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FIRE ENDURANCE TEST OF THERMO-LAG® 330-1 FIRE PROTECTIVE ENVELOPES (Special Tray Fitting With Two 18 in. Cable Tray Sections)

Project No. 11960-97186

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

November 15, 1994

Prepared For:

Tennessee Valley Authority
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in cooperation with

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ABSTRACT

A special steel tray fitting (a cross fitting with two outlets on each side) with two sections of 18 in. wide x 4 in. deep steel ladderback cable tray attached, clad with a nominal thickness of 5/8 in. Thermo-Lag® 330-1 and various upgrades as described herein, was 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.

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Project Manager

11/17/94
Date

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OMEGA POINT LABORATORIES

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

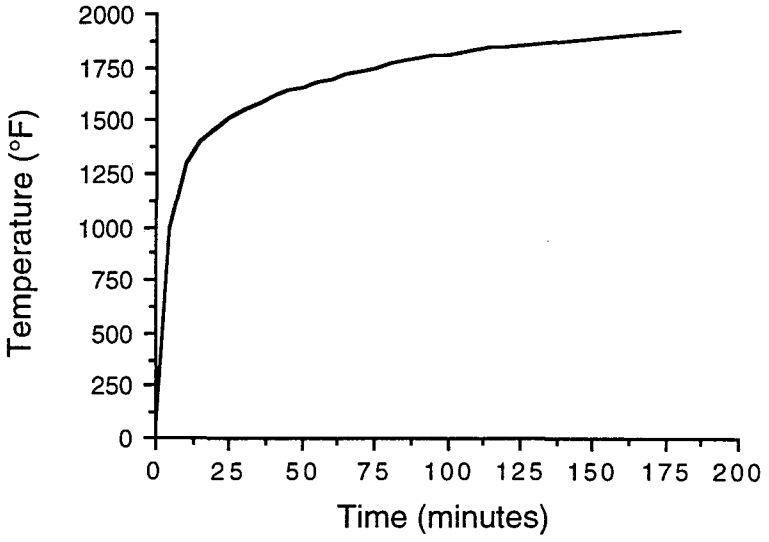
FIRE TEST FURNACE

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

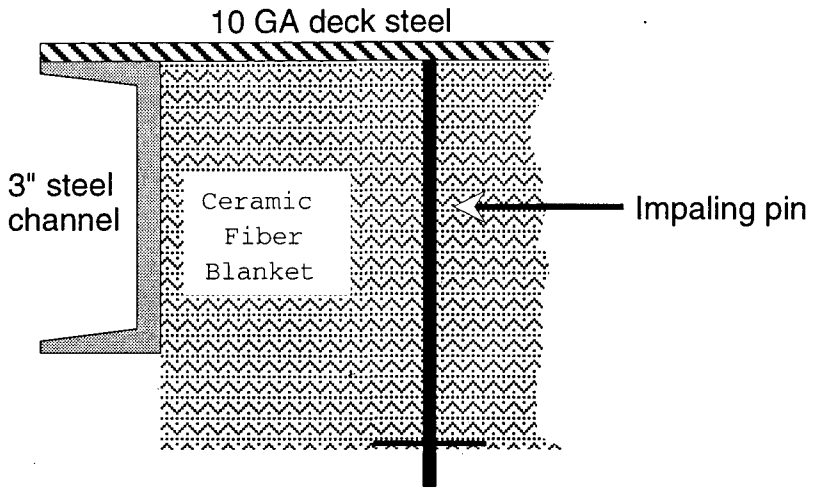
According to the Test Plan, following the fire exposure test, the test specimen is removed from the test furnace, lifted approximately 6 ft. from the ground (as measured from the lowermost part of the specimen), slowly turned (nominally 6 to 8 revolutions per minute) and exposed to the impact, erosion, 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 specimen is lifted high enough 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. 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.



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 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.

WEIGHT OF RACEWAY

RACEWAY	CABLE TRAY
18" Tray	4.00 lbs/lin. ft.
Special 18" Tray Cross Fitting	60.60 lbs.

* 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 RACEWAY. 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 TRAY)

The special fitting received from TVA was essentially a cross fitting with two 18 in. wide by 4 in. deep cable tray outlet per side, separated by 6 in. The overall length and width of the fitting were both 70 in. and the rung spacing was 6 in. Two sections of 18 in. by 4 in. deep ladderback cable tray, 6 in. rung spacing, (each 44 in. long) were fitted to one side of the cross fitting with standard splice plates. The overall length of the tray assembly was 114 in. and the overall width was 70 in. The entire assembly was centered under the test deck and support as described in the next section.

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

RACEWAY SUPPORTS

The special cross fitting was supported under the test deck with a "cage" constructed of 3 in. steel channel. A rectangular frame 60 in. wide by 61 in. deep was fashioned for the fitted to rest on. The frame was constructed of 3 in. steel channel, butt welded at the intersecting corners. The front and rear channel sections were positioned with the flanges facing outward and the left and right sections were oriented with the flanges facing inward. A vertical section of 3 in.

steel channel was fillet welded to each corner of the bottom framework. The vertical sections were sized to place the bottom of the cable tray side rail 36 in. below the insulated steel deck. 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 two cable tray sections 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 two cable trays which was supported at the ends 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 12 in. inboard of the free ends of the tray sections.

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 extended along the rear 18 in. cable tray, on the surface of the tray rungs, and, right to left, through the special tray fitting, one extended along the front 18 in. cable tray, on the surface of the tray rungs, and, right to left, through the special tray fitting, one passed, front to rear, through the left side of the special tray fitting, on the surface of the tray rungs and one passed, front to rear, through the right side of the special tray fitting, on the surface of the tray rungs.

In order to get a realistic measurement of the temperatures on the cable tray side rail surfaces, similar thermocouples were positioned nominally every 6 in. along the cable tray side rails, 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 to a common point on the special fitting (the rear outlet on the left side). A 1-1/2 in. diameter steel conduit extended from the mouth of the fitting, into an LB fitting, and passed vertically through the steel upper deck. This conduit was placed to provide passage for instrumentation leads and did not comprise a portion of the test sample. The addition of this conduit was necessary as no raceway penetrations were present in the cable tray design being evaluated.

A hole in the steel deck was provided around the instrumentation conduit and the perimeter was edged with 3 in. steel channel (flanges out). This blockout was sealed with Dow Corning 3-6548 RTV silicone foam material (after installation of the fire barrier material onto the conduit to protect the thermocouple leads). An internal seals was similarly constructed where the conduit exited the test furnace enclosure.

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 enclosure, and to cover a portion of 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.

3M M20A Mat

This material was used to cover the upper portion of the structural support members.

3/4 in. x 2 in. 10-Gauge Steel Angles

These angle were used to span across the cable trays and fitting to provide support and a method of attachment for the Thermo-Lag® 330-1 panels. Threaded steel

rod (3/8 in. diameter) was used to fasten the angles to the tray and secure the Thermo-Lag® 330-1 materials to the angles.

Application Methods

The 10 GA steel angles were cut to fit across the large tray fitting and between the two parallel trays. Threaded steel rod was used to connect the top and bottom angle sections together and to clamp them onto the tray side rails. The enclosure for the cable tray fitting and the cable tray sections was constructed from nominal 5/8 in. thick V-ribbed panels. The V-ribs were hammered flat along the tray edges where they came in contact with the 10 GA steel angle to obtain a tight fit. The pieces were pre-buttered with trowel grade material where they mated to any metal or another panel. They were secured to the raceway with fender washers and nuts and with stainless steel tie wires. All joints and seams were filled in with trowel grade material.

A skim coat of trowel grade material was applied to the enclosure and external stress skin installed in it while still wet. The external stress skin was secured to the enclosure with 1/2 in. long staples, fender washers and nuts. Another skim coat of trowel grade materials was applied over the external stress skin and allowed to dry. Strips of nominal 3/8 in. flat board material were cut (approximately 6 on. wide) and placed over seams. The strips were pre-buttered prior to installation. Additional washers and nuts were added to secured the strips to the enclosure. After the completed assembly had dried (approximately 24 fours), the final tie wires were installed on 6 in. spacing where possible.

The "Eighteen Inch Rule" for Thermo-Lag® 330-1 was applied to the supports. Two layers of 3M Corp. M20A mat were installed on the remaining portions of the vertical supports and were secured in place with 3M tape and stainless steel tie wire on 6 in. spacing. A collar (approximately 6 in. wide) of M20A was installed over the M20A to Thermo-Lag® 330-1 interface joint.

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 8, 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.
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 9:27 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 0:25 (min:sec) the outside surface of the test item was beginning to turn brown, and by 1:48 (min:sec) had ignited fairly uniformly across the exposed surfaces. By 3:46 (min:sec) the furnace was filled with intense smoke and heavy flaming. 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 majority of 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 skim coat had peeled away. The majority of the outermost coat of trowel grade was gone from the underside of the assembly.

The test specimen was elevated to a distance of approximately 6 ft. between the floor and the bottom of the test item and spun on a swivel at a rate of 6 – 8 revolutions per minute (to ensure exposure of as much of the exterior surface as possible) 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. After approximately 2 minutes of hose stream exposure on the bottom of the test sample, the deck was lowered to allow exposure of the top of the test item. After an additional two minutes the deck was raised to once again exposed the bottom of the sample.

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 assembly. The layer of external stress skin was exposed in spots and strips of the external stress skin were dislodged in places. Much of the 3M material on the supports 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. An explanation of the allowable limits is given following the table.

LOCATION	MAX. TEMP. (°F)	AVG. TEMP. (°F)
FRONT 18" CABLE TRAY		
Front Tray Side Rail	246	236
Rear Tray Side Rail	292	271
Bare #8 Wire on Rungs	308	288
REAR 18" CABLE TRAY		
Front Tray Side Rail	298	276
Rear Tray Side Rail	258	248
Bare #8 Wire on Rungs	321	291
SPECIAL TRAY FITTING		
Front Side Rail Sections	262	246
Rear Side Rail Sections	249	237
Right Side Rail Sections	267	263
Left Side Rail Sections	271	265
Right Bare #8 Wire on Rungs	301	286
Left Bare #8 Wire on Rungs	305	284

The average initial temperature for all thermocouples at the start of the test was 90°F, yielding an allowable temperature increase of 250°F, or 340°F actual for the average temperatures. (A 325°F increase above the 90°F initial temperature yields a maximum allowable individual temperature of 415°F, in accordance with ASTM E119-88.) All of the thermocouples on within the cable tray system met 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.

FRONT 18 in. CABLE TRAY

LOCATION	OBSERVATION
Top horizontal section.	Panel sagging into tray cavity approximately 1 in. to 1-1/2 in. Much of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Up to 3/4 in. char depth over external stress skin in places. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. of uncharred material remaining.
Bottom horizontal section.	Much of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Up to 3/4 in. char depth over external stress skin in places. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. of uncharred material remaining. Approximately 1/2 gal. of liquid flowed from tray cavity during disassembly. This liquid was deemed to have been moisture driven out of the Thermo-Lag® 330-1 materials as steam during the fire exposure. Note: the temperature of barrier interior is at or near steam point of water during exposure. See OPL test report No. 11960-97185 which notes a steam leakage at an external penetration seal during fire exposure. The liquid inside the barrier system condensed due to the cooling effects of the water hose stream test (and was discovered during disassembly). There were no barrier openings discovered at the end of the hose stream test and therefore no evidence of water intrusion from the hose stream test.

LOCATION (cont.)	OBSERVATION
Tray side rails.	Much 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. of uncharred material remaining.
Tray end.	Much 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 3/8 in. and 1/2 in. of uncharred material remaining. Inner panel of material totally intact.

REAR 18 in. CABLE TRAY

LOCATION	OBSERVATION
Top horizontal section.	Panel sagging into tray cavity approximately 1 in. to 1-1/2 in. Much of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Up to 3/4 in. char depth over external stress skin in places. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. of uncharred material remaining.

LOCATION (cont.)	OBSERVATION
Bottom horizontal section.	Much of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Up to 3/4 in. char depth over external stress skin in places. Approximately 1/2 in. char depth under external stress skin. Between 1/4 in. and 3/8 in. of uncharred material remaining. Approximately 1/2 gal. of liquid flowed from tray cavity during disassembly. This liquid was deemed to have been moisture driven out of the Thermo-Lag® 330-1 materials as steam during the fire exposure. Note: the temperature of barrier interior is at or near steam point of water during exposure. See OPL test report No. 11960-97185 which notes a steam leakage at an external penetration seal during fire exposure. The liquid inside the barrier system condensed due to the cooling effects of the water hose stream test (and was discovered during disassembly). There were no barrier openings discovered at the end of the hose stream test and therefore no evidence of water intrusion from the hose stream test.
Tray side rails.	Much 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. of uncharred material remaining.
Tray end.	Much 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 3/8 in. and 1/2 in. of uncharred material remaining. Inner panel of material totally intact.

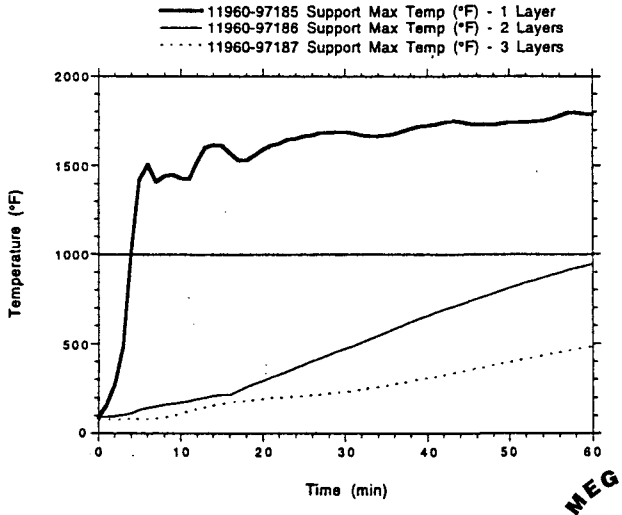
SPECIAL 18 in. CABLE TRAY FITTING

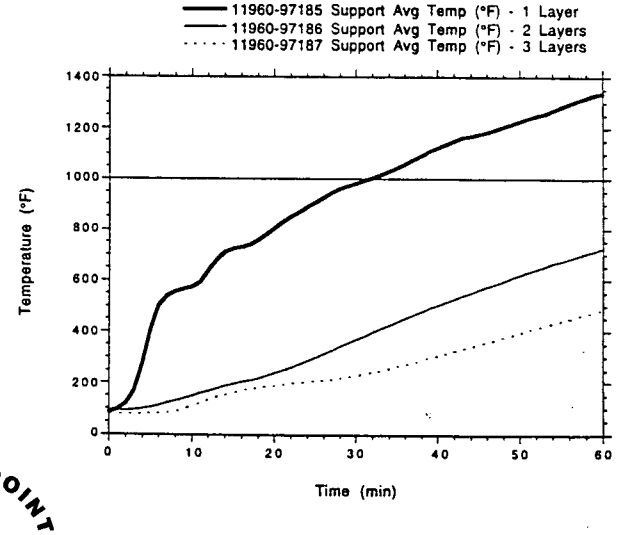
LOCATION	OBSERVATION
Top horizontal section.	Panels sagging into fitting cavity approximately 1/2 in. to 1 in. Most of outer char layer dislodged by hose stream test, exposing layer of external stress skin below. Approximately 1/2 in. char depth under external stress skin. Between 3/8 in. and 1/2 in. of uncharred material remaining. Material totally intact under strips along seams and joints. Trowel grade mounds covering nuts and washers in place and mostly intact.
Bottom horizontal section.	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. of uncharred material remaining. Material totally intact under strips along seams and joints. Trowel grade mounds covering nuts and washers in place and mostly intact.
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. of uncharred material remaining.
Tray fitting outlets.	Much 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 3/8 in. and 1/2 in. of uncharred material remaining. Inner panel of material totally intact.
Tray supports.	Much 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. of uncharred material remaining. Thermo-Lag® 330-1 material mostly intact at interface with 3M M20A. Outer layer of 3M M20A mostly dislodged. Inner layer intact but waterlogged and discolored.

CONCLUSIONS

The cable tray 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.

This test 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. Two layers of the M20A were applied to the support members in the deck presented herein. One layer of material was installed on the test deck for Project No. 11960-97185 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.





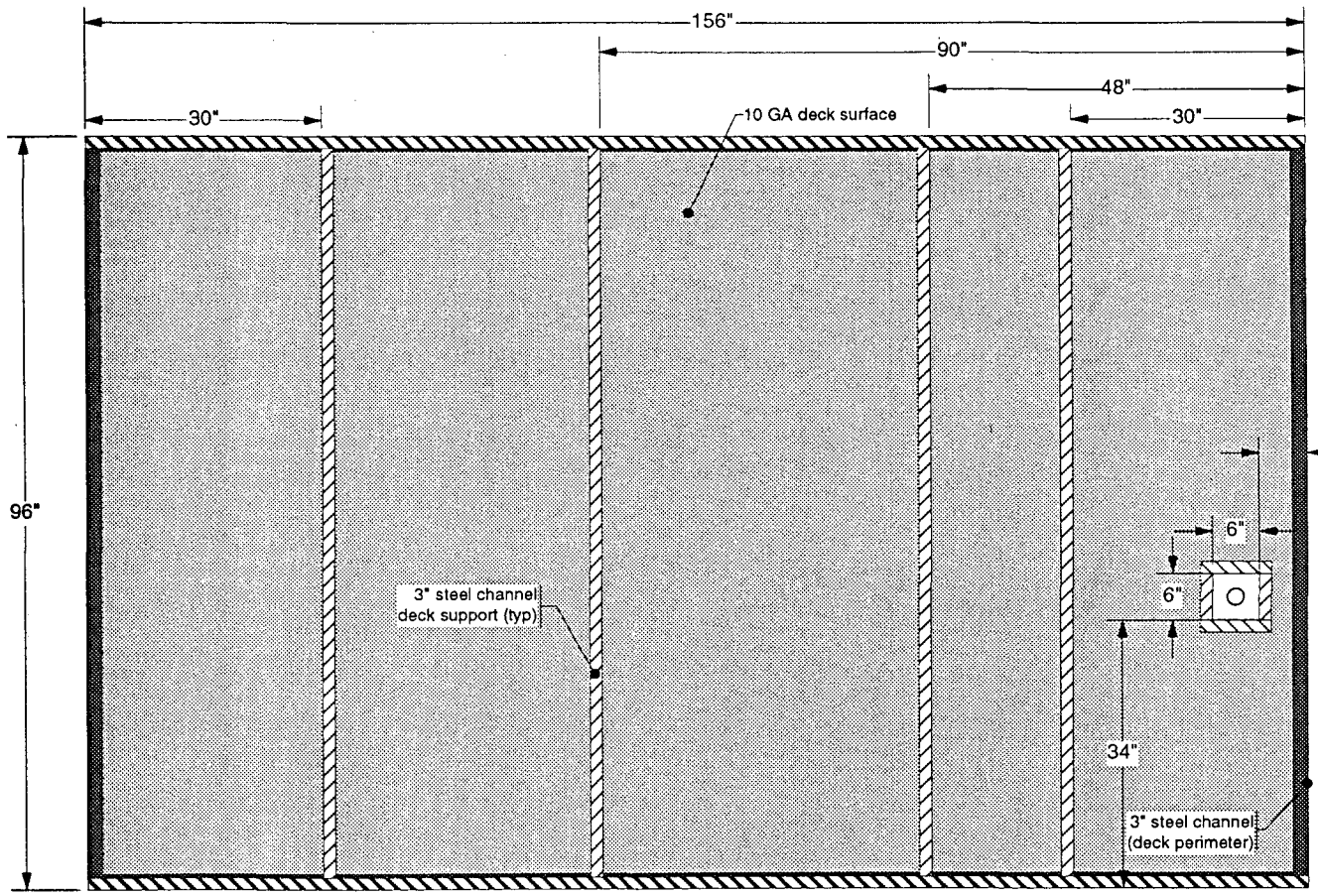
OMEGA POINT LABORATORIES

As the graphs on the previous page 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



OMEGA POINT LABORATORIES, INC. Project No. 11960-97186
TVA / TSI
Fig. 1 Plan View (Above Deck) - Test Deck #2, Rev. 1
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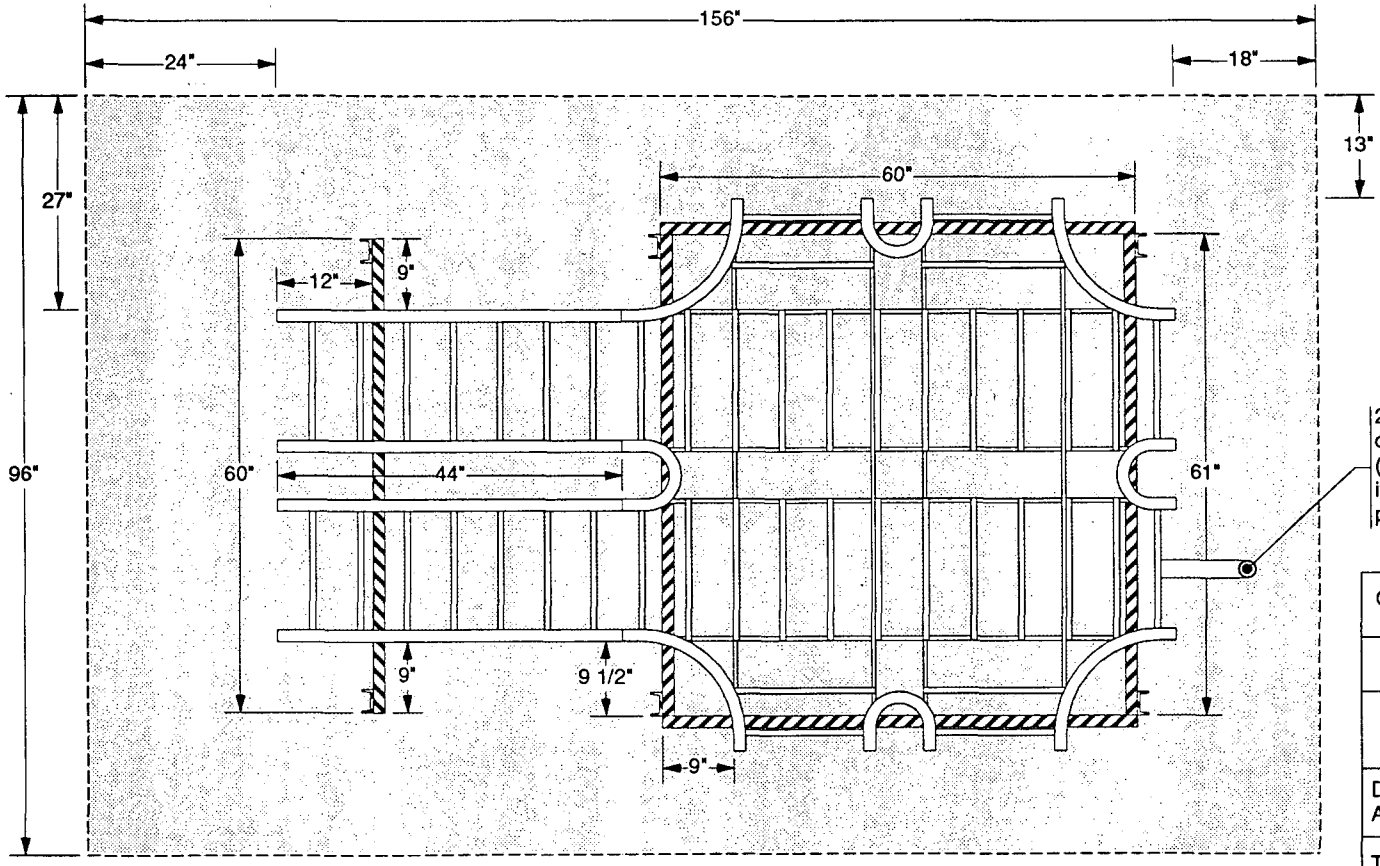
TVA Appr'l: JJ Piera Date: 7/5/94

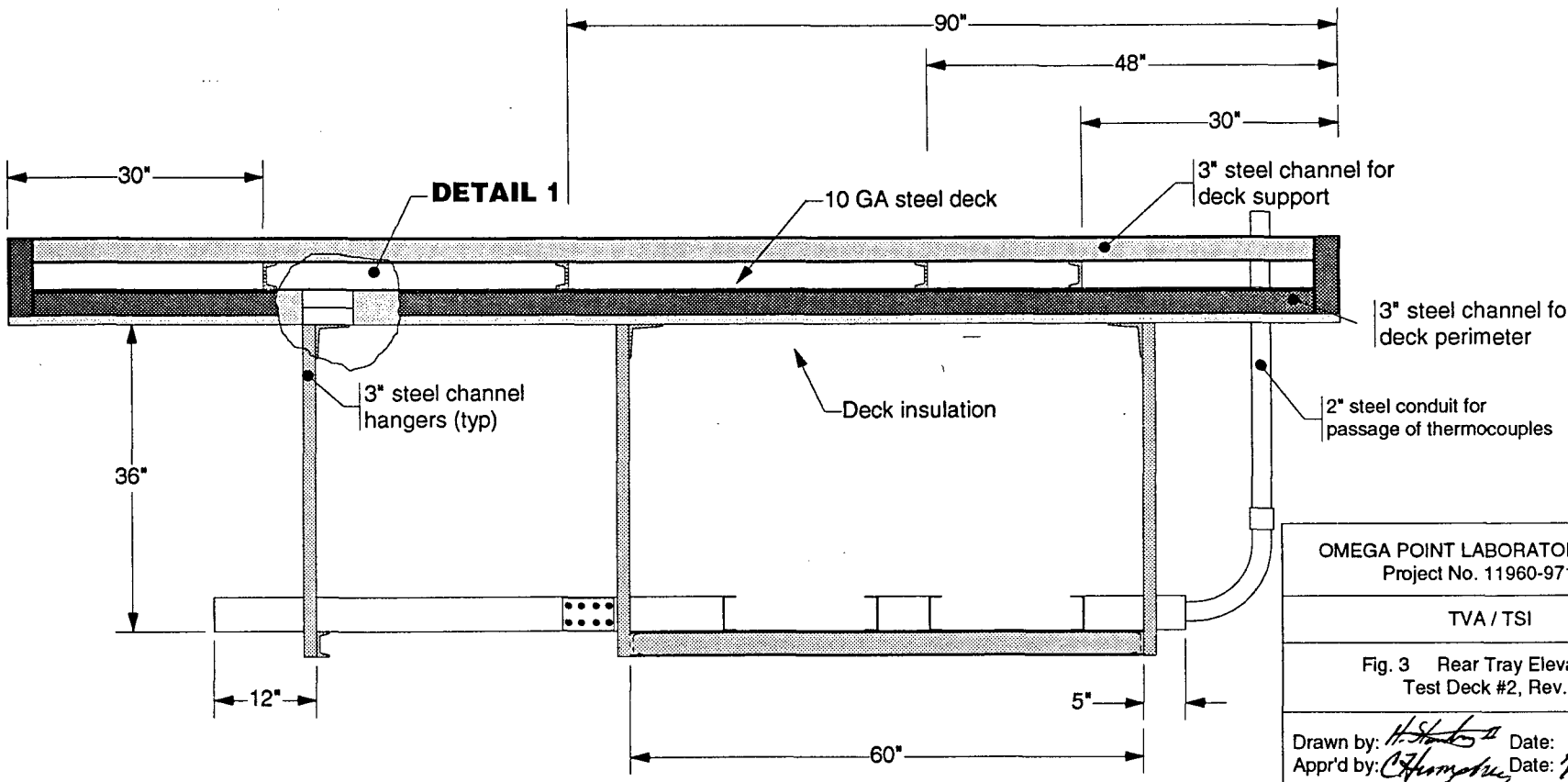


LEFT

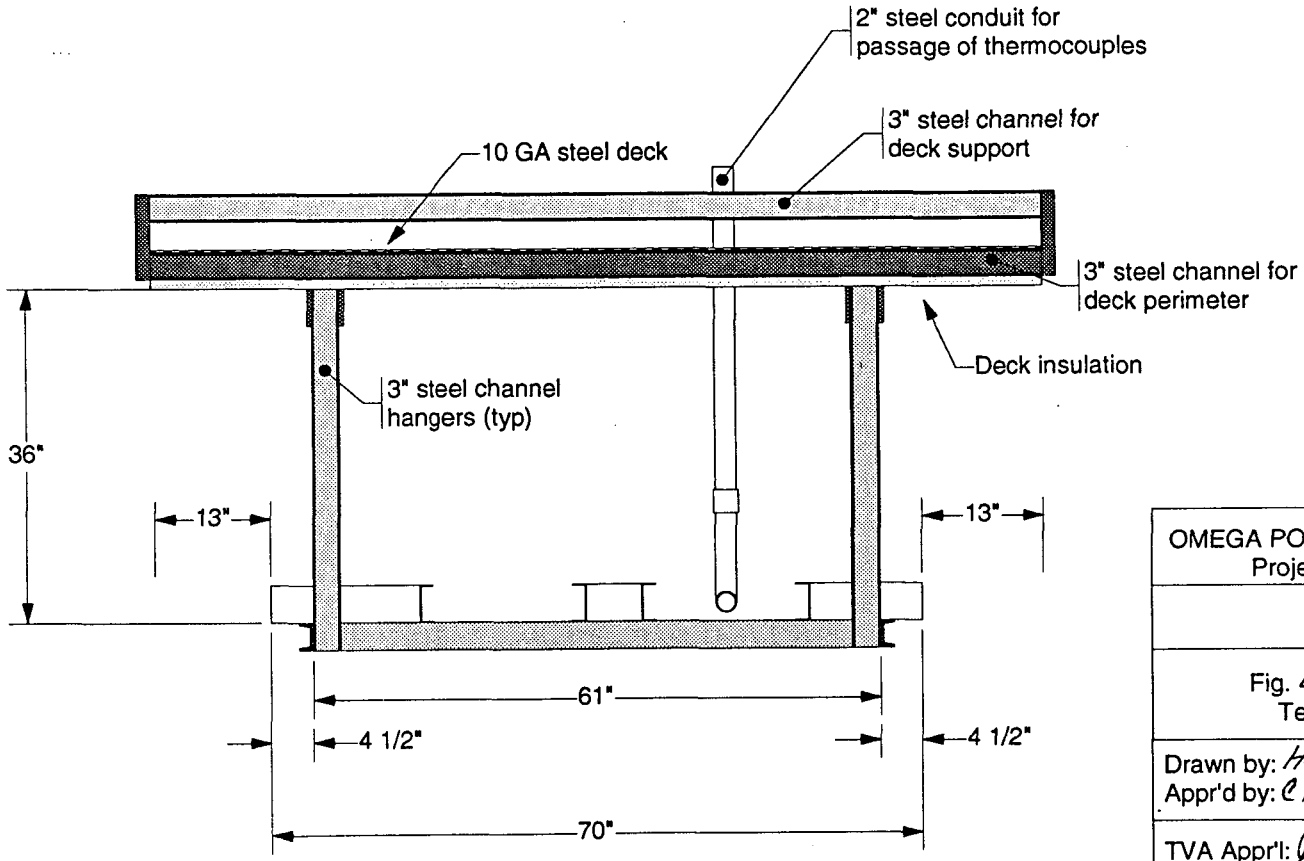
REAR

2" conduit for passage of thermocouple leads (not evaluated as a test item - used only for protection of instrumentation)

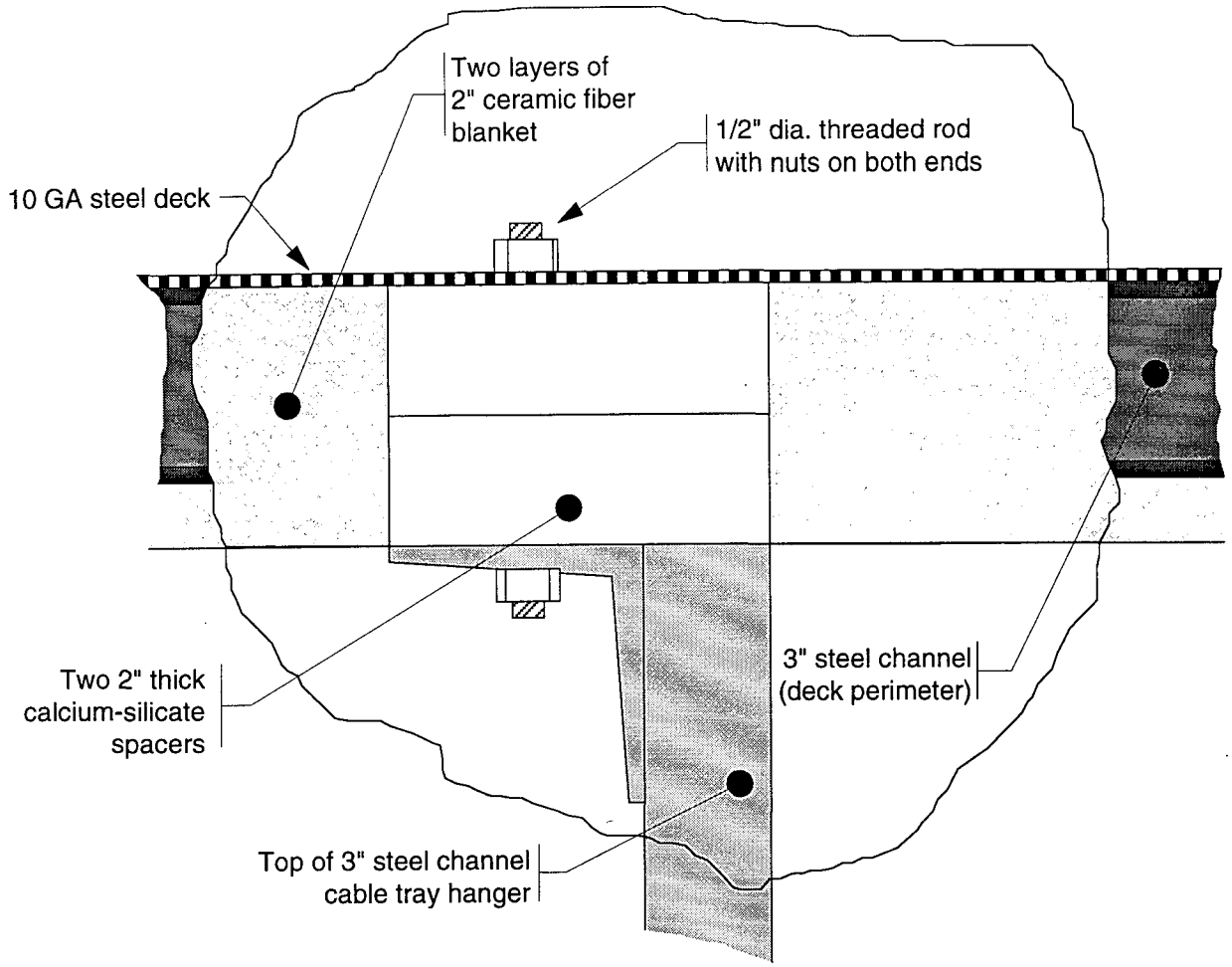
OMEGA POINT LABORATORIES, INC. Project No. 11960-97186
TVA/ TSI
Fig. 2 Plan View (Below Deck) - Test Deck #2, Rev. 1
Drawn by: H. Stanley II Date: 7/11/94 Appr'd by: C. Humphrey Date: 7/11/94
TVA Appr'l: J.J. Riera Date: 7/5/94



OMEGA POINT LABORATORIES, INC. Project No. 11960-97186
TVA / TSI
Fig. 3 Rear Tray Elevation - Test Deck #2, 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. 11960-97186
TVA / TSI
Fig. 4 Right End View - Test Deck #2, Rev. 1
Drawn by: H. Stanton III Date: 7/1/94 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. 11960-97186
TVA / TSI
Fig. 5 DETAIL 1 - Hanger Mount and Insulation

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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 35

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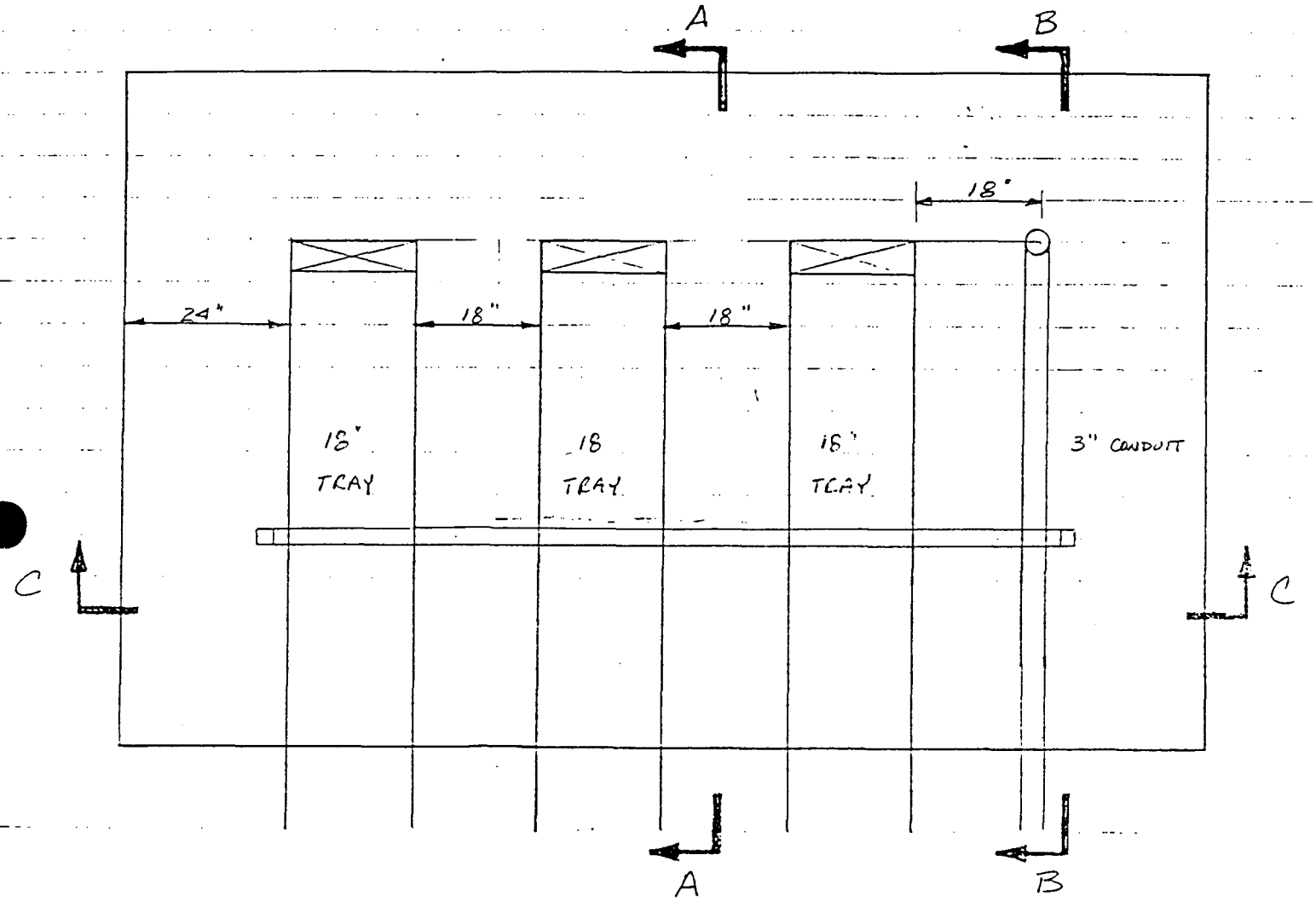

PLAN VIEW
TRAY FILL TEST
AND TSI-3M INTERFACE

36

SUBJECT TEST DECK 1 PROJECT TVA-TSI

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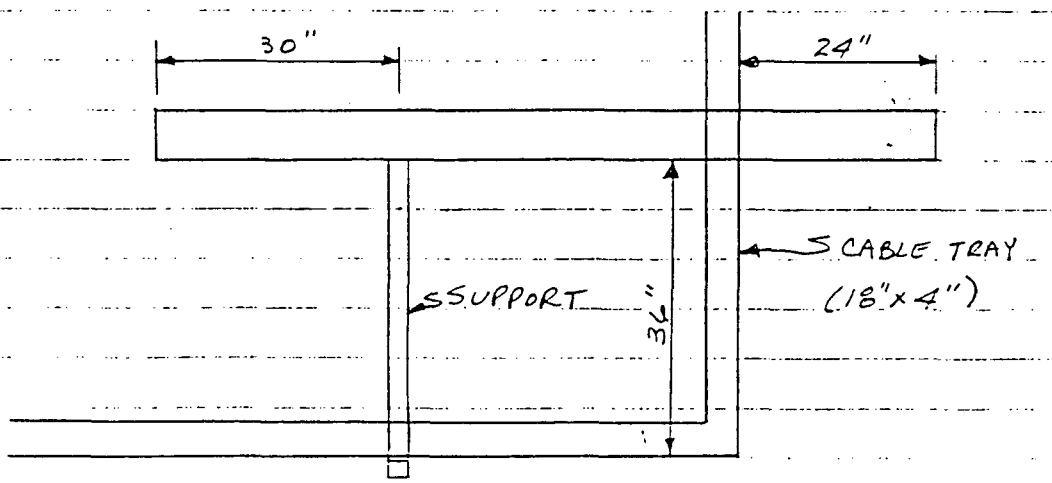
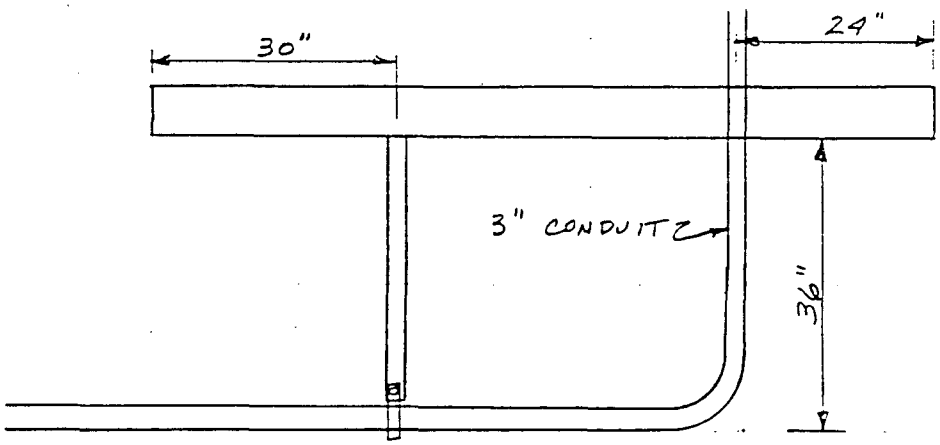


A-A

TYPICAL CABLE TRAY



B-B

TYPICAL CONDUIT

37

SUBJECT TEST DECK 1 PROJECT TVA-TSI

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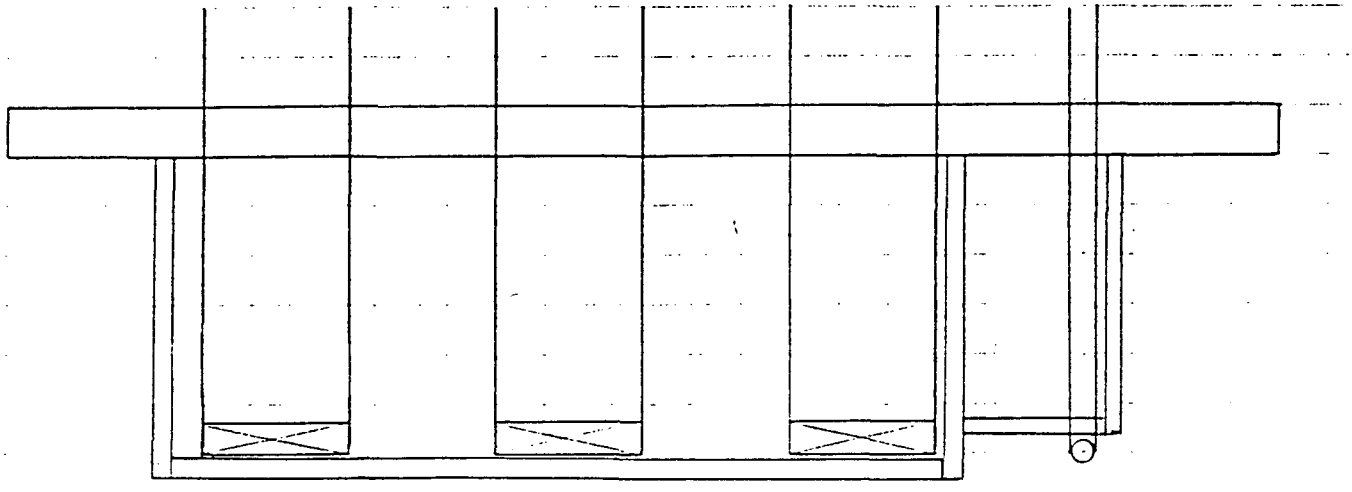

C - C
SUPPORT DETAIL

SUBJECT TEST DECK 2 PROJECT TVA-TSI 38

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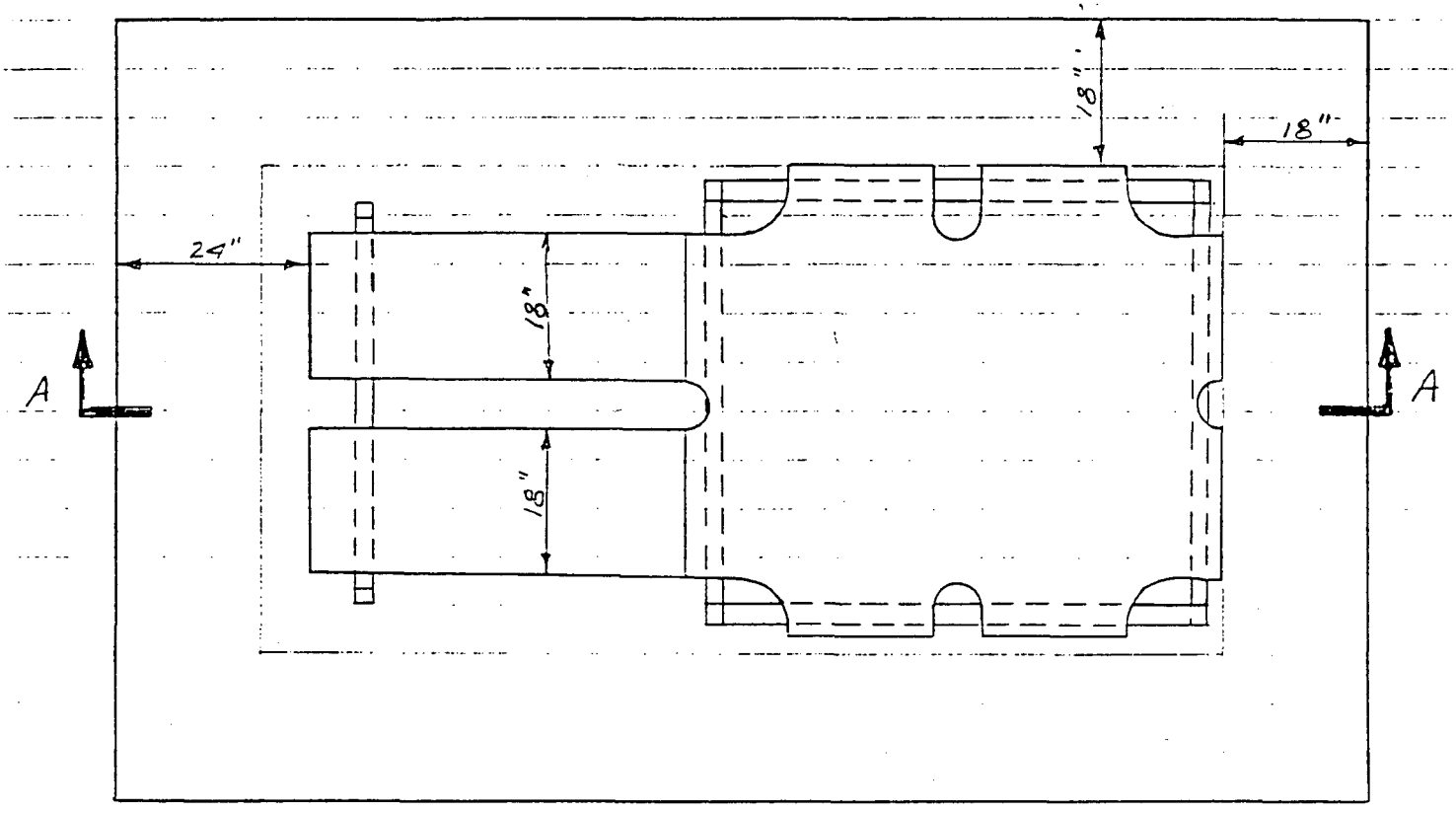

PLAN VIEW
SPECIAL TRAY

SUBJECT TEST DECK 2 PROJECT TVA-TSI

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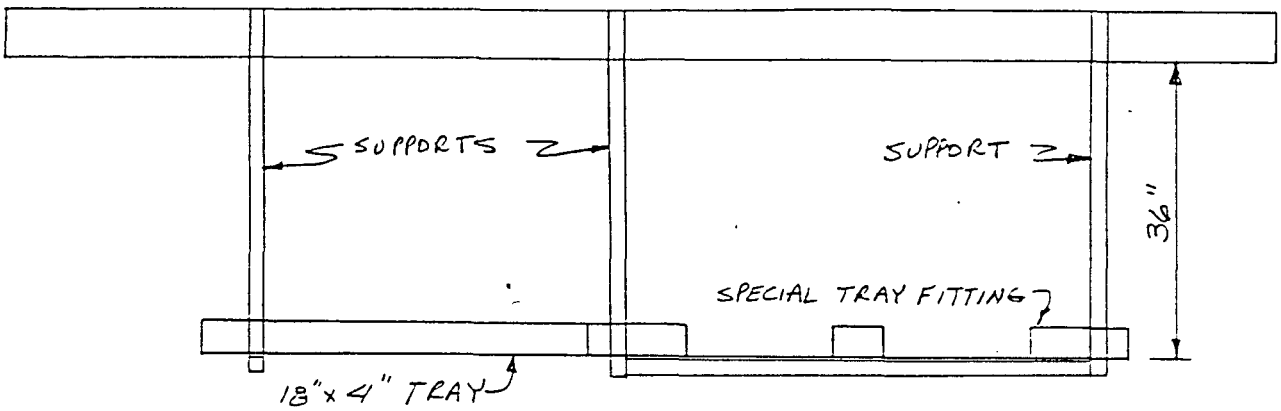

SECTION A-A
SPECIAL TRAY

SUBJECT TEST DECK 3 PROJECT TVA-TSI 40

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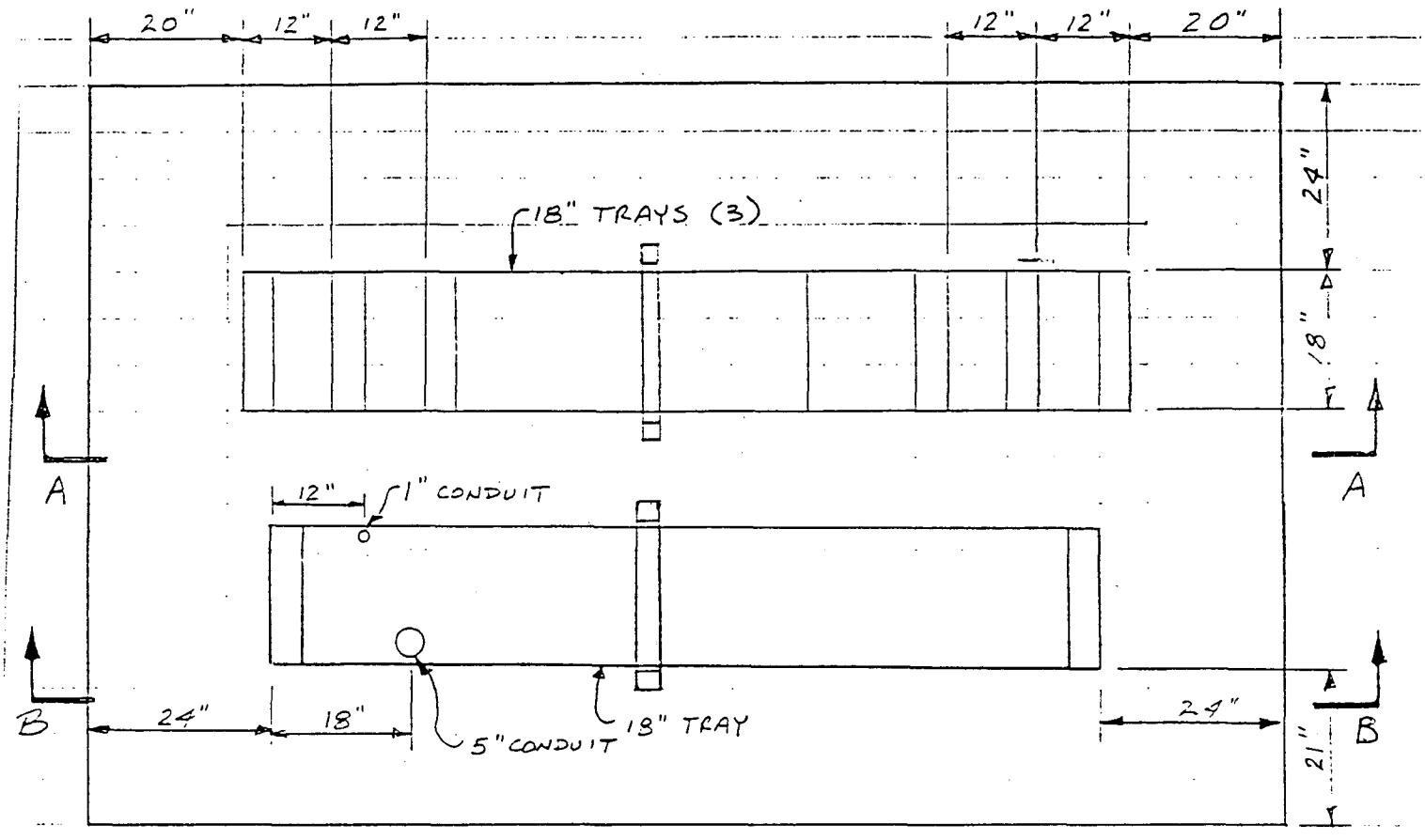
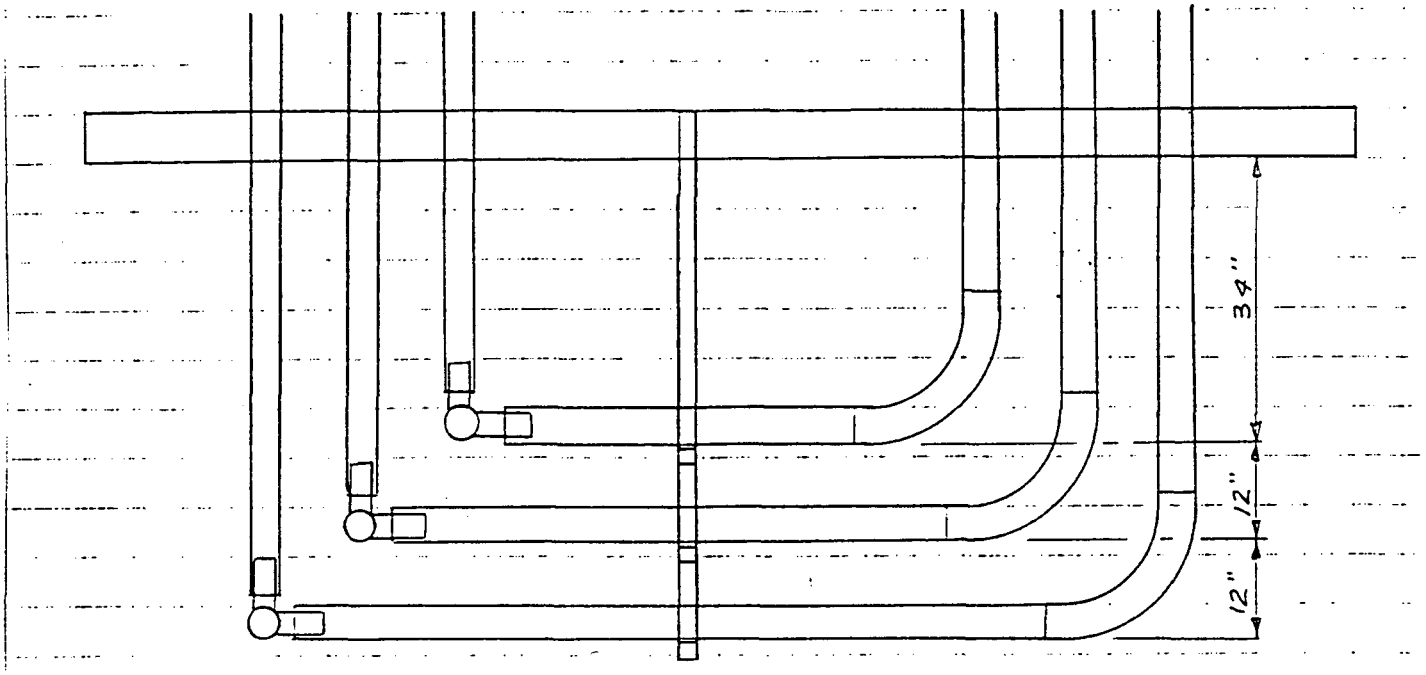


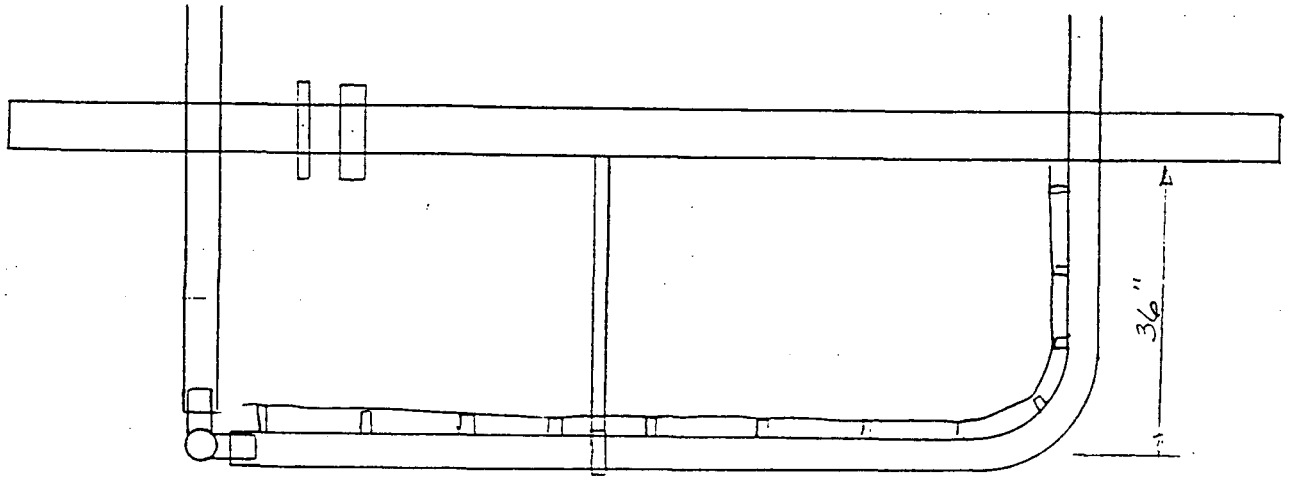
PLAN VIEW

SUBJECT TEST DECK 3 PROJECT 41

COMPUTED BY DATE CHECKED BY DATE



SECTION A-A



SECTION B-B

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

OMEGA POINT LABORATORIES

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]

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[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

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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

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[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

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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 tne 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 begins to degrade 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

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[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.)

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[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.L.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,

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[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.

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."

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	$\geq$ 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	$\leq$ 250 V dc $\leq$ 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.

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[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). Methods 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 barrier at the onset of the 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.

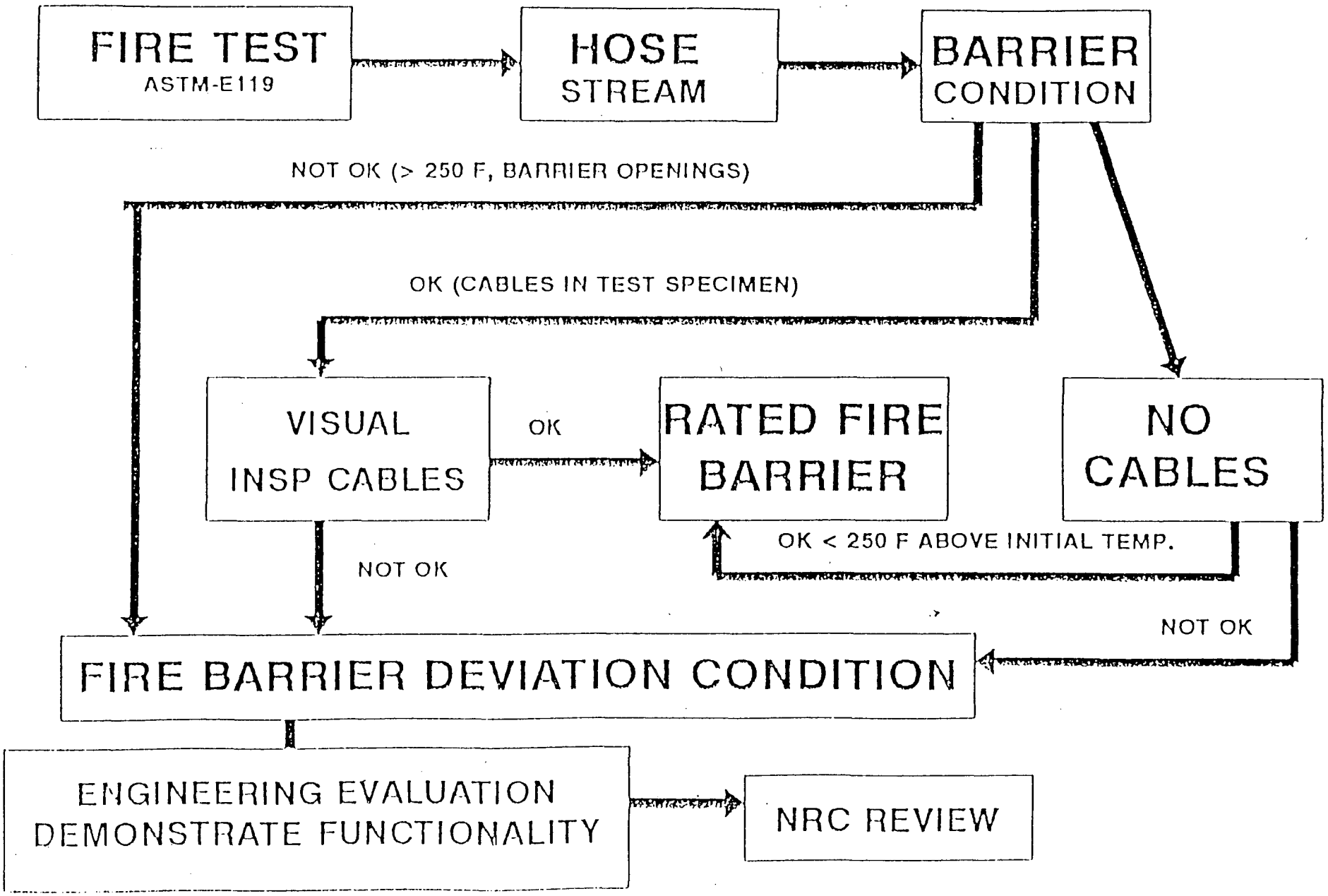
Note 4: This hose stream test method provides assurance that the cable tray or raceway fire barrier system has sufficient structural integrity to resist minor fire related barrier breaches caused by falling objects.

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.

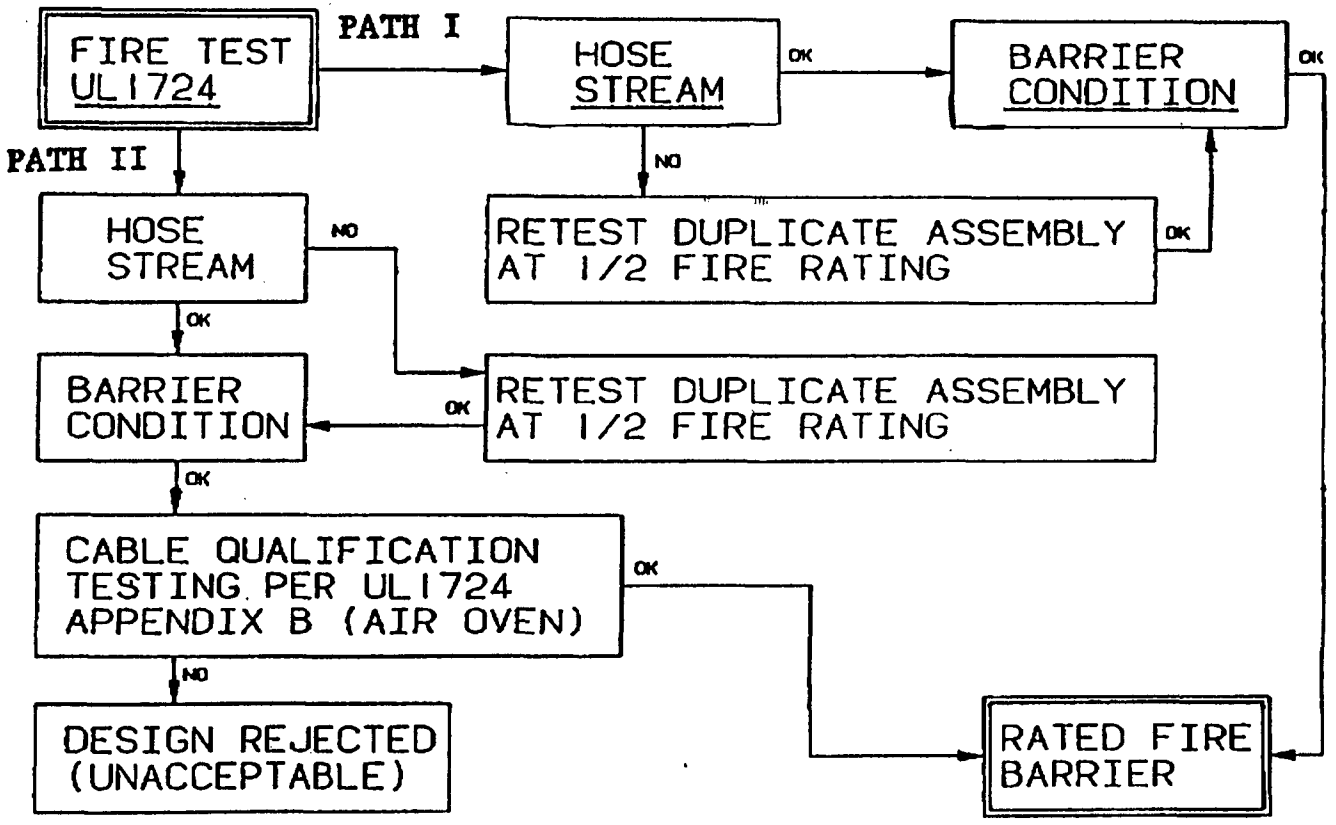
(4) Code of Federal Regulations, Title 10, Part 50, Energy, January 1, 1992.

(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

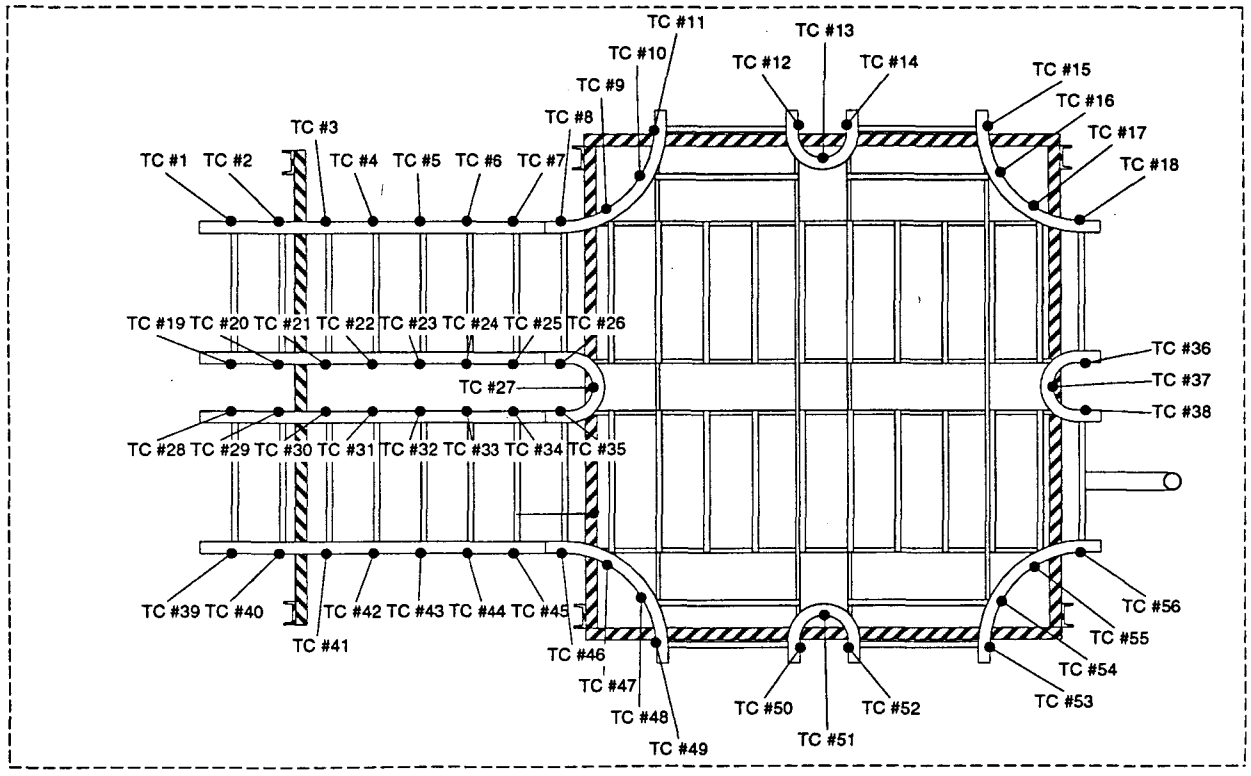


PATH I - RACEWAY $\Delta T_{avg.} \leq$ 250°F AND $\Delta T_{max.} \leq$ 325°F

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

Appendix C

THERMOCOUPLE LOCATIONS



REAR

LEFT

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 cable tray side rail.

OMEGA POINT LABORATORIES, INC. Project No. 11960-97186
TVA/ TSI
Fig. 6 Thermocouple Locations - Test Deck #2, Rev. 1
Drawn by: [illegible] Date: 7/6/94 Appr'd by: C Humphrey Date: 7/6/94

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97186

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 #: 97186

Test Deck #: 2

Item: Cable Tray Front Side Rail

Including Special Cross Fitting

TC Number	Description of exact physical location
E1	On vertical centerline of the tray side rail, 4" left of the free end.
E2	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E3	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E4	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E5	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E6	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E7	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E8	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E9	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E10	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E11	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple, 2" from the end of the cross opening.
E12	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the front of the furnace), 2" from the end of the cross opening, directly across from the previous thermocouple.
E13	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the front of the furnace), in the center of the section of fitting side rail between the two front cross openings.
E14	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the front of the furnace), 2" from the end of the cross opening, directly across from thermocouple E12.
E15	On vertical centerline of the fitting side rail, 2" from the end of the cross opening, directly across from the previous thermocouple.
E16	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E17	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E18	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple, 2" from the cross opening.

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. 97186

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 #: 97186

Test Deck #: 2

Item: Cable Tray Side Rails

Between The Two 18" Trays

TC Number	Description of exact physical location
E19	On vertical centerline of front tray rear rail, 4" left of the free end.
E20	On vertical centerline of front tray rear rail, 6" left of previous thermocouple.
E21	On vertical centerline of front tray rear rail, 6" left of previous thermocouple.
E22	On vertical centerline of front tray rear rail, 6" left of previous thermocouple.
E23	On vertical centerline of front tray rear rail, 6" left of previous thermocouple.
E24	On vertical centerline of front tray rear rail, 6" left of previous thermocouple.
E25	On vertical centerline of front tray rear rail, 6" left of previous thermocouple.
E26	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the right of the furnace), 6" from the previous thermocouple, directly across from E8.
E27	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the right of the furnace), in the center of the section of fitting side rail between the two right cross openings.
E28	On vertical centerline of rear tray front rail, 4" left of the free end.
E29	On vertical centerline of rear tray front rail, 6" left of previous thermocouple.
E30	On vertical centerline of rear tray front rail, 6" left of previous thermocouple.
E31	On vertical centerline of rear tray front rail, 6" left of previous thermocouple.
E32	On vertical centerline of rear tray front rail, 6" left of previous thermocouple.
E33	On vertical centerline of rear tray front rail, 6" left of previous thermocouple.
E34	On vertical centerline of rear tray front rail, 6" left of previous thermocouple.
E35	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the right of the furnace), 6" from the previous thermocouple, directly across from thermocouple E26.
E36	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the left of the furnace), 2" from the end of the cross opening, directly across from E18.
E37	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the left of the furnace), in the center of the section of fitting side rail between the two left cross openings.
E38	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the left of the furnace), 2" from the end of the cross opening, directly across from thermocouple E36.

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. 97186

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 #: 97186

Test Deck #: 2

Item: Cable Tray Rear Side Rail Including Special Cross Fitting

TC Number	Description of exact physical location
E39	On vertical centerline of the tray side rail, 4" left of the free end.
E40	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E41	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E42	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E43	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E44	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E45	On vertical centerline of the tray side rail, 6" left of the previous thermocouple.
E46	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E47	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E48	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E49	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple, 2" from the end of the cross opening.
E50	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the rear of the furnace), 2" from the end of the cross opening, directly across from the previous thermocouple.
E51	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the rear of the furnace), in the center of the section of fitting side rail between the two front cross openings.
E52	On vertical centerline of the fitting side rail (in the center, horse-shoe shaped section of fitting side rail toward the rear of the furnace), 2" from the end of the cross opening, directly across from thermocouple E50.
E53	On vertical centerline of the fitting side rail, 2" from the end of the cross opening, directly across from the previous thermocouple.
E54	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E55	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple.
E56	On vertical centerline of the fitting side rail, 6" left of the previous thermocouple, 2" from the cross opening.

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. 97186

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 #: 97186

Test Deck #: 2

Item: Bare #8 AWG Copper Wire in Front Tray Section (left to right across fitting)

TC Number	Description of exact physical location
C57	On bare #8 wire on tray rungs, 4" left of the free end of tray.
C58	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C59	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C60	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C61	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C62	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C63	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C64	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C65	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C66	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C67	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C68	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C69	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C70	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C71	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C72	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C73	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C74	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C75	On bare #8 wire on tray rungs, 6" left of the 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

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97186

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 #: 97186

Test Deck #: 2

Item: Bare #8 AWG Copper Wire in Rear Tray Section (left to right across fitting)

TC Number	Description of exact physical location
C76	On bare #8 wire on tray rungs, 4" left of the free end of tray.
C77	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C78	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C79	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C80	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C81	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C82	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C83	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C84	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C85	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C86	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C87	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C88	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C89	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C90	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C91	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C92	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C93	On bare #8 wire on tray rungs, 6" left of the previous thermocouple.
C94	On bare #8 wire on tray rungs, 6" left of the 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

THERMOCOUPLE PLACEMENT LOG - PROJECT NO. 97186

NOTE:
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Project #: 97186

Test Deck #: 2

Item: Bare #8 AWG Copper Wire in Special Fitting (front to rear across fitting)

TC Number	Description of exact physical location
	FRONT TO REAR ACROSS RIGHT SIDE OF FITTING
C95	On bare #8 wire on tray rungs, 2" from the front cross opening.
C96	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C97	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C98	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C99	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C100	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C101	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C102	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C103	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C104	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C105	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C106	On bare #8 wire on tray rungs, 6" from previous thermocouple, 2" from the rear cross opening
	FRONT TO REAR ACROSS LEFT SIDE OF FITTING
C107	On bare #8 wire on tray rungs, 2" from the front cross opening.
C108	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C109	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C110	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C111	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C112	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C113	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C114	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C115	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C116	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C117	On bare #8 wire on tray rungs, 6" from previous thermocouple.
C118	On bare #8 wire on tray rungs, 6" from previous thermocouple, 2" from the rear cross opening

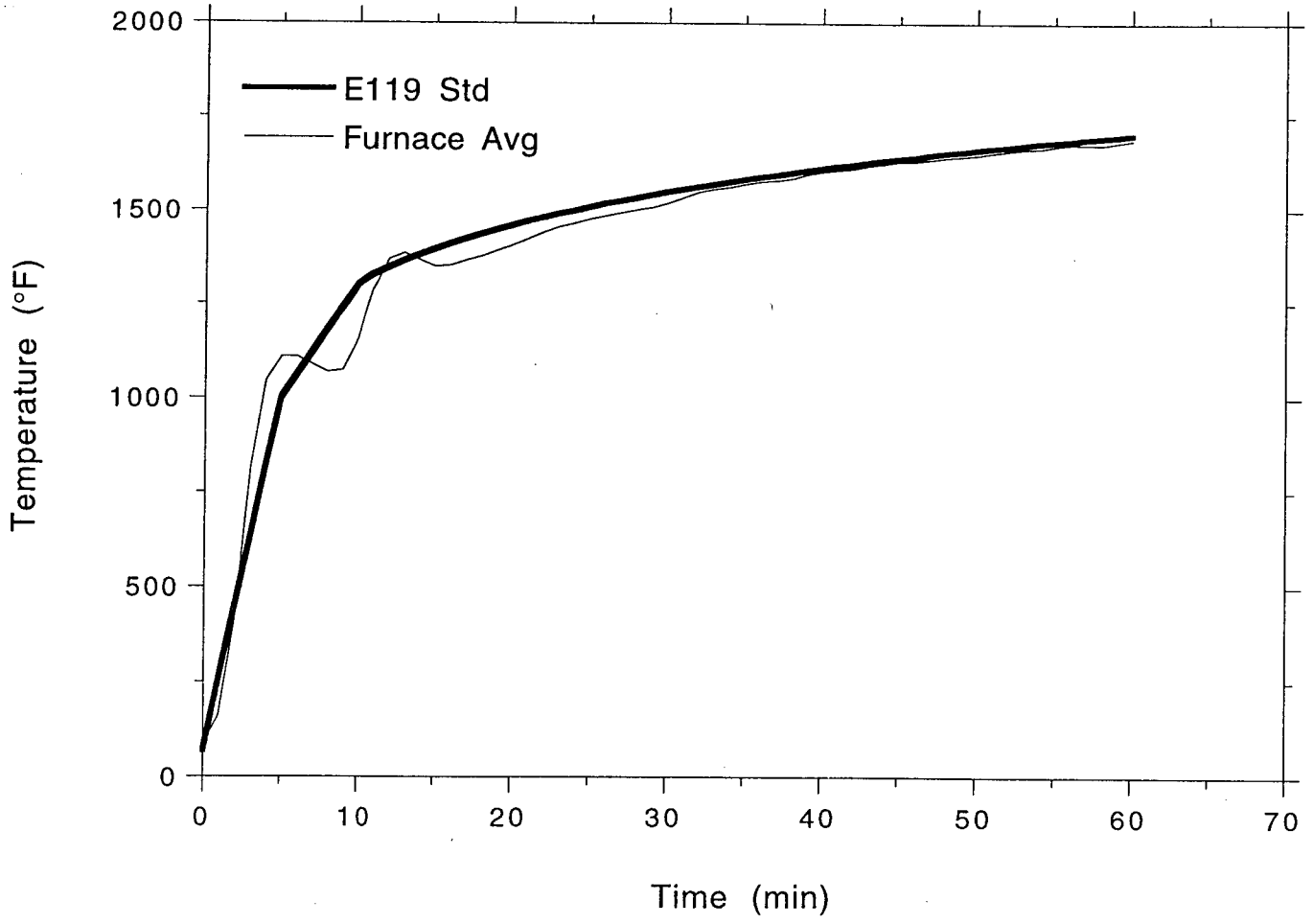
NOTE: TCs shall be numbered sequentially from 1 upwards for each deck assembly. Prefixes shall be added as follows: C (copper wire), and E (engineering TC), for instance c1, E35, etc.

