



10/5/91

APPENDIX III
TO THERMAL SCIENCE, INC.'S RESPONSE TO THE
UNITED STATES NUCLEAR REGULATORY COMMISSION'S
LETTER DATED 10 SEPTEMBER 1991

Enclosure 40

TSI Technical Note 20684-EIH
THERMO-LAG 330 Fire Barrier System Installation Procedures Manual
Prepared For Bechtel Power Corporation, For Georgia Power Company, Edwin
L. Hatch Power Plant

REV I November 4, 1985

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TSI TECHNICAL NOTE 20684 - EIH

THERMO-LAG 330 FIRE BARRIER SYSTEM
INSTALLATION PROCEDURES MANUAL

DATE OF ISSUE: AUGUST 15, 1985

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PREPARED FOR:

BECHTEL POWER CORPORATION

FOR:

GEORGIA POWER COMPANY

EDWIN I. HATCH POWER PLANT



November 5, 1985

Bechtel Power Corporation
15740 Shady Grove Road
Gaithersburg, Maryland 20877

Attention: Mr. Dan Gragan

Dear Mr. Gragan:

In reference to our telephone conversation of November 4, 1985, enclosed are three (3) copies of the revised TSI Technical Note 20684-EIH, THERMO-LAG 330 Fire Barrier System Installation Procedures Manual, which has been revised for Bechtel Power Corporation For Georgia Power Company - Edwin I. Hatch Power Plant, Issued November 4, 1985.

My apologies for not being able to transmit this document on November 4, 1985, as we previously discussed.

Sincerely yours,

James A. Rippe, Jr.
Vice President

JAR/mls

Enclosures

11/5/85

Note: transmitted before I reviewed

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THERMO-LAG 330 FIRE BARRIER SYSTEM

INSTALLATION PROCEDURES MANUAL

SECTION 1

GENERAL DESCRIPTION

SECTION I
GENERAL DESCRIPTION

1.0 INTRODUCTION

This section describes the THERMO-LAG 330 Fire Barrier System and its material components. The System is comprised of THERMO-LAG Stress Skin Type 330-69 and THERMO-LAG 330-1 Subliming Material. The System may be installed as Prefabricated Panels, Preshaped Sections, Flexi-Blanket, or by direct trowel methods. It is used to protect cable trays, conduit, cable drops (cables in free space), junction boxes and structural supports and hangers.

2.0 FIRE BARRIER DESIGNS

Four (4) basic designs of the THERMO-LAG 330 Fire Barrier System have applications in nuclear power generating installations. These four (4) designs are:

- Prefabricated Panel Design
- Preshaped Conduit Section Design
- Direct Trowel On Design
- Flexi Blanket Design

The following paragraphs highlight the major steps involved in installing these designs. The more detailed sequential steps involved in installing these designs are described in Section II.

2.1 Prefabricated Panel Design

The Prefabricated Panel Design is fitted and installed at the jobsite from THERMO-LAG 330-1 Prefabricated Panels. This installation involves cutting the number of sections required to form the Fire Barrier from the THERMO-LAG Prefabricated Panels and then mounting the sections on the component to be protected using approved stainless steel tie wires or other approved fasteners. The assembly is completed by filling in the scored areas and joints with THERMO-LAG 330-1 Subliming Material - Trowel Grade. The Prefabricated Panel Design shall be used to protect cable trays, cable drops, (cables in free space), conduit, instrumentation tubing, junction boxes, and structural supports.

2.2 Preshaped Conduit Section Design

The Preshaped Conduit Section Design is shipped to the jobsite ready for installation. Installation involves mounting the preshaped conduit sections on the conduit or cable drops to form cylindrical sections around the conduit or cable drop, and then fastening the sections together with approved stainless steel tie wires or banding material. The precoating of the sections prior to installation and the filling in of gaps or openings at the edges or joints of the assembled sections is accomplished using THERMO-LAG 330-1 Subliming Material - Trowel Grade, as required.

The Preshaped Conduit Section Design shall be used to protect conduit, cable drops and instrumentation tubing.

2.3 Direct Trowel On Design

The Direct Trowel On Design shall be used for protecting cable tray, conduit, cable drops, junction boxes and structural supports. This design involves an initial spray, brush or roller application of THERMO-LAG 351 Primer over the properly prepared surface, or 330-69 Stress Skin installation, followed by the trowel application of THERMO-LAG 330-1 Subliming Material - Trowel Grade, in the dry film thickness required to provide the specified level of fire resistance.

2.4 Flexi-Blanket Thermal Barrier Design

The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Design is comprised of a high temperature, subliming, heat blocking, flexible thermal barrier which is reinforced on both sides with a low density, fiberglass cloth, further implemented by a heat blocking thermal catalizer. One and three hour fire rated designs are assembled from these materials as follows:

..... The one hour fire rated design consists of two 0.250 inch minimum thickness layers of the THERMO-LAG 330-660 Flexi-Blanket Material.

..... The three hour fire rated design consists of five 0.250 inch minimum thickness layers of the THERMO-LAG 330-660 Flexi-Blanket Material.

The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Design is used to protect conduit, flex conduit, cable drops, pullboxes, condulets, structural supports and hangers.

3.0 MATERIAL COMPONENTS

The material components which shall be utilized in the various designs of the THERMO-LAG 330 Fire Barrier System are as follows:

3.1 THERMO-LAG Stress Skin Type 330-69

This material provides the strong mechanical base for the THERMO-LAG 330-1 Subliming Material. It is comprised of a pretreated open weave, self stiffened, steel mesh and is used to provide an enclosure over cable trays, conduits and other items.

3.2 THERMO-LAG 330-1 Subliming Material

This material provides the level of fire resistance specified for the installation. It is a water based, subliming, thermally activated fire resistive material which volatilizes at fixed temperatures, exhibits a volume increase through the formation of a multi-cellular matrix, and blocks heat to protect the substrate material to which it is applied.

This material is supplied in a trowel grade consistency (THERMO-LAG 330-1 Subliming Material - Trowel Grade) which is suitable for troweling or caulking type applications. It is further used in the fabrication of Preshaped Panels and Preshaped or Preformed Sections.

3.3 THERMO-LAG 351-2 Primer

This is a corrosion-inhibiting primer which is applied to properly prepared steel surfaces at the spread rate of circa 200 sq. ft. per gallon. This material will be applied to structural supports prior to the application of the Direct Trowel-On THERMO-LAG 330-1 Subliming Material.

3.4 THERMO-LAG 350 Two Part Topcoat

This material provides protection against water flow and climatic variations, chemical attack and physical abuse. It is applied at a spread rate of 50 sq. ft. per gallon.

3.5 Approved Tie Wires and Banding

The tie wires and the banding material approved for attaching the THERMO-LAG 330 Fire Barrier System shall be 18 ga. minimum standard stainless steel wire and 0.020 inch minimum by 1/2 inch minimum standard stainless steel banding. The use of other fasteners requires engineering approval prior to installation.

3.6 THERMO-LAG 330-660 Bulk Material

THERMO-LAG 330-660 is a water based, fireproofing, thermally activated, subliming and insulative coating. When exposed to flame, the material volatilizes at fixed temperatures; exhibits a small volume increase through formation of a multi-cellular matrix; absorbs and blocks heat to protect the substrate material. This material is supplied in a trowel grade consistency which is suitable for troweling or caulking type applications. It is used in conjunction with the THERMO-LAG 330-660 Flexi-Blanket System and will remain flexible after curing.

THERMO-LAC 330 FIRE BARRIER SYSTEM

INSTALLATION PROCEDURES MANUAL

SECTION 11

INSTALLATION PROCEDURES

SECTION II

INSTALLATION PROCEDURES

This section sets forth the sequential steps involved in the installation of the THERMO-LAG 330 Fire Barrier System to cable trays, conduit, cable drops, junction boxes, and structural supports.

1.0 GENERAL REQUIREMENTS

1.1 Qualification of Contractor

The application shall be performed by a qualified contractor who has had prior training in applying the materials and who has the equipment required to perform the application.

1.2 Safety Precautions

The contractor shall follow standard industrial safety practices established for the handling of chemical coatings and shall conform to applicable OSHA and safety rules in all aspects.

1.3 Storage

The THERMO-LAG 330 Fire Barrier System materials shall be stored off the ground when not in use in totally enclosed and weather protected areas provided for this purpose.

The Prefabricated Panels and Preshaped or Preformed Sections do not require any temperature protection. The Bulk Materials such as THERMO-LAG 330-1 Subliming Material - Trowel Grade, or the THERMO-LAG 330 Series Topcoat and THERMO-LAG 351 Series Primer shall be protected against freezing and from temperatures above 100F.

2.0 PREFABRICATED PANEL

2.1 PREFABRICATED PANEL READY ACCESS DESIGNS FOR CABLE TRAYS

Installation of the Prefabricated Panel Ready Access Design to cable trays involves cutting the number of sections required to form the Fire Barrier from one or three hour fire rated THERMO-LAG Prefabricated Panels, and then mounting the sections on the cable tray to be protected using stainless steel tie wires or banding. The sequential steps involved in installing this fire barrier design onto the cable trays are described in the following paragraphs. The one hour fire panel has a nominal thickness of $\frac{1}{2}$ " and the three hour panel has a nominal thickness of 1".

