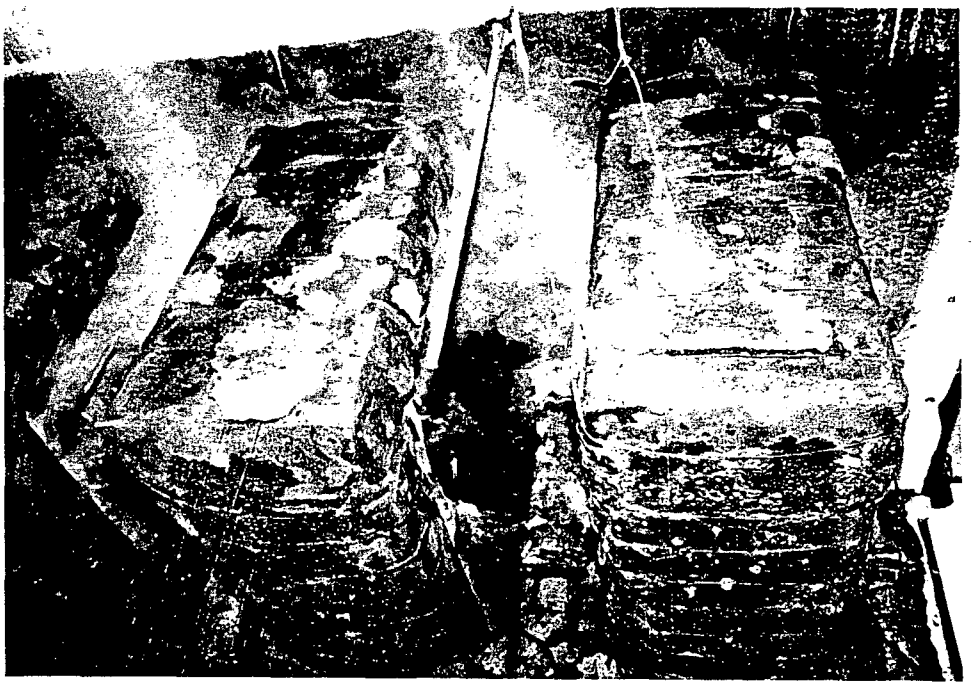
Underside of cable trays after water hose stream test.



Underside of conduit and trays after water hose stream test.

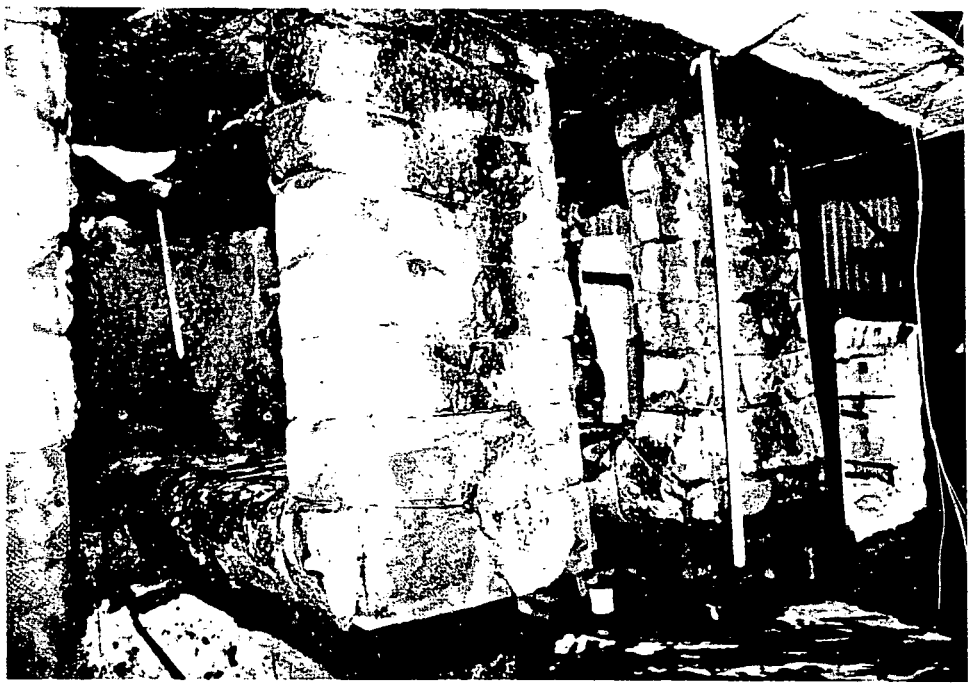


Conduit after water hose stream test.



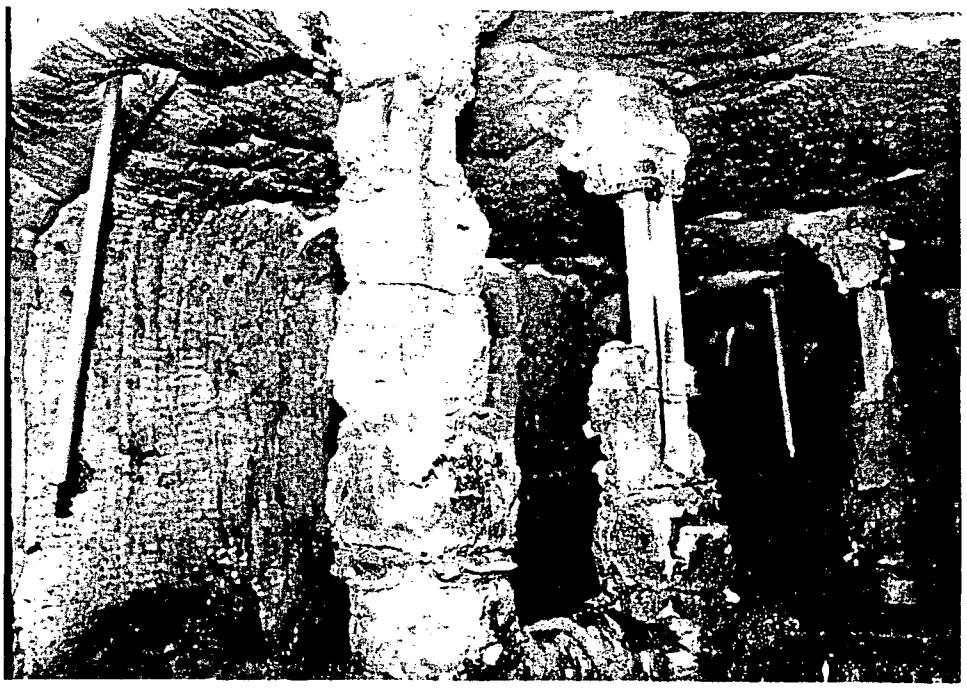
Left and center trays after water hose stream test.

