

APPLICATION MANUAL AND RECOMMENDATIONS FOR THERMO-LAG® 3000-SP

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SECTION -. REVISION SUMMARY

Revision	Date	Amendments
-	03.29.21	First revision
A	04.21.25	Primer Changes, Removal of Carbomastic 94MC

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SECTION -. INTRODUCTION

Audience

We assume that applicators of Carboline products understand the terminology associated with our products and the various pieces of spray equipment and application techniques.

The installation of the Thermo-Lag 3000-SP Epoxy Intumescent Paint System shall be performed only by contractor personnel trained or qualified by Carboline in the installation of the materials.

Locating Information

This guide incorporates a number of aids to help you locate information easily.

- Table of Contents
- Figure and Table Listings
- Page Headers and Footers
- Frequent Section, Subsection, and Topic Headings

Numbering System

To avoid a cumbersome numbering system, only chapters, sections, and subsections have a numerical designation. For example, "2.3.1" represents Chapter 2, Section 3, Subsection 1.

Illustrations and drawings generally appear at the end of this document.

Breakdown of Information

Frequent section and subject headings highlight other significant information within a chapter. Heading type style and indentations indicate the level of importance for the topics.

Related Publications and Documents

This document occasionally refers to other Guides, data sheets, or specifications that may be helpful. Copies are available from CARBOLINE. Related information can be accessed at www.carboline.com.

Other documents that may be helpful, include:

- OSHA - Occupational Safety and Health Administration Safety Rules
- National Spray Equipment Manufacturer's Association Precautions for Spraying
- Power tools, hand tools or other mechanical equipment operating procedures.

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SECTION -. SAFETY PRECAUTIONS

Thermo-Lag 3000-SP materials weigh approximately 10.5 – 11.5 pounds per gallon. Caution should be taken when lifting and moving the material to prevent injury.

Observe the National Spray Equipment Manufacturers Association precautions for spraying.

DO NOT point spray gun at any part of the human body.

Notes on Installation

Basis for Installation Procedures in This Guide

The installation steps and procedures in this guide were prepared with the best available data. All of the steps and procedures presented in this guide are based upon tests. As additional test and installation data becomes available, including revised installation procedures, CARBOLINE may update and modify this guide.

Note: This is a general Application Manual and cannot cover all possible situations which may arise in the field. For technical assistance, contact CARBOLINE's Fireproofing Technical Service Group at: 1-800-848-4645.

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SECTION 1. GENERAL CONDITIONS

1.1 SCOPE

This Application Manual describes the requirements for the application of the Thermo-Lag 3000-SP Epoxy Intumescent Paint System to steel surfaces for the oil, gas, refineries, petrochemical and LNG markets, based on the hydrocarbon requirements of UL 1709. For the application to any other substrates, markets or specifications, contact Carboline Technical Service or your local Carboline Sales Representative.

1.2 QUALITY CONTROL MANUAL

1.2.1 QUALIFICATIONS OF APPLICATORS/RESPONSIBILITIES OF PERSONNEL

The application shall be performed by a Qualified Applicator having Carboline training with proper equipment and experience.

1.2.2 REQUIREMENTS

In order to qualify, an Applicator shall:

- a) Undergo specific training by Carboline.
- b) Be experienced in the application of thick film coatings, preferably epoxy based.
- c) Have the necessary approved spray application equipment and recommended quality control instrumentation.
- d) Have in place an acceptable QA/QC system and be prepared to permit Carboline audits.
- e) Understand and recognize their statutory obligations with regard to health and Safety.

1.3 SAFETY PRECAUTIONS

The Applicator shall follow standard industrial hygiene practices for the handling of chemical coatings and shall conform to applicable codes of practice, regulations, and Owner Safety rules in all respects. Reference Thermo-Lag 3000-SP SDS for additional information and instruction. Where power tools hand tools, spray equipment or other mechanical equipment are being used, the proper operating procedures for each tool or piece of equipment, as well as eye, hearing and respiratory protection should be followed. Equipment used to apply Thermo-Lag 3000-SP is under high pressure. Any injury caused by high pressure liquids can be serious and immediate medical attention should be sought.

1.4 DELIVERY

Material shall be delivered to the site in original, unopened containers, bearing clearly visible product names, batch number, name of manufacturer, expiration date, and storage instructions.

1.5 STORAGE

Material not in immediate use shall be stored off the ground in a covered area assigned for that purpose. The materials in storage shall be protected from temperatures above 100°F (38°C) and below 32°F (0°C).

Prior to use with single component equipment, Thermo-Lag 3000-SP shall be pre-heated to a minimum of 70°F (21°C) for 24 hours prior to application.

1.6 PROTECTION OF ADJACENT SURFACES

The applicator shall mask off all adjacent areas and equipment from material overspray during the application. Overspray shall be removed promptly before material has cured. When applying these coating in windy conditions, additional precautions to control overspray should be undertaken.

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SECTION 2. MATERIALS

The Thermo-Lag 3000-SP Epoxy Intumescent Paint System consists of the following material components:

2.1 PRIMERS

Prior to use, all primer systems must be accepted by Carboline prior to use under Thermo-Lag 3000-SP. The acceptable primer system shall be applied to properly prepared surfaces in accordance with the manufacturer's and project specifications in a range of 3 – 5 mils (75 – 125 microns) DFT per SSPC PA2. Final dry film thickness in excess of this value shall be agreed upon by Carboline in writing. Refer to Appendix A, Carboline's Approved Primer List.

The general requirement for steel preparation before the application of an approved primer should meet SSPC-SP6, with a 1.5-2.0 mil (37-50 micron) angular profile. Contact Carboline Technical Service for surface preparation recommendations and specific primer requirements.

For field applications, existing coatings must attain a minimum 3A rating in accordance with ASTM D3359 Method A, X cut adhesion test. If acceptable, clean and lightly abrade in accordance with SSPC-SP2 or SP3 to roughen and de-gloss the surface. If not acceptable, the coating must be removed and areas re-primed with a compatible primer. If primer coating has acceptable adhesion, but is not compatible or compatibility is unknown, a tie-coat primer can be applied as a bonding or barrier coating. Contact Carboline Technical Service for a list of approved tie-coat primers and specific primer requirements.

Primer recoat intervals may vary from the published product datasheet when using under intumescent fireproofing products. Consult Carboline Technical Service for recommended cure times before applying Carboline intumescent products.

2.2 THERMO-LAG 3000-SP

Thermo-Lag 3000-SP is 95% solids, two component, thermally activated, intumescent epoxy coating formulated for single component and trowel applications. Thermo-Lag 3000-SP is supplied in half pails (2.25 gallons / 8.5 L).

When exposed to flame, the material volatilizes at fixed temperatures, exhibits a volume increase through formation of a multicellular matrix and absorbs and blocks heat to protect the substrate.

2.3 TOPCOATS

Topcoat systems must be acceptable to Carboline prior to use over Thermo-Lag 3000-SP. Refer to Appendix B, Carboline's Approved Topcoat List for various topcoat options.

2.4 FP-FIBERGLASS MESH

FP-Fiberglass Mesh is 5.3 oz./yd² (180 grams/m²), and must be purchased from Carboline. The application details of the FP-Fiberglass Mesh are dependent upon the design, size of steel, project requirements, etc. and can be found in the appendices of this manual.

FP-Fiberglass Mesh is utilized for UL Design No. XR618, and XR649.

2.5 HIGH TEMP MESH

The High Temp Mesh is an open weave carbon mesh and must be obtained from Carboline. The application details of the High Temp Mesh are dependent upon the design, size of steel, project requirements, etc. and can be found in the appendices of this manual. High Temp Mesh is utilized for UL Design Nos. XR620 and XR621.

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SECTION 3. EQUIPMENT REQUIREMENTS

3.1 APPROVED SINGLE COMPONENT EQUIPMENT FOR THERMO-LAG 3000-SP

The following approved single component manufacturers are suitable for the application of Thermo-Lag 3000-SP:

Fluid to Air Pump: Ratio of 45:1 or greater.
Minimum ¾" outlet on high pressure side with an output of 3.3 gallons/minute
(minimum)

- Graco® Xtreme XL Heavy Fluid Package (with stainless steel hopper feed)
- WIWA® Herkules 75:1 (with stainless steel hopper feed) or Carboline approved equivalent

Hopper feed is required with quick disconnect or camlock fittings and solvent resistant seals for all single leg applications. Please contact Carboline Technical Service for recommended pump setup options.