2.1.1 Installation of the One Hour Or Three Hour Ready Access Fire Barrier Design

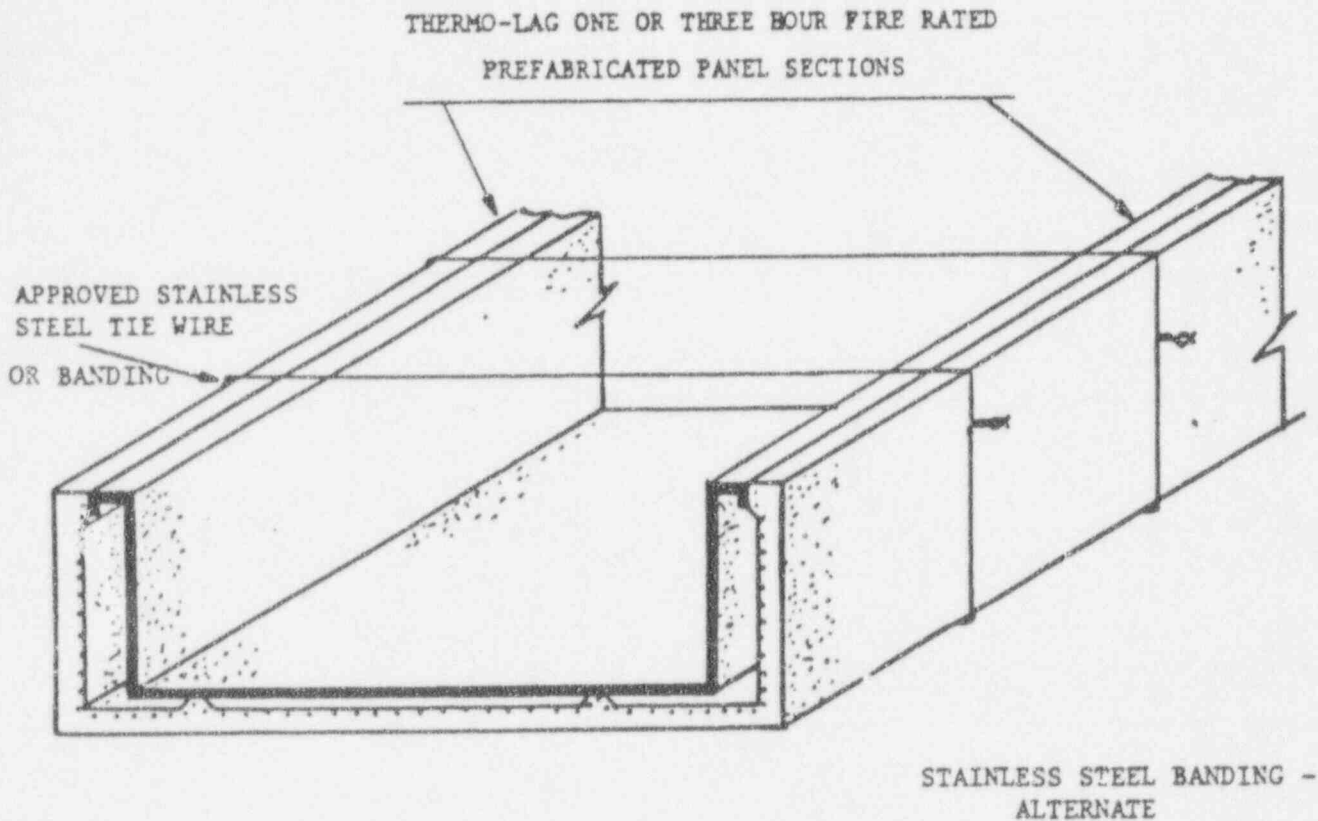
- a. Cut a piece of material large enough to form the bottom section from a one hour or three hour rated Prefabricated Panel. The width of the bottom section shall be equal to the sum of the base plus both side rails of the cable tray plus an allowance for the height of the v-stiffeners. The length of the bottom section shall not exceed 6.5 feet.
- b. Form a "U" shaped bottom section by scoring the panel and bending 90 degrees to provide for the side panels. Note that the stress skin shall always be placed inward against the surface requiring protection.
- c. Cut a piece of material large enough to form the top section from a one hour or three hour rated Prefabricated Panel. The width of the top section shall be equal to the base of the cable tray, plus the thickness of each of the two sides of the bottom U-shaped section. The length of the top section shall not exceed 6.5 feet.
- d. Mount the U shaped bottom section on the cable tray using stainless steel tie wires or banding as shown in Figure 1.
- e. Attach the flat top section to the installed bottom section using stainless steel tie wires or banding as shown in Figure 2. The maximum spacing between the tie wires or banding shall not exceed 12 inches. The distance from the end of a Prefabricated Panel to the tie wire or band shall be a maximum of 2 inches.
- f. Attach additional top and bottom sections to previously installed sections by butt joining them together at their ends.
- g. Complete the installation by filling in the edges and joints with THERMO-LAG 330-1 Subliming Material - Trowel Grade.

THERMO-LAG 330 FIRE BARRIER SYSTEM
 PREFABRICATED PANEL READY ACCESS DESIGN
 FOR CABLE TRAYS

SOLID BOTTOM TRAY - BOTTOM TRAY DETAILS

OR

LADDER BOTTOM TRAY - BOTTOM TRAY DETAILS

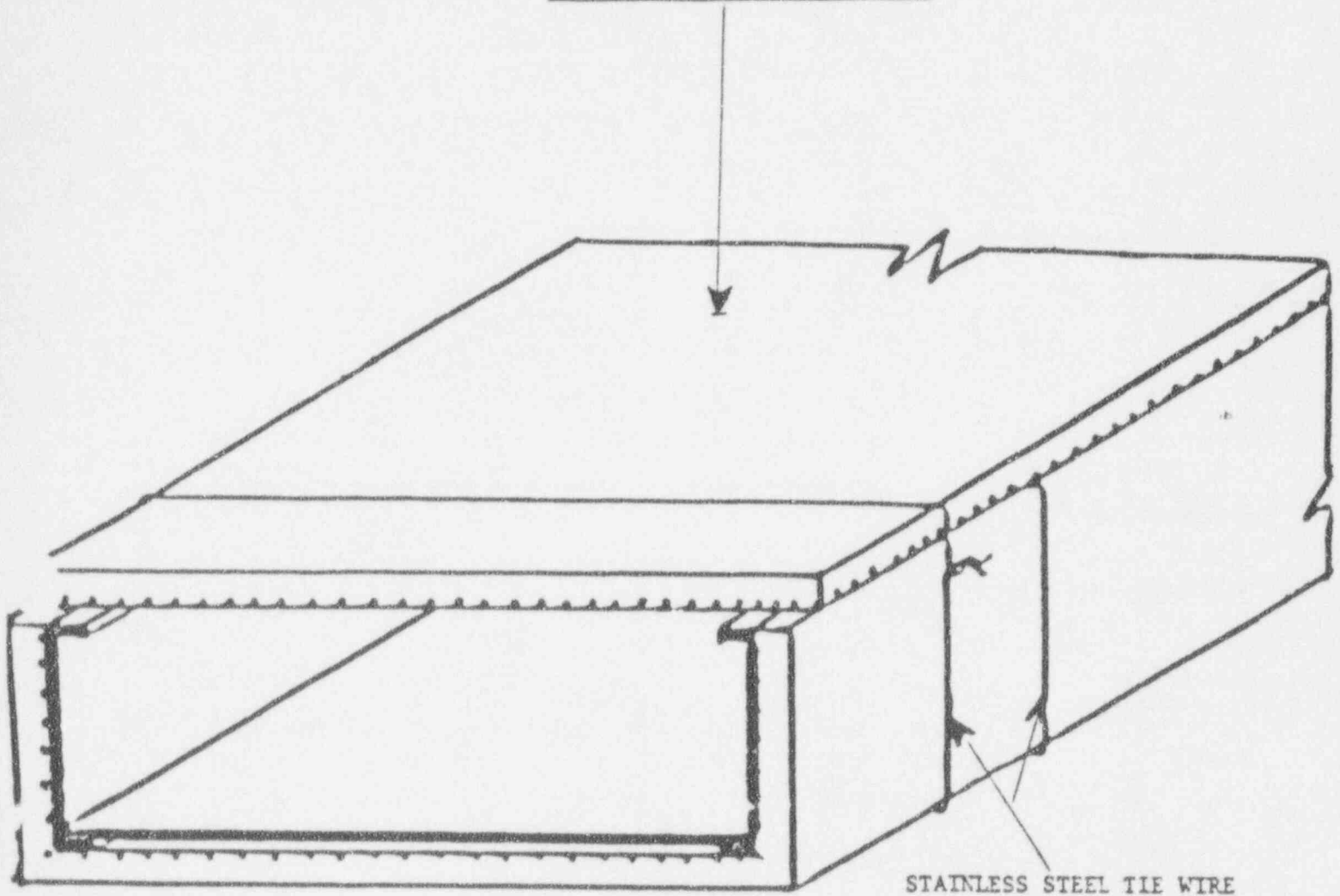


"TYPICAL" INSTALLATION DETAILS

TSL INC. 3260 BRANNON ST. LOUIS, MO. 63133.		
DESIGN: NONE	APPROVED BY: <i>[Signature]</i>	DATE: J. DUMPIE
DATE: 2-6-84		
THERMO-LAG 330 FIRE BARRIER SYSTEM PREFABRICATED PANEL READY ACCESS DESIGN FOR CABLE TRAYS		
SOLID OR LADDER BOTTOM TRAY DETAILS		FIGURE NUMBER FIGURE 1

THERMO-LAG 330 FIRE BARRIER SYSTEM
PREFABRICATED PANEL READY ACCESS DESIGN FOR CABLE TRAYS
SOLID BOTTOM OR LADDER TRAY FIRE BARRIER ASSEMBLY

THERMO-LAG ONE OR THREE HOUR FIRE RATED
PREFABRICATED PANEL SECTIONS



STAINLESS STEEL TIE WIRE

STAINLESS STEEL BANDING -
ALTERNATE

"TYPICAL" INSTALLATION DETAILS

TST. INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
SCALE: NONE	APPROVED BY:	DESIGNED BY: J DUMPIS
DATE: 8-10-85		CHECKED:
THERMO-LAG 330 FIRE BARRIER SYSTEM: PREFABRICATED		
PANEL DESIGN FOR CABLE TRAYS		FIGURE 2

2.2 PREFABRICATED PANEL DESIGN FOR JUNCTION BOXES

Installation of the Prefabricated Panel Design on a junction box involves cutting sections of one or three hour fire rated THERMO-LAC Prefabricated Panel large enough to provide a "U" shape around the junction box and then mounting the sections onto the junction box, using stainless steel bands or other approved fasteners. The sequential steps involved in installing the fire barrier design are described in the following paragraphs.

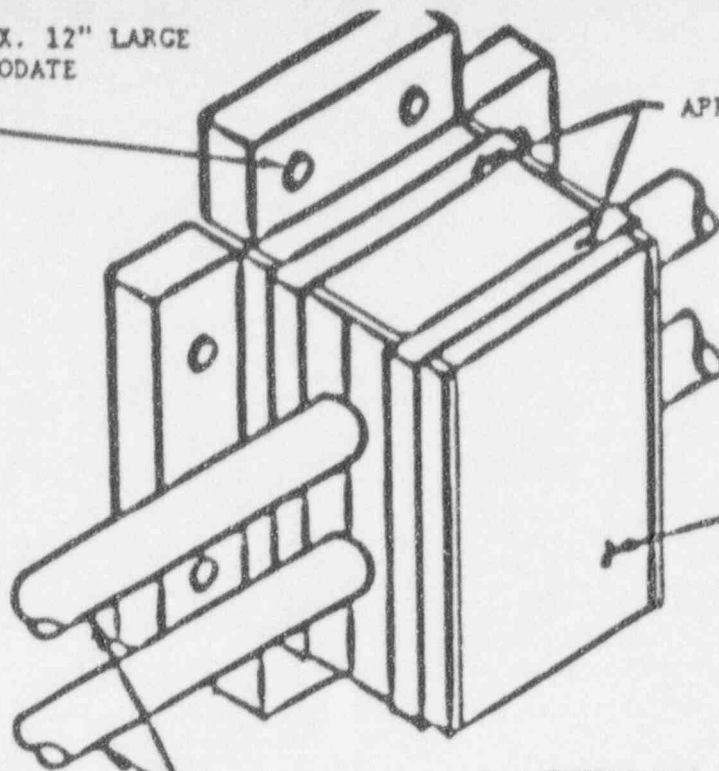
2.2.1 Installation of One Hour or Three Hour Fire Barrier Design

FOR A SURFACE MOUNTED JUNCTION BOX

- a. Cut a section from a one hour or three hour fire rated Prefabricated Panel large enough to form the top, front and bottom panels and required top and bottom flanges of the fire barrier assembly. The width of the section shall be equal to the width of the junction box plus an additional 1/4 inch to provide for sufficient clearance when installed. The length shall be equal to the sum of the top, front and bottom of the junction box plus 2 flanges large enough to accommodate the approved fasteners and an additional 1/2 inch to provide sufficient clearance when installed. An additional allowance shall be provided for the height of the "v"-stiffeners.
- b. Score the Prefabricated Panel section to shape the top, front and bottom panels and two flanges of the fire barrier enclosure.
- c. Form the top, front, and bottom panels and top and bottom flanges by making 90 degree bends. Note that the stress skin shall be placed inward against the surface requiring protection.
- d. Mount the formed section enclosure on the wall or ceiling using approved concrete fasteners. The concrete fasteners shall be spaced at a maximum distance of 12 inches with at least two concrete fasteners being used per flange. The concrete fasteners shall be site approved anchors of 1/4 inch minimum diameter and 3 1/2 inches minimum in length installed per standard site procedure.
- e. Cut two sections from a one hour or three hour fire rated Prefabricated Panel for the side panels of the fire barrier enclosure. Cut holes for conduit penetrations in the top, front and bottom panels as required and then cut the panel or panels into two pieces to facilitate installation around the conduit. Mount the side panels on the installed top, front and bottom section enclosure using stainless steel banding as shown in Figure 3.