Conduit, right and center trays after water hose stream test.

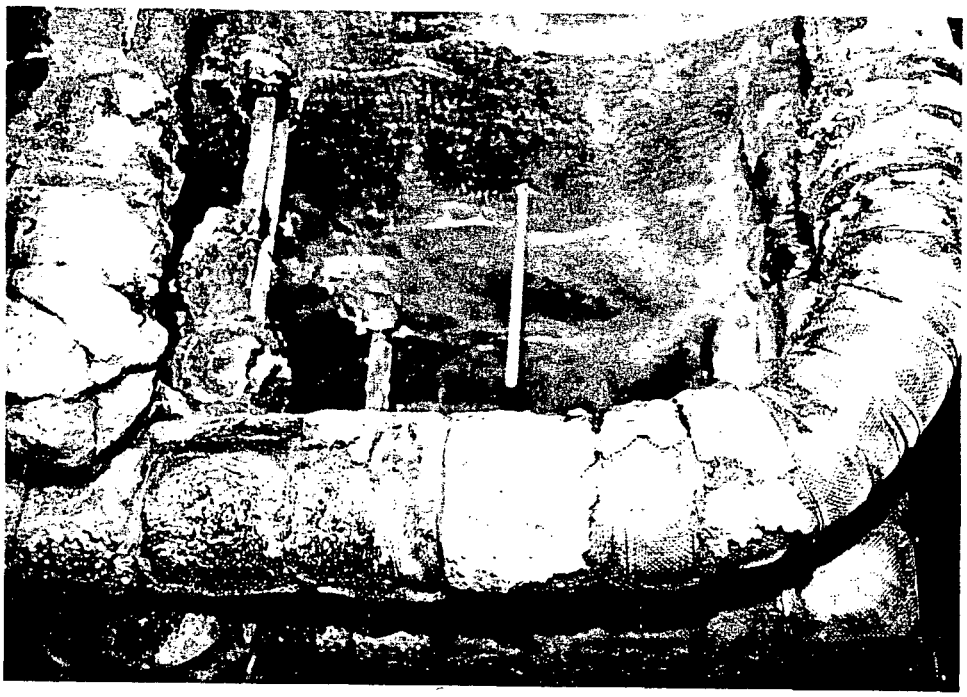


Center tray after water hose stream test.

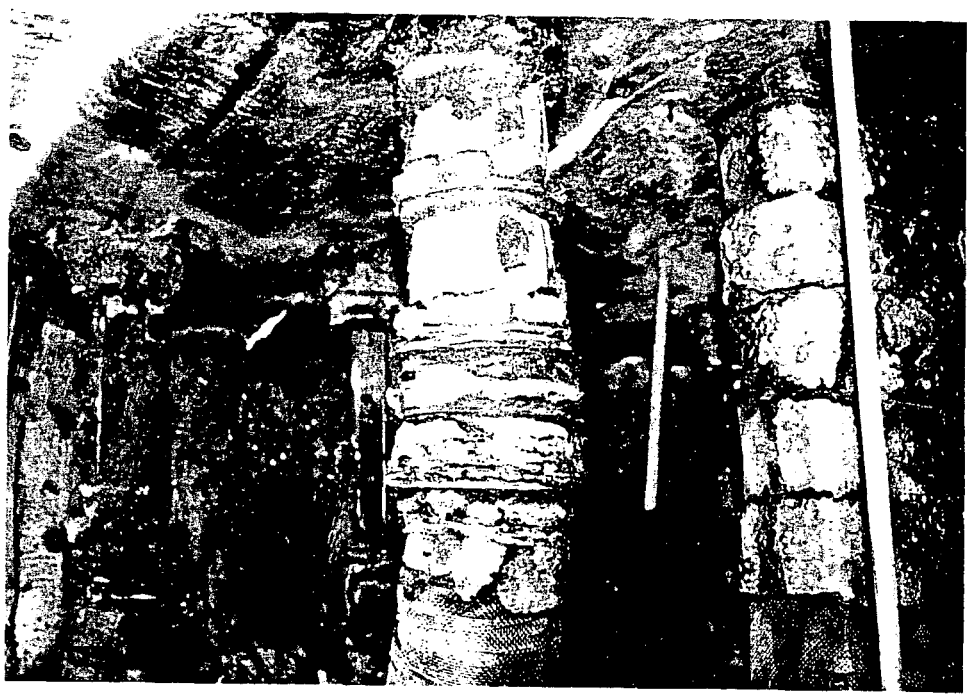
Interior of right cable tray.