It is essential that all the equipment used by the applicator is properly maintained. It is necessary to regularly change items such as seals, gun tips, packing and hoses.

Every applicator shall obtain a parts list and/or manual from the manufacturer for the proper operation of the equipment and its maintenance.

Any company which has not utilized the specific pump prior to applying Thermo-Lag 3000-SP shall be trained in the proper operation of the pump by the pump manufacturer. Carboline takes no responsibility for the lack of proper instruction on the use of the pump.

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SECTION 4. SURFACE PREPARATION & PRIMING

4.1 DEGREASING, BLASTING AND PRIMING

4.1.1 DEGREASING

All surfaces shall be cleaned and degreased prior to grit blasting the steel per SSPC SP1. When selecting a cleaning method, the primer manufacturer's and project recommendations must be adhered to.

When it is necessary to clean the surface of Thermo-Lag 3000-SP before applying a further coat or top coating, solvent wiping with toluene, Thinner #19 is recommended.

4.1.2 BLASTING

All blasting abrasive shall be dry, clean and free from contaminants. Where grit is used, contact primer manufacturer for specific details on acceptable blast abrasive and other industry standards.

4.1.3 CARBON STEEL SURFACE PREPARATION

The general requirement for steel preparation before the application of an approved primer shall meet SSPC SP6 (Sa 2), with a minimum angular anchor profile of 1.5 – 2.0 mils (37 – 50 microns). Refer to specific primer's product datasheet for specific requirements.

4.1.4 GALVANIZED SURFACE PREPARATION

Galvanizing requires a roughened surface for optimum adhesion/performance of high build epoxies. Remove any contaminants per SSPC SP1; ensure there are no chemical treatments that may interfere with adhesion; and abrade the surface to establish a suitable roughness per SSPC-SP7 (Sa1) with a minimum angular anchor profile of 1.5 – 2 mils (37 – 50 microns). Prime with Carboguard 893 SG Primer @ 3 – 5 mils (75 – 125 microns) (DFT) per SSPC PA2.

4.1.5 STAINLESS STEEL SURFACE PREPARATION

All steel surfaces shall be blasted to a SSPC-SP7 (Sa 1) with a minimum angular anchor profile of 1.5 – 2 mils (37 – 50 microns). Prime with Carboguard 893 SG Primer @ 3 – 5 mils (75 – 125 microns) (DFT) per SSPC PA2.

4.2 PRIMING

Only primer systems acceptable by Carboline shall be used under Thermo-Lag 3000-SP. The primer shall be applied in accordance with the manufacturer's and project's specification. Refer to Appendix A, CARBOLINE's Approved Primer List.

The primer system thickness range shall be between 3 – 5 mils (75 – 125 microns) (DFT) per SSPC PA2. Any other final dry film thickness in excess of this value shall be agreed upon by Carboline in writing.

4.2.1 PRIMER THICKNESS

As previously stated, controlling the thickness of applied primers is very important. The following method will be the only one accepted by Carboline:

- Use a flat polished steel plate to calibrate the measuring device to zero.
- Calibrate equipment device to a known thickness using manufacturers supplied shims.
- Use the measuring device to measure individual primer coats and multi-coat thicknesses.
- Record measurements at the rate specified by the project.
- Thickness of primer must be sufficient to fully cover blast profile.

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4.2.2 PRIMER REACTIVATING

If multiple primer coats are required, care must be taken to ensure that the manufacturers recommended maximum recoat time has not been exceeded.

4.2.3 PRIMER ADHESION

The coating inspector for the project must be satisfied that the adhesion values of the primer system meet the project specification.

For field applications, existing coatings must attain a minimum 3A rating in accordance with ASTM D3359 Method A, X cut adhesion test. If acceptable, clean and lightly abrade in accordance with SSPC-SP2 or SP3 to roughen and de-gloss the surface. If not acceptable, the coating must be removed and areas re-primed with a compatible primer. If primer coating has acceptable adhesion, but is not compatible or compatibility is unknown, a tie-coat primer can be applied as a bonding or barrier coating. Contact Carboline Technical Service for a list of approved tie-coat primers and specific primer requirements

4.3 SURFACE PREPARATION WHERE AN EXISTING / NON-APPROVED PRIMER WAS INSTALLED

This section applies to areas where an existing / non-approved primer system has been installed and the existing surface was prepared to SSPC SP6 (Sa 2) with a minimum of 1.5 – 2 mils (37 – 50 microns) profile.

Ultra-high-pressure water jetting may be employed to remove a primer or other coating where no dry blast surface preparation is permitted. Thoroughly water jet the surface until the original blasted surface has been revealed. The cleaned surface should be blown dry with clean, dry compressed air to remove water residues. Immediately after, the clean surface shall be primed with an approved wet blast type primer, in accordance with the manufacturer's and project specification. Contact Carboline for the current list of acceptable wet blast type primers.

No wet blast system shall be used without first consulting with Carboline prior to startup of the project.

Note: Ultra high-pressure water jetting will not generate an accepted profile on steel that has not been previously profiled.

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SECTION 5. MATERIAL PREPARATION

5.1 MATERIAL PRE-HEATING

Prior to introduction into spray equipment the material shall be pre-heated to a minimum of 70°F (21°C) for 24 hours prior to application. Cold material will not spray well and material that is over-heated will reduce the pot-life and working time. Material can be heated using heated storage units or hot rooms. These are normally constructed from storage containers that are insulated to maintain desired temperature and fitted with a suitable temperature controllable heater. Smaller custom-made hot boxes can be used for small projects to heat enough pails to maintain daily production. In hot climates the material may have to be maintained at a cooler temperature to stay within application range. Material temperature can be measured using a probe thermometer or IR gun.

Do not use electric jacket heaters that wrap around the outside of the pails. These can overheat the outside perimeter of the pails and “cook” the material around the inside making the material unusable.

5.2 MIXING & MIX RATIO

For single component applications, the product is supplied in 4.5 gallon (17.0 liter) kits, one ½ full pail of part A and one 1/2 full pail of part B. Add up to 1 quart (1 liter) of Plasite Thinner #19, Thinner #242E or Carboline approved equivalent to part B and mix until fully incorporated. Stage material by adding part B on top of part A. Material can be left staged for entire days' production (8 hours), but not overnight.

Mix staged material with rectangular paddle mixing blade until completely blended and consistent color is achieved. Once mixed, material should be immediately introduced into single component equipment and spraying should commence.

5.3 MESH REINFORCEMENT FOR STRUCTURAL STEEL

After the first coat of Thermo-Lag 3000-SP has been applied to within the tolerance of mesh placement, the mesh is placed in position as detailed in certification or approval documentation. See Appendix C. Mesh shall not be left uncovered overnight it must be encapsulated with a minimum of 40 mils – (1 mm).

Wide Flange Section

Ensure that the proper mesh reinforcement is utilized based on the project specific UL Design, i.e.

Design No. XR 618 & XR649 – FP-Fiberglass Mesh

Design No. XR 620 – High Temp Mesh

Design No. XR 621 – High Temp Mesh

Rolled Hollow Section (RHS)

Tubular and other hollow steel sections are reinforced in a similar manner except that the entire surface is reinforced by using one or two pieces of mesh.

All mesh shall be overlapped 1” (25mm) minimum on longitudinal seams

5.4 TERMINATION ONTO NON-FIREPROOFED STEEL (SECONDARY STEEL)

Where the material terminates to non-fire protected steel, the Thermo-Lag 3000-SP shall be sprayed to the specified thickness and beveled on a 45° angle down to the substrate. The topcoat system shall continue down onto the non-fireproofed substrate a minimum 2” (50 mm) to insure a proper seal.

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5.5 MOCK-UP INSTALLATION

Prior to actual production work, a representative sample shall be prepared following all specified procedures and approved thickness / finish / surface quality. This sample must then be approved by representatives of the owner, applicator, architect and any others having a vested interest in the installation. The actual production work must follow, and conform to, the standards and approved finish / surface quality of the site sample.

The site sample is a mandatory requirement and shall be made available to all parties throughout the completion of the project.

5.6 RECORD KEEPING

The maintaining of proper records is an essential requirement for all Thermo-Lag 3000-SP projects. The minimum requirements will be established by the project specification.

5.7 WELD CUT BACK

It is often necessary to mask off areas on the structure before the application of Thermo-Lag 3000-SP to allow for future welding. As heat is generated during the welding process, either during a preheating stage and/or during the welding itself, it is important that a suitable distance is left around the weld area to prevent damage to the adjacent Thermo-Lag 3000-SP.