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

Appendix D

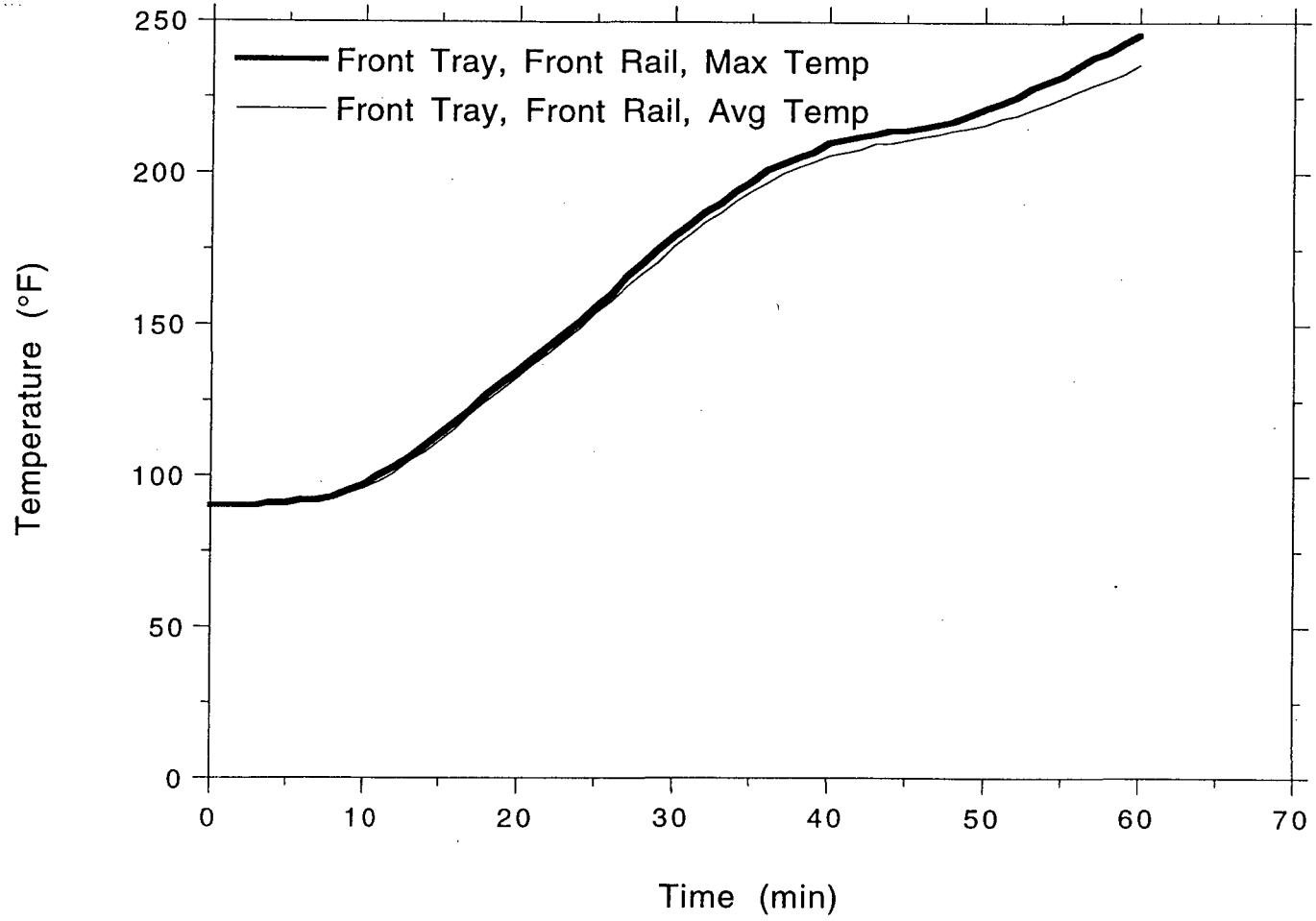
TEST DATA

TSI/TVA
Project No. 11960-97186
Furnace Temperature



OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



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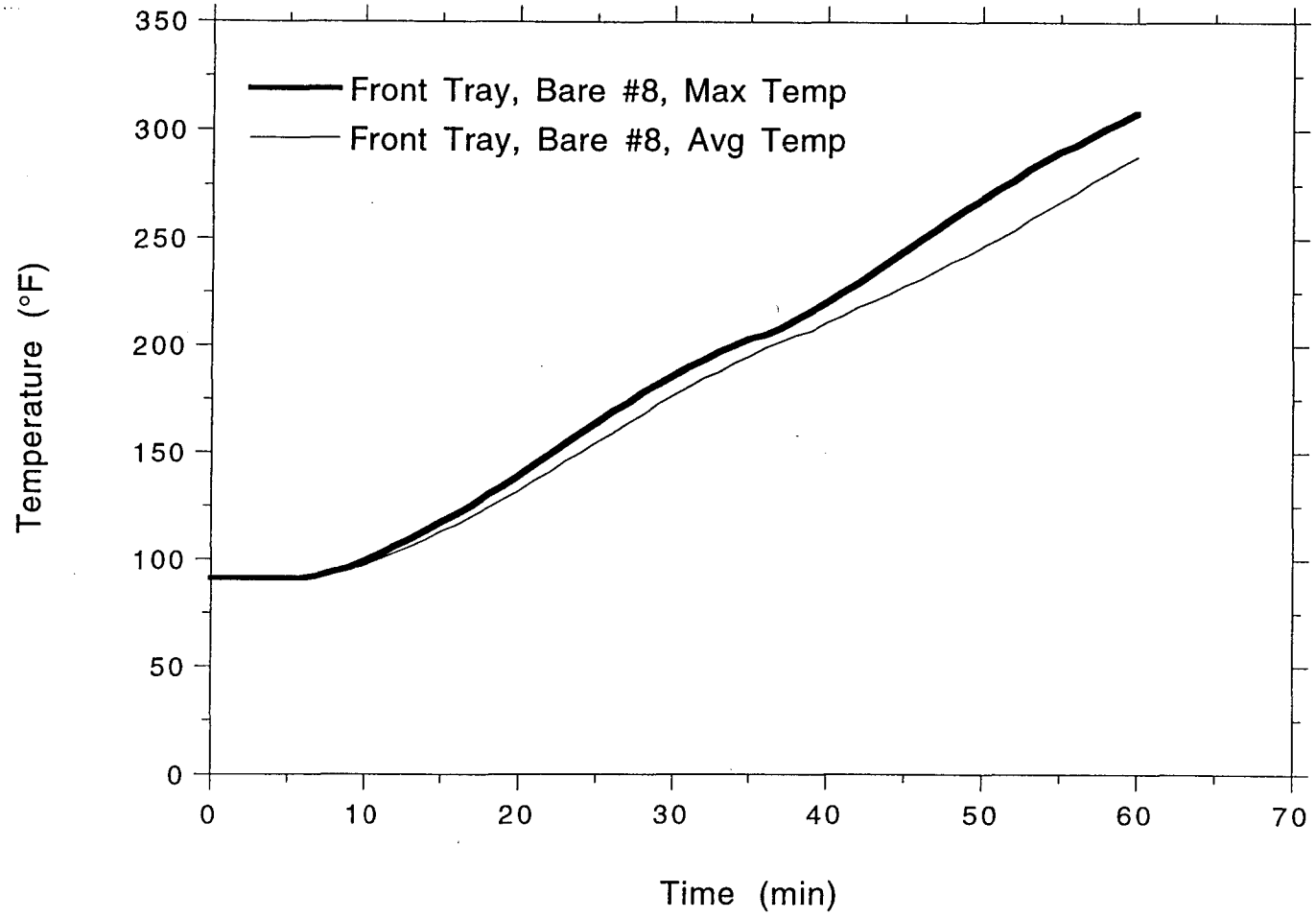
Project No. 11960-97186
Average/ Maximum Temperatures



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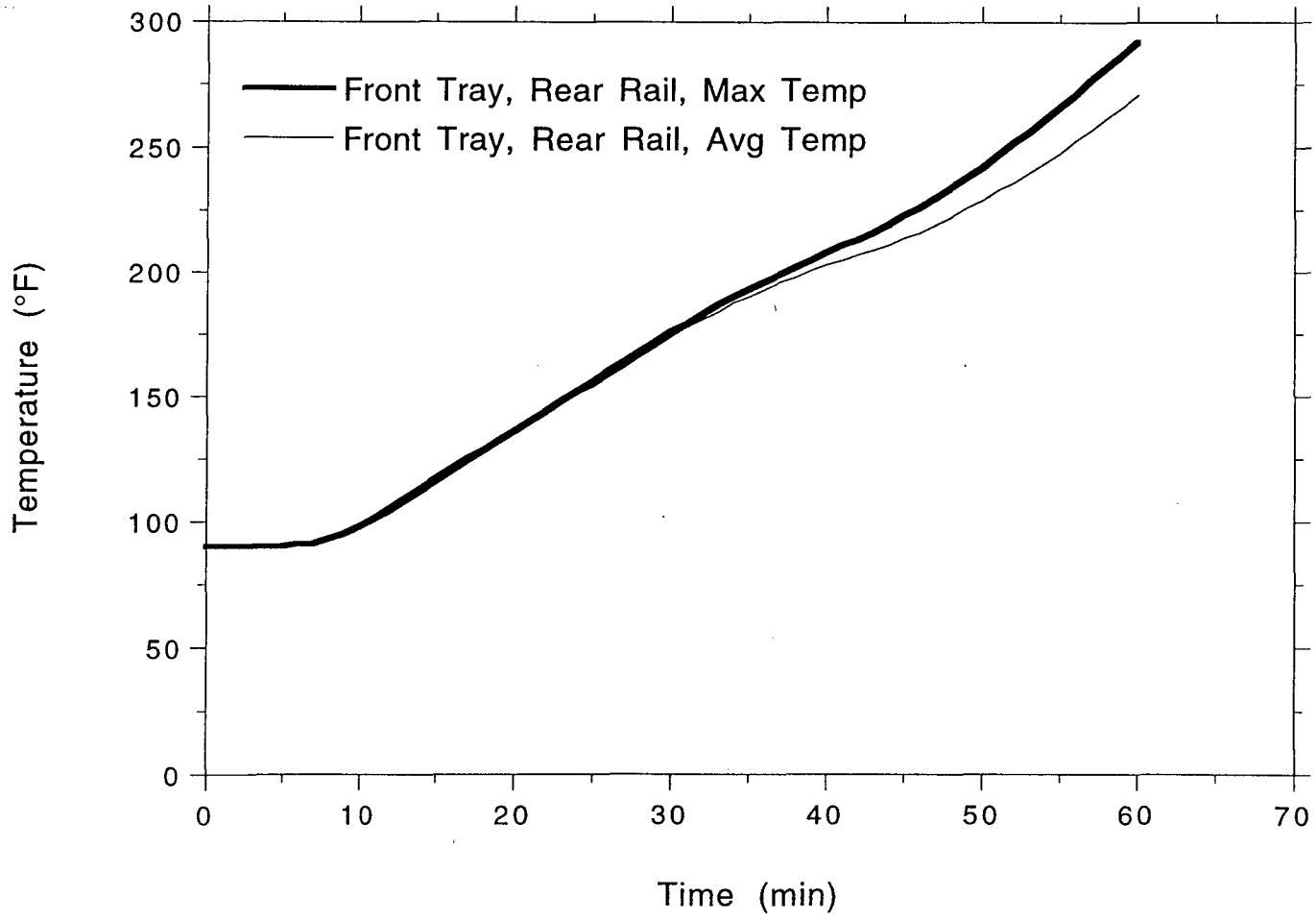
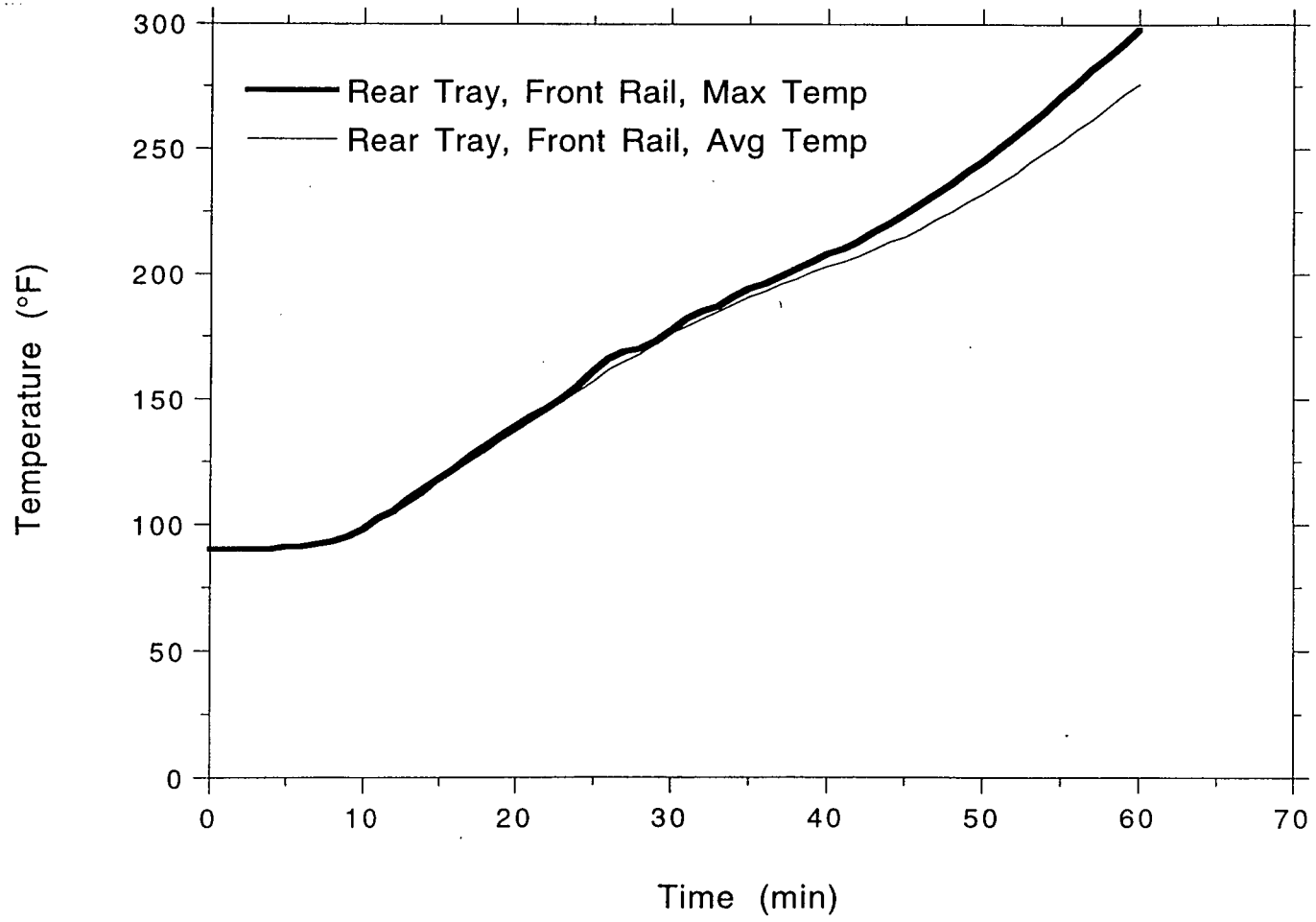
TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



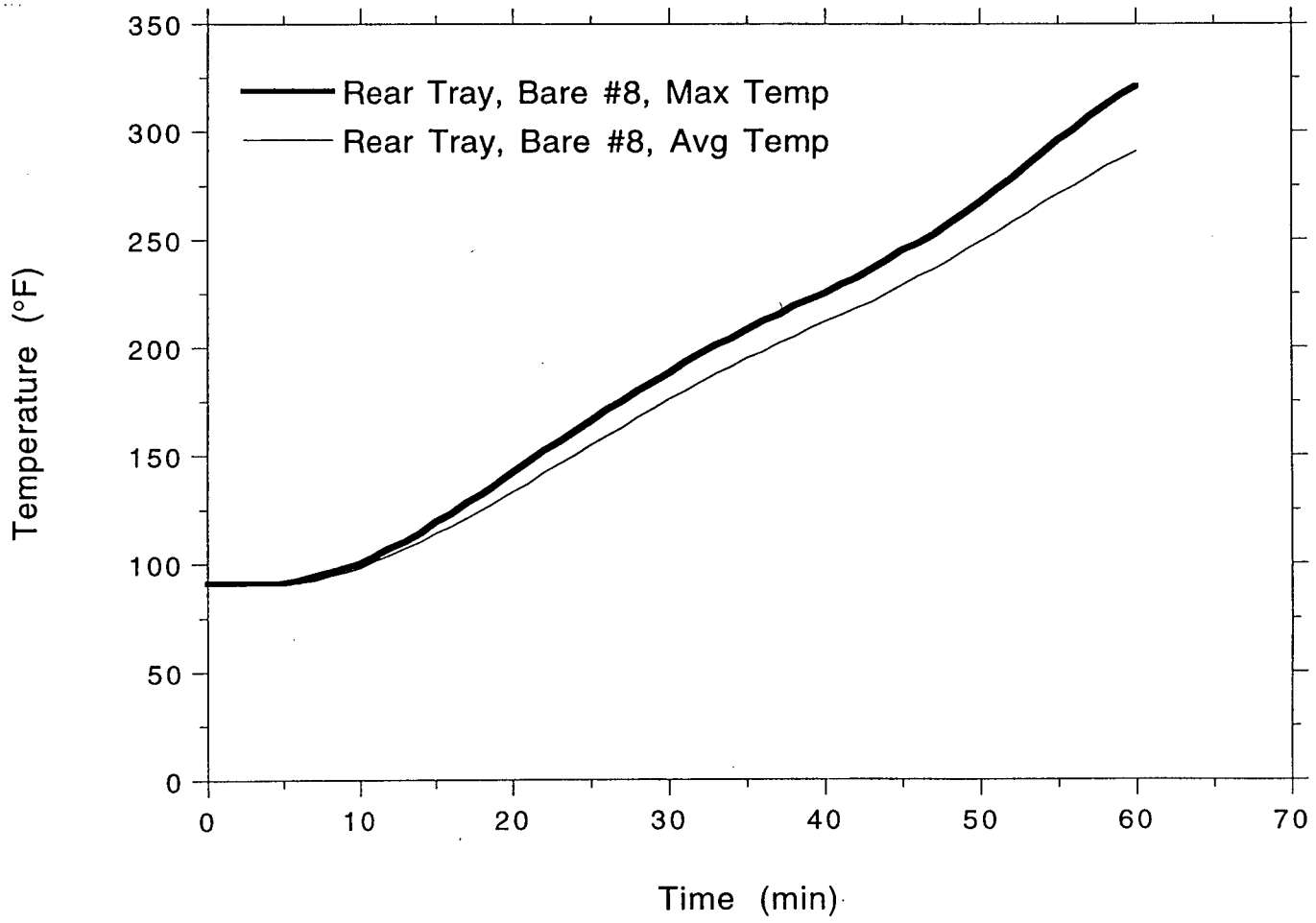
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



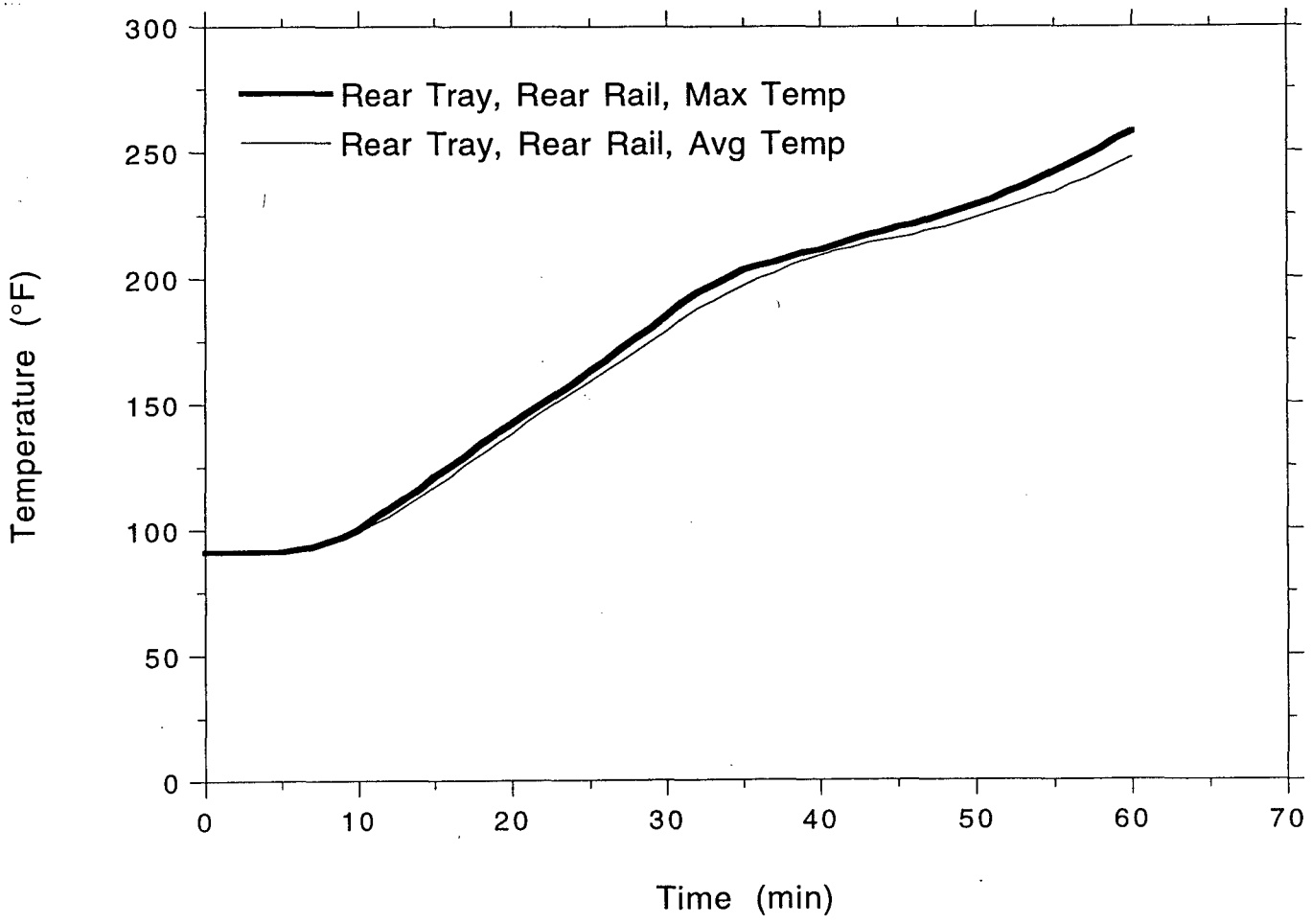
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



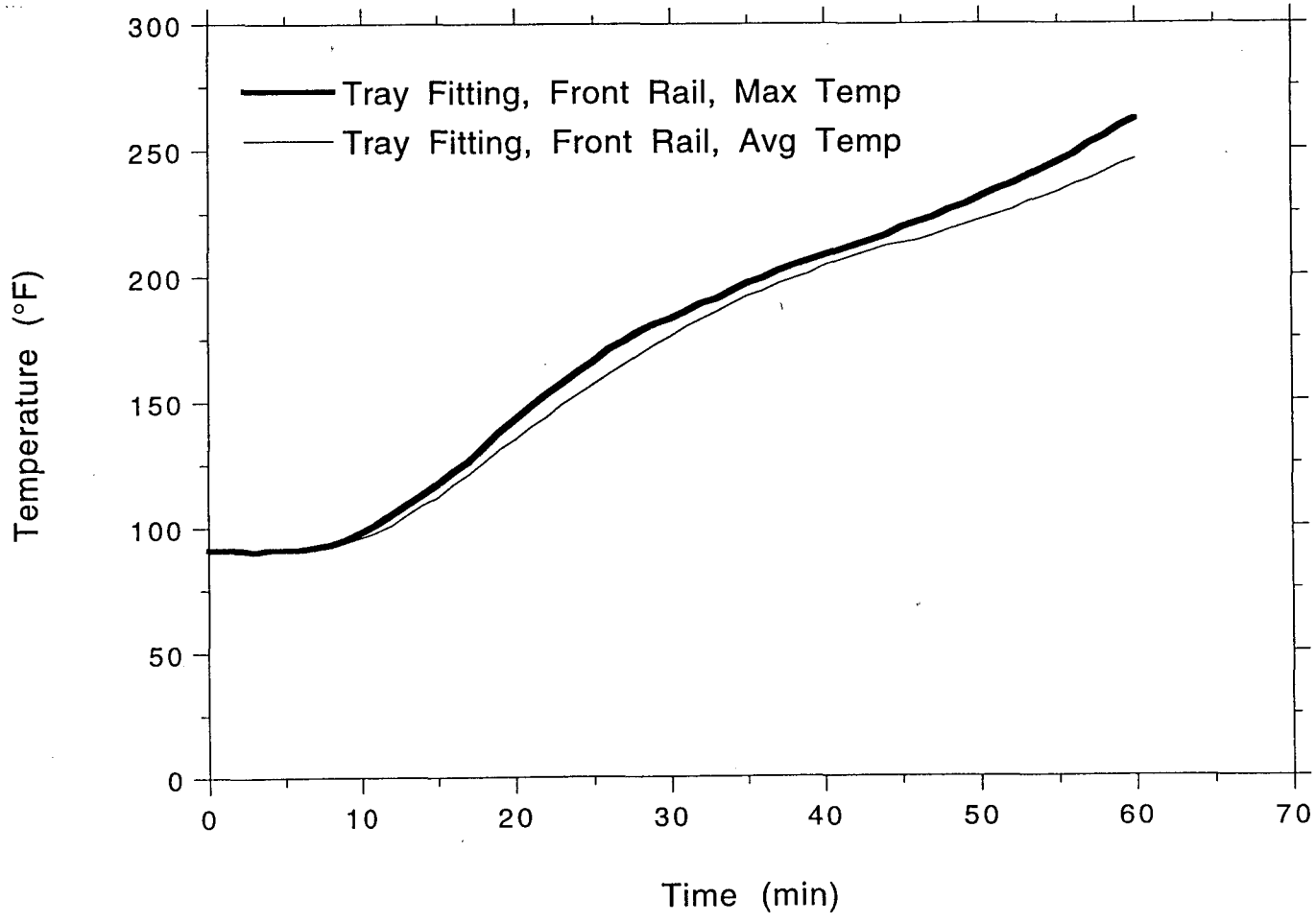
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



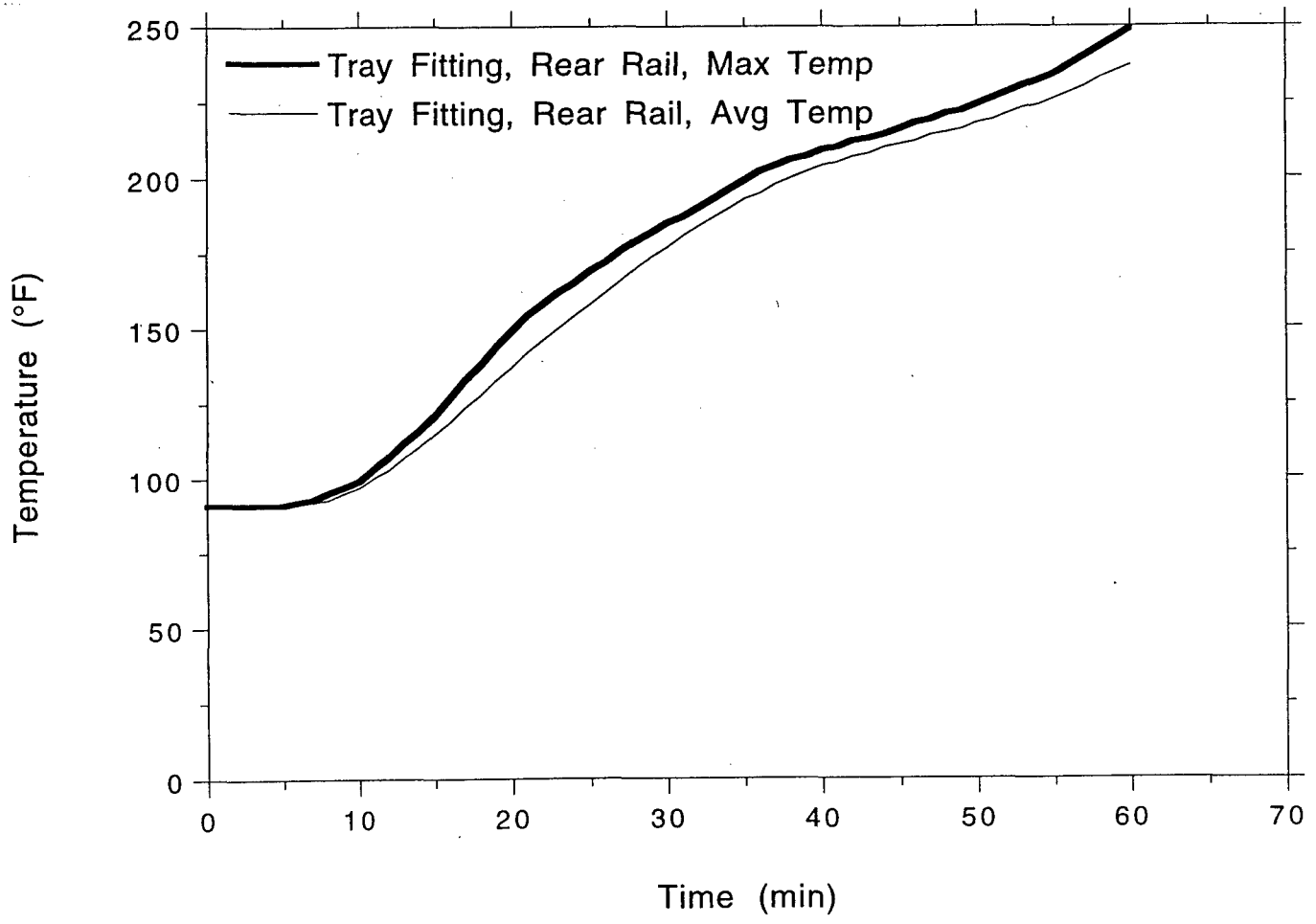
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



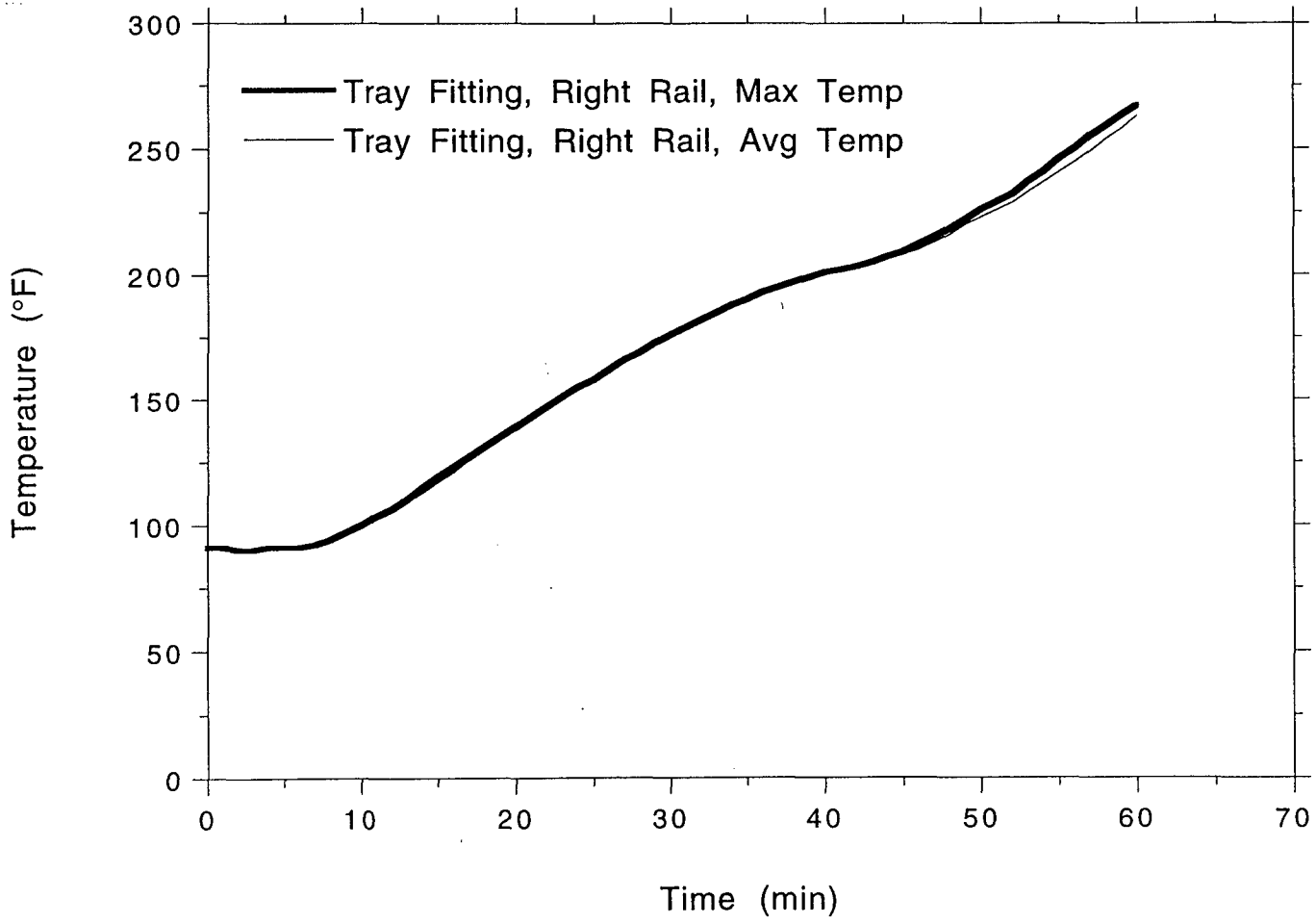
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



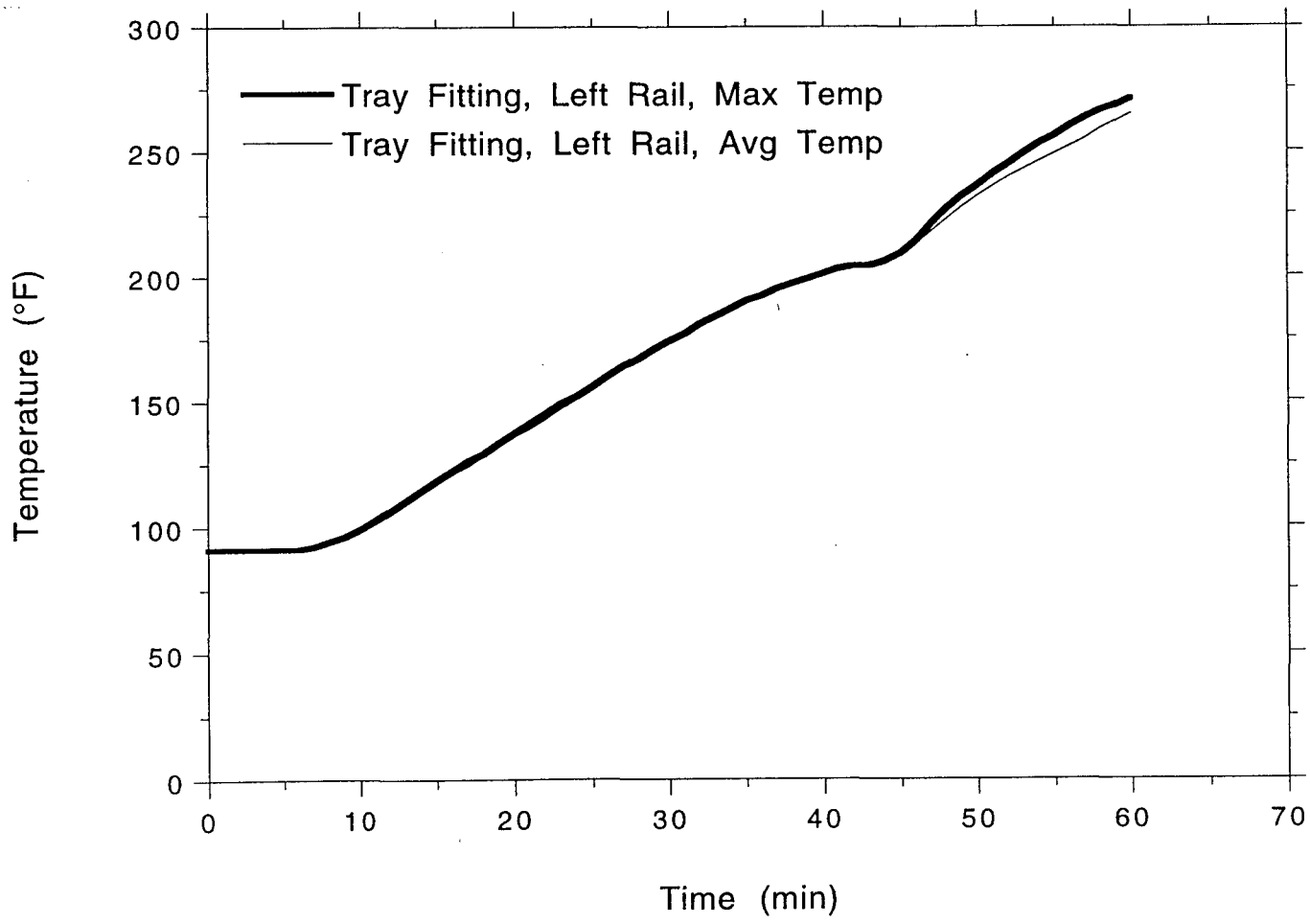
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



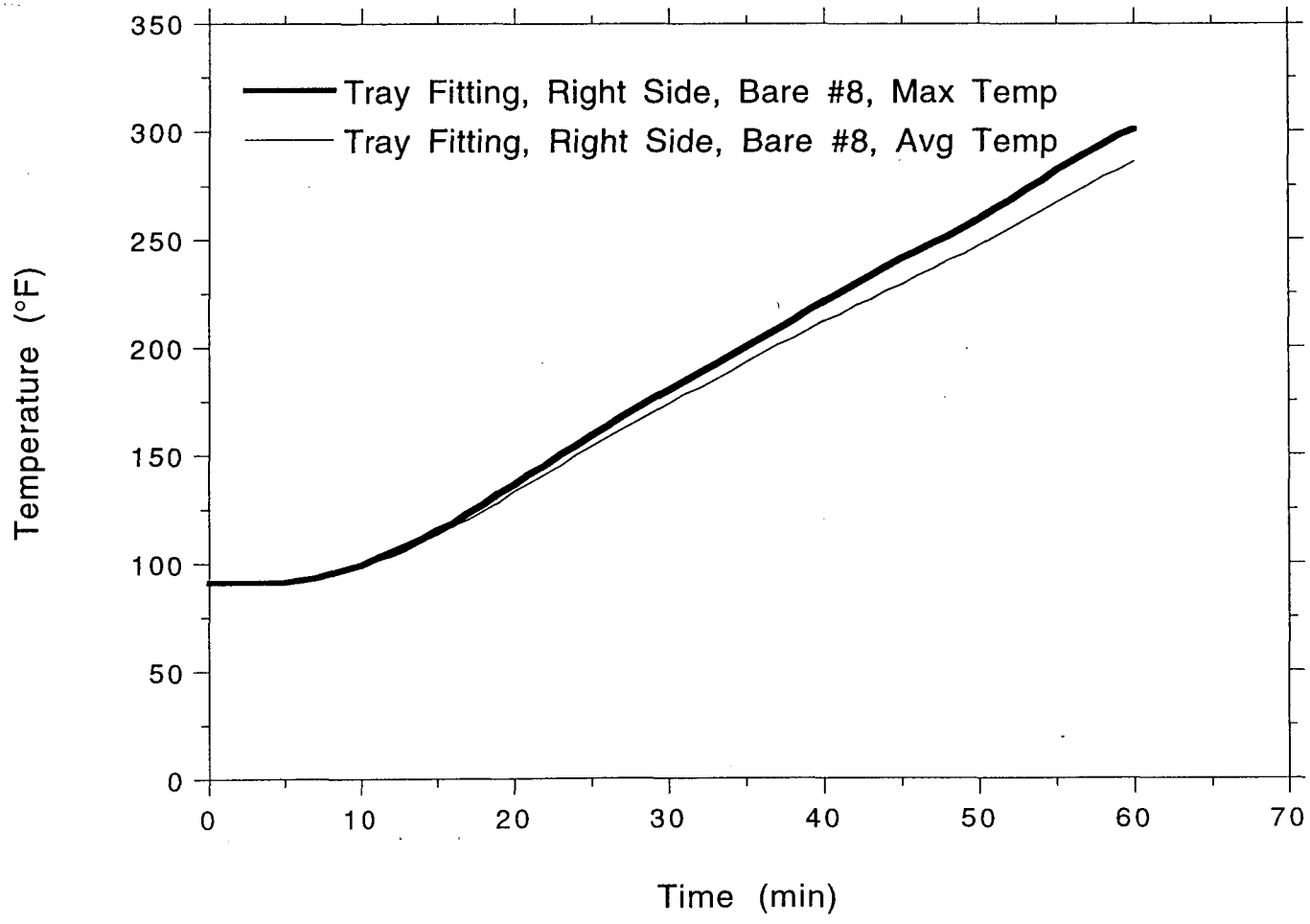
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



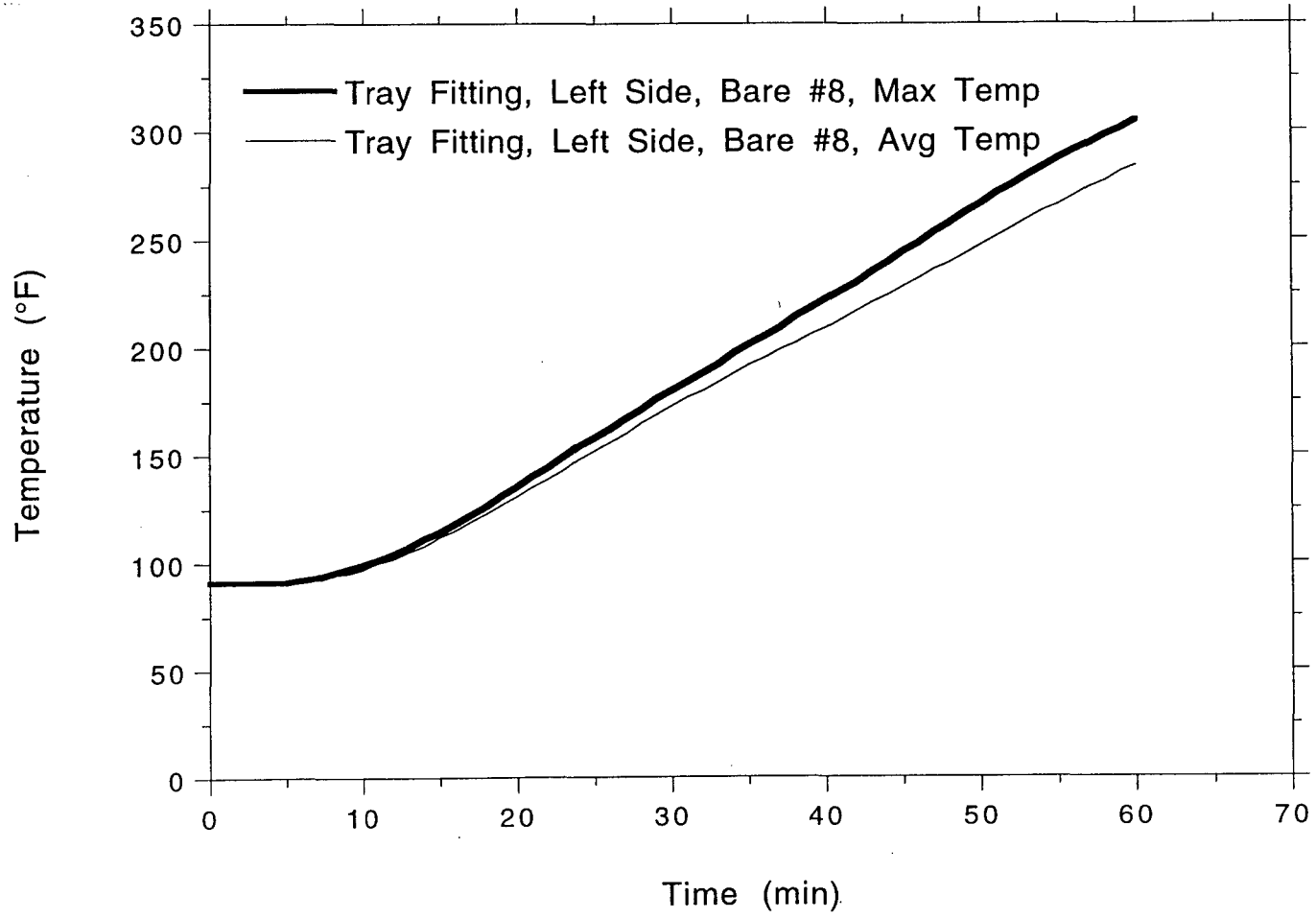
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



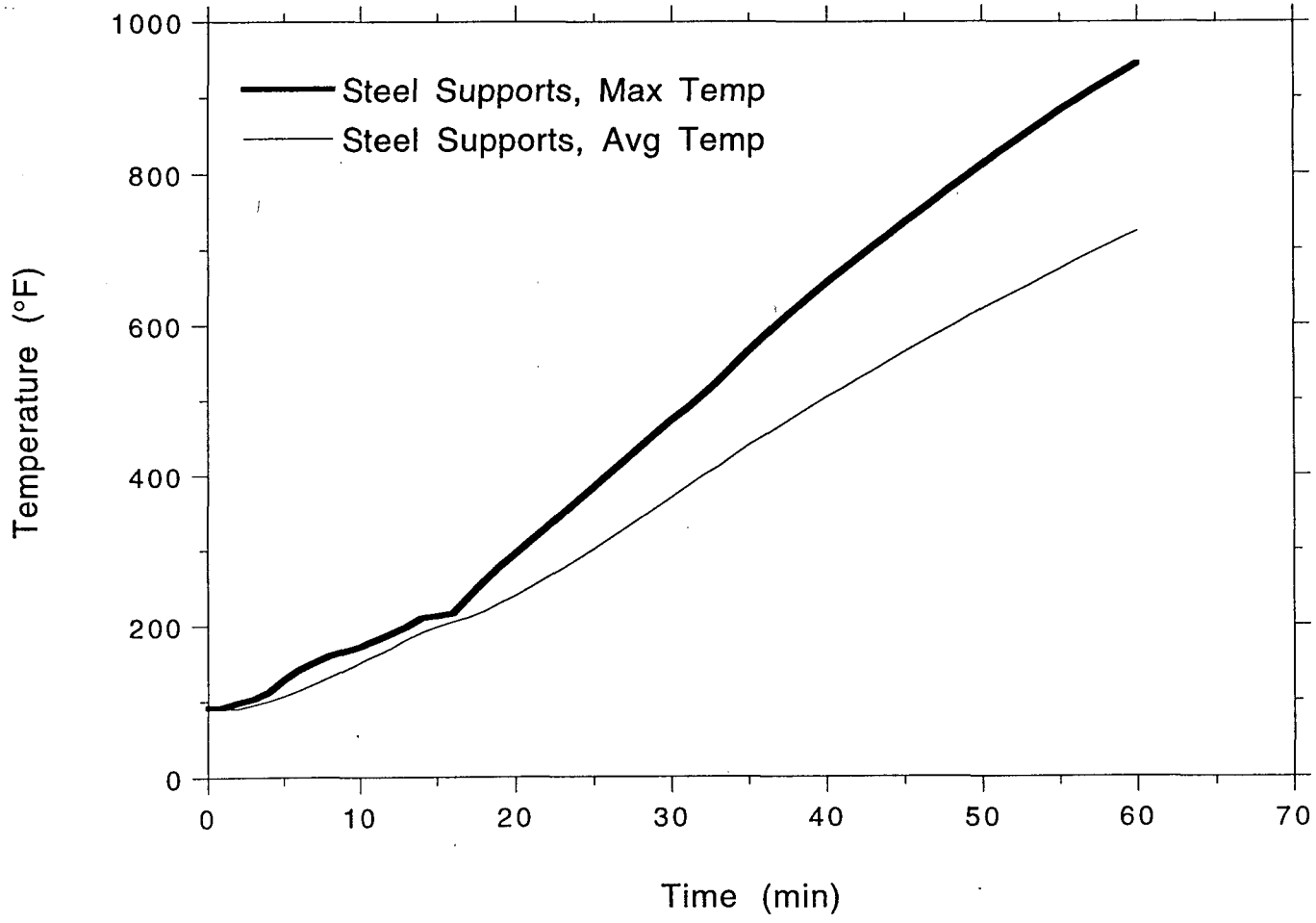
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



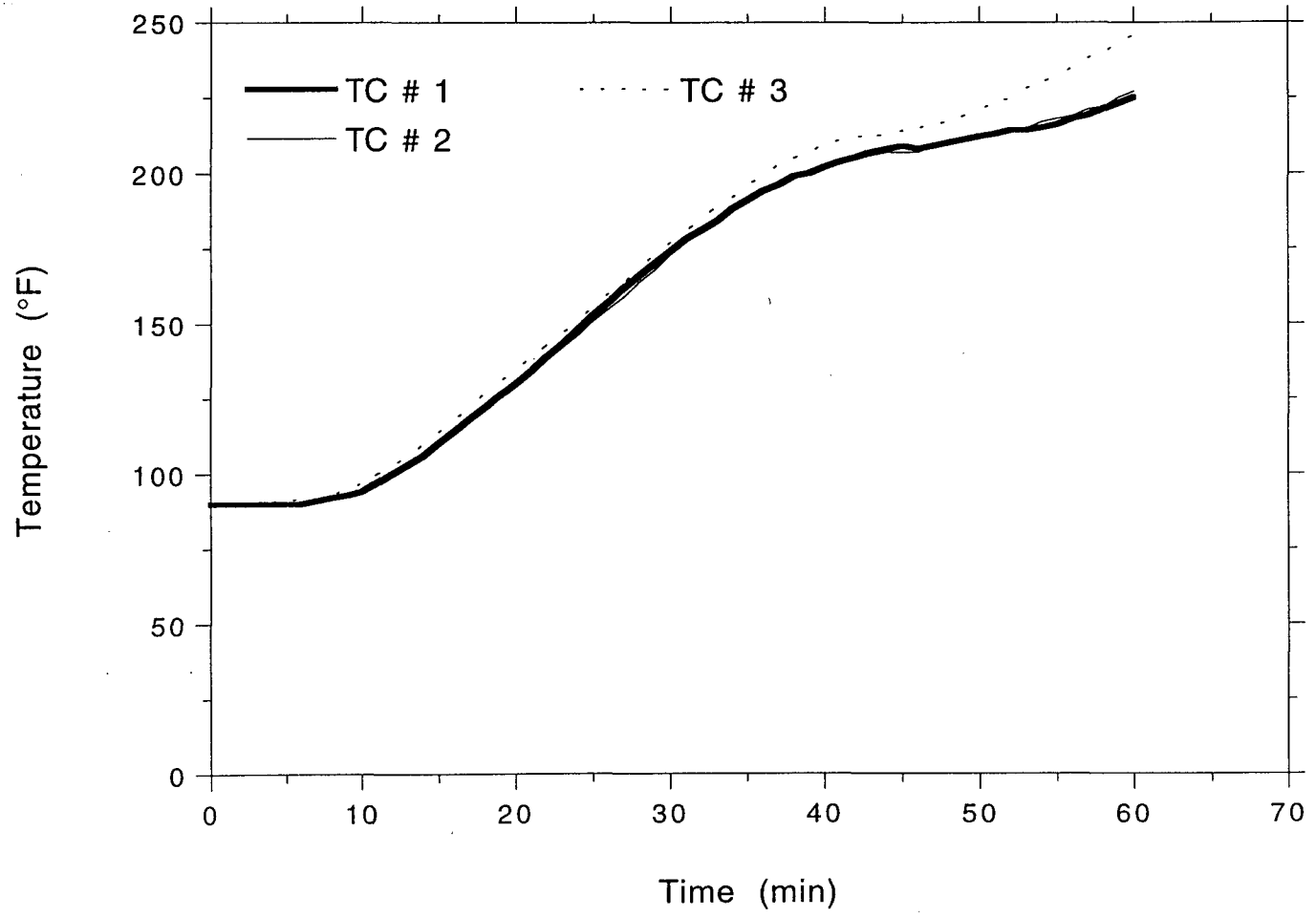
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Average/ Maximum Temperatures



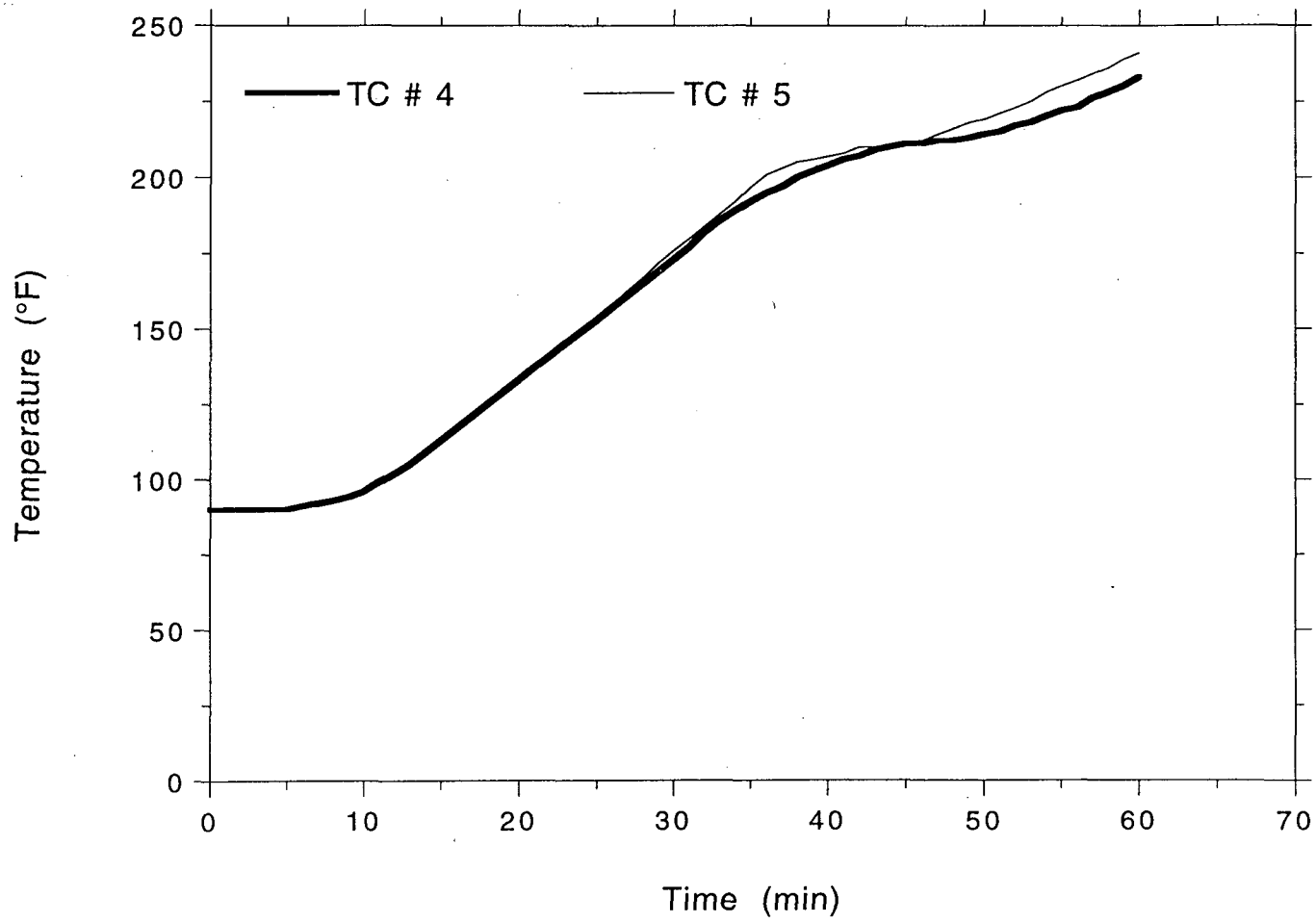
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, Front Rail



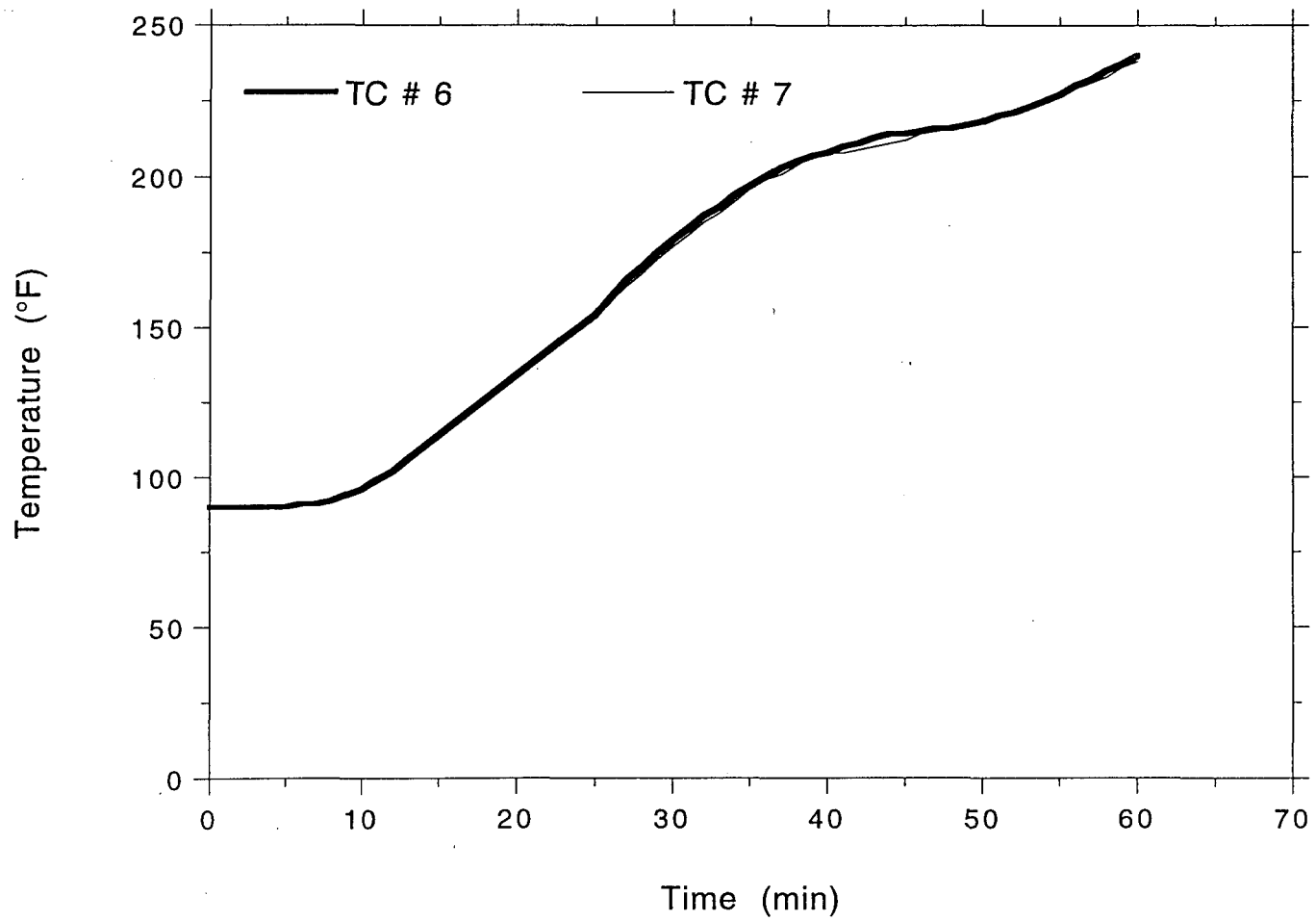
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, Front Rail



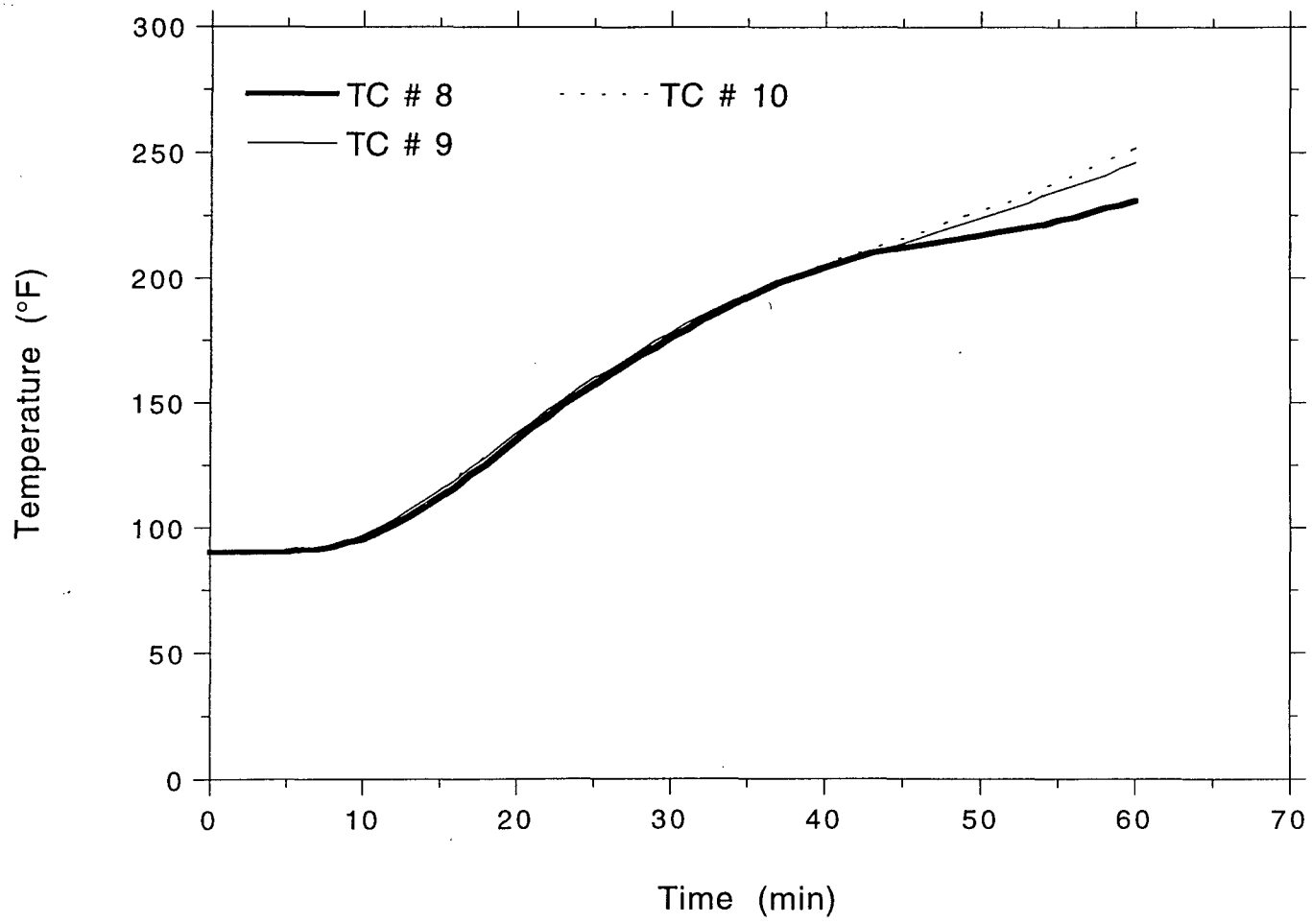
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, Front Rail



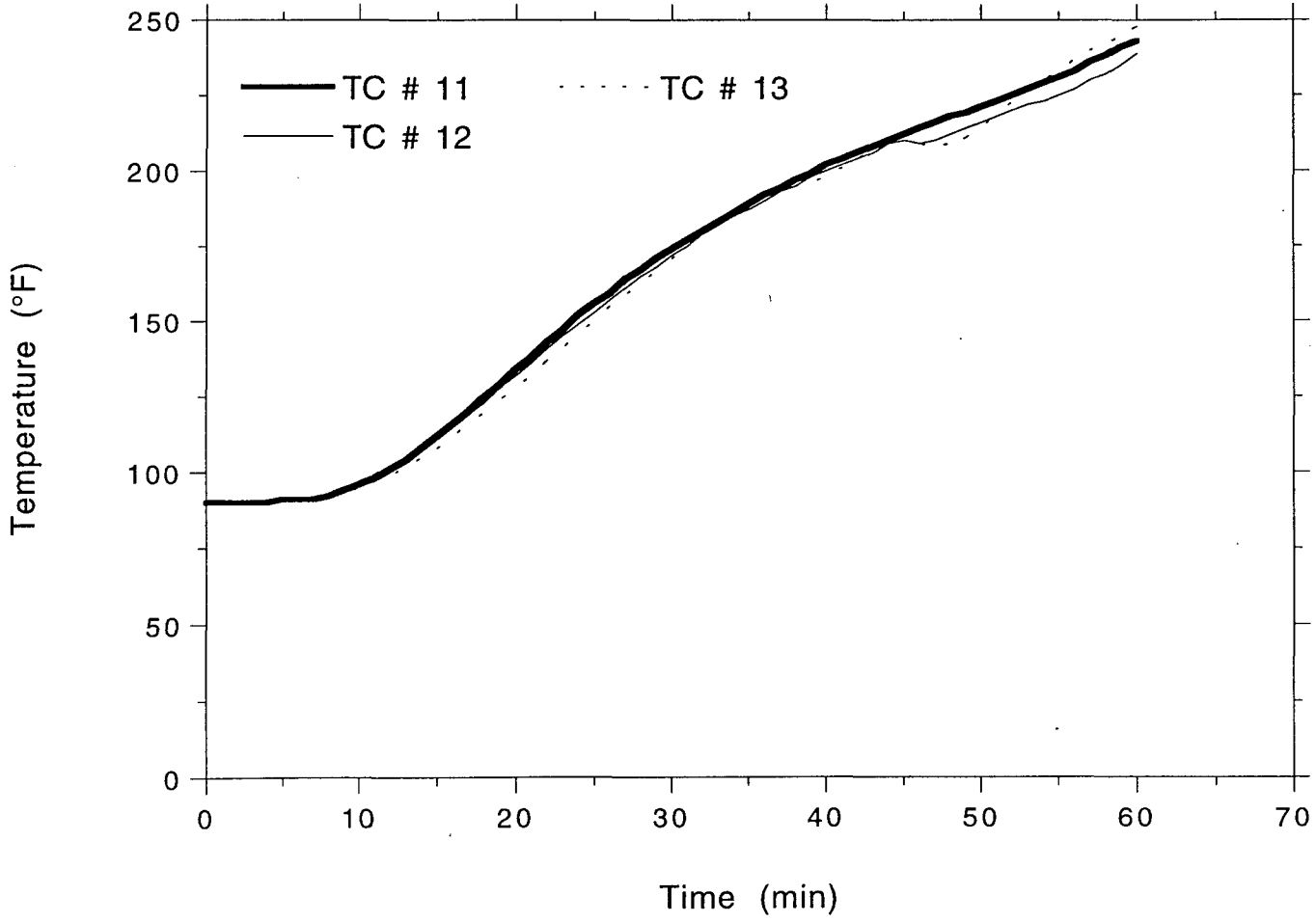
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Front Rail



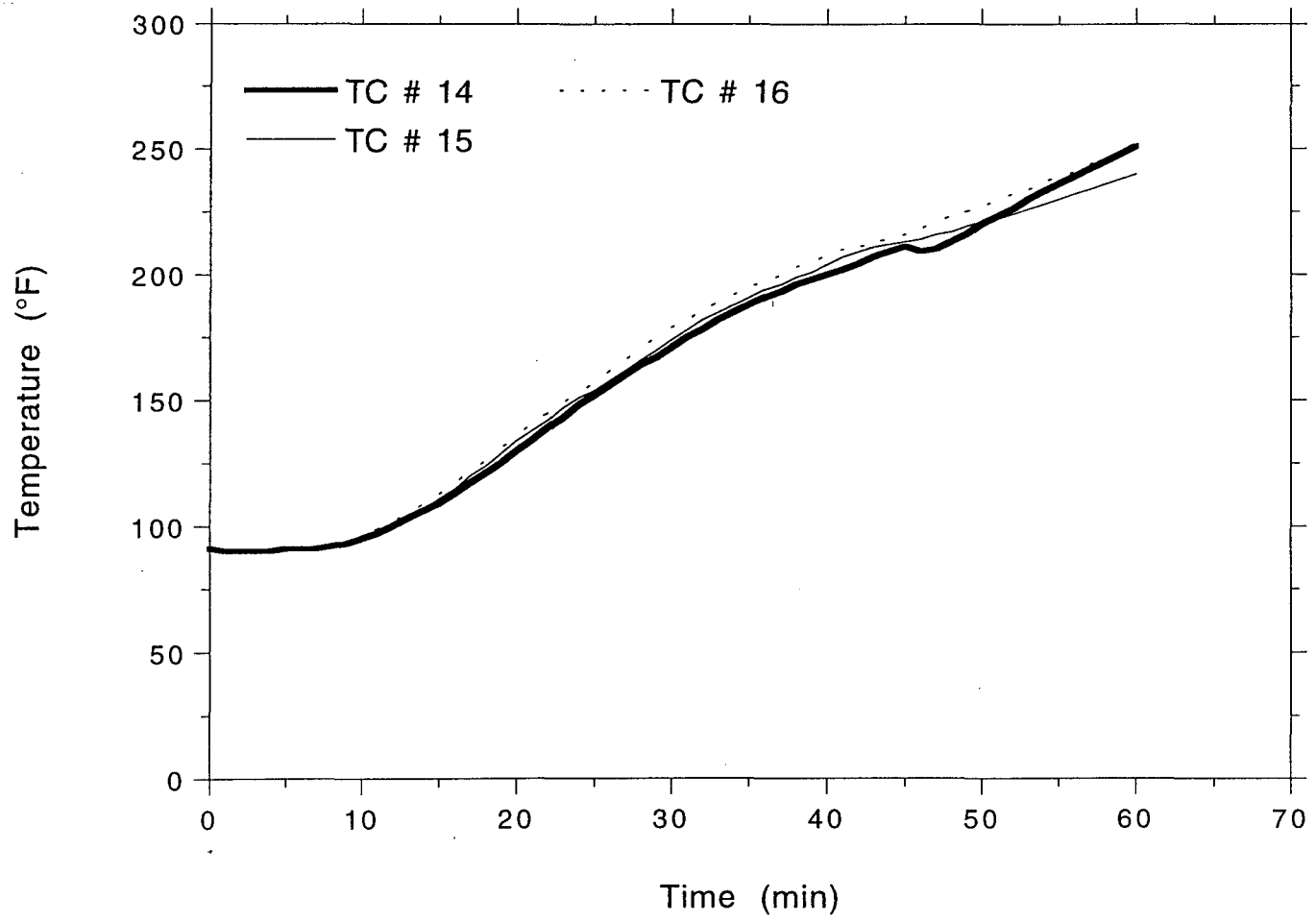
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Front Rail



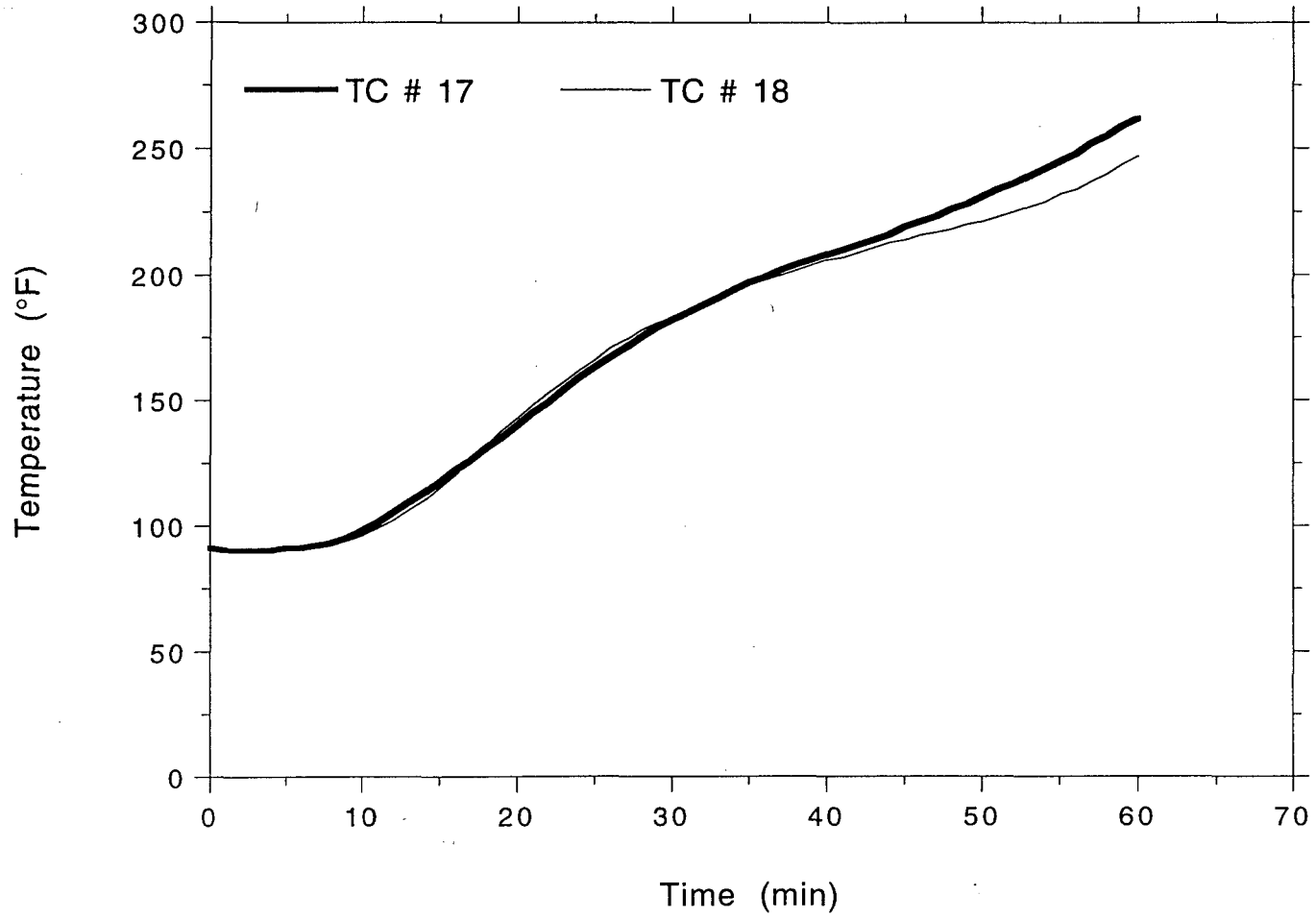
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Front Rail



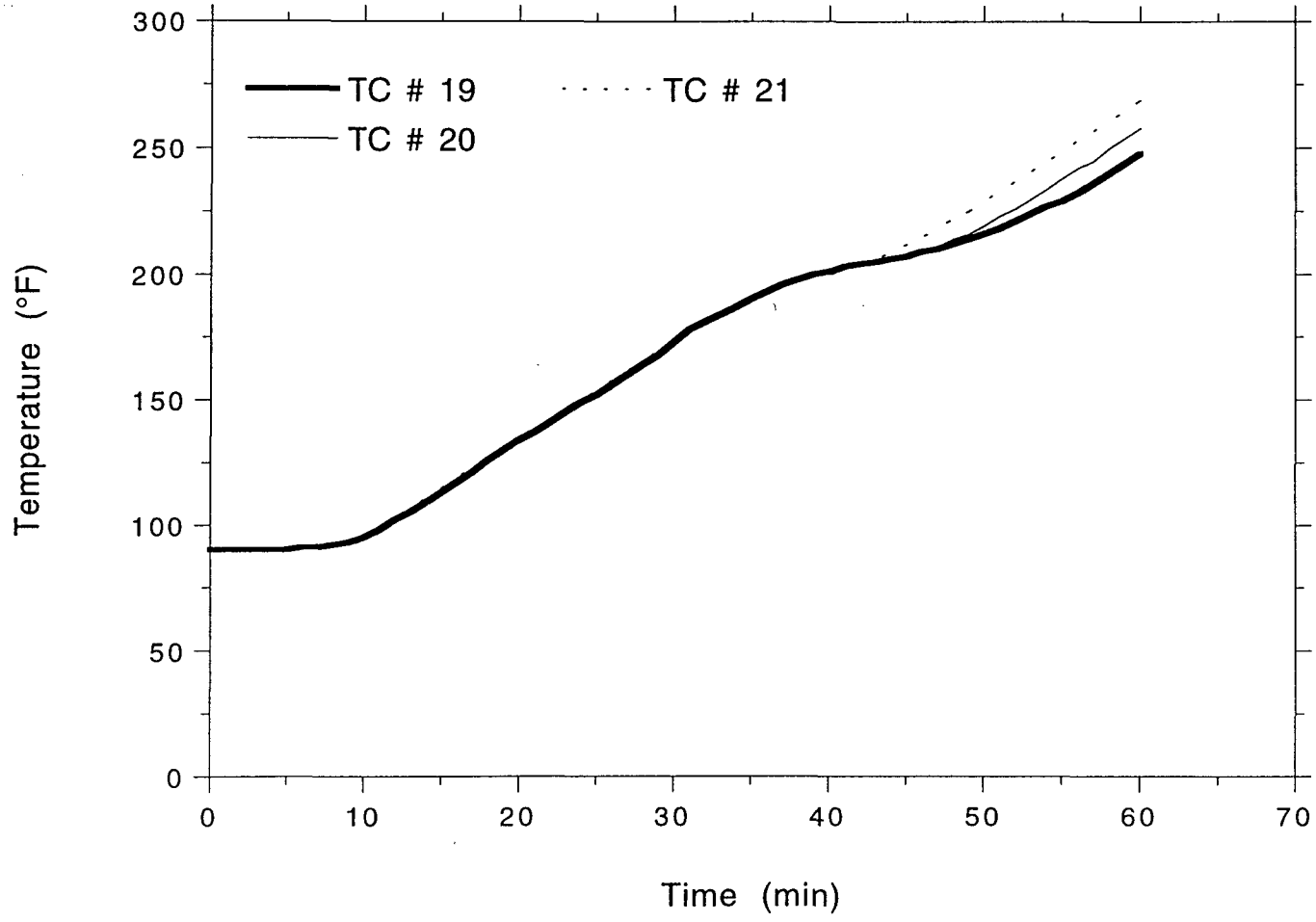
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Front Rail



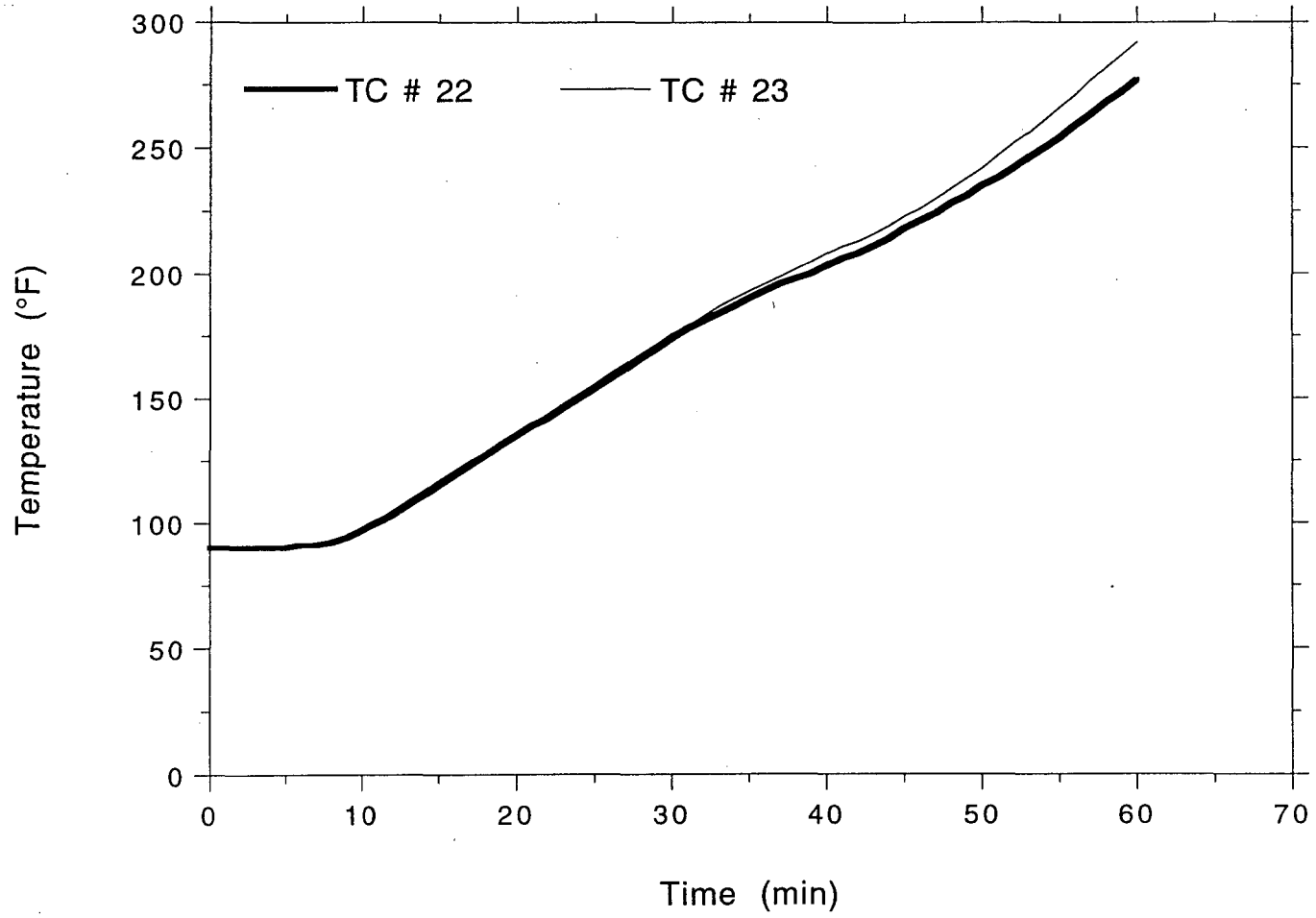
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, Rear Rail