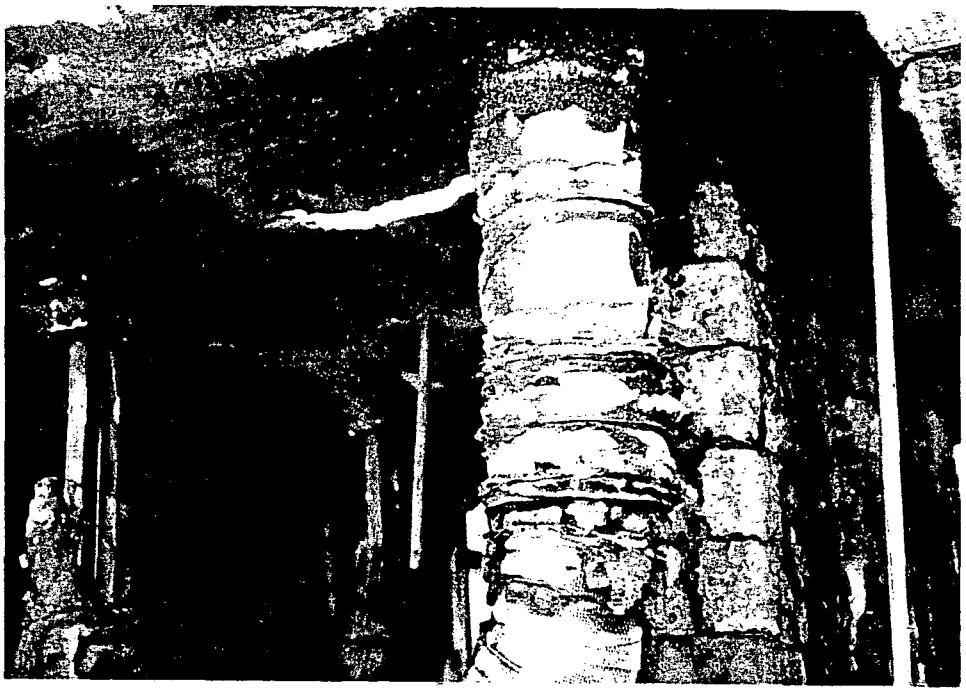
Support members clad with 3M material.



Conduit radial bend section.



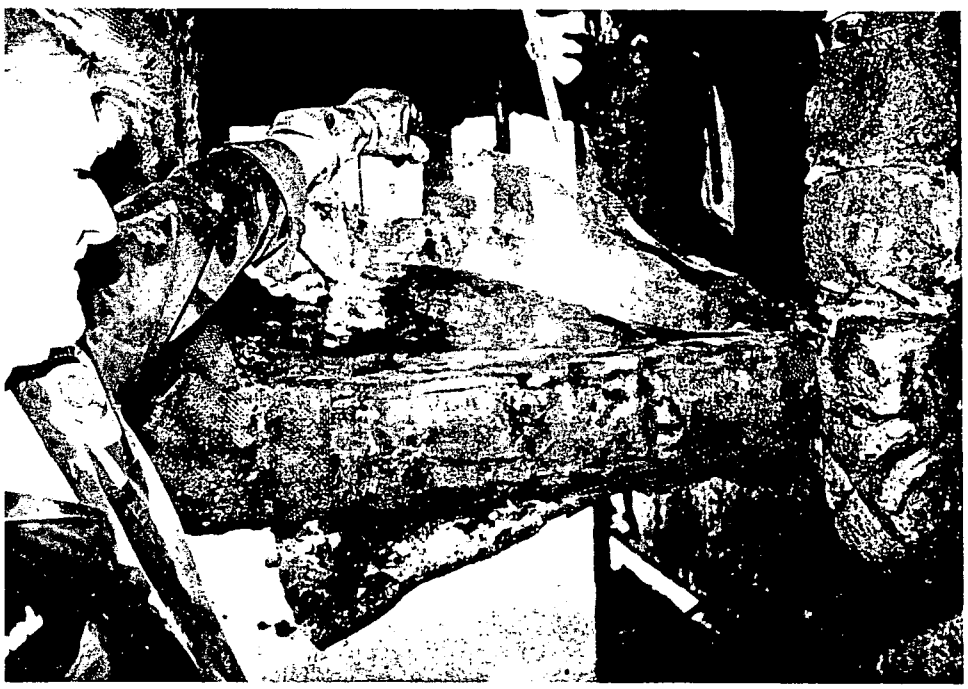
Conduit section clad with 3M materials.



Conduit section clad with 3M materials.

End of conduit radial bend section.

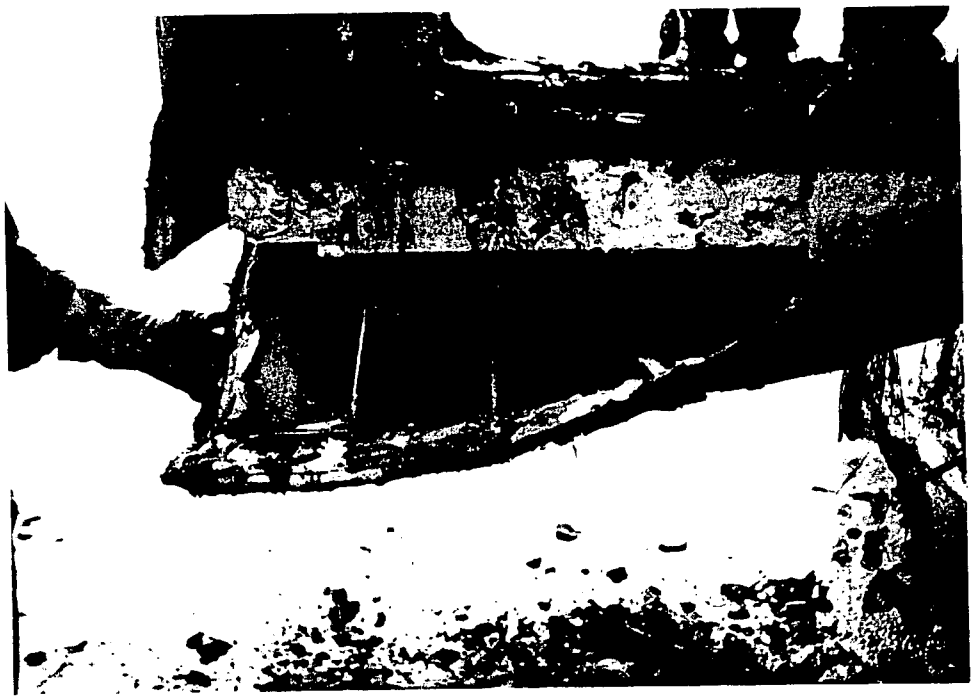
Tie wires cut from left tray assembly.