For small weld attachments such as the addition of clips and hangers, a cutback distance of 2" (50mm) on each side of the weld areas should be sufficient. When carrying out welding close to Thermo-Lag 3000-SP, a discoloration may be observed. This discoloration denotes that the Thermo-Lag 3000-SP has received too much heat and the bond to the steel is likely to have been affected. When this happens, the discolored Thermo-Lag 3000-SP must be removed as described in **Removal and Repair Procedures**. For larger welds, i.e. full girth, a cutback of 12" (300 mm) each side of the weld area may be sufficient.

The cutback distances given below assume that the weld will be made at the center and are given as recommendations only. The precise nature of the weld, including the mass of steel and the method of preheating used, will determine the precise distance. As indicated above, discoloration of the Thermo-Lag 3000-SP will denote that an insufficient cutback distance has been used.

Weld Preheat Temperature	Time (Hr.)	Total Cutback (mm)
212°F / 100°C	4-8	30" / (750)
212°F / 100°C	8-12	40" / (1000)
302°F / 150°C	4-8	30-40" / (750-1000)
302°F / 150°C	8-12	40-50" / (1000-1250)

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SECTION 6. THERMO-LAG 3000-SP SINGLE COMPONENT APPLICATION PROCEDURES

6.1 Surface Preparation

- A. Surface must be clean, dry and free of any dirt, oil, grease or other contamination prior to surface preparation.
- B. Clean surface to specified standard, typically SSPC-SP1.
- C. The general requirement for steel preparation before the application of an approved primer should meet SSPC-SP6, with a 1.5-2.0 mil (37-50 micron) angular profile. Contact Carboline Technical Service for recommendations and specific primer requirements.

6.2 Primer Application

- A. All surfaces must be clean, dry and properly prepared as stated above prior to primer application.
- B. All primers must be approved by Carboline prior to use and applied within manufacturers' and projects' stated specifications. If an unknown primer has been applied, contact your Carboline Fireproofing representative for recommendations.
- C. The primer thickness range shall be between 3-5 mils (75-125 microns) DFT per SSPC-PA2. Any other final DFT in excess of this value shall be agreed upon by Carboline in writing.

6.3 Thermo-Lag 3000 SP Single Component Requirements

Fluid to Air Ratio Pump: All fluid to air ratio pumps shall be approved by CARBOLINE prior to use. The startup procedures below are general guidelines only. Always follow specific equipment manufacturer guidelines for equipment operation.

Gun:	WIWA 500F PFP gun or equivalent Carboline approved mastic gun with high pressure swivel
Tip Size:	0.027" - 0.035" Graco XHD Heavy duty RAC non- diffuser tips
Fan Size:	6" - 10"
Material Hose:	Solvent Resistant: 3/4" I.D. (50' max.) + 1/2" I.D. (25' max.) whip hose
Air Requirements:	As per specific pump requirements
Static Mixer:	Standard 12 turn 3/4" mixer (optional)

Note: When spraying THERMO-LAG 3000 SP through single component airless equipment, the working pot life to achieve a good spray pattern will be approximately 30 minutes once the material is mixed at 70°F (21°C). In order to spray THERMO-LAG 3000 SP with this equipment set up, the material shall be thinned with toluene, Plasite Thinner #19, Thinner #242E or CARBOLINE approved equivalent. Maximum thinner added not to exceed 1 quart (1 liter) per 4.5 gallon (3.79 L) kit. Thinning the material will slow the curing process and reduce film build. The product film build with this set up is 80-100 mils (2 - 2.5 mm) per coat. CARBOLINE must approve the use of other thinners prior to start up.

6.4 Thermo-Lag 3000 SP Single Component (batch mix) Application

(Environmental)

- A. Before applying Thermo-Lag 3000 S, confirm that proper environmental conditions are met. Minimum ambient temperature: 41°F (5°C) and rising, maximum relative humidity 85%, steel surface temperature must be 5°F (3°C) above the dew point.
- B. Confirm that the surface has been prepared to specification.
- C. Verify that a Carboline approved primer has been correctly installed to correct thickness and is properly cured. Ensure that the application is within the primer's recoat window.
- D. Confirm that adjacent areas are properly masked off.
- E. THERMO-LAG 3000 SP must be protected from direct rain until it has reached sufficient cure. If water contamination does occur to uncured THERMO-LAG 3000 SP, any uncured material must be removed and reapplied prior to topcoating.

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(Material)

- A. Material must be heated to a minimum of 70°F (21°C) - 90°F (32°C) to spray through this airless equipment set up.
- B. Thoroughly mix Parts A and B well - separately - before using. Use 1/2" electric or air driven drill with a rectangular paddle mixer. Must be 300 rpm under load (minimum).
- C. Add thinner into part B and mix thoroughly.
- D. Stage Part B onto Part A and mix thoroughly until uniform consistency and color is achieved.

(Equipment Setup)

- A. The pump, hopper and all lines shall be clean and free from any contamination.
 - a. Pour mixed material into hopper.
 - b. Remove spray gun from the end of the hose.
 - c. Turn pump pressure up only high enough to move material to the end of the delivery line.
 - d. Turn off air and replace spray gun.
 - e. Increase air pressure until appropriate fan pattern is achieved.

(Application)

- A. Apply enough pressure to the main pump to achieve a proper fan pattern.
- B. Typical film build for single component application is 60-120 mils (1.5- 3mm) per coat.
- C. Lighter coats will have a better surface appearance.
- D. Care shall be taken to keep the fan pattern at an angle of 90 degrees to the surface and at 12" (305mm) to 18" (457mm) away from the surface.
- E. Apply 1st coat of Thermo-Lag 3000 between 60-120 mils
- F. Check the wet film thickness with WFT gauge
- G. Mesh should be installed as described in the individual UL design.
- H. Install mesh reinforcement (fiberglass or high temp mesh)
 - a. Use solvent resistant mohair rollers or putty knives to embed the mesh into the wet coating
 - b. Mist the rollers with Thinner#19 to prevent them from sticking to material
 - c. Pre-cut mesh must be completely embedded into material (no air pockets)
 - d. All seams in mesh must have 1" overlap
 - e. Wait four hour between coats to allow material to set up
- I. Continue building material at 60-120 mils per coat to design thickness
 - a. Use WFT gauge to make sure thickness is consistent
 - b. Back roll each coat to hide mesh pattern and smooth surface. Allow material to sufficiently gel prior to back rolling (typically 20-30 minutes @ 70°F (21°C, if required).
- J. Special care should be taken when spraying flange edges on structural steel members to ensure complete coverage and a consistent thickness. The normal spray pattern on the outside and the inside surfaces of the flanges should cause the material to flow and wrap around the edge of the flange. If the coating on the flange edge is uneven after application, the edge shall be rolled lightly in order to provide an even surface.
- K. If backrolling, to keep rollers moist, mist solvent resistant mohair rollers. Use toluene, Plasite Thinner #19 or Thinner #242E to keep roller from sticking to the material. CARBOLINE recommends the use of solvent resistant spray bottles to minimize the use of solvents. Excessive build-up of material in angle areas can be removed or leveled by rolling the surface with a solvent resistant short napped mohair roller. Do not use excessive solvent during rolling, as this will retard the surface cure of the material.
- L. Allow material to cure between coats, the material must be clean and sufficiently cured prior to applying subsequent coats of THERMO-LAG 3000 SP. Please reference recoat table below for guidance:

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Typical Overcoating Times Between Thermo-Lag 3000-SP Coats

Temperature (°F/°C)	Minimum Time (Hours)	Maximum Time (Days)
50°F (10°C)	5	7
77°F (25°C)	4	7
85°F (29°C)	4	7
95°F (35°C)	2	7
110°F (43°C)	1	7

If the overcoat time has been exceeded, the surface of the Thermo-Lag 3000-SP must be reactivated as described below:

Greater than 72 hours but less than 7 days: Thermo-Lag 3000-SP must be solvent wiped with toluene, Plasite Thinner #19 or Thinner #242E to reactivate the surface and remove contaminants.

7 Days or beyond: The material must be "Sweep Blasted" or abrade to remove any contamination or particulate. The freshly blasted or abraded surface must then be solvent wiped toluene or Plasite Thinner #19 or Thinner #242E to reactivate the Thermo-Lag 3000-SP and to remove contaminants.