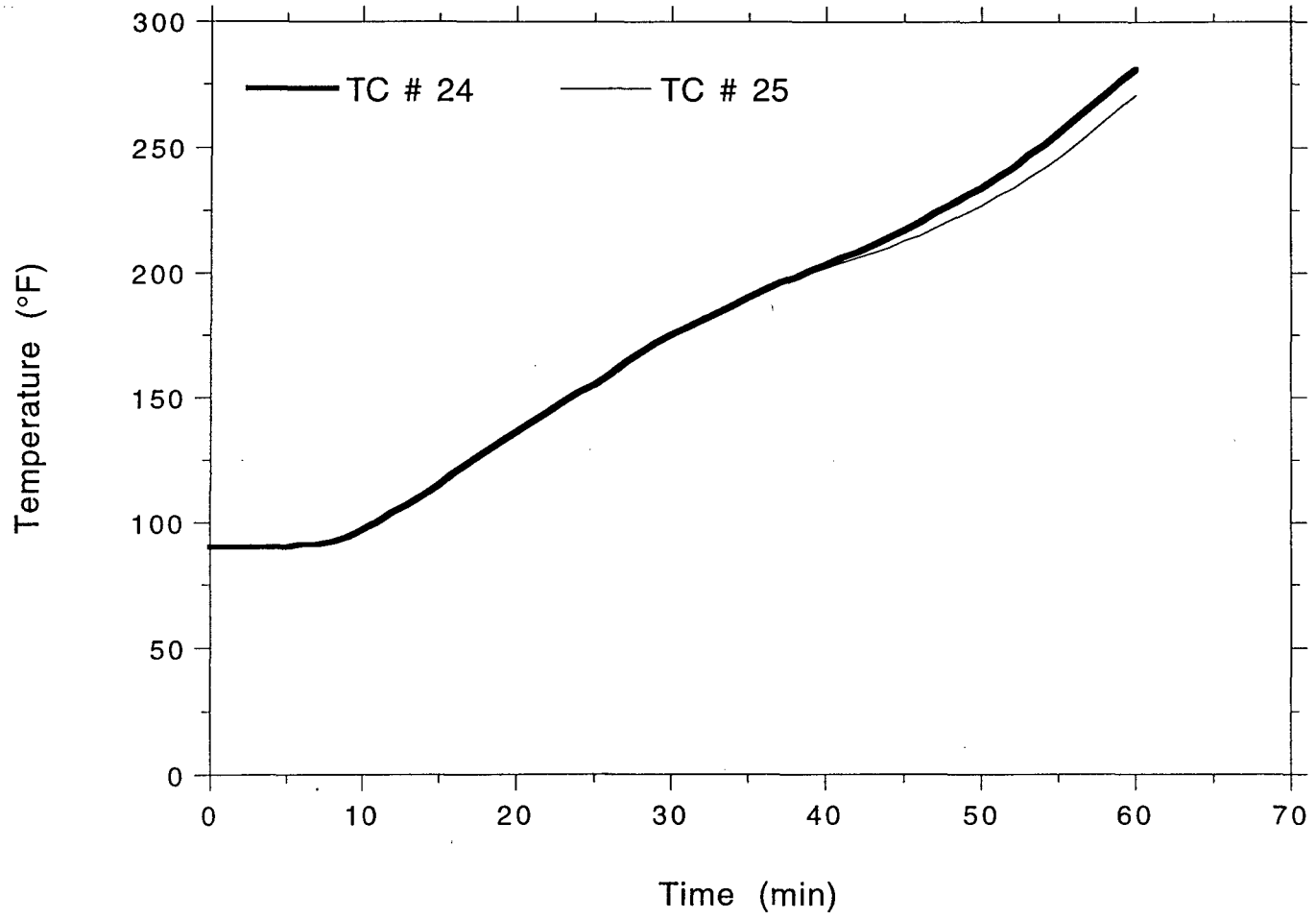
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, Rear Rail



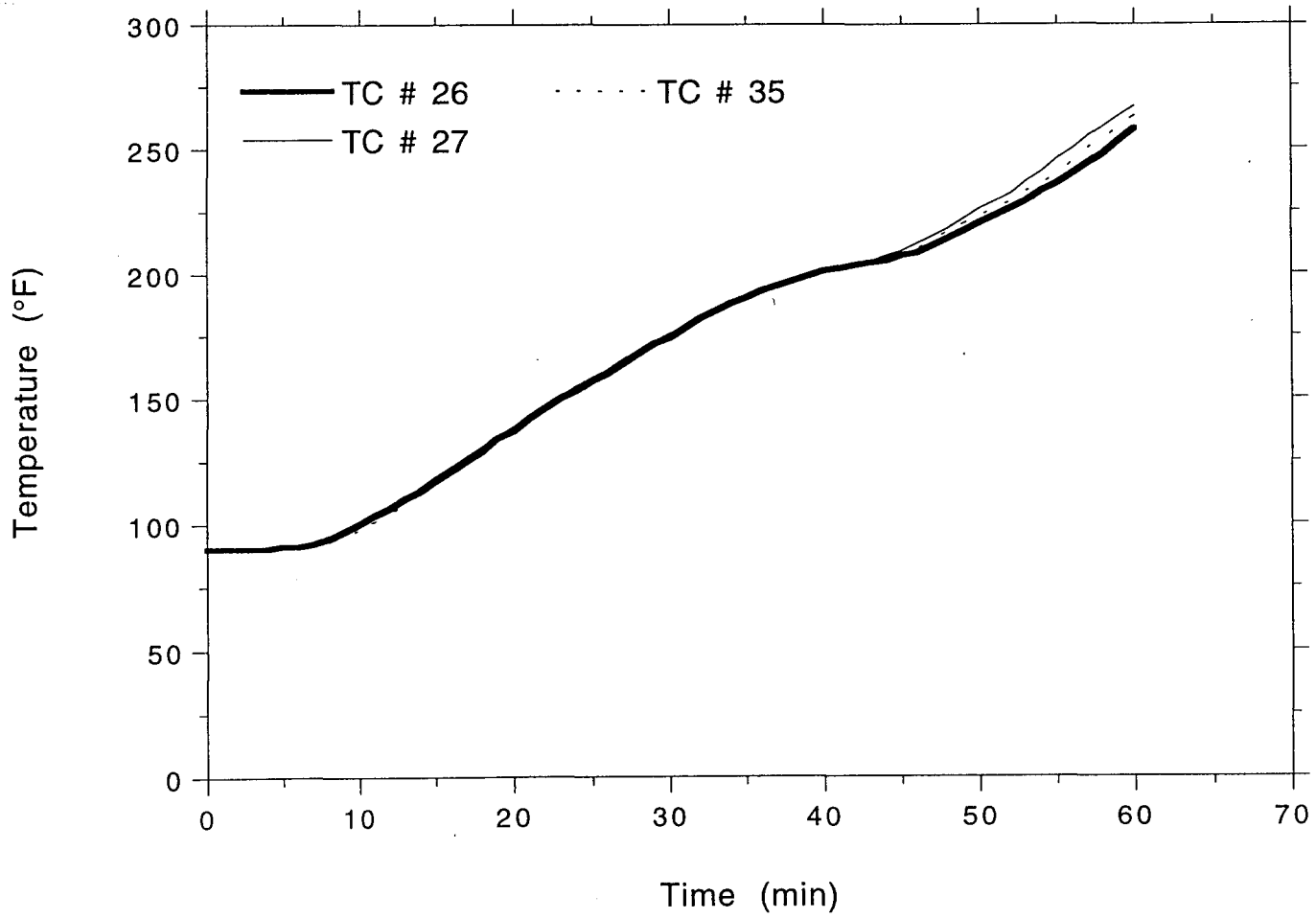
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, Rear Rail



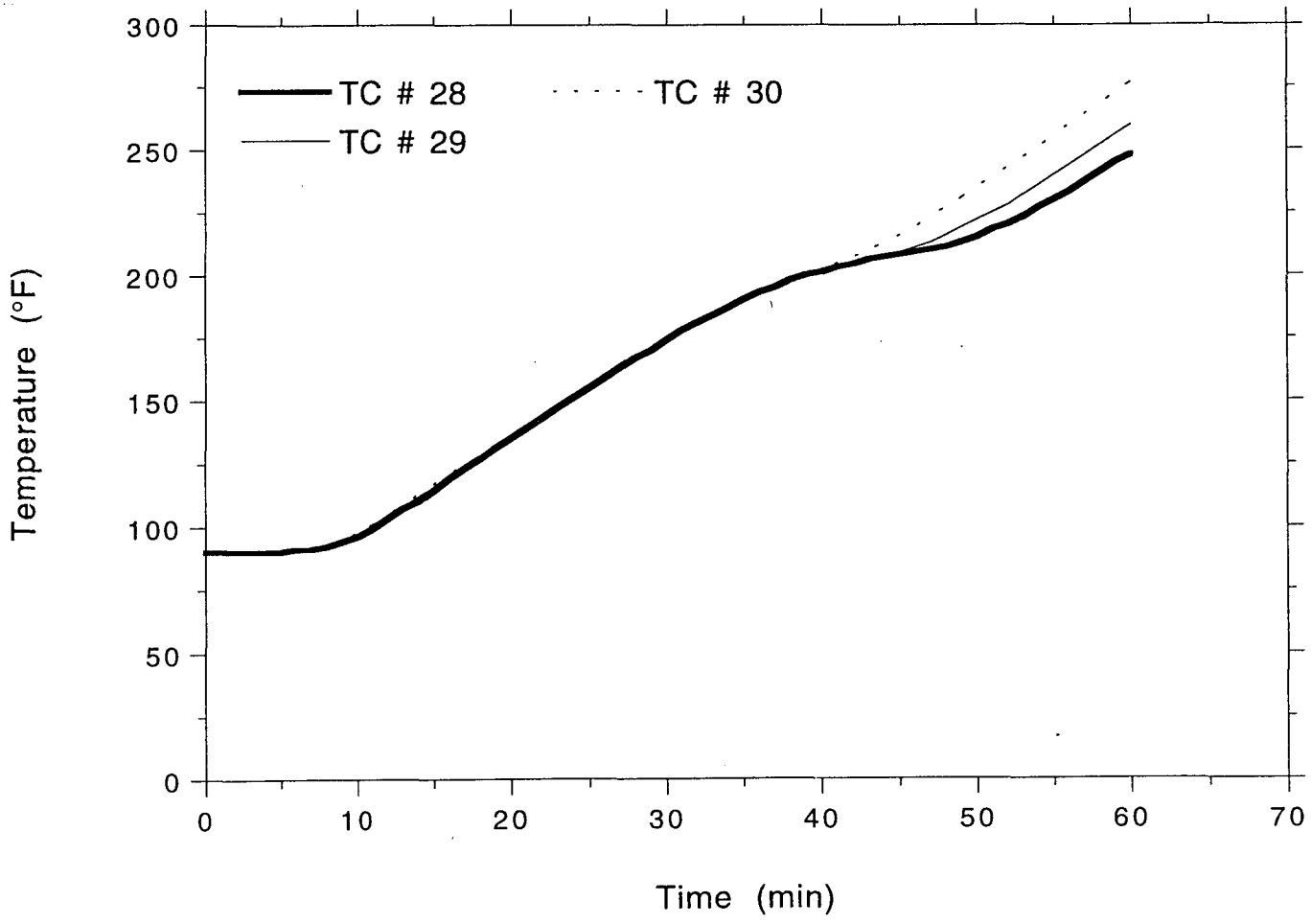
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Right Rail



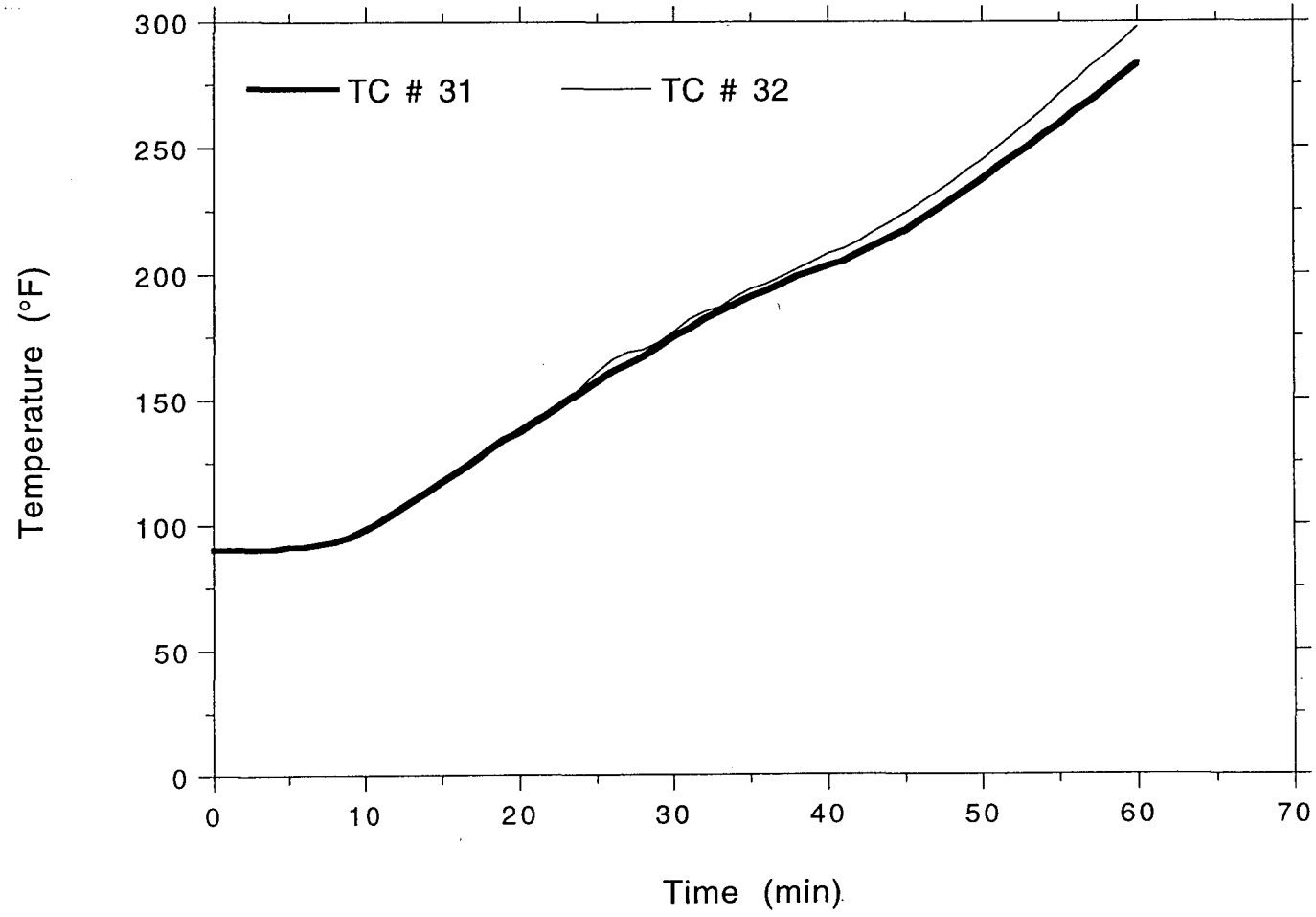
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, Front Rail



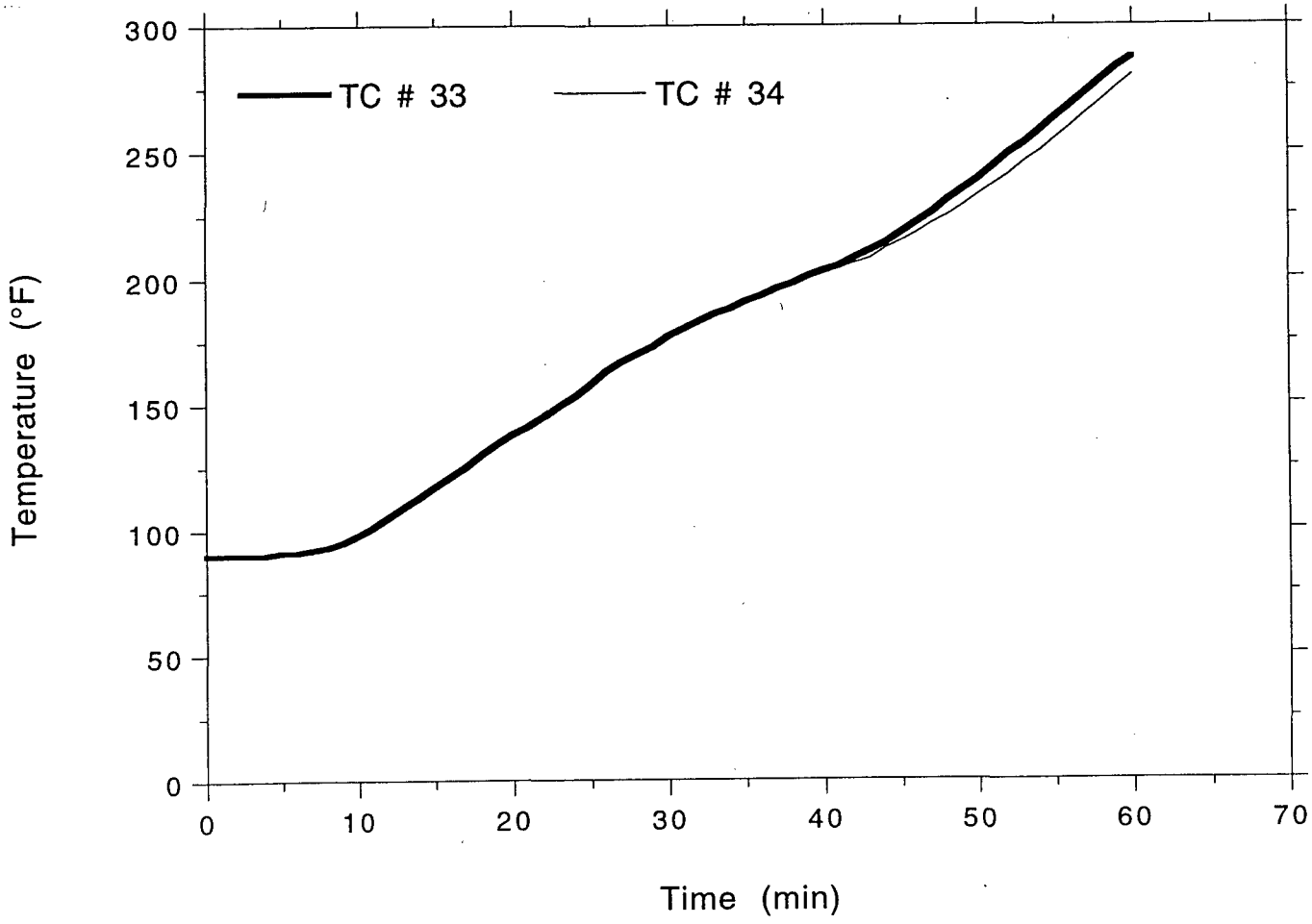
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, Front Rail



OMEGA POINT LABORATORIES

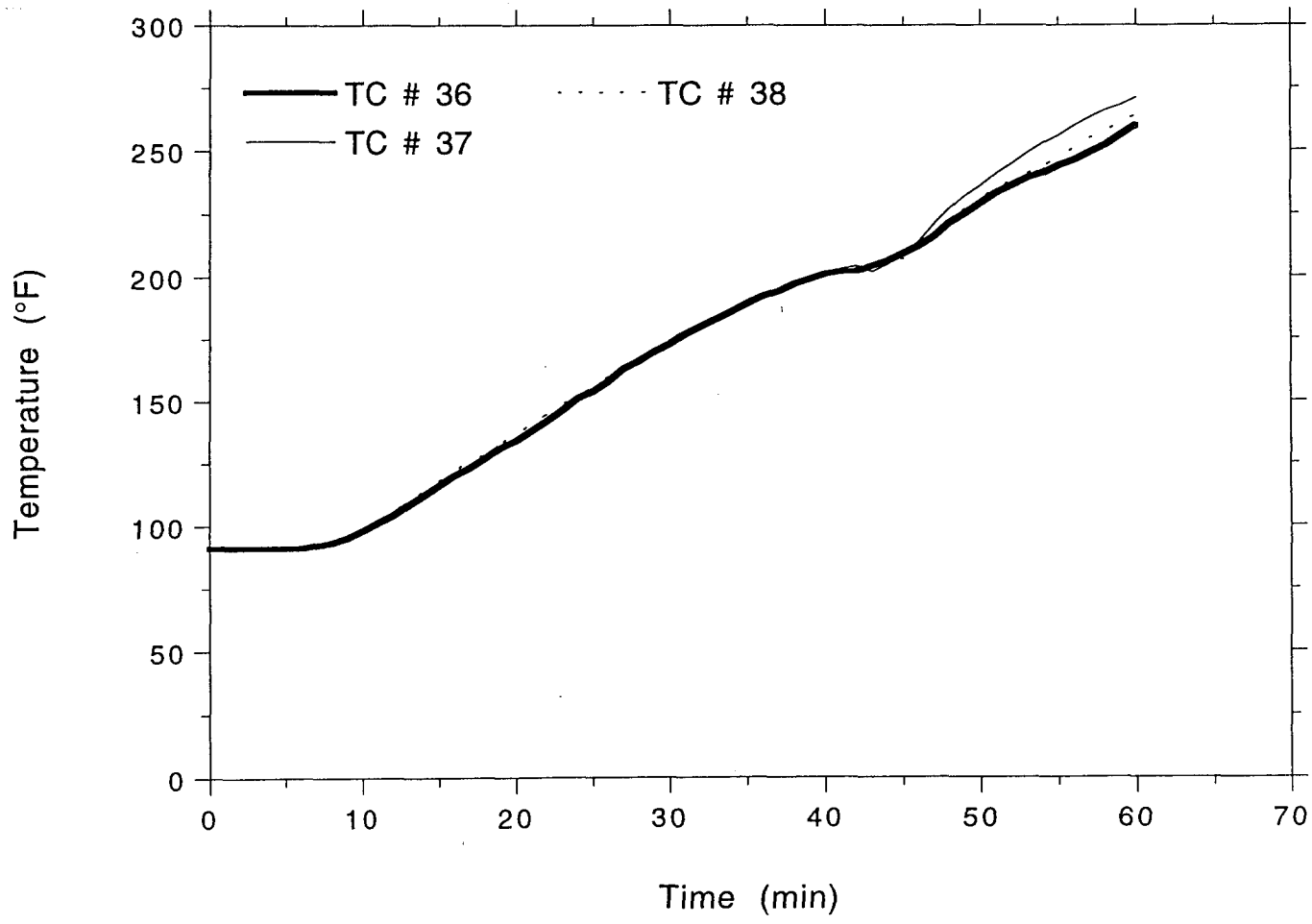
TSI/TVA
Project No. 11960-97186
Rear Tray, Front Rail



OMEGA POINT LABORATORIES

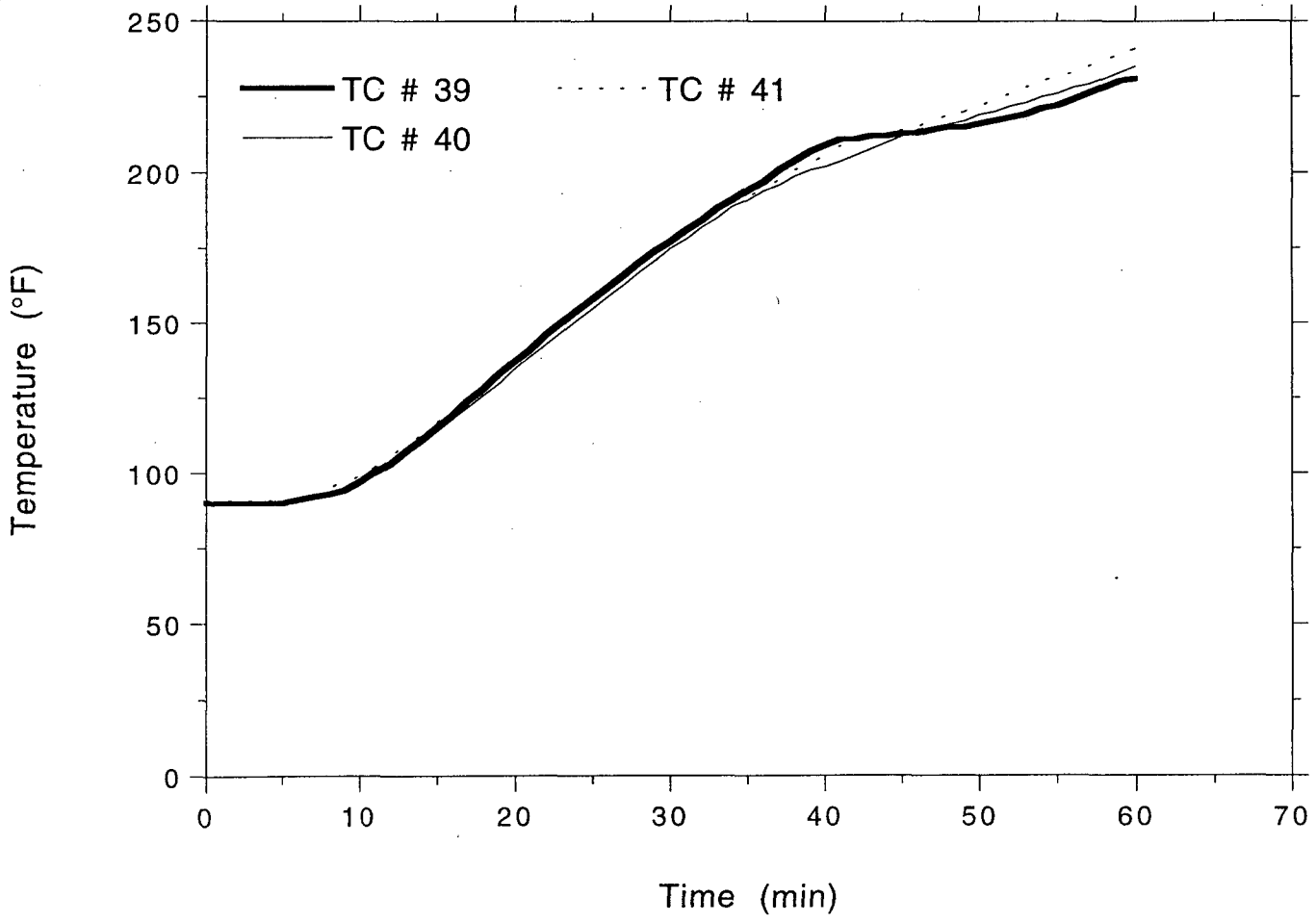
E-13

TSI/TVA
Project No. 11960-97186
Tray Fitting, Left Rail



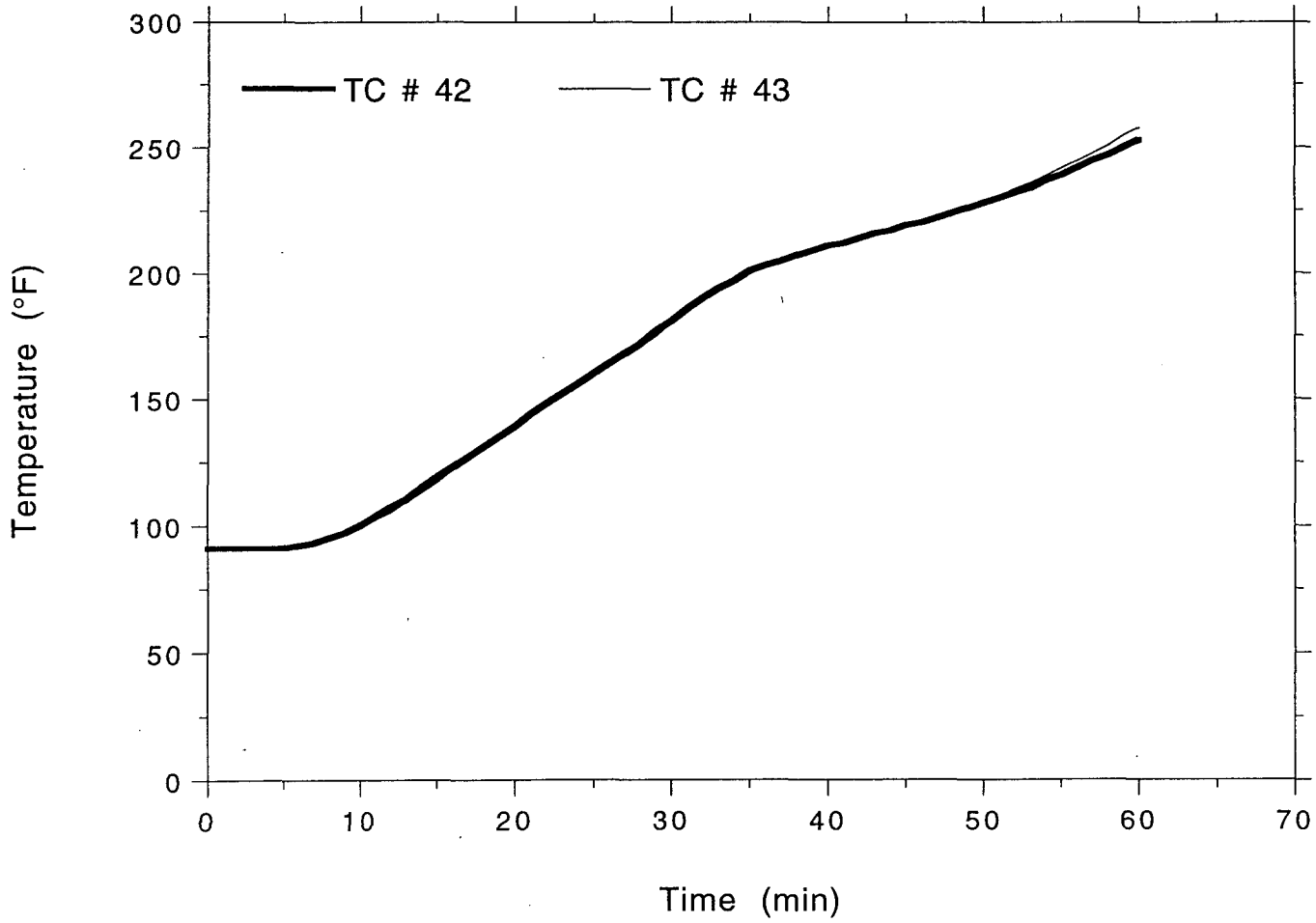
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, Rear Rail



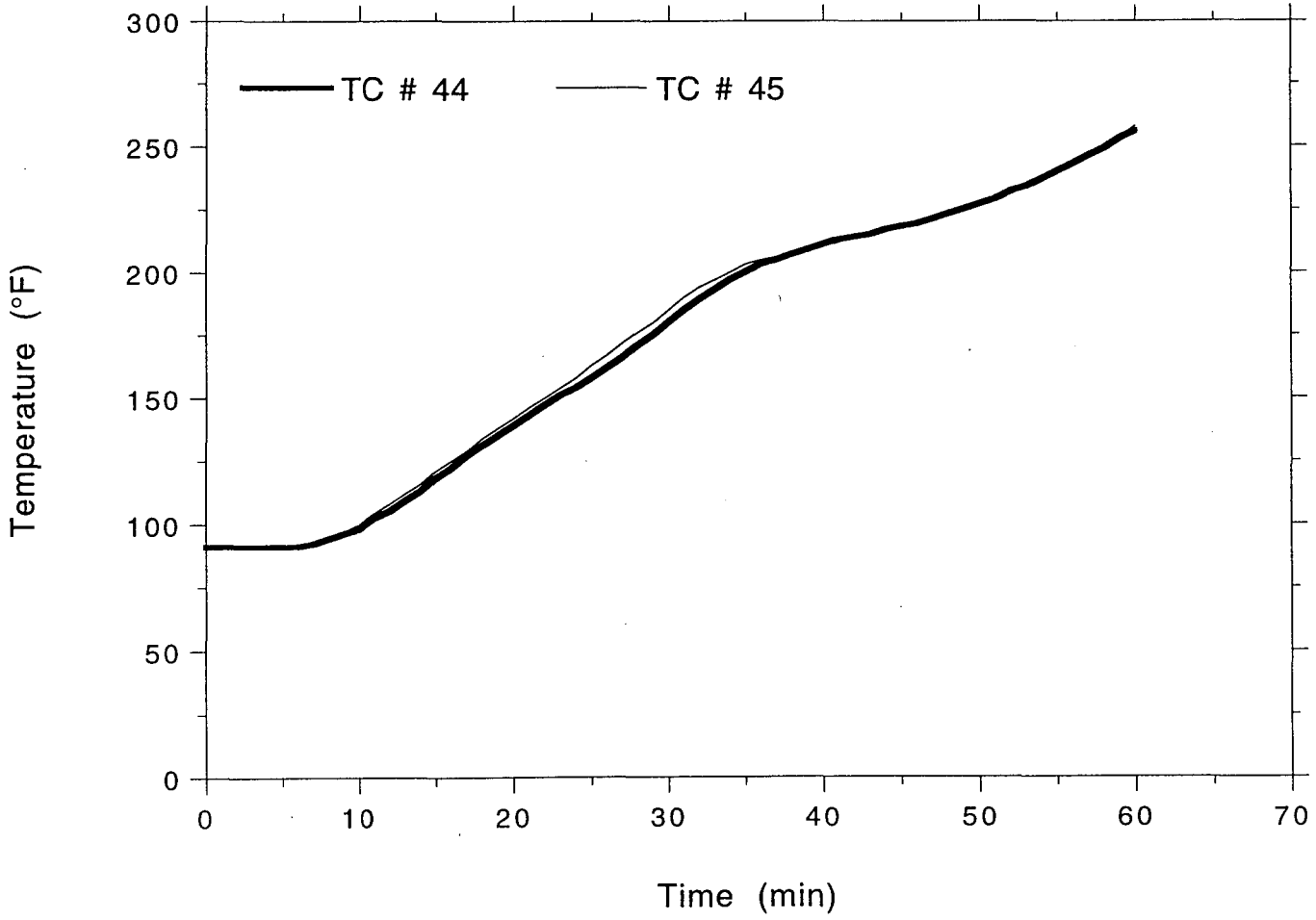
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, Rear Rail



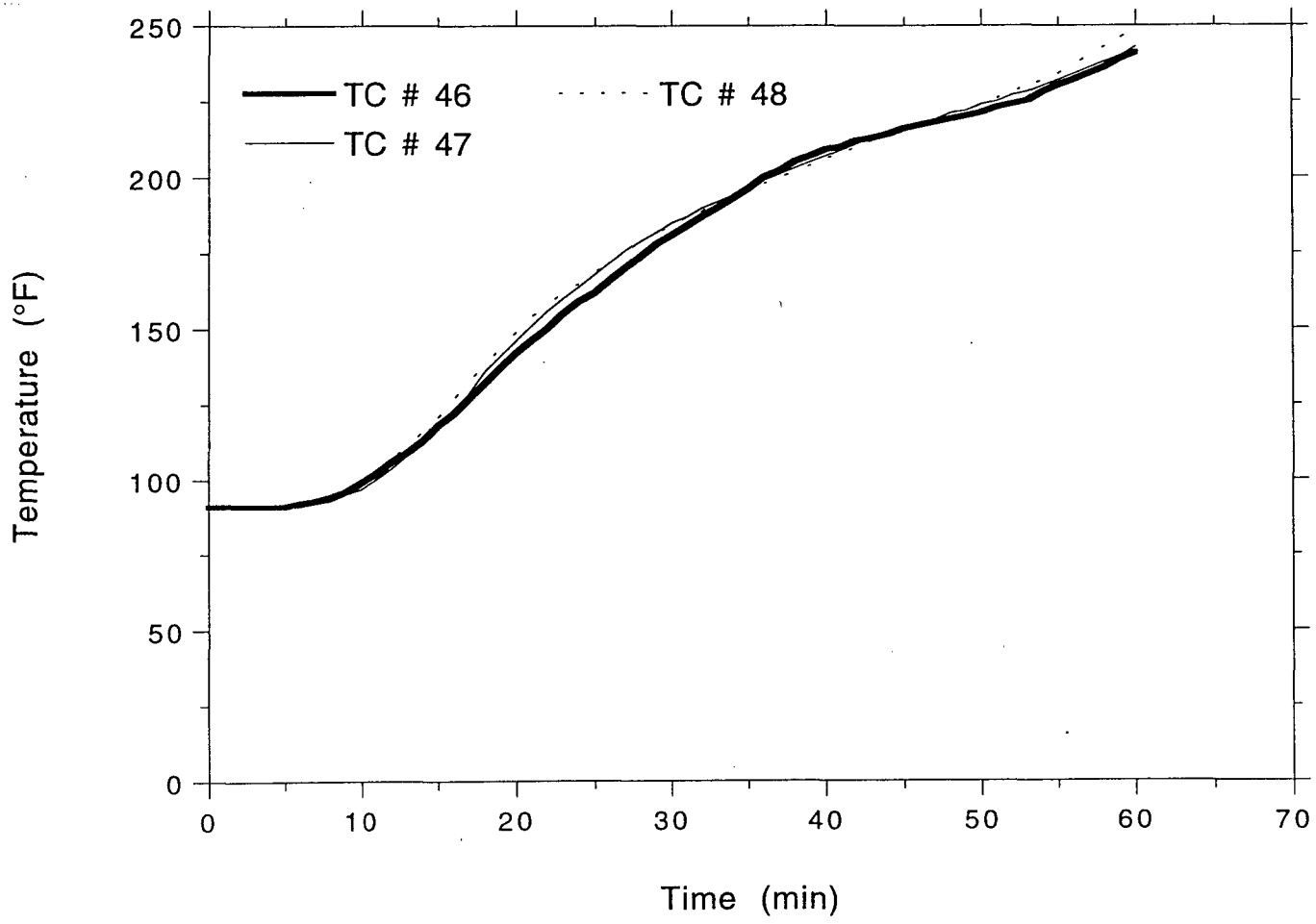
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, Rear Rail



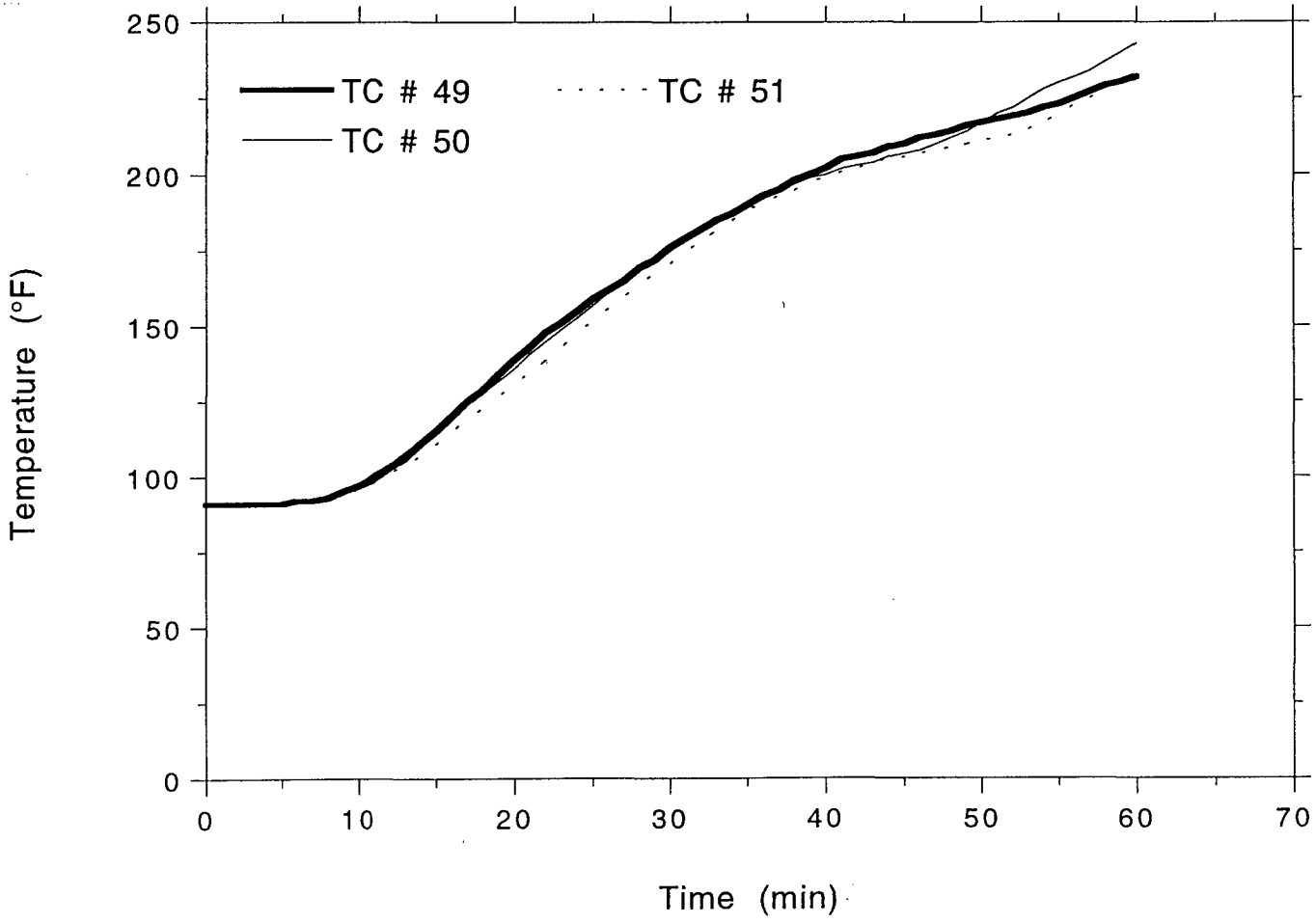
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Rear Rail



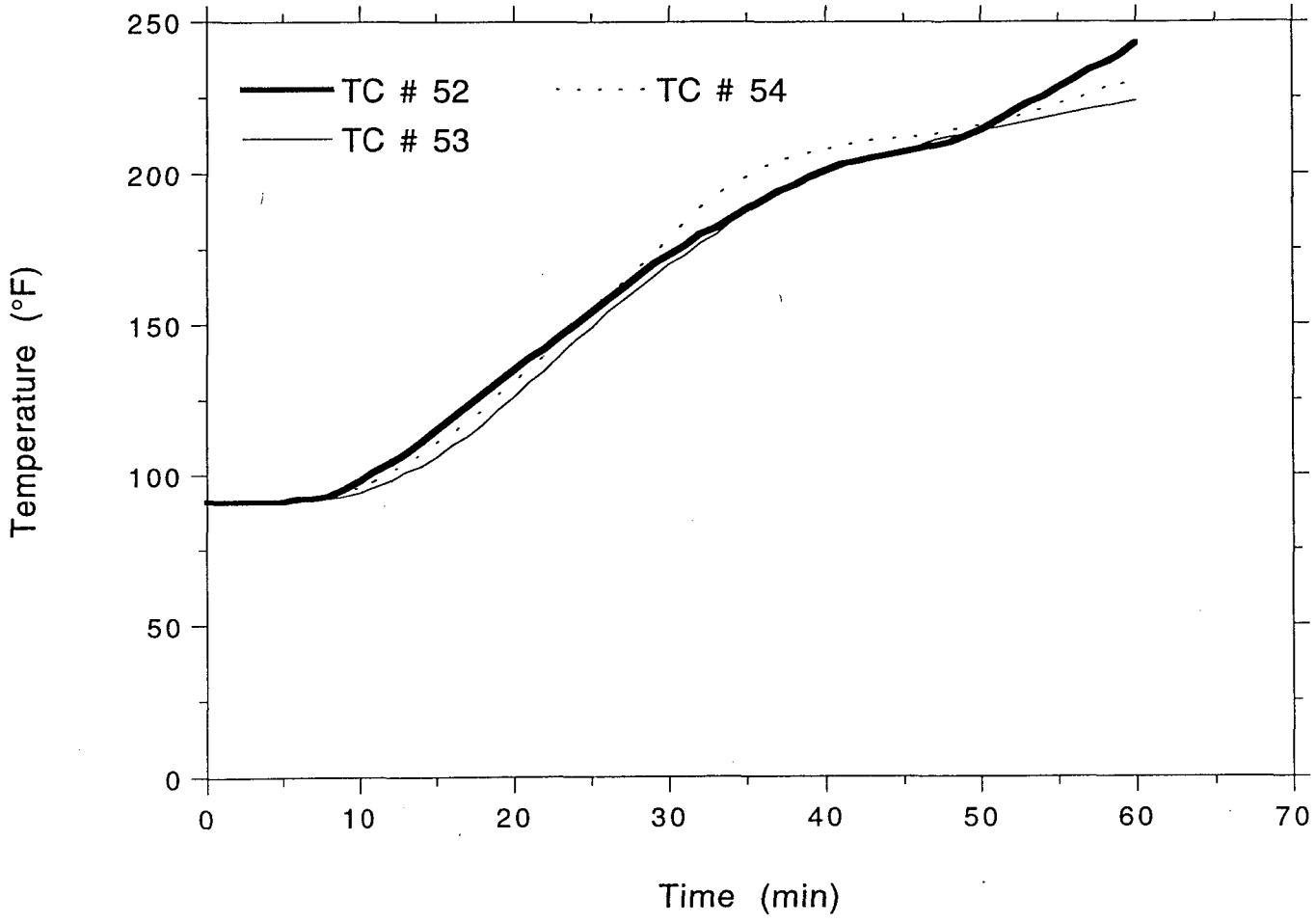
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Rear Rail



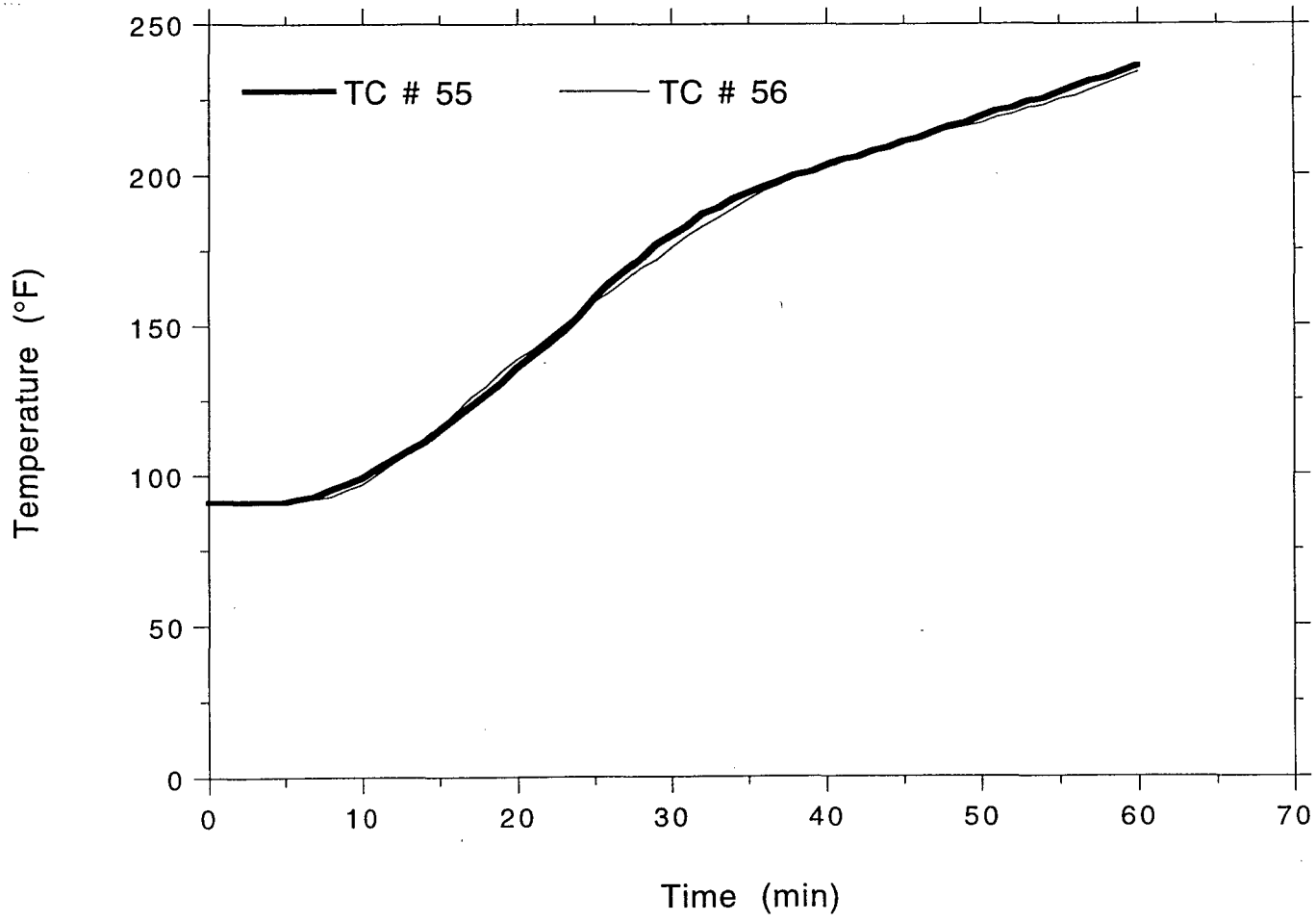
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Rear Rail



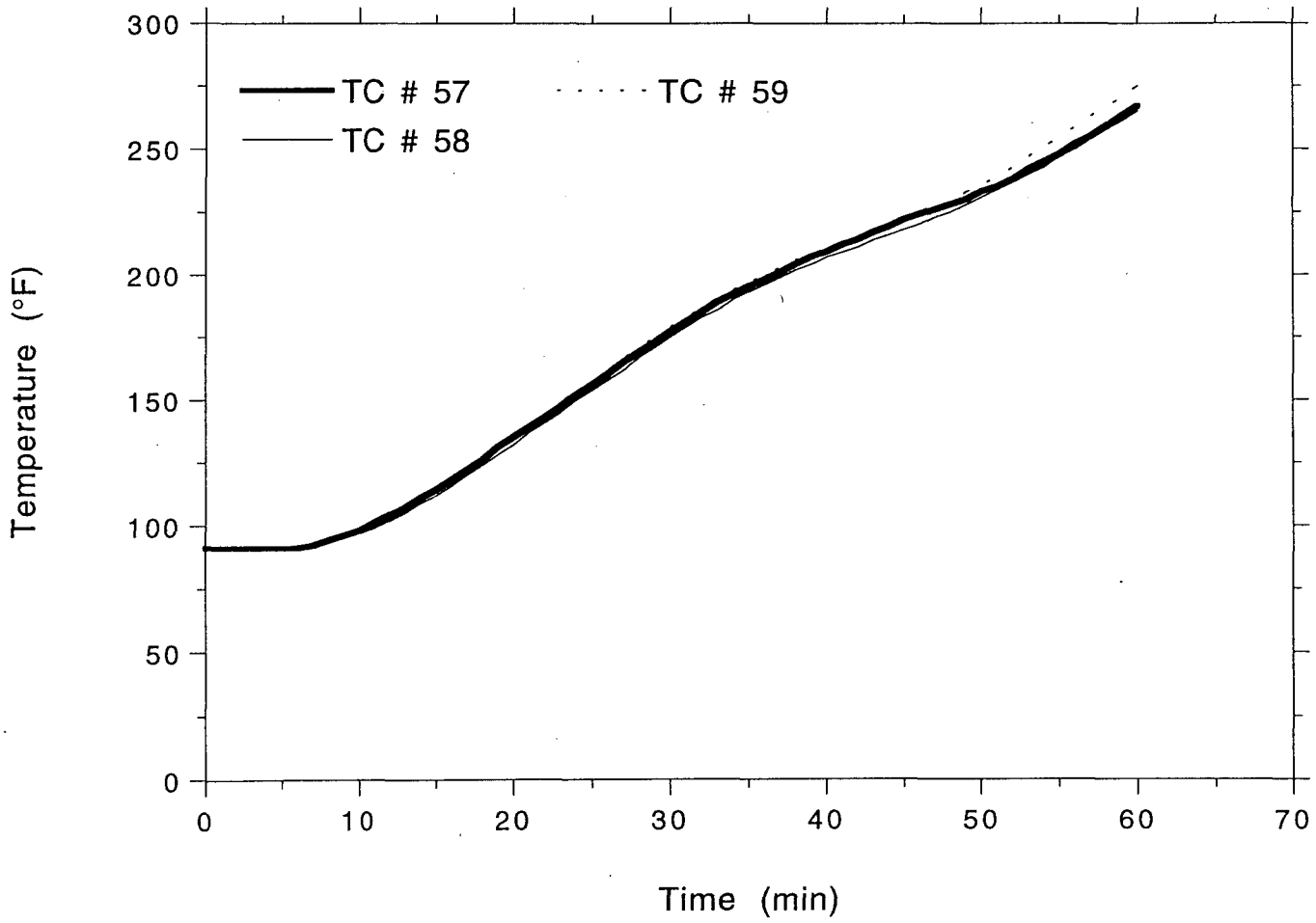
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Rear Rail



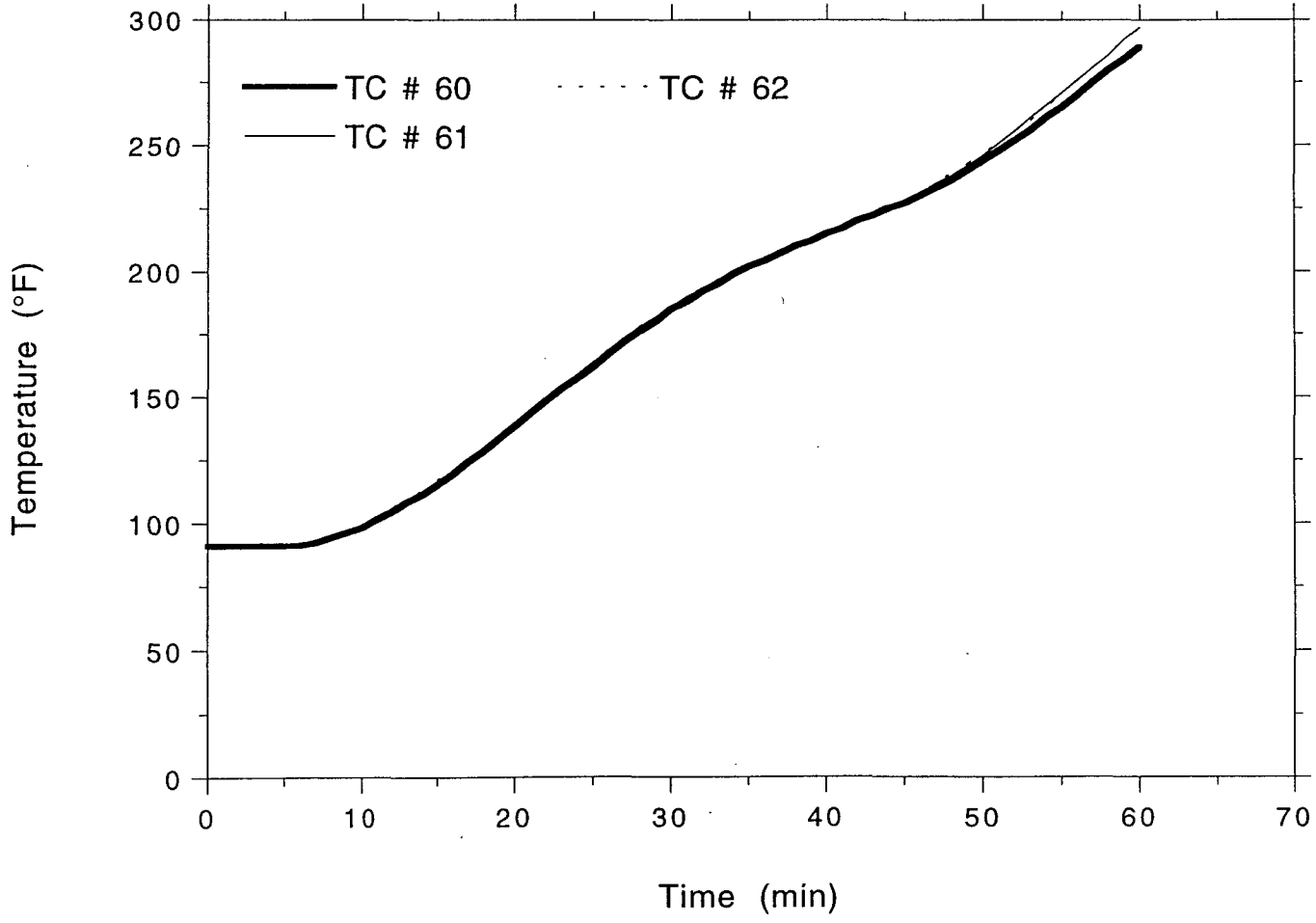
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



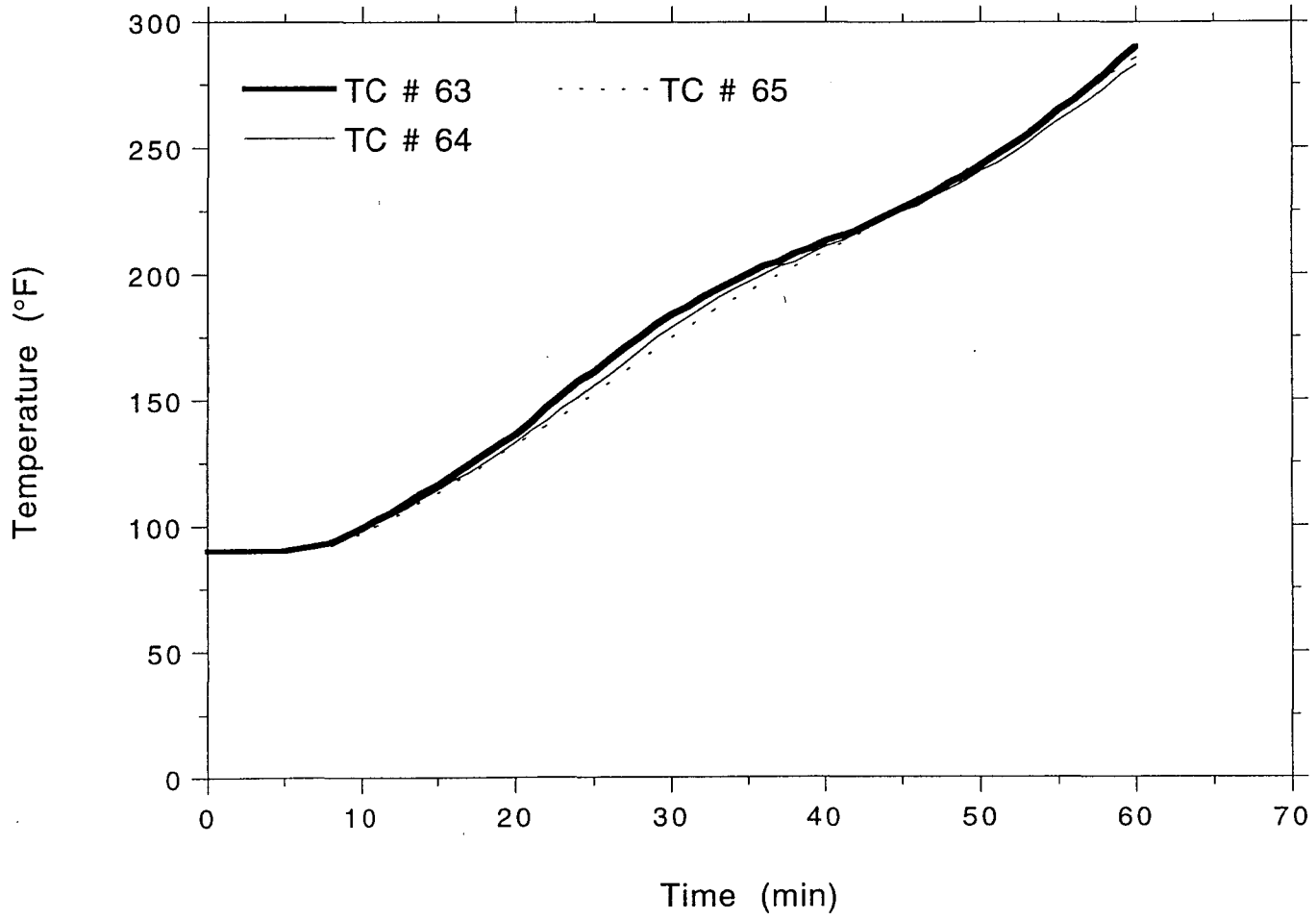
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



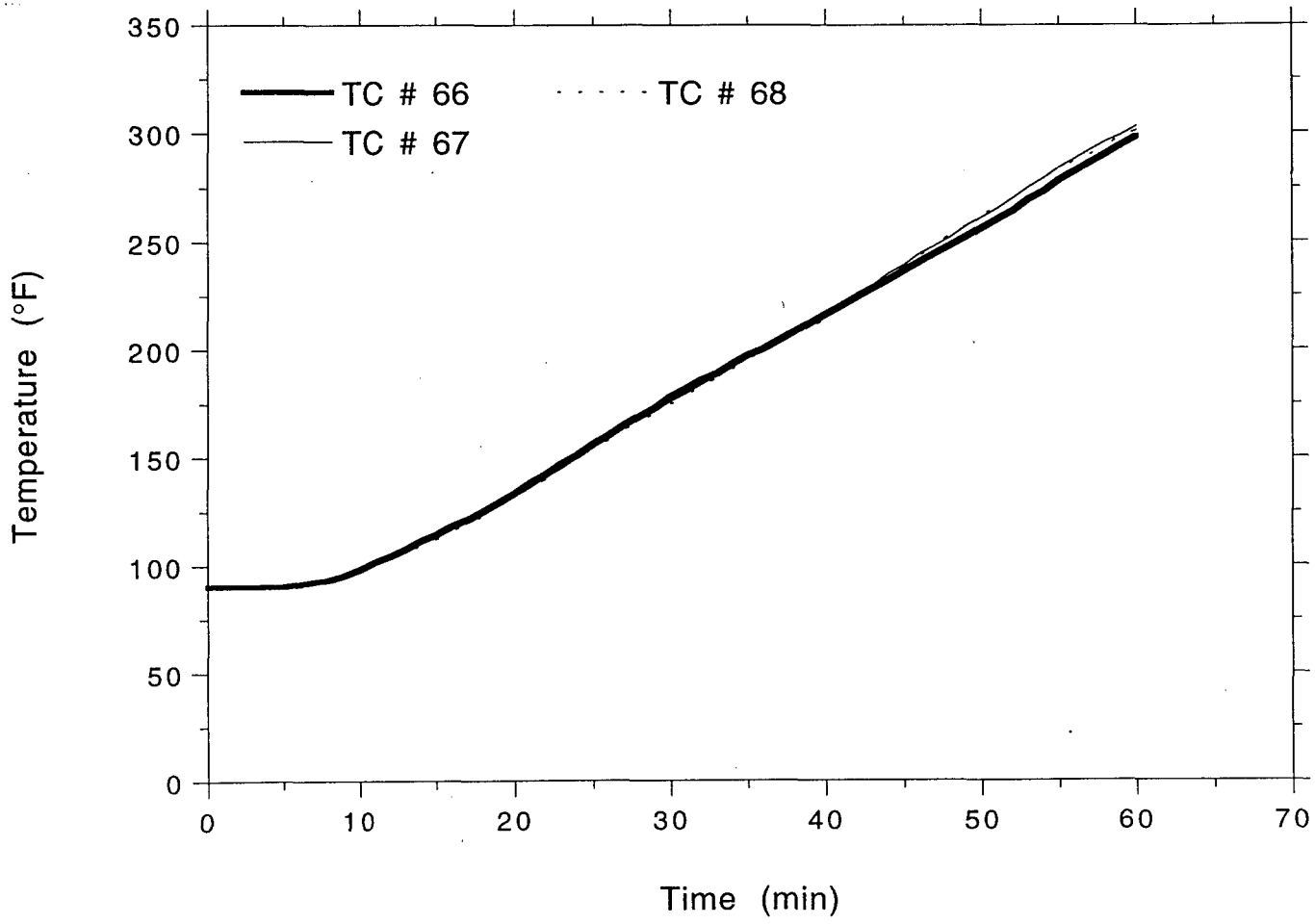
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



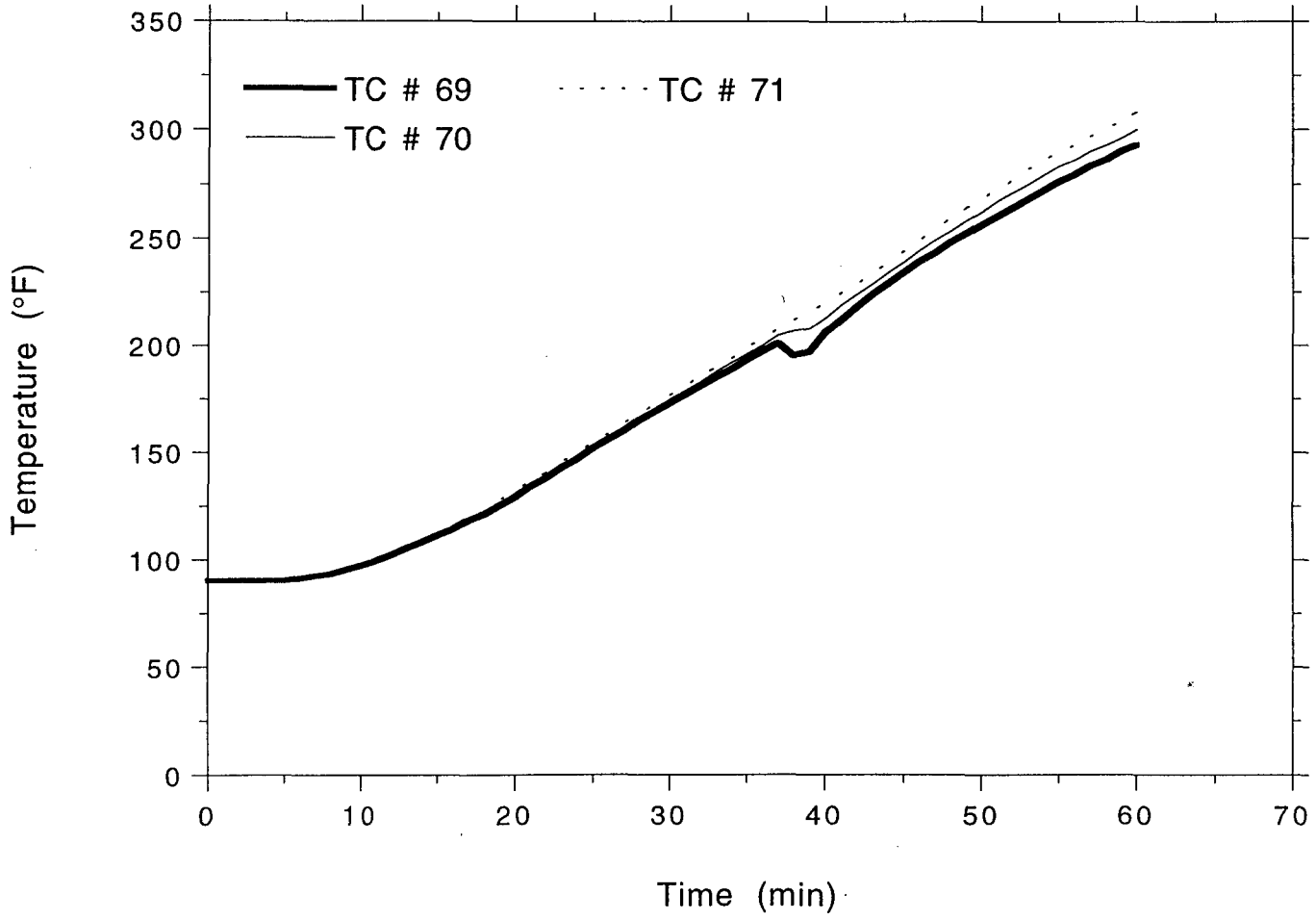
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



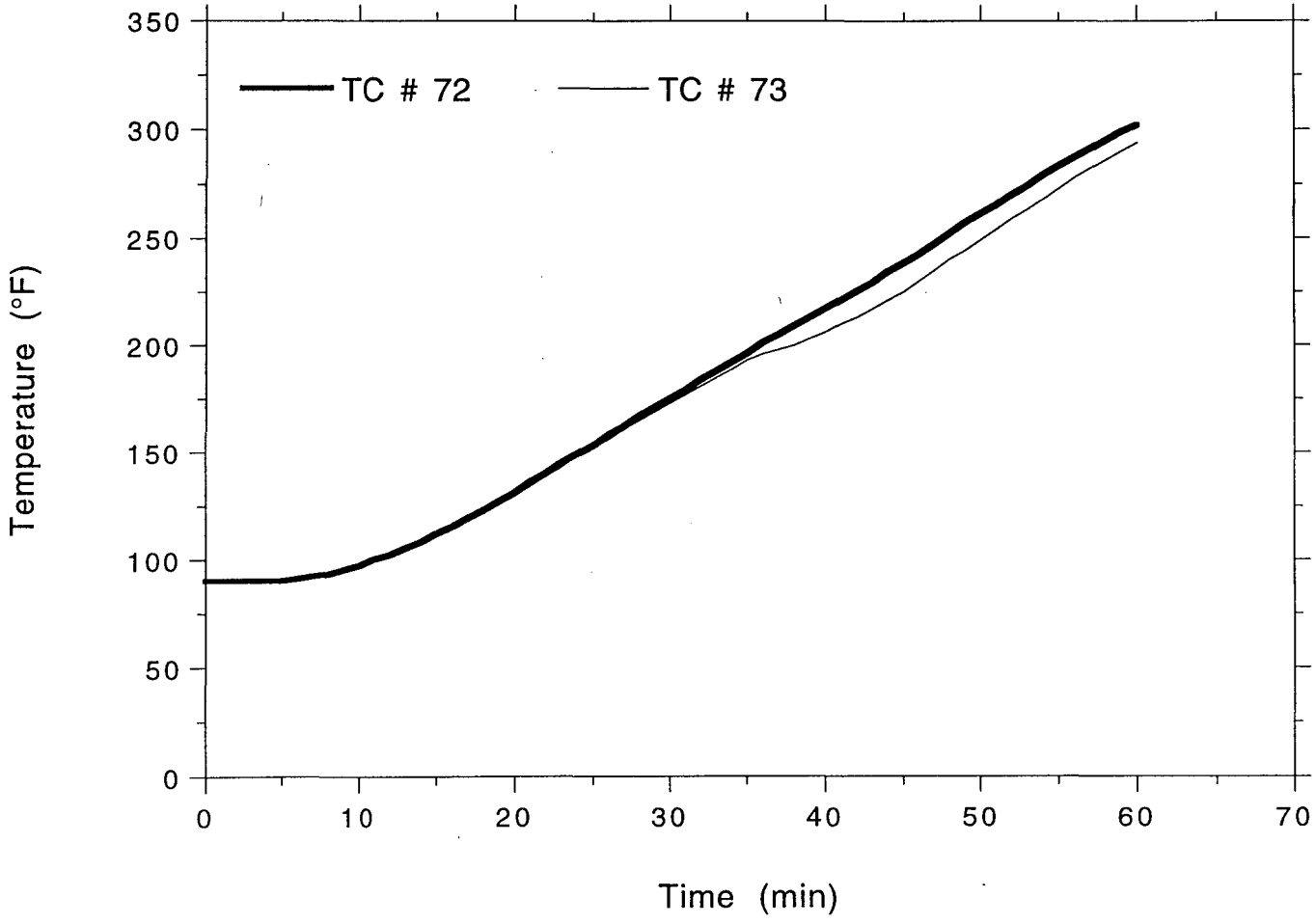
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



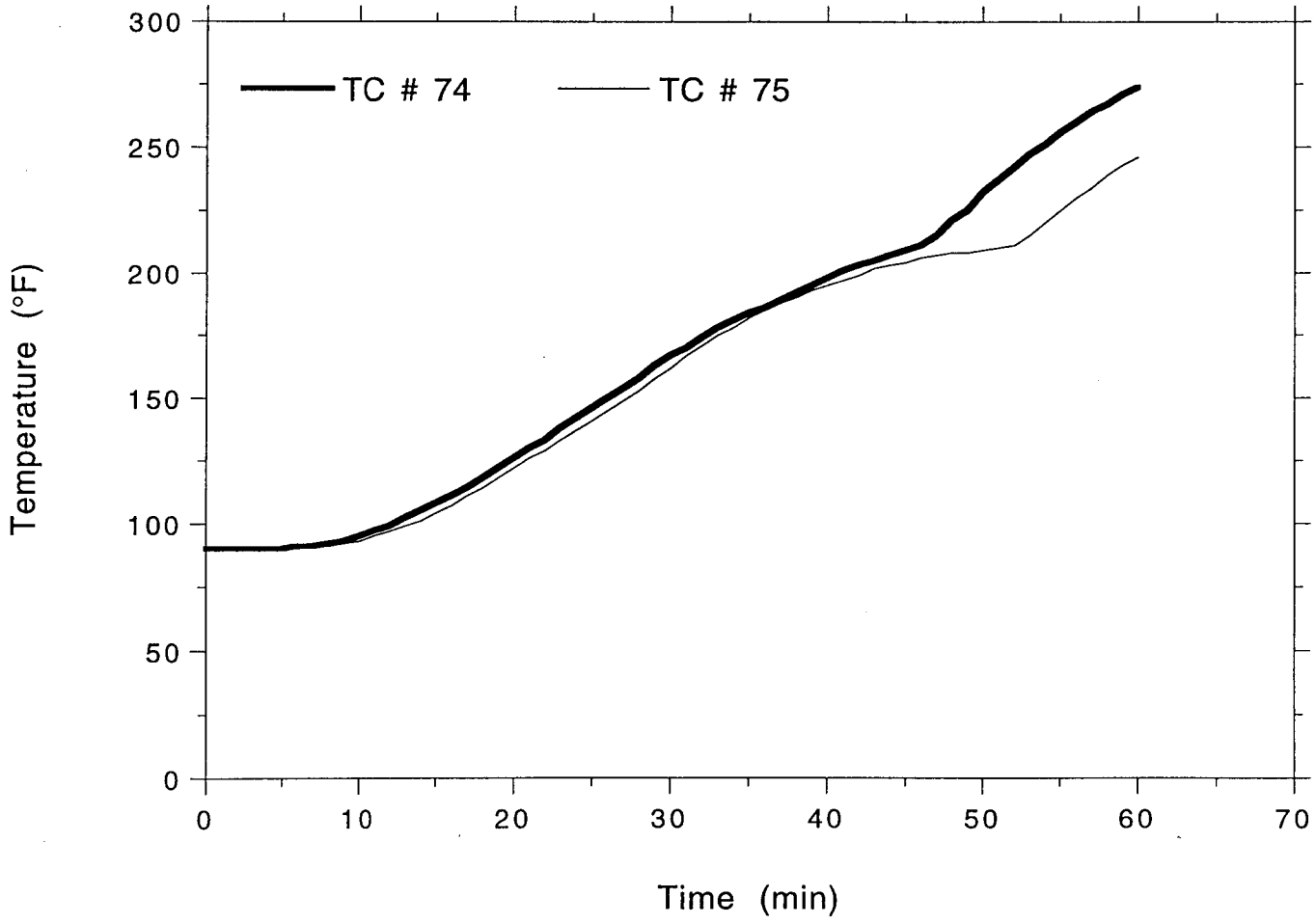
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



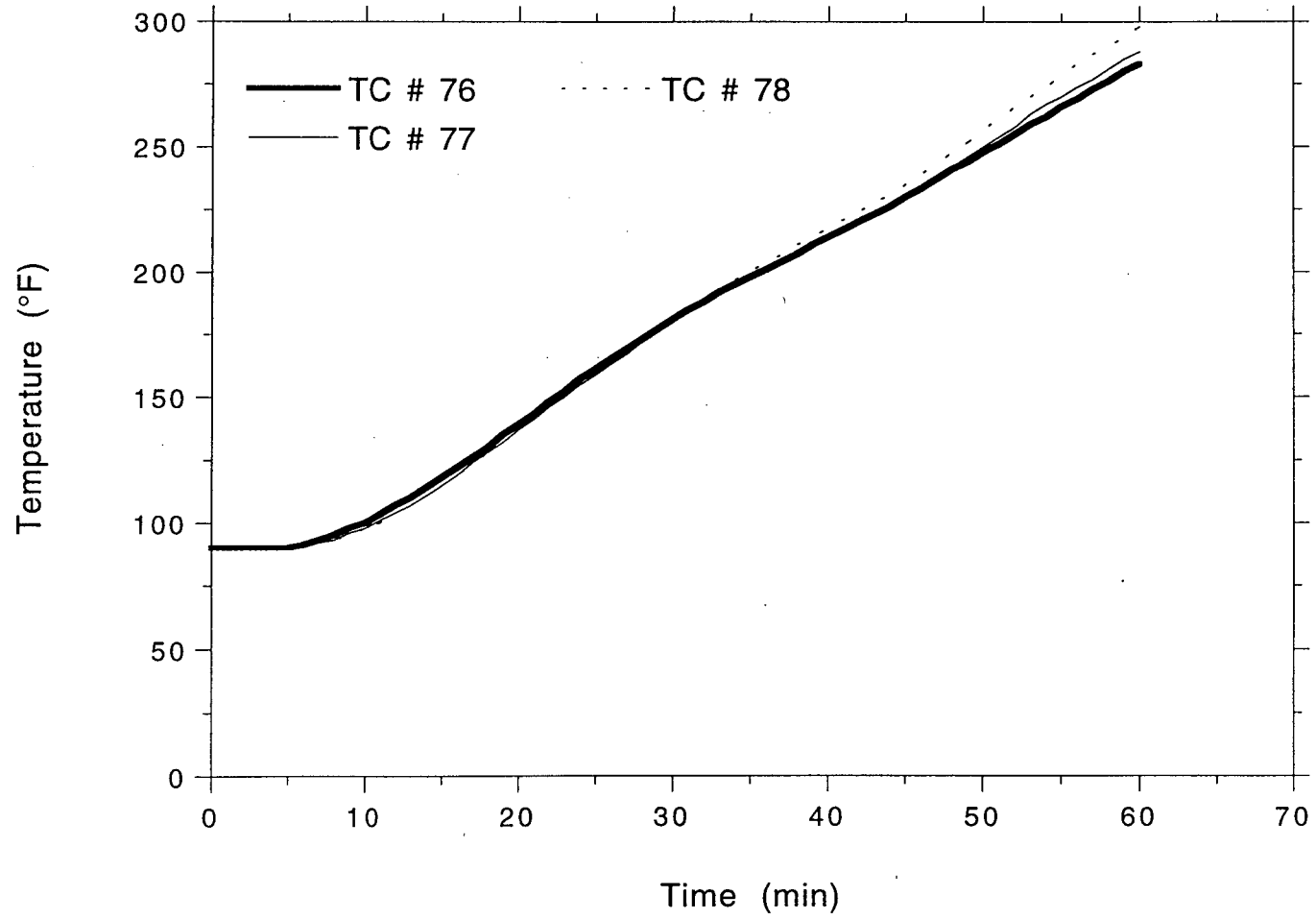
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Front Tray, #8 on Rungs



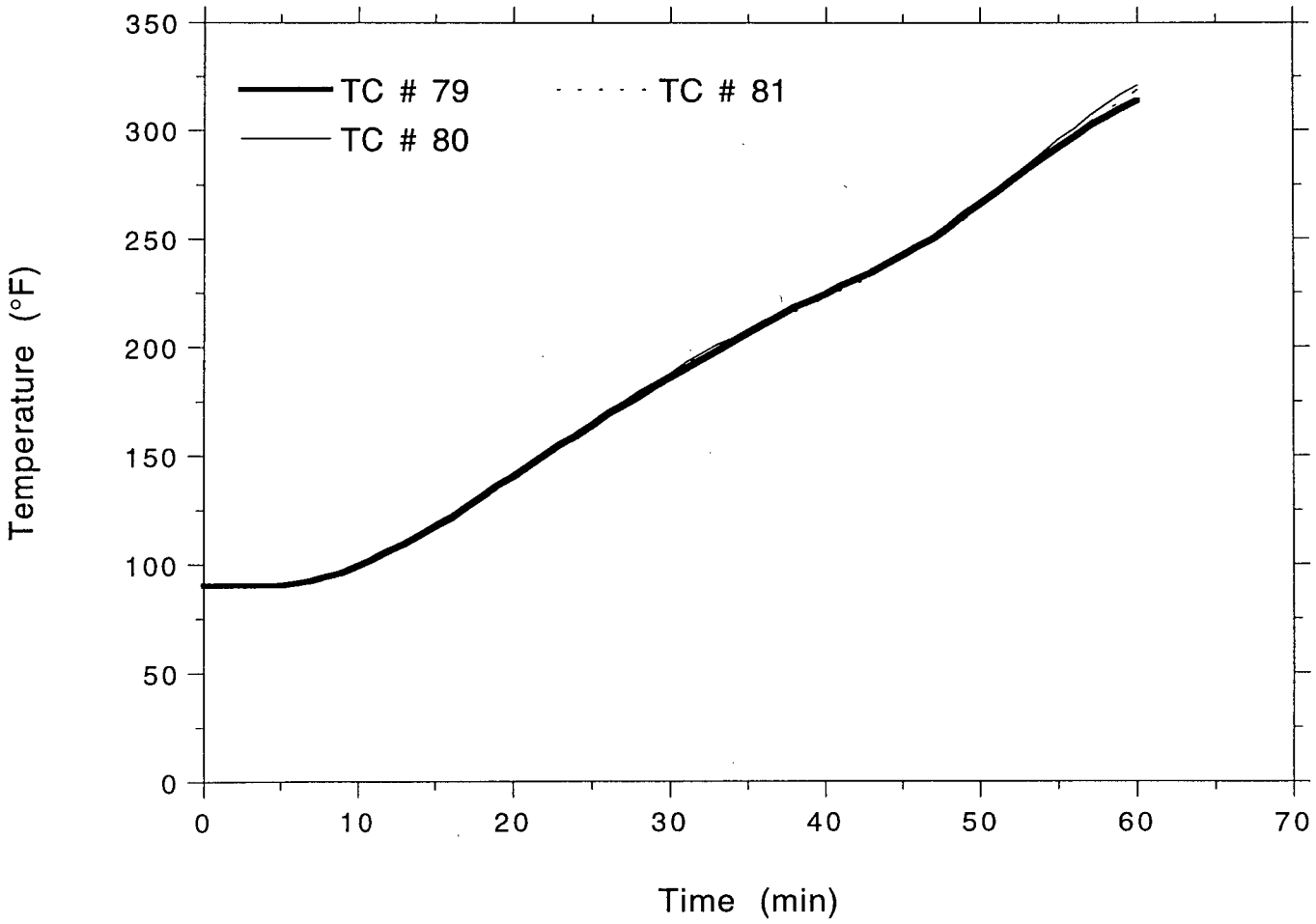
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