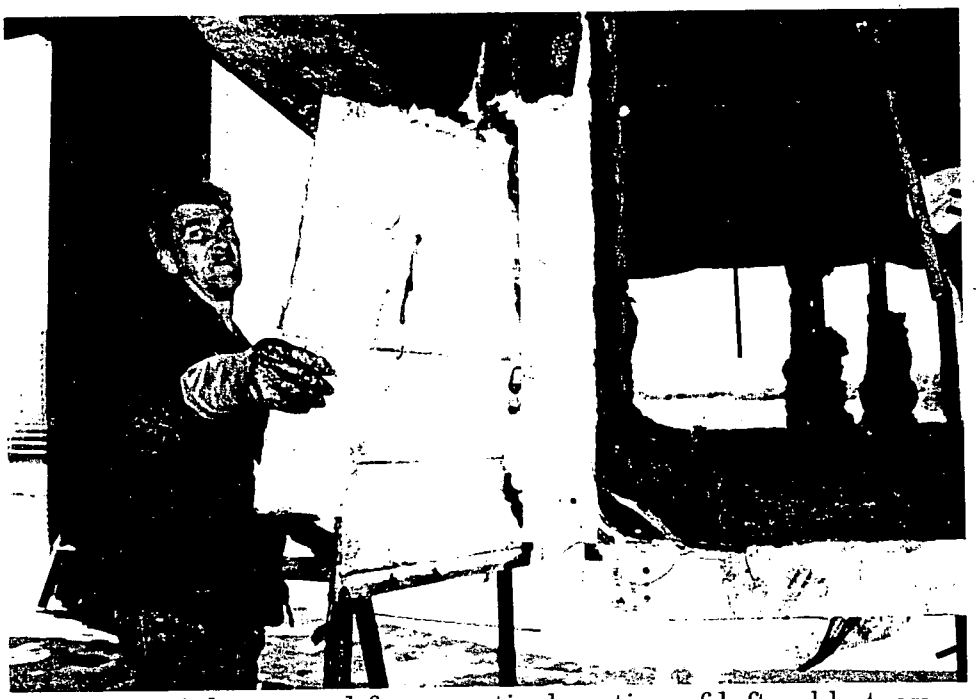
External stress skin removed from horizontal section of left cable tray.

External stress skin removed from horizontal support members under left cable tray.

External stress skin removed from bend section of left cable tray.



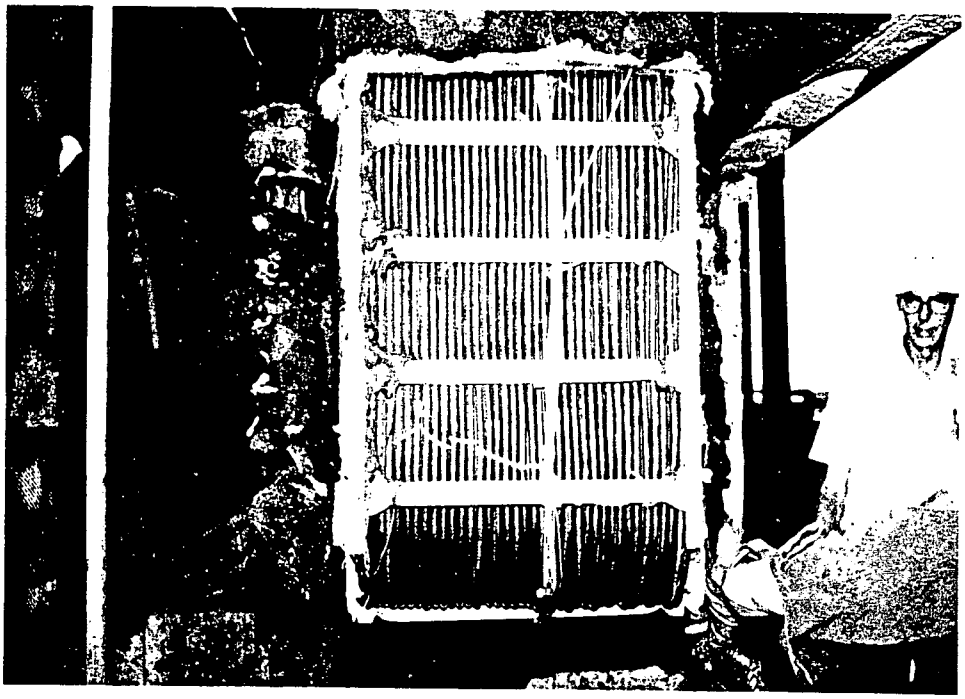
Material removed from horizontal section of left cable tray.



Material removed from vertical section of left cable tray.

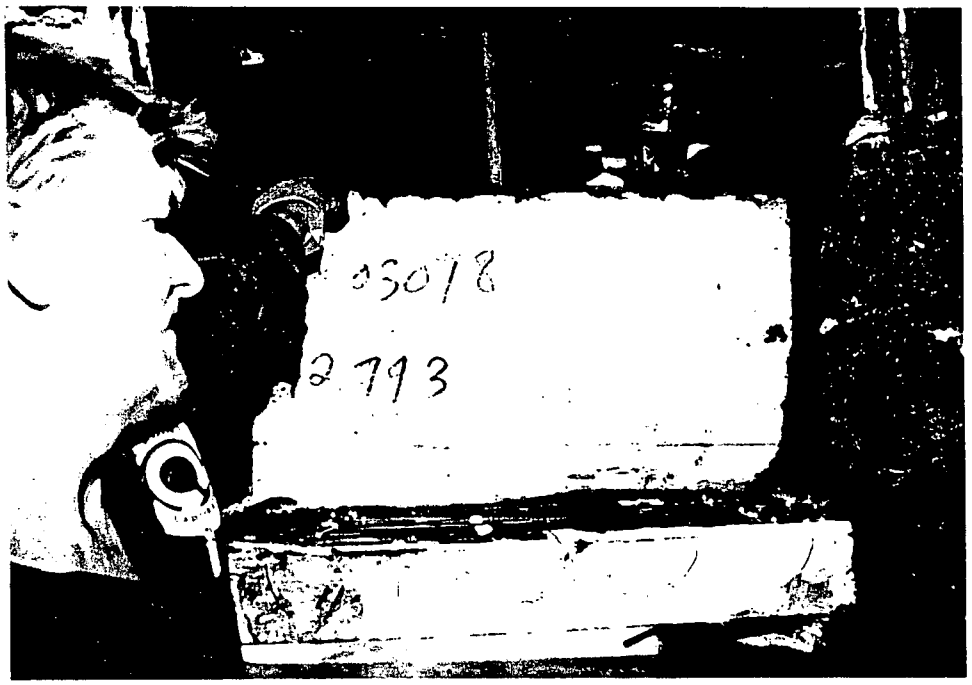
Material removed from horizontal section of left cable tray.