- N. The Applicator shall take frequent WFT measurements during application, using a penetrating measuring device to ensure that the coating is uniformly applied at the required film thickness. The thickness checks shall be made as required by the project.
- O. The final thickness shall be specified in project drawings and owner specifications. Thicknesses for Thermo-Lag 3000-SP are outlined in published fire test designs. The number of thickness checks and other issues regarding this topic are determined by the project specification. If no standard or guidance exists in project specification, Technical Manual 12-B and/or SSPC PA2 can be used for reference. All matters relating to thickness shall be decided between the owner and the applicator prior to the startup of the job.

6.5 Topcoat Application

- A. Where the material terminates to non-fire protected steel or blockout areas, the THERMO-LAG 3000 or THERMO-LAG 3000 SP shall be sprayed to the specified thickness and beveled on a 45° angle down to the substrate. The topcoat system shall continue down onto the non-fireproofed substrate (minimum 2" or 50 mm) to insure a proper seal.
- B. The typical minimum topcoating time for THERMO-LAG 3000 SP is 48 hours at 70°F (21°C). The maximum allowable time to topcoat the THERMO-LAG 3000 SP is 7 days at 70°F (21°C). If this time is exceeded, the area should be sweep blasted or abrade with 40 grit paper (or approved equal), then solvent wiped, prior to topcoating.
- C. Carboline approved topcoats or topcoat systems can be used to meet project specifications for color, finish, service requirements and UV protection.
- D. Confirm that Thermo-Lag 3000 SP has been applied to the specified dry film thickness by using an electronic or magnetic dry film thickness gauge.
- E. The Thermo-Lag 3000 SP must be sufficiently cured and be clean, dry and free of any contamination prior to topcoat application.
- F. All topcoats must be approved by Carboline prior to use.
- G. Ensure topcoat is applied within manufacturers' and projects stated ambient conditions, temperature and relative humidity specifications.
- H. The topcoat shall be applied in accordance with the manufacturer and project specification. Refer to the Thermo-Lag 3000 SP design for topcoat requirements.

6.6 Safety

- A. Only trained and qualified applicators should install Thermo-Lag 3000 SP.
- B. Follow all safety precautions on the Thermo-Lag 3000 SP SDS when applying this material.
- C. Always use appropriate personal protective equipment and wash with hot soapy water if necessary.
- D. Ensure proper maintenance and cleaning of the equipment.

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SECTION 7. THERMO-LAG 3000-SP TROWEL APPLICATION PROCEDURES

Both Thermo-Lag 3000 P and Thermo-Lag 3000 SP can be trowel applied. Thermo-Lag 3000 SP is recommended for trowel applications and is available in half kits to facilitate batch mixing of the material (half pail of Part A, and half pail of part B). Please note Thermo-Lag 3000 can be mixed by any volume, provided that the ratio is 1:1.

7.1 Surface Preparation

- A. Surface must be clean, dry and free of any dirt, oil, grease or other contamination prior to surface preparation.
- B. Clean surface to specified standard, typically SSPC-SP1.
- C. The general requirement for steel preparation before the application of an approved primer should meet SSPC-SP6, with a 1.5-2.0 mil (37-50 micron) angular profile. Contact Carboline Technical Service for recommendations and specific primer requirements.

7.2 Primer Application

- A. All surfaces must be clean, dry and properly prepared as stated above prior to primer application.
- B. All primers must be approved by Carboline prior to use and applied within manufacturers' and projects' stated specifications. If an unknown primer has been applied, contact your Carboline Fireproofing representative for recommendations.
- C. The primer thickness range shall be between 3-5 mils (75-125 microns) DFT per SSPC-PA2. Any other final DFT in excess of this value shall be agreed upon by Carboline in writing.

7.3 Thermo-Lag 3000 SP Trowel Application

(Environmental)

- A. Before applying Thermo-Lag, confirm that proper environmental conditions are met. Minimum ambient temperature: 41°F (5°C) and rising, maximum relative humidity 85%, steel surface temperature must be 5°F (3°C) above the dew point.
- B. Confirm that the surface has been prepared to specification.
- C. Verify that a Carboline approved primer has been correctly installed to correct thickness and is properly cured. Ensure that the application is within the primer's recoat window.
- D. Confirm that adjacent areas are properly masked off.

(Mixing)

- A. Pre-heat material to 70-90°F (21-32°C).
- B. Thoroughly mix part A and part B separately prior to incorporating them together.
- C. Mix material using ½" drill with rectangular mixing paddle capable of achieving 300 rpm under load.
- D. Thermo-Lag 3000 shall be mixed 1:1 by volume
- E. Stage part B on top of part A
- F. Material can be left staged during 8-hour production schedule, but do not leave staged material overnight as it will begin to catalyze at interface between part A and part B.
- G. For trowel applications, no thinner is required. If thinning is desired to increase the pot life and enhance workability, Thermo-Lag 3000 may be thinned up to 5% by volume with Carboline Thinner #19, Thinner #242 or approved equal.
- H. Once mixed, Thermo-Lag 3000 SP will have a working pot life of approximately 45 minutes.
- I. After material is mixed, it should be poured out of mass onto a table or flat surface which prevents the material from setting up too quickly.
- J. A mixed kit of Thermo-Lag 3000 SP should be split between 4-5 workers to facilitate application within working time.

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(Application)

- A. Trowel material to point of mesh placement using hawk and trowel. Typical film build for trowel application is 160-250 mils (4-6 mm) per coat (not thinned). Addition of thinner will reduce film build.
- B. Lighter coats will have a better surface appearance.
- C. Allow material to sufficiently gel prior to applying mesh reinforcement or back rolling (typically 20-30 minutes @ 70°F (21°C)).
- D. Apply pre-cut FP-Fiberglass Mesh or High Temp Mesh reinforcement into the wet coating where required (refer to section 5 for details).
- E. Allow applied material to cure sufficiently to support the weight and trowel application of subsequent coats. The thickness which can be applied in a single coat and cure times will depend on the temperature, humidity and applicator technique.
- F. Build material to final thickness in as many coats required. Use mohair rollers (moistened with Carboline Thinner #19, Thinner #242 or approved equal) to smooth any imperfections in the coating. Surface finish must meet project specifications.

7.4 Mesh Reinforcement Application

- A. Only use Carboline FP-Fiberglass Mesh or Carboline High Temp Mesh.
- B. For specific mesh requirements and design details on mesh placement refer to Appendix C.
- C. Pre-cut all mesh prior to commencing the application of Thermo-Lag 3000.
- D. Apply pre-cut mesh into the wet Thermo-Lag 3000 as described in the UL design.
- E. Ensure that the mesh reinforcement is completely embedded into the wet material using trowels and/or solvent resistant mohair rollers. Lightly mist rollers with a Carboline approved solvent to aid in backrolling.
- F. If mesh will be left overnight, a light 40 mil (1mm) coat of Thermo-Lag should be skim trowel applied to ensure full encapsulation of the mesh.

7.5 Topcoat Application

- A. Carboline approved topcoats or topcoat systems can be used to meet project specifications for color, finish, service requirements and UV protection.
- B. Ensure that the Thermo-Lag 3000 system has been properly installed
- C. Confirm that Thermo-Lag 3000 has been applied to the specified dry film thickness by using an electronic or magnetic dry film thickness gauge.
- D. The Thermo-Lag 3000 must be sufficiently cured and be clean, dry and free of any contamination prior to topcoat application.
- E. All topcoats must be approved by Carboline prior to use.
- F. Ensure topcoat is applied within manufacturers' and projects stated ambient conditions, temperature and relative humidity specifications.
- G. The topcoat shall be applied in accordance with the manufacturer and project specification. Refer to the Thermo-Lag 3000 design for topcoat requirements.

7.6 Safety

- A. Only trained and qualified applicators should install Thermo-Lag 3000.
- B. Follow all safety precautions on the Thermo-Lag 3000 P & Thermo-Lag 3000 SP SDS when applying this material.
- C. Always use appropriate personal protective equipment and wash with hot soapy water if necessary.
- D. Ensure proper maintenance and cleaning of the equipment.

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SECTION 9. THERMO-LAG 3000-SP BLOCKOUT APPLICATION PROCEDURES

Both Thermo-Lag 3000-P and Thermo-Lag 3000-SP can be used for blockout applications. Thermo-Lag 3000-SP is recommended for trowel applications and is available in half kits to facilitate batch mixing of the material (half pail of Part A, and half pail of part B). Please note Thermo-Lag 3000 can be mixed by any volume, provided that the ratio is 1:1.