HOLE SPACING MAX. 12" LARGE
ENOUGH TO ACCOMODATE
ANCHOR

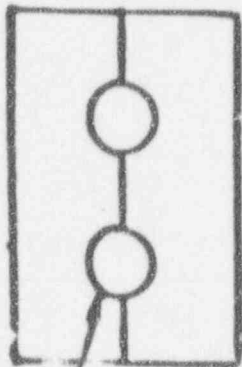
APPROVED STAINLESS STEEL BANDS



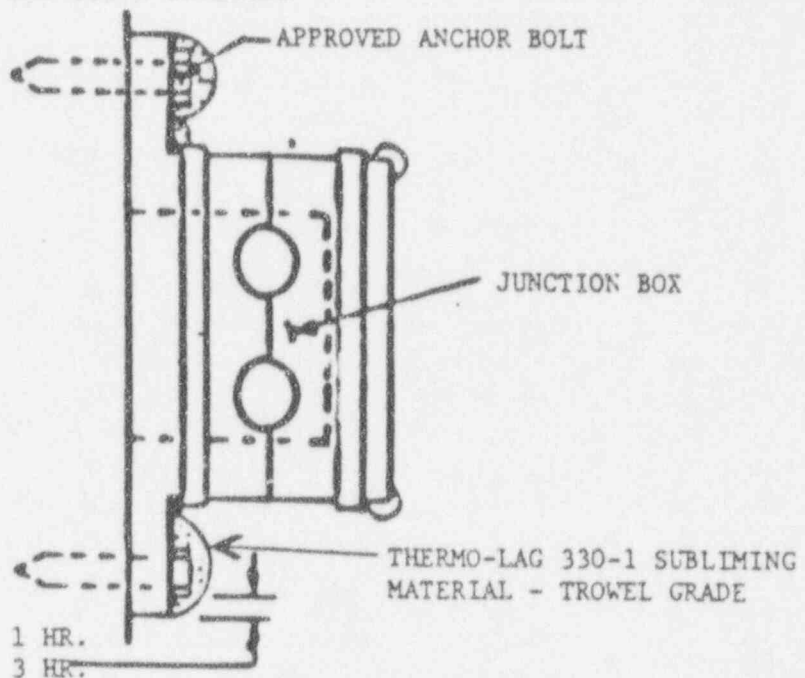
THERMO-LAG ONE OR THREE
HOUR RATED PREFABRICATED
PANEL SECTIONS

THERMO-LAG 330 FIRE BARRIER SYSTEM
PREFABRICATED PANEL DESIGN FOR JUNCTION BOX
SURFACE MOUNTED JUNCTION BOX

ALL NON PROTECTED CONDUIT
MUST BE WRAPPED FOR 18" MEASURED
FROM THE OUTER SURFACE OF THE THERMO-LAG 330-1 ENVELOPE



HOLE FOR
CONDUIT OPENING



APPROVED ANCHOR BOLT

JUNCTION BOX

THERMO-LAG 330-1 SUBLIMING
MATERIAL - TROWEL GRADE

1/2" = 1 HR.
1" = 3 HR.

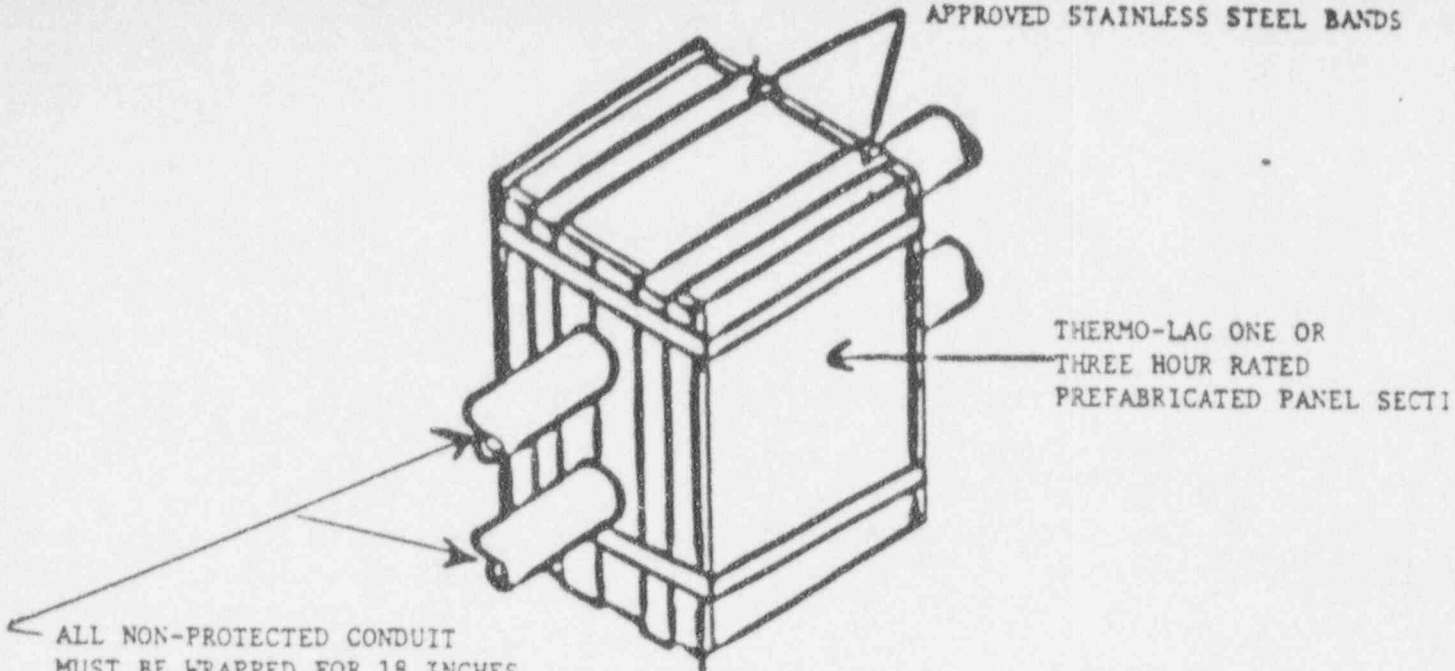
TST. INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
REV. NONE	APPROVED BY:	DATE: 8-10-85
THERMO-LAG 330 FIRE BARRIER SYSTEM PREFABRICATED PANEL DESIGN FOR JUNCTION BOXES-SURFACE MOUNTED		FIGURE 3
JUNCTION BOX		

- f. Complete the installation by filling all edges and joints and covering exposed anchorages with $\frac{1}{2}$ " or 1", as applicable, of THERMO-LAG 330-1 Subliming Material - Trowel Grade.

FOR A JUNCTION BOX NOT SURFACE MOUNTED

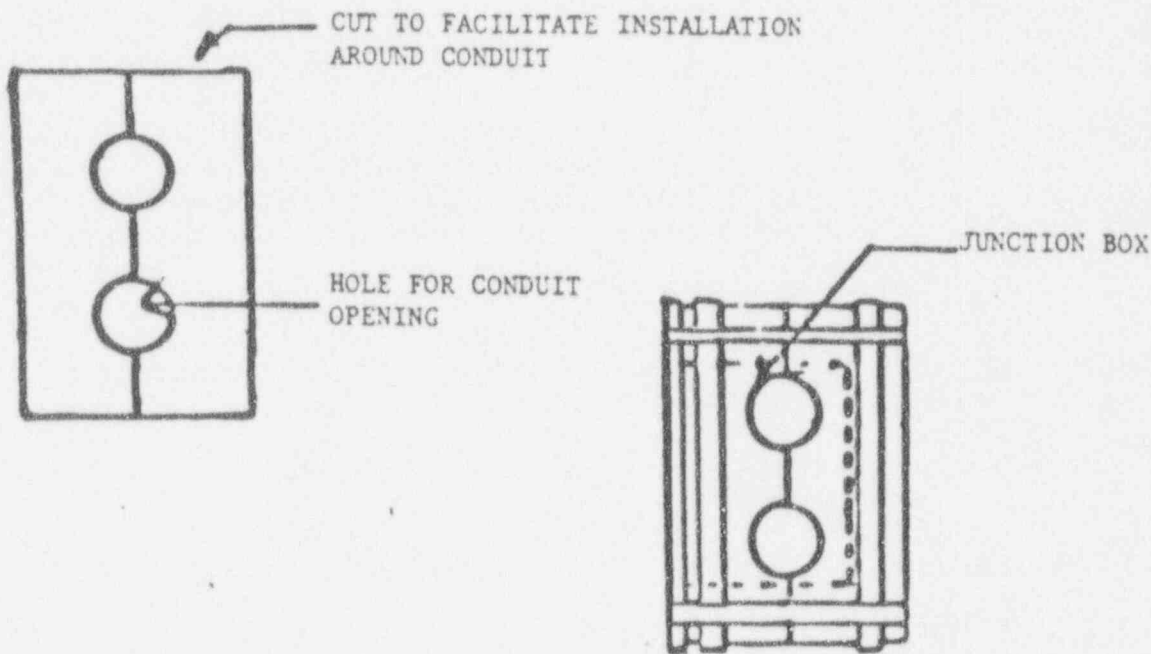
- g. Cut a section from a one or three hour fire rated Prefabricated Panel large enough to form the top, front and bottom panels of the fire barrier assembly. The width of the section shall be equal to the width of the junction box plus an additional $\frac{1}{4}$ inch to provide for sufficient clearance when installed. The length shall be equal to the sum of the top, front, and bottom of the junction box plus an additional $\frac{1}{2}$ inch to provide sufficient clearance when installed.
- h. Score the Prefabricated Panel section to shape the top, front, and bottom panels of the fire barrier enclosure.
- i. Form the top, front and bottom panels by making 90 degree bends. Note: the Stress Skin shall be placed inward against the surface requiring protection.
- j. Cut another section from a one or three hour fire rated Prefabricated Panel large enough to form the side and back panels of the fire barrier assembly. Cut holes for conduit penetrations in the side and back panels as required and then cut the panel or panels into two pieces to facilitate installation around the conduit.
- k. Score the Prefabricated Panel section to shape the side and back panels of the fire barrier enclosure.
- l. Form the side and back panels by making 90 degree bends.
- m. Mount the two fire barrier sections on the junction box and fasten the two sections together using stainless steel banding as shown in Figure 4.
- n. Complete the installation by filling all edges and joints with THERMO-LAG 330-1 Subliming Material - Trowel Grade.

APPROVED STAINLESS STEEL BANDS



ALL NON-PROTECTED CONDUIT
MUST BE WRAPPED FOR 18 INCHES
MEASURED FROM THE OUTER SURFACE
OF THE THERMO-LAG 330-1 ENVELOPE

THERMO-LAG 330 FIRE BARRIER SYSTEM
PREFABRICATED PANEL DESIGN FOR JUNCTION BOXES
JUNCTION BOX NOT SURFACE MOUNTED



"TYPICAL" INSTALLATION DETAILS

TSL INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
REV. NONE	APPROVED BY:	***** J DUMPIE
DATE: 6-1-85		*****
THERMO-LAG 330 FIRE BARRIER SYSTEM PREFABRICATED PANEL DESIGN FOR JUNCTION BOXES - JUNCTION BOX NOT SURFACE MOUNTED		***** FIGURE 4

2.3 PRESHAPED CONDUIT SECTION DESIGN FOR CONDUIT, CABLE DROPS AND INSTRUMENT TUBING

Installation of the THERMO-LAG Preshaped Conduit Section Design on conduit, cable drops and instrument tubing involves mounting two of the semi-circular preshaped conduit sections at a time, and fastening them together using stainless steel tie wires or banding. The sequential steps involved in installing this fire barrier design are described in the following paragraphs.