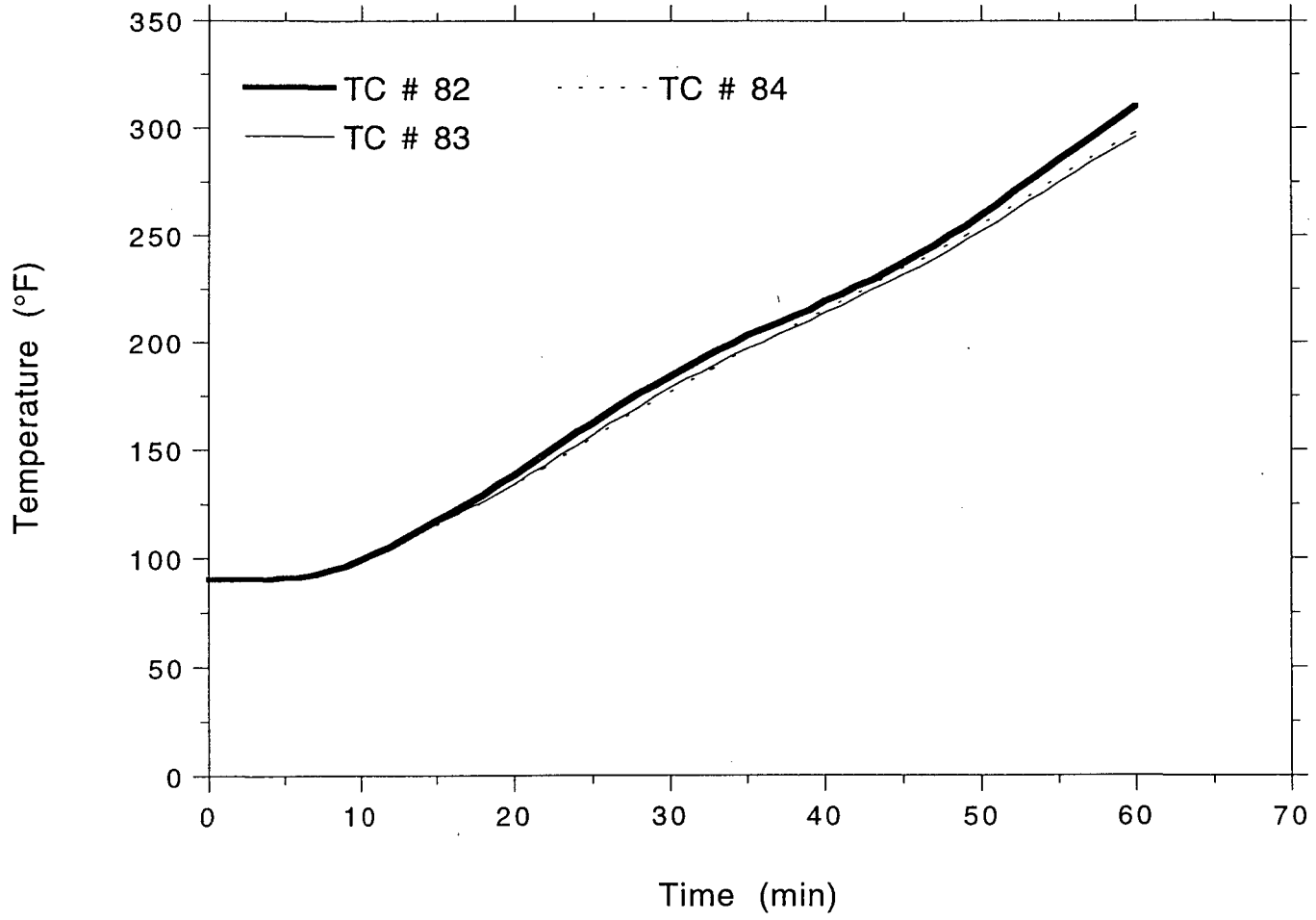
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



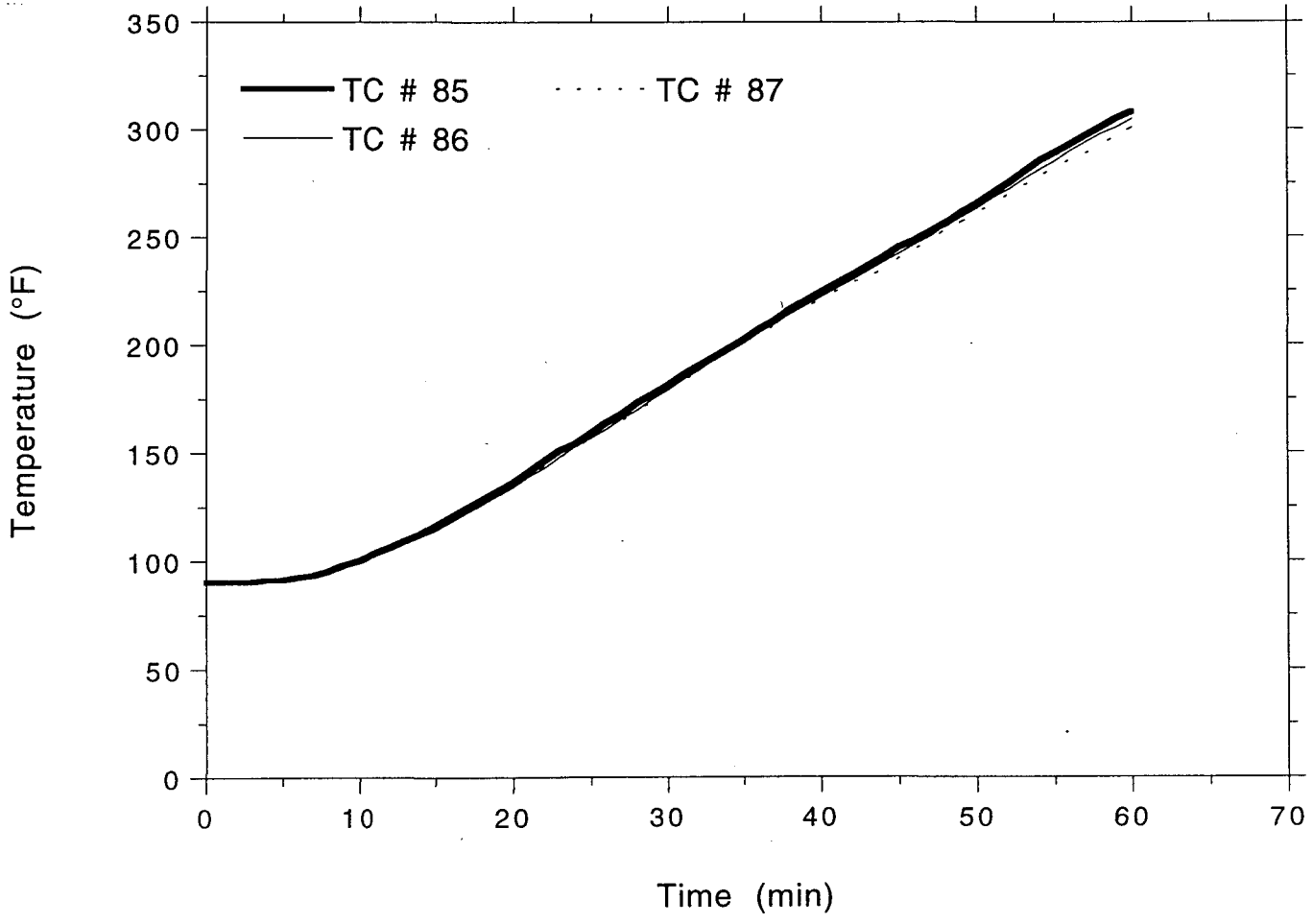
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



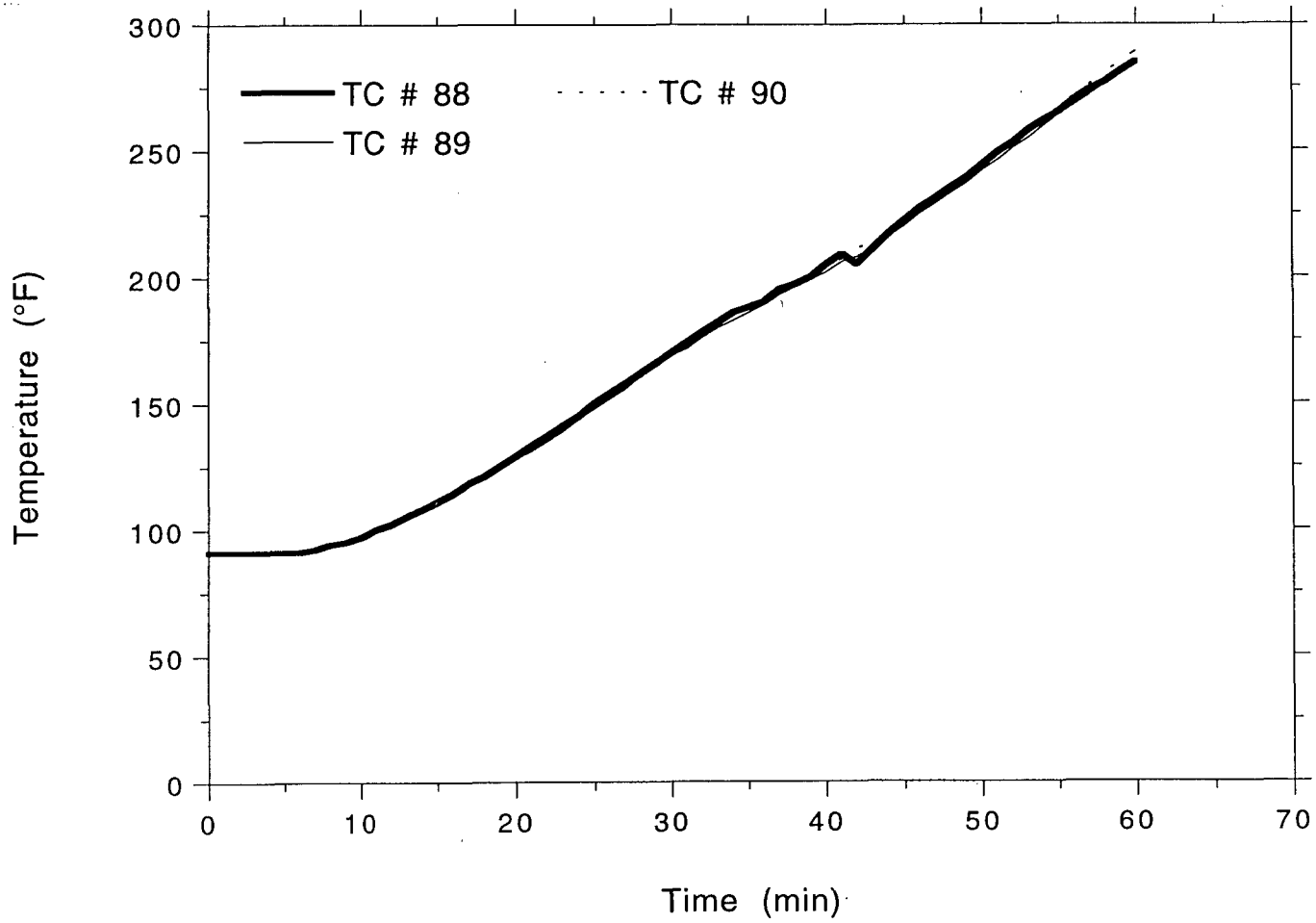
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



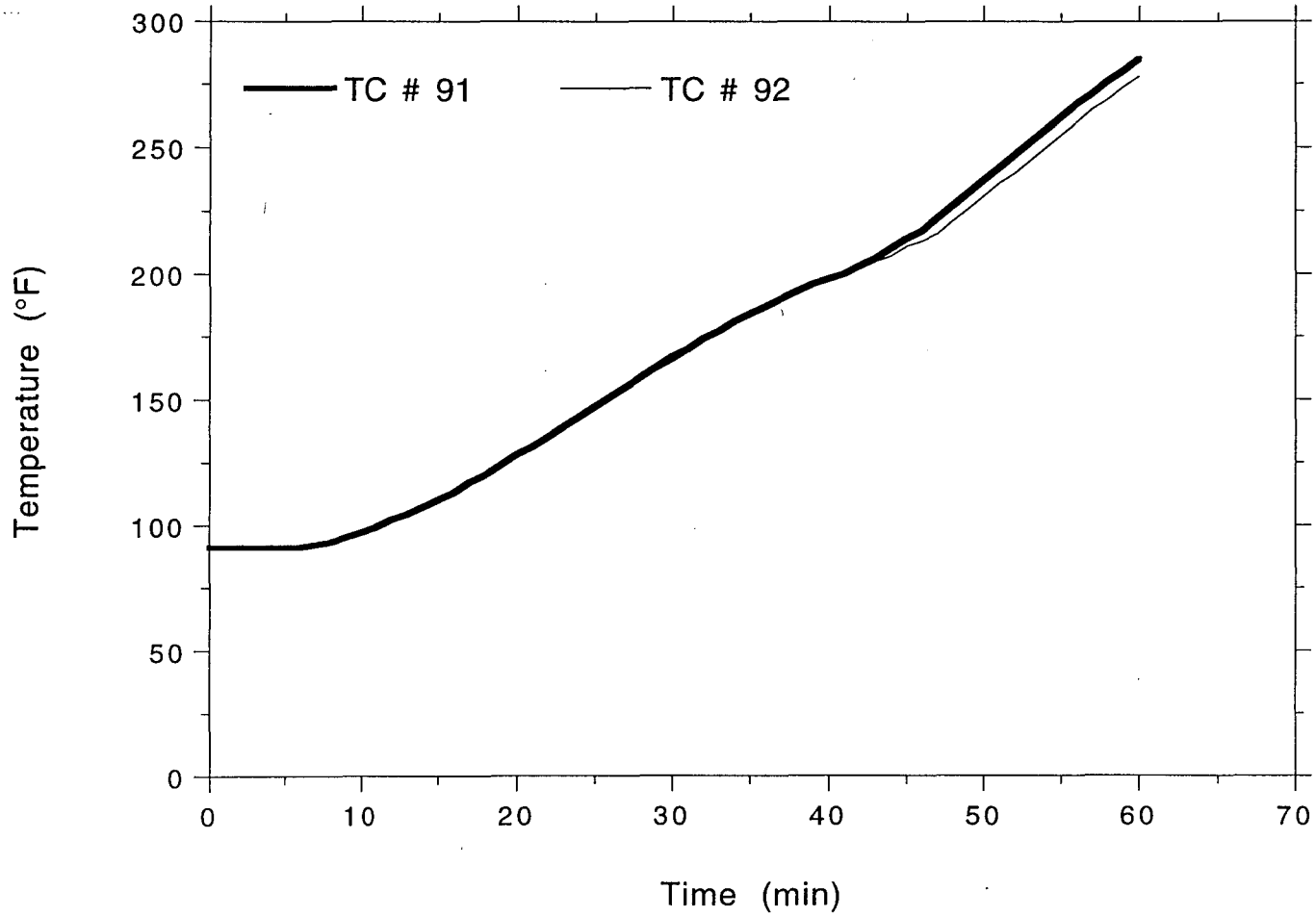
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



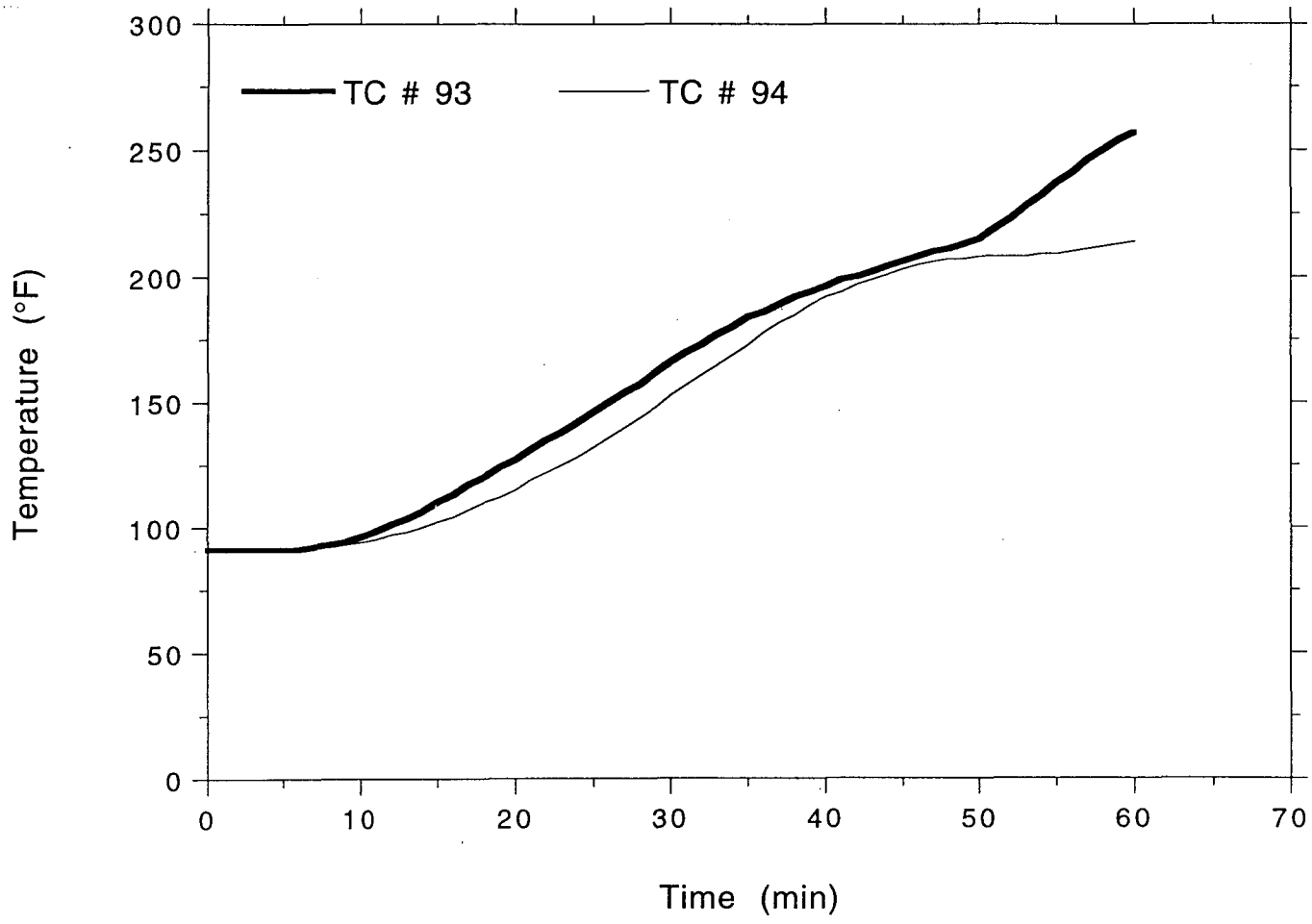
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



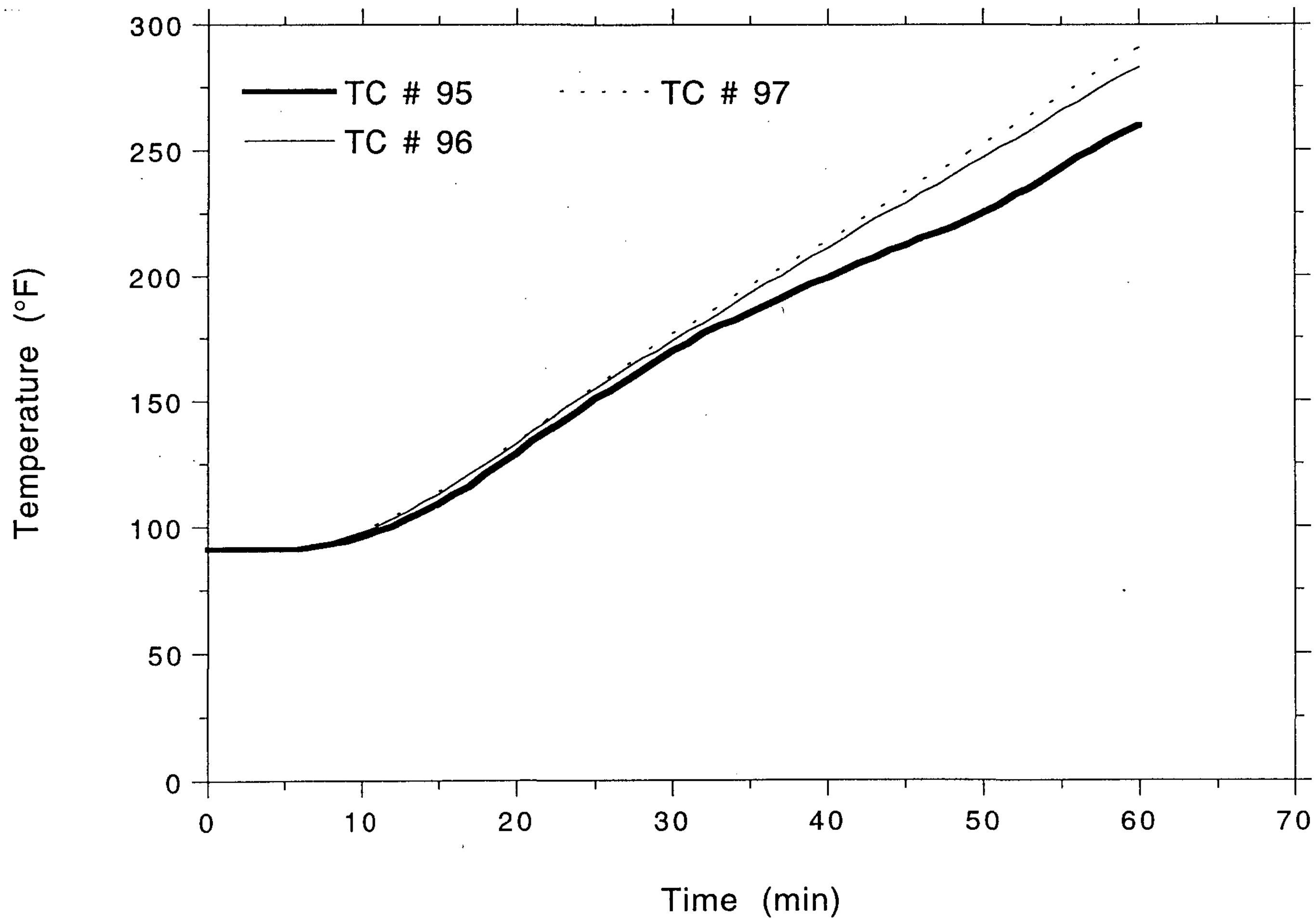
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Rear Tray, #8 on Rungs



OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Right Side, #8 on Rungs



TSI/TVA
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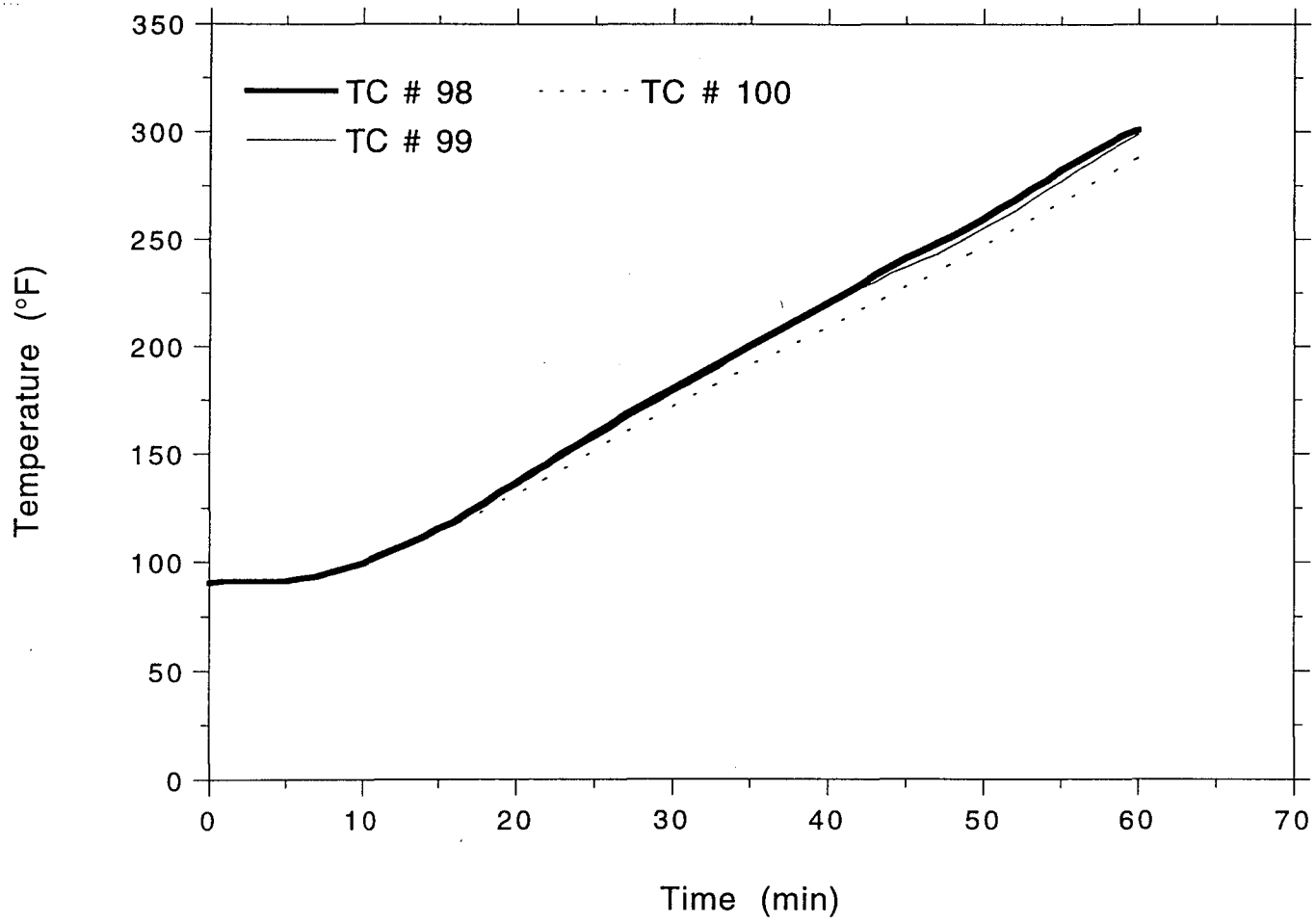
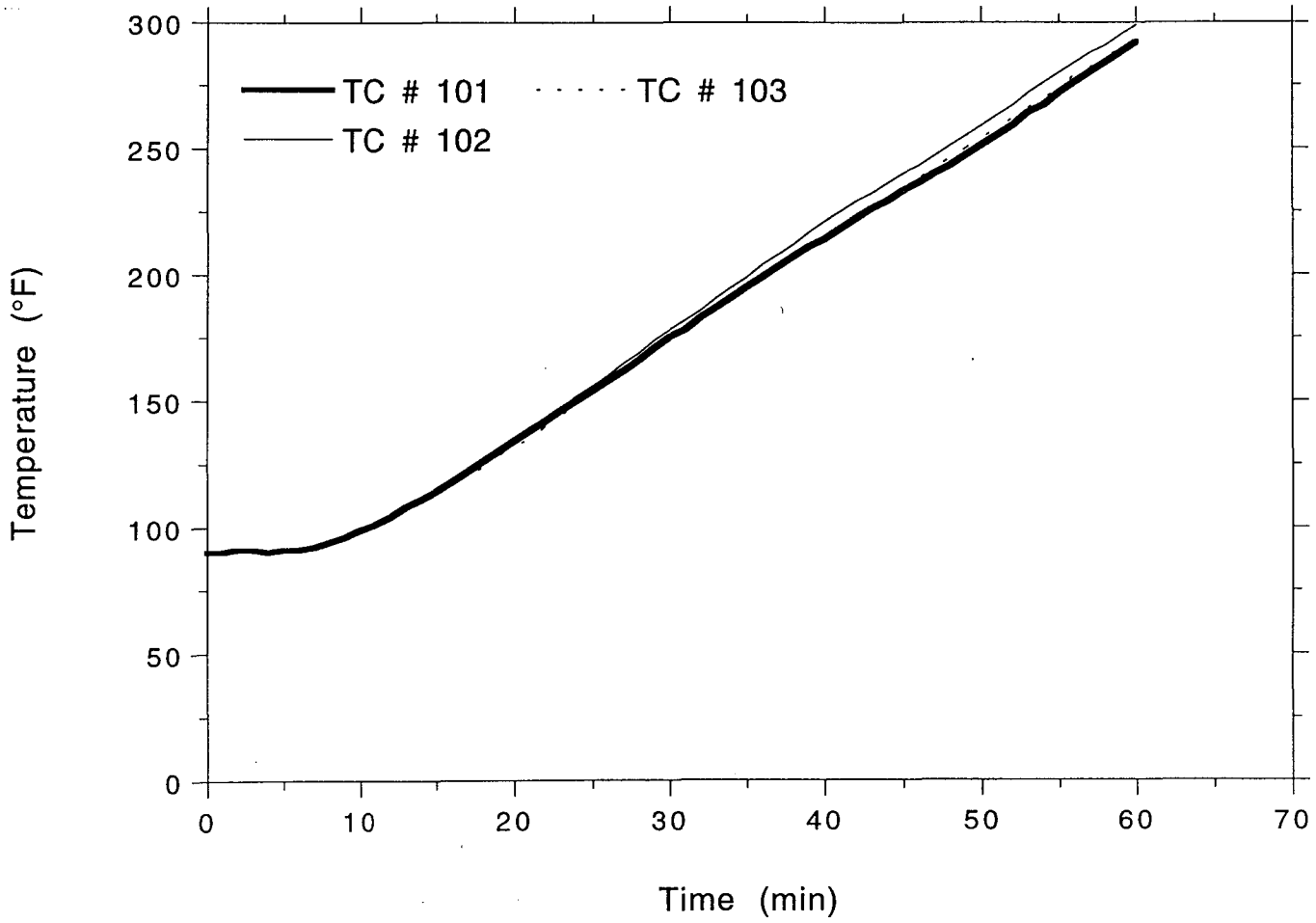
Tray Fitting, Right Side, #8 on Rungs



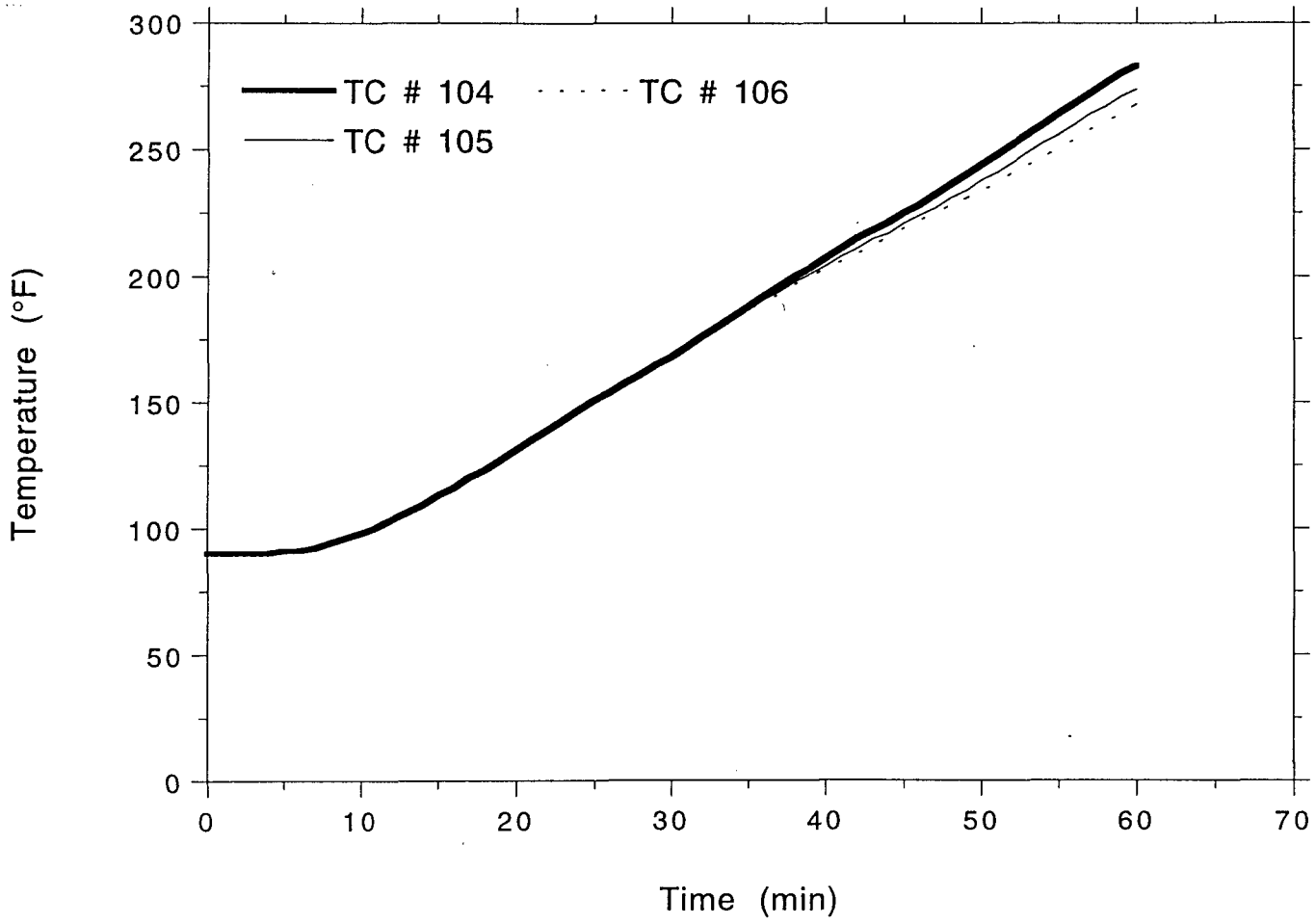
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Right Side, #8 on Rungs



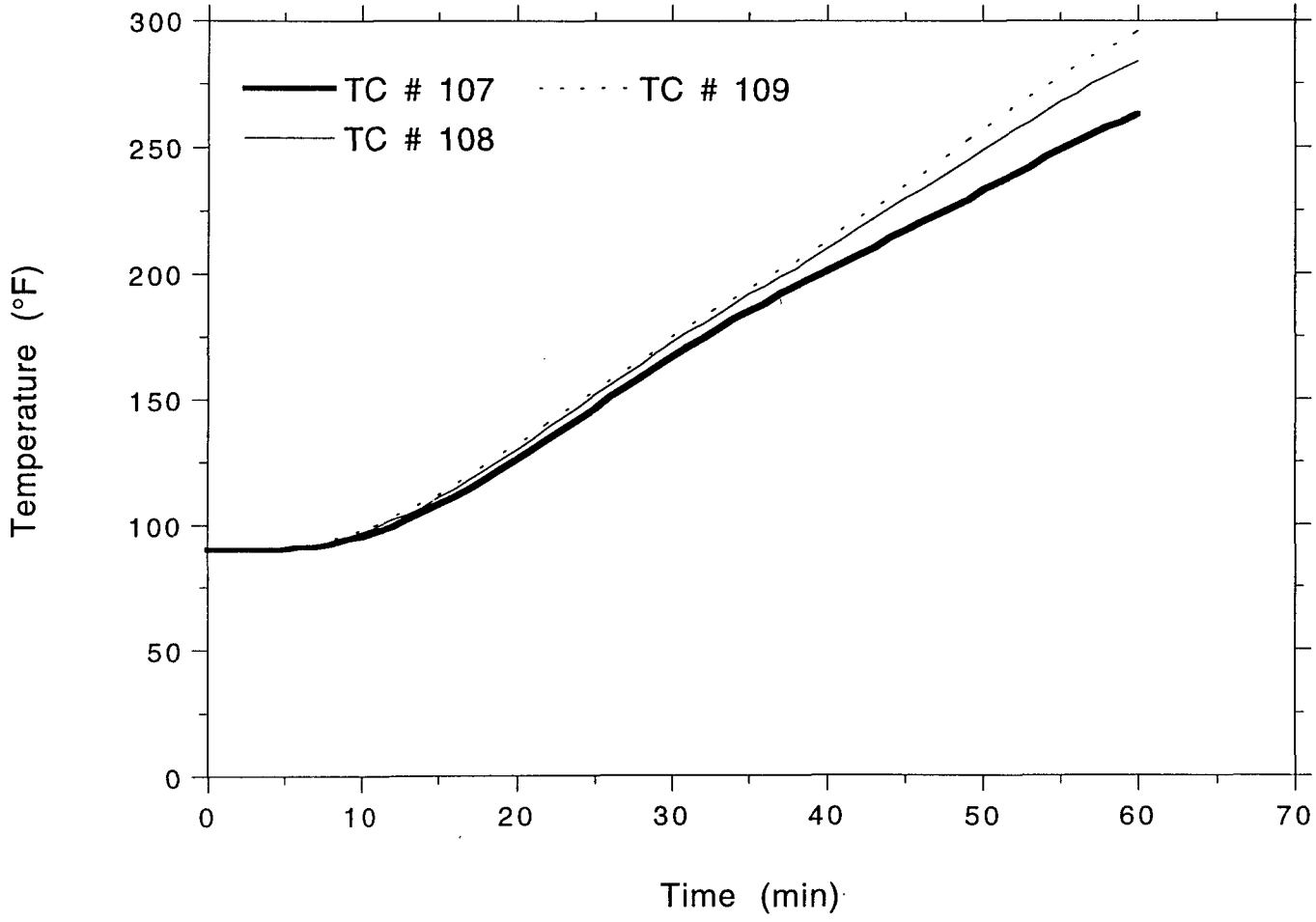
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Right Side, #8 on Rungs



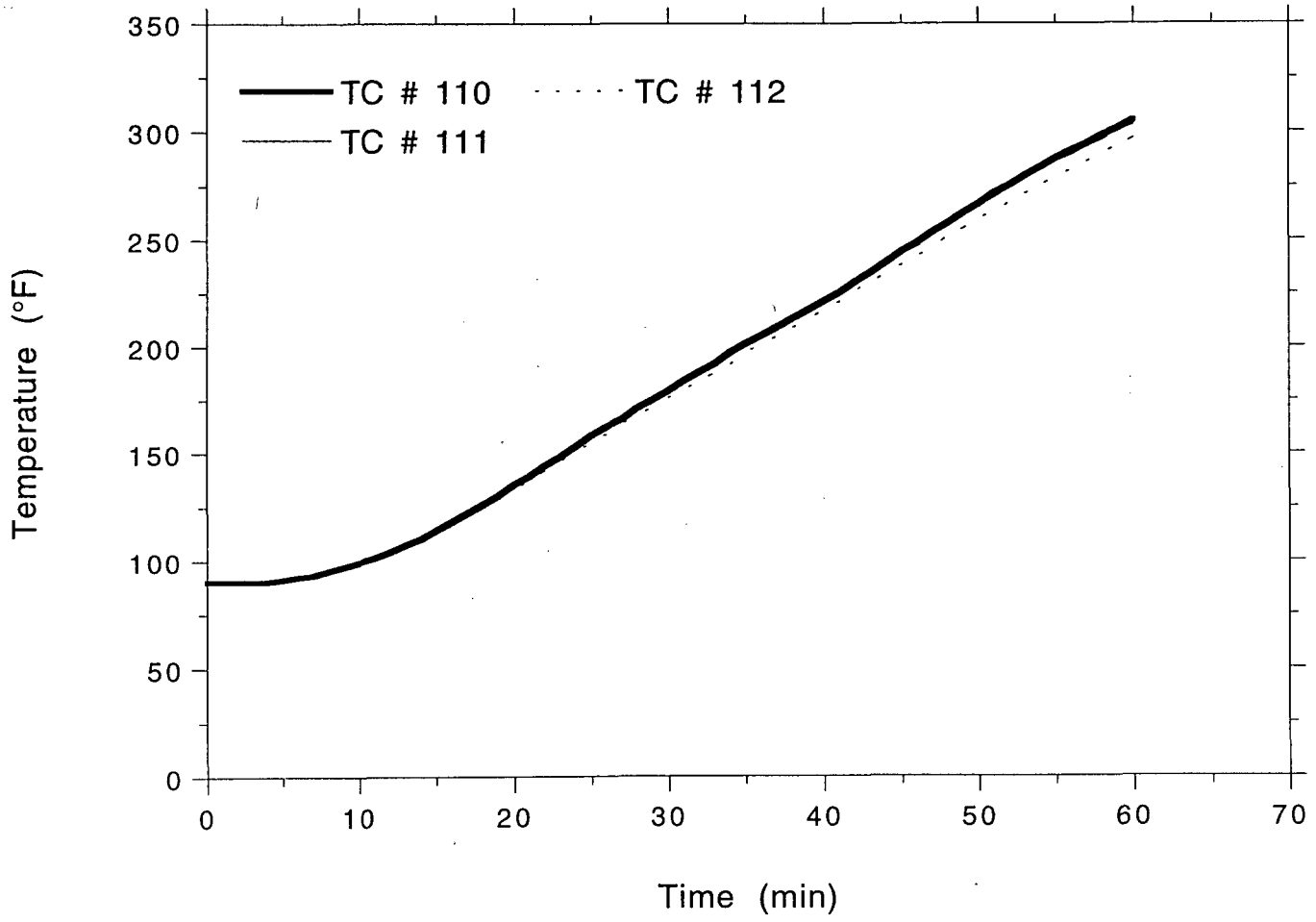
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Left Side, #8 on Rungs



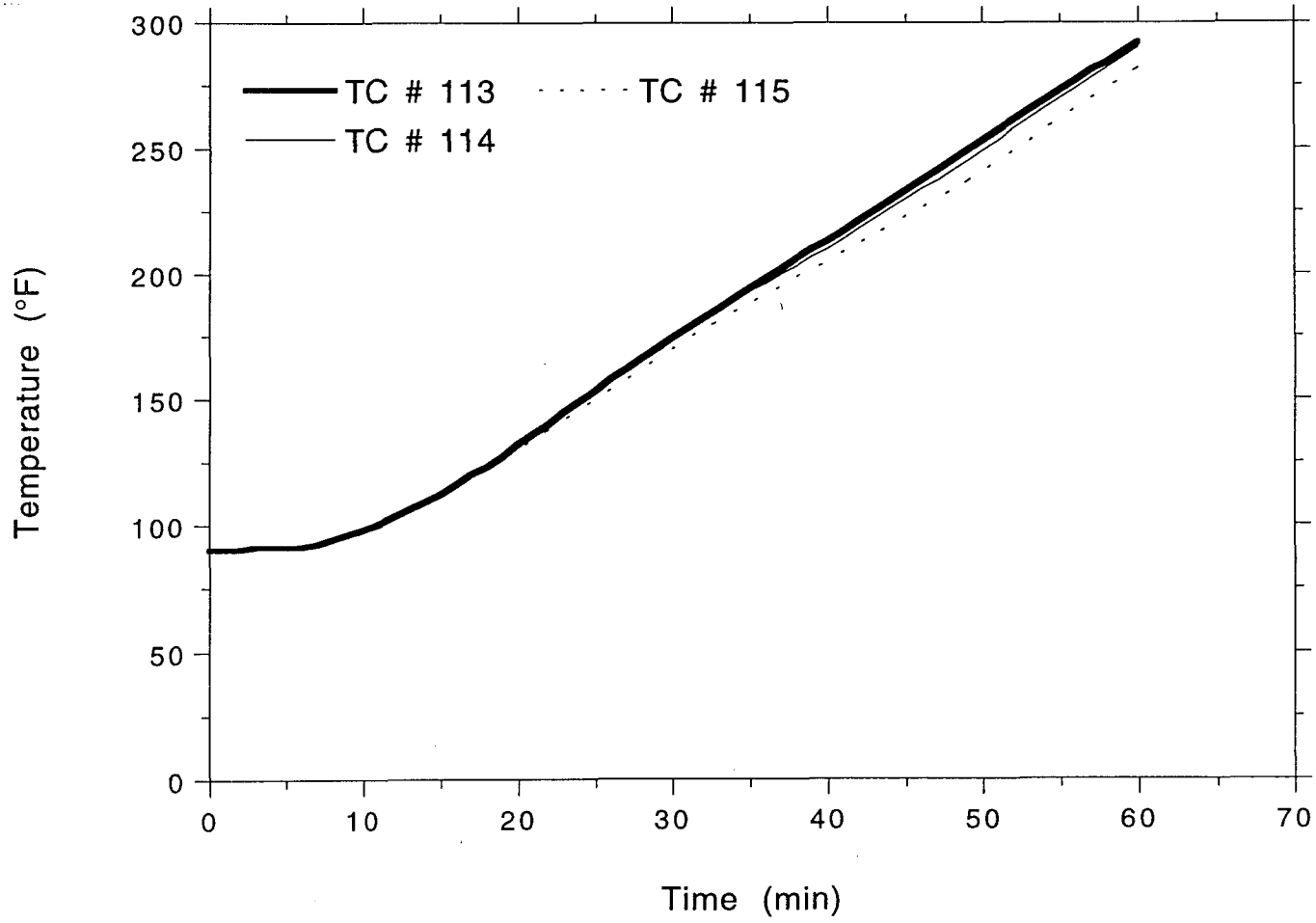
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Left Side, #8 on Rungs



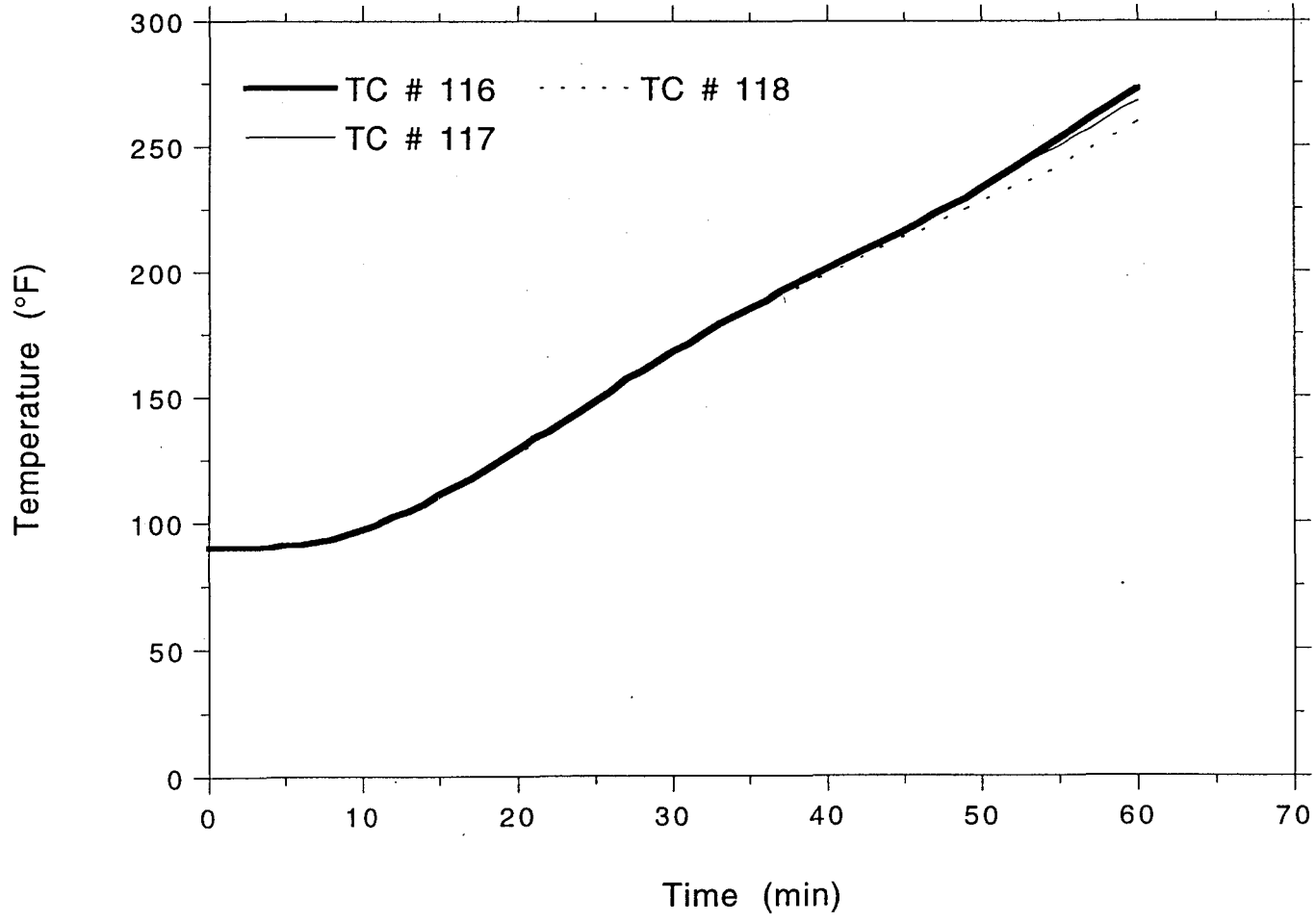
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Left Side, #8 on Rungs



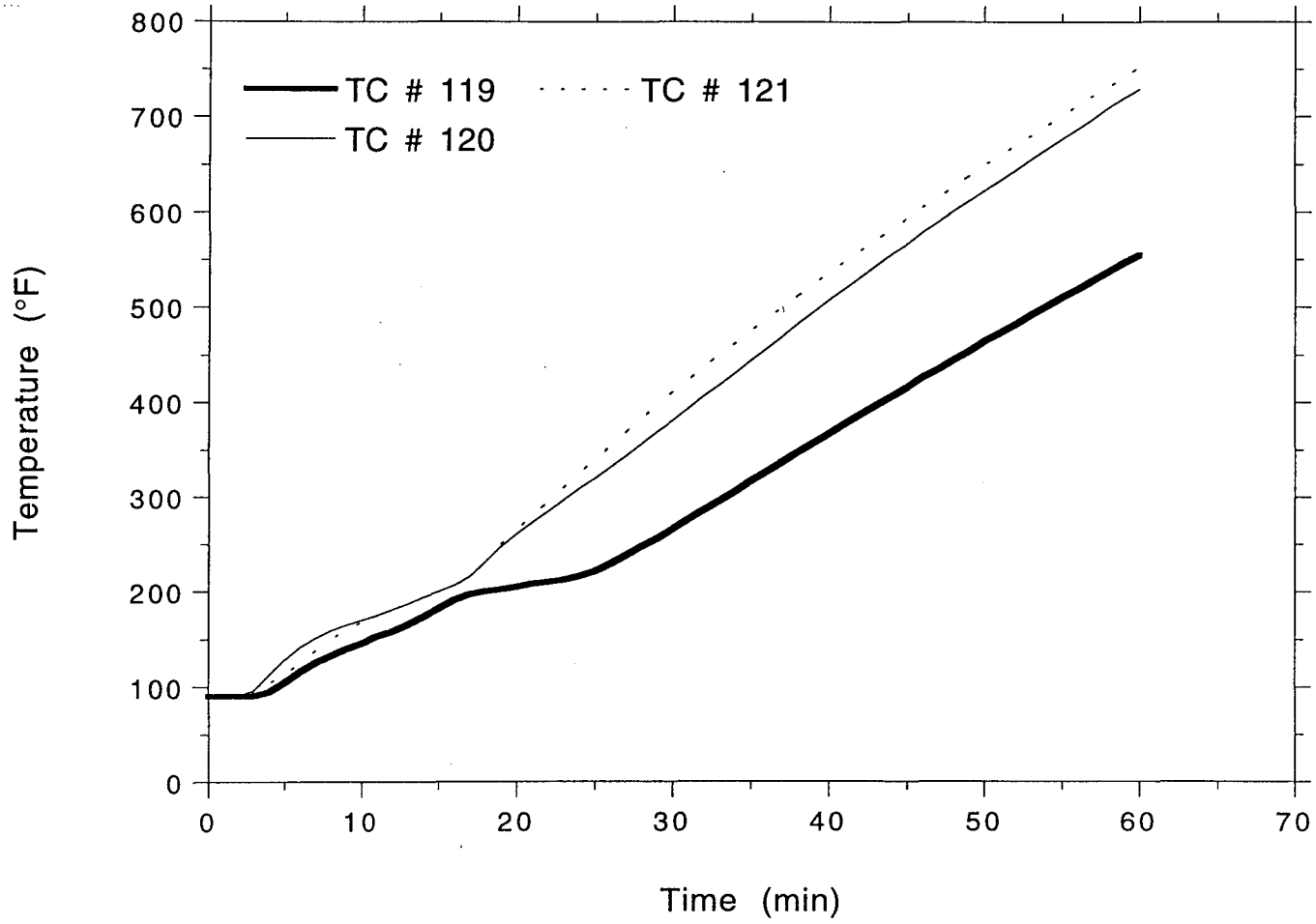
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Tray Fitting, Left Side, #8 on Rungs



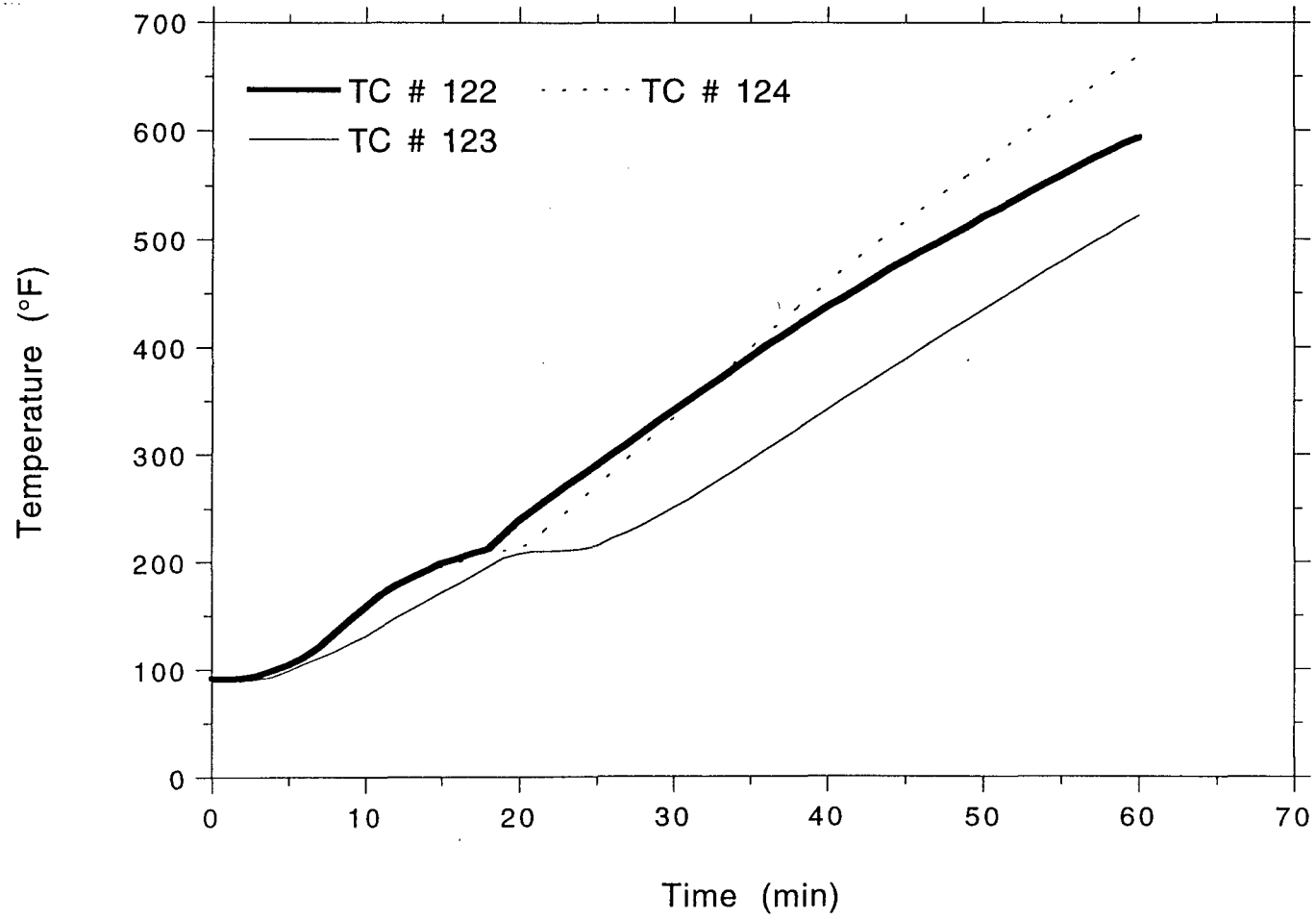
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



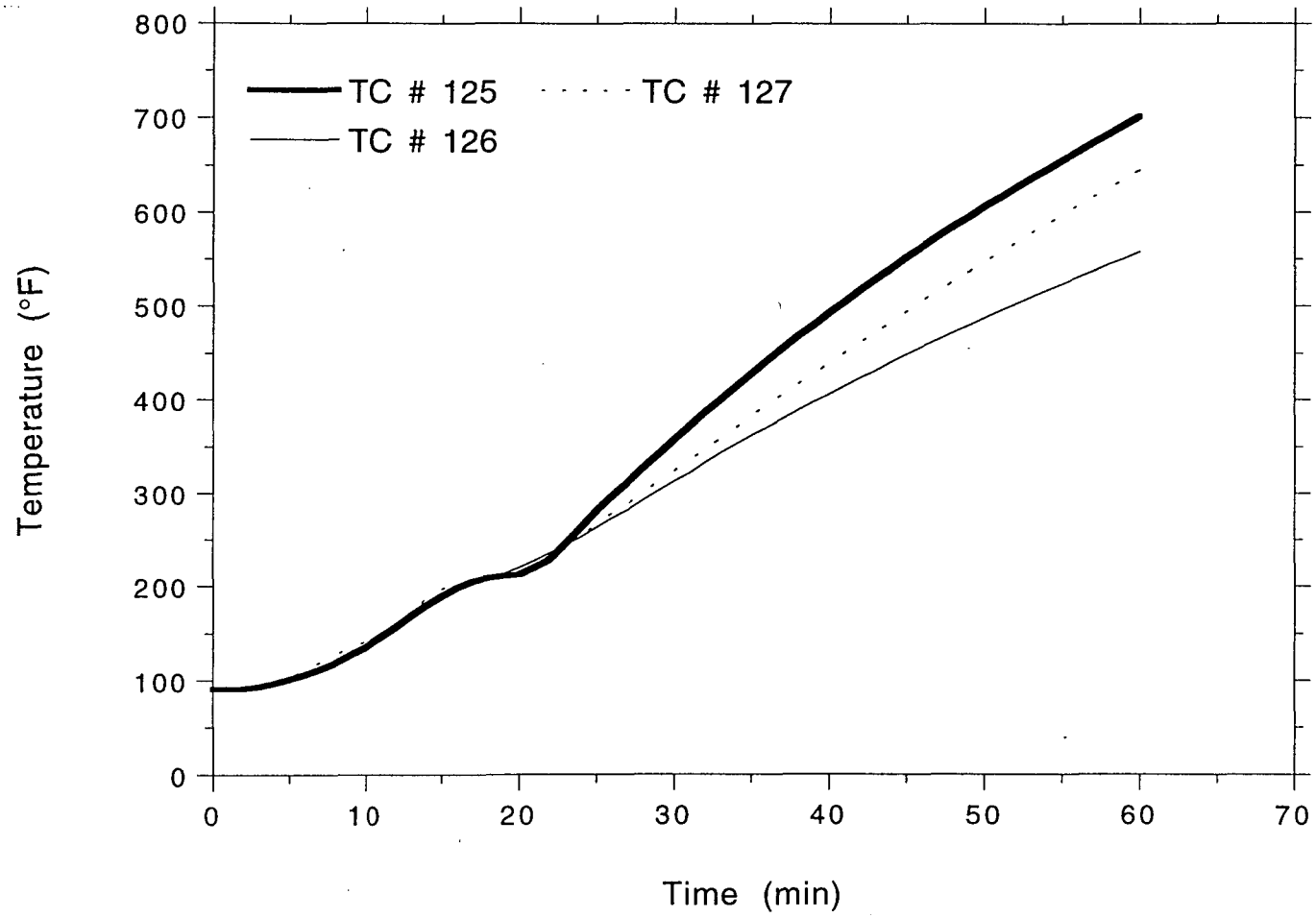
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



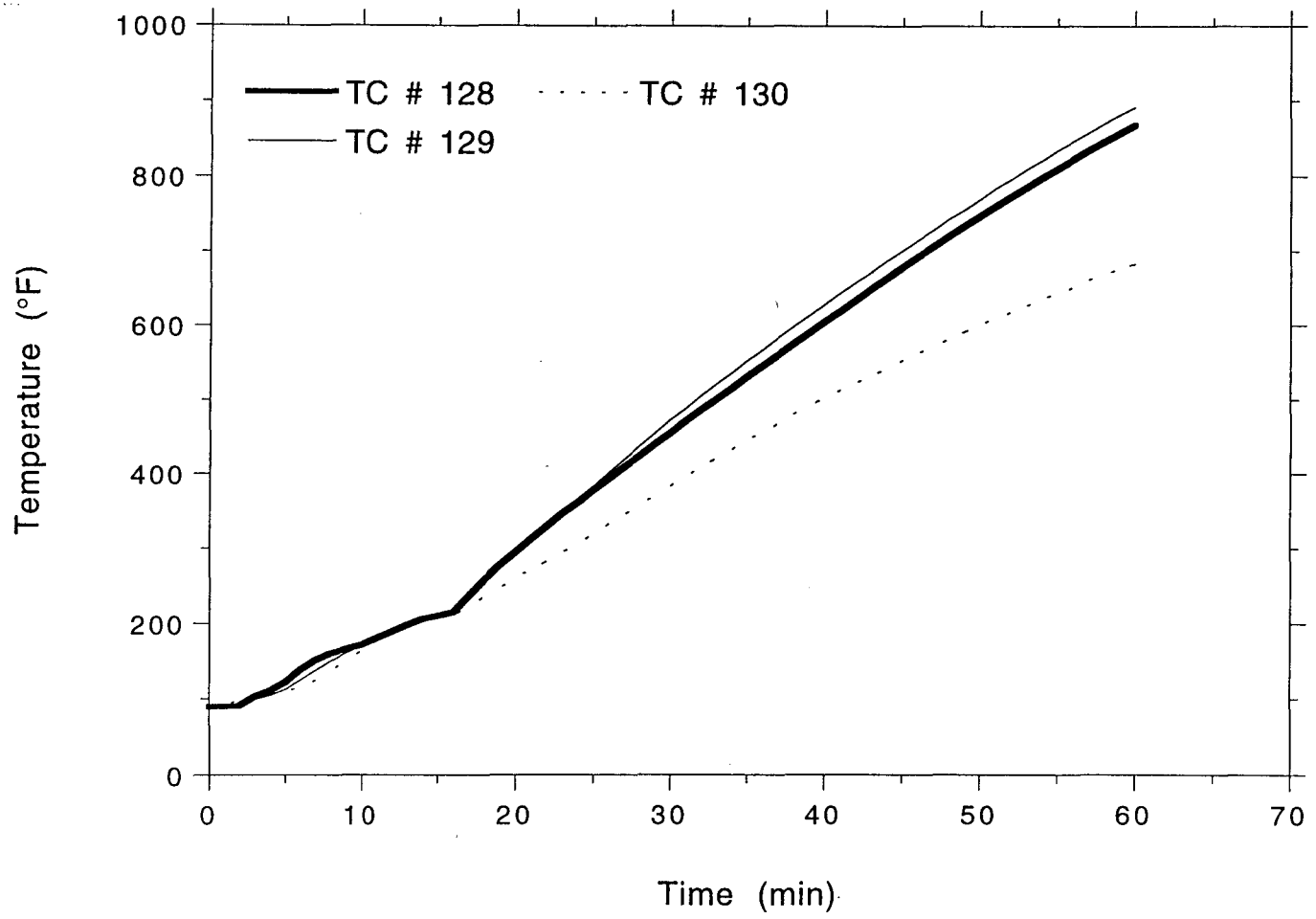
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



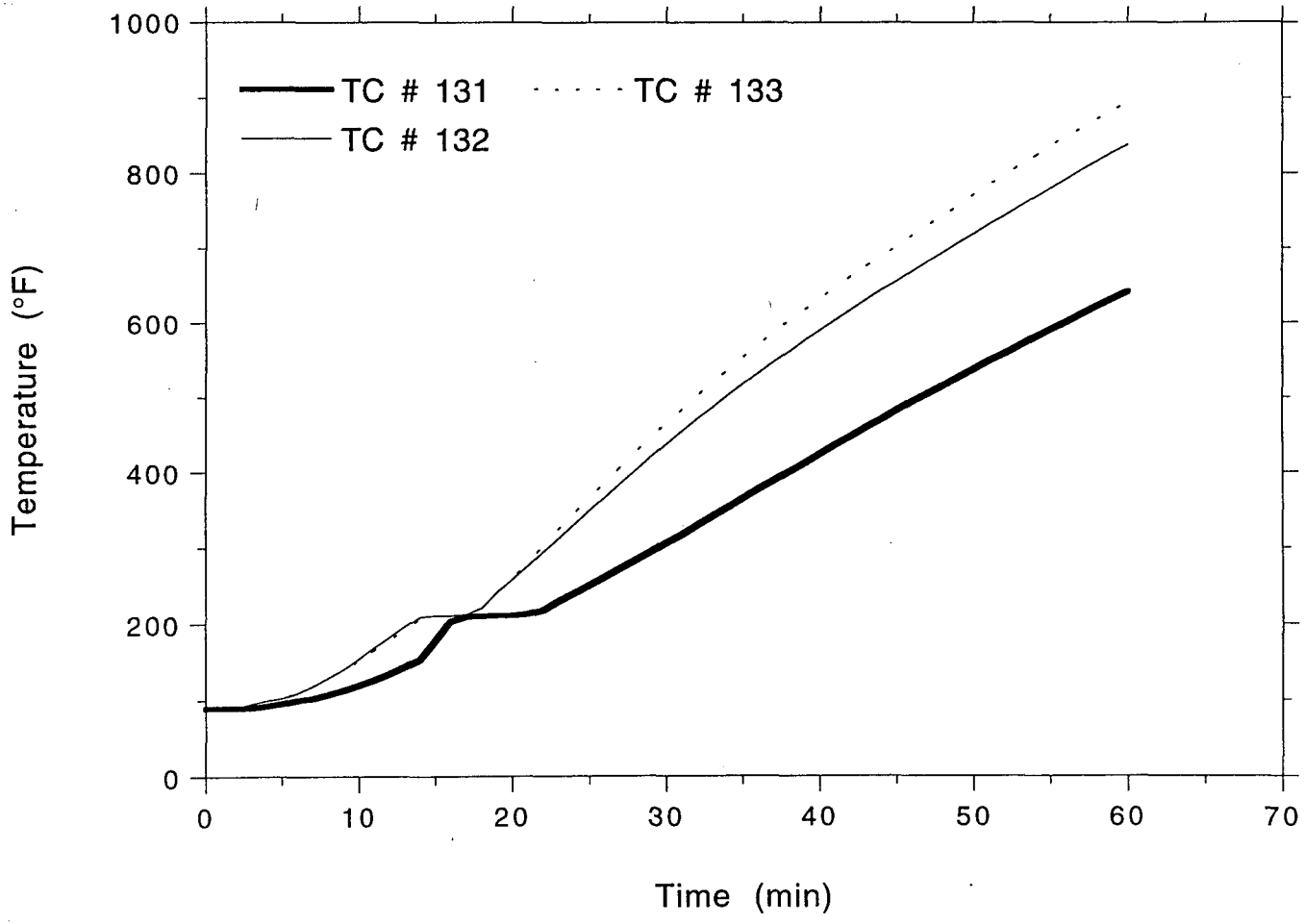
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



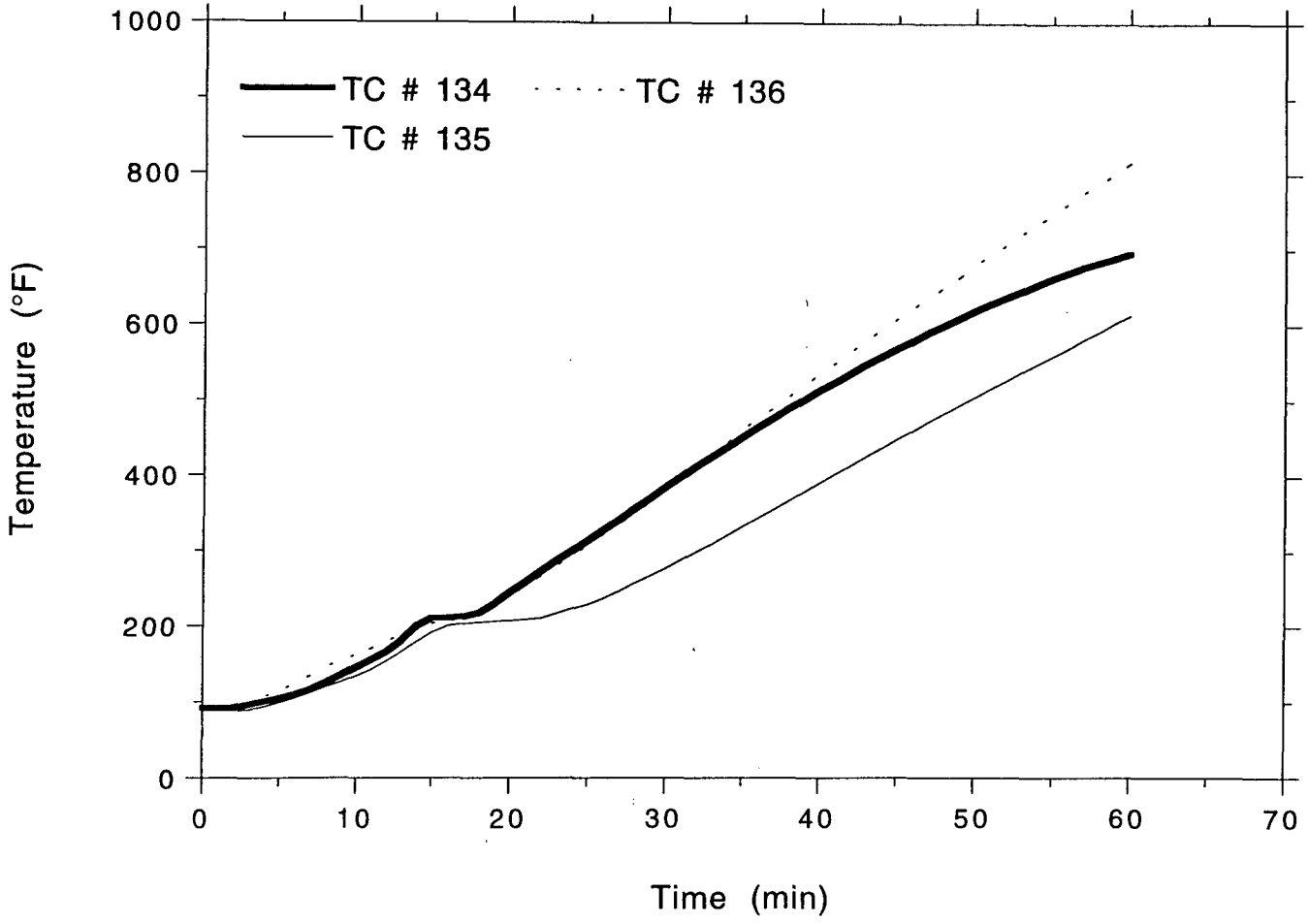
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



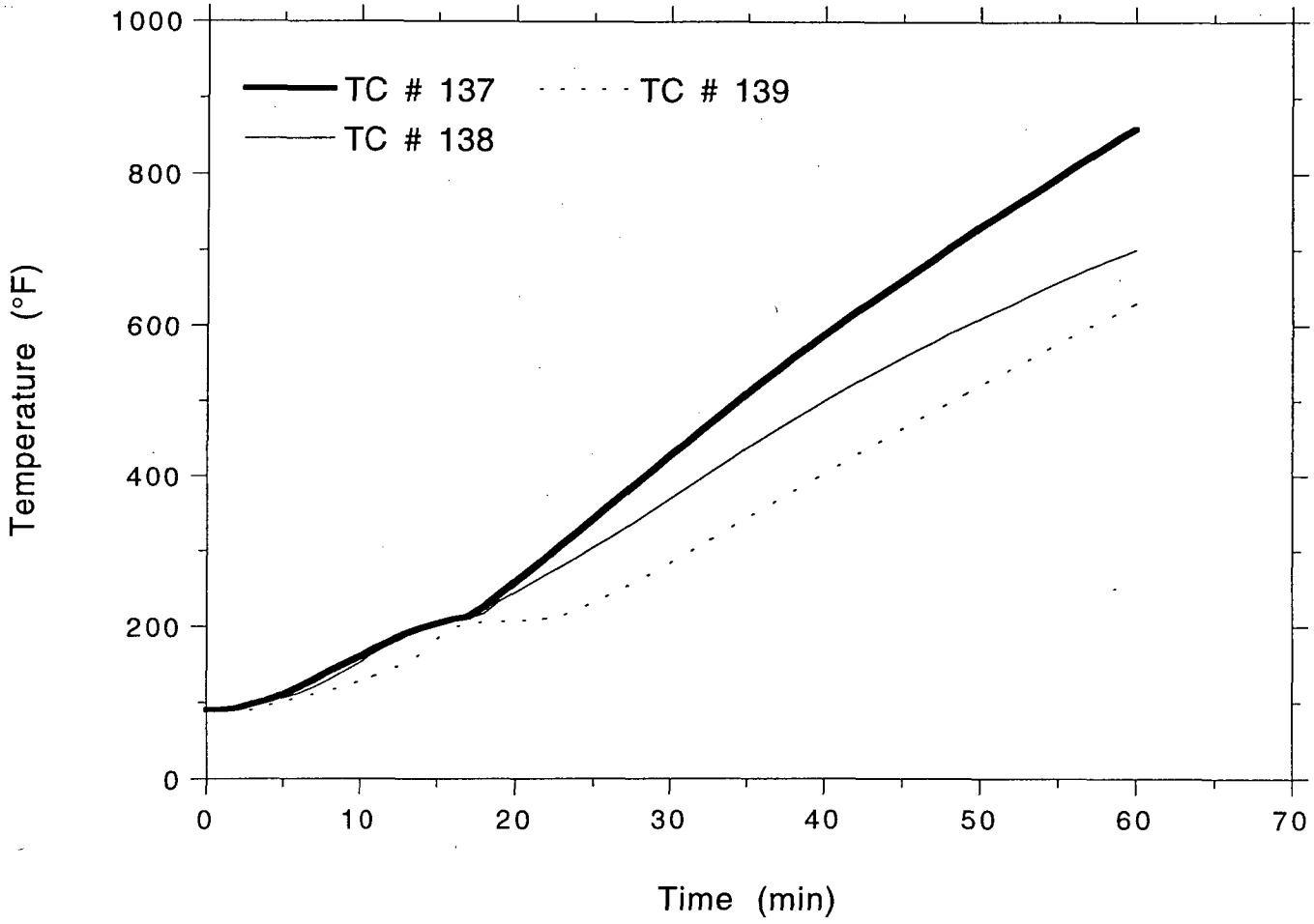
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



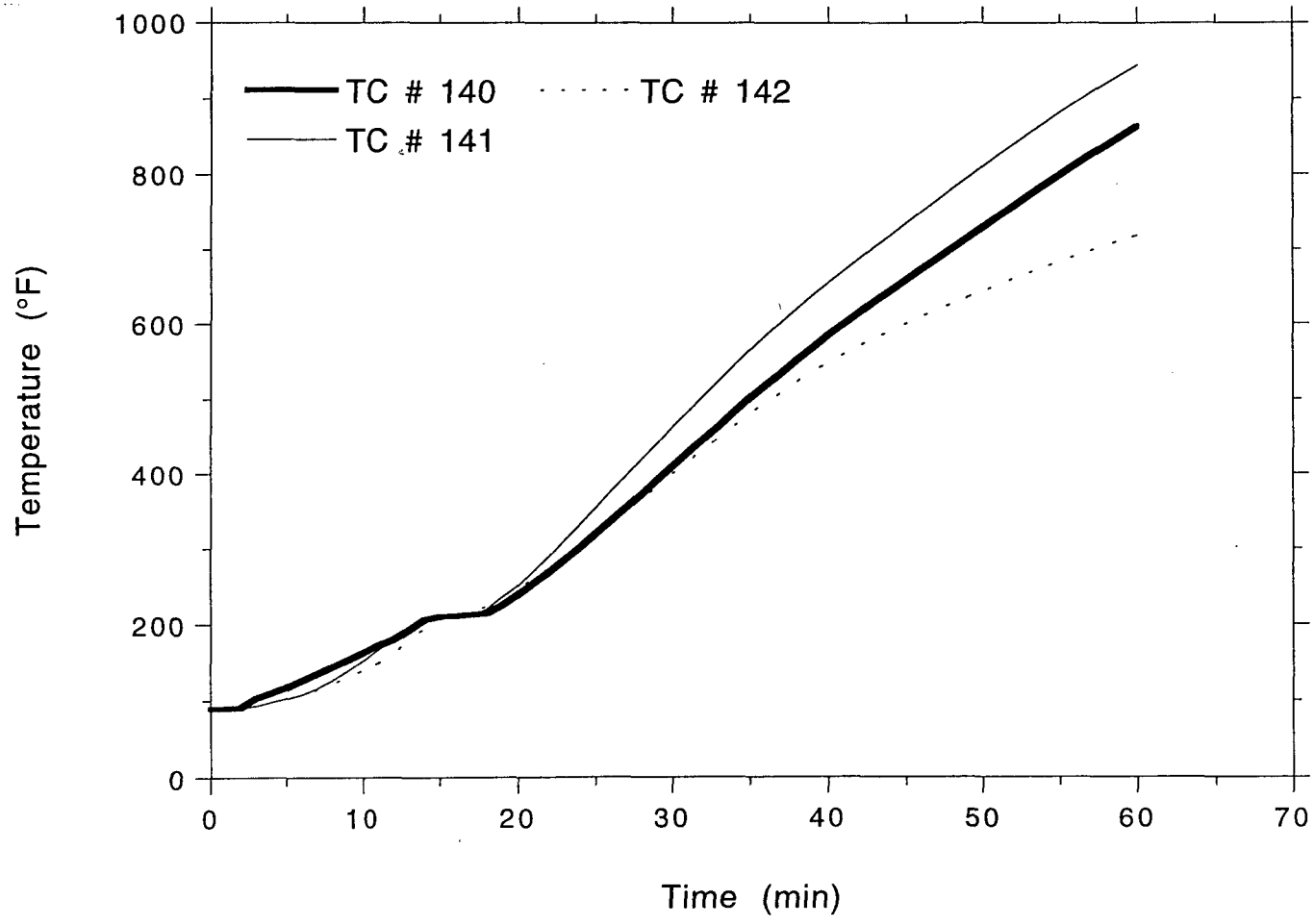
OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



OMEGA POINT LABORATORIES

TSI/TVA
Project No. 11960-97186
Steel Supports



OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	E119 Std (°F)	Furnace Avg (°F)	Front Tray Front Rail Max Temp (°F)	Front Tray Front Rail Avg Temp (°F)	Front Tray Bare #8 Max Temp (°F)	Front Tray Bare #8 Avg Temp (°F)	Front Tray Rear Rail Max Temp (°F)
0	68	88	90	90	91	90	90
1	254	159	90	90	91	90	90
2	440	402	90	90	91	90	90
3	627	812	90	90	91	90	90
4	813	1046	91	90	91	90	90
5	1000	1111	91	90	91	90	90
6	1060	1111	92	91	91	91	91
7	1120	1089	92	91	92	92	91
8	1180	1068	93	92	94	93	93
9	1240	1074	95	94	96	95	95
10	1300	1157	97	96	99	97	98
11	1327	1286	100	98	102	100	101
12	1346	1369	103	101	106	103	105
13	1364	1386	106	105	109	106	109
14	1380	1366	110	108	113	109	113
15	1395	1349	114	112	117	113	117
16	1410	1353	118	116	121	116	121
17	1423	1366	122	121	125	120	125
18	1436	1378	127	125	130	124	128
19	1448	1392	131	129	134	128	132
20	1459	1407	135	133	139	132	136
21	1470	1423	139	137	144	137	140
22	1480	1441	143	141	149	141	144
23	1490	1455	147	145	154	146	148
24	1499	1466	151	149	159	150	152
25	1508	1476	156	154	164	155	156
26	1517	1485	160	158	169	159	160
27	1525	1493	166	163	173	164	164
28	1533	1502	170	167	178	168	168
29	1541	1508	175	171	182	173	172
30	1548	1520	179	176	186	177	176
31	1555	1534	183	180	190	181	179
32	1562	1550	187	184	193	185	183
33	1569	1557	190	187	197	188	187
34	1576	1563	194	191	200	192	190
35	1582	1571	197	194	203	195	193
36	1588	1577	201	197	205	199	196
37	1594	1580	203	200	208	202	199
38	1600	1585	205	202	212	205	202
39	1606	1597	207	204	216	207	205

OMEGA POINT LABORATORIES

Time (min)	E119 Std (°F)	Furnace Avg (°F)	Front Tray Front Rail Max Temp (°F)	Front Tray Front Rail Avg Temp (°F)	Front Tray Bare #8 Max Temp (°F)	Front Tray Bare #8 Avg Temp (°F)	Front Tray Rear Rail Max Temp (°F)
40	1612	1604	210	206	220	211	208
41	1617	1608	211	207	225	214	211
42	1622	1612	212	208	229	218	213
43	1627	1619	213	210	234	221	216
44	1633	1625	214	210	239	224	219
45	1638	1630	214	211	244	228	223
46	1642	1631	215	212	249	231	226
47	1647	1636	216	213	254	235	230
48	1652	1641	217	214	259	239	234
49	1656	1644	219	215	264	242	238
50	1661	1648	221	216	268	246	242
51	1665	1654	223	218	273	250	247
52	1669	1658	225	219	277	254	252
53	1674	1664	228	221	282	259	256
54	1678	1665	230	223	286	263	261
55	1682	1671	232	225	290	267	266
56	1686	1677	235	227	293	271	271
57	1690	1677	238	229	297	276	277
58	1693	1675	240	231	301	280	282
59	1697	1681	243	233	304	284	287
60	1701	1689	246	236	308	288	292
Max Temp:			246	236	308	288	292
Max Allowed:			415	340	416	340	415