Cables in vertical section of left cable tray.

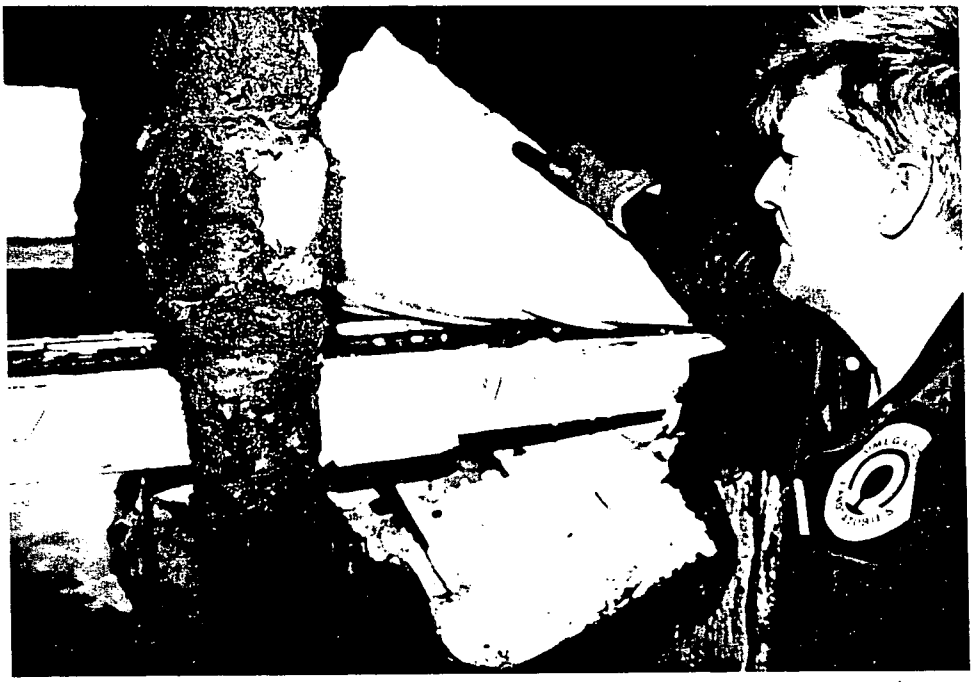


Cables in vertical section of left cable tray.

Material removed from top horizontal section of left cable tray.



Material removed from horizontal section of left cable tray.



Material removed from top horizontal section of left cable tray.

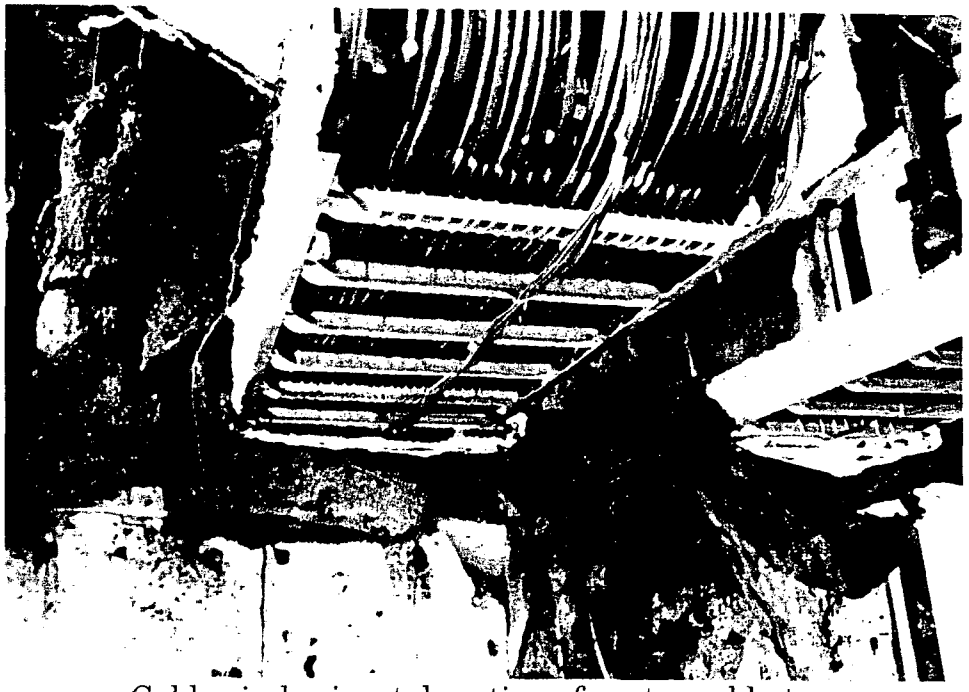
Cable in vertical and bend area sections of left cable tray.

External stress skin removed from center cable tray.

Material removed from horizontal section of center cable tray.

Material removed from bottom horizontal section of center cable tray.