2.3.1 Installation of One Hour or Three Hour Fire Barrier Design

- a. Precoat the edges on one of the one or three hour fire rated THERMO-LAG Preshaped Conduit Sections with a one quarter to a one half inch bead of THERMO-LAG Subliming Material - Trowel Grade.
- b. Mount the coated section and one other one or three hour fire rated section on the conduit, cable drop or instrument tube with the edges flush with each other to form a cylindrical section around the conduit, cable drop or instrument tube. Fasten the two sections together using stainless steel tie wires or banding installed at 12 inch intervals, maximum, as shown in Figure 5. The distance from the end of a preshaped conduit section to the tie wire or band shall be a maximum of 2 inches.
- c. Complete the installation by filling gaps and joints with THERMO-LAG 330-1 Subliming Material - Trowel Grade, as required.
- d. Apply a one quarter to one half inch bead of THERMO-LAG 330-1 Subliming Material - Trowel Grade to the end of the installed section, and attach the next section making sure that the ends are butted and flush.

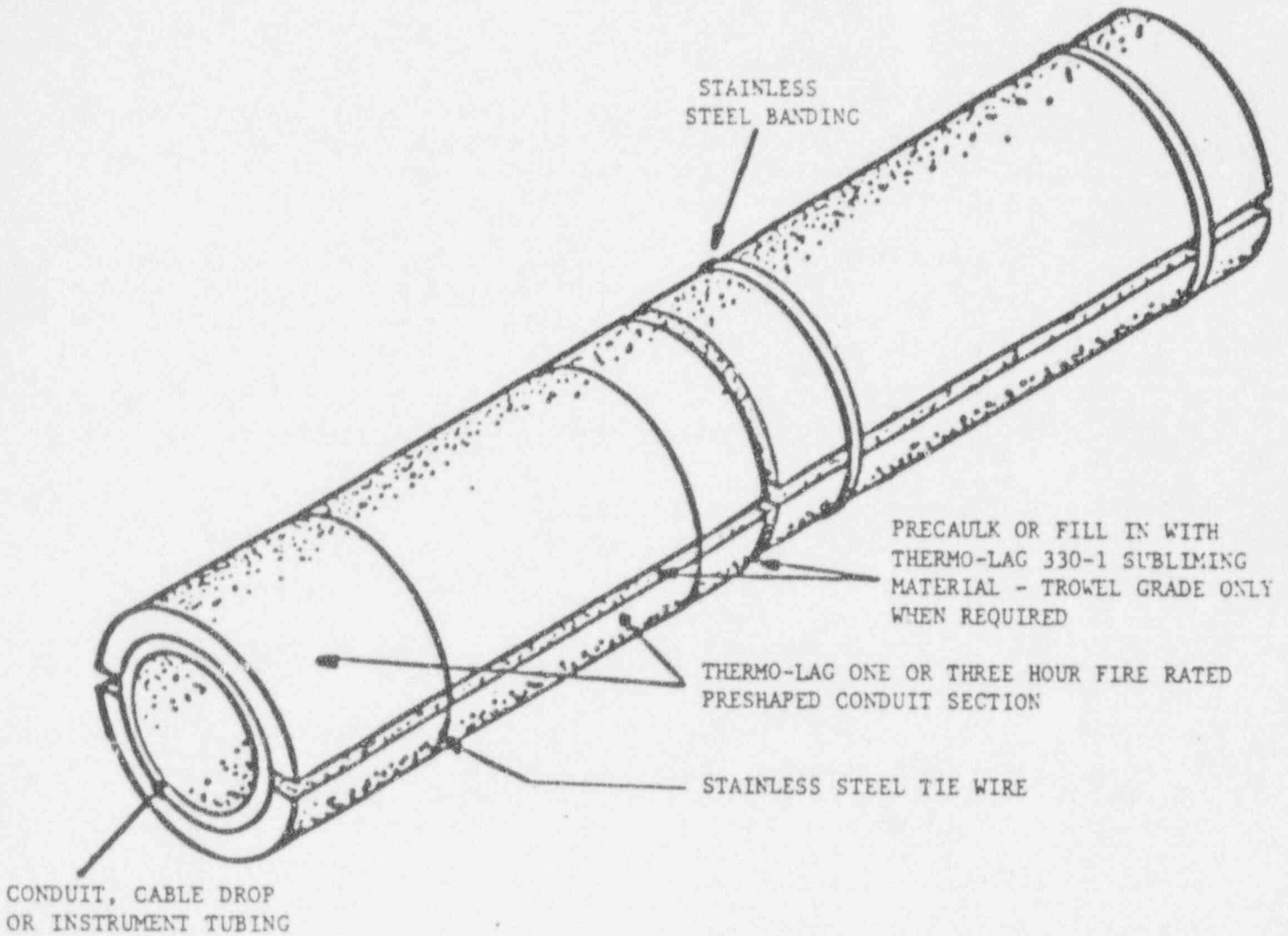
AS AN OPTION

- e. Assemble two one or three hour Preshaped Conduit Sections on the conduit, cable drop or instrument tube without preapplication of the THERMO-LAG 330-1 Subliming Material - Trowel Grade to the edges and end joints. After installation, fill in all gaps or openings at the edges or joints with THERMO-LAG 330-1 Subliming Material - Trowel Grade.

THERMO-LAG 330 FIRE BARRIER SYSTEM

PRESHAPED CONDUIT SECTION DESIGN

FOR CONDUIT, CABLE DROPS AND INSTRUMENT TUBING



"TYPICAL" INSTALLATION DETAILS

TSL INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
SCALE: NONE	APPROVED BY:	***** J DUMPIE
DATE: 2-7-84		*****
THERMO-LAG 330 FIRE BARRIER SYSTEM PRESHAPED CONDUIT SECTION DESIGN FOR CONDUIT, CABLE DROPS AND INSTRUMENT TUBING		***** FIGURE 5

2.4 PREFABRICATED PANEL DESIGN FOR STRUCTURAL SUPPORTS AND HANGERS

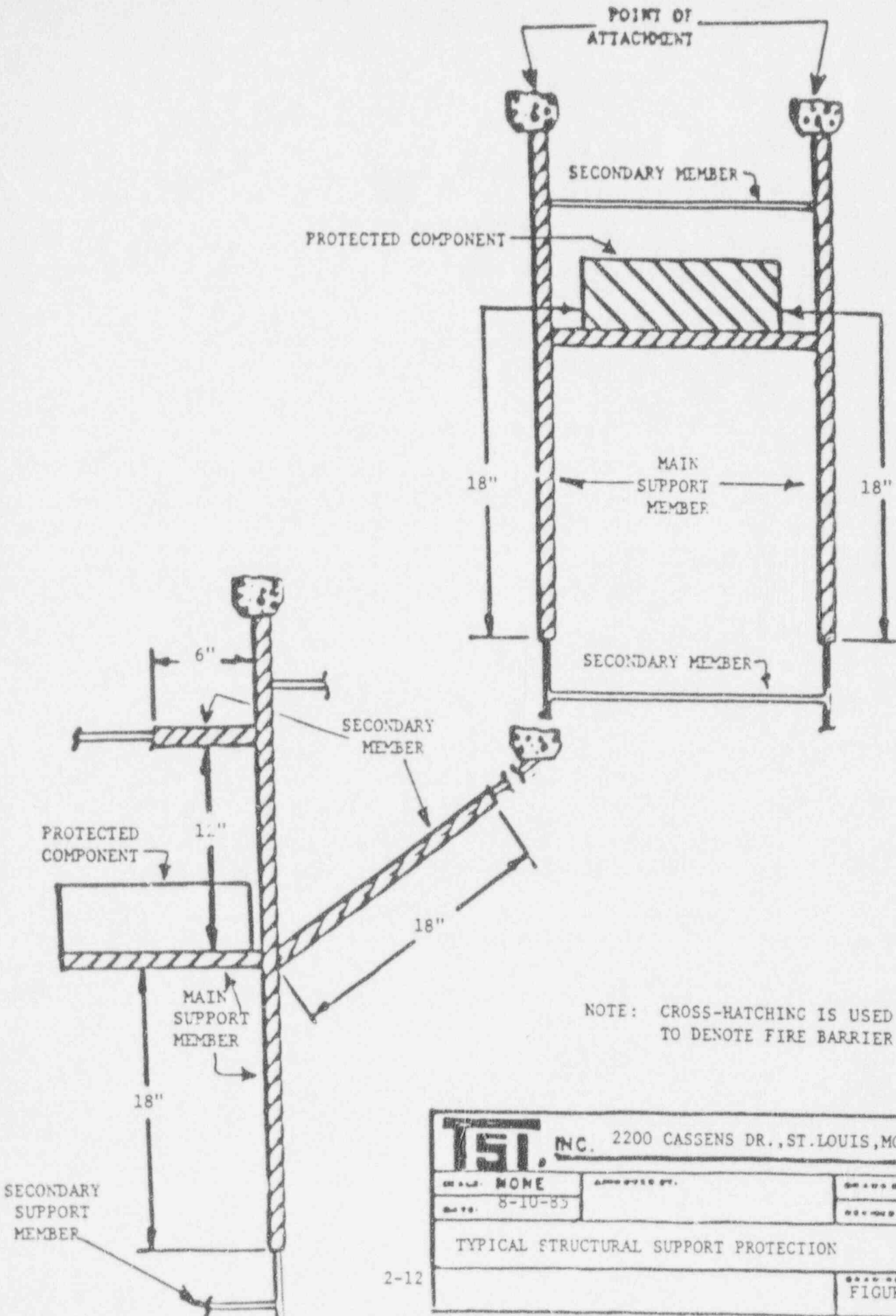
Installation of the Prefabricated Panel Design to structural supports and hangers involves cutting the number of panel sections required to form the fire barrier from one or three hour fire rated THERMO-LAG Prefabricated Panels, and then mounting the sections of panel onto the component to be protected using 18 ga. minimum stainless steel tie wires or 0.5" x 0.020" minimum stainless steel banding material. The sequential steps involved in installing this fire barrier design are described in the following paragraphs.

All structural supports forming a part of or supporting the THERMO-LAG 330 fire barrier and the structures, systems and components contained therein shall be protected to provide fire resistance equivalent to that required by the barrier. Prefabricated Panel Design, Direct Trowel On Design or Flexi-Blanket Design may be used for this purpose.

Structural supports are, in general, composed of primary and secondary members. Primary members are the main load carrying members for the protected component. Secondary members are defined as bracing any unrelated support arms and members. Primary support members shall be protected from their point of attachment to a point at least 18 inches below the support arm carrying the protected component. Only those portions of secondary supports within eighteen inches, as measured linearly along the support from the outer surface of the protected component need to be protected. Typical examples are shown in Figure 6.