8.1 Surface Preparation

- A. Surface must be clean, dry and free of any dirt, oil, grease or other contamination prior to surface preparation.
- B. Clean surface to specified standard, typically SSPC-SP1.
- C. Steel surfaces must be blasted to SSPC-SP6. (ISO 8501-1 / Sa 2 ½ with a minimum blast profile of 1.5-2.0 mils (37-50 microns).

8.2 Primer Application

- A. All surfaces must be clean, dry and properly prepared as stated above prior to primer application.
- B. All primers must be approved by Carboline prior to use.
- C. Ensure primer is applied within manufacturer's stated ambient conditions, steel temperature and relative humidity specifications.
- D. The primer shall be applied in accordance with the manufacturer's and project's specification.
- E. The primer thickness range shall be between 3-5 mils (75-125 microns) DFT per SSPC-PA2. Any other final DFT in excess of this value shall be agreed upon by Carboline in writing.

8.3 Thermo-Lag 3000 Trowel or Spray Application

(Environmental)

- A. Before applying Thermo-Lag, confirm that proper environmental conditions are met. Minimum ambient temperature: 41°F (5°C) and rising, maximum relative humidity 85%, steel surface temperature must be 5°F (3°C) above the dew point.
- B. Confirm that the surface has been prepared to specification.
- C. Verify that a Carboline approved primer has been correctly installed to correct thickness and is properly cured. Ensure that the application is within the primer's recoat window.
- D. Confirm that adjacent areas are properly masked off.

(Mixing)

- A. Pre-heat material to 70-90°F (21-32°C).
- B. Thoroughly mix part A and part B separately prior to incorporating them together.
- C. Mix material using ½" drill with rectangular mixing paddle capable of achieving 300 rpm under load.
- D. Thermo-Lag 3000 shall be mixed 1:1 by volume
- E. Stage part B on top of part A
- F. Material can be left staged during 8 hour production schedule, but do not leave staged material overnight as it will begin to catalyze at interface between part A and part B.
- G. For trowel applications, no thinner is required. For spray applications or to increase the pot life and enhance workability, Thermo-Lag 3000 may be thinned up to 5% by volume with Carboline Thinner #19, Thinner #242 or approved equal. 1 quart (1 liter) per 4.5 gallon kit maximum.
- H. For trowel applications, mixed material should be poured out of mass onto a table or flat surface which prevents the material from setting up too quickly. A mixed kit of Thermo-Lag 3000 SA or SP should be split between 4-5 workers to facilitate trowel application within working time. For spray applications, application should commence immediately after mixing.

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(Application)

- A. Remove topcoat from blockout area and abrade back a minimum of 2" (50 mm) onto existing Thermo-Lag 3000 application. Ensure dust and debris are removed prior to application of Thermo-Lag 3000. Solvent wipe the exposed edges of the Thermo-Lag 3000 to re-activate surface.
- B. Apply material to point of mesh placement using hawk and trowel or recommended airless equipment (See latest revision of application guide for equipment set up and recommendations. Typical film build for trowel application is 160-250 mils (4-6 mm) per coat (unthinned). Typical film build for spray application by single leg is 80-160 mils (2-5 mm) per coat (thinned 5% by volume).
- C. Thermo-Lag 3000 and FP-Fiberglass mesh applied to block-out areas shall be butted to the existing material.
- D. Lighter coats will have a better surface appearance.
- E. Allow material to sufficiently gel prior to applying mesh reinforcement or back rolling (typically 20-30 minutes @ 70°F (21°C)).
- F. Apply pre-cut FP-Fiberglass Mesh or High Temp Mesh reinforcement into the wet coating where required (refer to Appendix C)
- G. Allow applied material to cure sufficiently to support the weight and application of subsequent coats. The thickness which can be applied in a single coat and cure times will depend on the temperature, humidity and applicator technique.
- H. Build material to final thickness in as many coats required. Use trowels or mohair rollers (moistened with Carboline Thinner #19, Thinner #242 or approved equal) to smooth any imperfections in the coating. Surface finish must meet project specifications.

8.4 Mesh Reinforcement Application

- A. Only use Carboline FP-Fiberglass Mesh or Carboline High Temp Mesh.
- B. For specific mesh requirements and design details on mesh placement and requirements refer to Appendix C
- C. Pre-cut all mesh prior to commencing the application of Thermo-Lag 3000.
- D. Apply pre-cut mesh into the wet Thermo-Lag 3000 as per the UL design.
- E. Ensure that the mesh reinforcement is completely embedded into the wet material using trowels and/or solvent resistant mohair rollers. Lightly mist rollers with a Carboline approved solvent to aid in backrolling.
- F. If mesh will be left overnight, a light 40 mil (1mm) coat of Thermo-Lag should be skim trowel applied to ensure full encapsulation of the mesh.

8.5 Topcoat Application

- A. Carboline approved topcoats or topcoat systems can be used to meet project specifications for color, finish, service requirements and UV protection.
- B. Ensure that the Thermo-Lag 3000 system has been properly installed.
- C. Confirm that Thermo-Lag 3000 has been applied to the specified dry film thickness by using an electronic or magnetic dry film thickness gauge.
- D. The Thermo-Lag 3000 must be sufficiently cured and be clean, dry and free of any contamination prior to topcoat application.
- E. All topcoats must be approved by Carboline prior to use.
- F. Ensure topcoat is applied within manufacturer's stated ambient conditions, temperature and relative humidity specifications.
- G. The topcoat shall be applied in accordance with the manufacturer and project specification. Refer to the topcoat product data sheet for thickness requirements.

8.6 Safety

- A. Only trained and qualified applicators should install Thermo-Lag 3000.
- B. Follow all safety precautions on the Thermo-Lag 3000 SDS when applying this material.
- C. Always use appropriate personal protective equipment and wash with hot soapy water if necessary.
- D. Ensure proper maintenance and cleaning of the equipment.

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SECTION 9: CLEAN-UP PROCEDURES

9.1 GENERAL PROCEDURES

The application area shall be maintained in a clean and orderly condition. Following the application, all overspray, debris, and equipment shall be removed and the area left in a condition acceptable to the Owner and General Contractor.

9.2 SINGLE COMPONENT PROCEDURES

Single component equipment must be flushed with toluene, Plasite Thinner #19, Thinner #242E, MEK or Carboline approved equivalent immediately after every use. The spray gun, static mixer and all hand tools must be immediately hand cleaned at the end of each spray period using toluene, Plasite Thinner #19, Thinner #242E, MEK or Carboline approved equivalent.

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SECTION 10: REMOVAL AND REPAIR PROCEDURES

10.1 REMOVAL

The preferred method is to cut through the Thermo-Lag 3000-SP at right angles to the substrate with a disc saw around the area to be removed. Make sure that the steel substrate is not damaged. A power chisel can then be used to “chip” away the material from the substrate.

It is essential that proper safety precautions are taken during this operation. Reference shall be made to the products' Safety Data Sheets (SDS) and all site safety requirements.

10.2 REPAIRS – GENERAL

In instances when material has been damaged or is in need of repair the following procedures shall be followed:

The primer system shall be reinstated to its original specification.

1. Remove all damaged material back to solidly adhered material. All edges can be left as butt joints to a 90-degree angle or beveled to a 45-degree angle.
2. Abrade a minimum of 2" around the area to be patched.
3. All edges and areas abraded must be solvent cleaned and allowed to dry before commencing application.
4. It is important that the newly applied Thermo-Lag 3000-SP blends into the existing material to achieve a uniform appearance.
5. If the area does not exceed 4" x 4", no mesh reinforcement is required for the repair areas. If the dimensions exceed 4" x 4", mesh reinforcement shall be installed as per the UL tested design.
6. The material shall be troweled or spray applied to the appropriate thickness based on the project specification and fire test certification.
7. The specified topcoat system shall be applied, based on the original specification, in strict accordance with Carboline's written instructions.

10.3 REPAIRS – WATER CONTAMINATION

If rain or condensation occurs during application or shortly thereafter, moisture may be absorbed into the uncured material. In addition, an amine bloom may form on the Thermo-Lag 3000-SP surface. These conditions will affect intercoat adhesion.