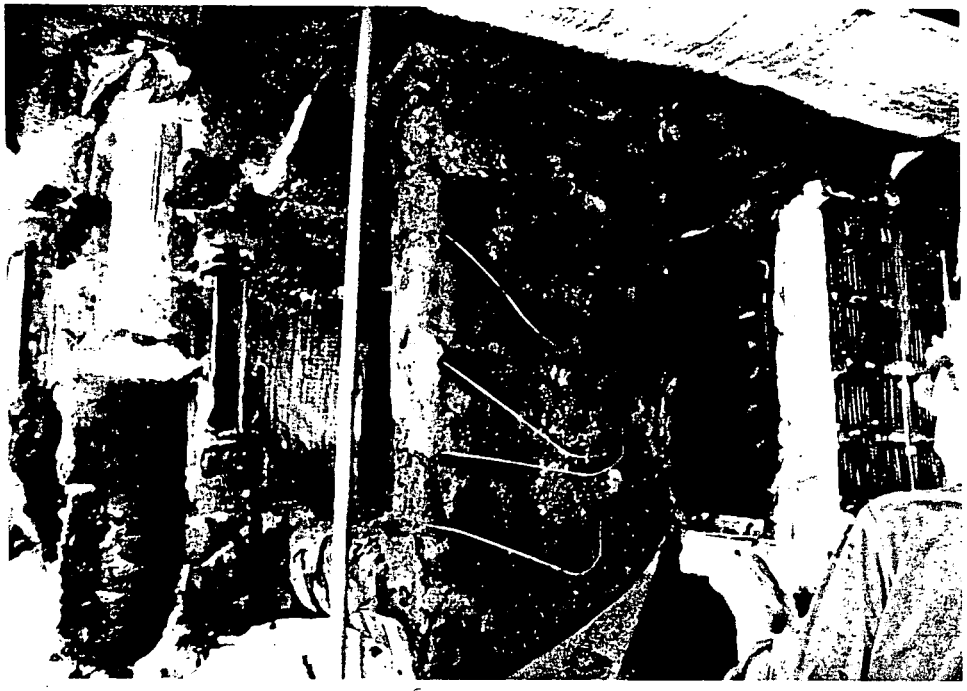
Cables in vertical section of center cable tray.



Cables in horizontal section of center cable tray.

Material removed from vertical section of center cable tray.

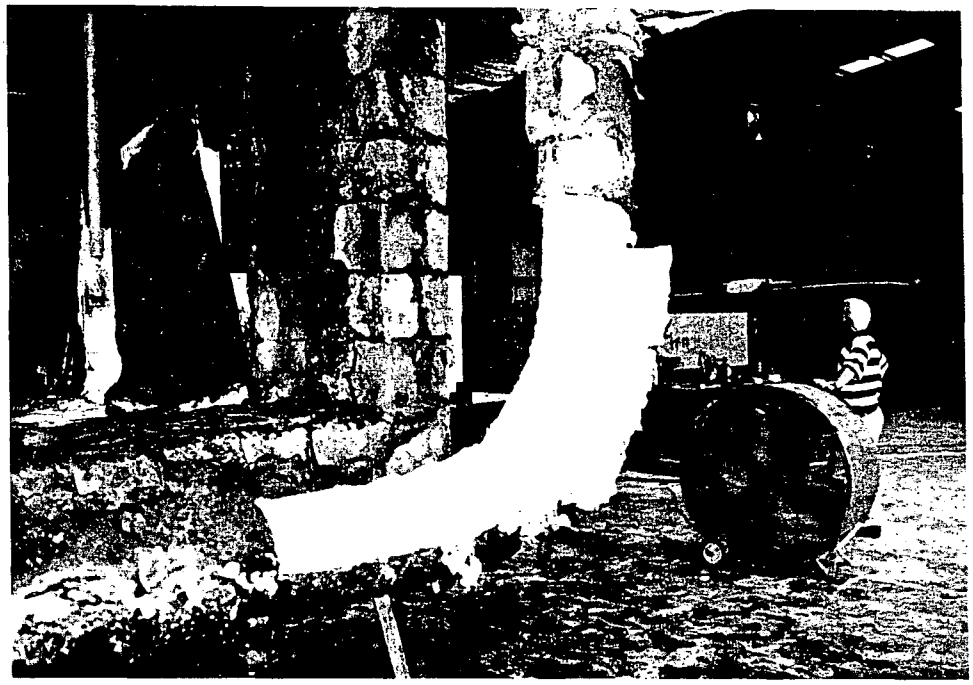
External stress skin removed from right cable tray.



Material removed from vertical section of right cable tray.

External stress skin removed from radial section of conduit.

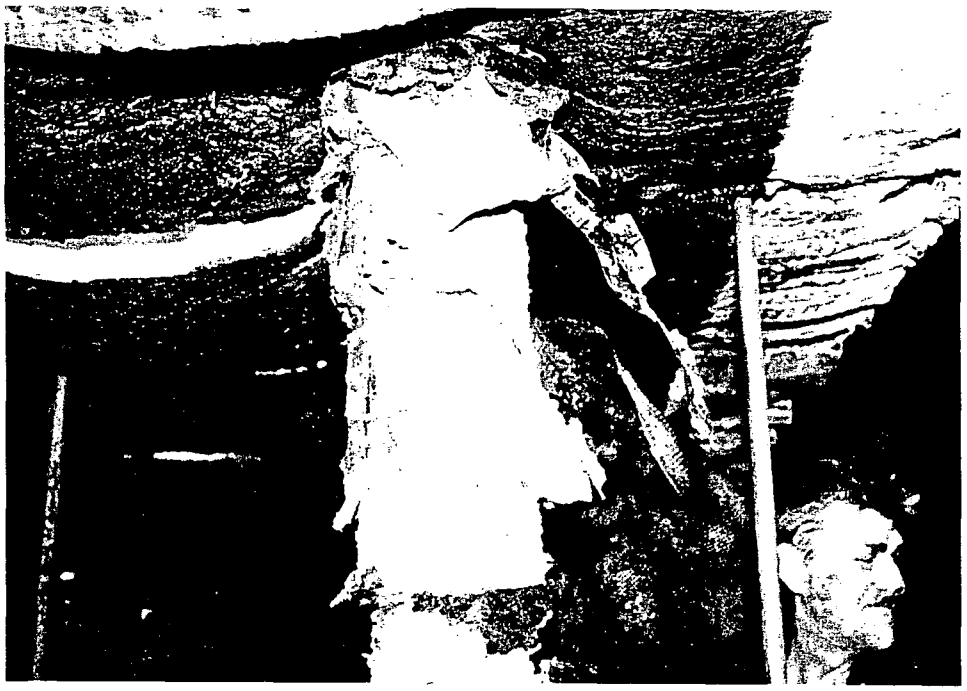
Material removed from radial section of conduit.