2.4.1 Installation of the One Hour Fire Barrier Design

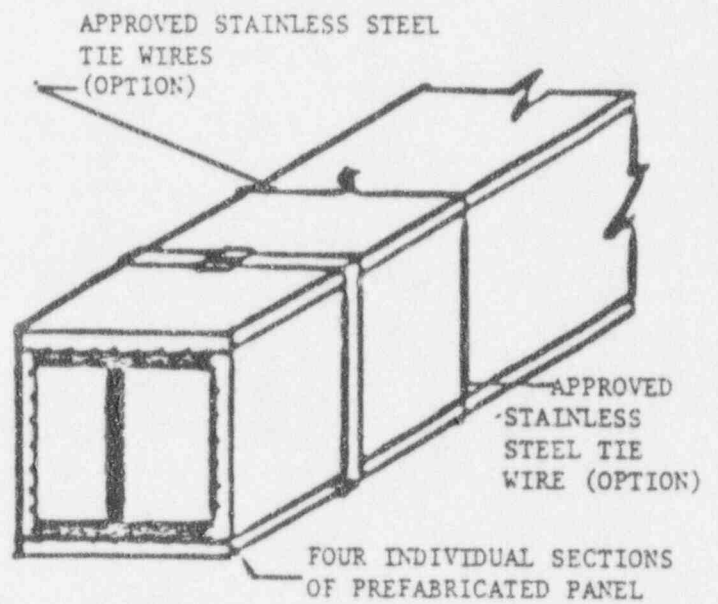
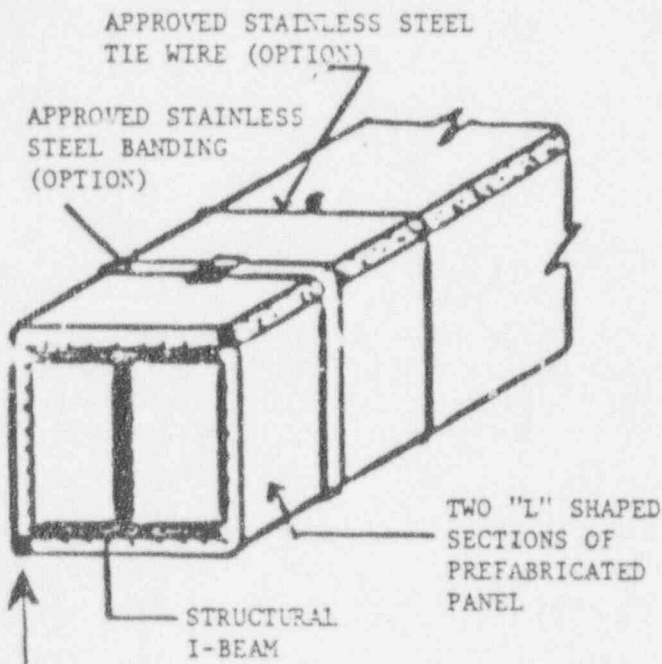
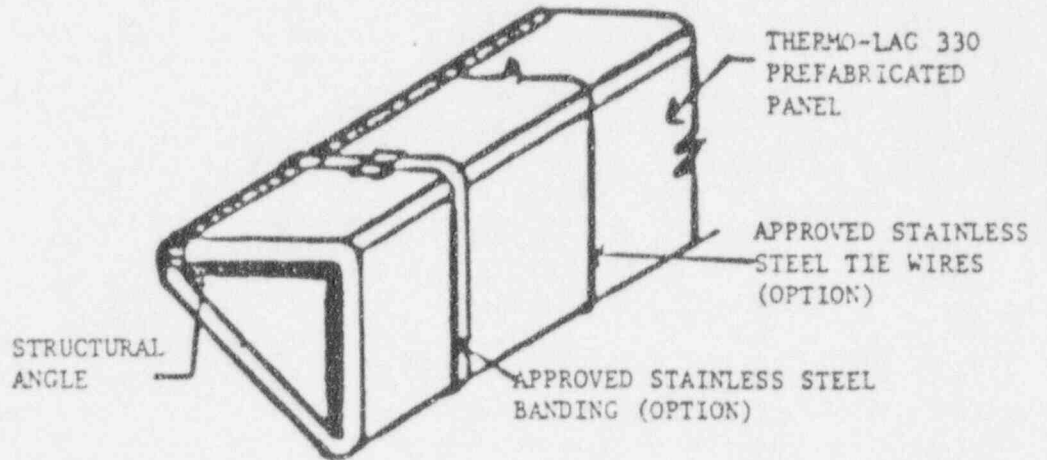
- a. Cut two pieces from a one hour fire rated Prefabricated Panel large enough to form two equal sections for enclosing the structural support or hanger. The width of each piece shall be equal to the sum of the width and depth of the component plus an additional 1/4 inch for clearance. The length of each piece shall not exceed 6 1/2 feet which is the standard length of a Prefabricated Panel.
- b. Form an "L" shaped section with the Stress Skin side in from each of the two pieces of Prefabricated Panel. The width and depth of each "L" shaped section shall be sufficient to enclose 1/2 of the component.
- c. Mount the two "L" shaped sections on the structural support or hanger, using 18 ga. minimum stainless steel tie wire or 0.5" x 0.020" minimum stainless steel banding material installed at 12 inch intervals, maximum, as shown in Figure 7.



TST. INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
DESIGN: NONE	APPROVED BY:	DESIGNED BY: J DUMPIS
DATE: 8-10-85		
TYPICAL STRUCTURAL SUPPORT PROTECTION		
2-12		FIGURE 6

THERMO-LAG 330 PREFABRICATED PANEL DESIGN

FOR SUPPORTS AND HANGERS



THERMO-LAG 330-1 TROWEL GRADE

TSL INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
DESIGN: NONE	APPROVED BY:	***** J DUMPIE
DATE: 10-23-65		*****
THERMO-LAG 330 PREFABRICATED PANEL DESIGN FOR		
SUPPORTS AND HANGERS		
		***** FIGURE 7

- d. Attach additional Prefabricated Panel sections to previous installed sections by butting them together.
- e. Complete the installation by filling all edges and joints with THERMO-LAC 330-1 Subliming Material - Trowel Grade.

AS AN OPTION

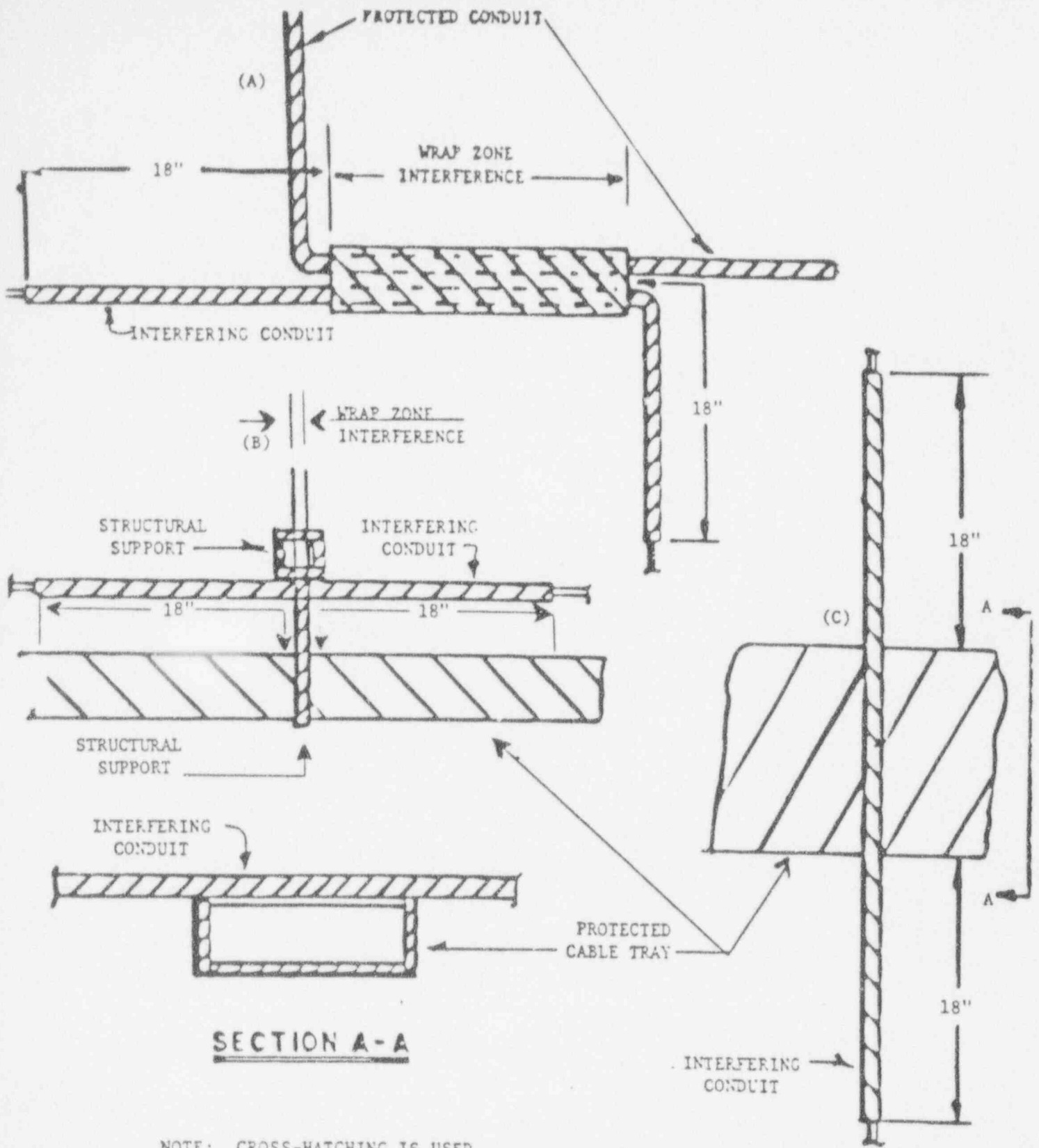
- f. Cut four individual pieces from a one hour Prefabricated Panel large enough to enclose the structural support or hanger.
- g. Mount the four pieces on the structural support or hanger using 18 ga. minimum stainless steel tie wire or 0.5" x 0.020" minimum stainless steel banding material, installed at 12 inch intervals, maximum.
- h. Attach additional Prefabricated Panel sections to previous installed sections by butting them together.
- i. Complete the installation by filling all edges and joints with THERMO-LAC 330-1 Subliming Material - Trowel Grade.

2.4.2 Installation of a Three Hour Fire Barrier

Using three hour fire rated Prefabricated Panels, form and mount a three hour fire barrier on a structural support or hanger following the procedures described in steps 2.4.1 through 2.4.2.

3.0 WRAP ZONE INTERFERENCES

- a. To prevent thermal shorts into the fire barrier system, all penetrating components (i.e. secondary supports, electrical or seismic) into the fire barrier system, should be fire protected to the same level of fire resistance as the component for a distance of at least 18 inches minimum as measured from the outer surface of the fire barrier; covering all continuous paths. (A fire test report regarding the eighteen inch minimum fire protection requirement is presented in TSI's Technical Note 84-12-181).
- b. Figure 8 shows typical examples.
- c. All 4 designs can be used - prefabricated panels, preformed conduit sections, flexi-blanket and direct trowel on.



NOTE: CROSS-HATCHING IS USED TO DENOTE FIRE BARRIER

TST, INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
DRAWN BY: NONE DATE: 8-10-85	APPROVED BY:	CHECKED BY: J. DUMPIE
TYPICAL WRAP ZONE INTERFERENCES		FIGURE 8

4.0 INTERFACES

Installation of cable tray, conduit and instrument tubing that interfaces with penetration seals, walls, ceilings, and other raceways is accomplished using either Prefabricated Panel or direct trowel on methods. Typical installations using three methods are briefly described and illustrated in the following paragraphs.

4.1 Installation of One or Three Hour Interfaces Between a Cable Tray or Conduit and a Penetration Seal

4.1.1 Cut and form a box shaped and flanged section from a one or three hour rated Prefabricated Panel as is shown in Figure 10. The minimum height of the flange shall be sufficient to cover the wall opening and accommodate approved concrete fasteners. Note that the stress skin shall always be placed inward against the surface requiring protection.

4.1.2 Mount the four sided and flanged section, using approved concrete fasteners, installed at 12 inch intervals maximum, and two per flange minimum, to fasten the section to the concrete wall. Use stainless steel tie wires or banding installed at 12 inch maximum intervals to secure the four sided section to the tray or conduit. Fill in gap seams and cover mounting bolts with trowel grade material.