Take the following action if water contamination occurs:

Contamination	Action
Cured Thermo-Lag 3000-SP (fresh water)	Dry and solvent wipe
Cured Thermo-Lag 3000-SP (salt water)	Warm water wash - maximum 60°C (140°F) Dry and solvent wipe
Uncured Thermo-Lag 3000-SP	Remove source of moisture Allow Thermo-Lag 3000-SP to cure Dry and solvent wipe Remove and replace all uncured material

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SECTION 11: SHOP APPLICATION CONSIDERATIONS & INFORMATION

11.1 INTRODUCTION

Thermo-Lag 3000-SP is a suitable material for offsite application and the steel is then later shipped to the job site in either stick or modular assembly. This allows for a more consistent application of the material off site and elimination of interference with other trades which may affect application flow. When this type of application is performed, contact Carboline for advice. In general, follow the application of Thermo-Lag 3000-SP as per the guidelines in this manual.

The following additional requirements are necessary:

11.2 BLOCK OUT AREAS

Prior to application of the shop fireproofing, define all areas of the steel structures that do not receive Thermo-Lag 3000-SP until after the erection phase of the construction. These areas which are not to receive Thermo-Lag 3000-SP shall be masked off in the proper dimensions, prior to application. The size of the block out shall be determined by the applicator, owner or engineering firm. Thermo-Lag 3000-SP has high bond strength, and cannot be easily removed. For in shop application, the specified topcoat system shall extend beyond the applied Thermo-Lag 3000-SP by a minimum of ½" (13 mm). After steel is erected, the topcoat shall be mechanically removed from the edges and back a minimum of 2" (50 mm) from the edge of the block out.

Application to the block out areas may now continue, utilizing spray or trowel methods.

The blocked-out edges can be left as butt joints to a 90-degree angle or beveled to a 45-degree angle.

The specified topcoat system shall be applied, based on the original specification, in strict accordance with Carboline's written instructions.

11.2.1 BOLTED CONNECTION

Where the spacing between bolt patterns exceed 4" (100 mm), reinforcing mesh strips are required to be installed. Please contact Carboline Fireproofing Technical Service for recommendations.

11.3 HANDLING, STORAGE AND ERECTION

11.3.1 UNLOADING

Generally, the fireproofed steel is loaded and unloaded with a crane to permit maximum loading of each truck. It is not advisable to unload fireproofed steel with forklifts, as the steel is nested in ways that forklifts do not easily accommodate and damage to fireproofing may occur.

11.3.2 RIGGING

Wherever possible, steel should not be rigged to the fireproofed portion of the member. Shackles at end holes are a generally acceptable practice and provide the best method for unloading members. Follow all site-specific safety standards for handling structural steel.

11.4 DUNNAGE

Members should be stored on proper dunnage (on the block out areas) to avoid exposure to the ground and moisture.

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11.4.1 ORIENTATION OF MEMBERS

Members should be stacked with webs vertical to avoid ponding of water and snow. Elevate one end of the steel member to provide water run-off.

11.4.2 STACKING

Where members must be double stacked, avoid placing dunnage on the fireproofed surfaces.

11.5 RIGGING

Avoid using chokers against fireproofed surfaces. Wherever possible, add erection tabs or bolt holes at the beam ends to allow top rigging without using chokers around the fireproofing. Follow all site-specific safety standards for handling structural steel.

11.5.1 SWING RADIUS

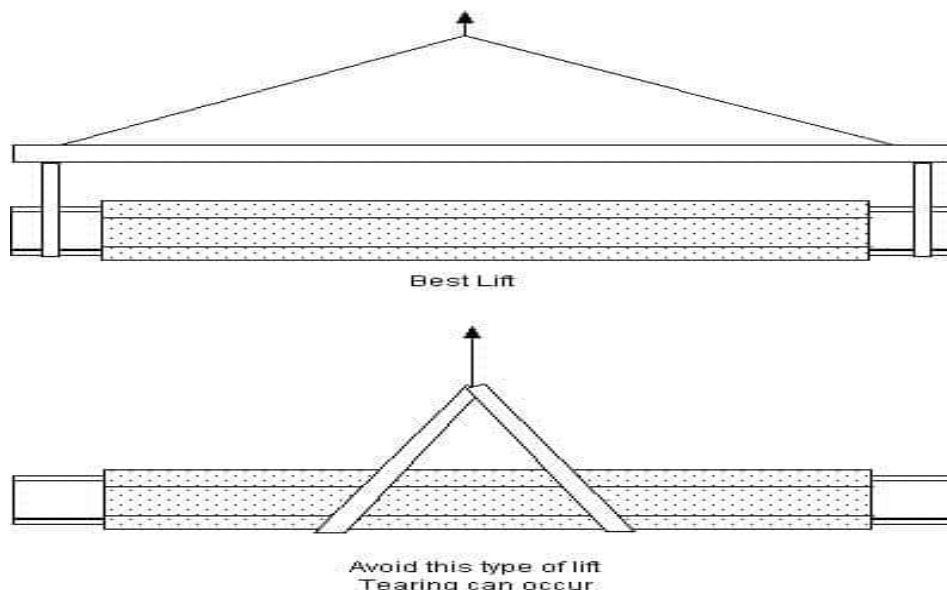
Where infill beams use framing angles, the erector must be aware of the swing radius of the member impacting the fireproofing. This type of connection has a blockout on each side of the holes on the primary member. When the block out dimension is insufficient, the erector is advised to remove a minimal amount of fireproofing on ONE SIDE ONLY. It is better to remove a minimal amount of fireproofing than to make all the connections unnecessarily large. Follow all site-specific safety standards.

11.5.2 CONSIDER GROUND ASSEMBLY

On repetitive structures and modular construction, pre-assembling the units can minimize the amount of block outs required and damage to the fireproofed steel.

11.6 LIFTING

All pre-erection projects will require the steel to be lifted onto trucks or into place on the jobsite. All lifting shall be done utilizing the block out areas for strapping, shackling to erection tabs or bolt holes. Lifting should be performed from a 2-point lift so to ensure the straps are flat against the steel, so that no slipping and tearing can occur.



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SECTION 12: CONNECTIONS POST APPLICATION

12.1 CLAMP ON CONNECTIONS INSTALLED AFTER APPLICATION OF THERMO-LAG 3000-SP

Examples of clamp on connections include pipe, sprinkler pipe and utilities support brackets. Small to medium size clamps and clips are usually left unprotected. Large clamps and clip supports are usually protected with the same thickness as the structural member, due to the possibility of heat transfer. These connection details are not usually addressed in the fire test design information. It is recommended that the Authorities Having Jurisdiction be consulted for approval.

Where support clamps are required to be protected, the coating should be applied where the clamps are in contact with the structural member, and for four inches beyond the structural member. Refer to the Thermo-Lag 3000-SP application instructions above for information including product limitations, required surface preparation, humidity, temperature, application rates, cure times, and topcoat application.

If Thermo-Lag is damaged when the clamped connections are removed, the affected area should be touched up in accordance with "PATCHING SMALL DAMAGED AREAS" above.

12.2 WELDED CONNECTIONS INSTALLED AFTER APPLICATION OF THERMO-LAG

Welded items such as plates and wide bracket supports are usually protected with the same Thermo-Lag 3000-SP thickness as the supporting member due to the possibility of heat transfer. These details are usually not addressed in the fire test design information. We recommend the Authorities Having Jurisdiction be consulted for approval and confirmation of their requirements.

Prior to welding connections, remove the Thermo-Lag 3000-SP to a minimum of three inches beyond the area to be welded by using a grinder, utility knife, chisel or sandblasting. Remove an additional ¼ inch of topcoat by using a medium grit sandpaper. After welding is complete, clean the steel surface to remove all dust, grease, dirt, etc....that would affect the bond, and reapply the specified primer. Apply the Thermo-Lag 3000-SP to the areas in need of repair and to the connecting items if required.

12.3 BOLTED STEEL CONNECTIONS INSTALLED AFTER THE APPLICATION OF THERMO-LAG

Bolts of threaded rods of ¾ inch diameter or less are usually left unprotected. Bolts or threaded rods greater than ¾ inch diameter are usually protected with the same thickness of Thermo-Lag 3000-SP as the supporting member, due to the possibility of heat transfer. These connection details are usually not addressed in the fire test design information. We recommend the Authorities Having Jurisdiction be consulted for approval and confirmation of their requirements. If drill oil is used, oil should be cleaned as soon as possible.

If Thermo-Lag 3000-SP is damaged after drilling, the damaged area should be touched up in accordance with "PATCHING SMALL DAMAGED AREAS" above. If there is no damage to the Thermo-Lag system after drilling, no additional treatment is required.