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	Front Tray Rear Rail Avg Temp (°F)	Rear Tray Front Rail Max Temp (°F)	Rear Tray Front Rail Avg Temp (°F)	Rear Tray Bare #8 Max Temp (°F)	Rear Tray Bare #8 Avg Temp (°F)	Rear Tray Rear Rail Max Temp (°F)
0	90	90	90	91	90	91
1	90	90	90	91	90	91
2	90	90	90	91	90	91
3	90	90	90	91	90	91
4	90	90	90	91	91	91
5	90	91	91	91	91	91
6	91	91	91	92	91	92
7	91	92	92	94	92	93
8	92	93	93	96	94	95
9	94	95	95	98	96	97
10	97	98	97	100	98	100
11	100	102	101	103	101	104
12	103	105	104	107	104	108
13	107	110	108	110	107	112
14	111	114	112	114	110	116
15	115	118	117	119	114	121
16	119	122	121	123	117	125
17	123	127	125	128	121	129
18	127	131	129	132	125	134
19	131	135	133	137	129	138
20	135	139	137	142	133	142
21	139	143	141	147	137	146
22	143	146	145	152	142	150
23	147	150	149	156	146	154
24	151	155	153	161	150	158
25	154	161	157	166	155	163
26	158	166	162	171	159	167
27	162	169	165	175	163	172
28	166	170	168	180	168	176
29	170	173	172	184	172	180
30	174	177	176	188	176	185
31	178	182	179	193	180	190
32	181	185	182	197	184	194
33	184	187	185	201	188	197
34	188	191	188	204	191	200
35	190	194	191	208	195	203
36	193	196	193	212	198	205
37	196	199	196	215	202	206
38	198	202	198	219	205	208
39	201	205	201	222	209	210

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	Front Tray Rear Rail Avg Temp (°F)	Rear Tray Front Rail Max Temp (°F)	Rear Tray Front Rail Avg Temp (°F)	Rear Tray Bare #8 Max Temp (°F)	Rear Tray Bare #8 Avg Temp (°F)	Rear Tray Rear Rail Max Temp (°F)
40	203	208	203	225	212	211
41	205	210	205	229	215	213
42	207	213	207	232	218	215
43	209	217	210	236	221	217
44	211	220	213	240	225	218
45	214	224	215	245	229	220
46	216	228	218	248	233	221
47	219	232	222	252	236	223
48	222	236	225	257	240	225
49	226	241	229	262	245	227
50	229	245	232	267	249	229
51	233	250	236	273	253	231
52	236	255	240	278	258	234
53	240	260	245	284	262	236
54	244	265	249	290	267	239
55	248	271	253	296	271	242
56	253	276	258	301	275	245
57	257	282	262	307	279	248
58	262	287	267	312	284	251
59	266	292	272	317	287	255
60	271	298	276	321	291	258
Max Temp:	271	298	276	321	291	258
Max Allowed:	340	415	340	416	340	416

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	Rear Tray Rear Rail Avg Temp (°F)	Cross Front Rail Max Temp (°F)	Cross Front Rail Avg Temp (°F)	Cross Rear Rail Max Temp (°F)	Cross Rear Rail Avg Temp (°F)	Cross Right Rail Max Temp (°F)
0	91	91	90	91	91	91
1	91	91	90	91	91	91
2	91	91	90	91	91	90
3	91	90	90	91	91	90
4	91	91	90	91	91	91
5	91	91	91	91	91	91
6	91	91	91	92	92	91
7	92	92	91	93	92	92
8	94	93	92	95	93	94
9	96	95	94	97	95	97
10	99	98	96	99	97	100
11	102	101	98	103	100	103
12	105	105	101	107	103	106
13	109	109	105	112	107	110
14	113	113	109	116	111	115
15	117	117	112	121	115	119
16	121	122	117	127	119	123
17	126	126	121	133	124	127
18	130	132	126	138	128	131
19	134	138	131	144	133	135
20	138	143	135	149	137	139
21	143	148	140	154	142	143
22	147	153	144	158	146	147
23	151	157	149	162	150	151
24	155	162	153	165	154	155
25	159	166	157	169	158	158
26	163	171	161	172	162	162
27	167	174	165	176	166	166
28	171	178	169	179	170	169
29	175	181	173	182	174	173
30	179	183	176	185	177	176
31	184	186	180	187	181	179
32	188	189	183	190	184	182
33	191	191	186	193	187	185
34	194	194	189	196	190	188
35	197	197	192	199	193	190
36	200	199	194	202	195	193
37	202	202	197	204	198	195
38	205	204	199	206	200	197
39	207	206	201	207	202	199

OMEGA POINT LABORATORIES

Time (min)	Rear Tray Rear Rail Avg Temp (°F)	Cross Front Rail Max Temp (°F)	Cross Front Rail Avg Temp (°F)	Cross Rear Rail Max Temp (°F)	Cross Rear Rail Avg Temp (°F)	Cross Right Rail Max Temp (°F)
40	209	208	204	209	204	201
41	211	210	206	210	205	202
42	212	212	208	212	207	203
43	214	214	210	213	208	205
44	215	216	212	214	210	207
45	216	219	213	216	211	209
46	217	221	214	218	212	212
47	219	223	216	219	214	215
48	220	226	218	221	215	218
49	222	228	220	222	216	222
50	224	231	222	224	218	226
51	226	234	224	226	219	229
52	228	236	226	228	221	232
53	230	239	229	230	223	237
54	232	242	231	232	224	241
55	234	245	233	234	226	246
56	237	248	236	237	228	250
57	239	252	238	240	230	255
58	242	255	241	243	233	259
59	245	259	244	246	235	263
60	248	262	246	249	237	267
Max Temp:	248	262	246	249	237	267
Max Allowed:	341	416	340	416	341	416

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	Cross Right Rail Avg Temp (°F)	Cross Left Rail Max Temp (°F)	Cross Left Rail Avg Temp (°F)	Cross #8 AWG Right Side Max Temp (°F)	Cross #8 AWG Right Side Avg Temp (°F)
0	91	91	91	91	90
1	90	91	91	91	90
2	90	91	91	91	91
3	90	91	91	91	91
4	91	91	91	91	91
5	91	91	91	91	91
6	91	91	91	92	91
7	92	92	92	93	92
8	94	94	93	95	94
9	96	96	96	97	96
10	99	99	98	99	98
11	102	102	102	102	101
12	106	106	105	105	103
13	109	110	109	108	106
14	113	114	113	111	110
15	117	118	117	115	113
16	121	122	121	118	117
17	126	126	124	123	120
18	130	129	128	127	124
19	134	133	132	132	128
20	138	137	136	136	133
21	142	141	139	141	137
22	146	145	143	145	141
23	150	149	147	150	145
24	154	152	151	154	150
25	157	156	155	159	154
26	161	160	159	163	158
27	165	164	163	168	162
28	169	167	167	172	166
29	172	171	170	176	170
30	175	174	174	180	174
31	179	177	177	184	178
32	182	181	180	188	181
33	185	184	184	192	185
34	188	187	187	196	189
35	190	190	189	200	193
36	193	192	192	204	197
37	195	195	194	208	201
38	197	197	197	212	204
39	199	199	199	217	208

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	Cross Right Rail Avg Temp (°F)	Cross Left Rail Max Temp (°F)	Cross Left Rail Avg Temp (°F)	Cross #8 AWG Right Side Max Temp (°F)	Cross #8 AWG Right Side Avg Temp (°F)
40	200	201	201	221	212
41	202	203	202	225	215
42	203	204	203	229	219
43	204	204	203	233	222
44	206	206	205	237	226
45	208	209	208	241	229
46	210	214	213	244	233
47	213	221	218	248	236
48	216	227	223	251	240
49	220	232	228	255	243
50	223	236	232	259	247
51	226	241	236	264	251
52	229	245	240	268	255
53	233	249	243	273	259
54	237	253	246	277	263
55	241	256	249	282	267
56	245	260	252	286	271
57	249	263	255	290	275
58	254	266	259	294	279
59	258	268	262	298	282
60	263	271	265	301	286
Max Temp:	263	271	265	301	286
Max Allowed:	341	416	341	416	340

OMEGA POINT LABORATORIES

Time (min)	Cross #8 AWG Left Side Max Temp (°F)	Cross #8 AWG Left Side Avg Temp (°F)	Clad Sup-ports Max Temp (°F)	Clad Sup-ports Avg Temp (°F)	TC # 1 (°F)	TC # 2 (°F)	TC # 3 (°F)
0	91	90	92	91	90	90	90
1	91	90	92	91	90	90	90
2	91	90	98	91	90	90	90
3	91	90	103	95	90	90	90
4	91	90	112	100	90	90	91
5	91	91	128	107	90	90	91
6	92	91	141	114	90	91	92
7	93	92	151	123	91	91	92
8	95	94	160	132	92	92	93
9	97	95	166	141	93	93	95
10	99	97	172	151	94	95	97
11	101	100	180	160	97	97	100
12	104	102	189	170	100	100	103
13	107	105	198	181	103	103	106
14	111	108	210	191	106	107	110
15	114	112	212	199	110	110	114
16	118	115	216	205	114	114	118
17	122	119	237	211	118	118	122
18	126	123	259	219	122	122	127
19	131	127	277	230	126	126	131
20	135	131	295	240	130	131	135
21	140	135	312	251	134	134	139
22	144	139	329	263	139	138	143
23	149	143	347	275	143	142	147
24	154	148	366	288	148	146	151
25	158	152	384	301	153	151	156
26	162	156	402	315	157	155	160
27	167	160	420	329	162	159	164
28	171	165	438	343	166	164	169
29	176	169	456	357	170	168	173
30	180	173	473	371	174	173	177
31	184	177	489	385	178	177	181
32	188	180	506	399	181	181	185
33	192	184	525	412	184	185	189
34	197	188	545	426	188	188	192
35	201	192	565	440	191	191	196
36	205	195	584	453	194	194	199
37	209	199	603	466	196	196	203
38	214	202	621	479	199	199	205
39	218	206	639	492	200	201	207

Time (min)	Cross #8 AWG Left Side Max Temp (°F)	Cross #8 AWG Left Side Avg Temp (°F)	Clad Sup-ports Max Temp (°F)	Clad Sup-ports Avg Temp (°F)	TC # 1 (°F)	TC # 2 (°F)	TC # 3 (°F)
40	222	209	656	504	202	202	210
41	226	213	672	516	204	204	211
42	230	217	688	528	205	205	212
43	235	221	704	540	207	206	212
44	239	224	719	552	208	207	213
45	244	228	735	564	209	207	214
46	248	232	750	575	208	207	215
47	253	236	766	587	209	209	216
48	257	239	781	598	210	210	217
49	262	243	796	610	211	211	219
50	266	247	811	621	212	212	221
51	271	251	826	632	213	213	223
52	275	255	840	643	214	214	225
53	279	259	854	653	214	215	228
54	283	263	868	664	215	217	230
55	287	266	882	674	216	218	232
56	291	270	895	685	218	219	235
57	294	274	908	695	219	221	238
58	298	277	920	705	221	222	240
59	301	281	932	715	223	225	243
60	305	284	944	724	225	227	246
Max Temp:	305	284	944	724	225	227	246
Max Allowed:	416	340	417	341	415	415	415

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 4 (°F)	TC # 5 (°F)	TC # 6 (°F)	TC # 7 (°F)	TC # 8 (°F)	TC # 9 (°F)	TC # 10 (°F)	TC # 11 (°F)	TC # 12 (°F)
0	90	90	90	90	90	90	90	90	91
1	90	90	90	90	90	90	90	90	91
2	90	90	90	90	90	90	90	90	90
3	90	90	90	90	90	90	90	90	90
4	90	90	90	90	90	90	90	90	91
5	90	90	90	90	90	91	91	91	91
6	91	91	91	91	91	91	91	91	91
7	92	91	91	91	91	91	92	91	91
8	93	92	92	92	92	93	93	92	92
9	94	94	94	94	94	95	95	94	94
10	96	96	96	96	95	97	97	96	95
11	99	99	99	99	98	100	100	98	98
12	102	102	102	102	101	103	103	101	100
13	105	105	106	105	104	107	107	104	104
14	109	109	110	109	108	111	111	108	107
15	113	113	114	113	112	115	115	112	111
16	117	117	118	118	116	119	120	116	115
17	121	121	122	122	121	124	124	120	119
18	125	125	126	126	125	128	129	125	123
19	129	129	130	131	130	133	133	129	128
20	133	133	134	135	135	138	138	134	132
21	137	138	138	139	140	142	142	138	136
22	141	142	142	143	144	147	146	143	141
23	145	146	146	147	149	151	150	147	145
24	149	150	150	151	153	156	153	152	149
25	153	154	154	155	157	160	158	156	153
26	157	158	160	159	161	163	162	159	157
27	161	163	166	164	165	167	166	164	161
28	165	167	170	168	169	171	170	167	165
29	169	172	175	173	172	175	174	171	168
30	173	176	179	177	176	178	178	174	172
31	177	180	183	181	179	182	182	177	175
32	182	184	187	185	183	185	185	180	179
33	186	188	190	188	186	188	188	183	182
34	189	192	194	192	189	191	191	186	185
35	192	197	197	196	192	193	193	189	187
36	195	201	200	199	195	196	196	192	190
37	197	203	203	201	198	198	199	194	193
38	200	205	205	204	200	200	201	197	195
39	202	206	207	207	202	202	203	199	198

OMEGA POINT LABORATORIES

Time (min)	TC # 4 (°F)	TC # 5 (°F)	TC # 6 (°F)	TC # 7 (°F)	TC # 8 (°F)	TC # 9 (°F)	TC # 10 (°F)	TC # 11 (°F)	TC # 12 (°F)
40	204	207	208	208	204	204	206	202	200
41	206	208	210	208	206	206	208	204	202
42	207	210	211	209	208	208	210	206	204
43	209	210	213	210	210	210	212	208	206
44	210	211	214	211	211	212	214	210	209
45	211	211	214	212	212	214	216	212	210
46	211	212	215	214	213	216	218	214	209
47	212	214	216	215	214	218	220	216	210
48	212	216	216	216	215	220	223	218	212
49	213	218	217	217	216	222	225	219	214
50	214	219	218	218	217	224	227	221	216
51	215	221	220	220	218	226	229	223	218
52	217	223	221	221	219	228	231	225	220
53	218	225	223	223	220	230	234	227	222
54	220	228	225	225	221	233	236	229	223
55	222	230	227	227	223	235	239	231	225
56	223	232	230	229	224	237	241	233	227
57	226	234	232	231	226	239	244	236	230
58	228	236	235	233	228	241	247	238	232
59	230	239	237	236	229	244	249	241	235
60	233	241	240	238	231	246	252	243	239
Max Temp:	233	241	240	238	231	246	252	243	239
Max Allowed:	415	415	415	415	415	415	415	415	416

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 13 (°F)	TC # 14 (°F)	TC # 15 (°F)	TC # 16 (°F)	TC # 17 (°F)	TC # 18 (°F)	TC # 19 (°F)	TC # 20 (°F)
0	91	91	90	91	91	90	90	90
1	91	90	90	91	90	90	90	90
2	91	90	90	91	90	90	90	90
3	90	90	90	90	90	90	90	90
4	91	90	90	90	90	90	90	90
5	91	91	90	91	91	90	90	90
6	91	91	91	91	91	91	91	91
7	91	91	91	91	92	91	91	91
8	92	92	92	92	93	92	92	92
9	93	93	93	94	95	94	93	94
10	95	95	95	96	98	96	95	96
11	97	97	97	99	101	99	98	99
12	99	100	100	102	105	102	102	102
13	102	103	103	105	109	106	105	105
14	105	106	107	109	113	110	109	109
15	108	109	111	113	117	115	113	113
16	112	113	115	117	122	120	117	118
17	116	117	120	122	126	126	121	122
18	120	121	124	126	131	132	126	126
19	124	125	129	131	135	138	130	130
20	128	130	134	136	140	143	134	134
21	132	134	138	141	145	148	137	138
22	137	139	142	145	149	153	141	142
23	141	143	147	149	154	157	145	145
24	146	148	151	153	159	162	149	149
25	150	152	154	157	163	166	152	153
26	155	156	158	162	167	171	156	157
27	159	160	162	166	171	174	160	161
28	163	164	166	171	175	178	164	165
29	167	167	170	175	179	181	168	169
30	171	171	174	179	182	183	173	173
31	175	175	178	182	185	186	178	177
32	179	178	182	186	188	189	181	180
33	182	182	185	189	191	191	184	183
34	185	185	188	192	194	193	187	186
35	188	188	191	195	197	196	190	189
36	191	191	194	197	199	198	193	192
37	193	193	196	200	202	200	196	195
38	195	196	199	203	204	202	198	197
39	196	198	201	205	206	204	200	199

OMEGA POINT LABORATORIES

Time (min)	TC # 13 (°F)	TC # 14 (°F)	TC # 15 (°F)	TC # 16 (°F)	TC # 17 (°F)	TC # 18 (°F)	TC # 19 (°F)	TC # 20 (°F)
40	198	200	204	208	208	206	201	201
41	201	202	207	210	210	207	203	203
42	204	204	209	211	212	209	204	204
43	207	207	211	213	214	211	205	205
44	209	209	212	214	216	213	206	206
45	210	211	213	216	219	214	207	207
46	209	209	214	218	221	216	209	209
47	208	210	216	221	223	217	210	211
48	209	213	217	223	226	218	212	214
49	211	216	219	225	228	220	214	216
50	214	220	221	227	231	221	216	219
51	219	223	222	230	234	223	218	223
52	223	226	224	232	236	225	221	226
53	227	230	226	234	239	227	224	230
54	230	233	228	237	242	229	227	234
55	233	236	230	239	245	232	229	238
56	237	239	232	241	248	234	232	242
57	240	242	234	244	252	237	236	245
58	242	245	236	246	255	240	240	250
59	245	248	238	248	259	244	244	254
60	248	251	240	251	262	247	248	258
Max Temp:	248	251	240	251	262	247	248	258
Max Allowed:	416	416	415	416	416	415	415	415

OMEGA POINT LABORATORIES

Time (min)	TC # 21 (°F)	TC # 22 (°F)	TC # 23 (°F)	TC # 24 (°F)	TC # 25 (°F)	TC # 26 (°F)	TC # 27 (°F)	TC # 28 (°F)
0	90	90	90	90	90	90	91	90
1	90	90	90	90	90	90	91	90
2	90	90	90	90	90	90	90	90
3	90	90	90	90	90	90	90	90
4	90	90	90	90	90	90	91	90
5	90	90	90	90	90	91	91	90
6	91	91	91	91	91	91	91	91
7	91	91	91	91	91	92	92	91
8	92	92	93	92	93	94	94	92
9	94	94	95	94	94	97	96	94
10	96	97	98	97	97	100	99	96
11	99	100	101	100	100	103	103	99
12	103	103	105	104	104	106	106	103
13	107	107	109	107	108	110	110	107
14	111	111	113	111	111	113	115	110
15	115	115	117	115	116	117	119	114
16	119	119	121	120	120	121	123	119
17	123	123	125	124	124	125	127	123
18	127	127	128	128	128	129	131	127
19	131	131	132	132	132	134	135	131
20	135	135	136	136	136	137	139	135
21	139	139	140	140	140	142	143	139
22	142	142	144	144	144	146	147	143
23	146	146	148	148	148	150	151	147
24	150	150	152	152	152	153	155	151
25	154	154	156	155	156	157	158	155
26	158	158	160	159	159	160	162	159
27	162	162	164	164	163	164	166	163
28	166	166	168	168	167	168	169	167
29	170	170	172	172	172	172	173	170
30	174	174	176	175	175	174	176	174
31	177	178	179	178	178	178	179	178
32	181	181	183	181	181	182	182	181
33	184	184	187	184	184	185	185	184
34	187	187	190	187	187	188	188	187
35	190	190	193	190	190	190	190	190
36	193	193	196	193	193	193	193	193
37	195	196	199	196	195	195	195	195
38	198	198	202	198	198	197	197	198
39	200	200	205	201	200	199	198	200

Time (min)	TC # 21 (°F)	TC # 22 (°F)	TC # 23 (°F)	TC # 24 (°F)	TC # 25 (°F)	TC # 26 (°F)	TC # 27 (°F)	TC # 28 (°F)
40	202	203	208	203	202	201	200	201
41	203	206	211	206	204	202	201	203
42	205	208	213	208	206	203	203	204
43	206	211	216	211	208	204	205	206
44	209	214	219	214	210	205	207	207
45	212	218	223	217	213	207	209	208
46	215	221	226	220	215	208	212	209
47	218	224	230	224	218	211	215	210
48	222	228	234	227	221	214	218	211
49	225	231	238	231	224	217	222	213
50	229	235	242	234	227	220	226	215
51	233	238	247	238	231	223	229	218
52	237	242	252	242	234	226	232	220
53	241	246	256	247	238	229	237	223
54	245	250	261	251	242	233	241	227
55	249	254	266	256	246	236	246	230
56	253	259	271	261	251	240	250	233
57	257	263	277	266	256	244	255	237
58	261	268	282	271	261	248	259	241
59	265	272	287	276	266	253	263	245
60	269	277	292	281	271	258	267	248
Max Temp:	269	277	292	281	271	258	267	248
Max Allowed:	415	415	415	415	415	415	416	415

Time (min)	TC # 29 (°F)	TC # 30 (°F)	TC # 31 (°F)	TC # 32 (°F)	TC # 33 (°F)	TC # 34 (°F)	TC # 35 (°F)	TC # 36 (°F)
0	90	90	90	90	90	90	91	91
1	90	90	90	90	90	90	90	91
2	90	90	90	90	90	90	90	91
3	90	90	90	90	90	90	90	91
4	90	90	90	90	90	90	91	91
5	91	91	91	91	91	91	91	91
6	91	91	91	91	91	91	91	91
7	91	92	92	92	92	91	92	92
8	93	93	93	93	93	93	93	93
9	95	95	95	95	95	95	95	95
10	97	98	98	98	98	97	98	98
11	100	101	101	102	101	101	101	101
12	104	105	105	105	105	104	104	104
13	108	109	109	110	109	109	108	108
14	112	113	113	114	113	113	112	112
15	116	117	117	118	117	117	116	116
16	120	121	121	122	121	122	120	120
17	124	125	125	127	125	126	124	123
18	128	128	130	131	130	130	128	127
19	132	132	134	135	134	134	133	131
20	136	136	137	139	138	138	137	134
21	140	140	141	143	141	142	141	138
22	144	144	145	146	145	146	145	142
23	147	148	149	150	149	150	149	146
24	151	152	153	155	153	154	153	151
25	156	157	157	161	158	158	157	154
26	160	160	161	166	163	162	161	158
27	164	164	164	169	167	167	166	163
28	167	168	167	170	170	170	169	166
29	171	171	171	173	173	173	173	170
30	174	175	175	177	177	177	176	173
31	178	178	178	182	180	180	179	177
32	181	181	182	185	183	183	182	180
33	184	184	185	187	186	186	185	183
34	187	187	188	191	188	187	187	186
35	190	190	191	194	191	190	190	189
36	193	193	193	196	193	192	193	192
37	195	196	196	199	196	195	195	194
38	197	198	199	202	198	197	197	197
39	199	200	201	205	201	200	199	199

Time (min)	TC # 29 (°F)	TC # 30 (°F)	TC # 31 (°F)	TC # 32 (°F)	TC # 33 (°F)	TC # 34 (°F)	TC # 35 (°F)	TC # 36 (°F)
40	202	203	203	208	203	202	200	201
41	203	205	205	210	205	204	202	202
42	205	207	208	213	208	206	203	202
43	206	210	211	217	211	208	205	204
44	208	213	214	220	214	212	206	206
45	209	216	217	224	218	215	208	209
46	211	219	221	228	222	218	210	212
47	213	223	225	232	226	222	213	216
48	216	227	229	236	231	225	217	221
49	219	231	233	241	235	229	220	225
50	222	235	237	245	239	233	223	229
51	225	239	242	250	244	237	226	233
52	228	243	246	255	249	241	229	236
53	232	247	250	260	253	246	233	239
54	236	251	255	265	258	250	236	241
55	240	256	259	271	263	255	240	244
56	244	260	264	276	268	260	245	246
57	248	264	268	282	273	265	250	249
58	252	268	273	287	278	270	254	252
59	256	273	278	292	283	275	259	256
60	260	277	283	298	287	280	263	260
Max Temp:	260	277	283	298	287	280	263	260
Max Allowed:	415	415	415	415	415	415	416	416

OMEGA POINT LABORATORIES

Time (min)	TC # 37 (°F)	TC # 38 (°F)	TC # 39 (°F)	TC # 40 (°F)	TC # 41 (°F)	TC # 42 (°F)	TC # 43 (°F)	TC # 44 (°F)
0	91	91	90	90	91	91	91	91
1	91	91	90	90	91	91	91	91
2	91	91	90	90	91	91	91	91
3	91	91	90	90	91	91	91	91
4	91	91	90	90	91	91	91	91
5	91	91	90	91	91	91	91	91
6	91	91	91	91	92	92	91	91
7	92	92	92	92	93	93	92	92
8	94	94	93	93	95	95	94	94
9	96	96	94	95	97	97	96	96
10	99	99	97	97	99	100	99	98
11	102	102	100	100	102	103	102	102
12	105	106	103	103	106	107	105	105
13	109	110	107	106	109	110	109	109
14	113	114	111	110	113	115	113	113
15	117	118	115	114	117	119	117	118
16	120	122	119	118	121	123	122	122
17	124	126	124	122	125	127	127	127
18	128	129	128	126	129	131	131	131
19	132	133	133	130	133	135	135	135
20	135	137	137	135	137	139	140	139
21	139	141	141	139	141	144	144	143
22	143	145	146	143	146	148	148	147
23	147	149	150	147	150	152	151	151
24	151	152	154	151	155	156	155	154
25	155	156	158	155	159	160	159	158
26	159	160	162	159	163	164	163	162
27	163	164	166	163	166	168	167	166
28	166	167	170	167	170	172	171	171
29	170	171	174	171	174	177	175	175
30	174	174	177	175	177	181	180	180
31	177	177	181	178	181	186	186	185
32	181	181	184	182	184	190	190	189
33	184	184	188	185	187	194	195	193
34	187	187	191	189	190	197	198	197
35	190	190	194	191	192	201	201	200
36	192	192	197	194	195	203	203	203
37	195	194	201	196	198	205	205	205
38	197	197	204	199	201	207	207	207
39	199	198	207	201	203	209	209	209

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Time (min)	TC # 37 (°F)	TC # 38 (°F)	TC # 39 (°F)	TC # 40 (°F)	TC # 41 (°F)	TC # 42 (°F)	TC # 43 (°F)	TC # 44 (°F)
40	201	200	209	202	206	211	211	211
41	203	202	211	204	209	212	213	213
42	204	203	211	206	211	214	215	214
43	202	204	212	208	212	216	217	215
44	205	205	212	210	213	217	218	217
45	209	207	213	212	214	219	220	218
46	214	211	213	214	215	220	221	219
47	221	217	214	215	217	222	223	221
48	227	223	215	216	219	224	225	223
49	232	227	215	217	220	226	227	225
50	236	231	216	219	222	228	229	227
51	241	235	217	220	224	230	231	229
52	245	238	218	222	226	232	234	232
53	249	241	219	223	228	234	236	234
54	253	244	221	225	230	237	239	237
55	256	247	222	226	232	239	242	240
56	260	251	224	228	233	242	245	243
57	263	255	226	229	235	245	248	246
58	266	258	228	231	237	247	251	249
59	268	261	230	233	239	250	255	253
60	271	264	231	235	241	253	258	256
Max Temp:	271	264	231	235	241	253	258	256
Max Allowed:	416	416	415	415	416	416	416	416

OMEGA POINT LABORATORIES

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Time (min)	TC # 45 (°F)	TC # 46 (°F)	TC # 47 (°F)	TC # 48 (°F)	TC # 49 (°F)	TC # 50 (°F)	TC # 51 (°F)	TC # 52 (°F)
0	91	91	91	91	91	91	91	91
1	91	91	91	91	91	91	91	91
2	91	91	91	91	91	91	91	91
3	91	91	91	91	91	91	91	91
4	91	91	91	91	91	91	91	91
5	91	91	91	91	91	91	91	91
6	92	92	91	92	92	92	92	92
7	93	93	92	93	92	92	92	92
8	95	94	93	94	93	94	93	93
9	97	96	95	96	95	96	94	95
10	100	99	97	99	97	98	96	98
11	104	102	100	103	99	101	98	101
12	108	106	104	107	103	104	101	104
13	112	109	108	112	106	108	104	107
14	116	113	112	116	111	112	107	111
15	121	118	117	121	115	116	111	115
16	125	122	123	127	120	120	115	119
17	129	127	129	133	125	124	119	123
18	134	132	136	138	129	128	123	127
19	138	137	141	144	134	132	127	131
20	142	142	146	149	139	136	131	135
21	146	146	151	154	143	141	135	139
22	150	150	156	158	148	145	139	142
23	154	155	160	162	151	149	143	146
24	158	159	164	165	155	153	148	150
25	163	162	168	169	159	157	152	154
26	167	166	172	172	162	161	156	158
27	172	170	176	176	165	164	160	162
28	176	174	179	179	169	168	164	166
29	180	178	182	182	172	172	168	170
30	185	181	185	184	176	175	171	173
31	190	184	187	187	179	178	175	176
32	194	187	190	189	182	182	178	180
33	197	190	192	192	185	184	182	182
34	200	193	194	194	187	187	185	185
35	203	196	197	196	190	190	188	188
36	205	200	199	198	193	193	191	191
37	206	202	201	200	195	195	193	194
38	208	205	203	202	198	197	195	196
39	210	207	205	204	200	199	198	199

OMEGA POINT LABORATORIES

Time (min)	TC # 45 (°F)	TC # 46 (°F)	TC # 47 (°F)	TC # 48 (°F)	TC # 49 (°F)	TC # 50 (°F)	TC # 51 (°F)	TC # 52 (°F)
40	211	209	207	206	202	200	199	201
41	213	210	209	208	205	202	201	203
42	214	212	211	210	206	203	202	204
43	215	213	213	212	207	204	204	205
44	217	214	214	214	209	206	205	206
45	218	216	216	216	210	207	206	207
46	219	217	218	217	212	208	207	208
47	220	218	219	219	213	210	208	209
48	222	219	221	221	214	212	209	210
49	224	220	222	222	216	214	210	212
50	226	221	224	224	217	217	211	214
51	229	223	225	226	218	220	212	217
52	231	224	227	228	219	222	213	220
53	234	225	228	230	220	225	215	223
54	237	228	230	232	222	228	217	225
55	240	230	232	234	223	230	220	228
56	243	232	234	237	225	232	223	231
57	247	234	236	240	227	234	225	234
58	250	236	238	243	229	237	228	236
59	254	239	240	246	230	240	230	239
60	258	241	243	249	232	243	233	243
Max Temp:	258	241	243	249	232	243	233	243
Max Allowed:	416	416	416	416	416	416	416	416

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 53 (°F)	TC # 54 (°F)	TC # 55 (°F)	TC # 56 (°F)	TC # 57 (°F)	TC # 58 (°F)	TC # 59 (°F)	TC # 60 (°F)
0	91	91	91	91	91	91	91	91
1	91	91	91	91	91	91	91	91
2	91	91	91	91	91	91	91	91
3	91	91	91	91	91	91	91	91
4	91	91	91	91	91	91	91	91
5	91	91	91	91	91	91	91	91
6	91	91	92	92	91	91	91	91
7	92	92	93	92	92	92	92	92
8	92	93	95	93	94	93	94	94
9	93	94	97	95	96	95	95	96
10	94	96	99	97	98	97	97	98
11	96	98	102	100	101	99	100	101
12	98	101	105	104	104	102	103	104
13	101	104	108	107	107	105	106	108
14	103	107	111	112	111	109	109	111
15	106	111	115	116	114	112	113	115
16	110	114	119	121	118	116	117	119
17	113	118	123	126	122	120	121	124
18	117	122	127	130	126	124	125	128
19	122	127	131	135	131	128	130	133
20	126	131	136	139	135	132	135	138
21	131	136	140	142	139	137	139	143
22	135	140	144	146	143	141	144	148
23	140	145	148	150	147	145	148	153
24	145	149	153	154	152	150	153	157
25	149	155	159	158	156	154	158	162
26	154	160	164	161	160	158	162	167
27	158	164	168	165	165	162	167	172
28	162	169	172	169	169	167	171	176
29	166	173	177	172	173	171	175	180
30	170	179	180	176	177	175	179	185
31	173	184	183	180	181	179	183	188
32	177	189	187	183	185	183	187	192
33	180	193	189	186	189	186	191	195
34	184	196	192	189	192	190	194	199
35	187	199	194	192	195	193	197	202
36	190	202	196	195	198	196	200	204
37	193	204	198	197	201	199	203	207
38	196	206	200	200	204	202	206	210
39	198	207	201	202	207	204	208	212

OMEGA POINT LABORATORIES

Time (min)	TC # 53 (°F)	TC # 54 (°F)	TC # 55 (°F)	TC # 56 (°F)	TC # 57 (°F)	TC # 58 (°F)	TC # 59 (°F)	TC # 60 (°F)
40	200	208	203	204	209	207	211	215
41	202	209	205	206	212	209	213	217
42	204	210	206	207	214	211	215	220
43	206	211	208	209	217	214	217	222
44	207	211	209	210	219	216	220	225
45	208	212	211	211	222	218	222	227
46	209	212	212	213	224	220	224	230
47	211	213	214	214	226	223	226	233
48	212	214	216	215	228	225	229	236
49	213	215	217	216	230	228	233	240
50	214	216	219	217	233	231	236	244
51	215	217	221	219	235	234	239	248
52	216	218	222	220	238	237	243	252
53	217	220	224	222	242	240	247	256
54	218	221	225	223	245	243	251	261
55	219	223	227	225	248	247	255	265
56	220	224	229	226	252	250	259	270
57	221	226	231	228	255	254	263	275
58	222	228	232	230	259	258	267	280
59	223	229	234	232	263	261	271	284
60	224	231	236	234	267	265	275	289
Max Temp:	224	231	236	234	267	265	275	289
Max Allowed:	416	416	416	416	416	416	416	416

OMEGA POINT LABORATORIES

Time (min)	TC # 61 (°F)	TC # 62 (°F)	TC # 63 (°F)	TC # 64 (°F)	TC # 65 (°F)	TC # 66 (°F)	TC # 67 (°F)	TC # 68 (°F)
0	90	90	90	90	90	90	90	90
1	90	90	90	90	90	90	90	90
2	90	90	90	90	90	90	90	90
3	90	90	90	90	90	90	90	90
4	90	90	90	90	90	90	90	90
5	90	90	90	90	90	90	90	90
6	91	91	91	91	91	91	91	91
7	92	92	92	91	91	92	92	92
8	94	94	93	93	93	93	93	93
9	96	96	96	95	95	95	95	95
10	99	99	99	98	97	98	98	98
11	102	102	102	101	100	101	101	100
12	105	106	105	104	103	104	104	103
13	109	109	109	107	106	107	107	106
14	112	113	113	111	110	111	110	109
15	116	117	116	114	113	114	113	112
16	120	121	120	118	117	118	117	116
17	124	125	124	121	120	121	120	119
18	129	130	128	125	124	125	124	123
19	134	134	132	129	128	129	128	128
20	139	139	136	133	132	133	132	132
21	144	144	141	138	136	138	136	136
22	149	149	147	142	140	142	141	140
23	154	154	152	147	144	147	145	145
24	159	159	157	151	148	151	150	150
25	164	164	161	156	153	156	155	154
26	168	169	166	160	157	160	159	158
27	173	173	171	165	162	165	164	163
28	178	178	175	170	166	169	168	167
29	182	182	180	175	171	173	172	171
30	186	186	184	179	175	178	176	175
31	190	189	187	183	179	182	180	179
32	193	193	191	187	183	186	184	183
33	197	196	194	191	187	189	188	187
34	200	199	197	194	190	193	192	191
35	203	202	200	197	193	197	196	195
36	205	205	203	200	197	200	200	199
37	208	207	205	203	200	204	204	203
38	210	210	208	205	203	208	208	207
39	213	212	210	208	206	212	213	210

Time (min)	TC # 61 (°F)	TC # 62 (°F)	TC # 63 (°F)	TC # 64 (°F)	TC # 65 (°F)	TC # 66 (°F)	TC # 67 (°F)	TC # 68 (°F)
40	215	215	213	211	209	216	217	214
41	218	217	215	213	212	220	221	219
42	220	220	217	216	215	224	226	224
43	223	222	220	219	219	228	230	228
44	226	225	223	222	223	232	235	233
45	228	228	226	225	226	236	239	238
46	231	231	229	227	230	240	244	243
47	235	235	232	231	234	244	248	248
48	238	239	236	234	237	248	252	253
49	242	243	239	237	241	252	257	257
50	246	247	243	241	245	256	261	262
51	251	251	247	244	248	260	265	266
52	256	256	251	248	252	264	270	270
53	261	260	255	252	257	269	275	275
54	266	265	260	257	261	273	279	279
55	271	271	265	261	265	278	284	283
56	276	276	269	265	269	282	288	287
57	281	281	274	269	273	286	292	290
58	286	287	279	274	278	290	296	294
59	292	292	285	279	282	294	299	298
60	297	297	290	283	286	298	303	301
Max Temp:	297	297	290	283	286	298	303	301
Max Allowed:	415	415	415	415	415	415	415	415

OMEGA POINT LABORATORIES

Time (min)	TC # 69 (°F)	TC # 70 (°F)	TC # 71 (°F)	TC # 72 (°F)	TC # 73 (°F)	TC # 74 (°F)	TC # 75 (°F)	TC # 76 (°F)
0	90	90	90	90	90	90	90	90
1	90	90	90	90	90	90	90	90
2	90	90	90	90	90	90	90	90
3	90	90	90	90	90	90	90	90
4	90	90	90	90	90	90	90	90
5	90	90	90	90	90	90	90	90
6	91	91	91	91	91	91	90	91
7	92	92	92	92	92	91	91	93
8	93	93	93	93	93	92	91	95
9	95	95	95	95	95	93	92	98
10	97	97	97	97	97	95	93	100
11	99	99	100	100	100	97	95	103
12	102	102	103	102	102	99	97	107
13	105	105	106	105	105	102	99	110
14	108	108	109	108	108	105	101	114
15	111	111	112	112	111	108	104	118
16	114	115	116	115	115	111	107	122
17	118	118	119	119	118	114	111	126
18	121	122	123	123	122	118	114	130
19	125	126	128	127	126	122	118	135
20	129	131	132	131	130	126	122	139
21	134	135	137	136	134	130	126	143
22	138	139	141	140	139	133	129	148
23	143	144	146	145	143	138	133	152
24	147	149	150	149	148	142	137	157
25	152	153	155	153	152	146	141	161
26	156	157	159	158	156	150	145	165
27	160	162	164	162	161	154	149	169
28	165	166	168	167	165	158	153	173
29	169	170	173	171	169	163	158	177
30	173	175	177	175	173	167	162	181
31	177	179	181	179	177	170	167	185
32	181	183	186	184	181	174	171	188
33	185	188	190	188	185	178	175	192
34	189	192	194	192	189	181	178	195
35	193	196	199	196	193	184	182	198
36	197	200	203	201	196	186	185	201
37	201	205	208	205	198	189	188	204
38	195	207	212	209	200	192	190	207
39	197	208	216	213	203	195	193	211

Time (min)	TC # 69 (°F)	TC # 70 (°F)	TC # 71 (°F)	TC # 72 (°F)	TC # 73 (°F)	TC # 74 (°F)	TC # 75 (°F)	TC # 76 (°F)
40	206	213	220	217	206	198	195	214
41	212	219	225	221	210	201	197	217
42	218	224	229	225	213	203	199	220
43	224	229	234	229	217	205	202	223
44	229	234	239	234	221	207	203	226
45	234	239	244	238	225	209	204	230
46	239	244	249	242	230	211	206	233
47	243	249	254	247	235	215	207	237
48	248	253	259	252	240	221	208	241
49	252	258	264	257	244	225	208	244
50	256	262	268	261	249	232	209	248
51	260	267	273	265	254	237	210	251
52	264	271	277	270	259	242	211	255
53	268	275	282	274	263	247	215	259
54	272	279	286	279	268	251	220	262
55	276	283	290	283	273	256	225	266
56	279	286	293	287	278	260	230	269
57	283	290	297	291	282	264	234	273
58	286	293	301	295	286	267	239	276
59	290	296	304	299	290	271	243	280
60	293	300	308	302	294	274	246	283
Max Temp:	293	300	308	302	294	274	246	283
Max Allowed:	415	415	415	415	415	415	415	415

OMEGA POINT LABORATORIES

Time (min)	TC # 77 (°F)	TC # 78 (°F)	TC # 79 (°F)	TC # 80 (°F)	TC # 81 (°F)	TC # 82 (°F)	TC # 83 (°F)	TC # 84 (°F)
0	90	90	90	90	90	90	90	90
1	90	90	90	90	90	90	90	90
2	90	90	90	90	90	90	90	90
3	90	90	90	90	90	90	90	90
4	90	90	90	90	90	90	91	91
5	90	90	90	90	91	91	91	91
6	91	91	91	91	91	91	91	91
7	92	92	92	92	92	92	92	92
8	93	93	94	94	94	94	94	94
9	96	95	96	97	96	96	96	96
10	98	98	99	100	99	99	99	99
11	101	100	102	103	102	102	101	102
12	104	104	106	107	106	105	105	105
13	107	107	109	110	110	109	108	108
14	111	111	113	114	114	113	112	112
15	115	115	117	119	118	117	116	115
16	119	119	121	123	122	121	119	119
17	124	123	126	128	127	125	123	122
18	128	128	131	132	131	129	126	126
19	132	132	136	137	136	134	130	130
20	137	137	140	142	141	138	134	134
21	141	141	145	147	146	143	139	138
22	146	146	150	152	151	148	143	142
23	150	151	155	156	156	153	148	147
24	155	155	159	161	161	158	152	151
25	159	160	164	166	166	162	157	156
26	163	164	169	171	170	167	162	160
27	167	168	173	175	175	172	166	165
28	172	173	177	180	179	176	170	169
29	176	177	182	184	184	180	175	173
30	180	181	186	188	188	184	179	177
31	184	185	190	193	192	188	183	181
32	187	189	194	197	196	192	186	185
33	191	193	198	201	199	196	190	189
34	194	197	202	204	203	199	194	193
35	198	200	206	208	206	203	197	197
36	201	204	210	212	210	206	200	200
37	204	207	214	215	213	209	204	204
38	207	211	218	219	216	212	207	208
39	211	214	221	222	219	215	210	212

Time (min)	TC # 77 (°F)	TC # 78 (°F)	TC # 79 (°F)	TC # 80 (°F)	TC # 81 (°F)	TC # 82 (°F)	TC # 83 (°F)	TC # 84 (°F)
40	214	218	224	225	223	219	214	215
41	217	221	228	229	226	222	217	219
42	220	224	231	232	229	226	221	223
43	223	228	234	236	233	229	225	227
44	227	231	238	239	237	233	228	231
45	230	235	242	243	241	237	232	235
46	234	239	246	247	245	241	235	238
47	238	243	250	252	250	245	239	242
48	242	248	255	257	254	250	243	246
49	246	252	261	262	259	254	248	250
50	250	257	266	267	264	259	252	255
51	254	261	271	273	270	264	256	259
52	258	266	277	278	276	270	261	264
53	263	270	282	284	281	275	266	268
54	267	274	287	290	287	280	270	273
55	270	279	292	296	293	285	275	277
56	274	283	297	301	298	290	279	282
57	277	287	302	307	304	295	284	286
58	281	290	306	312	309	300	288	290
59	285	294	310	317	314	305	292	294
60	288	298	314	321	319	310	296	298
Max Temp:	288	298	314	321	319	310	296	298
Max Allowed:	415	415	415	415	415	415	415	415

OMEGA POINT LABORATORIES

Time (min)	TC # 85 (°F)	TC # 86 (°F)	TC # 87 (°F)	TC # 88 (°F)	TC # 89 (°F)	TC # 90 (°F)	TC # 91 (°F)	TC # 92 (°F)
0	90	90	90	91	91	91	91	91
1	90	90	91	91	91	91	91	91
2	90	91	91	91	91	91	91	91
3	90	91	91	91	91	91	91	91
4	91	91	91	91	91	91	91	91
5	91	91	91	91	91	91	91	91
6	92	92	92	91	91	91	91	91
7	93	93	94	92	92	92	92	92
8	95	95	96	94	93	93	93	93
9	98	97	98	95	95	95	95	95
10	100	99	100	97	96	97	97	97
11	103	102	103	100	99	99	99	99
12	106	105	105	102	101	102	102	102
13	109	108	108	105	104	105	104	105
14	112	111	111	108	107	108	107	108
15	116	114	115	111	110	111	110	111
16	120	118	118	114	113	114	113	114
17	124	122	122	118	117	118	117	117
18	128	126	126	121	120	121	120	120
19	132	130	130	125	124	125	124	124
20	136	134	134	129	128	129	128	128
21	141	139	139	133	131	132	131	131
22	146	143	144	137	135	136	135	135
23	151	148	148	141	139	140	139	139
24	154	153	152	145	144	144	143	143
25	159	157	157	150	148	148	147	147
26	164	161	161	154	152	153	151	151
27	168	166	165	158	156	157	155	154
28	173	170	170	162	161	161	159	158
29	177	175	174	166	165	166	163	162
30	181	179	179	170	169	170	167	165
31	186	184	183	174	172	174	170	169
32	190	188	188	178	176	178	174	173
33	194	193	193	182	180	181	177	176
34	198	197	197	186	183	185	181	180
35	202	201	201	188	186	188	184	183
36	207	206	205	190	189	191	187	187
37	211	210	209	195	193	195	190	190
38	216	214	214	197	196	198	193	192
39	220	218	217	200	199	201	196	195

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 85 (°F)	TC # 86 (°F)	TC # 87 (°F)	TC # 88 (°F)	TC # 89 (°F)	TC # 90 (°F)	TC # 91 (°F)	TC # 92 (°F)
40	224	222	221	205	202	204	198	197
41	228	226	225	209	206	207	200	200
42	232	230	229	205	208	211	203	202
43	236	234	231	211	211	214	206	205
44	240	238	235	217	216	218	210	207
45	245	242	240	222	220	222	214	211
46	248	246	244	227	225	226	217	213
47	252	250	248	231	229	230	222	216
48	256	255	253	235	233	234	227	221
49	261	259	257	239	237	239	232	226
50	265	263	261	244	242	244	237	231
51	270	268	265	249	246	248	242	236
52	275	272	270	253	251	253	247	240
53	280	277	274	258	255	258	252	245
54	285	281	278	262	260	263	257	250
55	289	285	282	265	264	267	262	255
56	293	290	286	270	268	272	267	260
57	297	294	289	274	272	276	271	265
58	301	298	293	277	276	281	276	269
59	305	301	297	281	280	285	280	274
60	308	305	301	285	284	289	285	278
Max Temp:	308	305	301	285	284	289	285	278
Max Allowed:	415	415	415	416	416	416	416	416

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 93 (°F)	TC # 94 (°F)	TC # 95 (°F)	TC # 96 (°F)	TC # 97 (°F)	TC # 98 (°F)	TC # 99 (°F)	TC # 100 (°F)
0	91	91	91	91	90	90	90	90
1	91	91	91	91	91	91	91	91
2	91	91	91	91	91	91	91	91
3	91	91	91	91	91	91	90	91
4	91	91	91	91	91	91	91	91
5	91	91	91	91	91	91	91	91
6	91	92	91	92	91	92	92	91
7	92	92	92	93	93	93	93	92
8	93	92	93	94	94	95	95	94
9	94	93	94	96	96	97	97	96
10	96	94	96	98	98	99	99	98
11	98	95	98	100	101	102	102	101
12	101	97	100	103	104	105	105	104
13	103	98	103	106	107	108	108	107
14	106	100	106	110	110	111	111	110
15	110	102	109	113	114	115	114	114
16	113	104	113	117	117	118	118	117
17	117	107	116	121	121	123	122	120
18	120	110	121	125	125	127	126	124
19	124	112	125	129	130	132	131	128
20	127	115	129	133	134	136	135	131
21	131	119	134	138	138	141	139	135
22	135	122	138	142	143	145	144	139
23	138	125	142	147	147	150	148	143
24	142	128	146	151	152	154	153	147
25	146	132	151	155	156	159	157	152
26	150	136	154	159	160	163	161	156
27	154	140	158	163	164	168	166	160
28	157	144	162	167	169	172	170	164
29	162	148	166	170	173	176	174	168
30	166	153	170	174	177	180	178	172
31	170	157	173	178	180	184	182	176
32	173	161	177	181	184	188	186	180
33	177	165	180	185	188	192	190	183
34	180	169	182	189	192	196	195	187
35	184	173	185	193	196	200	200	191
36	186	178	188	197	200	204	204	195
37	189	182	191	200	203	208	208	198
38	192	185	194	204	207	212	212	202
39	194	189	197	208	211	216	216	206

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 93 (°F)	TC # 94 (°F)	TC # 95 (°F)	TC # 96 (°F)	TC # 97 (°F)	TC # 98 (°F)	TC # 99 (°F)	TC # 100 (°F)
40	196	192	199	211	214	220	219	209
41	199	194	202	215	218	224	223	213
42	200	197	205	219	222	228	227	217
43	202	199	207	223	226	233	230	220
44	204	201	210	226	230	237	234	224
45	206	203	212	229	234	241	237	228
46	208	205	215	233	238	244	240	231
47	210	206	217	236	241	248	243	235
48	211	207	219	240	245	251	247	239
49	213	207	222	244	249	255	251	243
50	215	208	225	247	253	259	255	247
51	219	208	228	251	256	264	259	251
52	223	208	232	254	260	268	263	255
53	228	208	235	258	264	273	268	259
54	232	209	239	262	268	277	273	263
55	237	209	243	266	272	282	277	267
56	241	210	247	269	276	286	282	271
57	246	211	250	273	280	290	286	276
58	250	212	254	277	284	294	291	280
59	254	213	257	280	288	298	295	284
60	257	214	260	283	291	301	299	288
Max Temp:	257	214	260	283	291	301	299	288
Max Allowed:	416	416	416	416	415	415	415	415

OMEGA POINT LABORATORIES

Time (min)	TC # 101 (°F)	TC # 102 (°F)	TC # 103 (°F)	TC # 104 (°F)	TC # 105 (°F)	TC # 106 (°F)	TC # 107 (°F)
0	90	90	90	90	91	91	90
1	90	90	90	90	90	91	90
2	91	91	91	90	91	91	90
3	91	90	90	90	91	91	90
4	90	91	90	90	91	91	90
5	91	91	91	91	91	91	90
6	91	92	91	91	91	91	91
7	92	93	93	92	92	92	91
8	94	94	94	94	93	93	92
9	96	97	96	96	95	95	94
10	99	99	98	98	97	97	95
11	101	102	101	100	99	99	97
12	104	104	103	103	102	102	99
13	108	107	107	106	105	105	102
14	111	111	110	109	108	108	105
15	114	114	113	113	112	112	108
16	118	118	117	116	115	115	111
17	122	122	120	120	119	119	114
18	126	126	124	123	122	123	118
19	130	130	128	127	126	126	122
20	134	135	132	131	130	130	126
21	138	139	135	135	134	134	130
22	142	143	140	139	138	138	134
23	146	147	144	143	143	142	138
24	150	152	149	147	147	146	142
25	154	156	153	151	151	150	146
26	158	160	157	154	155	154	151
27	162	165	161	158	159	158	155
28	166	169	166	161	162	162	159
29	171	174	170	165	166	166	163
30	175	178	174	168	169	169	167
31	178	182	178	172	173	173	171
32	183	186	182	176	177	176	174
33	187	191	186	180	180	180	178
34	191	195	190	184	184	183	182
35	195	199	195	188	187	187	185
36	199	204	199	192	191	190	188
37	203	208	203	196	194	193	192
38	207	212	207	200	198	197	195
39	211	217	211	203	201	200	198

OMEGA POINT LABORATORIES

Time (min)	TC # 101 (°F)	TC # 102 (°F)	TC # 103 (°F)	TC # 104 (°F)	TC # 105 (°F)	TC # 106 (°F)	TC # 107 (°F)
40	214	221	215	207	204	203	201
41	218	225	218	211	208	206	204
42	222	229	222	215	211	209	207
43	226	232	226	218	215	212	210
44	229	236	230	221	217	216	214
45	233	240	234	225	221	219	217
46	236	243	238	228	224	222	220
47	240	247	242	232	227	225	223
48	243	251	246	236	231	228	226
49	247	255	250	240	234	231	229
50	251	259	254	244	238	234	233
51	255	263	258	248	241	237	236
52	259	267	262	252	245	241	239
53	264	272	266	256	249	244	242
54	267	276	270	260	253	247	246
55	272	280	274	264	256	251	249
56	276	284	279	268	260	254	252
57	280	288	282	272	264	258	255
58	284	291	286	276	267	261	258
59	288	295	290	280	271	264	260
60	292	299	293	283	274	268	263
Max Temp:	292	299	293	283	274	268	263
Max Allowed:	415	415	415	415	416	416	415

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 108 (°F)	TC # 109 (°F)	TC # 110 (°F)	TC # 111 (°F)	TC # 112 (°F)	TC # 113 (°F)	TC # 114 (°F)
0	90	90	90	90	90	90	90
1	90	90	90	90	90	90	90
2	90	90	90	90	90	90	90
3	90	90	90	90	91	91	91
4	90	90	90	91	91	91	91
5	91	91	91	91	91	91	91
6	91	91	92	92	91	91	91
7	92	92	93	93	93	92	92
8	93	94	95	95	94	94	94
9	95	96	97	97	96	96	96
10	97	98	99	99	98	98	98
11	99	100	101	101	101	100	100
12	102	103	104	104	103	103	103
13	104	106	107	107	106	106	106
14	107	109	110	111	109	109	109
15	111	112	114	114	113	112	113
16	114	116	118	118	117	116	116
17	118	120	122	122	121	120	119
18	122	124	126	126	125	123	123
19	126	128	130	131	129	127	127
20	130	132	135	135	133	132	131
21	134	136	139	140	137	136	135
22	139	141	144	144	142	140	140
23	143	145	148	149	146	145	144
24	147	149	153	154	151	149	148
25	152	154	158	158	155	153	153
26	156	158	162	162	159	158	157
27	160	162	166	167	164	162	161
28	164	166	171	171	168	166	166
29	169	170	175	176	172	170	170
30	173	175	179	180	176	174	174
31	177	179	184	184	180	178	178
32	180	183	188	188	184	182	182
33	184	187	192	192	188	186	185
34	188	190	197	197	192	190	189
35	192	194	201	201	197	194	193
36	195	198	205	205	201	198	196
37	199	202	209	209	205	202	200
38	202	205	213	214	209	206	203
39	206	209	217	218	213	210	207

OMEGA POINT LABORATORIES

Time (min)	TC # 108 (°F)	TC # 109 (°F)	TC # 110 (°F)	TC # 111 (°F)	TC # 112 (°F)	TC # 113 (°F)	TC # 114 (°F)
40	210	213	221	222	217	213	210
41	214	218	225	226	221	217	214
42	218	222	230	230	226	221	218
43	222	226	234	235	230	225	222
44	226	230	239	239	234	229	226
45	230	235	244	243	238	233	230
46	233	239	248	248	242	237	234
47	237	244	253	252	246	241	237
48	241	248	257	257	251	245	241
49	245	253	262	261	255	249	245
50	249	257	266	265	259	253	249
51	253	261	271	269	263	257	253
52	257	266	275	274	267	261	258
53	260	270	279	278	271	265	262
54	264	274	283	282	275	269	266
55	268	278	287	286	279	273	270
56	271	282	291	289	282	277	274
57	275	286	294	293	286	281	278
58	278	289	298	296	290	284	282
59	281	292	301	300	293	288	286
60	284	296	305	303	297	292	290
Max Temp:	284	296	305	303	297	292	290
Max Allowed:	415	415	415	415	415	415	415

OMEGA POINT LABORATORIES

Time (min)	TC # 115 (°F)	TC # 116 (°F)	TC # 117 (°F)	TC # 118 (°F)	TC # 119 (°F)	TC # 120 (°F)	TC # 121 (°F)
0	90	90	91	91	90	91	91
1	90	90	91	91	90	91	91
2	90	90	90	91	90	91	92
3	91	90	91	91	90	96	95
4	91	90	91	91	94	112	104
5	91	91	91	91	104	128	113
6	91	91	91	91	115	141	125
7	92	92	92	92	125	151	138
8	94	93	93	93	132	159	150
9	95	95	95	94	139	165	160
10	97	97	97	96	145	170	168
11	100	99	99	98	152	175	175
12	103	102	102	101	158	181	181
13	106	104	104	104	165	187	187
14	109	107	108	107	173	194	194
15	112	111	111	110	182	200	200
16	115	114	114	113	191	207	206
17	119	117	118	117	197	216	216
18	122	121	121	120	200	232	232
19	126	125	125	124	202	247	250
20	130	129	129	127	205	261	265
21	134	133	132	131	208	273	280
22	138	136	136	135	210	285	295
23	142	140	140	139	212	297	310
24	146	144	144	143	216	309	325
25	150	148	148	147	221	320	339
26	154	152	153	152	229	332	354
27	158	157	157	156	238	344	369
28	162	160	161	160	247	356	383
29	166	164	165	164	256	369	397
30	170	168	168	168	266	381	411
31	174	171	172	172	276	394	424
32	178	175	176	175	286	407	438
33	181	179	179	179	296	419	451
34	185	182	182	182	306	432	463
35	188	185	186	185	317	445	476
36	192	188	189	188	327	457	489
37	195	192	192	191	337	470	501
38	199	195	195	193	347	483	513
39	202	198	198	196	357	496	525

Time (min)	TC # 115 (°F)	TC # 116 (°F)	TC # 117 (°F)	TC # 118 (°F)	TC # 119 (°F)	TC # 120 (°F)	TC # 121 (°F)
40	205	201	201	199	367	508	537
41	209	204	204	202	377	520	549
42	212	207	207	205	387	532	560
43	216	210	210	208	397	544	572
44	219	213	214	211	406	556	583
45	223	216	217	214	416	567	594
46	226	219	220	216	426	579	605
47	230	223	223	219	435	590	616
48	233	226	226	222	445	601	627
49	237	229	230	225	454	612	638
50	241	233	233	228	464	622	649
51	245	237	237	231	473	633	659
52	249	241	240	234	482	644	670
53	253	245	244	236	492	655	680
54	258	249	247	239	501	666	691
55	262	253	250	242	510	677	701
56	266	257	254	246	519	687	712
57	270	261	257	249	528	698	722
58	274	265	261	253	537	709	732
59	278	269	265	256	546	719	742
60	282	273	268	260	555	729	752
Max Temp:	282	273	268	260	555	729	752
Max Allowed:	415	415	416	416	415	416	416

OMEGA POINT LABORATORIES

Time (min)	TC # 122 (°F)	TC # 123 (°F)	TC # 124 (°F)	TC # 125 (°F)	TC # 126 (°F)	TC # 127 (°F)	TC # 128 (°F)
0	92	89	90	91	92	90	90
1	92	89	90	91	92	90	90
2	92	89	91	91	92	90	91
3	94	91	94	93	93	92	103
4	99	93	99	96	95	97	110
5	104	99	104	101	99	103	122
6	111	105	112	105	104	110	138
7	121	111	121	111	110	119	151
8	133	117	132	118	117	127	160
9	146	124	143	126	124	135	166
10	158	131	159	135	134	142	172
11	169	139	172	145	146	149	180
12	178	148	179	156	156	159	189
13	185	156	185	168	166	173	198
14	192	164	190	179	177	187	206
15	199	172	195	189	187	197	210
16	203	179	199	198	198	203	215
17	208	187	205	205	205	204	236
18	212	196	209	209	210	206	259
19	225	204	211	211	213	209	277
20	239	208	213	212	220	213	295
21	249	210	220	219	227	221	312
22	260	210	235	228	236	233	329
23	270	211	246	244	244	244	346
24	280	212	258	262	253	255	361
25	290	215	271	280	263	266	378
26	300	222	284	296	273	278	393
27	310	228	297	311	282	289	409
28	320	235	309	327	293	301	424
29	331	243	322	342	303	312	440
30	341	251	335	357	313	324	455
31	351	259	348	372	322	336	471
32	361	268	361	386	333	348	486
33	371	277	374	400	344	359	501
34	381	286	387	414	353	371	516
35	391	295	399	428	362	383	531
36	401	305	412	442	371	394	546
37	410	314	424	455	380	406	561
38	419	323	436	468	389	417	575
39	428	333	448	480	398	428	590

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	TC # 122 (°F)	TC # 123 (°F)	TC # 124 (°F)	TC # 125 (°F)	TC # 126 (°F)	TC # 127 (°F)	TC # 128 (°F)
40	437	342	460	493	406	440	605
41	445	352	472	505	415	451	619
42	454	361	483	517	424	462	634
43	463	371	495	529	432	473	649
44	472	380	506	540	441	484	663
45	480	389	517	552	449	495	678
46	488	399	528	563	457	506	692
47	496	408	539	574	465	516	706
48	504	417	550	585	473	527	720
49	512	426	560	595	480	537	734
50	521	435	571	606	488	547	747
51	528	444	581	616	496	558	760
52	536	453	591	626	503	568	773
53	544	462	601	636	510	578	785
54	552	471	611	645	517	588	798
55	559	479	621	655	524	597	810
56	567	488	631	664	531	607	822
57	574	497	641	674	538	617	834
58	581	505	650	683	545	626	846
59	588	514	660	692	551	636	857
60	594	522	669	702	558	645	868
Max Temp:	594	522	669	702	558	645	868
Max Allowed:	417	414	415	416	417	415	415

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI. September 8, 1994

Time (min)	TC # 129 (°F)	TC # 130 (°F)	TC # 131 (°F)	TC # 132 (°F)	TC # 133 (°F)	TC # 134 (°F)	TC # 135 (°F)
0	91	92	90	90	91	92	89
1	91	92	90	90	91	92	89
2	92	98	90	91	92	92	89
3	99	103	90	95	95	96	90
4	104	106	92	99	99	100	94
5	113	110	95	103	104	104	99
6	125	116	99	109	110	109	105
7	138	125	102	118	118	116	113
8	150	137	107	129	128	125	120
9	161	151	113	140	140	135	127
10	170	164	119	154	152	145	135
11	179	176	126	168	165	155	143
12	189	188	134	182	178	166	154
13	198	197	143	196	193	180	166
14	205	205	153	209	206	200	180
15	209	209	176	211	211	211	192
16	216	211	203	211	211	211	201
17	237	223	209	212	212	212	204
18	256	237	210	221	221	217	205
19	274	249	211	241	241	230	207
20	292	260	211	259	260	245	208
21	310	272	212	276	281	259	209
22	328	283	217	294	302	273	211
23	347	295	229	312	324	287	217
24	366	307	240	331	345	300	224
25	384	320	250	349	366	314	230
26	402	333	261	367	387	328	238
27	420	345	272	385	407	342	248
28	438	358	283	403	427	357	258
29	456	371	294	421	447	371	268
30	473	384	306	438	466	385	278
31	489	397	317	455	484	399	289
32	506	410	329	471	502	413	300
33	522	422	341	487	520	426	311
34	537	434	353	503	537	439	322
35	553	447	365	518	554	452	334
36	568	458	377	533	571	465	345
37	584	469	389	548	587	477	357
38	599	481	400	562	603	490	368
39	614	492	412	577	618	502	380

OMEGA POINT LABORATORIES

Time (min)	TC # 129 (°F)	TC # 130 (°F)	TC # 131 (°F)	TC # 132 (°F)	TC # 133 (°F)	TC # 134 (°F)	TC # 135 (°F)
40	629	503	424	590	633	514	392
41	644	513	436	604	648	525	404
42	658	523	447	617	662	536	415
43	672	533	459	631	676	548	427
44	687	542	470	644	689	558	438
45	701	553	482	656	703	569	450
46	715	563	493	669	717	579	461
47	729	572	504	682	730	590	473
48	743	582	515	694	744	599	484
49	756	592	526	707	757	609	495
50	770	601	537	719	771	619	506
51	784	610	548	732	784	628	517
52	797	619	558	744	797	637	528
53	810	627	569	756	811	645	539
54	822	636	580	768	823	654	550
55	835	644	590	780	836	662	560
56	847	652	600	792	848	670	571
57	858	661	611	804	860	677	582
58	870	669	621	815	872	683	592
59	881	677	631	827	883	689	603
60	892	683	641	838	894	695	613
Max Temp:	892	683	641	838	894	695	613
Max Allowed:	416	417	415	415	416	417	414

OMEGA POINT LABORATORIES

Time (min)	TC # 136 (°F)	TC # 137 (°F)	TC # 138 (°F)	TC # 139 (°F)	TC # 140 (°F)	TC # 141 (°F)	TC # 142 (°F)
0	90	91	92	89	90	90	91
1	90	91	92	89	90	91	91
2	90	92	92	89	91	91	92
3	99	98	100	91	103	93	94
4	107	103	103	96	109	98	98
5	114	110	106	101	117	103	103
6	124	119	112	106	126	108	108
7	135	129	120	111	135	116	114
8	145	140	130	116	144	127	122
9	154	150	141	122	153	139	131
10	163	160	153	128	163	153	140
11	171	170	165	135	172	166	149
12	180	180	178	144	180	181	161
13	189	190	190	152	192	198	180
14	198	198	198	164	206	210	195
15	204	204	204	184	210	212	207
16	207	209	208	199	211	211	211
17	209	213	210	204	212	211	216
18	215	226	218	206	214	221	225
19	228	242	234	207	225	236	237
20	241	258	245	208	239	251	248
21	254	274	257	209	253	270	261
22	267	291	269	211	268	290	274
23	281	308	280	214	284	311	288
24	294	325	292	223	301	332	303
25	308	342	305	231	319	354	318
26	323	359	317	241	336	376	334
27	337	376	330	251	354	398	350
28	352	393	343	261	372	420	367
29	367	410	357	273	391	441	383
30	383	427	370	284	409	463	400
31	399	444	384	296	428	484	416
32	415	461	397	308	446	504	433
33	430	477	411	320	464	525	449
34	446	494	424	332	483	545	465
35	462	510	438	344	501	565	481
36	477	526	451	356	518	584	496
37	492	542	464	368	535	603	510
38	507	558	476	380	552	621	524
39	522	573	489	392	568	639	537

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Time (min)	TC # 136 (°F)	TC # 137 (°F)	TC # 138 (°F)	TC # 139 (°F)	TC # 140 (°F)	TC # 141 (°F)	TC # 142 (°F)
40	537	588	501	404	584	656	549
41	551	603	513	416	600	672	560
42	566	618	525	428	615	688	571
43	580	632	536	440	630	704	581
44	595	646	547	452	644	719	591
45	609	660	558	464	659	735	601
46	623	674	569	476	673	750	610
47	637	688	579	487	687	766	619
48	651	702	590	499	701	781	627
49	665	716	600	510	715	796	636
50	680	730	610	522	729	811	644
51	694	743	620	533	743	826	652
52	708	757	629	544	757	840	661
53	722	770	639	555	771	854	668
54	735	783	649	566	785	868	676
55	749	796	658	577	798	882	684
56	762	810	667	588	812	895	691
57	776	822	676	599	825	908	698
58	789	835	685	609	838	920	705
59	802	848	693	620	850	932	712
60	815	860	701	630	863	944	718
Max Temp:	815	860	701	630	863	944	718
Max Allowed:	415	416	417	414	415	415	416

OMEGA POINT LABORATORIES

Project No. 97186 TVA / TSI September 8, 1994

Time (min)	Laboratory Ambient (°F)	Furnace #1 (°F)	Furnace #2 (°F)	Furnace #3 (°F)	Furnace #4 (°F)	Furnace #5 (°F)	Furnace #6 (°F)	Furnace #7 (°F)
0	82	90	89	89	90	90	89	86
1	82	153	151	133	155	150	136	147
2	82	405	410	338	395	315	279	320
3	82	873	902	711	893	646	581	586
4	83	1166	1229	1035	1204	948	888	771
5	82	1237	1313	1164	1291	1085	1053	839
6	82	1230	1312	1193	1304	1116	1106	850
7	82	1202	1288	1183	1284	1112	1110	842
8	82	1170	1258	1163	1265	1099	1097	833
9	83	1169	1226	1167	1236	1106	1101	861
10	82	1237	1272	1222	1277	1167	1157	965
11	83	1345	1369	1315	1372	1275	1238	1092
12	82	1431	1466	1385	1480	1353	1307	1174
13	83	1471	1514	1427	1523	1386	1346	1185
14	82	1451	1506	1431	1506	1383	1358	1170
15	82	1436	1491	1424	1499	1372	1361	1151
16	82	1440	1492	1430	1506	1374	1373	1160
17	83	1449	1498	1439	1519	1380	1384	1179
18	82	1456	1510	1443	1523	1387	1391	1198
19	83	1464	1520	1452	1538	1395	1399	1214
20	83	1474	1528	1460	1549	1403	1404	1234
21	82	1482	1536	1466	1558	1409	1410	1261
22	83	1488	1550	1472	1569	1412	1413	1293
23	82	1495	1559	1479	1576	1418	1419	1317
24	82	1496	1572	1479	1575	1417	1420	1342
25	82	1502	1583	1482	1576	1421	1422	1361
26	83	1503	1585	1488	1588	1423	1427	1381
27	82	1511	1588	1495	1590	1427	1431	1401
28	82	1509	1591	1493	1585	1428	1432	1426
29	83	1509	1598	1493	1586	1427	1431	1449
30	83	1514	1603	1497	1590	1430	1434	1469
31	83	1518	1610	1498	1590	1433	1434	1500
32	83	1534	1623	1509	1604	1444	1441	1520
33	83	1533	1621	1512	1601	1451	1446	1542
34	84	1529	1617	1508	1595	1450	1440	1566
35	84	1533	1623	1513	1602	1452	1440	1585
36	84	1540	1628	1520	1613	1458	1447	1597
37	83	1536	1626	1522	1616	1460	1451	1609
38	83	1541	1627	1524	1617	1461	1453	1618
39	83	1555	1640	1530	1623	1471	1456	1626

Time (min)	Laboratory Ambient (°F)	Furnace #1 (°F)	Furnace #2 (°F)	Furnace #3 (°F)	Furnace #4 (°F)	Furnace #5 (°F)	Furnace #6 (°F)	Furnace #7 (°F)
40	83	1564	1643	1535	1624	1482	1461	1630
41	83	1565	1643	1538	1625	1485	1462	1634
42	83	1567	1644	1540	1625	1487	1464	1644
43	84	1572	1652	1545	1633	1492	1468	1653
44	83	1577	1655	1549	1637	1497	1473	1658
45	83	1578	1661	1555	1646	1500	1476	1671
46	84	1578	1660	1556	1646	1500	1478	1684
47	83	1589	1670	1564	1653	1505	1485	1685
48	83	1594	1673	1569	1656	1511	1491	1685
49	83	1598	1675	1571	1658	1515	1493	1685
50	83	1603	1676	1574	1660	1523	1496	1684
51	83	1603	1670	1573	1658	1527	1496	1688
52	83	1604	1673	1575	1662	1529	1497	1696
53	83	1610	1680	1581	1667	1532	1501	1701
54	84	1607	1673	1577	1661	1533	1501	1707
55	84	1608	1672	1576	1658	1535	1500	1720
56	83	1612	1676	1579	1661	1539	1502	1733
57	84	1609	1673	1577	1658	1538	1503	1741
58	84	1601	1666	1573	1654	1530	1499	1752
59	84	1606	1670	1575	1657	1532	1500	1756
60	83	1609	1670	1574	1656	1535	1499	1770

Max Temp:
Max Allowed:

OMEGA POINT LABORATORIES

Time (min)	Furnace #8 (°F)	Furnace #9 (°F)	Furnace #10 (°F)
0	86	86	86
1	195	182	193
2	585	429	540
3	1107	833	992
4	1160	1008	1046
5	1102	1026	1003
6	1040	1007	950
7	987	979	903
8	957	958	876
9	983	976	914
10	1118	1076	1075
11	1302	1238	1314
12	1374	1326	1394
13	1345	1321	1343
14	1290	1283	1279
15	1263	1249	1241
16	1263	1243	1251
17	1282	1252	1279
18	1303	1266	1306
19	1324	1281	1331
20	1348	1304	1361
21	1376	1329	1404
22	1409	1351	1454
23	1435	1370	1487
24	1456	1389	1518
25	1468	1407	1537
26	1483	1422	1547
27	1496	1434	1560
28	1514	1451	1588
29	1526	1465	1600
30	1551	1480	1630
31	1583	1505	1671
32	1604	1525	1691
33	1616	1541	1707
34	1631	1555	1734
35	1641	1569	1747
36	1646	1577	1746
37	1648	1586	1745
38	1661	1595	1756
39	1675	1609	1783

Time (min)	Furnace #8 (°F)	Furnace #9 (°F)	Furnace #10 (°F)
40	1689	1619	1798
41	1697	1627	1808
42	1704	1634	1815
43	1710	1641	1821
44	1721	1649	1830
45	1723	1653	1833
46	1723	1655	1833
47	1725	1658	1829
48	1732	1663	1832
49	1737	1667	1838
50	1750	1674	1844
51	1772	1688	1862
52	1783	1697	1867
53	1786	1705	1875
54	1800	1716	1874
55	1818	1732	1889
56	1821	1737	1908
57	1821	1740	1911
58	1819	1740	1918
59	1829	1749	1932
60	1854	1772	1950

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 #2: PROJECT NO. 97186

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. — 7/15/94 — Date

J. Price — TVA / TSI — 7/19/94 — Date

II. ELECTRICAL CABLE INSTALLATION

N/A

Omega Point Laboratories, Inc. — Date

TVA / TSI — Date

III. THERMOCOUPLE INSTALLATION

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

J. Price — TVA / TSI — 7/19/94 — 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 — 9/7/94
Omega Point Laboratories, Inc. — Date

J Pierce — 9/8/94
TVA / TSI — Date

V. FINAL PRE-BURN INSPECTION

C Humphrey — 9/7/94
Omega Point Laboratories, Inc. — Date

J Pierce — 9/8/94
TVA / TSI — Date

OMEGA POINT LABORATORIES

Event Log

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
All 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

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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 330 slab 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

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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 #03 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 held 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

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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 Therm-o-Lag sections. The score and fold method of applying Therm-o-Lag to the 90° elbow is used.	7/22/94	CH
Sections are held with the stainless steel tie wire.	7/22	CH
Therm-o-Lag wrap using the Vribbed board and the 18" cable trays is completed on all three trays of Test Deck #1 by TVA installers.	7/23	CH
Cable fill is completed on Test Deck #3 by OPL technicians.	7/25	CH
Second layer of pre-shaped Therm-o-Lag conduit sections are applied to the 3" conduit on Test Deck #1.	7/25	CH
Trowel grade Therm-o-Lag is applied over trays and conduit of Test Deck #1 before finial 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:
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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-Zag Supports between the cable trays on Test Deck #3.	7/26	CH
TVA installers measured, cut and installed T-Zag 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 Zag 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

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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.	7/27/94	CH
TVA installers begin the cutting and dry fitting of Thermo Lag 330-1 panels to the cable trays on Test Deck #3.	7/27	CH
Thermocouple verification is completed on this deck by OPL QA/QC.	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

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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

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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.	8/1/94	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

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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 Thermo-Lag pieces and the trowel grade Thermo-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 Thermo-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 effects readings,	8/2/94	CH

EVENT LOG

TVA/TSI

Client #11960

NOTE:
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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

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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 later 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

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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.	8/23/95	CH
This repair consists of adding Therm-o-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 NEI Therm-o-Lag Trowel grade material have been transferred to the TVA stock by an authorization letter from Biff Bradley. This material is from batch number 93-11649 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:
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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 Fuller, 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" Thermo-lag wrap. Thermo-couples were attached to the metal before wrapping to give information 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

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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
D.J. 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:
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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 proces is verified by Debb 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: Dea Priest Omega Point Labs Connie Humphrey " " " Kerry Hitchcock " " " Richard Beasley " " " Debb Stansberry " " "	9/7/94	CH

EVENT LOG

TVA/TSI

Client #11960

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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 Cleda Patton " " " J. Pierce TVA Bill Baker TVA Mark Talley TVA Pat Madden USNRC Rich Johnson TSI Ben Fowler TVA (Installer) Bernard McQueen " "	9/7/94	CH
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 75 psi and a 30° spray from a distance of five feet for five minutes.	9/7/94	CH (#92LE003)
	9/7/94	CH

EVENT LOG

TVA/TSI

Client #11960

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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 thermo-couples are attached to the data acquisition equip-ment. 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

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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		
Cleddy Patton " " "		
Herb Staysberry " " "		
Connie Humphrey " " "		
Kerry Hitchcock " " "		
Richard Beasley " " "		
Laudencio Castañon " " "		
Pat Madden US NRC		
Rich Johnson TSI		
J. Pierce TVA		
Bill Baker "		
Mark Salley "		
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-Lag material was stripped away and the condition of the materials was documented by the OPL staff.	9/8	CH
Deck #3 is given the final pre burn inspection by TVA and OPL staff and is approved for testing.	9/19	CH
The test article is placed on the test furnace and the thermocouples are attached to the data acquisition system.	9/19	CH
Final pre burn inspection is performed by Herb 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~~ "		
Reg Priest Omega Point Labs		
Connie Humphrey " " "		
Cleda Patton " " "		
Herb Stansberry " " "		
Kerry Hitchcock " " "		
Richard Beasley " " "		
Laurencio Castanon " " "		
Ben Loveless TVA (installer)		
Bernard McKeen " "		
Temperature at time of test start was 73° with the relative humidity at 73%.	9/20	CH
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	9/20	CH
uses the 30° spray fog nozzle (OPL Equipment 92LE003 pressure gage) with a pressure of 75 psi from a distance of 50 feet for 5 minutes	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 Double Tray WP/WR NO. 97186 TEST DECK 2

LOT/CONTRACT NO. [signature] 7/26/94 EXPIRATION DATE ______

CRAFTSMAN [signature] DATE 7/26/94

QC INSPECTOR C Humphrey DATE 7/26/94

TYPICAL DRAWING NO. 47W243-10 & 12

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING		
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE		
CIRCUMFERENCE	[initials] 7/26/94	
SURFACE APPEARANCE		
MESH OVERLAPS		

REMARKS: Measure & cut T-Lag supports. Drill supports and attach All-Thread. Install supports on tray. T-Lag supports are within dimensional tolerances.

WBEP - 7197A

ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97186 TEST DECK 2

LOT/CONTRACT NO: *94-03847 & 94-03028 EXPIRATION DATE N/A

CRAFTSMAN J.L. Price DATE 7/27/94

QC INSPECTOR C Humphrey DATE 7/27/94

TYPICAL DRAWING NO. 47W243-10 & 12

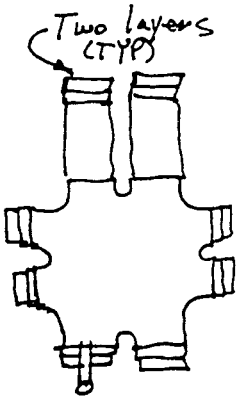
MONITORING POINTS

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

J.L.P. 7/27/94

REMARKS: * Panel Lot # 94-02012

Marked & cut panels to fit on tray. Used both score and fold method and individual piece method. Max thickness 3/4", Min Thickness 1/2". Installed two layers of 5/8" panel across the ends of the trays and fittings.



ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97186 Test Deck 2

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

CRAFTSMAN JJ Pierce DATE 7/28/94

QC INSPECTOR C Patton DATE 7-28-94

TYPICAL DRAWING NO. 47W293-10 & 12

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	ok	
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE		
CIRCUMFERENCE	JJP 7/28/94	
SURFACE APPEARANCE		
MESH OVERLAPS		

REMARKS: Panel Lot #s 94-03028, 94-03047, 94-02012
Hammered some ribs flat to achieve tight fit.
Used individual piece and score & fold method.
Attached pieces with tie wire and use of T-Lag supports.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97186 Test Deck 2

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

CRAFTSMAN J.J. Pierce DATE 7/29/94

QC INSPECTOR C Humphrey DATE 7/29/94

TYPICAL DRAWING NO. 97W293-10 & 12

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING	ok	
SEAMS OFFSET	NA	
JOINTS OFFSET	NA	
18" RULE	Yes	
CIRCUMFERENCE	N/A	
SURFACE APPEARANCE	ok	
MESH OVERLAPS		

REMARKS: Install pieces on tray supports. 3/8" Thick Panel Lot # 94-06051. Used to box in the 2" Conduit which was installed to provide a means of getting thermocouple leads out of the deck. No instrumentation on the conduit.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97186 - Test Deck 2

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

CRAFTSMAN J. Pierce DATE 7/30/94

QC INSPECTOR Veda Patton DATE 7-30-94

TYPICAL DRAWING NO. 47W243-10 & 12

MONITORING POINTS

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

REMARKS: Installed T-Lag on the conduit and end of tray. Completed support insulation.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97184-Test Deck 2

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

CRAFTSMAN JP Price DATE 8/1/94

QC INSPECTOR C Humphrey DATE 8/1/94

TYPICAL DRAWING NO. 97W243-10 & 12

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING		ok
SEAMS OFFSET	NA	N/A
JOINTS OFFSET	NA	N/A
18" RULE		N/A
CIRCUMFERENCE	JP 8/1/94	N/A
SURFACE APPEARANCE		ok
MESH OVERLAPS		OK

REMARKS: Attached stress skin to supports and tray. Applied skim coat of trowel over stress skin. Stitched stress skin overlap every 3"-5".

ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97186 - Test Deck 2

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

CRAFTSMAN JP Pierce DATE 8/2/94

QC INSPECTOR C Humphrey DATE 8/2/94

TYPICAL DRAWING NO. 47W243-10 & 12

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING		ok
SEAMS OFFSET	NA	ok
JOINTS OFFSET	NA	N/A
18" RULE		Yes
CIRCUMFERENCE	8/2/94	N/A
SURFACE APPEARANCE		ok
MESH OVERLAPS		Minimum 3"

REMARKS: Attached 3/8" flat panel pieces (6" wide) over seams on the top & bottom of the Double Cross. Cut off threaded rods flush with nuts. Covered nuts/rod with ball of putty and held in place by stress skin patch (~6" square) stapled to panel. Applied the final coat of trowel (skim coat) over entire assembly thick enough so stress skin is not visibly discernable.

ATTACHMENT 1

DATA SHEET

RACEWAY ID Double Cross Tray WP/WR NO. 97186-Test Deck 2

LOT/CONTRACT NO. N/A EXPIRATION DATE N/A

CRAFTSMAN J.A. Pierce DATE 8/3/94

QC INSPECTOR C Humphrey DATE 8/3/94

TYPICAL DRAWING NO. 47W243

MONITORING POINTS

	FIRST LAYER	SECOND LAYER
FASTENER SPACING		Tie wire 6" where possible
SEAMS OFFSET	NA	N/A
JOINTS OFFSET	NA	N/A
18" RULE	J.A.P 8/3/94	Yes
CIRCUMFERENCE		N/A
SURFACE APPEARANCE		ok
MESH OVERLAPS		N/A

REMARKS: Smooth surfaces with water & Scotch-Brite pads. Install tie wires

APPENDIX 7.1

G-98 REV. 0 SRN-98-01

Sheet 1 of 2

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 reskimed. (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.

ATTACHMENT 1

DATA SHEET

RACEWAY ID 97186 WP/WR NO. Test Deck #2 Sheet 1 of 2

LOT/CONTRACT NO. _____ EXPIRATION DATE _____

CRAFTSMAN [signature] DATE 9/1/94

QC INSPECTOR [signature] DATE 9-1-94

TYPICAL DRAWING NO. _____

MONITORING POINTS

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

NA

NA

REMARKS: Test Deck #2 had two(2) Layers of M-20-A MAT (manufactured by 3M) applied to the Structural Steel Supports above the 18" of Thermo-Lag protecting the raceway. The purpose will be to determine the thermal Protection provided to support steel & Thermo-Lag/3M interface by two(2) Layers of M-20-A.

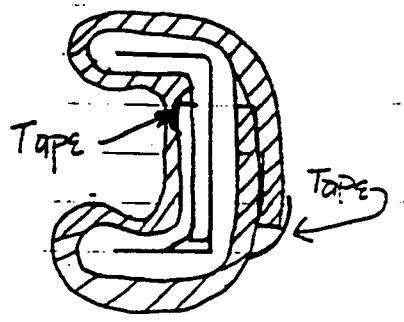
This deck is complete and ready for test.

218

SUBJECT 97186 PROJECT Test Deck #2

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

Thermo-Lag / 3M Interface

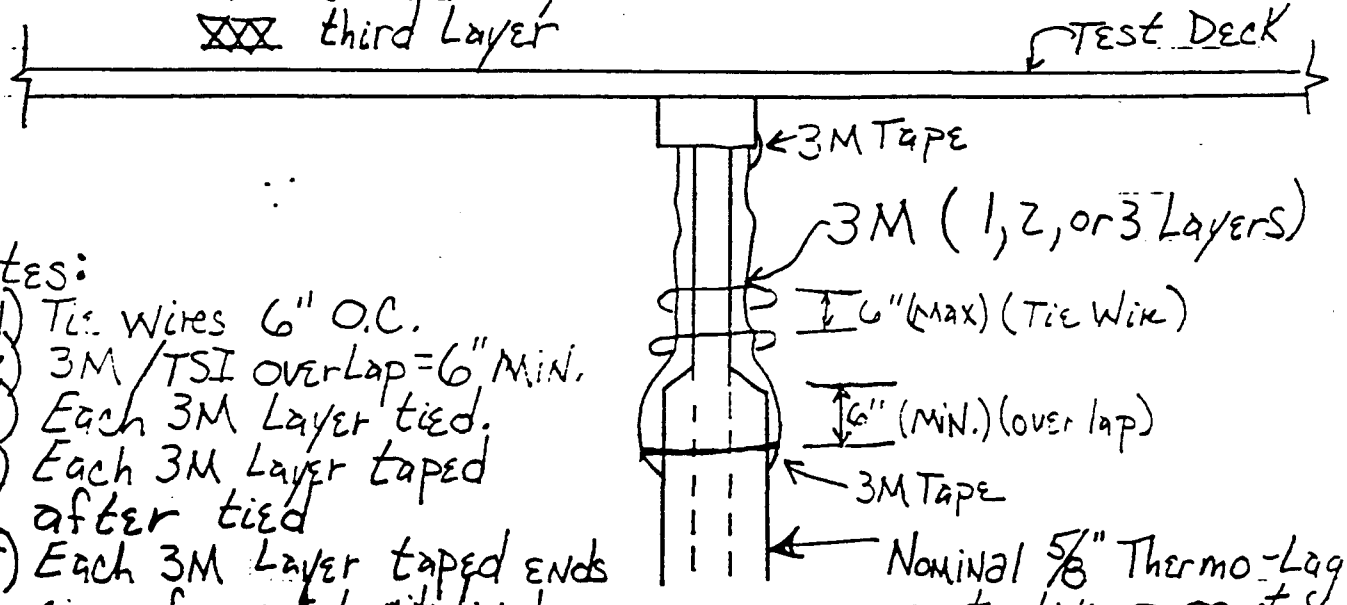


Deck #2

(2-Layer 3M)

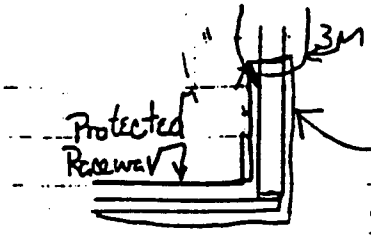
Plan View

Legend = first Layer
/// 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 Circumference & Longitudinal

Elevation



ThermoLag 18" on steel from protected raceway.

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

50-390 A6 12/23/94

-NOTICE-

THE ATTACHED FILES ARE OFFICIAL RECORDS OF THE INFORMATION & REPORTS MANAGEMENT BRANCH. THEY HAVE BEEN CHARGED TO YOU FOR A LIMITED TIME PERIOD AND MUST BE RETURNED TO THE RECORDS & ARCHIVES SERVICES SECTION P1-22 WHITE FLINT. PLEASE DO NOT SEND DOCUMENTS CHARGED OUT THROUGH THE MAIL. REMOVAL OF ANY PAGE(S) FROM DOCUMENT FOR REPRODUCTION MUST BE REFERRED TO FILE PERSONNEL.

-NOTICE-

9501120202

Certifications of Calibration and Conformance

OMEGA POINT LABORATORIES

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: 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	
TC Plugs	11400	200	200	0	T-1 Plugs	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:

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
8/15/94	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 10

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	GP

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.

[signature] 8/15/94
Quality Assurance Inspector

Manny Mocorro [signature]
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.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
TC Wire	11230	40K	37K	0	KK-TA/TA-2A	Y	Y	Good	None	X			LOT#'s: 105966-972; 106460; 106837-839 Order to be considered complete within 10% of original amount CH

FORM
1/29/93

2450

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:

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
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 6/28/94

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

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

Total	
Shipping	
Tax	
Invoice Total	

OMEGA POINT LABORATORIES
MATERIAL PURCHASING SPECIFICATIONS

SPECIFICATION NUMBER: MS--1123Q-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

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 Humphreys
Q/A Manager
Date 6/28/94

TECHNICAL EVALUATION

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. Humphreys
Q/A MANAGER
DATE 6/28/94

TECHNICAL EVALUATION

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.

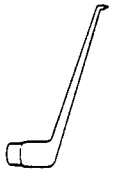
You will find our qualified sales and engineering staff eager to assist in selecting a design to meet the requirements of your specific application. Variations of this construction are available upon request, including aluminum Mylar* to reduce noise problems found in so many of today's plants.

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

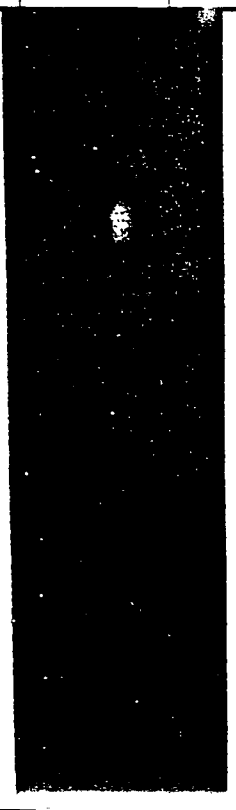
500°F (260°C) PFA insulation for improved electrical properties and high temperature applications



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.

SPOOLS & COILS > All shipments, unless specified otherwise by PMC, are made on non-returnable reels, spools or coils in one continuous length.

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

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, IN
16015 SHADY FALLS RO
ELMENDORF, TX 78

79838

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
7/27/94	OMEGA01	60	50	60	18794

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP	CODE
11530			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-TQ/TQ-24 REF. MS11230-97185 SCHED. SHIP 8/5/94	18,705'
2	20000.00	KK-TQ/TQ-24 REF. MS11230-97185 SCHED. SHIP 8/31/94	
3	1.00	CALIBRATION AT 200, 400, 600, 800 AND 1000°F (/0 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#	✓		✓		

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 ROA...
ELMENDORF, TX 781..

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
7/27/94	OMEG001	00	00	00	1370A

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP
11120		

SHIP VIA	F.O.B.	TERMS
UPS BLUE	LONDONDERRY, NH	NET 15

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
2	20000.00	KK-TA-T4-24 REF. MC11330-37135 SCHED. SHIP 8/31/94	5000
3	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... 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
8-31-94		1	34	✓		✓		

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 7811

DATE RECEIVED	CUSTOMER NO.	E	O	T	PMC JOB NO.
7/27/94	OMEG001	60	50	[illegible]	[illegible]774

CUSTOMER P.O. NUMBER	REQUESTED SHIP	SCHEDULED SHIP	CODE
[illegible]381			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 10

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QUANTITY SHIPPED
1	15000.00	KR-TA, TR-2 REF. MS11230-97185	13856
3	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	✓			✓	[illegible]

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

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.

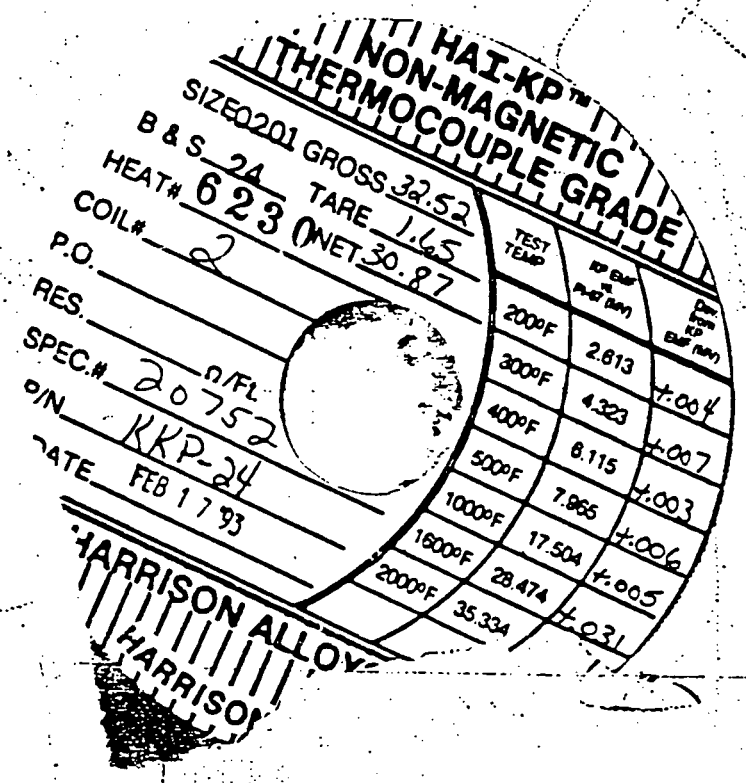
John Robinson
Quality Assurance Inspector

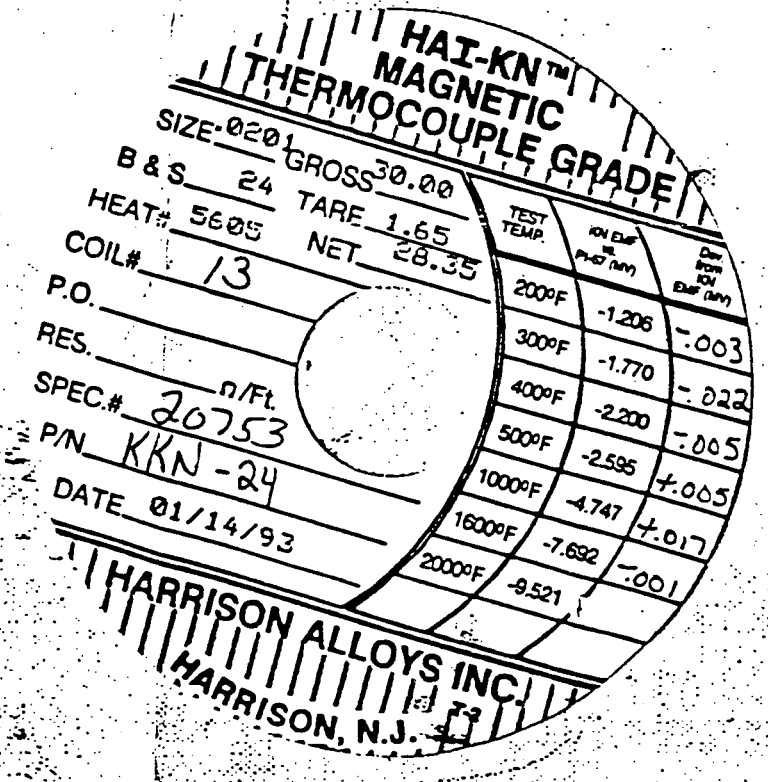
Quality Assurance Manager

57 HARVEY ROAD
LONDONDERRY, NH
03053
(603) 432-WIRE
FAX (603) 432-0435

Good KK material to Special Limitson Run # 6518 1-13-94

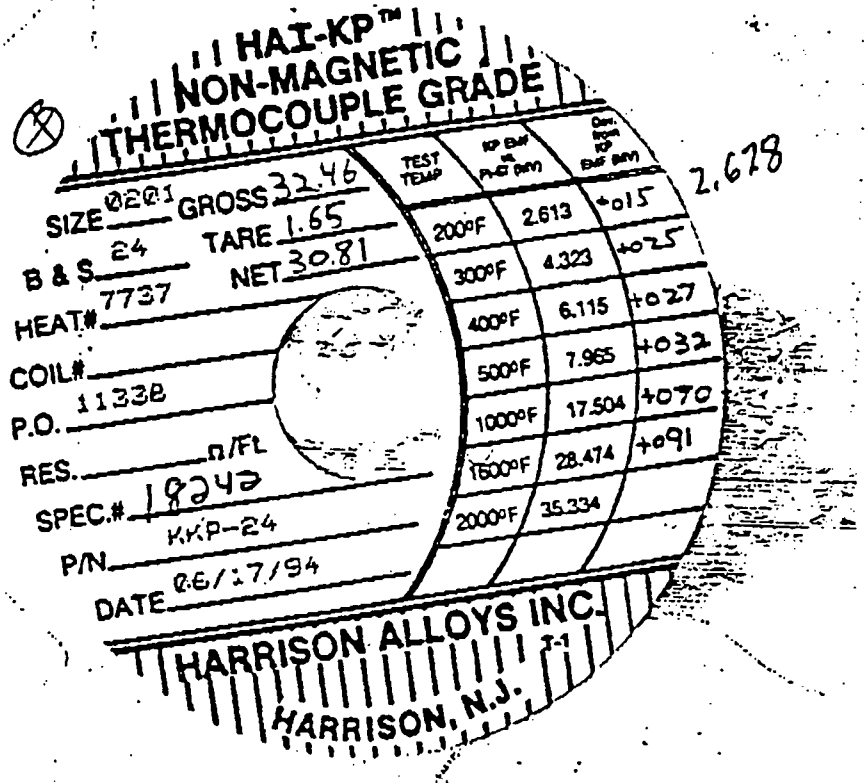
We re used for Spool 105-966.





Bare Wire Reel # 18242 used on Spool #s

105-967, 105-968, 105-969, 105-970, 105-971 & 105-972



2.678

Bare Wire Reel # 17623 Used
On Spool #'s 105-967, 105-968, 105-969
105-970, 105-971 & 105-972

HAI-KN™
MAGNETIC
THERMOCOUPLE GRADE

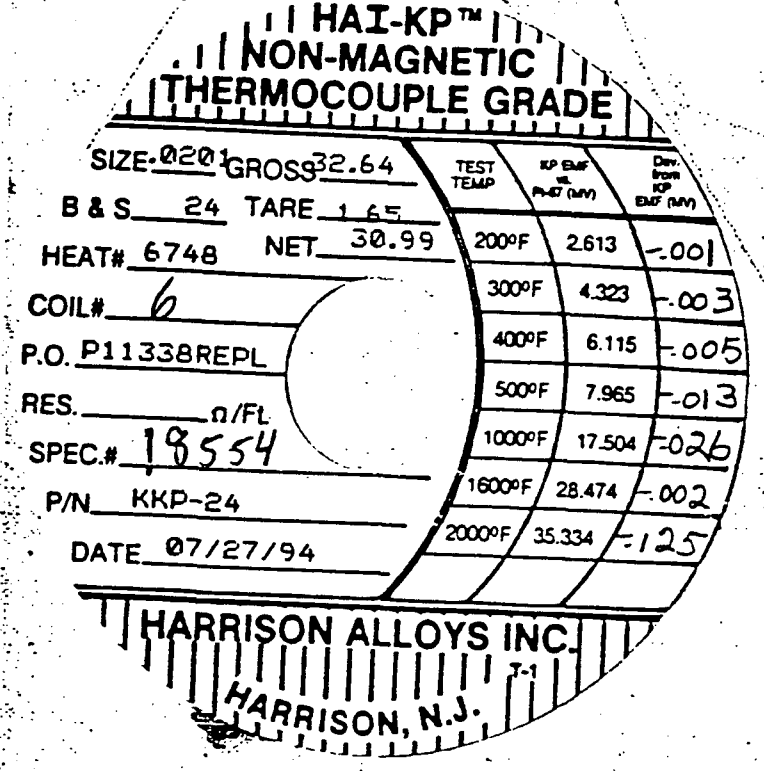
SIZE .0201 GROSS 33.31
B & S 24 TARE 1.65
NET 31.66
HEAT# 5605
COIL# 14
P.O.
RES. Ω/Ft.
SPEC.# 17623
P/N KKN-24
DATE 01/14/93

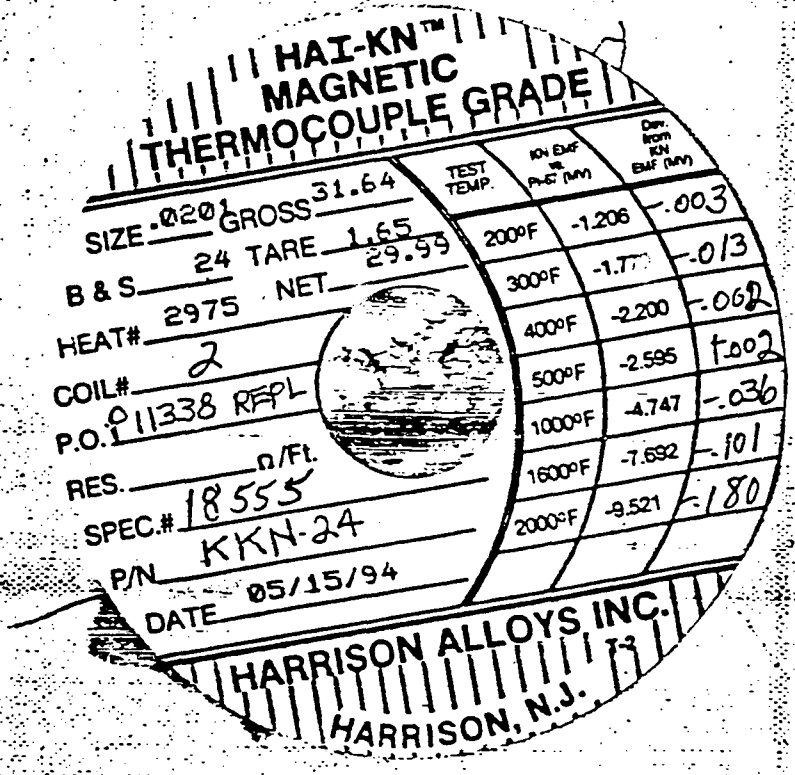
TEST TEMP.	KN EMF vs. Pt-4% (MV)	Dev. from KN EMF (MV)
200°F	-1.206	-.003
300°F	-1.770	-.015
400°F	-2.200	+.002
500°F	-2.595	+.014
1000°F	-4.747	+.018
1600°F	-7.692	-.008
2000°F	-9.521	

HARRISON ALLOYS INC.
HARRISON, N.J.

These Two Reels 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.
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 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.
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 1435 - 11960

DATE RECEIVED 9-7-94

DATE INSPECTED 9-8-94

INSPECTED BY: J 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
TC 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

280

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:

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
8/5/94	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	

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

78230

SHIP TO

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	OMEG001	[illegible]	[illegible]	[illegible]	[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 5. METERS
2. CFT 6. FEET
3. POUNDS 7. LOT
4. EACH NET 8. OTHER

ITEM	QUANTITY ORDERED	PART NUMBER / DESCRIPTION	QUANTITY SHIPPED
1	12000.00	FR-1A.TA-24 REF. M511390-11960	12265
2	1.00	CALIBRATION AT [illegible] 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.
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112-9784

DATE 8/31/94
CUSTOMER PO# 1139-O
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

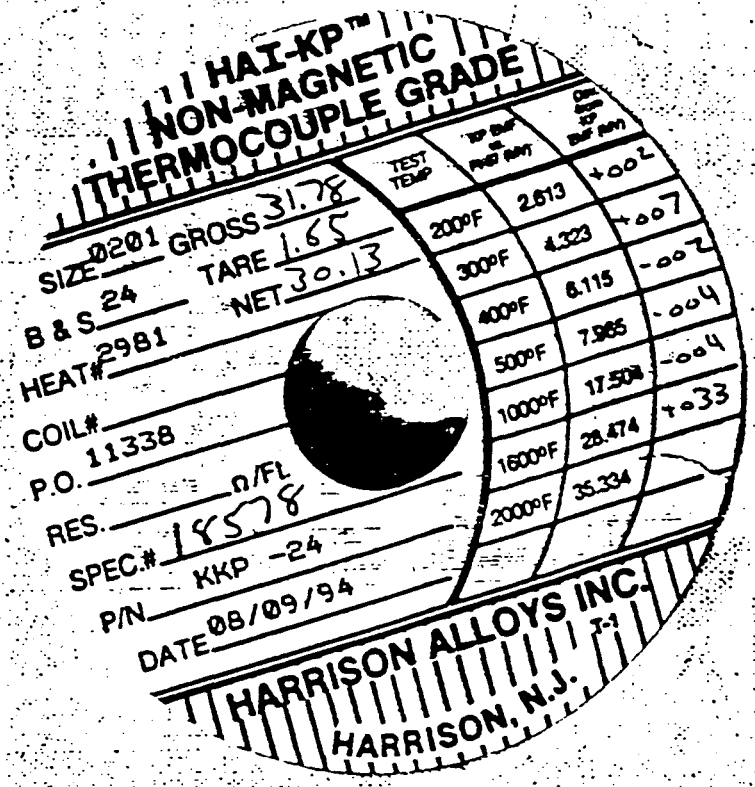
Quality Assurance Manager

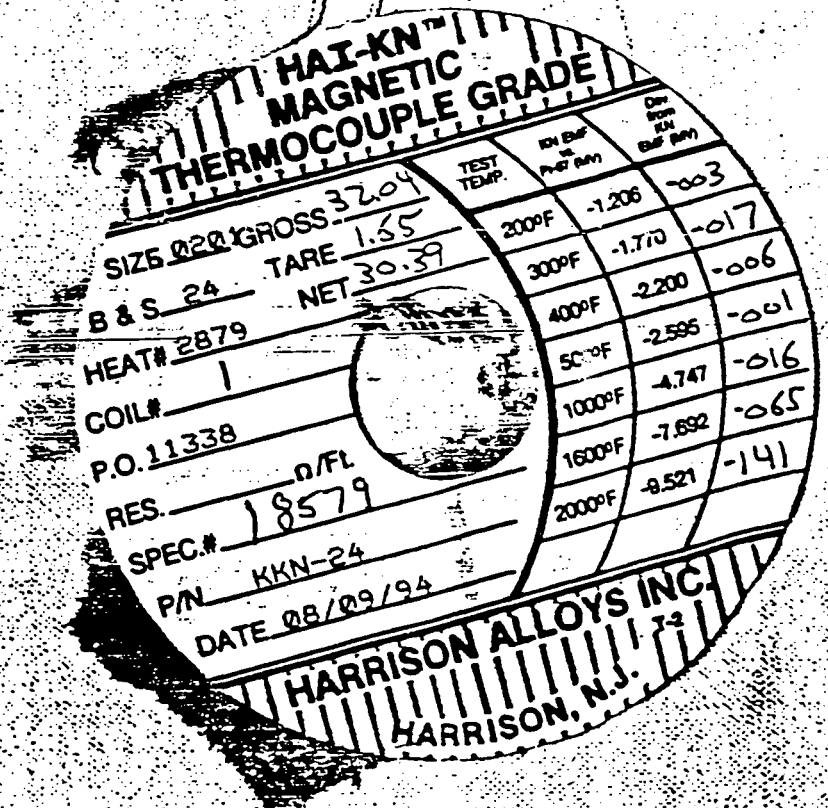
57 HARVEY ROAD
LONDONDERRY, NH
03053
(603) 432-WIRE
FAX (603) 432-0435

These Two Rolls were used To Manufacture Job No 18959

T.C.

Good. KK.
Special Limits
8-16-94





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OMEGA POINT LABORATORIES
COMMERCIAL GRADE DEDICATION

PURCHASING SPEC. NO: MS-113902-11960

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

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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

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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.

ELS, SPOOLS & COILS > All shipments, unless specified otherwise by PMC, are made on non-returnable reels, spools or coils in one continuous length.

ES & 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.	CONtD 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 spec. 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:

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
7/19/94	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 Q 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

285

Rothe Development, Inc.
Metrology Services Division
[redacted] Sinclair Rd.
[redacted]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

[redacted]ved 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

230

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

R #'s 20,30,208,150

COMMENTS CAL DATA PROVIDED

WORK PERFORMED:

Cal'd

EN 74 °F
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
[illegible] NIST TEST# 250839
[illegible] NIST TEST# 251316
Hz WWVB Transmission

INSPECTED BY Joe A Mendoza
COMMENTS:

RDI 1001

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

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): Bothe Development
4614 Sinclair Rd.
San Antonio, TX
78222

Ship Date: 2/14/94
Return Date: 2/28/94
P.O. #: 11120

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:

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	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

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

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

235

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-466-1-1

SERIAL # 703297

TYPE Digital Temp Calibrator

ACCES. RCVD. Probe handle

- [ ] REPAIR
- [ ] 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 [*]
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:

DI 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 MAIL 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

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 303

METROPLEX METROLOGY LABORATORY

PHONE Metro (817) 267-4999
FAX (817) 540-1410

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

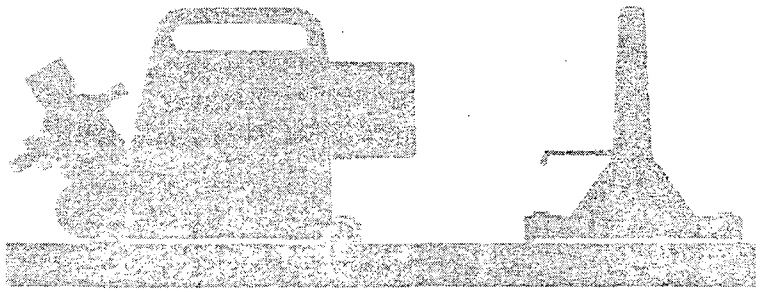
SOLD TO
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784

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
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
	10 Pieces	F94-03018
Item 02		
	28 Pieces	
No Shelf Life On Conduit	(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
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

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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

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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-LAG 330 RIBBED PANEL NOMINAL 3/8" THICK, 4'x6½' NOM.	1 PANEL	F93-11048
	4	F94-02012
	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

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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
ITEM 07	7	F94-03028
	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

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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

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 PAGE NO. 1

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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

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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
Manager Quality Control

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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
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

TSI

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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

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Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
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 and Temperature Readers have 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	Y	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	Y	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

317

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185, 86487
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.	COMD MATL Y/N	CERT. RECD 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 Tie Wire	NA	0	100lb.	0	16ga, Type 304	Y	Y	Good	None	X			
Stainless Steel Banding	NA	0	3 rolls	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

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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
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

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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	5 Pieces	F9-105037
THERMO-LAG Preshaped Conduit Sections	3 Pieces	F92-09051
Thickness: 0.625" ± 0.125" Nom. Size: 4"	10 Pieces	F92-11018
Item 02	10 Pieces	F94-03018
	28 Pieces	
No Shelf Life On Conduit	(In 2 Cartons)	

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David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
BILL OF LADING: 21334
MODE OF TRANSPORT: DYNAMIC TRANSIT PREPAID

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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

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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

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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
David O'Bryant
Manager Quality Control

DATE OF SHIPMENT: 30 June 1994
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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
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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

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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

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
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
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

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	F94-04 05
Item 13	10 Pieces (In 1 Carton)	

No Shelf Life On Conduit

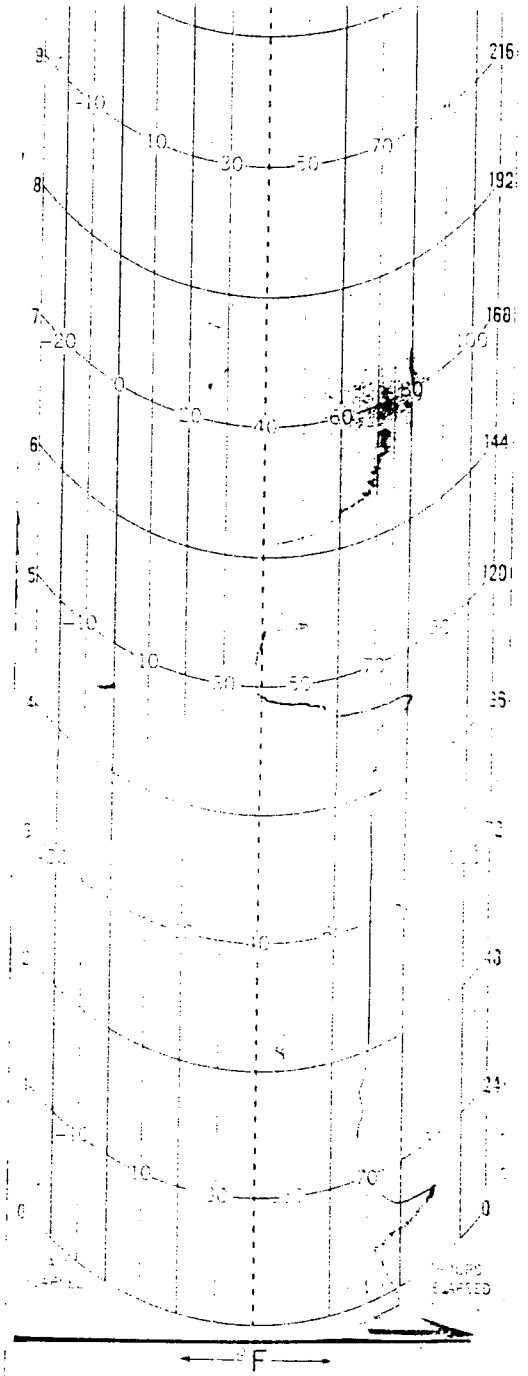
This will certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV 92362V, to Omega Point Laboratories San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point Laboratories, 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

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: Omega Point

CAR CONT: _____

PER: _____

CITY: St. Louis

SHIPPER: T&I

DATE: 6-30-94 TIME: 1:30pm

INSTR. No. _____

CHART 27

LOAD CARTRIDGE – ADVANCE CHART

32 DAY (–30° + 110° F)

PART NO. 840-95

PARTLOW THERMA-GARD

NEW HARTFORD, N.Y. 13413

START

SHORT FORM — ORIGINAL — NOT NEGOTIABLE

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.**
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 (Sub. to Correction)	Class or Rate	Check Column
1	✓	CARTON TVA PART #158100 ✓			
		16 PCS. 1" ITEM 01			
2	✓	CARTONS TVA PART NO. 158400 ✓	100 lb.		
		28 PCS. 4" ITEM 02			
1	✓	CARTON TVA PART NO. 238100 ✓	300		
		16 PCS. 1" ITEM 03			
1	✓	CARTON TVA PART NO. 338300 ✓	150		
		8 PCS. 3 INCH (UPGRADE) ITEM 04			
1	✓	CARTON TVA PART NO. 438300 ✓	90		
		8 PCS. 3" (UPGRADE) ITEM 05			
1	✓	PALLET TVA PART NO. 1384X6	90		
		27 EA. THERMO LAG 330 RIBBED PANEL	700		
		3/8" THICKNESS 4'x6½' NOM. ITEM 06			
4	✓	PALLETS TVA PART NO. 1584X6			
		46 PANELS THERMO LAG 330 RIBBED PANEL	5200 lb.		
		5/8" THICKNESS NOM. 4'x6½' ITEM 7			
2	✓	PALLETS CONTAINING: 40 x 50 LB. PAILS			
		[redacted] THERMO LAG 330-1 SUBLIMING COATING	2400		
		TROWEL GRADE ITEM 08 TVA PART TG-330			
1	✓	1 x 5 gal. pail containing temp. recorder			
		STORE ABOVE 32 F AND BELOW 100F AT ALL TIMES			
		CARTON CONTAINING: STRESS SKIN ASTM E437			
	✓	TYPE 304 SS Wire/plain weave 8x8 square	120 lb.		
		mesh wire cloth 0.017" DIA. Wire ITEM 09			
	✓	CARTON CONTAINING:			
		3 Rolls SS Banding ITEM [redacted] 11	10 Lb.		
	✓	3 Rolls (100 Lb.) SS TIE WIRE TYPE 304			
		ITEM 10			
	✓	1 BOX OF 1000 [redacted] SS CLIPS ITEM 11			
	✓	CARTON TVA PART NO. 158340 ✓			
		3/4" [redacted] 10 PCS. ITEM 12	50		
	✓	CARTON TVA PART NO. 238340 ✓			
		SIZE 3/4 INCH UPGRADE ITEM 13 (10 PCS.)	100		

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."

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 ...fication.

...certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according ...able regulations of the Department of Transportation.

...ent 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."

...print in lieu of stamp; not a part of Bill of Lading approved by the Department of Transportation.

...e the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
...f declared value of the property is hereby specifically stated by the shipper to be not exceeding ____________

...NT IS CORRECTLY DESCRIBED.
...EIGHT ____________ 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. According Certificates complying with 49 CFR 173, 430 (a) in effect ... NOTE: Procedure used through June 30, 1976 ...

...MAL SCIENCE, INC. Shipper Per ____________ Shipper

Shipper, Per [signature] [signature: Dynamic Transit] Agent, Per

...ost office address of shipper **2200 Cassens Dr., St. Louis, MO 63026**

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.	CONTD MATL Y/N	CERT. REC'D 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 335

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	

VIA	INIT.	CONTACT
UPS-NEXT DAY AIR	Ken	Denise

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

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 ~~8-29-94~~ 8/31/94
DATE INSPECTED ~~8-29-94~~ 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.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Stress Skin	NA	0	2rolls	0	SS-008-010-48	Y	N	Good	None	X			Receiving Verification Only
SS Tie Wire	NA	0	25lbs	0	16ga annealed Type 304	Y	Y	Good	None	X			

FORM
1/29/93

PACKING LIST 337

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	

TING	INIT.	CONTACT
UPS-NEXT DAY AIR	Ken	Denise

314-[illegible]

QUANTITY ORDERED*	DESCRIPTION (PART NUMBER / MESH / WIRE / MATERIAL / WIDTH / CODE)	QUANTITY SHIPPED*
600.00	SS-008-0170-48 8X8 .017 304SS 48" A I606	600.00

150'-0" } 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 H 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 Elvin 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.

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, 97337 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. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
Temperature Recorder	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	10	0	158AX6 F94-02012	Y	X	Good	None	X			
" "	NA	0	1	0	158AX6 F94-03028	X	Y	Good	None	X			
" "	NA	0	4	0	158AX6 F94-03047	Y	Y	Good	None	X			
" "	NA	0	7	0	158AX6 F94-04005	Y	Y	Good	None	X			
" "	NA	0	16	0	158AX6 F94-07014	Y	Y	Good	None	X			
" "	NA	0	1	0	158AX6 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.

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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 NO. TV92363V

At ST. LOUIS, MISSOURI 63026 8/18 19 94 Shipper's No. 21398

Carrier DYNAMIC TRANSIT PREPAID Agent's No.

Consigned to TENNESSEE VALLEY AUTHORITY c/o OMEGA POINT LABORATORIES (Mail or street address of consignee—For purposes of notification only.)

Destination 16015 SHADY FALLS ROAD 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 (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: ✓ 6 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: STEEL 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 blank 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

THE 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

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.

Permanent post office address of shipper 2200 Cassens Dr., St. Louis, MO 63026

TSI

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

350

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

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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

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

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

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

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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
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

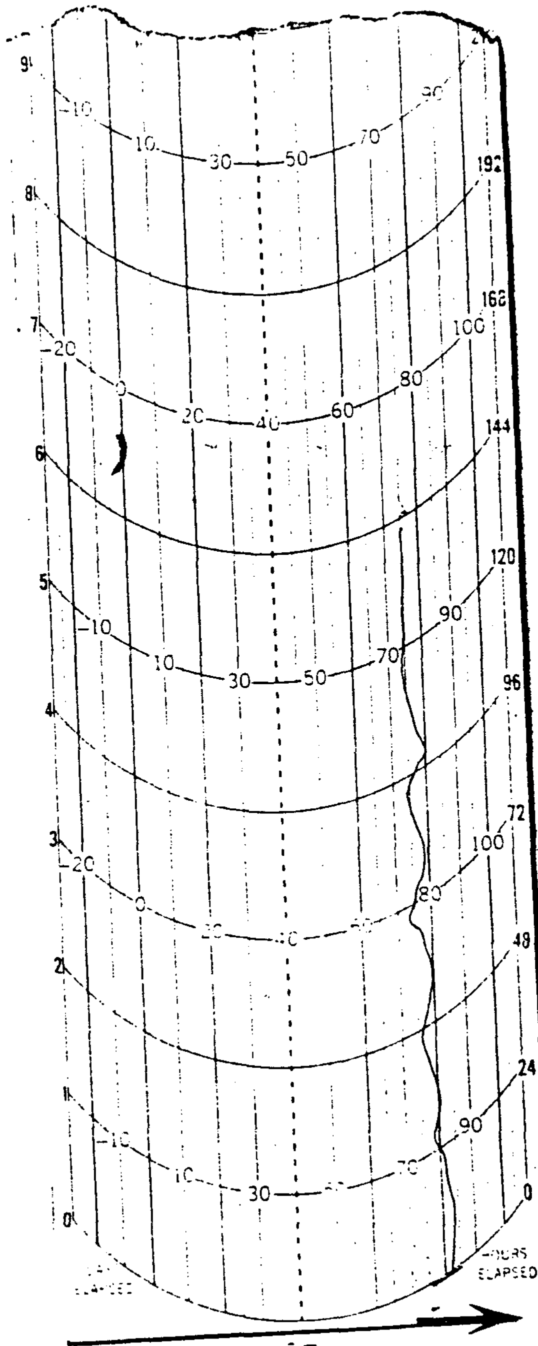
This will certify that the above listed THERMO LAG Materials, shipped under Contract Order No. TV92362V, to Omega Point Lab., Elmendorf, TX Meet the requirements of TSI's manufactured and written Quality Control Spec. for TVA This material does not contain asbestos.

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 Dugga Point
CAR CONT.:
PER:
CITY: St. Louis
SHIPPER: I S I
DATE: 8/18/94 TIME: 9:50
INSTR. No.:

CHART 71

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: 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	
Thermo-Lag panel 1"X4'X6½'	NA	0	1	0	F94-08003	Y	N	Good	None	X			Thermo-Lag 330-1 trowel grade upgrade 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.	COND 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

362

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.**
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

HI[illegible]MENT 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 Agent, Per

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: 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
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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 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

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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

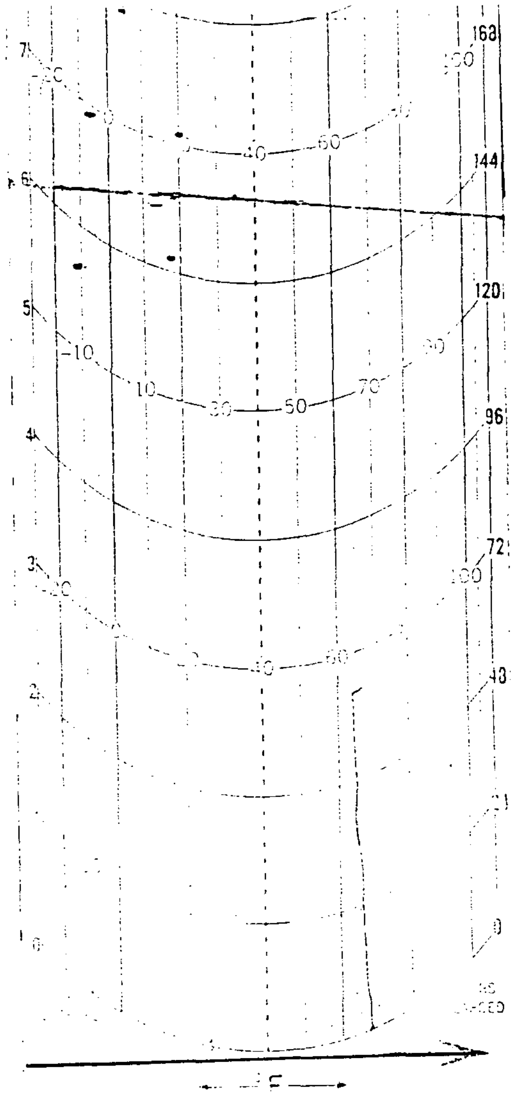
LOT NUMBER	QUANTITY	TEST NO:	DESCRIPTION	ANALYSIS	SPECIFICATION
94-09009	1000 LBS. (20 x 50 Lb. Pails)	A-2	WT/GALLON	10.16	10.5 ± 1.5
		A-3	pH	8.5	8 ÷

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 PAGE NO. 1



CAR NO. ____________________

CITY: San Antonio, Tx

CONSIGNEE: TVA / Omega Point

CAR CONT.: ____________________

PER: ____________________

CITY: St. Louis

SHIPPER: TSL

DATE: 9-23-94 TIME: 10:15am

INSTR. NO.: ____________________

CHART 71

32 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 Order	Rec'd	B.O.	I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS SEE	ACCEPTANCE Accept	Hold	Reject	REMARKS
1.	TEST ARTICLE 3 STEEL COLUMNS	N/A	0	3	0	SIZE 16" X 36"	N	N	GOOD	REMARKS NONE CH	X			TEST ARTICLES (ITEMS 1-6) REC'D WITH THIS SHPMT, BUT ARE NOT PART OF PROJECTS #97553 THRU #97555, RECEIVING VERIFICATION ONLY. CH
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			

FORM 1/29/93

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TVA/TS1
CLIENT/PROJECT NUMBER 11960-97553-55
RECEIVED FROM TS1
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			C/HART RECORDER RETURNED TO TS1. TEMPERATURES RECORDED ARE WITHIN ACCEPTABLE RANGE. RECEIVING VERIFICATION ONLY. CH
12.	12" 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

382

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	800 Lb		
		3 COLUMNS 16 x 50			
		1 COLUMN 10 x 49			
		3 FT. LONG (ED TAYLOR)			
1		PALLET CONTAINING	400 LB.		
		3 INCH CONDUIT U SHAPE TEST ARTICLE			
1		PALLET CONTANING:	100 LB		
		3 INCH CONDUIT 10 FT. STRAIGHT			
		1½ INCH CONDUIT 10 FT. STRAIGHT			
1		PALLET CONTAINING:	500 LB.		
		18 INCH CABLE TRAY 12 FT			
		TVA ORDER/ 21494			
1		PALLET CONTAINING: 8 PANELS	1800 LB.		
		SIZE: 4' x 6½' NOMINAL THICKNESS:			
		1.25" + 0.250" ITEM 1			
1		PALLET CONTANINING:	1750 LB.		
		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			
1		CARTONS OF THERMO LAG 330 PRESHAPED	125 lb.		
		CONDUIT SIZE 1" x 250" 24 Pcs. (11)			
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 of 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 Jane Elizalde — Agent, Per _____

Permanent post office address of shipper **2200 Cassens Dr., St. Louis, MO 63026**

THERMAL SCIENCE INC.

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 Pozaud
HEAD OF SHIPPING

THERMAL SCIENCE INC.

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 Pozzuoli
HEAD OF SHIPPING

TSI

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
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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

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	F94-08021
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

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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 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		

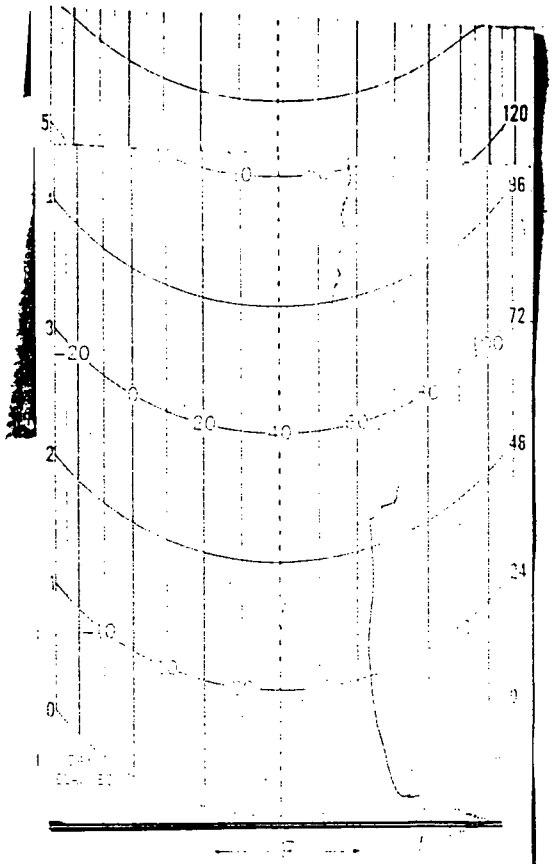
This is to certify that the above listed THERMO-LAG Materials shipped under Contract Order No. TV92362V, to Omega Point Laboratories, San Antonio, TX, Meet the requirements of Thermal Science, Inc. manufactured and written Quality Control specifications for Tennessee Valley Authority c/o Omega Point 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-Bank
CAR CONTENTS
PER
CITY St. Louis
SHIPPER TSI
DATE 10-8-94 TIME 8715
INSTR. No.

CHART 27

2. FILL IN DATA

1. LOAD CARTRIDGE - AT

32 DAY (-20° + 110° F)

PART NO. 8-40-95

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 PROTECTION	B
EXTREME	4		

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.

MATERIAL SAFETY DATA SHEET PRODUCT NAME: Thermo-Lag 770

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			I.D. NO.	CONT'D 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 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 ORIGINAL ORDER impression, and retained by the Agent.

400

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
ST. LOUIS, MISSOURI 63026

CONTRACT

10/12/ 19 94 Shipper's No.

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 (Subject to Correction)	Class or Rate	Check Column
4		PALLETS CONTAINING: 63 PANELS - THERMO-LAG 770-1 PANELS SIZE: 40 INCH X 94 INCH THICKNESS: 3/8 INCH ITEM 4	4800 LB.		
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:

$

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

THIS SHIPMENT IS CORRECTLY DESCRIBED.

CC 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

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

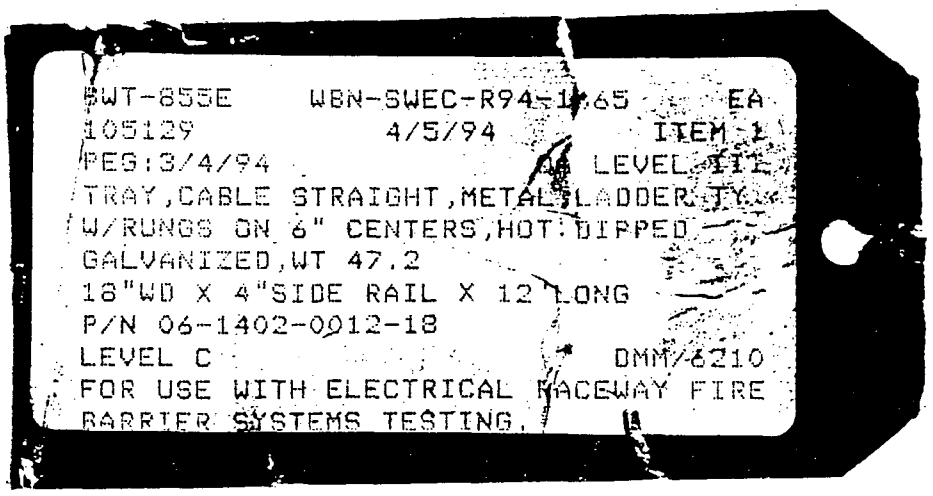
Q/A RECEIVING REPORT

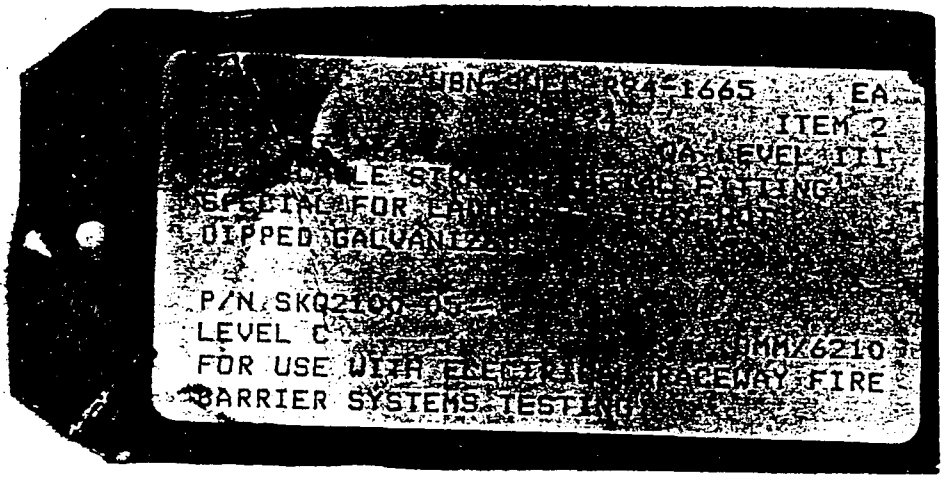
CLIENT/PROJECT NAME TVA/TSI
CLIENT/PROJECT NUMBER 11210/TBD
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

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.	CONTD MATL Y/N	CERT. REC'D 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 in use upon delivery; 6 pieces were damaged slightly (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
LEVEL C
DMM/6210
FOR USE WITH
RACEWAY FIRE
BARRIER SYSTEMS TESTING

ELMENDORF SHADDY FALLS RD 8100
05916702 TX 78112
PO# NONE
20
OVERNITE PHONE NUMBER (210)662-0966
Peggy

264706 OVNT
FREIGHT BILL NUMBER 345 608 583
CITY RTE/BYD SCAC 2M
DEST SNT
PICK UP DATE 05/16/94
ORIG KNX

TENNESSEE VALLEY AUTHORITY 345 608
WATTS BAR NUCLEAR PLANT 405
SPRING CITY TN 37381
00994265
ADV CAR NONE
BL#
AD
OV 61.75
BD

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 ★ ★ ★

Ofes Bent & Damage
1/ loose upon Del

TTL PCS 2 TTL WT 300

DELIVERY EXCEPTIONS

SIGNATURE	FIRM	ODOM	ARRIVE	DEPART	TOTAL CHARGES
		009	9:16	9:45	61.75 C
RECEIVED THE ABOVE PROPERTY IN GOOD CONDITION EXCEPT AS NOTED.		DATE 5-23-94	PCS 1 Pc	INITIALS RDW	

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 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. RECD 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	A3L6043612L	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	ALU34ELL	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 (FEB-5-70)

SHIPPING TICKET

NO. 55694-00873

407

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR ATHENS, AL 35611 7/14 19 94

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER-NCR-N&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		
[redacted]		CAP, 3", #PLG300A		1	EA		
[redacted]		COUPLING, 3/4", ALUMINUM		2	EA		
15		CONDUIT OUTLET, 4"		7	EA		

QA-0

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

0115008526

TRACKING NUMBER 0115008526

408

RECIPIENT'S COPY

1 From (Your Name) Please Print: DANNY T. ROBINSON
Date: 7-14-94
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

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

YOUR INTERNAL BILLING REFERENCE INFORMATION (optional) (First 24 characters will appear on invoice.)

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
- [ ] 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 (d)
- [ ] 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 4 [ ] B.S.C. 5 [ ] Station 2 [ ] On-Call Stop

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 1960-97185-87
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. RECD 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	–	4pr	–	1079-1302-02	Y	N	"	"	X			
Cable 16AWG	NA	–	1reel	–	Reel #12963	X	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. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
3/4" Alumn Conduit	NA	-	2	-	AVK-542K	Y	N	Good	None	X			Receiving verification only
2" Alum Conduit	NA	-	5	-	AVK-543K	Y	N	"	"	X			Non-safety related material.
2.5" Alum Conduit	NA	-	1	-	BBN-621X	Y	N	"	"	X			CM
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/TSI
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. REC'D 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

SHIPPING TICKET

NO. 413

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., MSPS

SHIP TO
OMEGA POINT LAB
16015 SHADY FALLS ROAD
ELMENDORF, 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.	2	Conduit, 3/4" Aluminum	AVK-542M	2	PC		
2.	5	Conduit, 2" Aluminum	AVK-543K	5	PC		
3.	1	Conduit, 2.5" Aluminum	BBM-521X	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-260E	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-557M	1	EA		
25.	4	Conduit Coupling, 3" Aluminum	BET-731P	4	EA		
26.	8	Conduit Coupling, 4" Aluminum	XBBET-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

CUSTOMER COPY (BLUE)

CONSIGNEE	INBOUND TRAILER	SHIPPER
OMEGA POINT LAB 16015 SHADY FALLS RD [...]MENDORF TX 78112 6358100	288858 OVNT	TVA NUCLEAR PLANT BROWNS FERRY RD ATHENS AL 35611 02521271 (205)729-2000
	FREIGHT BILL NUMBER: 391 634 025	391 634 025
PO# NONE	CITY RTE/BYD SCAC: 2M — DEST: SNT	ADV CAR
OVERNITE PHONE NUMBER: (210)662-0966	PICK UP DATE: 05/25/94 — ORIG: DCT	BL# 5569400740
31		AD — OV — BD

2P

DELIVERY RECEIPT COPY: 1

OVERNITE TRANSPORTATION COMPANY

391 634 025

COLLECT THIS AMOUNT $.0 $.0

# PCS	HM	PT	DESCRIPTION OF ARTICLES AND SPECIAL MARKINGS	WEIGHT	NMFC	RATE	CHARGES
4		SK	4 HANDLING UNIT(S) CONDUIT & FITTING SECTION 7 SIGNED BILL TO: 00501491 80205 OVERNITE 1-2"x10' AL conduit bent Roger [illegible] 6-2-94	2567	050940-00		

4 ◀ TTL PCS — TTL WT ▶ 2567

[DEL]IVERY EXCEPTIONS	SIGNATURE	FIRM	ODOM	ARRIVE	DEPART	TOTAL CHARGES
	Cleda Patton		DATE	PCS	INITIALS	P

RECEIVED THE ABOVE PROPERTY IN GOOD CONDITION EXCEPT AS NOTED

OMEGA POINT LABORATORIES

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: CPatton

ITEM DESCRIPTION	P.O. NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	COMD MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE Accept	Hold	Reject	REMARKS
3" gal. Conduit	NA	–	2	–	720092260 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	–	429818 BIN-409R	Y	N	Good	None	X			

FORM
1/29/93

425

SHIPPING TICKET

416

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	BLB-258A	1	ea		
3	3	STRAP RETAINING 3 in PIPE 42981B	BJH-409E	3	ea		
		ALL ITEMS QA 3					
		5/2/94 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.	COMD 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. 418
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

0005121

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.					
		KEY : TRACKING # 9400031847					

SHIPPING WEIGHT

DISTRIBUTION OF TRANSPORTATION CHARGES

DATE SHIPPED 07/15 19 94 G. B. L. No. TV

METHOD OF SHIPMENT FED EXP

3 — 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 [illegible] 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

4159 0115008530

RECIPIENT'S COPY

1 Date 7-15-94

From (Your Name) Please Print

Your Phone Number (Very Important) (205) 729-4661

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: Omegh Point Lab

Department/Floor No.

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.): 1615 Shady Hill Rd

City: Elmendorf State: TX ZIP Required: 78112

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†)
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
☐ _____
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 2 ☒ On-Call Stop 3 ☐ Drop Box 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
FORMAT #158
158
PRINTED IN U.S.A.

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.	COND 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

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-972~~58~~-604-97332-38
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	BGK730W	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)

SHIPPING TICKET

No. 862-94-0974

422

SHIPPER J.M. WILLIAMS

POINT OF ORIGIN NEAR SPRING,CITY, TN 37381 8-26 19 94

SHIPPING STOREROOM WATTS BAR NUCLEAR PLANT

AUTHORITY R.D. HALL PROJ MGR N.E.

SHIP TO

OMEGA POINT LABORATORIES, 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	BPP177P	2	EA		
4		2-1/2 - 3 IN LB COVER	MBT792M	5	EA		
5		2-1/2 -3 IN LB GASKET	BGP836C	5	EA		
6		1 IN GASKET BPQ043N		2	EA		
7		2IN GASKET	BGK730W	5	EA		
8		2 IN LB COVER AQP157N		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

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: 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	
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)

SHIPPING TICKET

No. 35694-01057 424

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

P TO
OMEGA POINT LAB
16015 SHADY FALLS ROAD
ELREDORF, 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 9569284303

413M 9569284303

RECIPIENT'S COPY

1 Date

From (Your Name) Please Print | Your Phone Number (Very Important)
Company | Department/Floor No.
Street Address
City | State | ZIP Required

2 To (Recipient's Name) Please Print | Recipient's Phone Number (Very Important)
Company | Department/Floor No.
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.)
City | State | ZIP Required

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)
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)
☒ 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 | MESSENGER 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

CLIENT/PROJECT NAME TS1/TVA
CLIENT/PROJECT NUMBER 11960-97185-87+97257-60
RECEIVED FROM TVA
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 14-14 . 11960
DATE RECEIVED 8-10-94
DATE INSPECTED 8-10-94
INSPECTED BY: C Patton

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	CONFD MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
1" steel Conduit	NA	0	7	0	AWD-015W	Y	N	Good	None	X			Receiving Verification only 10' Length for a total of 70 feet

FORM
1/29/93

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY
SHIPPING TICKET

No. S5694-01017

SHIPPER 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 BE OMEGA POINT LABS
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112

ACCT NO. (DO NOT INCLUDE TRANSPORTATION CHARGES)

DEBIT 0005131 ~~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

0115008830

4159M 0115008830

RECIPIENT'S COPY

1 Date 8-8-94

From (Your Name) Please Print: [illegible]

Your Phone Number: (205-729- [illegible]

Company: [illegible]

Street Address: [illegible]

City: ATHENS | State: AL | ZIP Required: 3 5 6 [illegible]

2 To (Recipient's Name) Please Print: [illegible]

Company: [illegible]

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes): 1601 [illegible] Falls [illegible]

City: Elmendorf | State: TX | ZIP Required: 78112

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
5 DELIVERY AND SPECIAL HANDLING
6 PACKAGES | WEIGHT In Pounds Only | YOUR DECLARED VALUE

1 | 125

OTHER | 51 ☐ OTHER | DELIVER WEEKDAY
FEDEX LETTER
52 ☐ FEDEX PAK | 31 ☐ HOLD AT FEDEX LOCATION SATURDAY (Fill in Section H)
13 ☐ FEDEX BOX | 53 ☐ FEDEX BOX | 3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
14 ☐ FEDEX TUBE | 54 ☐ FEDEX TUBE | 9 ☐ SATURDAY PICK-UP (Extra charge)

Total | Total 125 | Total

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

Special Handling
4 ☐ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE — Dangerous Goods Shipper's Declaration not required
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

Freight Service (for packages over 150 lbs.)
70 ☒ OVERNIGHT FREIGHT **
80 ☐ TWO-DAY FREIGHT
** Confirmed reservation required
† Delivery commitment may be later in some areas.

DIM SHIPMENT (Chargeable Weight)
☐ L x W x H

Received At
Regular Stop | 3 ☐ Drop Box | 4 ☐ B.S.C. | 5 ☐ Station | On-Call Stop

7 Release Signature

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

FedEx Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 3/94
PART #137201 FXEM 5/94
FORMAT #158

158

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PRINTED IN U.S.A.

429

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI/TVA
CLIENT/PROJECT NUMBER 11960-97185-87 & 97332-88 97257-60
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			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	
Junction Box	0	0	1	0	Ref # 94-5349	Y	N/A	Good	None	X			Receiving Verification Only NOTE: CK
1'X1'X5'													

FORM
1/29/93

430

TVA 144 (FD-5-70)

TENNESSEE VALLEY AUTHORITY
SHIPPING TICKET

No. G 578597
431

SHIPPER TVA - HORACE CROWDEN

POINT OF ORIGIN MUSCLE SHOALS, AL. 8-24- 19 94

SHIPPING ROOM POWER SERVICE SHOPS

AUTHORITY BFN-N-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 14421 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 434

SHIPPER TENNESSEE VALLEY AUTHORITY

POINT OF ORIGIN NEAR, ATHENS, AL. 35611 10-4- 1994

SHIPPING STOREROOM BROWNS FERRY NUCLEAR PLANT

AUTHORITY DAN OLIVER, SUPV., MEPS

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

HSVA #74

DATE SHIPPED 10-4- 19 94 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

42304— 2819333775

... CALL 800-238-5355 TOLL FREE. ... RICO AND ALL NON U.S. LOCATIONS.

AIRBILL
PACKAGE TRACKING NUMBER 2819333377

435

RECIPIENT'S COPY

1 [redacted]

Date: 10-4-94

From (Your Name) Please Print: C. J. Burt

Company: TVA/BROWNS FERRY NUCLEAR PLT

Your Phone Number (Very Important): (205) 729-4641

Street Address: BROWNS FERRY RD

Department/Floor No.

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 ...: ( )

Company: Omega Point Lab

Department/Fl...

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 827 / 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

Federal Express ...
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

7 Release Signature:

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			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" 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. 850-15485 437

SHIPPER L. J. Wheeler | POINT OF ORIGIN Soddy Daisy, Tn 10-11 19 94

SHIPPING STOREROOM Sequoyah Nuclear Stores | AUTHORITY L. J. Wheeler

SHIP TO

Omega Point Laboratories
16015 Shady Falls Rd
Elsenedorf, Texas 78112
ATTN: Kent Brown

BILL TO

ACCT No. (DO NOT INCLUDE TRANSPORTATION CHARGES)
DEBIT
00014PG

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 1006070 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 T#9941008800
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 _____ MATERIAL RECEIVED _____ 19 _____
CARRIER'S CHARGE _____ NAME OF CARRIER _____
DELIVERY CHARGES _____ MATERIAL CHECKED IN BY _____
TOTAL COST _____ STORES LEDGER POSTED BY _____

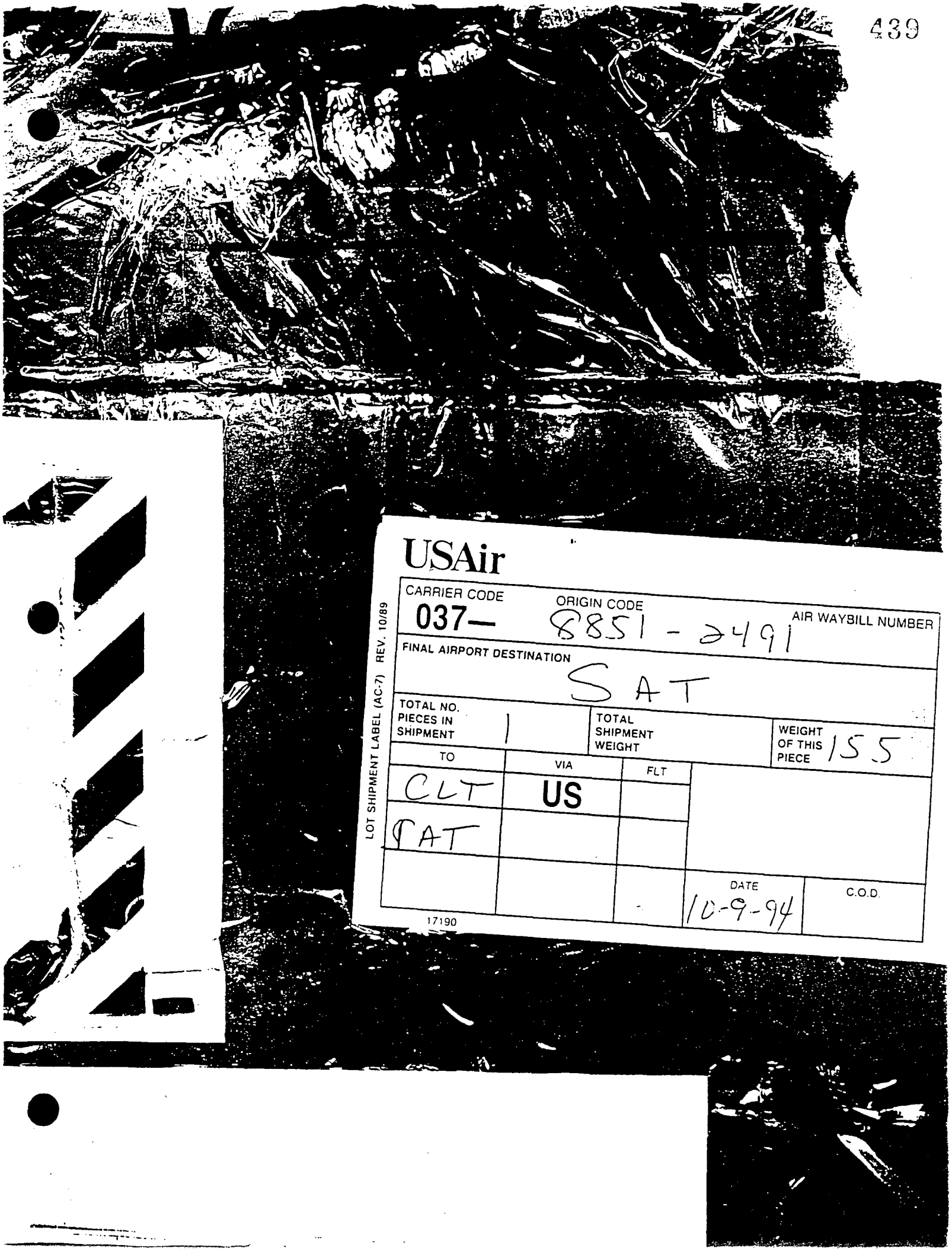
Q/A RECEIVING REPORT

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

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.

LOT SHIPMENT LABEL (AC-7) REV. 10/89

17190

☐ REGULAR
☐ PREPAID
☐ COLLECT

CAMPBELL DELIVERY SERVICE, INC.
P.O. BOX 460289
SAN ANTONIO, TEXAS 78246-0289
PHONE (210) 826-8110
RRC NO. 4756

440

№ 1274

DATE

CARRIER	Sonic
SHIPPER	
ADDRESS	
CITY	
AIRBILL NO.	TEH 31453
CONSIGNEE	Omega Point Labs
ADDRESS	16015 Shady Falls Rd
CITY	Elmendorf TX 78112

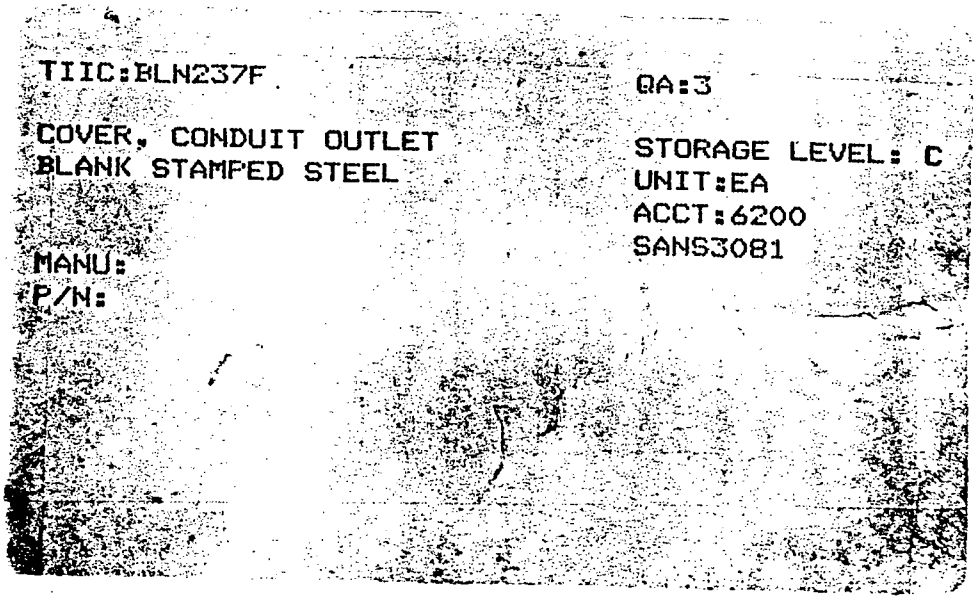
NO PIECES	DESCRIPTION	WEIGHT
1	(Ken Kent B/OA)	
	REFERENCE NO.	
	US 885 7491	155

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	SHIPPERS SIG	TIME	C.O.D. AMOUNT →	
DRIVER		DATE		
DRIVER	RECEIVED GOOD ORDER	TIME	BUS/AIRLINE CHARGES →	
DRIVER		DATE	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 Soltec
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. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Channel	11250	10	10	—	CAN3X4.1#X20	Y	Y	Good	None	X			
3"X4.1 Channel X 20													
ANGLE IRON 4"X4"X½X20	11250	1	1	—	ANG 4X C07	Y	Y	Good	None	X			

FORM
1/29/93

A42

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:	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
7/5/94	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
SHIP VIA:
COMMENTS:

TELEPHONE #: (512) 635-8100

ORDER DATE: 7/05/94
SALESMAN: CASEY HARMS

REQUEST DATE: 7/05/94

LINE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
01	[redacted]	10	CHN 3X4.1#X20	3" X 4.1# CHANNEL X 20	820	28.75	235.75
02	[redacted]	1	ANG 4XC07	4 X 4 X 1/2 X 20	256	25.80	66.05

TOTAL WEIGHT: 1076 LBS

RECEIVED BY: [redacted]

NET BEFORE TAX	301.80
TAX.....	23.39
GRAND TOTAL...	325.19

smi STRUCTURAL METALS, INC.
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	6.2
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.

445

STRUCTURAL METALS, INC.
BOX [redacted] SEGUIN, TEXAS 78156-0911
210-37[redacted]8200

CERTIFIED TEST REPORT

IS A TRUE COPY FROM TESTS PERFORMED IN OUR LABORATORY.

The following tests conform to the requirements of the specifications listed.

DAN SCHACHT
QUALITY CONTROL MANAGER

4/29/94

N	S115812	S	768400	S	8000
. NO	B9418932	O	TOL TEC PRODUCTS	H	TOL TEC
		L	5390 DIETRICH	I	P/U ^ MILL
		D	SAN ANTONIO TX	P	SEGUIN TX
) NO	V183809	T	78219	T	
) DATE	04/28/94	O		O	

AT D	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
189	L 3X3X3/16	20	ASTM A36-91	1	54200	75300	31.0	8				010394	3.670
133	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 D	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
189	.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 Tolter
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1422.11960
DATE RECEIVED 8-23-94
DATE INSPECTED 8-23-94
INSPECTED BY: Q 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 29230 *
* * * * * * * * * * * * * * * * *

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 3
PLACED BY: KERRY
SHIP VIA:
COMMENTS:

TELEPHONE #: (512) 635-8100

ORDER DATE: 8/23/94
SALESMAN: CASEY HARMS

REQUEST DATE: 8/23/94

LINE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
01	1	1	TUB 6XC09X40	6 X 6 X SCH X 40	1419	1999.00	799.60
02	0	0		MUST HAVE MTR **	0	.00	.00
05	2	2	ANG 2XC03X25ALUM	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

NAME AND ADDRESS OF PRODUCER'S PLANT — USINE PRODUCTRICE
FIRMA U… NSCHRIFT DES HERSTELLERWERKS

VALE…
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	NOMBRE-NUMBER / ANZAHL	LONGUEUR (FEET) / LENGTH-LANGE	MASSE (LBS) / MASS - MASSE
2	6" X 6" X ,500"	8	320,01	11221
3	7" X 7" X 3/8"	5	200,00	6569
6	8" X 8" X ,500"	2	79,98	3946
11	12" X 2" X ,250"	10	400,00	9016
12	12" X 4" X ,250"	6	239,99	6239

QUANTITE TOTALE-TOTAL QUANTITY-GESAMTMENGE

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 - ROHRANALYSE

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	0,126	1,440	0,012	0,007											
2	24904	0,160	1,450	0,018	0,008											
3	26255	0,131	1,400	0,016	0,009											
6	15158	0,158	1,430	0,013	0,007											
11	15158	0,158	1,430	0,013	0,007											
12	26401	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	75662	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 : M. SZKOLNIK
PRODUCTEUR / PRODUCER / HERSTELLER

DATE DATUM : 29/11/93

XT 77444

Toi Kenny
Frem: B.J.
6X6X500
Sq Tube

FROM TOLTEC STEEL 6614672 TO 6358101 08/25/1994 09:42
TOTAL P.01 PAGE.001
P.01
666 8402
AUG 25 '94 11:02
050

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. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Angle Iron 3½"x2½"x⅜"x20'	11460	1	1	0	ANG-3½x2½xC05	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: 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:
SHIP VIA:
COMMENTS:

TELEPHONE #: (210) 635-8100

ORDER DATE: 8/25/94
SALESMAN: CASEY HARMS

REQUEST DATE: 8/25/94

LINE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
01	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

WEIGHT: 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 • CHEMICAL ANALYSIS
• PROPRIÉTÉS PHYSIQUES • ANALYSE CHIMIQUE

JUL. 18,1994 20:25

097068

3231.4

O'NEAL STEEL
108 BOGGSTOWN RD.
SHELBYVILLE, INDIANA
U.S.A.
46176

ATTENTION:

CUST. ORDER NUMBERS / N° DE COMM. DU CLIENT: SEE * BELOW

MATERIAL TESTED / MATÉRIAU ÉPROUVÉ | HEAT NUMBER / 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

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: C 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	TUB4X4X.25X20	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

* * * * * * * * * * * * * * * * *
* S A L E S O R D E R 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: 11320
PLACED BY: CLETA
SHIP VIA:
COMMENTS:

TELEPHONE #: (512) 635-8100

ORDER DATE: 7/20/94
SALESMAN: CASEY HARMS

REQUEST DATE: 7/20/94

LINE	ORDER QTY	SHIP QTY	COD PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
01	1	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

WEIGHT: 652 LBS

RECEIVED BY: Jesse Elizalde

NET BEFORE TAX	229.62
TAX.....	17.80
GRAND TOTAL...	247.42

B/L # 72969

NUCOR STEEL
A Division of NU[redacted] Corporation
JEWETT, TEXAS 75846 PH (903) 626-4461

Date [redacted]/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	ELONG 8 INCH SCALE %	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

CHIEF METALLURGIST

MELTED AND MANUFACTURED IN U.S.A.

HANNA

Certification 391000 5/12/94 459

ipped Hanna Steel Corporation
ro 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

il 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				
NTINUED							
53179	01403	A500 B		66,000	76,000	26.0	B84
53179	45472	A500 B		68,500	76,500	27.0	B86
53184	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				
55060	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				
13223	C85226	A500 B		55,000	69,000	30.0	B80
13224	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

inna Steel Corporation
12 Commerce Avenue
O. Box 558
irfield, Alabama 35064
05) 780-1111
UNS No. 00-402-9294

SUBJECT TO TERMS AND CONDITIONS ON BACK

Milton Stewart
Metallurgist

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI ITVA
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	
Angle iron 1½"x1½"x⅛"x20	11540	4	4	0	ANG1-½XC01	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

SALES ORDER 24569

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: 1154 Q
PLACED BY: KERRY
TELEPHONE #: (210) 635-9100
SHIP VIA:
COMMENTS:

ORDER DATE: 9/21/94
REQUEST DATE: 9 6, 94
SALESMAN: CASEY MANNS

LINE	ORDER QTY	SHIP QTY	SCO PART NUMBER	DESCRIPTION	WEIGHT	UNIT COST	EXTEND COST
1	4	4	ANG 1-1 2X20	1-1/2 X 1-1/2 X 1/3 X 20	98	25.00	25.00
2	1	1		****MILL CERTS REQUIRED	0	.00	.00

TOTAL WEIGHT: 98 LBS

NET BEFORE TAX	25.00
TAX.....	2.05
GRAND TOTAL...	28.05

RECEIVED BY: Richard Z Beasley

SMI

BC[illegible]911, SEGUIN, TEXAS 78156-0911
512[illegible]2-8200

CERTIFIED TEST REPORT

IS A TRUE COPY FROM TESTS PERFORMED IN OUR LABORATORY.

The following tests conform to the requirements of the specifications listed.

QUALITY CONTROL MANAGER
DAN SCHMITT 3/ 2/93

IN# SB2439
DL NO B9379472

S 170000 TOLTEC STEEL PRODUCTS, INC.
O [illegible]
L P O BOX SAN ANTONIO, TX 78219
D HOUSTON TX
T 77241
O

S 8001 [illegible] STEEL PRODUCTS, INC.
H [illegible]
I P/U @ THE MILL [illegible]
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 RSL	DATE ROLLED	LB/FT
2360	L 2.5X2.5X3/16	ASTM A36-89	1	53300	75000	31.5	8				081692	2.9[illegible]
3396	L 1.5X1.5X1/8	ASTM A36-89	1	55700	75200	23.0	8				101992	1.2[illegible]
4032	L 2X2X1/4	ASTM A36-89	1	52200	74600	27.5	8				113092	3.0[illegible]
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	.0[illegible]			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	.0[illegible]			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	.0[illegible]			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.

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME TSI / TVA
CLIENT/PROJECT NUMBER 11960-97185, 86+87, 9725-60
RECEIVED FROM Summers
PROJECT LOCATION Omega Point Labs
REPORT NUMBER 1399 . 11960
DATE RECEIVED 7-7-94
DATE INSPECTED 7-7-94
INSPECTED BY: D. 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

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

466

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

ORIGINAL

PACKING SLIP

NUMBER	PAGE
080330601	1

FROM: 2400 BROCKTON
SAN ANTONIO, TX 78217

06-JUL-1994, 11:26

I'W Am

SOLD TO: 09540800
OMEGA POINT LABORATORIES
15015 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

CUSTOMER PO NUMBER	JOB NAME	CONTACT	TYPE
1121-Q		KERRY	DEL

TCI - 8:30

ORDER DATE	SHIP DATE	SHIP VIA	FRT	SLSP	TAX	TERMS
28-JUN-1994	03-JUL-1994	Our Truck	PC	243	000	10th, Net 20th

LINE	QTY ORD	QTY B.O.	QTY SHIP	PART NUMBER / DESCRIPTION	BIN LOC / ORDER	INST	UNIT PRICE	U/M	EXTENDED PRICE
002	1000	0	1000	COP BARE-B 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: 7/6/94 CUSTOMER SIGNATURE: [signature]

SERVICE WIRE CO.