4.2 Installation of One or Three Hour Self Supporting Interface Between Conduit or Instrument Tubing and a Wall or Ceiling

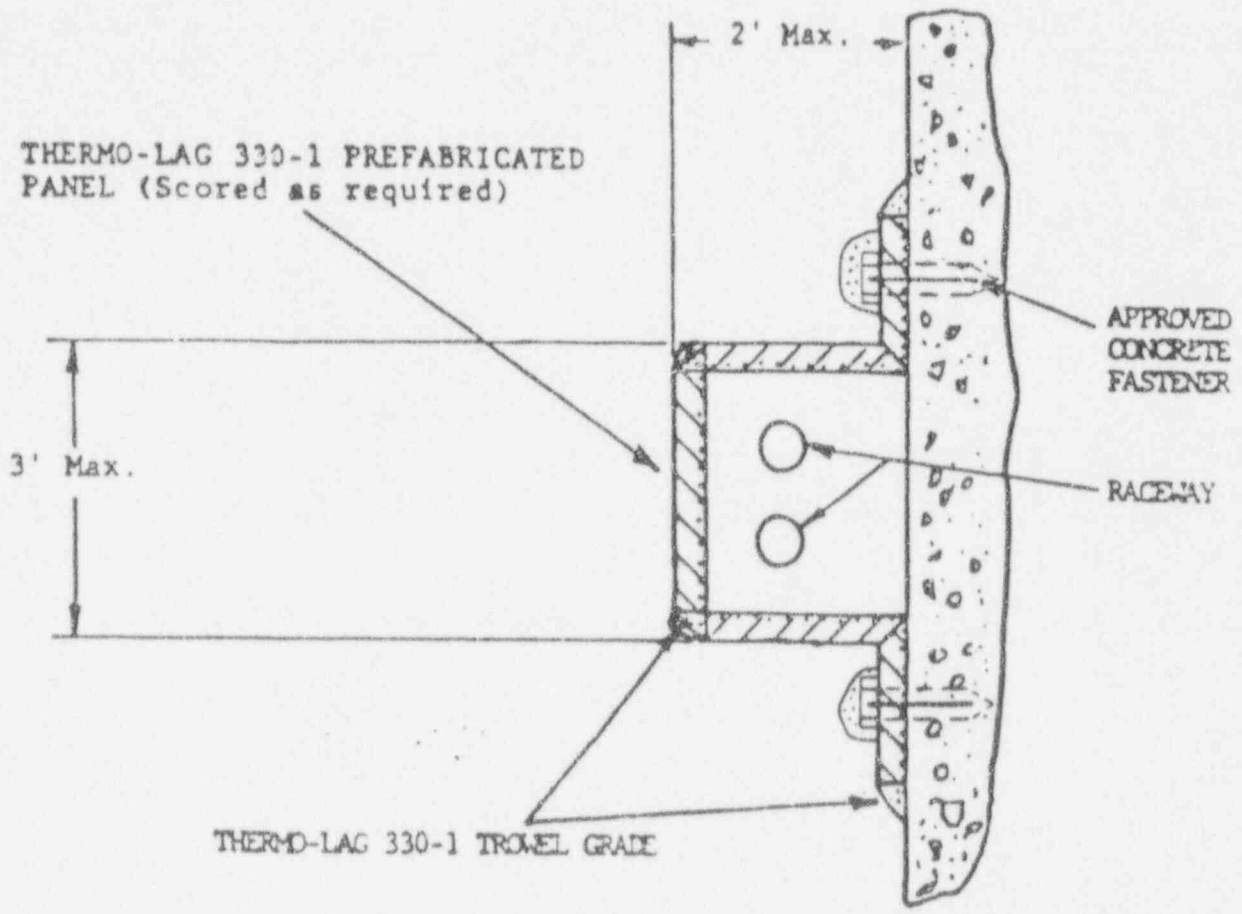
4.2.1 Cut and form a three sided and flanged section from a one or three hour rated prefabricated panel as shown in Figure 9. The minimum height of the flange shall be sufficient to provide for the concrete fasteners.

4.2.2 Mount the three sided and flanged section on the cable tray or conduit using approved concrete fasteners to secure the section to the wall or ceiling.

4.2.3 Apply a coating of THERMO-LAG 330-1 Subliming Material - Trowel Grade in a dry film thickness of .500" (+.125, -0) for one hour protection and 1.000" (+0.25, -0) for three hour protection to the edges and joints of the installed section using a trowel or stiff bristle brush to fill in any gaps or holes.

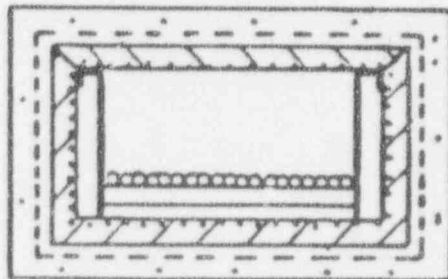
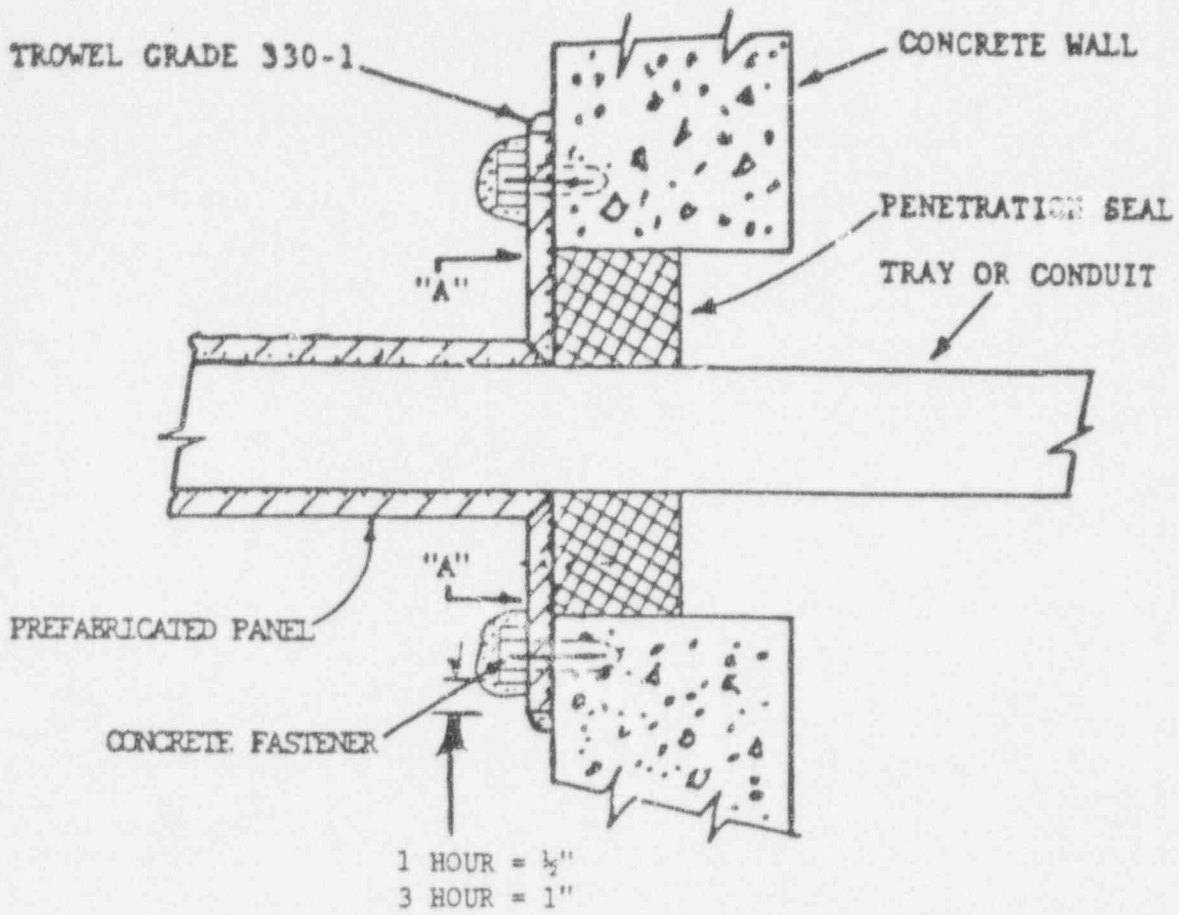
4.3 Installation of One and Three Hour Interface Between a Cable Tray and a Conduit

- 4.3.1 Install a one hour or three hour fire rated Prefabricated Panel Ready Access Design on the cable tray following the instructions given in Section 2.1.
- 4.3.2 Install a one hour or three hour fire rated Preshaped Conduit section on a conduit or cable bundle penetrating a cable tray fire barrier for a minimum distance of eighteen inches from the point of penetration.
- 4.3.3 Apply a coating of THERMO-LAG 350 Primer to the horizontal structural support member and to the vertical structural supports from the horizontal support member to the ceiling, wall or floor support prior to the trowel application of one or three hour fire protection. Also apply the primer coating to any penetrating structural member for a minimum distance of 18 inches from its point of intersection with a cable tray fire barrier prior to the trowel application of one or three hour fire protection.
- 4.3.4 Trowel apply a coating of THERMO-LAG 330-1 Subliming Material - Trowel Grade in a dry film thickness of .500" (+.125, -0) for one hour fire protection and 1.000 (+.25, -0) for three hour fire protection.



2-18

TST THERMO-LAG		3260 BRANNON AVENUE, ST LOUIS	
		MISSOURI 63139	
SCALE NONE	DESIGNED BY	DRAWN BY D.M.P.S.	
DATE 3-19-84	<i>D. Johnson</i>		CHECKED
Typical THERMO-LAG Raceway Interface with a Wall or Ceiling using Prefabricated Panels			
			FIGURE 9



SECTION "A - A"

TSI, INC. 3260 BRANNON ST. LOUIS, MO. 63139.		
SCALE NONE	APPROVED BY <i>L. A. Johnson</i>	DRAWN BY J. DUMPIS
DATE 3-19-84	2-19	CHECKED
TYPICAL THERMO-LAG RACEWAY INTERFACING W/ PENETRATION SEAL		
		DRAWING NUMBER FIGURE 10

5.0 DIRECT TROWEL-ON DESIGN

5.1 THERMO-LAG 351 Primer Application

- 5.1.1 Prepare the surface of the bare or previously painted steel component for application of the THERMO-LAG 351 Type Primer by removing any dirt, scale, rust, or other contaminants. Never apply the primer directly over any hard or glossy painted surface without roughening the surface in accordance with standard painting practices.

NOTE: a. Dull galvanized (hot dipped) structural members need not be primed.

b. Previously painted structural members may be wrapped with stress skin (330-69) as an alternate.

- 5.1.2 Make sure that the cleaned steel surface is compatible with the THERMO-LAG 330-1 Subliming Material by making cross hatch adhesion tests as follows:

.....Cross Hatch Adhesion Test.....

The primer is cut over an area approximately 4" by 4" in a square matrix, each square being approximately $\frac{1}{2}$ " by $\frac{1}{2}$ ". A high quality tape is applied diagonally to the square. Upon completion of the tape application, it is rubbed in firmly to assure good adhesion. With one complete jerking motion, the tape is removed. If more than 3 percent of the Primer is removed from the surface, the application is faulty. This test should be performed in areas which are deemed critical. Upon completion of the Cross Hatch Adhesion Test, the test areas should be coated again with the THERMO-LAG 351-2 Primer by either brushing or light spray. Always apply a barrier coat of THERMO-LAG 351 Type Primer over steel surfaces which have been previously primed with a zinc based primer. All doubtful surfaces should be removed using mechanical cleaning methods.