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APPENDIX A: ACCEPTABLE PRIMER LIST

Qualified Primer	VOC (g/l)	Thermo-Lag 3000-P	Notes
Carbocoat 115 VOC ⁽²⁾	340	2	<p>(1) Designates primers that require a minimum 24 hr. cure @ 70°F before applying intumescent fireproofing.</p> <p>(2) Designates primers that require a minimum 7 day cure @ 70°F before applying intumescent fireproofing.</p> <p>(3) Designates primers that can only be used as tie-coat primers under intumescent fireproofing.</p> <p>(4) For exterior applications, contact Carboline Technical Service before applying Rustbond.</p> <p>(5) Designates primers that require a minimum 4 hr. cure @ 70°F before applying intumescent fireproofing.</p> <p>(6) Designates primer that can be used for clean room applications.</p> <p>(7) Designates primer that is NORSOK compliant.</p>
Carbocoat 8229 ⁽²⁾⁽⁶⁾	268	2,6	
Carboguard 553 ⁽¹⁾	80	1	
Carboguard 635 ⁽¹⁾	296	1	
Carboguard 890 ⁽¹⁾	214	1	
Carboguard 893 SG LT ⁽¹⁾	318	1	
Carboguard 893 SG ⁽¹⁾	336	1	
Carbomastic 94 ⁽¹⁾⁽⁷⁾	120	1,7	
Carbomastic 94 TL ⁽¹⁾	95	1	
Carbomastic 15 ⁽¹⁾	88	1	
Carbomastic 242 ⁽¹⁾	327	1	
Carbomastic 615 ⁽¹⁾	172	1	
Carbozinc 858 ⁽¹⁾⁽⁷⁾	318	1,7	
Carbozinc 859 ⁽¹⁾	326	1	
Carbozinc 859 VOC ⁽¹⁾	95	1	
Rustbond ⁽¹⁾⁽⁴⁾	85	1	
Carbozinc 11 + Carboguard 893 SG ⁽¹⁾	479 336	1	
Carbozinc 11 + Rustbond ⁽¹⁾⁽⁴⁾	479 85	1,4	

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APPENDIX B: TOPCOAT LIST

Qualified Topcoat	VOC (g/L)	Thermo-Lag 3000-P	Notes
Carbocoat 8215 VOC	336	2,4	<p>(1) Approved for interior general purpose - exposed to temperature and humidity fluctuations during changing construction conditions.</p> <p>(2) Approved for interior conditioned space - fireproofing is under constant heat; temperature and humidity do not fluctuate.</p> <p>(3) Approved for exterior ratings - exposed to the elements.</p> <p>(4) Approved topcoats tested for clean room applications - Consult Carboline Technical Service for specific details prior to application.</p> <p>(5) For exterior projects, the following topcoats shall be used:</p> <p>Carbomastic 94 & 94 TL at 5 mils DFT. Carboguard 1340 at 2 mils DFT Carbothane 133 HB at 3 mils DFT Carbothane 133 MC at 3 mils DFT</p> <p>**Carbomastic 94 TL is the UL Category XKXC2 Approved Topcoat for Fire Resistive Applications. Alternate topcoat systems may be used with certifications other than UL. See UL Designs for details.</p>
Carbothane 133 MC	97	2	
Sanitile 845	97	2,4	
Carboguard 1340 Carbothane 133HB	95 383	1,2,3,5	
Carboguard 1340 Carbothane 133 MC	95 97	1,2,3,5	
Carbomastic 94	120	1,2,3,5	
Carbomastic 94 TL	95	1,2,3,5	

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APPENDIX C: UL DESIGN DETAILS

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Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

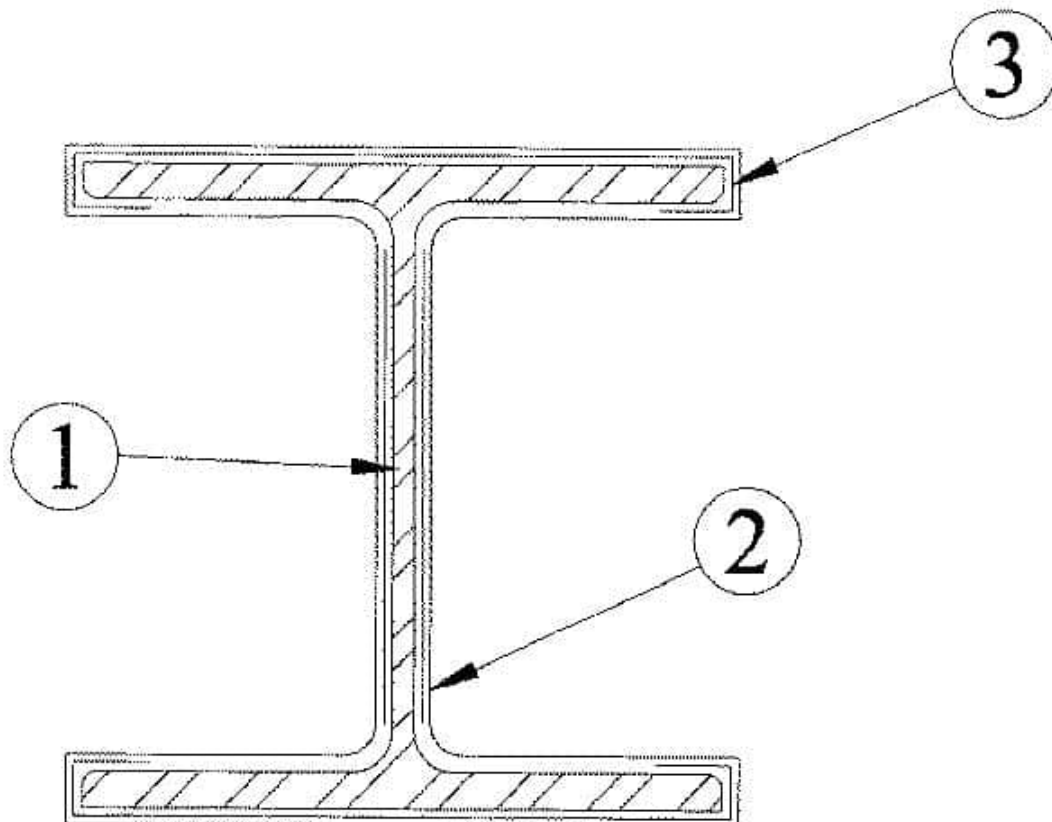
BYBU - Fire-resistance Ratings - ANSI/UL 1709

Design No. XR618

August 01, 2023

Ratings — 1/2, 1, 1-1/2, 2, 2-1/2, 3, and 4 Hr

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



1. **Steel Column** — Min W10X49 wide flange steel column.

2. **Mastic and Intumescent Coating*** — Spray applied in one or more coats to the thickness shown in the table below to column surfaces which must be free of dirt, loose scale and oil. Column surfaces to be primed with 2 mils of an epoxy primer. Coating lightly rolled after final coat with a paint roller.

Rating Hr	Min Thkns In.
1/2	0.078(+)
1	0.12
1-1/2	0.21
2	0.31
2-1/2	0.41
3	0.50
4	0.69

(+) Glass Fiber Mesh not required with this rating.

CARBOLINE CO — Types Thermo-Lag 3000-SP, Thermo-Lag 3000-P, Thermo-Lag 3000-SA, Thermo-Lag 3000-A, Thermo-Lag 3000-FC, Thermo-Lag E100, and Thermo-Lag E100S INVESTIGATED FOR UL 2431 CLASSIFICATION CATEGORY I- A and EXTERIOR ENVIRONMENTAL PURPOSE.

3. **Glass Fiber Mesh** — Nom 3/16 in. by 3/16 in. glass fiber mesh applied over each flange for the 1 through 4 hr ratings. In addition, the 1-1/2 hr through 3-1/2 hr shall have mesh placed in each web covering the whole web area. The mesh shall be placed at approximately mid-depth of the coating for the 1 and 1-1/2 hr ratings and at 0.12 in. for the remaining ratings.

4. **Top Coat*** — Type Carbomastic 94 TL topcoat applied over mastic and intumescent coating (Item 2) at 0.005 to 0.012 in. thicknesses.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2023-08-01

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- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
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- Only products which bear UL's Mark are considered Certified.