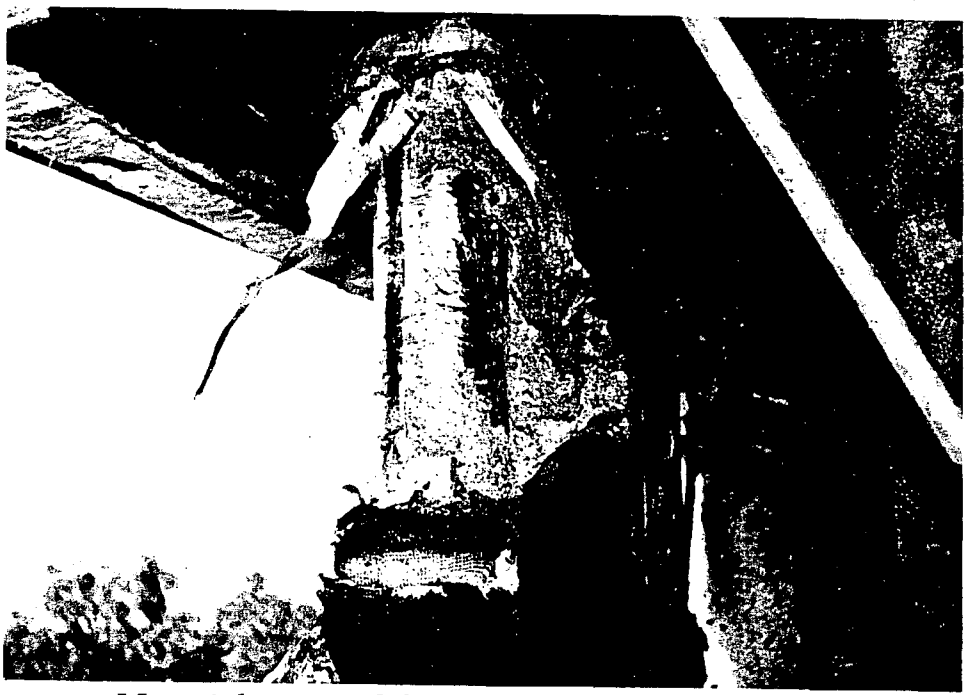
Material removed from radial section of conduit.

Material removed from radial section of conduit.

Material removed from vertical section of conduit.



Material removed from vertical section of conduit.



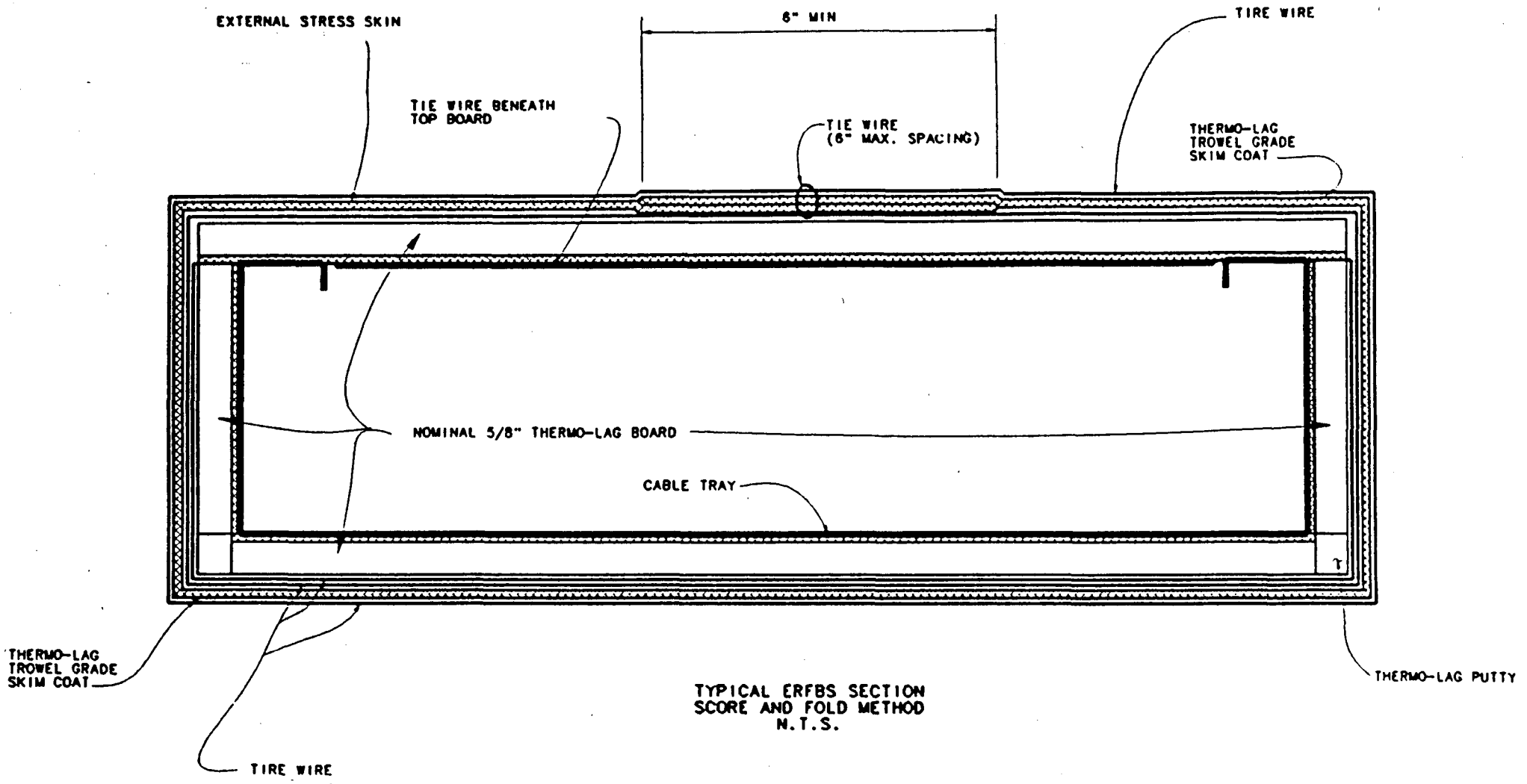
Material removed from vertical section of conduit.

Material removed from horizontal section of conduit.