- 5.1.3 Apply the Primer to the properly prepared steel surface in one continuous coat using spray equipment, brush or roller. The minimum acceptable dry primer thickness should be 0.002 inches which is normally achieved by applying at a spread rate of circa 200 sq. ft. per gallon.
- 5.1.4 Measure Primer thickness using an approved magnetic direct reading gauge.

5.2 THERMO-LAG 330-1 Subliming Material Trowel Application

5.2.1 Coat the primed steel surface area with THERMO-LAG 330-1 Subliming Material,

5.2.2 Trowel the material to a uniform thickness using moderate pressure and avoid overworking. The trowel should be wetted with water when a smooth finish is required. A dry film thickness of 0.500" (+.125, -0) for one hour protection and 1.000" (+0.25, -0) for three hour protection shall be provided.

5.3 Dry Film Thickness Measurements

Take dry film thickness measurements after the applied material has cured. Measurement shall be made using electrical, penetrating, or magnetic measuring instruments.

6.0 THERMO-LAG 330-660 FLEXI-BLANKET THERMAL BARRIER DESIGN FOR CONDUITS, CABLE DROPS, FLEX CONDUIT, INSTRUMENT TUBING AND STRUCTURAL SUPPORTS

Installation of the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Design to conduit, cable drops, flex conduit, instrument tubing and structural supports involves cutting blanket wrap sections from a sheet of THERMO-LAG 330-660 Flexi-Blanket Material, and then wrapping the component to be protected with the required number of layers of blanket to provide one or three hours fire resistance. The sequential steps involved in applying the fire barrier design are described in the following paragraphs.

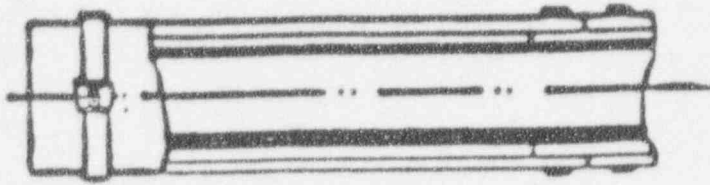
6.1 Installation of a One Hour Fire Rated Design - Blanket Wrap

- 6.1.1 Cut the first blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier material to the length required to wrap the conduit, flex conduit, cable drop bundle or instrument tubing plus at least a two (2) inch overlap. The length of the first layer shall be sufficient to enclose the total or a portion of the total length of the component to be protected.
- 6.1.2 Wrap the first layer of the Flexi-Blanket material around the component to be protected, taking care to overlap the material by at least two (2) inches.
- 6.1.3 Secure the first layer of the Flexi-Blanket material to the component using 18 ga. minimum stainless steel tie wires or 0.5" x 0.200" minimum stainless steel banding material, installed at a maximum of 2" from each end and at six (6) inch intervals maximum.
- 6.1.4 Cut and install additional first layers of Flexi-Blanket material in the same manner as described in Steps 6.1.1 through 6.1.3, taking care to butt join the first layer pieces.
- 6.1.5 Cut the second blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi Blanket Thermal Barrier material to the length required to wrap the raceway plus at least a two (2) inch overlap. The second layer shall be staggered at least four (4) inches from the butt joint of the first layer to provide for an adequate overlap when installing the second layer over the first layer.
- 6.1.6 Wrap the second layer of the Flexi-Blanket material around the installed first layer taking care to overlap the material by at least two (2) inches, and locate the overlap 180 degrees opposite from that of the prior layer.

- 6.1.7 Seal the overlapped seam using THERMO-LAC 330-660 Bulk Grade Material.
- 6.1.8 Secure the second layer of the Flexi-Blanket material around the first layer using 18 ga. minimum stainless steel tie wires or 0.5" x 0.020" minimum stainless steel banding material, installed at a maximum of six (6) inch intervals.
- 6.1.9 Cut and install additional second layers of the Flexi-Blanket material in the same manner as described in Steps 6.1.5 through 6.1.8 taking care to butt join the second layer pieces and to secure the butt joint using 18 ga. minimum stainless steel tie wires or 0.5" x 0.200" minimum stainless steel banding material. A schematic of this fire barrier design is shown in Figure 11.
- 6.1.10 Fill in any gaps and joints with the THERMO-LAG 330-660 Bulk Grade Material.

FLEXI-BLANKET DESIGNS

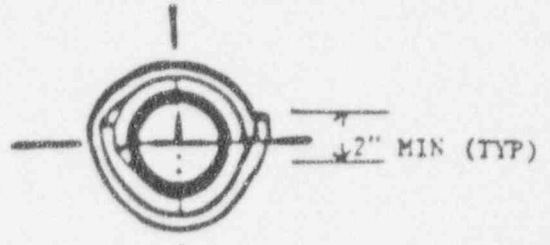
CONDUIT OR FLEX CONDUIT



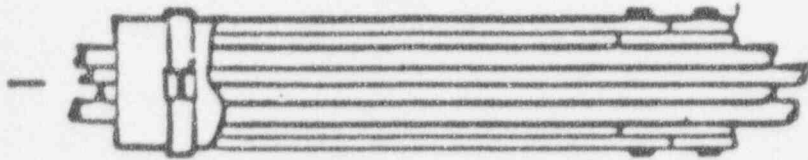
BLANKET WRAP

4"
MIN (TYP)

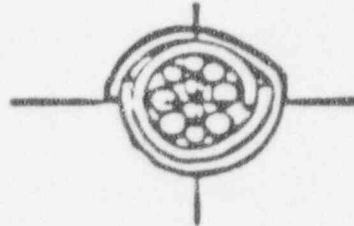
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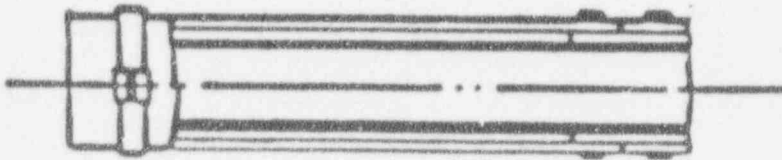
2"
MIN (TYP)



BLANKET WRAP



UNISTRUT



BLANKET WRAP



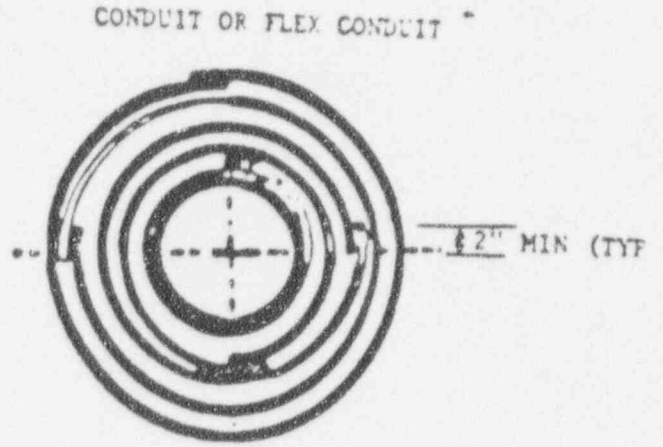
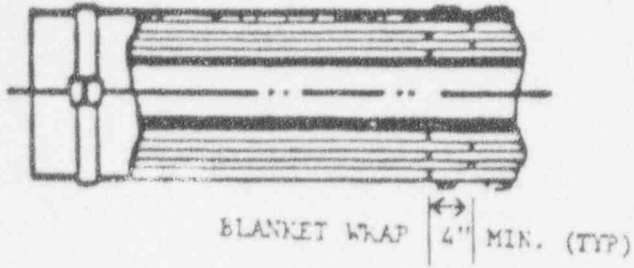
(CONCEPTUAL)

ISI, INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
SCALE: NONE	APPROVED BY:	DESIGNED BY: J. D. M. P. I. S.
DATE: 2-28-85		DATE:
ONE HOUR THERMO-LAG 330-660 FLEXI-BLANKET DESIGNS		
2-24		FIGURE 11

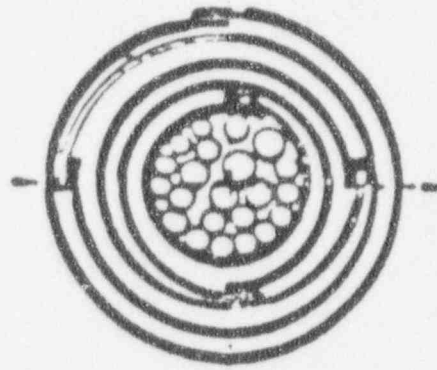
6.2 Installation of a Three Hour Fire Rated Design - Blanket Wrap

- 6.2.1 Cut the first blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier material to the length required to wrap the conduit, flex conduit, cable drop bundle or instrument tubing plus at least a two (2) inch overlap. The length of the first layer shall be sufficient to enclose the total or a portion of the total length of the component to be protected.
- 6.2.2 Install the first layer of the Flexi-Blanket material in the same manner as described in Steps 6.1.1 through 6.1.4.
- 6.2.3 Cut the second blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi Blanket Thermal Barrier material to the length required to wrap the raceway plus at least a two (2) inch overlap. The second layer shall be staggered at least four (4) inches from the butt joint of the first layer to provide for an adequate overlap when installing the second layer over the first layer.
- 6.2.4 Install the second layer of the Flexi-Blanket material in the same manner as described in Steps 6.1.6 through 6.1.9 except eliminate sealing the overlapped seams with the THERMO-LAG 330-660 Bulk Grade Material.
- 6.2.5 Install the third blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier in the same manner as that described for the second layer in Step 6.2.4, except position the overlap 90 degrees from that of the second layer.
- 6.2.6 Install the fourth blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier in the same manner as that described for the third layer except positioning the overlap 180 degrees from that of the third layer.
- 6.2.7 Install the fifth blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier in the same manner as that described for the fourth layer except positioning the overlap 90 degrees from that of the fourth layer, and sealing the overlapped seam with THERMO-LAG 330-660 Bulk Grade Material. Be sure that one (1) stainless steel tie wire or band is used to secure the installed five (5) layers at their butt joint junctions with adjoining layers. A schematic of this fire barrier design is shown in Figure 12.
- 6.2.8 Fill in any gaps and joints with THERMO-LAG 330-660 Bulk Grade Material.