MANUFACTURER

CULLODEN, WV (304)743-8600 PITTSBURGH, PA (412)325-1666 HOUSTON, TX. (713)674-6666

467

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

#79 TX 779-675

66287011695

MFG DATE

BASTR7SD8
8 AWG 7STR
BARE CU STRAND SD

GROSS	TARE	NET	FEET
			1000

CUTTING

DRAWING

STRANDING

CABLING

ARMOR

JACKET

INSULATION

TESTING

468

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 Hank
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 Summers
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. RECD 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 471

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

LINE	QTY. ORD.	QTY. B.O.	QTY. SHP.	PART NUMBER / DESCRIPTION	BIN LOC. / UPC	INST	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 Hitchcock]

472

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 # 1134Q on our Bill of Lading (shipping document) # 080764101, 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 Davis
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
CLIENT/PROJECT NUMBER 11960-97185-8709257-60
RECEIVED FROM Summers Electric
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 1418 .11960
DATE RECEIVED 8-23-94
DATE INSPECTED 8-23-94
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	
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 d Patton
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 475

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
3-AUG-1994	18-AUG-1994	Our Truck	PC	236	000	10th, Net 20th

LINE	QTY. ORD.	QTY. B.O.	QTY. SHP.	PART NUMBER / DESCRIPTION	BIN LOC. / UPC	NST	UNIT PRICE	UM	EXTENDED PRICE
01	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

MASTER FORM #2250

PICKED BY | CHECKED BY | DATE 8/23 | CUSTOMER SIGNATURE Richard D. Beasley 1:00

476

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 # 11410 on our Bill of Lading (shipping document) # 08125 1801, 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: 9-22-94
Signature: John Hamm
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. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
4" steel locknut	1145Q	4	4	0	KSPT110	X	X	Good	None	X			
4" gal Cond Strap	1145Q	25	25	0	KIN-C105-4	Y	X	Good	None	X			
3" gal Cond Strap	1145Q	15	15	0	KIN-C105-3	Y	Y	Good	None	X			
2½" gal cond Strap	1145Q	5	5	0	KIN-C105-2½	Y	Y	Good	None	X			
2" gal Cond Strap	1145Q	20	20	0	KIN-C105-2	X	Y	Good	None	X			
3" Sq Head Plug	1145Q	3	3	0	RPP PLG300S	X	Y	Good	None	X			
1" gal Cond Strap	1145Q	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:	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
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
479

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
145Q		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	NST	UNIT PRICE	UM	EXTENDED PRICE
01	4	0	4	SPT 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 C103-3 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 C105-3 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 [ ] CHECKED BY [ ] DATE [ ] RECEIVED BY [ ]

SUMMERS ELECTRIC COMPANY
A Summers Group, Inc. company

CUSTOMER

PACKING SLIP 480

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 #225C

PICKED BY | CHECKED BY | DATE 8/24/94 | CUSTOMER SIGNATURE Richard Beasley

481

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) # 081360401, 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

482

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 Harris
Title: INSIDE SALES

2400 BROCKTON
P.O. BOX 17747
SAN ANTONIO, TEXAS 78217
512/824-1451

Q/A RECEIVING REPORT

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 Humphreys

ITEM DESCRIPTION	P.O. NO.	QUANTITY			I.D. NO.	CONFD MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
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:	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
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. 1157Q

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

SHIPPING ORDER

15156140

B-LINE® SYSTEMS, INC.
509 West Monroe Street
Highland, Illinois 62249-0326
Phone: 618-654-2184

S

RS1
SYM

SHIPPING ORDER NO.: 8942-9261

DATE: 9/29/94

488

0026073

SOLD TO:

OMEGA POINT LABORATORY
16015 SHADDY FALLS RD
ELMENDORF TX 78112

Bernie 9-30-94

SHIP TO:

OMEGA POINT LABORATORY
16015 SHADDY FALLS RD
ELMENDORF TX 78112

89429261

PAGE NO. 1 OF 1 TERMS - NET 30 DAYS

1-CTN=6#

CUST. ORDER NO.	DATE RECEIVED	LAST SHIPPED	SHIPPING DATE	VIA	COL	PPD	CHG	ALC
11570	9/29/94		10/03/94	Air		X	X	

DIV.	SALESMAN	SHIP FROM	F.O.B.	DATE SHIPPED	B/L	WEIGHT
7	8800 E	TROY	TROY	10-3-94	358077	79#

TOM FENOGLIO

1 of 2 - 73

ORDERED	DUE	SHIPPED	BACK ORDER	UNIT	*	PART NUMBER	DESCRIPTION
2	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]

CERTIFICATE OF CONFORMANCE

P. O. No.: 1157Q 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, 9ZN-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®

PAGE 01 OF 01

800-826-3875

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

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	4.20

RECEIVED IN GOOD CONDITION EXCEPT AS NOTED
FIRM:

BY: June Elizalde

DELIVERED BY: R Knight

DATE: 10-5-94

CONSIGNEE COPY

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME: TSI / TVA
CLIENT/PROJECT NUMBER: 11960-97257-604 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: 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	
Pipe Clamps 1"	11429	10	10	-	P-2558-10	Y		Good	None	X			Complete Shipment
Pipe Clamps 4"	11429	~~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: Omegh Point Lake

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	P-253-40 4 - - -				
	Back Ordered 10 P-253-40				

TAX

TOTAL

Received By C Humphries

☐ 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: 9/30/84

Invoice: 21664

YOUR ORDER NO.	JOB NAME	Terms: 2% – 10 days, Net 30 days
1142 Q		

QUANTITY	DESCRIPTION	LIST	UNIT	DISCOUNT	AMOUNT
10	P-2559-4J 4 Hold Down Straps				

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, 97332-38
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			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
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 Pow 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 10 E 6 ([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
REPORT NUMBER 1431 . 11960
CLIENT/PROJECT NUMBER 11960-97185-87. 97257-60 97332-38
DATE RECEIVED 8-30-94
RECEIVED FROM Hilti, Inc
DATE INSPECTED 8-30-94
PROJECT LOCATION Omega Point Labs
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	
KwikBolt	11480	200	200	0	00045360S	Y	Y	Good	None	X			
1/2"X2 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

502

* *FIRST ORIGINAL* * * *FIRST ORIGIN

13635 STEMMONS FREEWAY
FARMERS BRANCH, TX 75234

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
08/29/94	459353-01	1750	RICHARD CARPENTER	51	09/29/94-16:16:33

ACCT. #	ACCT. NAME AND CUSTOMER PURCHASE ORDER NO.	DDAATT
8989177	OMEGA POINT LABORATORIES 1148Q	58-07-01

THANK YOU FOR CALLING HILTI CUSTOMER SERVICE 1-800-879-8000
DICK DAVITO EXT 6109

NE	ITEM #	ITEM DESCRIPTION	DUE	SHIP	B/O	BIN-LOC
1	000453605	KWIK BOLT II 14-214(100/BX) * * * END OF SHIPPER * * * HILTI IS CLASSIFIED AS A LARGE BUSINESS	2	2		R5

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

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
08/29/94	459353-01	1750	RICHARD CARPENTER	51	08/29/94-16:16:23

ACCT. #	ACCT. NAME AND CUSTOMER PURCHASE ORDER NO.	DDAATT
8989177	OMEGA POINT LABORATORIES 1148Q	58-07-01

THANK YOU FOR CALLING HILTI CUSTOMER SERVICE 1-800-879-8000
DICK DAVITO EXT 6109

LINE	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

CHECK

PACK

RECEIVED BY

DATE RECEIVED

TITLE

202-6 (1-92) 000964502

COPY

SUBJECT TO TERMS AND CONDITIONS ON REVE

504

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

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			I.D. NO.	COND MATL Y/N	CERT. RECD Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
KWIK BOLT II 3/8"X3 3/4"	11510	200	200	0	000453647	Y		Good	None	X			
KWIK BOLT II 1/2"X7"	11510	100	100	0	000453795	Y		Good	None	X			
DRILL BIT 6"X1/2"	11510	1	1	0	000280370	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:

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:	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
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 Patton
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**

507

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

CUSTOMER PHONE NUMBER ( ) —

PURCHASE ORDER NUMBER 115/Q

ACCOUNT NUMBER 5918111777

BILL TO
NAME Omega Plastic
STREET
P.O. BOX
CITY STATE ZIP

SHIP TO
CITY STATE ZIP

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 #

MARKET CODES

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
			KB 3/633/4	2		2				
			KB 1/2 7	1		1				
			Tec 1/2 6	1		1				

NOTES/SHIPPING INSTRUCTIONS

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 KMH

Salesmen are not authorized to make warranties regarding specific applications —

CUSTOMER'S SIGNATURE X Kerry Hitchcock

DATE 8-30-94 TITLE Tech

TOTAL ORDER
$
TAX
FREIGHT
NET ORDER $
SHIP C.O.D. $
APPROVED BY
DATE ENTERED TIME
S.E. OPERATOR

SUBJECT TO TERMS AND CONDITIONS ON REVERSE SIDE.

TOOLS WARRANTED TO ORIGINAL PURCHASER ONLY

000965350 F-333 (2/92)

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"x4½" CH "See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements." QA Approval C Patton Date 9/29/94	100		$0.00

Special Instructions

Certificate of Compliance/conformance

Ordered By: Cleda Patton

Project #: TSI/TVA

Total	$0.00
Shipping	
Tax	
Invoice Total	$0.00

CUSTOMER COPY

511

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			1CB 1/4-3/4	2		2				
2			1CB 1/4-4 1/2	1		1				

NOTES/SHIPPING INSTRUCTIONS

TOTAL ORDER
$
TAX
FREIGHT
NET 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

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

Salesmen are not authorized to make warranties regarding specific applications –

CUSTOMER'S SIGNATURE X Kerry Hutchens
DATE 9/30 TITLE

SHIP C.O.D. $
APPROVED BY
DATE ENTERED TIME
S.E. OPERATOR

SUBJECT TO TERMS AND CONDITIONS ON REVERSE SIDE.

TOOLS WARRANTED TO ORIGINAL PURCHASER ONLY

000965350 F-333 (2/92)

512

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 99257-60
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 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"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	06-1079-130702	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: C Dalton

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	
Tie Wire .062"	NA	0	100±	0	30455.062"	Y	N	Good	None	X			Receiving Verification Only.

FORM
1/29/93

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: 517
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

58098518

CTI W/B NO.

CTI CONTROL NO.

DATE 7-20-94

SHIPPERS B/L NO.

S[illegible]RS ORDER NO.

CONSIGNEES ORDER NO.

RELEASE NO.

Cannonball Trucking, Inc.

P.O. Box 262523, Houston, Texas 77207-2523 • 644-7300
Fax # (713) 644-9431

INTRASTATE ☐ ICC ☐ LOCAL ☐

FROM: SHIPPER	TO: CONSIGNEE
Southwestern Wire Cloth	[illegible]
STREET ADDRESS 7851 W Belt North	STREET ADDRESS [illegible]
CITY Hou, TX STATE ZIP	CITY Elmendorf STATE Tx ZIP 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					

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

"[illegible]ment 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.
[illegible]here the rate is dependent on value, shippers are required to state in writing the agreed [illegible] value of property hereby specifically stated by the shipper to be not exceeding: $ per
"It [illegible]stood 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 defendant shall bear full responsibility for all legal fees and any interest expense subsequent thereto."

CARRIER
CANNONBALL TRUCKING, INC.
P.O.BOX 262523
Houston, Texas 77207-2523

I hereby certify that the dates and time shown is correct.
CARRIER **CANNONBALL TRUCKING,INC.** DATE 7-20-94
DRIVER Sherry #6

Permanent post office address of carrier

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/TUA
CLIENT/PROJECT NUMBER 11960-97185.86+87
RECEIVED FROM Adams 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.	COND MATL Y/N	CERT. REC'D Y/N	CONTAINER INTEGRITY	EXCEPTIONS	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
1/2" Med. 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. 520
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:	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
7/11/94	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.: 0279340

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
073666	09D	11260	DEL. AM				NET 10	07/11/94	1

QTY. ORDERED	QTY. SHIPPED	QTY. BACK ORDERED	PROD. LINE	PART NO.	DESCRIPTION	UNIT PRICE	EXTENDED PRIC
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

RECEIVED BY:

IVAN

SALE AMOUNT	63.00
SALES TAX	4.38
TOTAL	67.38

522

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

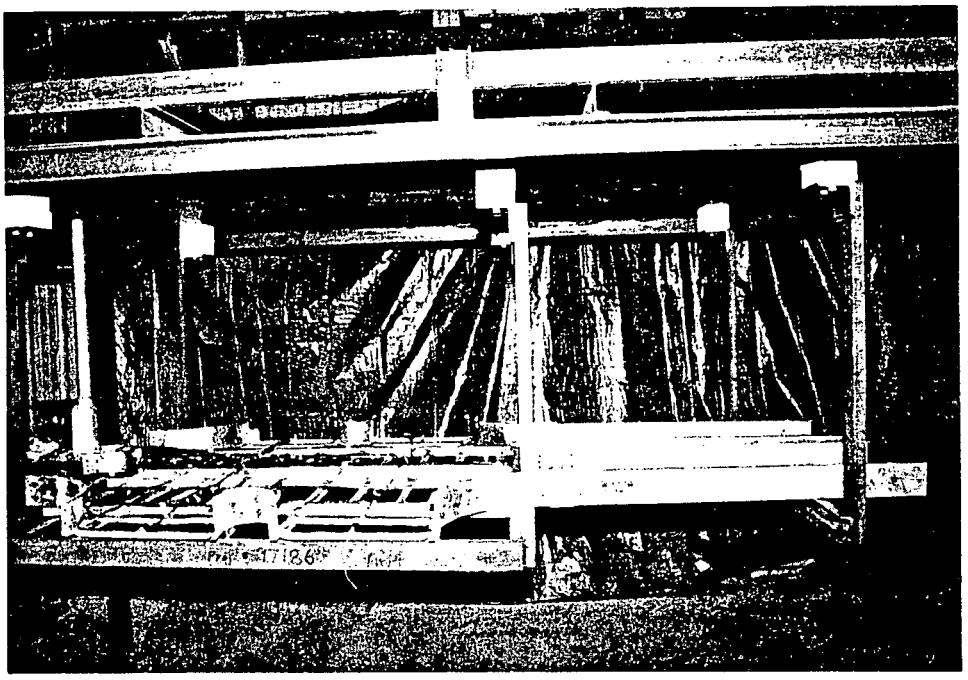
To Whom It May concern:

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.

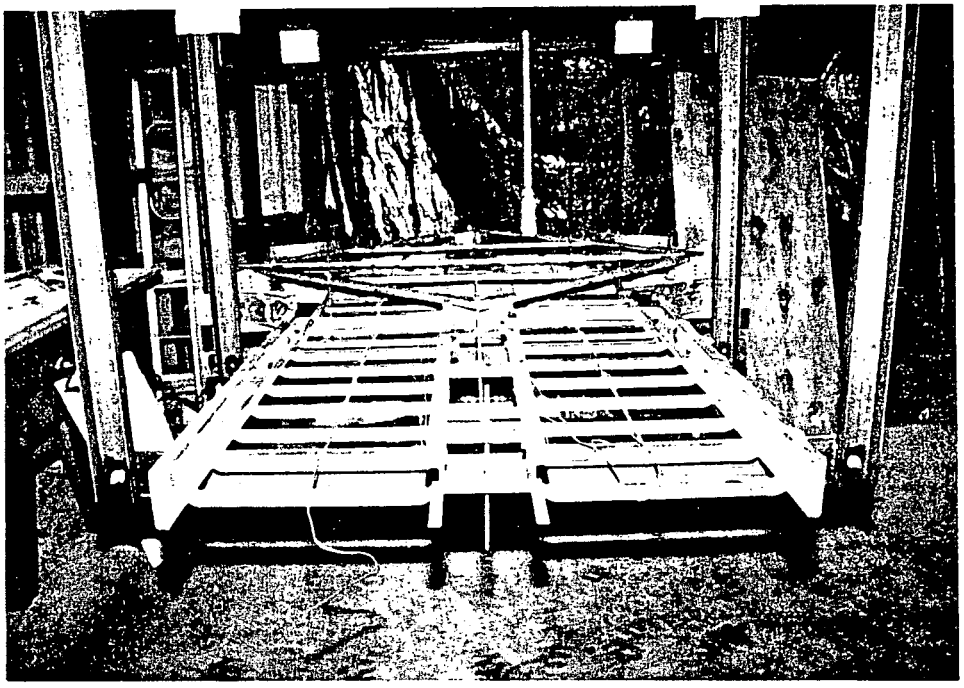
Date: 7/25/94
Signature: Teresa H. DeBord
Title: Office Manager

Appendix F

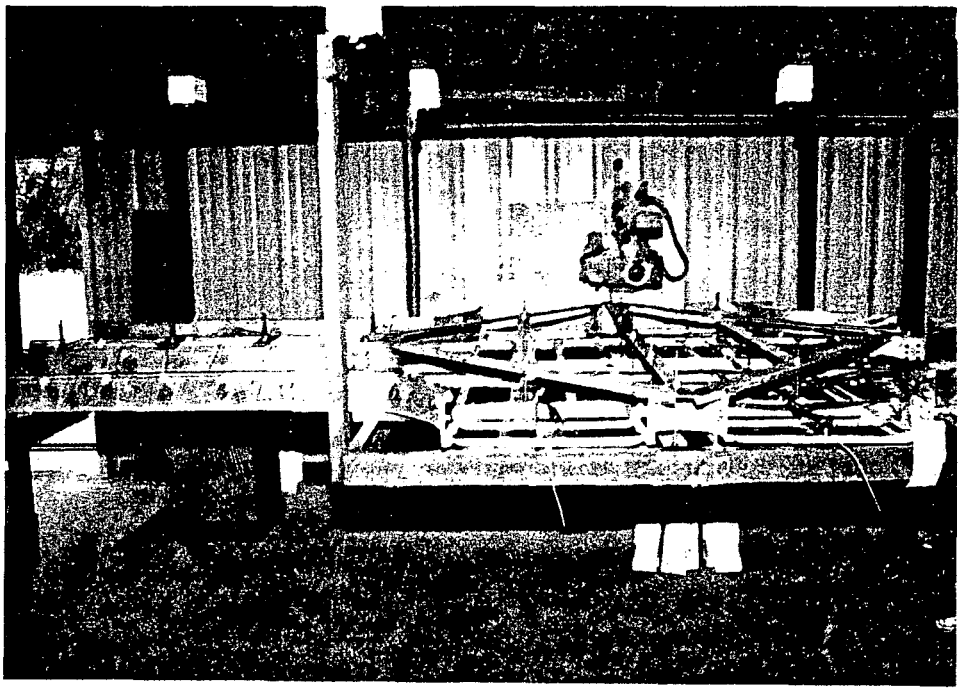
PHOTOGRAPHS



Assembled tray system (note conduit for thermocouple routing only).

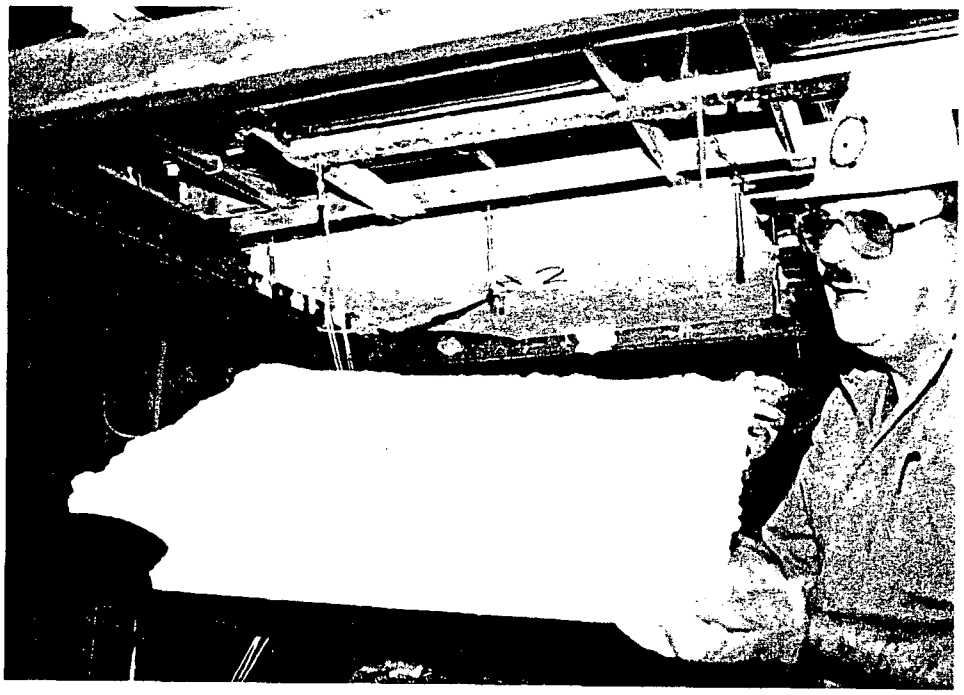


Right end view of finished tray assembly showing tray orientation.

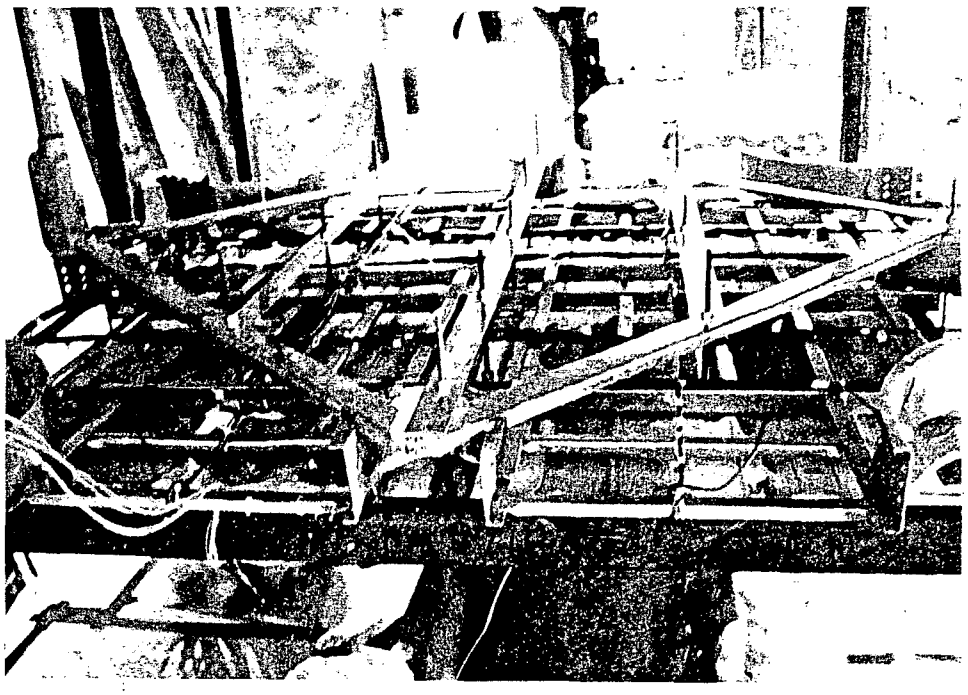


View of special fitting showing additional support angles added.

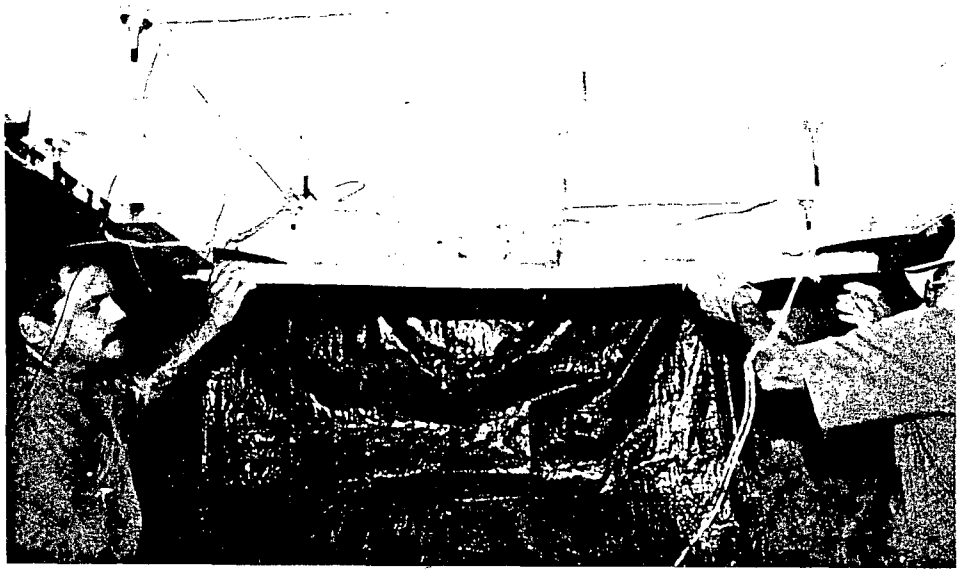
Pre-buttered panels installed on bottom of special fitting.



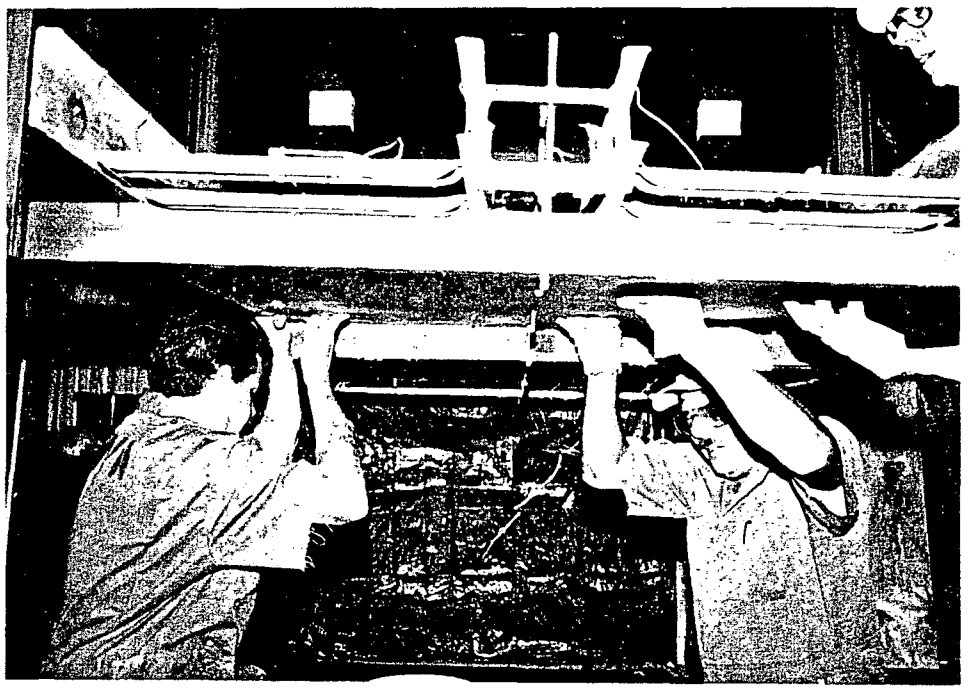
Pre-buttered panels installed on bottom of special fitting.



View of top of special fitting showing stud locations.



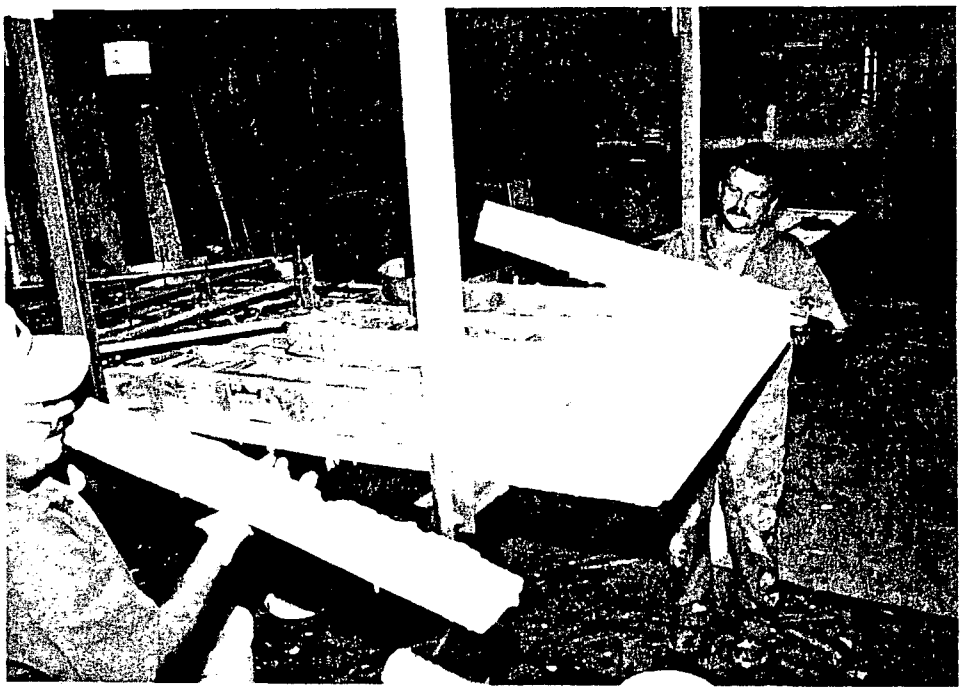
Strips of material added and secured with washers, nuts and tie wire for extra support on the bottom of the special fitting.



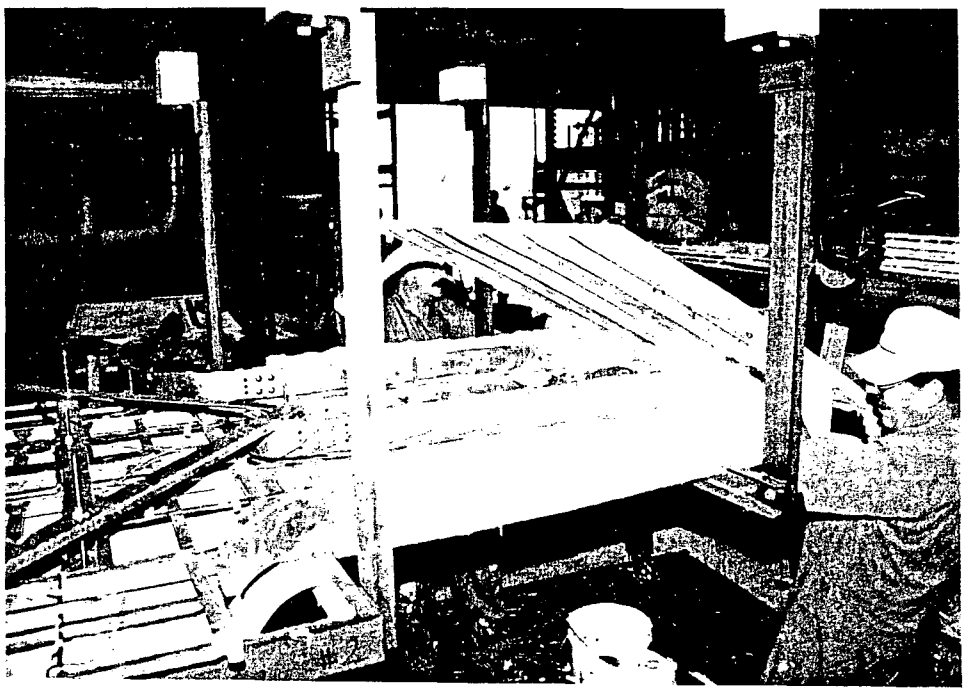
Panel installed onto bottom of horizontal tray runs.

Stainless steel tie wire stitches installed at joint locations.

Panels held in place with washers and nuts and stainless steel tie wire.



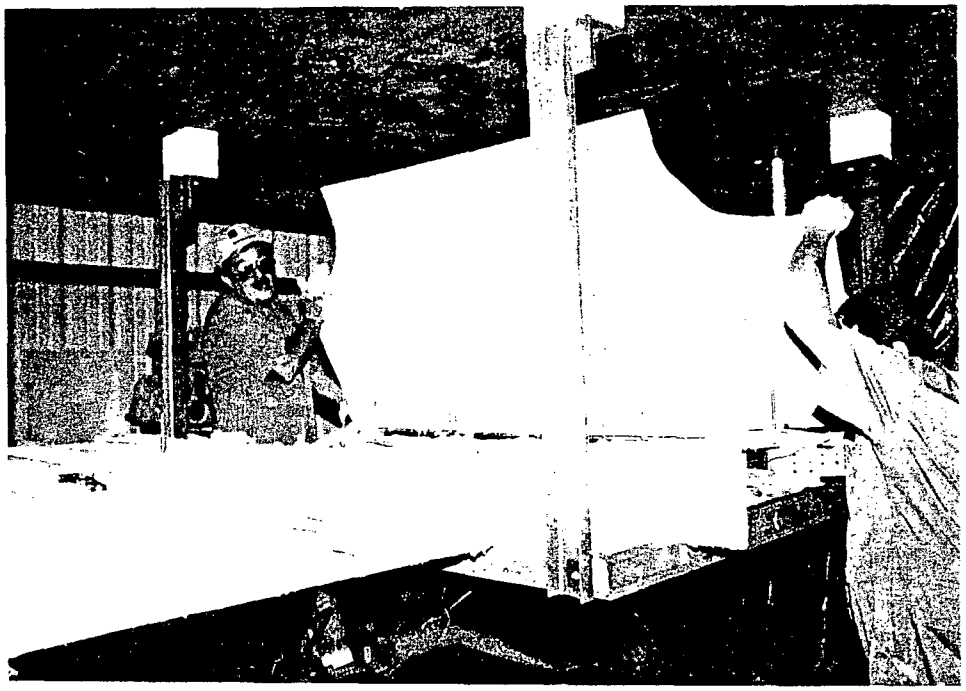
Pre-buttered panels installed on cable tray side rails.



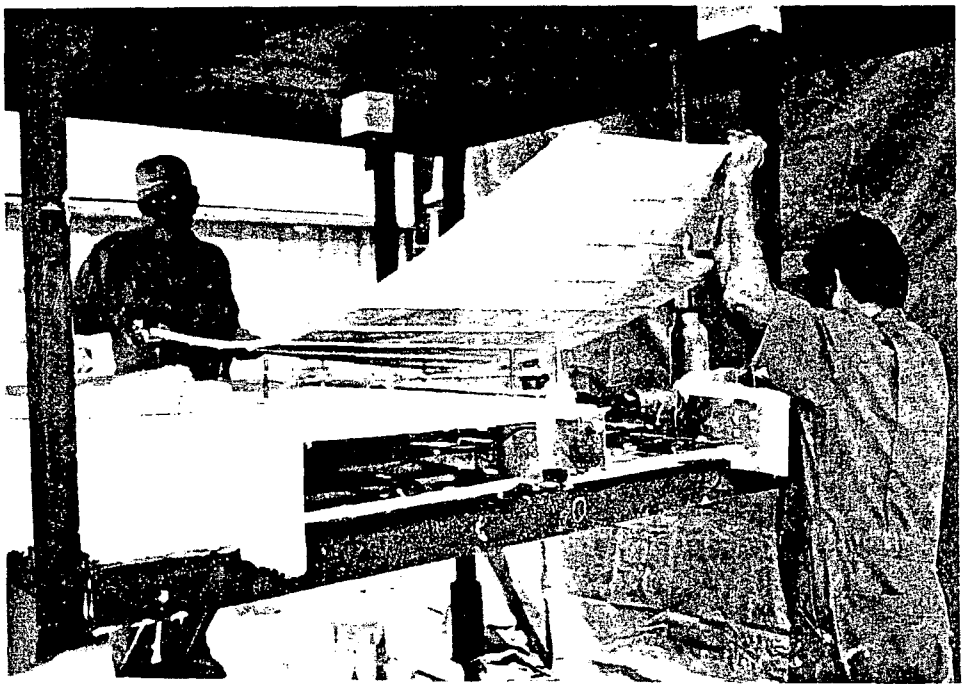
Pre-buttered panel installed on top of cable tray horizontal runs.

Panels secured with washers and nuts.

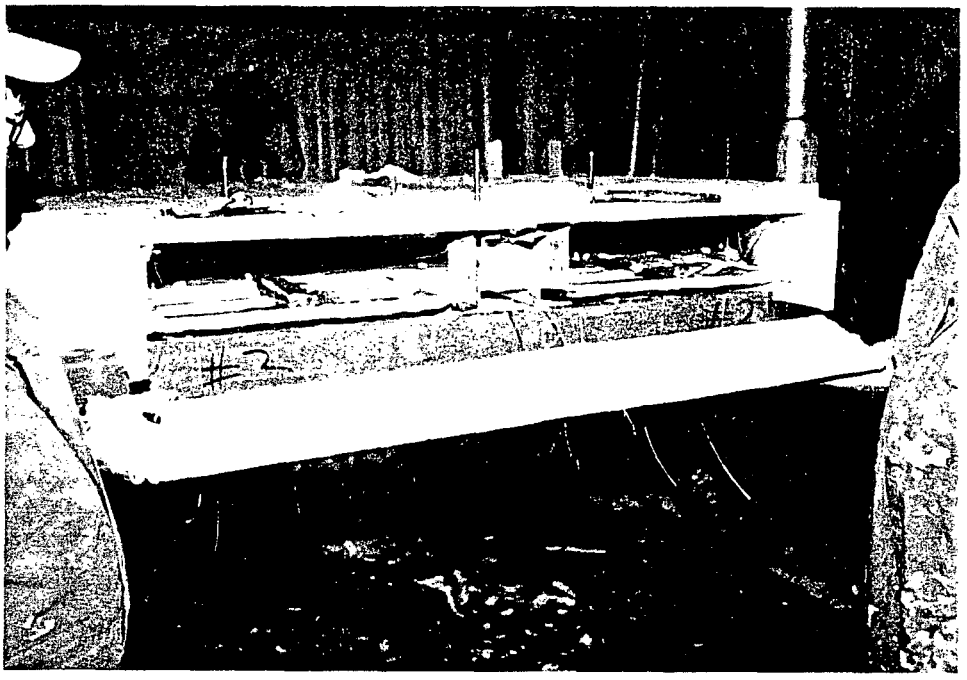
Scored and folded panel installed on curved side rail of special fitting.



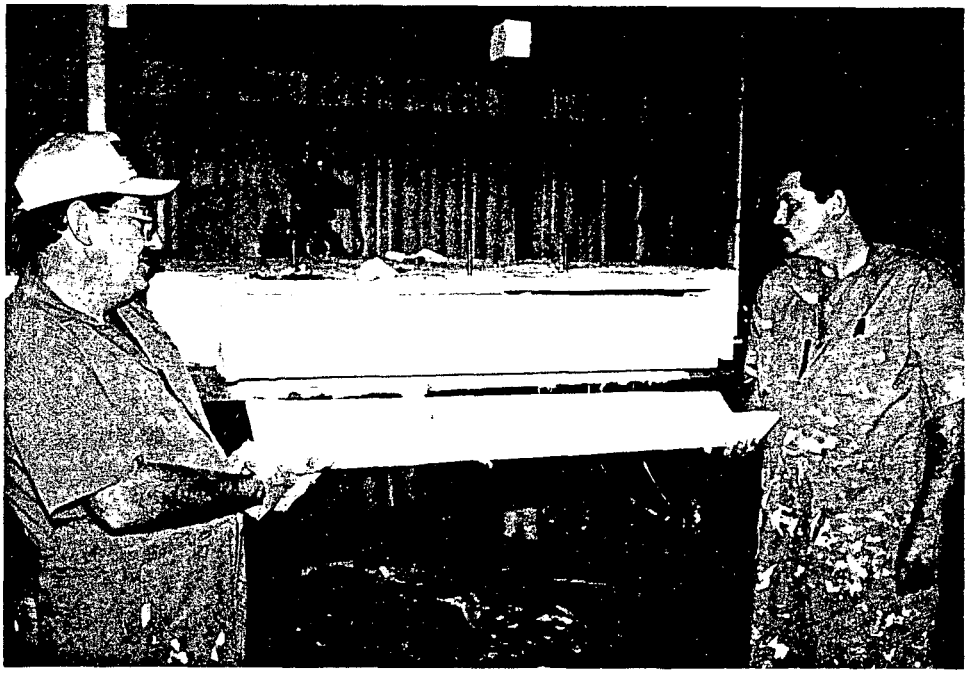
Panel installed onto top of special tray fitting.



Panel installed onto top of special tray fitting.

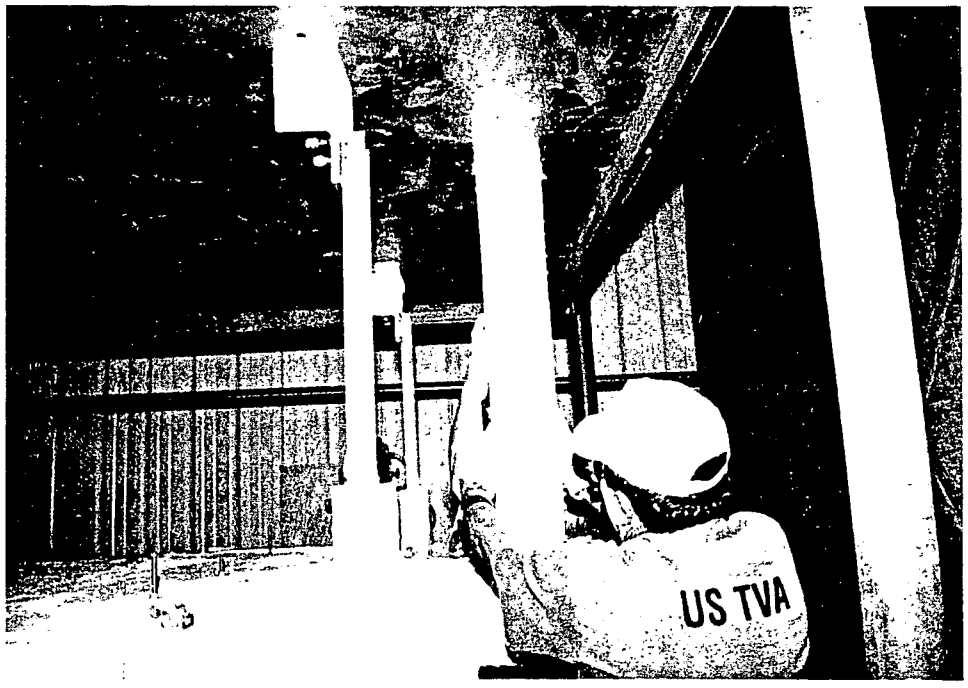


Panel installed at outlets of special tray fitting.

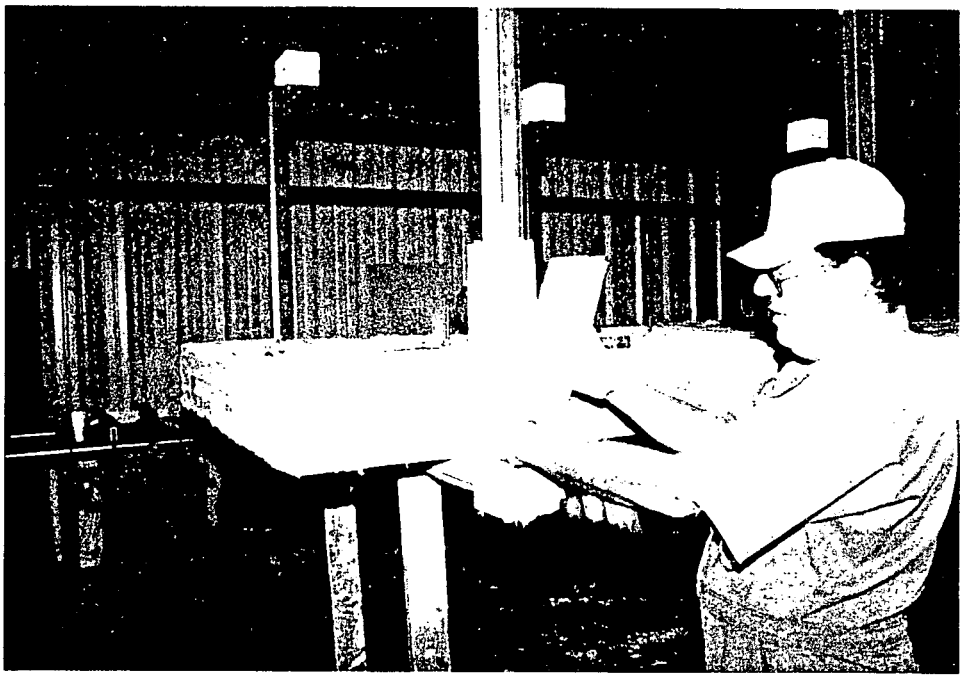


Pre-buttered panels installed at outlets of special tray fitting.

LB enclosure fit around condulet and secured with stainless steel tie wires.

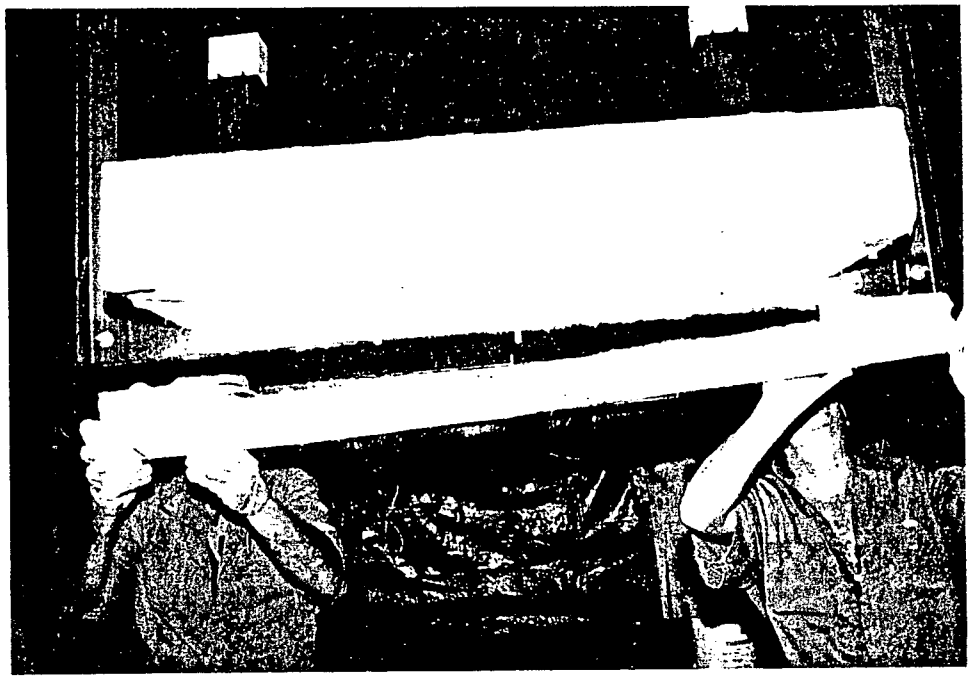


Panels installed around conduit in a box assembly.

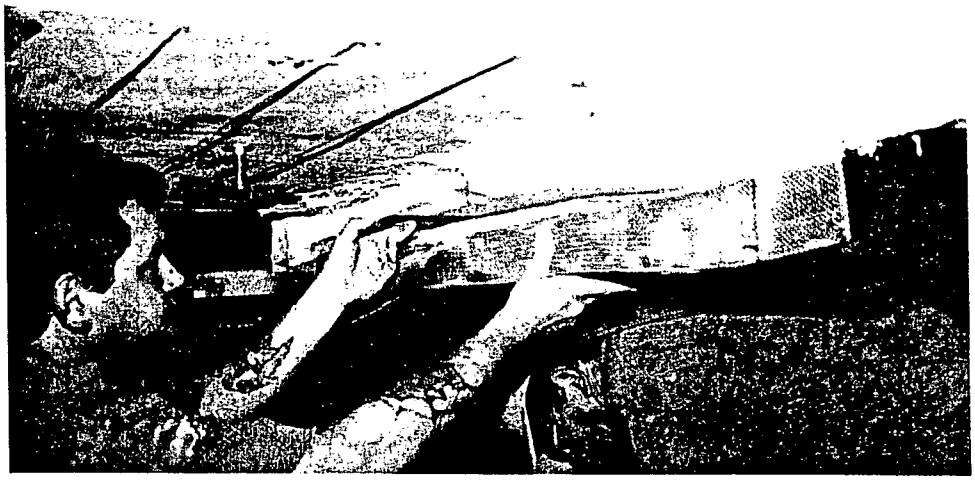


Pre-buttered panels installed onto support members.

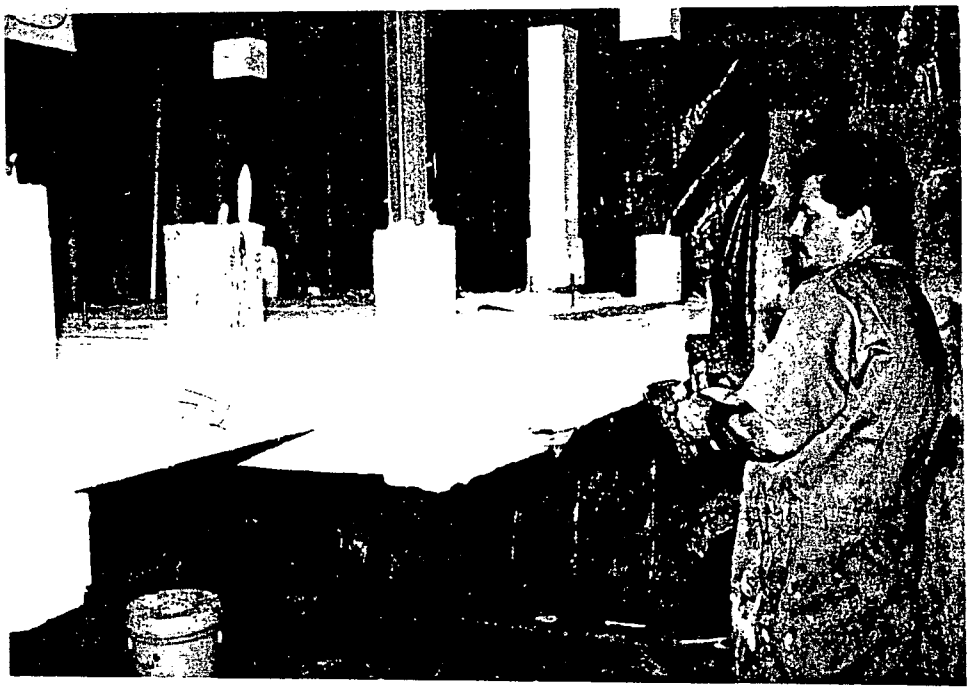
Pre-buttered panels installed onto support members.



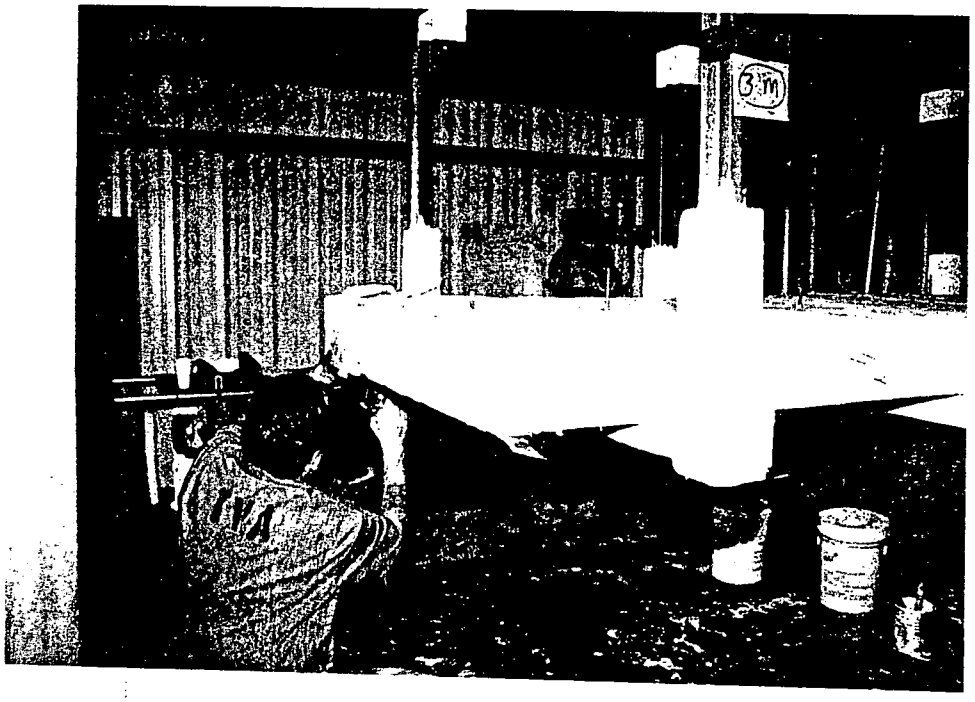
Pre-buttered panels installed onto support members.



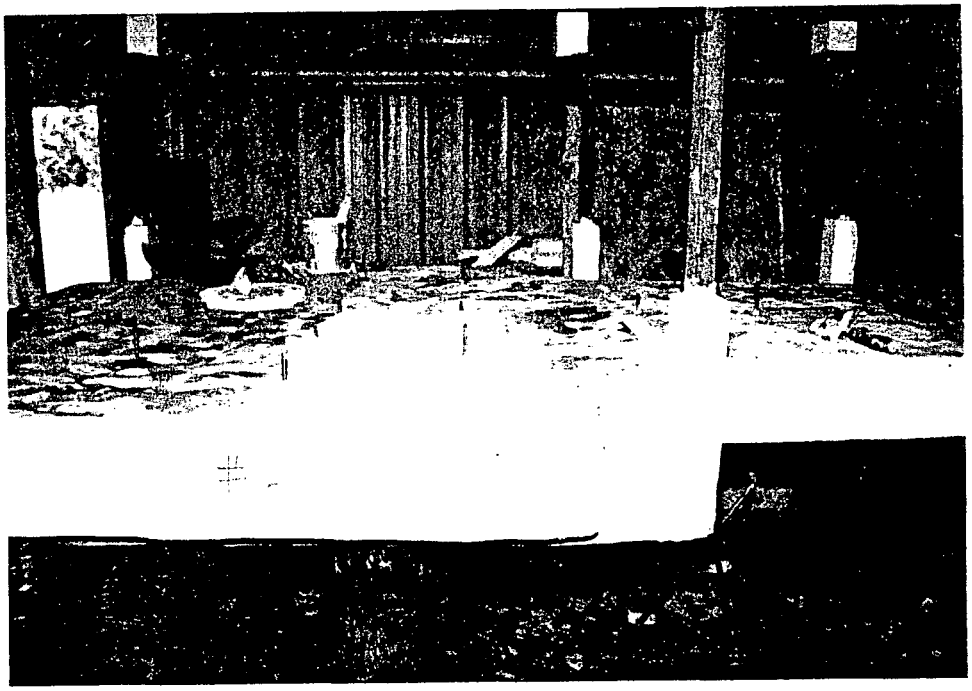
External stress skin fitted around horizontal support member.



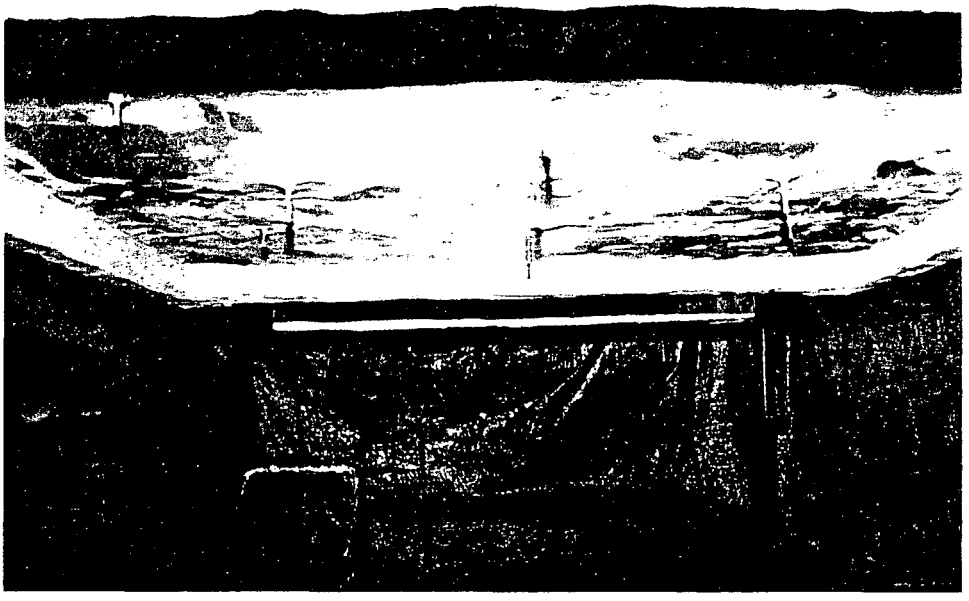
External stress skin stapled into place on outlet of special tray fitting.



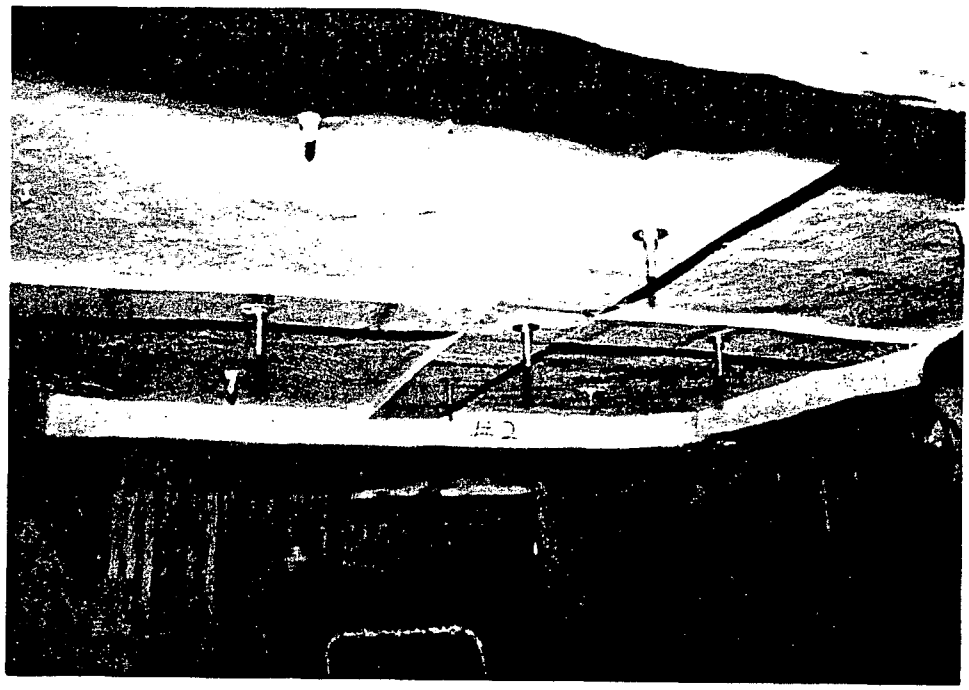
External stress skin stapled into place on free end of cable trays (note sign idicates that 3M M20-A material will be added to tops of supports).



External stress skin installed over special tray fitting.

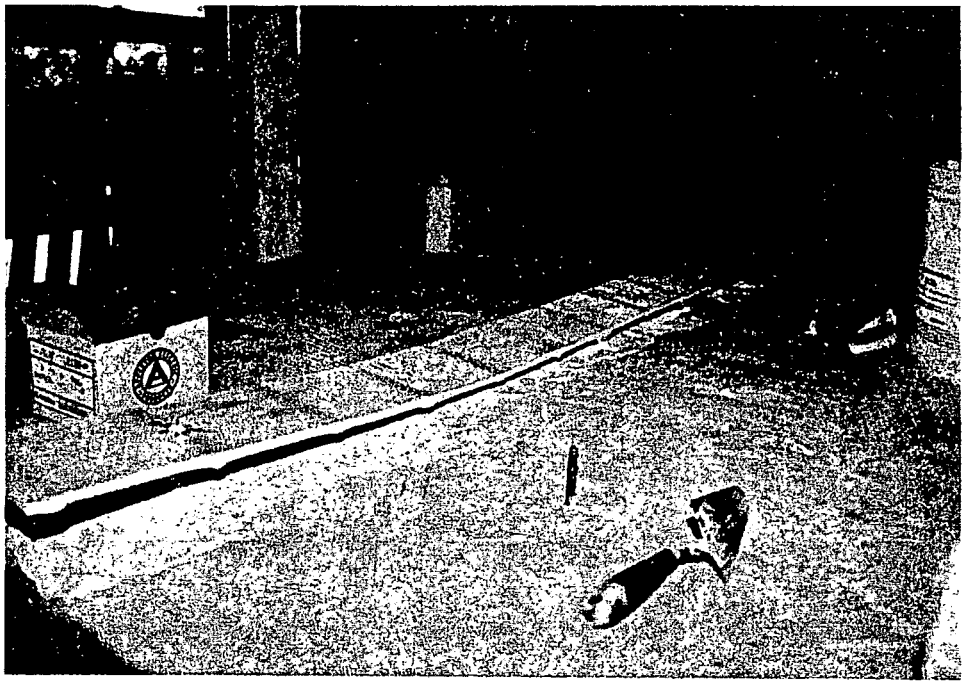


External stress skin installed over special tray fitting.

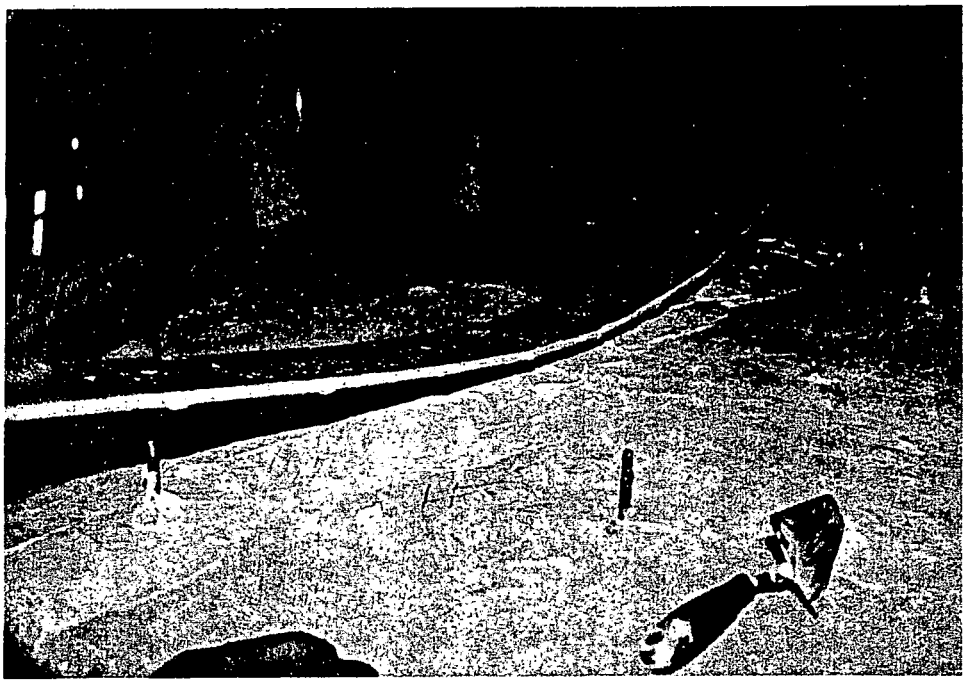


Strip material installed on bottom of special tray fitting.

Mounds of trowel grade material installed over nuts and washers.

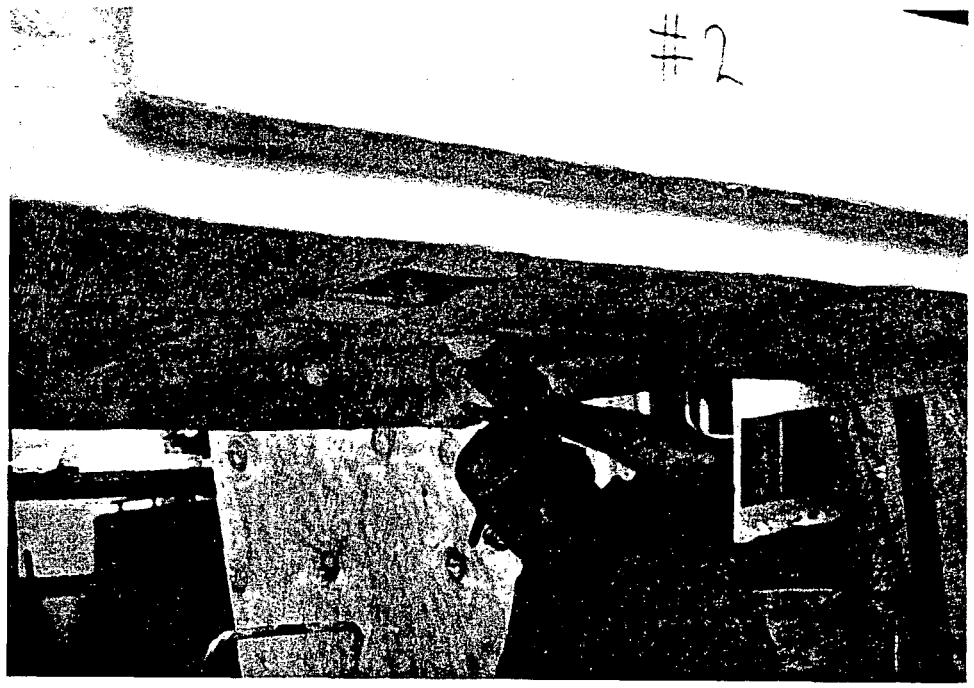


Strip of material to be installed along joint in top of special tray fitting enclosure.

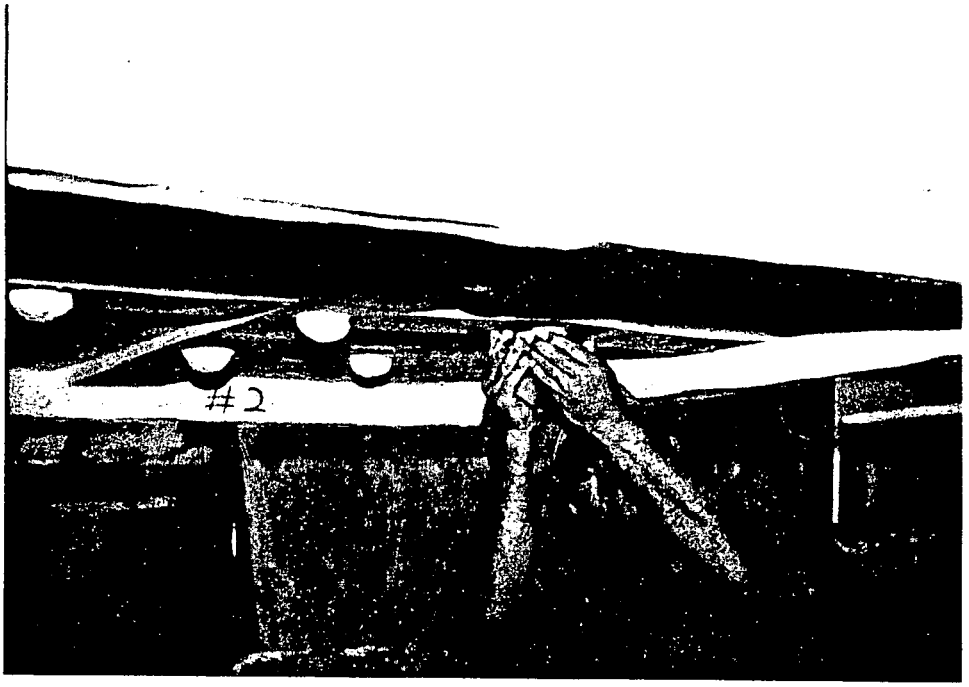


Strip of material covered with external stress skin and installed over joint.

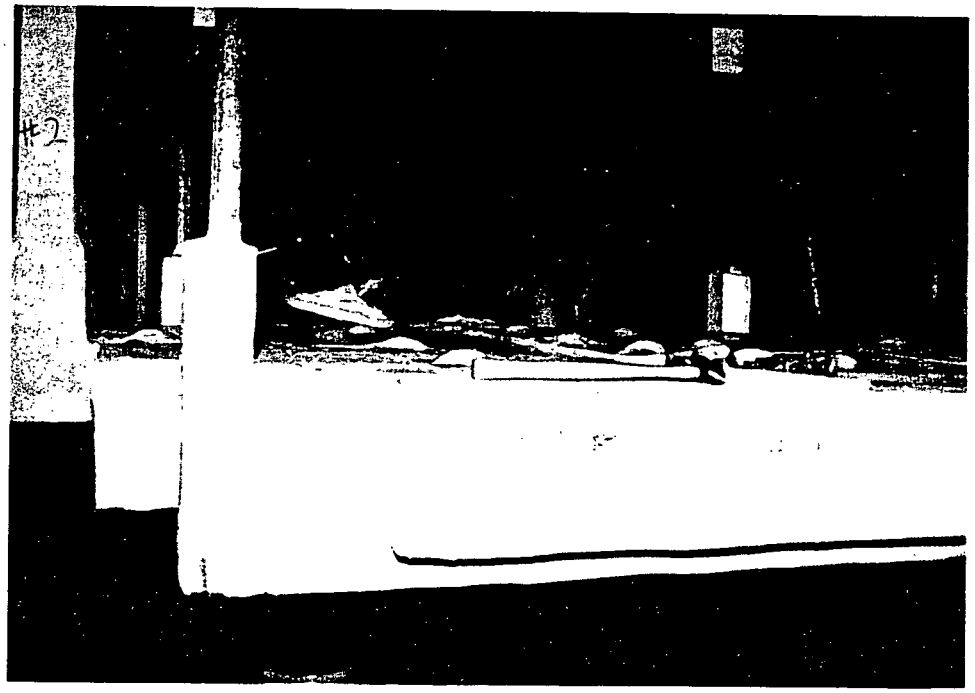
External stress skin patches stapled in place over trowel grade mounds.



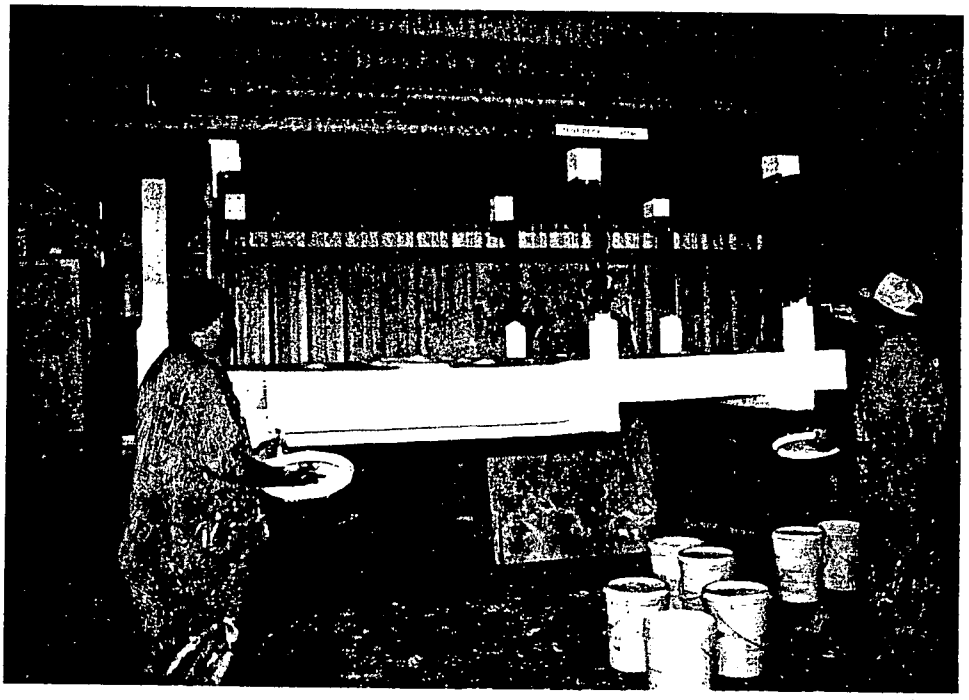
Mounds of trowel grade material installed over nuts and washers.



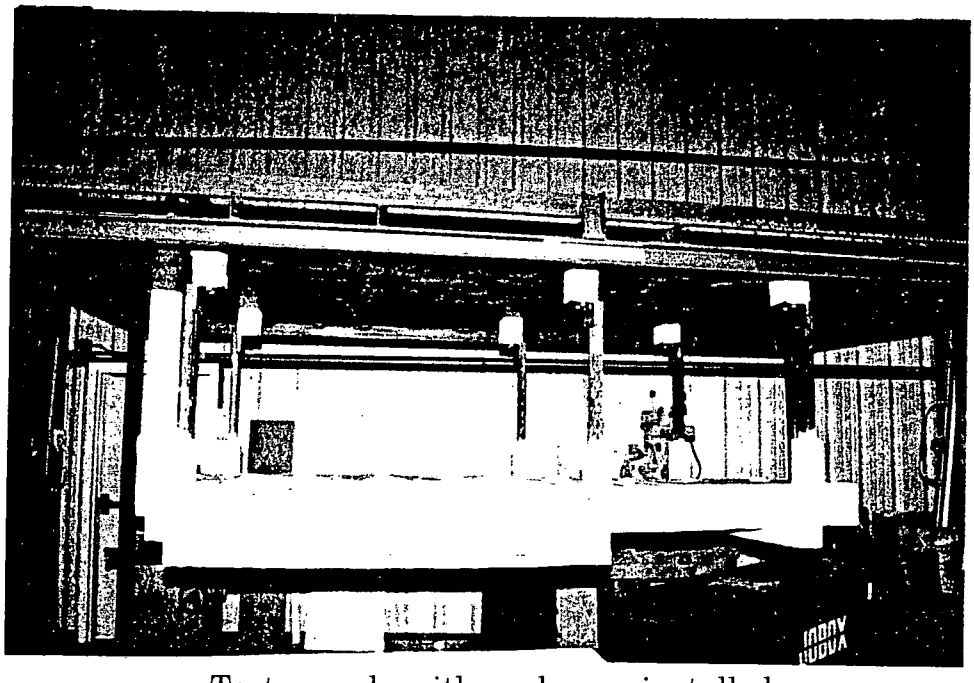
External stress skin patches stapled in place over trowel grade mounds.



Trowel grade material applied over external stress skin on surface of test sample.



Trowel grade material applied over external stress skin on surface of test sample.



Test sample with enclosure installed.

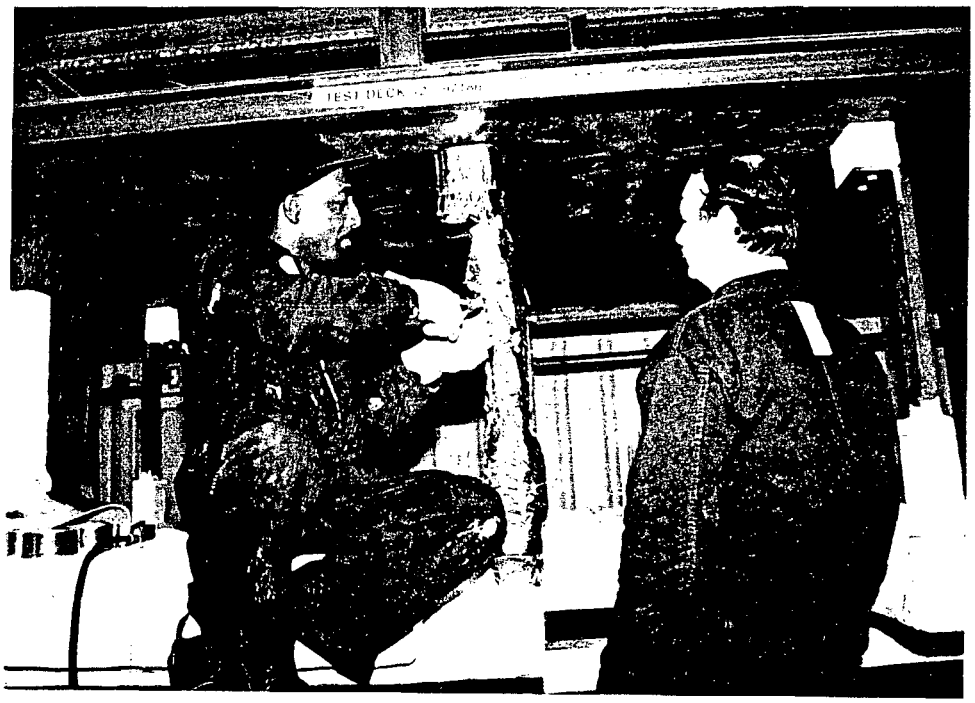
3M material wrapped around top of support member.

First layer of 3M material wrapped around vertical sections of support members.

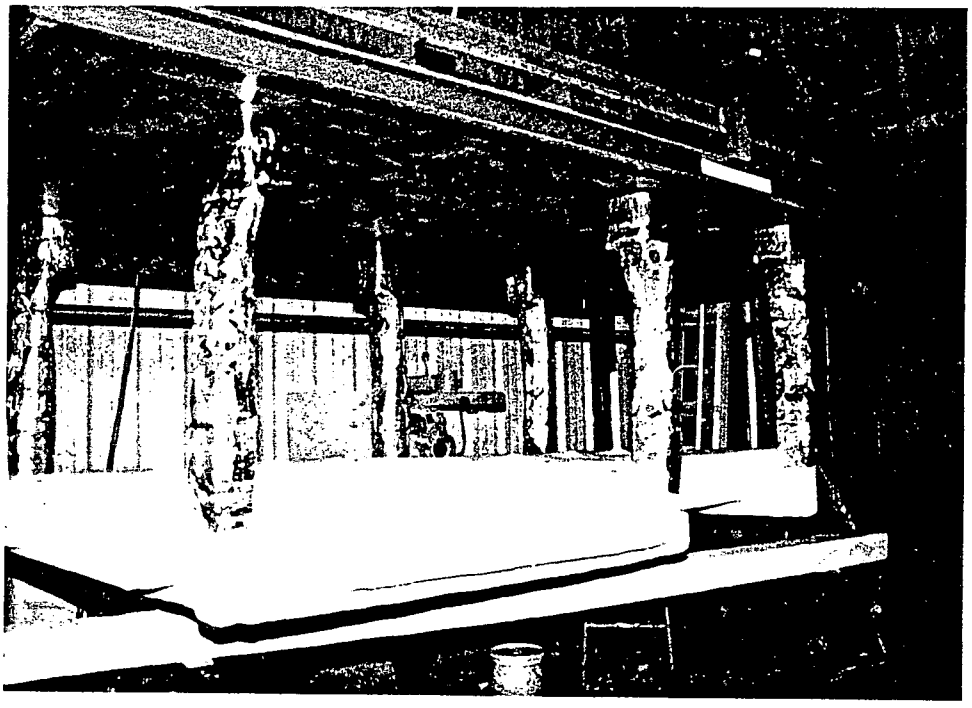
First layer of 3M material secured to support member with stainless steel tie wire.

Second and final layer of 3M material installed on top of support member.

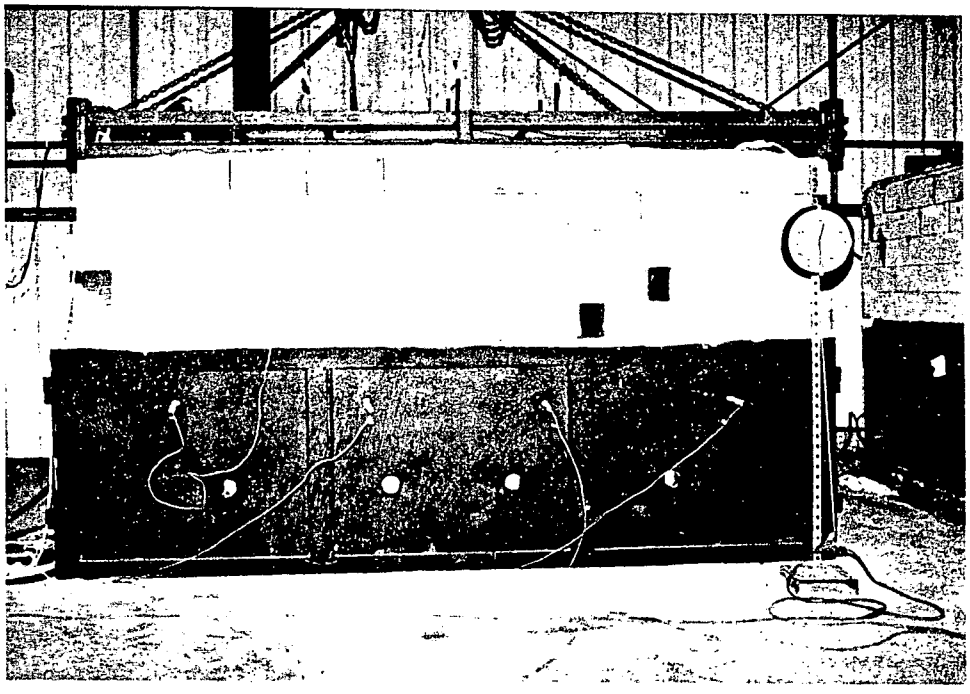
Second and final layer of material installed on support and secured with foil tape.



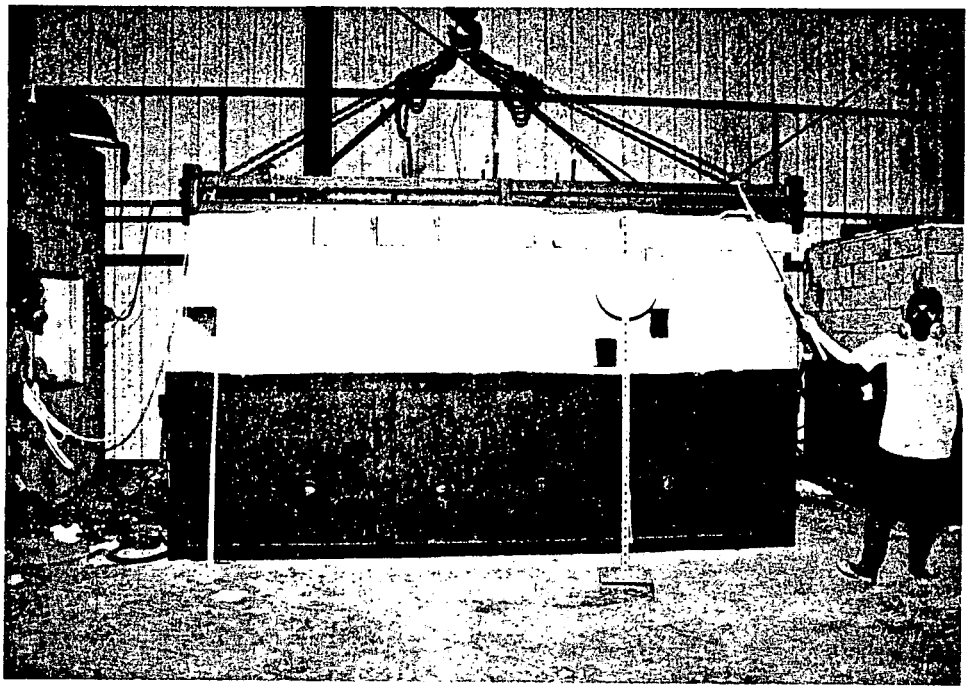
Second layer of 3M material secured with stainless steel tie wire.