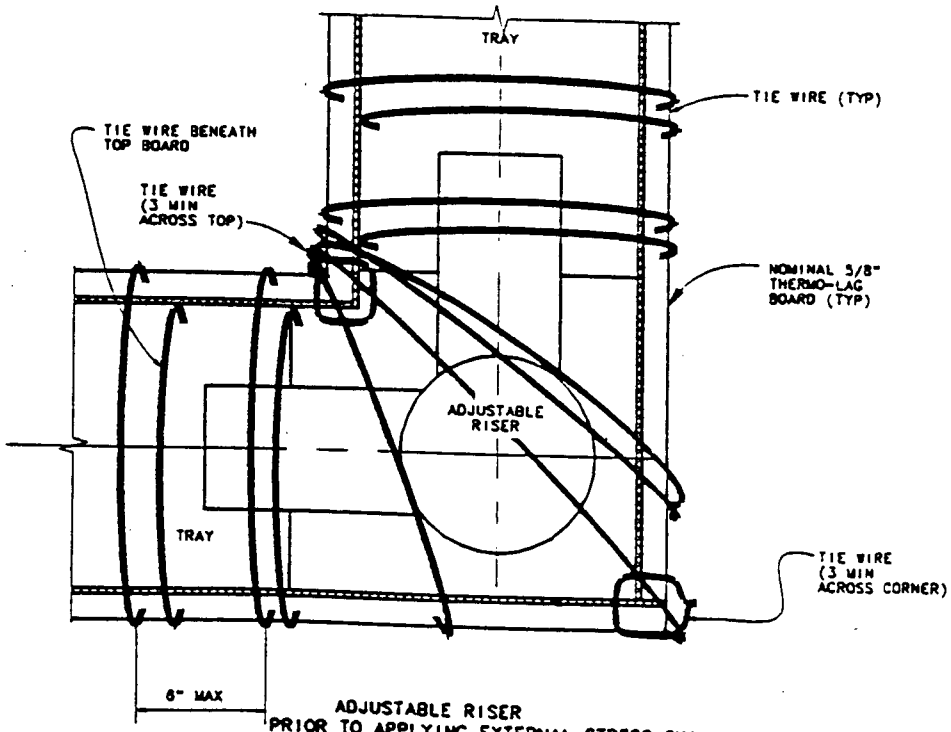
Material removed from vertical section of support member.

Appendix G

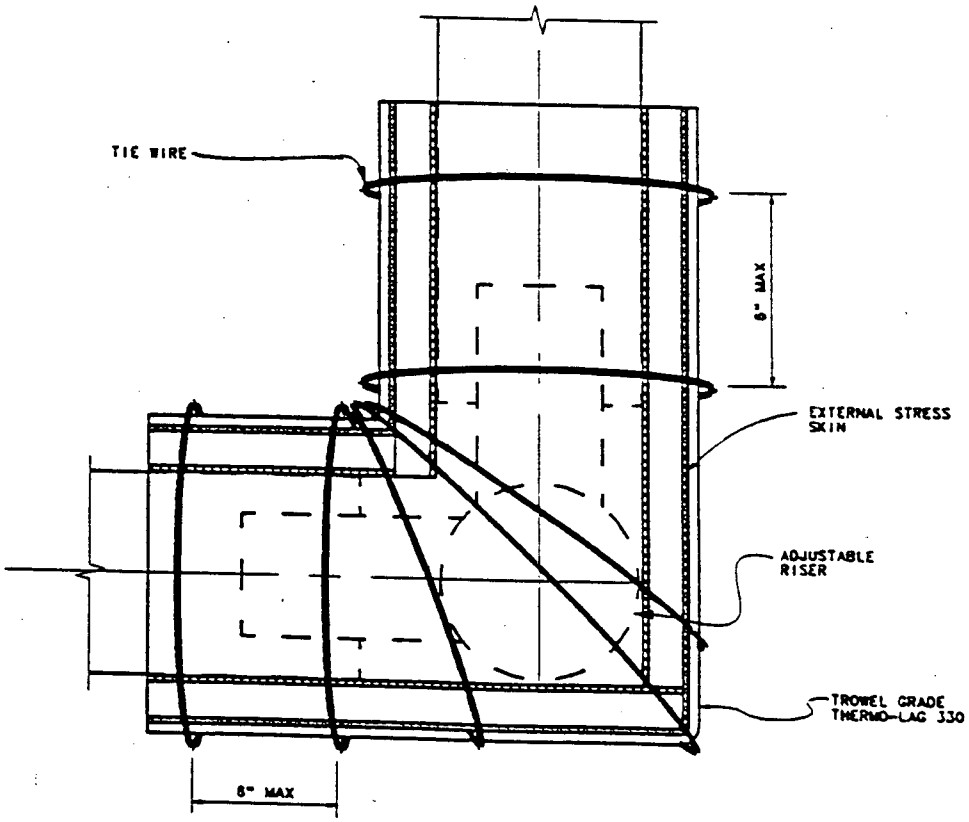
THERMO-LAG® 330-1 INSTALLATION DETAILS



TYPICAL ERFBS SECTION
SCORE AND FOLD METHOD
N.T.S.



ADJUSTABLE RISER
PRIOR TO APPLYING EXTERNAL STRESS SKIN
(SIDE RAIL PIECES
REMOVED TO SHOW DETAIL)
N.T.S.



ADJUSTABLE RISER
(EXTERNAL STRESS SKIN APPLIED
COVERED WITH TROWEL)
N.T.S.

TEST REPORT TRANSMITTAL FORM

To: Rubin Feldman
Thermal Science, Inc.
2200 Cassens Drive
St. Louis, MO 63026
(314) 349-1233

Re: Project No. 11960-97185 and 11960-97186

Enclosed, please find our final report on the above referenced projects. Should you notice any errors or omissions, please bring them to our attention immediately and we will correct the problem as quickly as possible.

Two additional copies of this report of being prepared for you and will be shipped at a later date. An additional copy of the test report will also be sent to TVA at a later date.

We appreciate your business and look forward to working with you again soon.

Sincerely,

Herbert W. Stansberry II,
Fire Test Technologist

c.c. Mark H. Salley
TVA
Watts Bar Nuclear Plant IOB-1M
P.O. Box 2000
Highway 68 near Spring City
Spring City, TN 37381
(6 copies)

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112-9784
210-635-8100 / FAX: 210-635-8101
800-966-5253