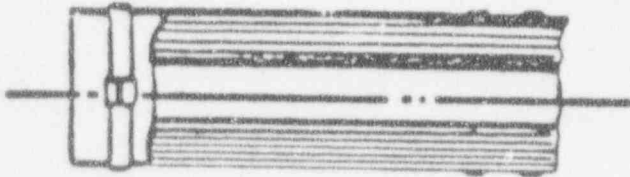
FLEXI BLANKET DESIGNS



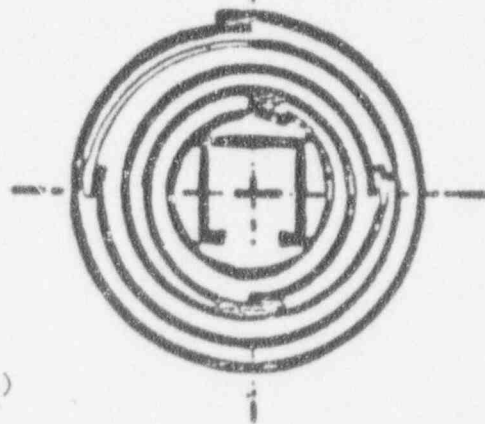
BLANKET WRAP



UNISTRUT



BLANKET WRAP



(CONCEPTUAL)

TST, INC. 2200 CASSENS DR., ST. LOUIS, MO. 63026		
SCALE: NONE	APPROVED BY:	DRAWN BY: J. DUMPLIS
DATE: 4-19-85		REVISED:
THREE HOUR THERMO-LAG 330-660 FLEXI-BLANKET DESIGN		FIGURE 12

6.3 Installation of a One Hour Fire Rated Design For Structural Supports and Hangers

- 6.3.1 Cut the first blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier material to the length required to wrap the structural support or hanger, plus at least a two (2) inch overlap. The length of the first layer shall be sufficient to enclose the total or a portion of the total length of the component to be protected.
- 6.3.2 Wrap the first layer of Flexi-Blanket material around the component to be protected, taking care to overlap the material by at least two (2) inches.
- 6.3.3 Secure the first layer of Flexi-Blanket material to the component using 18 ga. minimum stainless steel tie wires or 0.5" x 0.020" minimum stainless steel banding material, installed at a maximum of two (2) inches from each end and at six (6) inch intervals, maximum.
- 6.3.4 Cut and install additional first layers of Flexi-Blanket material in the same manner as described in Steps 6.1.1 through 6.1.4, taking care to butt join the first layer pieces.
- 6.3.5 Cut the second blanket wrap layer from a sheet of Flexi-Blanket Thermal Barrier material to the length required to wrap the structural support or hanger plus an overlap of at least two inches. The second layer shall be staggered at least four inches from the butt joint of the first layer to provide for an adequate overlap when installing the second layer over the first layer.
- 6.3.6 Wrap the second layer of Flexi-Blanket material around the installed first layer taking care to overlap the material by at least two (2) inches, and locate the overlap 180 degrees opposite from that of the first layer.
- 6.3.7 Seal the overlapped seam using THERMO-LAG 330-660 Bulk Grade Material.
- 6.3.8 Secure the second layer of Flexi-Blanket material around the first layer using 18 ga. minimum stainless steel tie wires or 0.5" x 0.020" minimum stainless steel banding material, installed at a maximum of 2" from each end at six (6) inch intervals.

6.3.9 Cut and install additional second layers of Flexi-Blanket material in the same manner as described in Steps 6.3.5 through 6.3.8, taking care to butt join the second layer pieces and to secure the butt joint using 18 ga. minimum stainless steel tie wires or 0.5" x 0.020" minimum stainless steel banding material. See Figure 11.

6.3.10 Fill in any gaps and joints with the THERMO-LAG 330-660 Bulk Grade Material.

6.4 Installation of a Three Hour Fire Barrier For Structural Supports And Hangers

6.4.1 Cut the first blanket wrap layer from a sheet of THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier material to the length required to wrap the structural support or hanger plus an overlap of at least two inches. The length of the first layer shall be sufficient to enclose the total or a portion of the total length of the structural support or hanger.

6.4.2 Install the first blanket wrap layer of Flexi-Blanket material in the same manner as described in Steps 6.1.1 through 6.1.4 for the fire rated design.

6.4.3 Cut the second blanket layer of Flexi-Blanket material to the length required to wrap the installed first layer with an overlap of at least two inches. The second layer shall be staggered at least four inches from the butt joint of the first layer, to provide for an adequate overlap when installing the second layer over the first layer.

6.4.4 Install the second blanket wrap layer of Flexi-Blanket material in the same manner as the second layer described in Steps 6.3.6 through 6.3.9 except eliminate sealing the overlapped seams with the THERMO-LAG 330-660 Bulk Grade Material.

6.4.5 Install the third blanket wrap layer of Flexi-Blanket material in the same manner as that described for the second layer in Step 6.4.4 except position the overlap 90 degrees from that of the second layer.

6.4.6 Install the fourth blanket wrap layer of Flexi-Blanket material in the same manner as the third layer described in Step 6.4.5 except position the overlap 180 degrees from that of the third layer.

- 6.4.7 Install the fifth blanket wrap layer from a sheet of THERMO-LAC 330-660 Flexi-Blanket Thermal Barrier in the same manner as that described in Step 6.4.6, except positioning the overlap 90 degrees from that of the fourth layer, and sealing the overlapped seam with THERMO-LAC 330-660 Bulk Grade Material. Be sure that one 18 ga. minimum stainless steel tie wire or 0.5" x 0.020" minimum stainless steel banding material is used to secure the installed five layers at their butt joint junctions with adjoining layers. See Figure 12.
- 6.4.8 Fill in any gaps and joints with THERMO-LAC 330-660 Bulk Grade Material.

7.0 REPAIR PROCEDURES

The repair of a damaged section in a THERMO-LAG 330 Fire Barrier is easily accomplished by cutting out and removing the damaged material and then filling in the cut out section with new material.

The first step in this procedure is to remove the damaged and loose material using a knife and scraper. Care should be exercised that the damaged material is cut back until sound adhering is reached.

The next step is to undercut the edges around the cut out section to form a beveled edge. All foreign matter is then removed from the exposed substrate surface in the cut out section.

Finally, the THERMO-LAG 330-660 Bulk Grade Material is troweled into the cut out section. If necessary, several coats can be applied to achieve the desired film thickness. Care should be taken to allow for shrinkage of the repair patch by building up a slight dome shape on the surface of the patch.

NOTE: Whole sections can be replaced using the procedures previously outlined in Section 1 and 2.

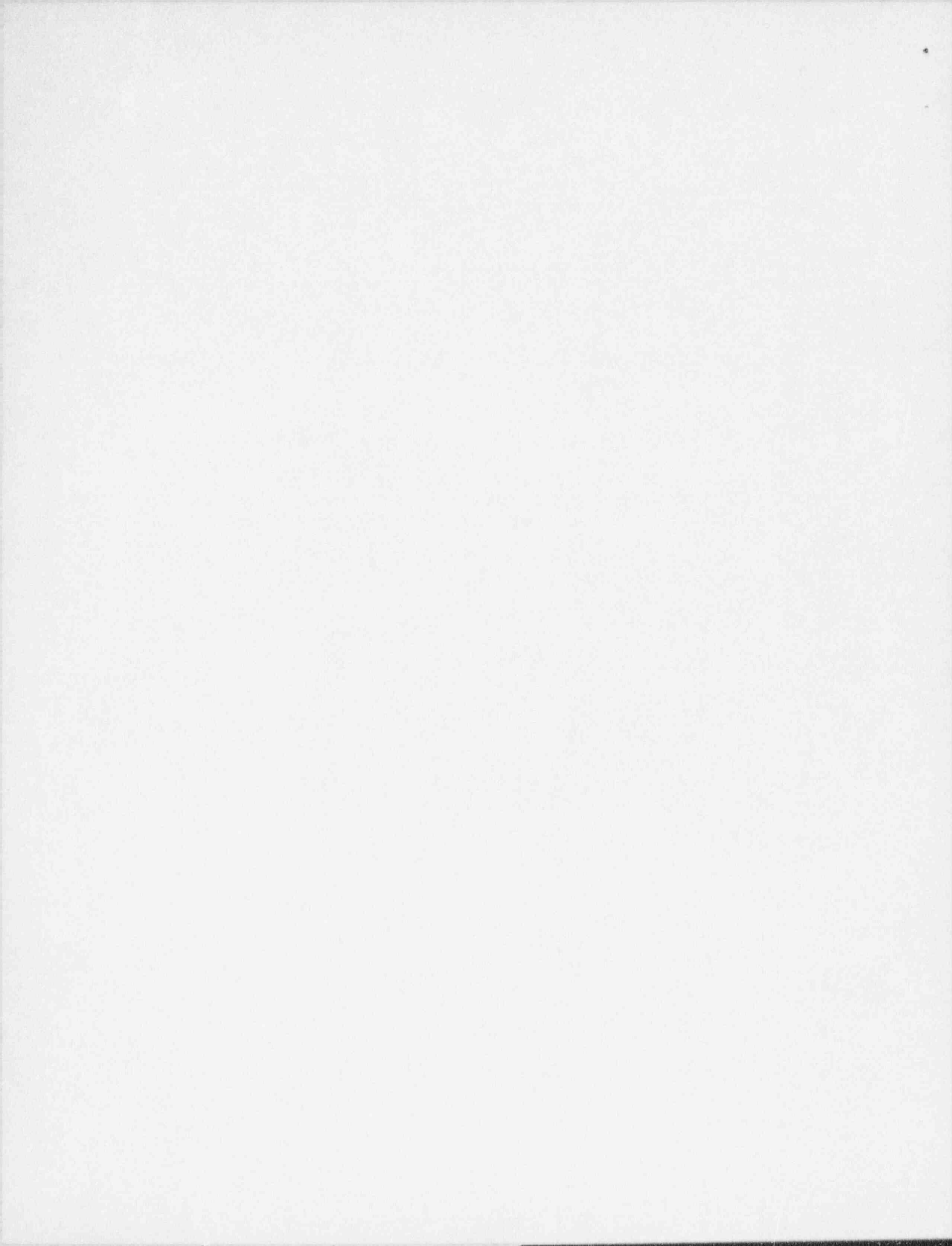
8.0 CABLE ADDITION/REPLACEMENT PROCEDURES

The addition or replacement of a cable in a THERMO-LAG 330 Fire Barrier is accomplished by removing sections of the fire barrier, adding or replacing the cable, and then reinstalling the sections.

The first step in this procedure is to remove the required number of fire barrier sections by cutting away the material at the edges and the butt flanges.

Next, the stainless steel tie wires or banding are cut and the fire barrier section removed from the cable raceway.

After the cable has been added or replaced, the fire barrier sections are reinstalled using stainless steel tie wires or banding. A coating of the THERMO-LAG 330-660 Bulk Grade Material, is then applied in the specified wet thickness to the edges and joints of the reinstalled sections using a trowel or stiff bristle brush to fill in any uncoated areas.



RECOMMENDED ON SITE QUALITY
CONTROL PROCEDURE

The following is a recommended quality control procedure to be followed on site in the installation of the THERMO-LAG 330 Fire Barrier System.

RECEIVING PROCEDURES

1. Prefabricated Panels and Preshaped Conduit Sections
 - a. Make a visual inspection for damage.

2. THERMO-LAG 330-1 Subliming Compound
 - a. Make a visual inspection for damage.
 - b. Read temperature recorder strip chart to verify that temperature limitations were not exceeded.
 - c. Test as an option that:
 1. Weight per gallon is as specified in A-2 TQAPM.
 2. pH value is as specified in A-3 TQAPM.

INSTALLATION PROCEDURES

1. Ensure that the proper one hour or three hour fire barrier design has been installed.
2. Check to see that the protected component is completely enveloped.
Note: A concrete surface, such as a wall, ceiling, or floor, can be a part of the envelope.
3. Check to see that the primary structural support of the protected component is coated with the designated thickness to the point of attachment.
4. Ensure that all seams and joints are filled and sealed with THERMO-LAG 330-1 Trowel Grade in order to prevent flame penetration into the envelope system.

5. Check to see that all fasteners, such as banding, tie wire, nuts and bolts, and concrete fasteners, are of proper type and spacing.

6. Ensure that all penetrating components into the envelope are protected for a minimum of 18 inches from the envelope with the same fire rating at the envelope.

7. Surface Cracks that do not penetrate to the substrate and do not exceed 0.050" wide, need not be filled.

RECOMMENDED LIST OF INSTALLATION TOOLS

The following is a recommended list of typical installation tools and equipment for installation of the THERMO-LAG 330 Fire Barrier System. These parts can usually be obtained from local suppliers.

Work Tables - 7'x4'

2" Nylon Brushes

All Purpose Caulking Guns

Band Circle Saws with carbide blades

Box Knives

1" Putty Knives

6" Putty Knives

Wire Cutters

Vice Grips

Trowels - 1" to 5"

Long Nose Pliers

Work Gloves

Dust Masks

Goggles

Protective Clothing

Organic and Particulate Matter Respirators

18 ga. Stainless Steel Tie Wire or Larger

or

Stainless Steel Banding .020 x $\frac{1}{2}$ " or Heavier