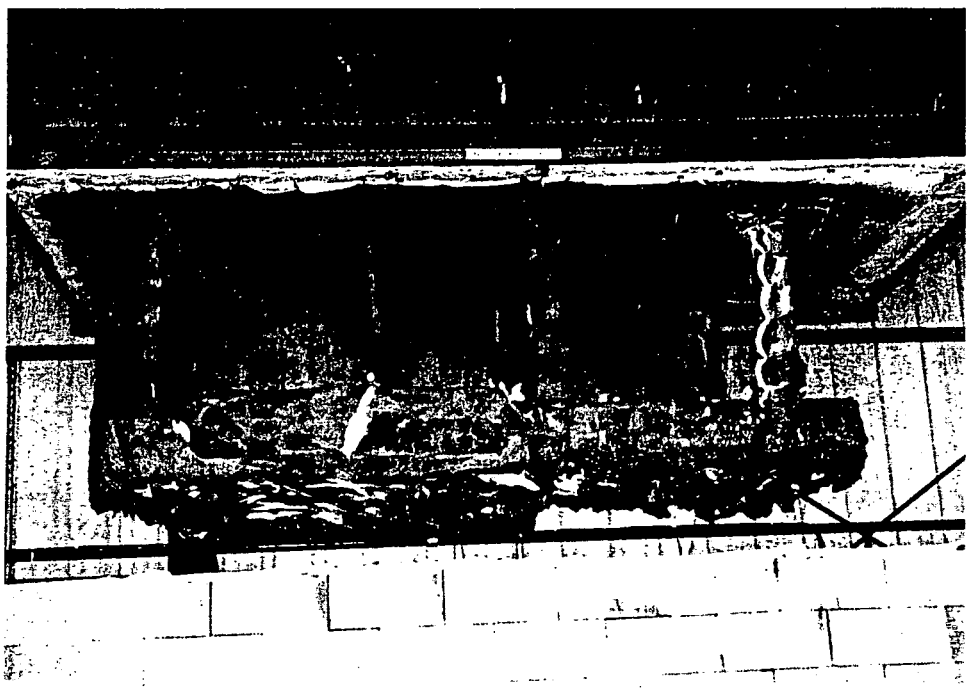
Completed application of two layers of 3M material on all vertical supports.



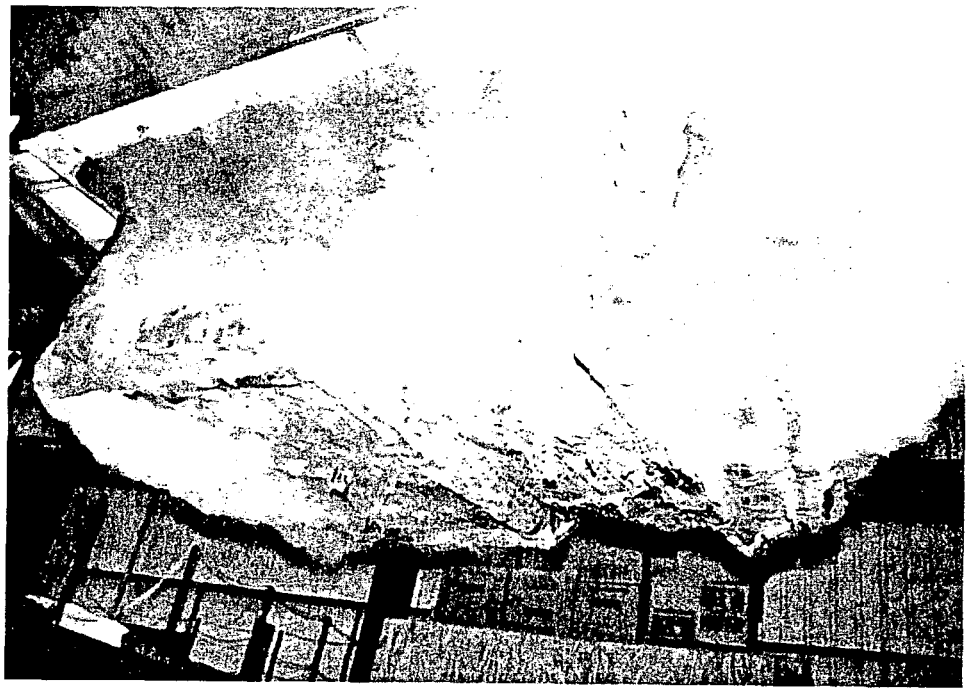
View of test deck on furnace after thirty minutes of fire exposure.



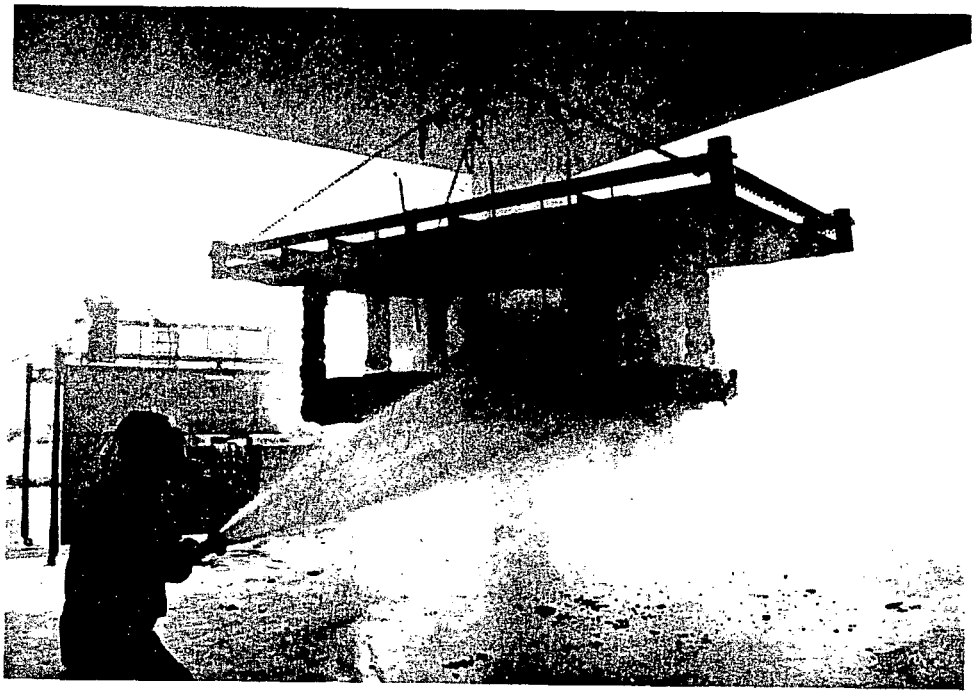
Test furnace at end of fire exposure (one hour).



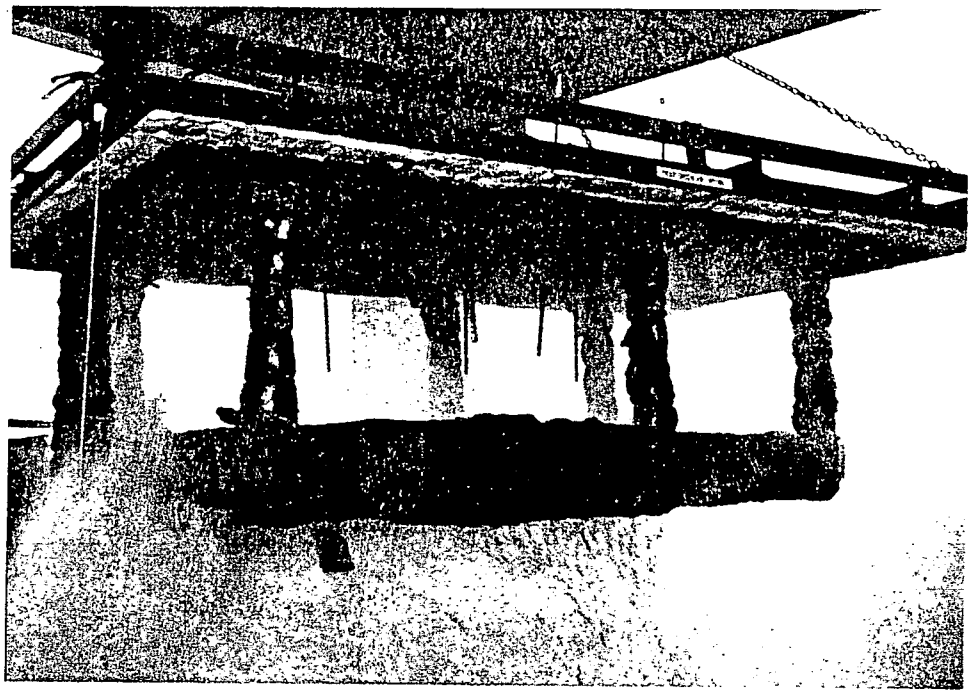
Test deck removed from test furnace and prepared for hose stream test.



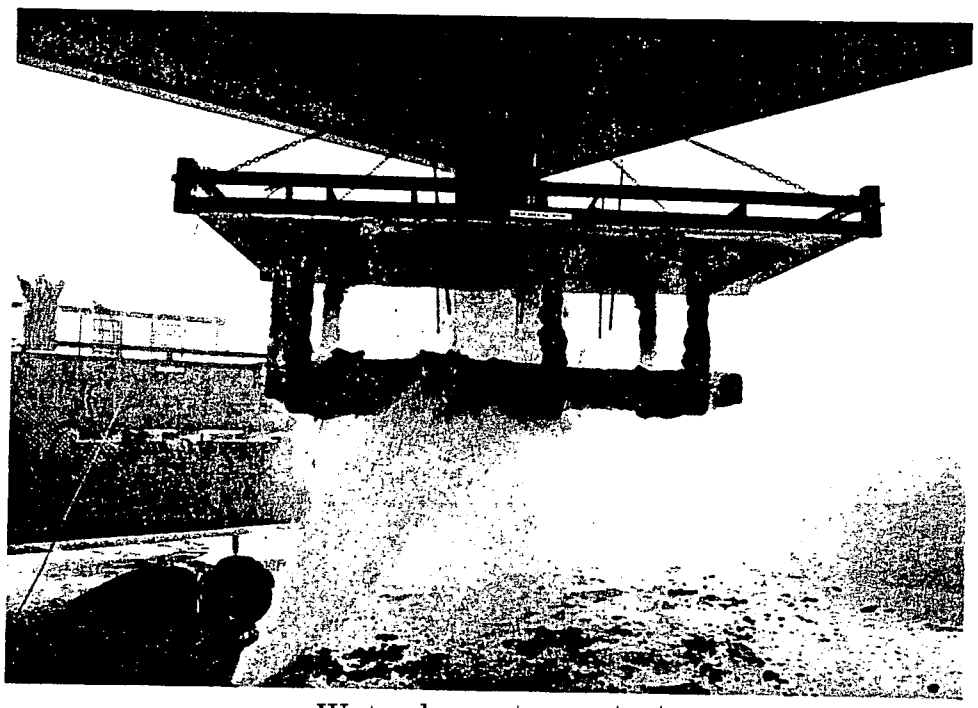
Underside of test sample prior to hose stream test.



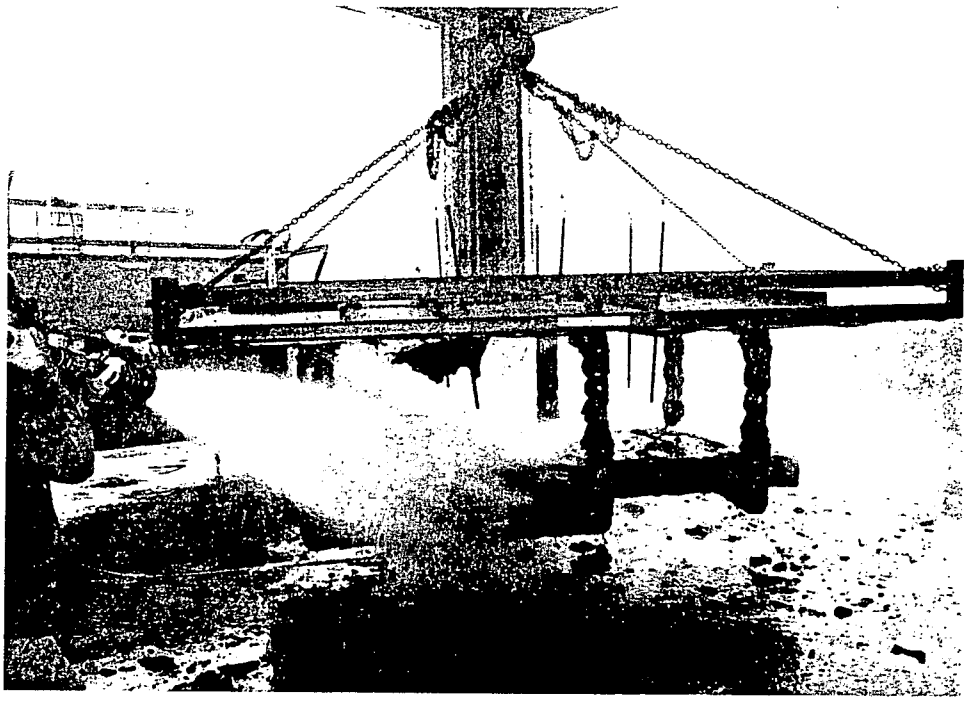
Water hose stream test.



Water hose stream test.

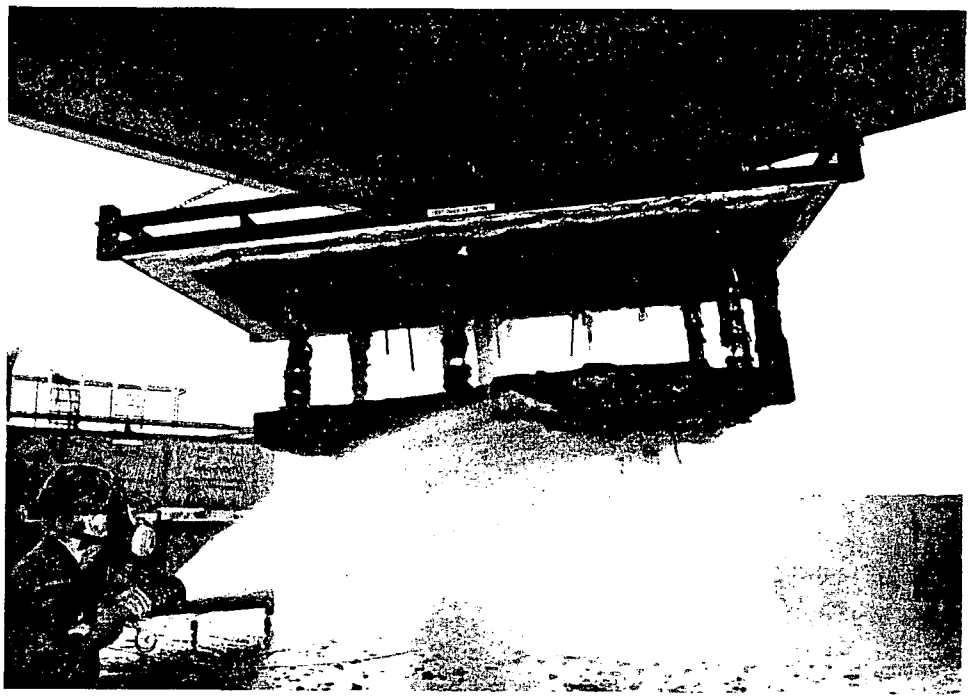


Water hose stream test.

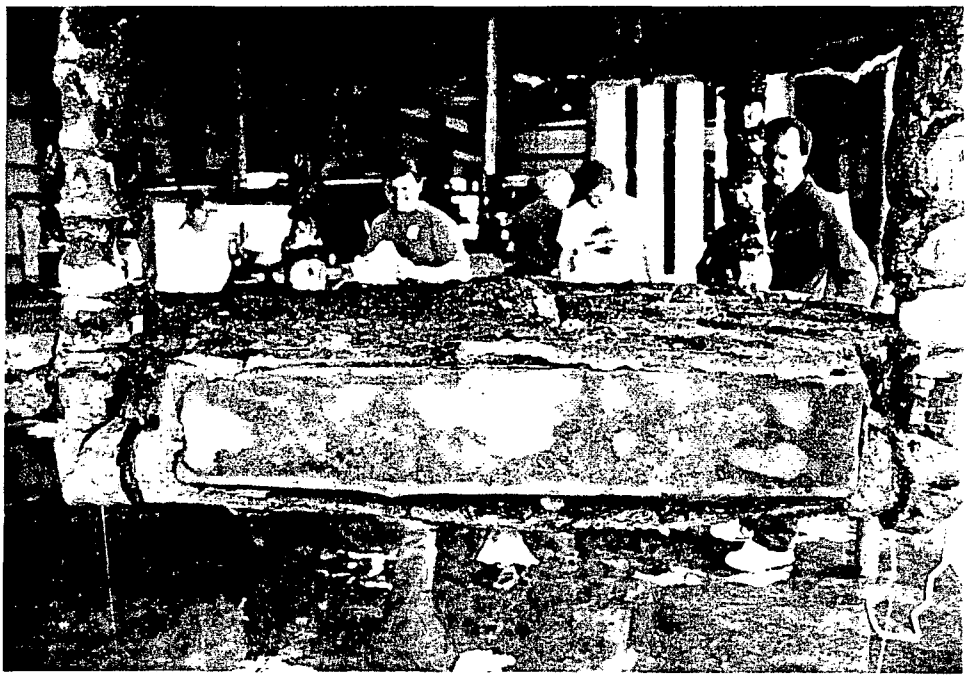


Water hose stream test.

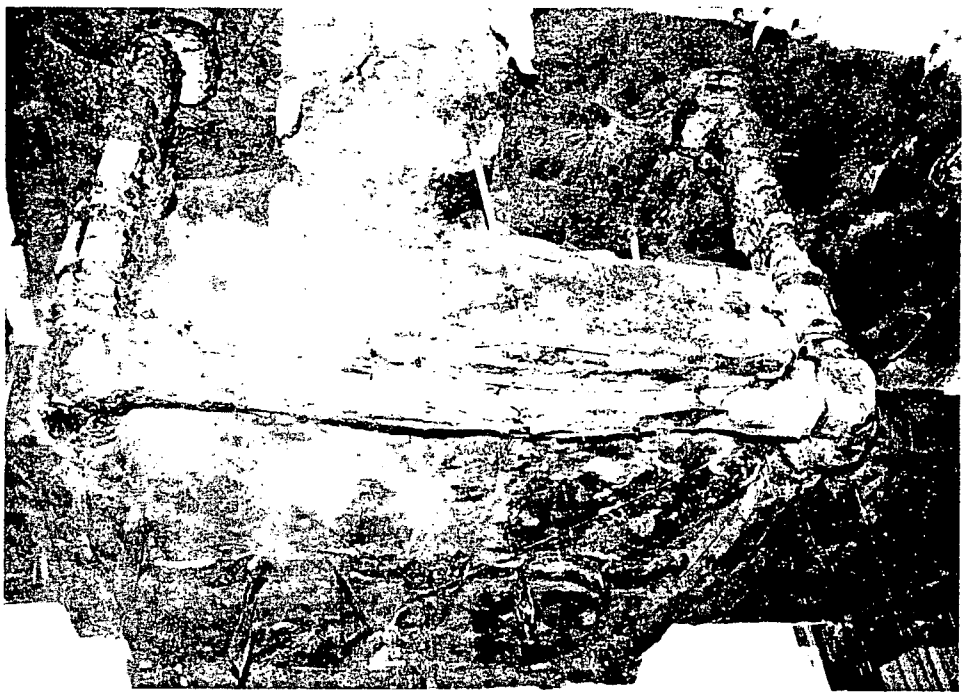
Water hose stream test.



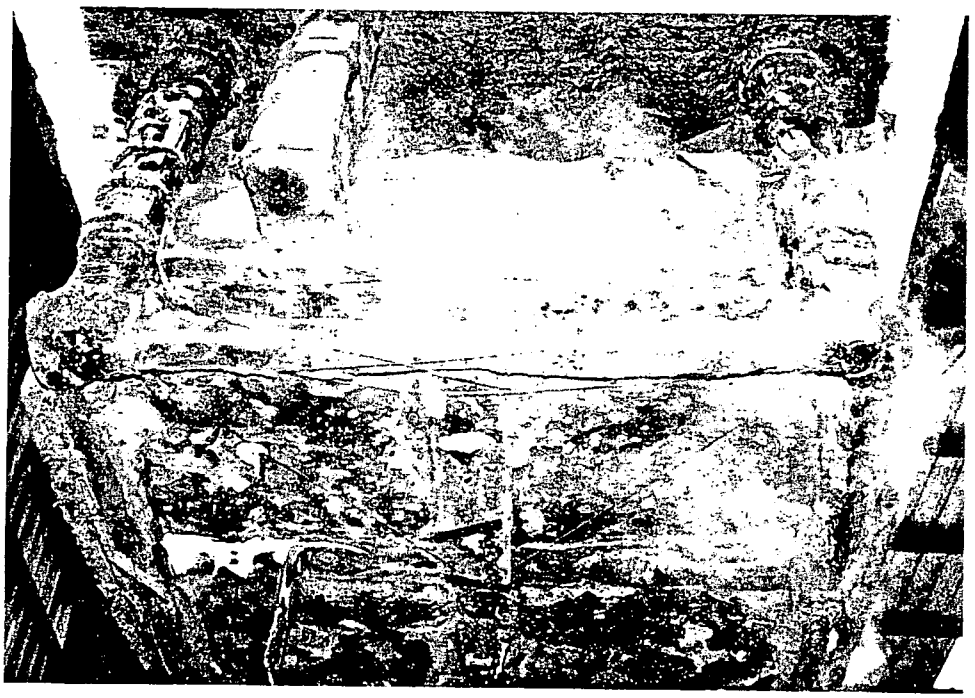
Water hose stream test.



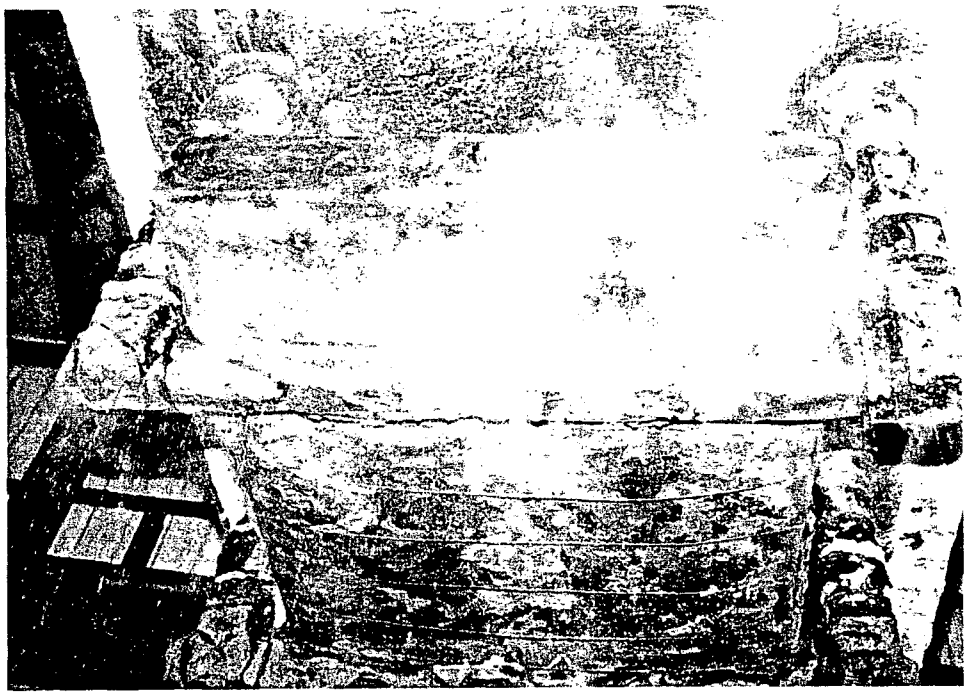
Rear of special tray fitting after hose stream test (note exposed external stress skin on outlet of fitting).



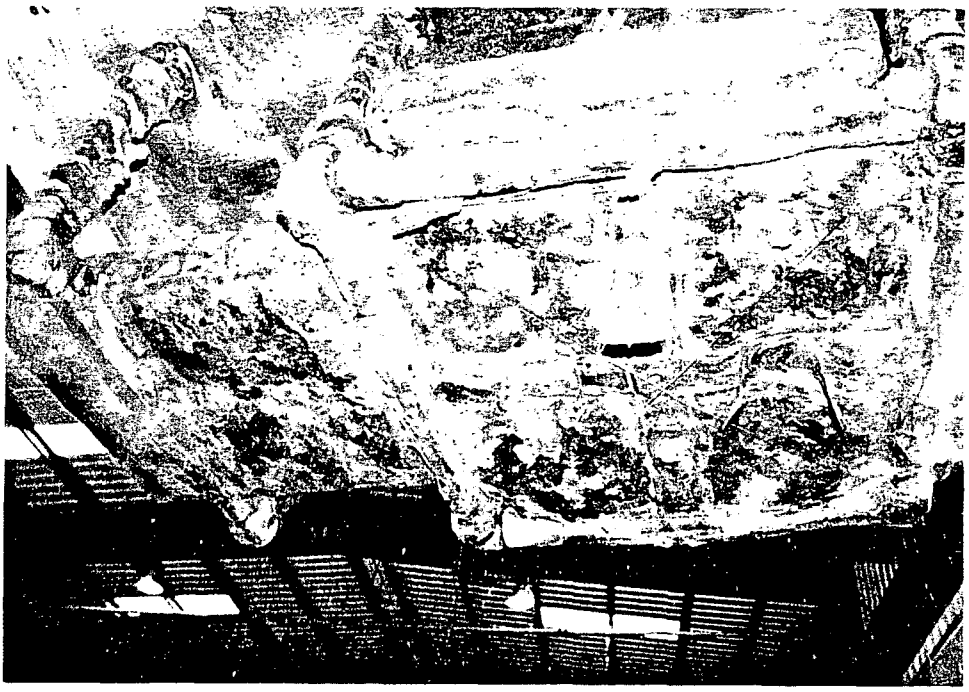
Underside of tray fitting after hose stream test.



Underside of tray fitting after hose stream test.



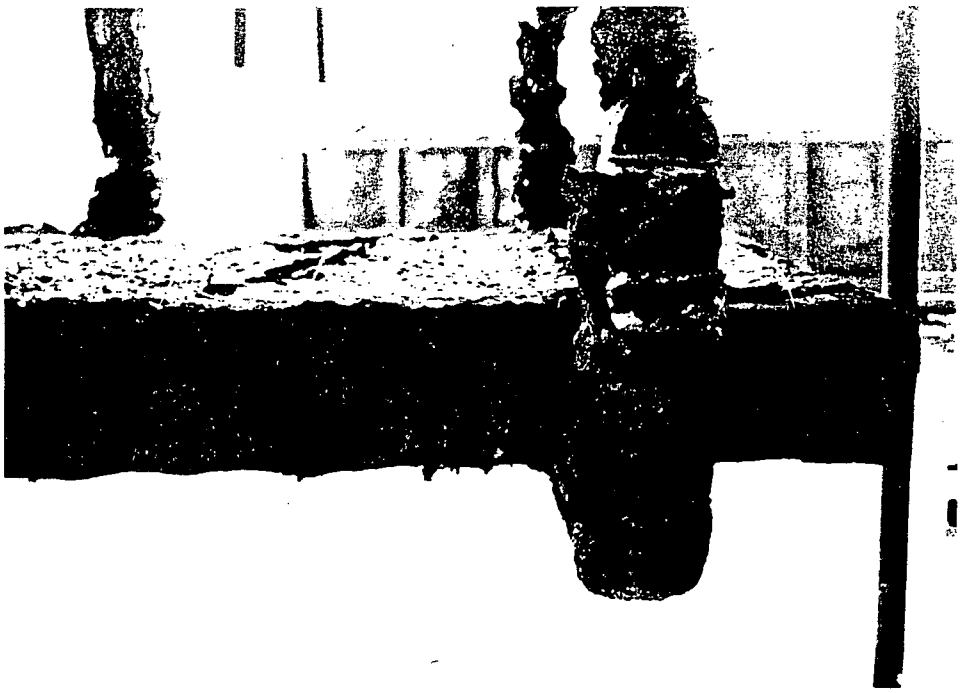
Underside of cable trays after hose stream test.



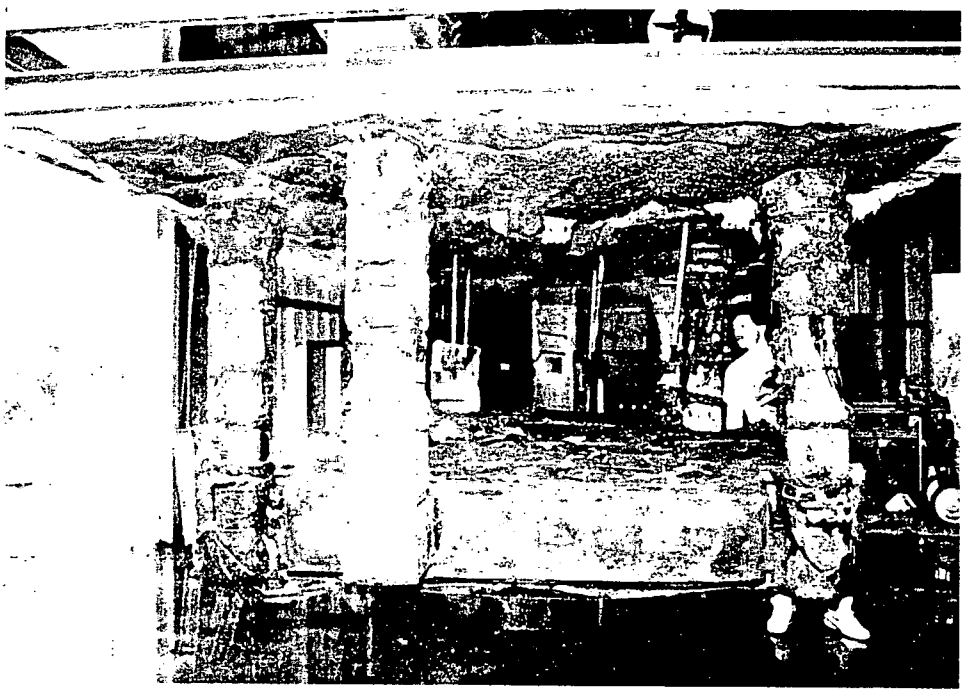
Underside of cable tray assembly after hose stream test.

Rear of cable trays after hose stream test.

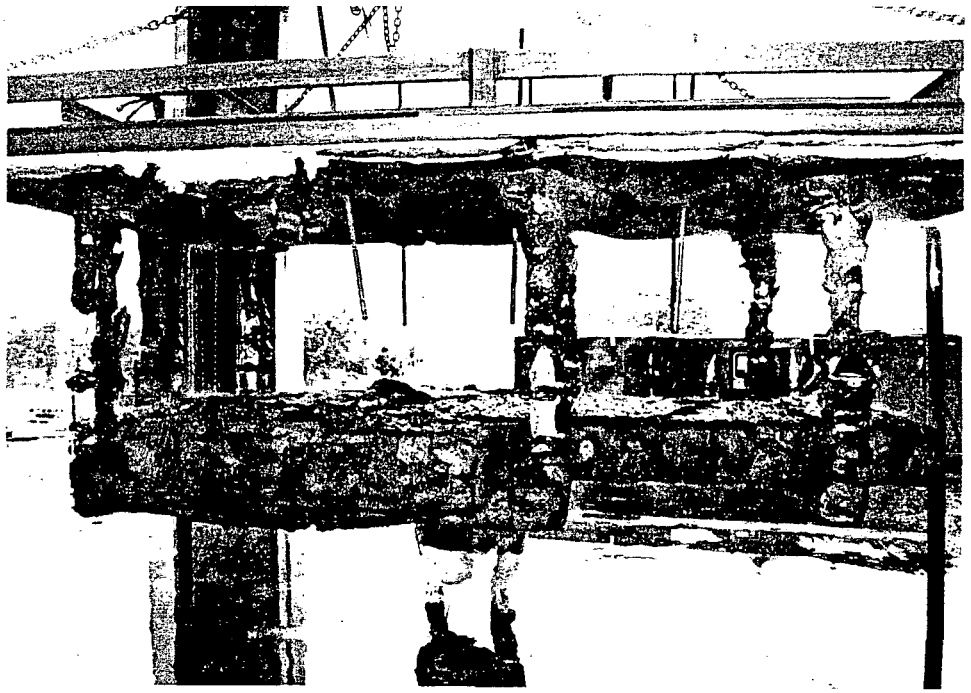
Right end of cable trays after hose stream test.



Typical support member after hose stream test.



Left end of tray assembly after hose stream.



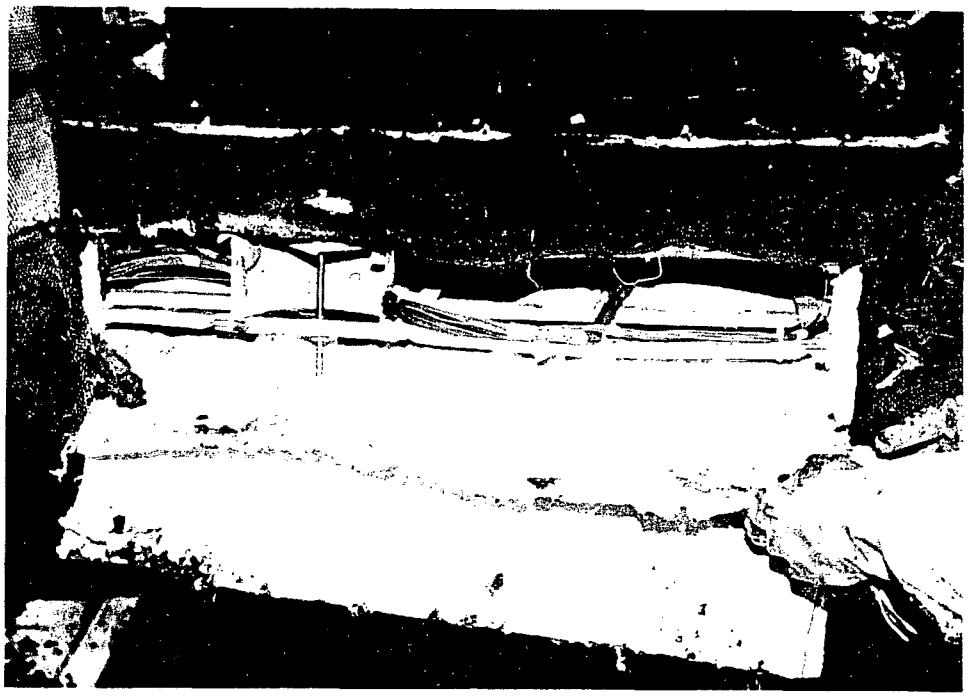
Front of test assembly after hose stream.

External stress skin removed from cable trays.

External stress skin removed from cable trays.

External stress skin removed from fitting (note material under strip).

Material removed from rear outlet of fitting.

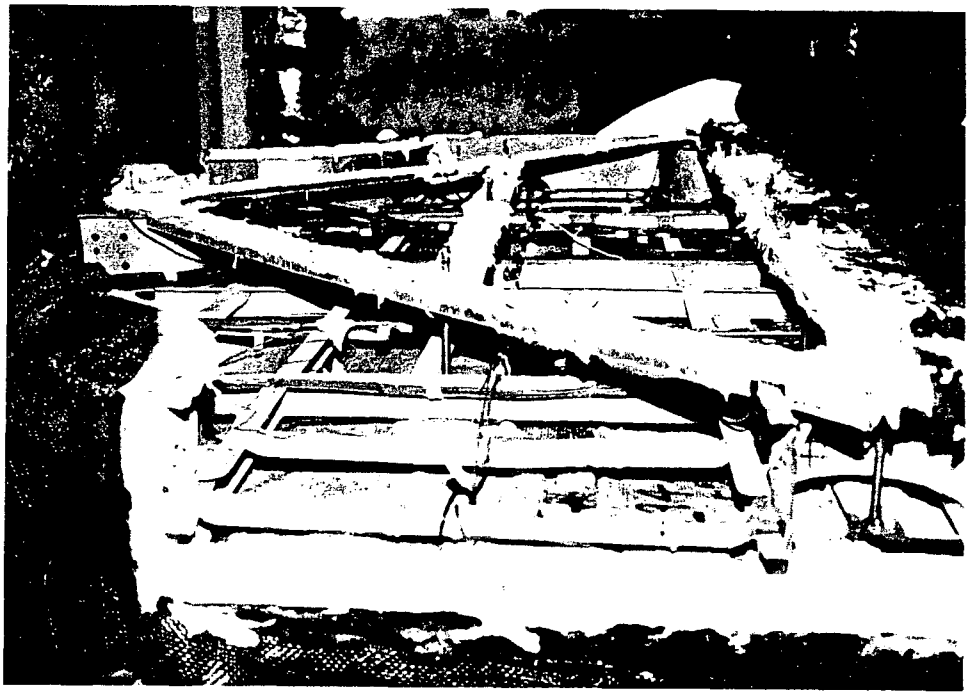


Material removed from rear outlet of fitting.

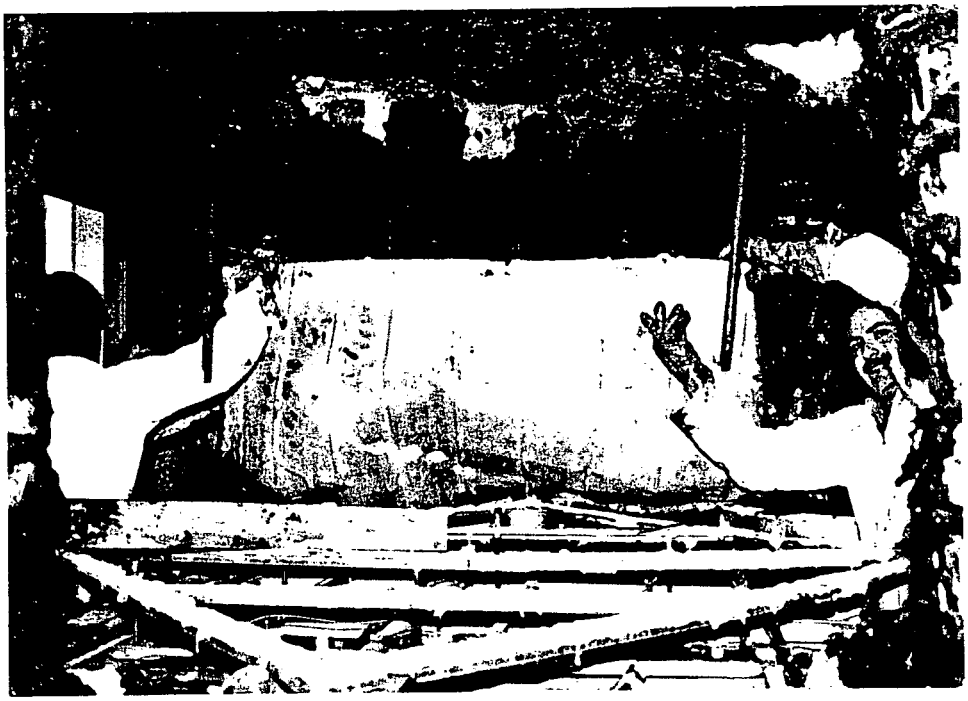
Material removed from front outlet of fitting.

Material removed from front outlet of fitting.

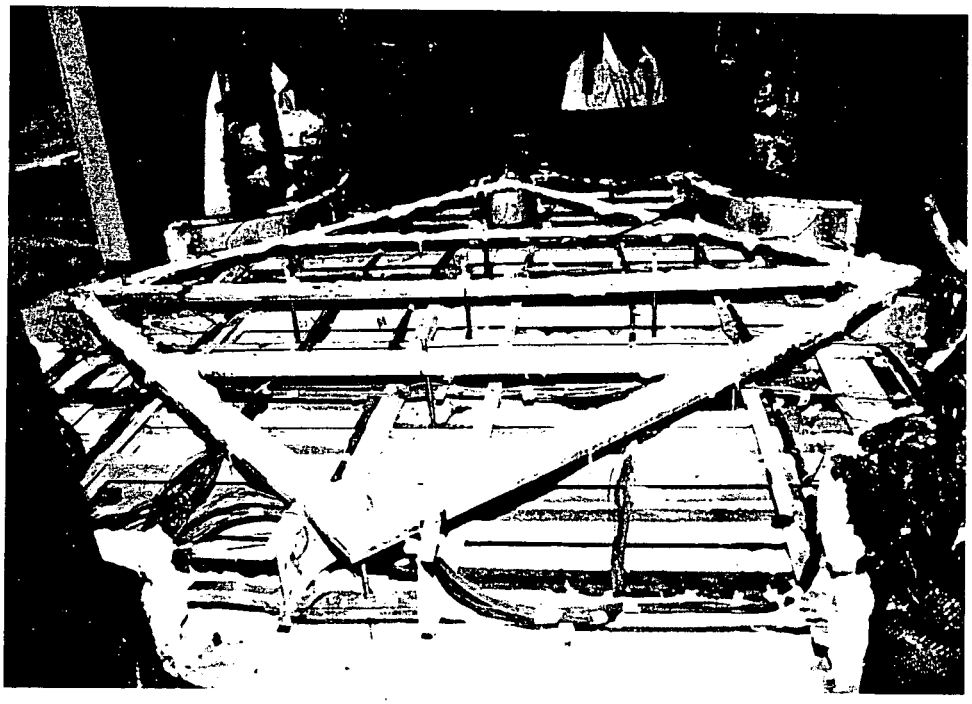
Material removed from top of fitting.



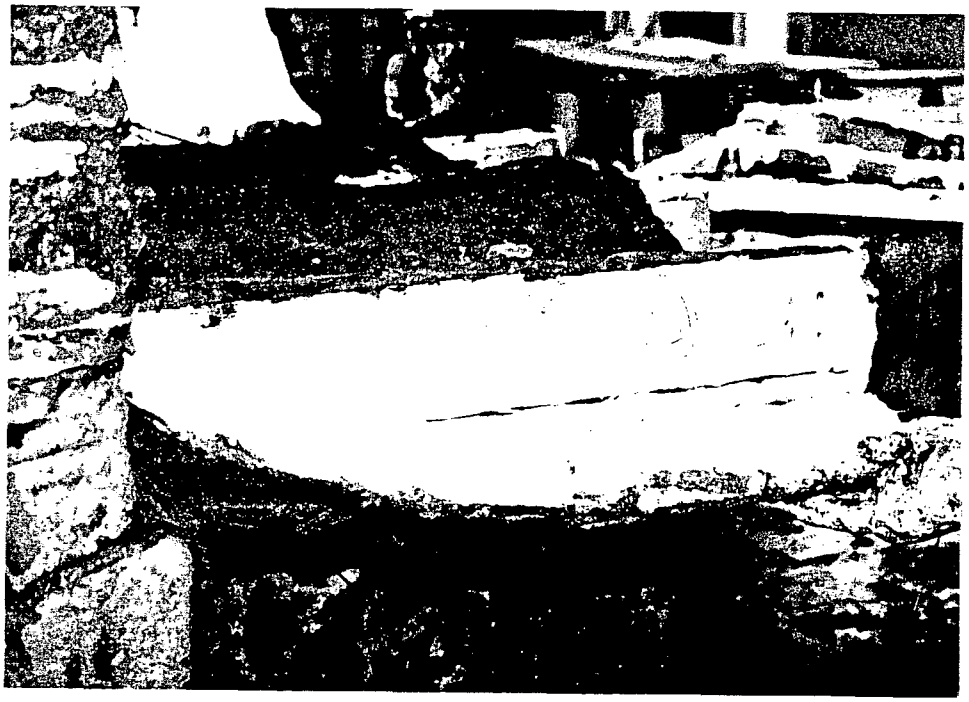
View of interior of special tray fitting.



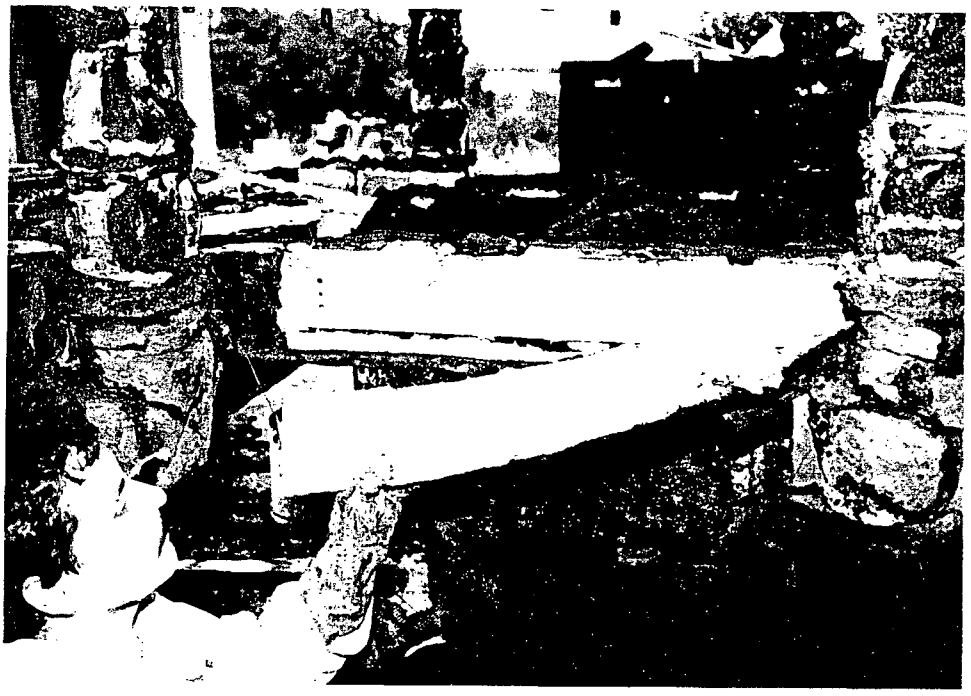
Material removed from top of fitting.



View of interior of special tray fitting.

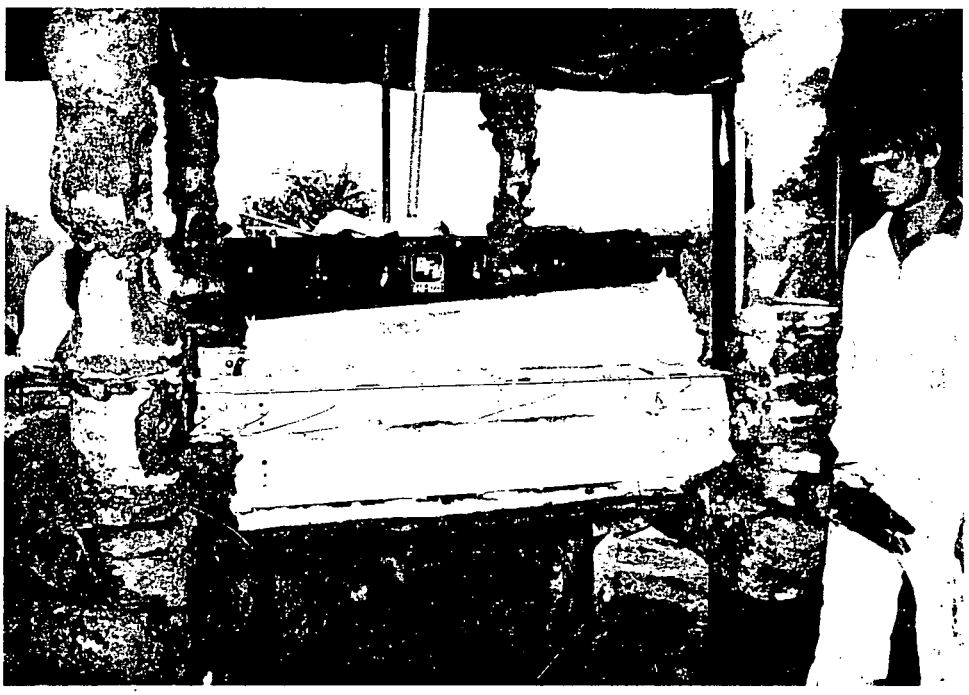


Material removed from tray side rails.

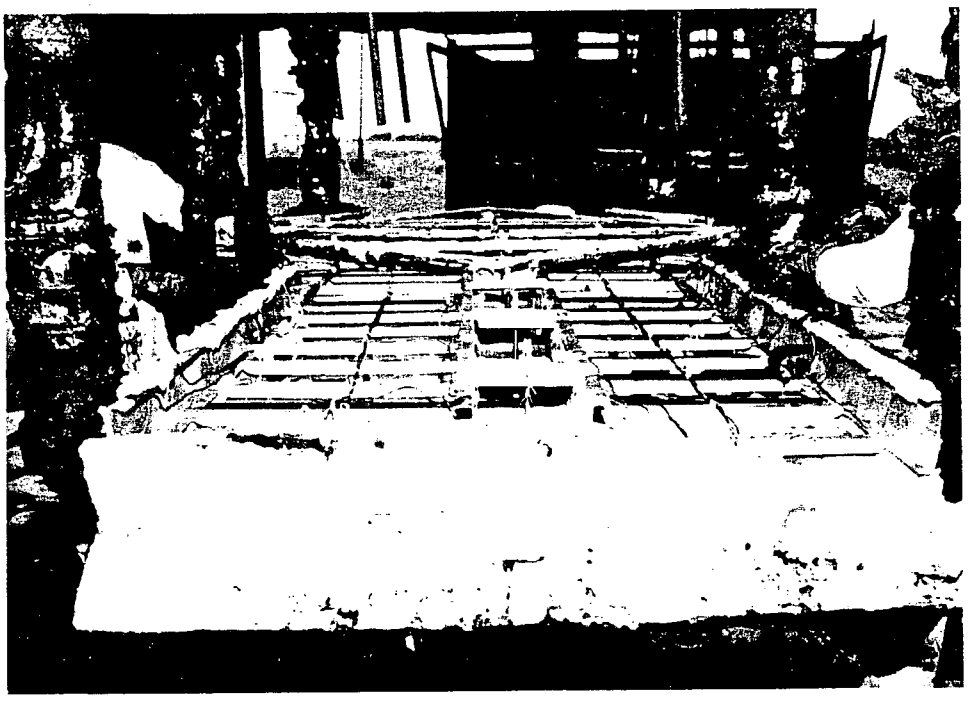


Material removed from tray side rails.

Material removed from free end of cable trays.

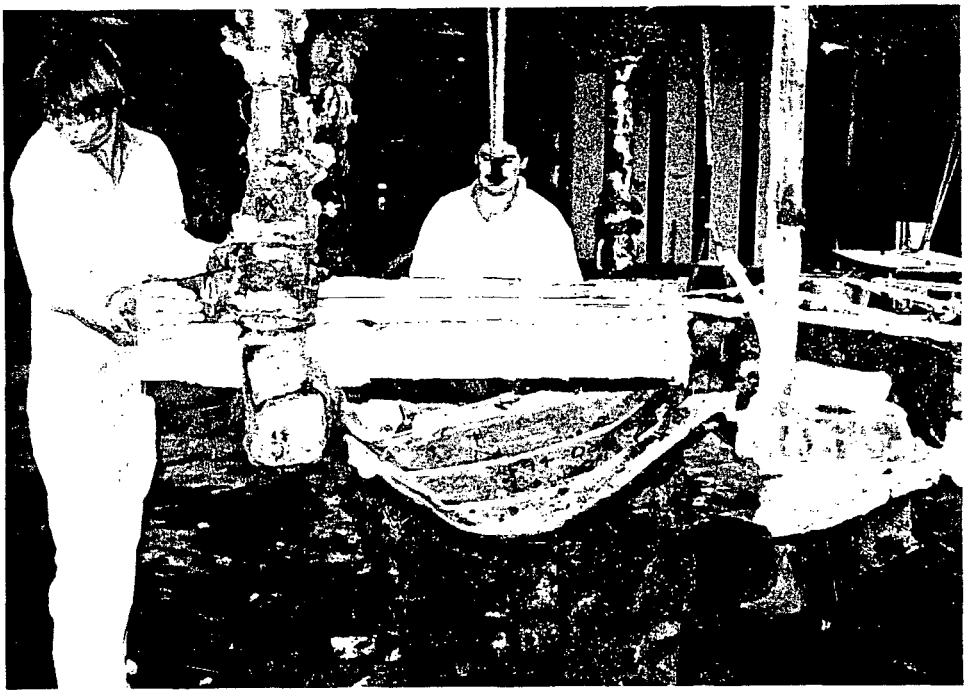


Material removed from top of cable trays.



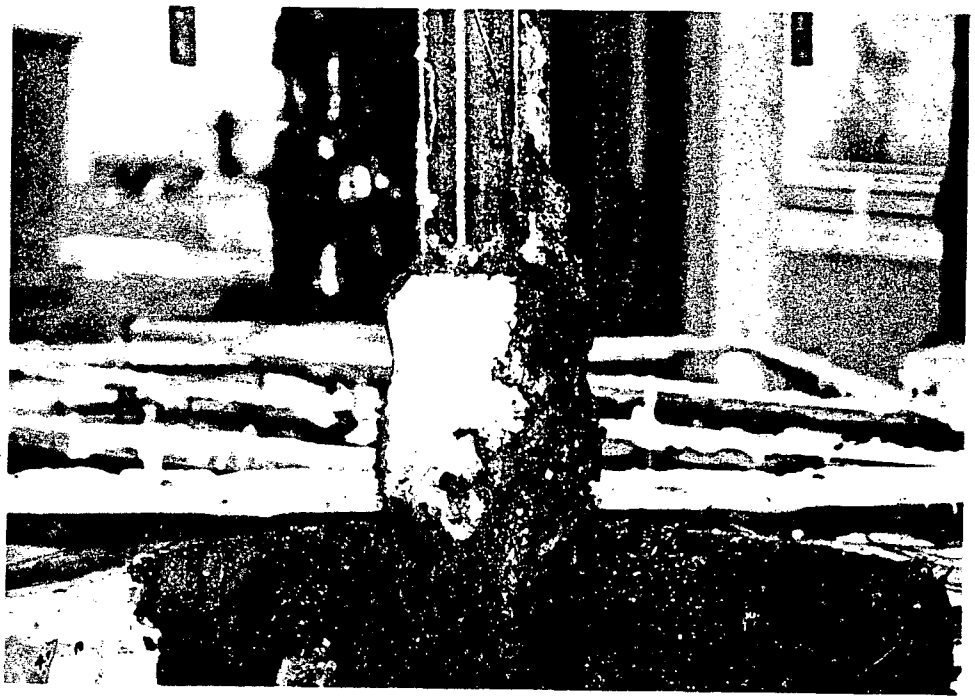
Interior of cable trays.

Material removed from bottom of cable trays.

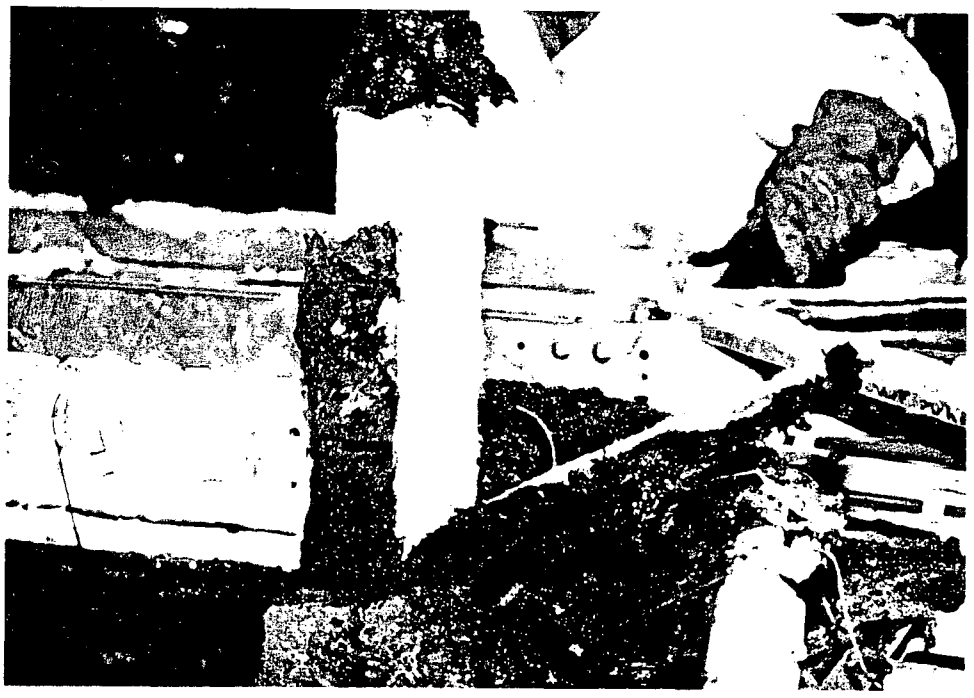


Material removed from bottom of cable trays.

3M material removed from top of vertical support member.



Material removed from vertical support member.

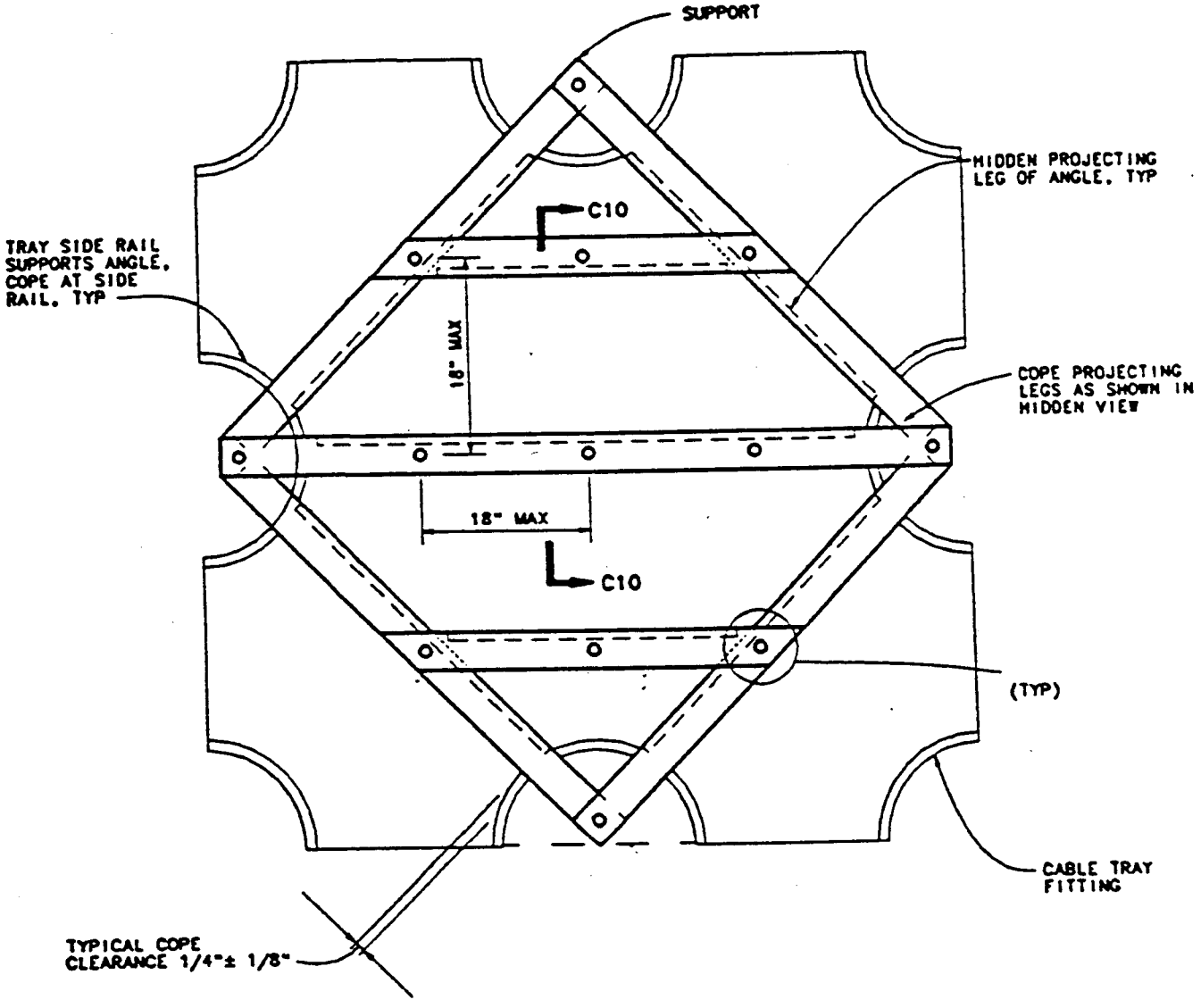


Material removed from support member.

Material removed from support member.

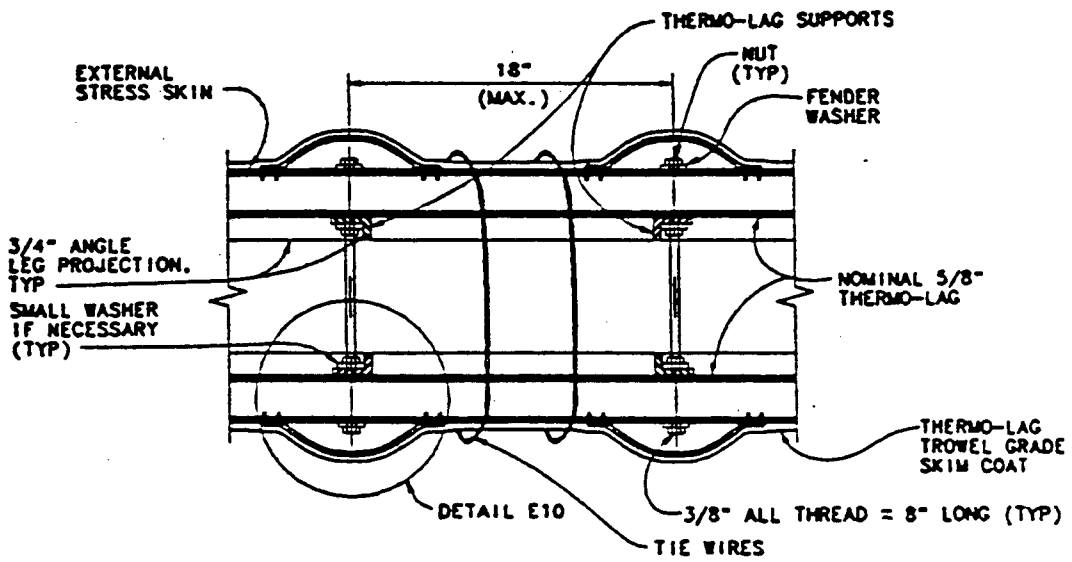
Appendix G

THERMO-LAG® 330-1 INSTALLATION DETAILS

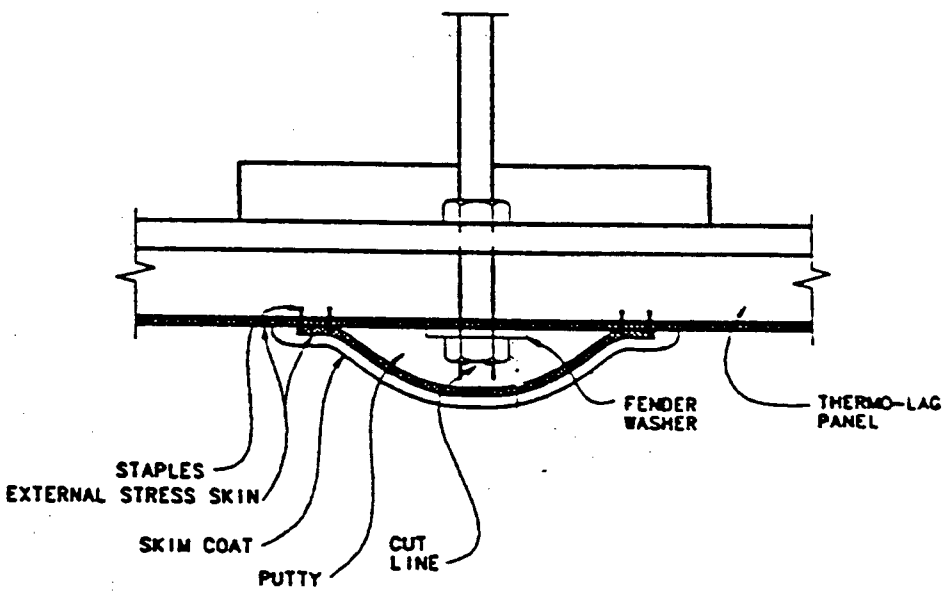


DET A10
DOUBLE CROSS FITTING
T-LAG SUPPORT DETAIL TOP VIEW

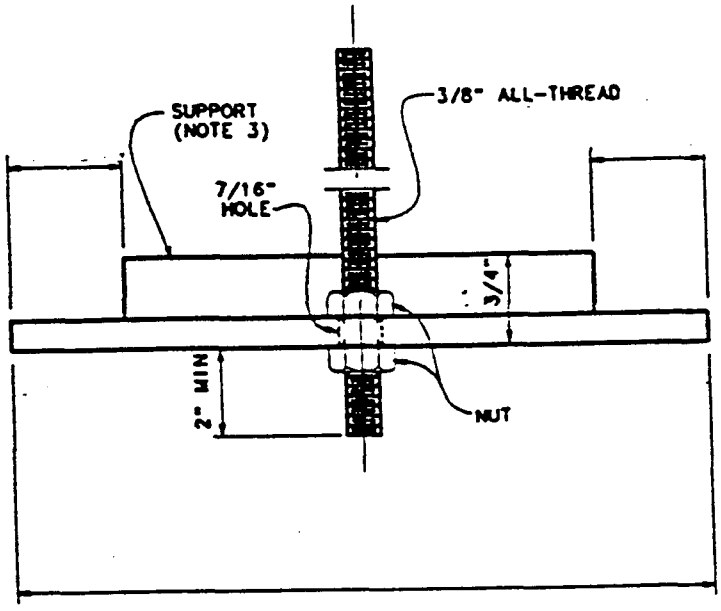
(N.T.S.)



C10-C10
T-LAG SPAN SUPPORT PARALLEL TRAYS
(N.T.S.)

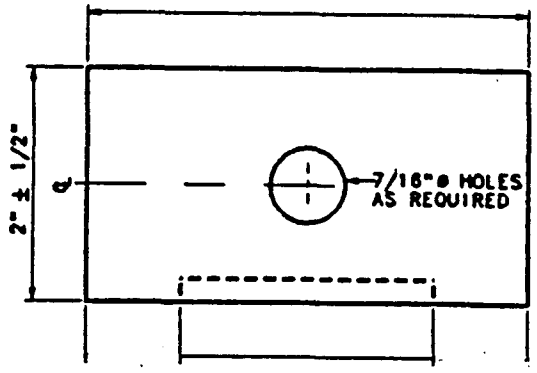


DET E10
SUPPORT WITH THERMO-LAG ATTACHED
(N.T.S.)



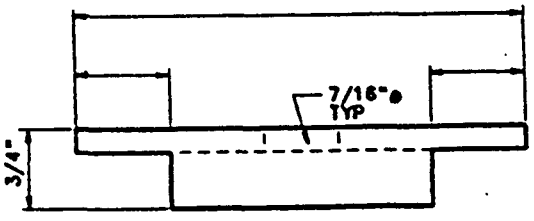
DET D10
SUPPORT WITH ROD

(N.T.S.)



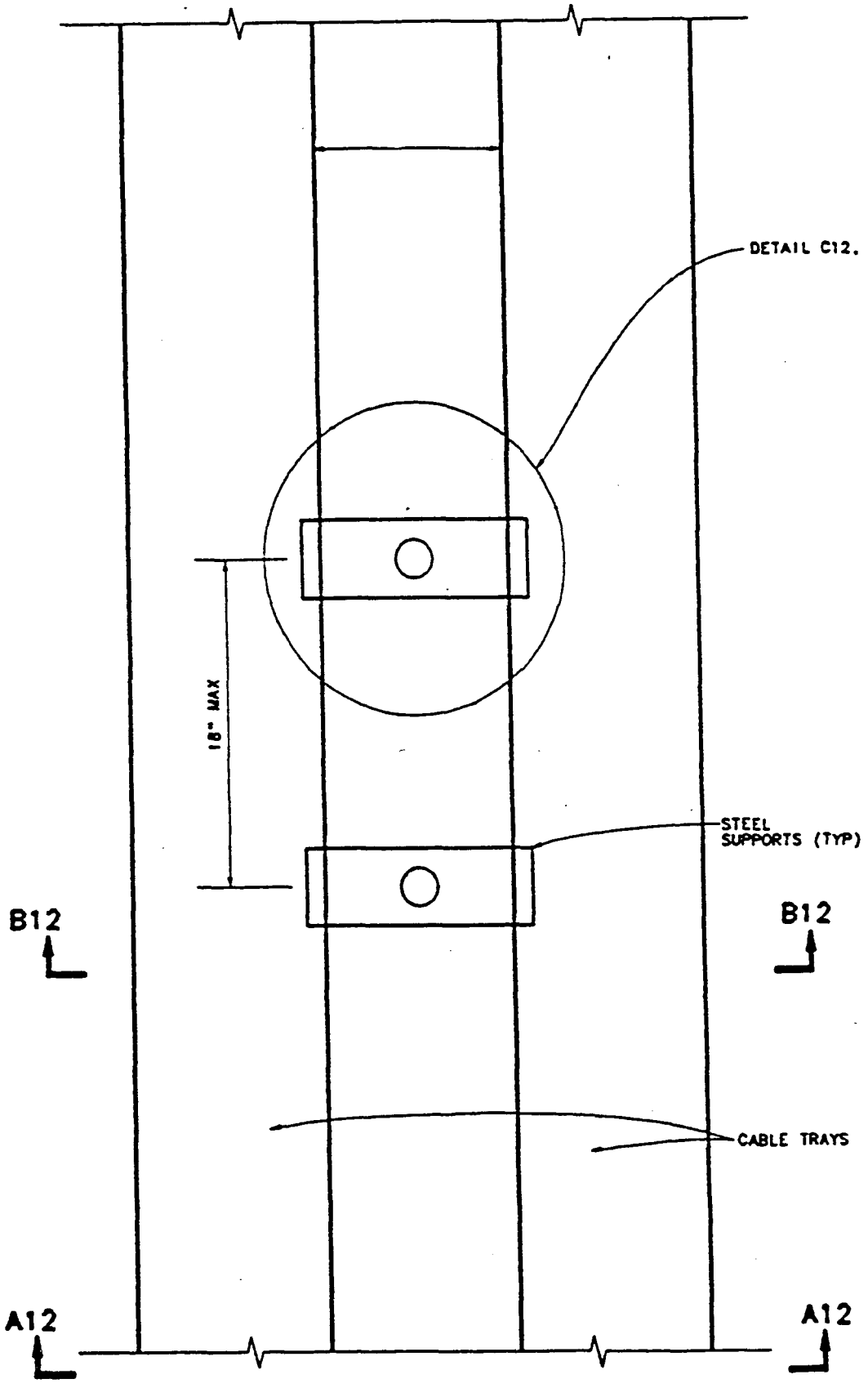
F10-F10
SUPPORT

N.T.S.



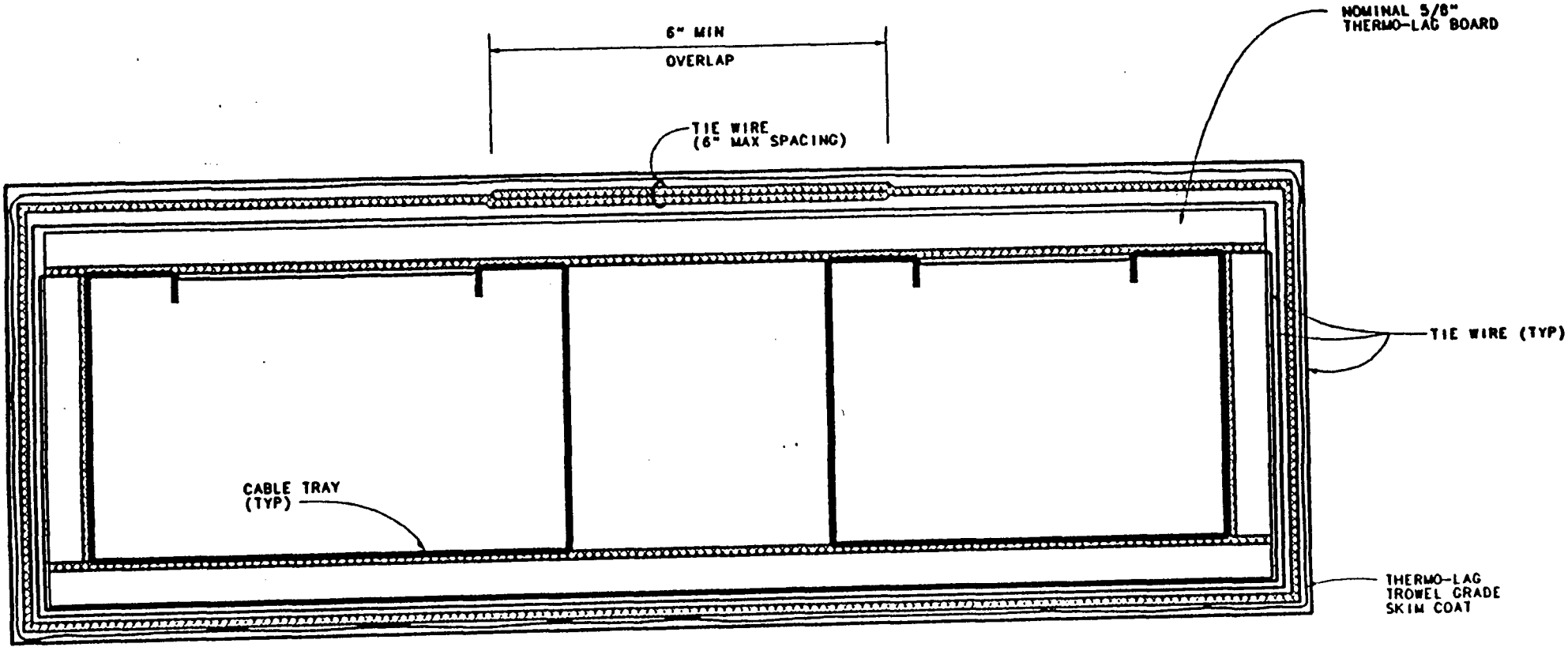
G10-G10
STEEL SUPPORT

N.T.S.

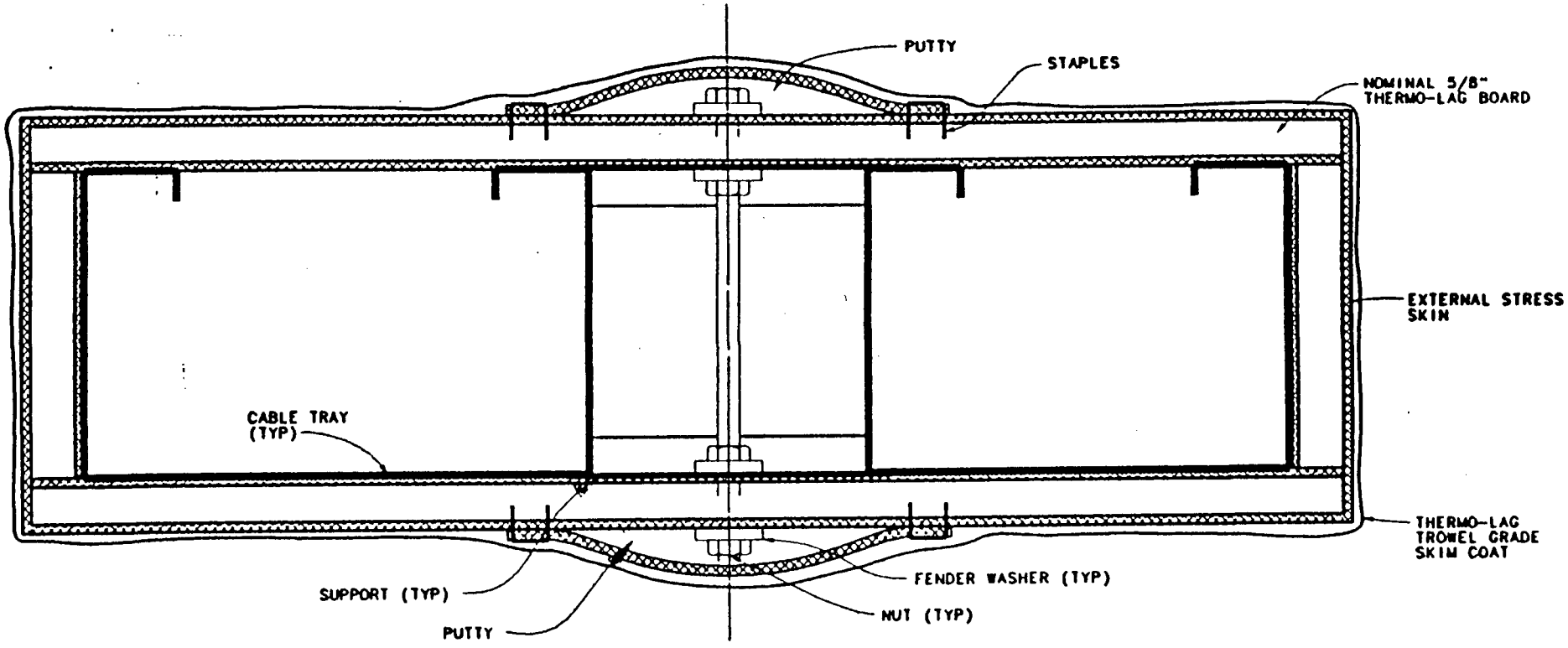


PARALLEL CABLE TRAYS
PROTECTED BY A SINGLE
THERMO-LAG ENCLOSURE
STEEL SUPPORT LOCATION

(THERMO-LAG NOT SHOWN)
(N.T.S.)

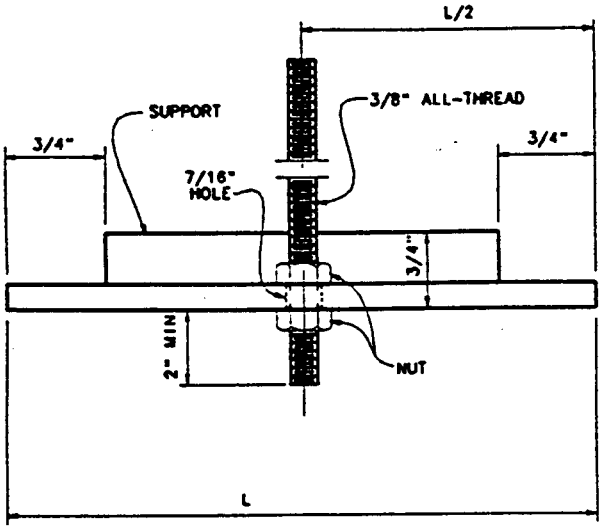


A12-A12
TYPICAL PARALLEL TRAYS
N.T.S.

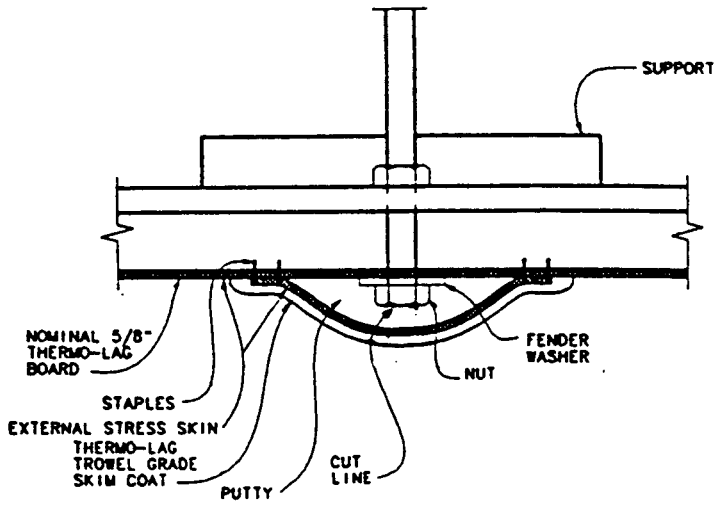


B12-B12

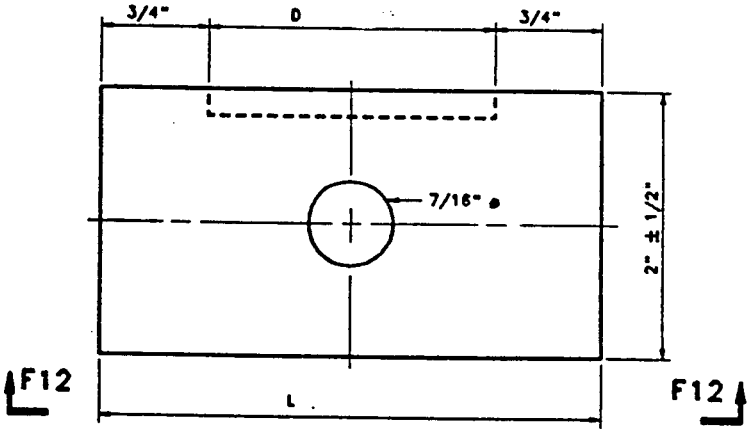
TYPICAL PARALLEL TRAYS
(TIE WIRES NOT SHOWN - SEE A12-A12)
N.T.S.



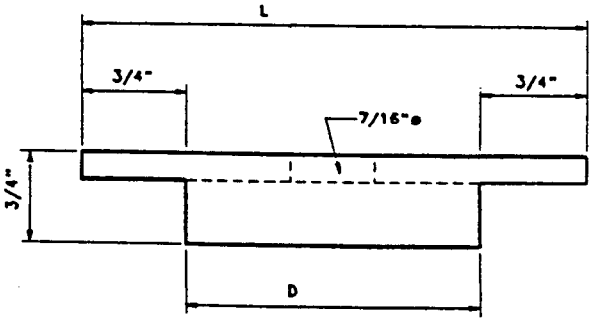
DET C12
SUPPORT WITH ROD
(N.T.S.)



DET D12
SUPPORT WITH THERMO-LAG ATTACHED
(N.T.S.)



DET E12
N.T.S.



DET F12
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
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