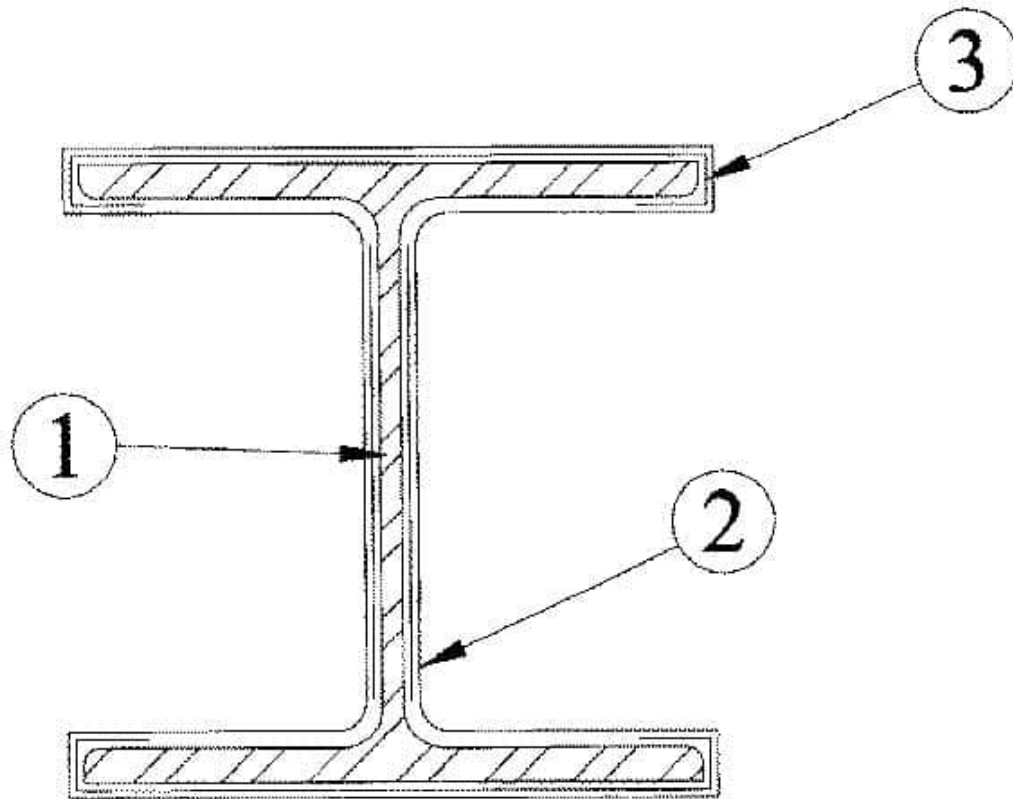
BYBU - Fire-resistance Ratings - ANSI/UL 1709

Design No. XR620

August 01, 2023

Ratings - 1, 1-1/2, 2, 2-1/2, 3 Hr (See Table)

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



1. **Steel Column** — Wide flange steel columns having a W/D ratio of .84 to 3.55 and a maximum flange width of 16-1/8 in. See table in Item 2. Table not intended to be all inclusive.

2. Mastic and Intumescent Coating — Spray applied in one or more coats to the thickness shown in the table below. Column surfaces which must be free of dirt, loose scale and oil. Column surfaces to be primed. Primer thickness approximately 0.0015 in. Coating lightly rolled after final coat with a paint roller.

CARBOLINE CO — Types Thermo-lag 3000-SP, Thermo-Lag 3000-P, Thermo-Lag 3000-SA, Thermo-Lag 3000-A, Thermo-Lag 3000-FC, Thermo-Lag E100, and Thermo-Lag E100S INVESTIGATED FOR UL 2431 CLASSIFICATION CATEGORY I- A and EXTERIOR ENVIRONMENTAL PURPOSE.

Wide Flange Steel Specifications			Time (min)				
Steel Size	W/D	HP/A	60 Thkns Required, In.	90 Thkns Required, In.	120 Thkns Required, In.	150 Thkns Required, In.	180 Thkns Required, In.
W12X279	3.48	39	0.12	0.13	0.19	0.25	0.35
W14X311	3.26	41	0.12	0.14	0.20	0.26	0.37
W12X252	3.19	42	0.12	0.14	0.20	0.26	0.37
W14X283	3.00	45	0.12	0.14	0.21	0.27	0.39
W12X230	2.94	46	0.12	0.14	0.21	0.27	0.39
W14X257	2.75	49	0.12	0.15	0.22	0.28	0.41
W12X210	2.72	49	0.12	0.15	0.22	0.28	0.41
W14X233	2.52	53	0.12	0.16	0.22	0.29	0.42
W14X228	2.44	55	0.12	0.16	0.23	0.30	0.43
W14X211	2.30	58	0.12	0.16	0.23	0.31	0.44
W12X170	2.26	59	0.12	0.16	0.24	0.31	0.44
W36X300	2.19	61	0.12	0.16	0.24	0.31	0.45
W14X193	2.12	63	0.12	0.17	0.24	0.32	0.45
W36X280	2.07	65	0.12	0.17	0.24	0.32	0.46
W12X152	2.04	66	0.12	0.17	0.25	0.32	0.46
W14X176	1.95	69	0.12	0.17	0.25	0.33	0.47
W36X260	1.92	70	0.12	0.17	0.25	0.33	0.47
W33X241	1.88	71	0.12	0.18	0.25	0.33	0.47
W12X136	1.84	73	0.12	0.18	0.26	0.33	0.48
W10X112	1.81	74	0.12	0.18	0.26	0.34	0.48
W14X159	1.77	75	0.12	0.18	0.26	0.34	0.48
W30X211	1.76	76	0.12	0.18	0.26	0.34	0.48
W33X221	1.72	78	0.12	0.18	0.26	0.34	0.49
W36X230	1.71	78	0.12	0.18	0.26	0.34	0.49
W10X100	1.63	82	0.12	0.18	0.27	0.35	0.49
W21X147	1.60	84	0.12	0.19	0.27	0.35	0.49
W33X201	1.58	85	0.12	0.19	0.27	0.35	0.50

W14X132	1.54	87	0.12	0.19	0.27	0.36	0.50
W24X146	1.48	91	0.12	0.19	0.28	0.36	0.50
W18X119	1.47	91	0.12	0.19	0.28	0.36	0.50
W12X106	1.47	91	0.12	0.19	0.28	0.36	0.50
W10X88	1.45	92	0.12	0.19	0.28	0.36	N/A
W14X120	1.40	95	0.12	0.19	0.28	0.37	N/A
W33X152	1.37	97	0.12	0.20	0.28	0.37	N/A
W8X67	1.36	98	0.12	0.20	0.28	0.37	N/A
W21X122	1.34	100	0.12	0.20	0.28	0.37	N/A
W12X96	1.34	100	0.12	0.20	0.28	0.37	N/A
W18X106	1.32	101	0.12	0.20	0.29	0.37	N/A
W36X150	1.28	104	0.12	0.20	0.29	0.38	N/A
W10X77	1.28	104	0.12	0.20	0.29	0.38	N/A
W21X93	1.24	108	0.12	0.20	0.29	0.38	N/A
W21X111	1.23	109	0.12	0.20	0.29	0.38	N/A
W14X82	1.22	109	0.12	0.20	0.29	0.38	N/A
W12X87	1.22	110	0.12	0.20	0.29	0.38	N/A
W24X117	1.20	112	0.12	0.20	0.29	0.38	N/A
W8X58	1.19	112	0.12	0.20	0.29	0.38	N/A
W14X99	1.17	114	0.12	0.20	0.30	0.39	N/A
W36X135	1.16	115	0.12	0.20	0.30	0.39	N/A
W10X68	1.14	117	0.12	0.21	0.30	0.39	N/A
W21X101	1.12	119	0.12	0.21	0.30	0.39	N/A
W12X79	1.11	120	0.12	0.21	0.30	0.39	N/A
W18X86	1.08	123	0.12	0.21	0.30	0.39	N/A
W18X71	1.08	124	0.12	0.21	0.30	0.39	N/A
W14X90	1.07	125	0.12	0.21	0.30	0.40	N/A
W16X77	1.06	126	0.12	0.21	0.30	0.40	N/A
W27X94	1.02	130	0.12	0.21	0.31	0.40	N/A
W14X68	1.03	130	0.12	0.21	0.31	0.40	N/A
W10X60	1.02	131	0.12	0.21	0.31	0.40	N/A
W30X99	1.00	134	0.12	0.21	0.31	0.40	N/A
W8X48	1.00	134	0.12	0.21	0.31	0.40	N/A
W21X73	0.99	135	0.12	0.21	0.31	0.40	N/A
W18X76	0.96	139	0.12	0.21	0.31	0.41	N/A

W16X57	0.95	140	0.12	0.21	0.31	0.41	N/A
W16X67	0.93	144	0.12	0.21	0.31	0.41	N/A
W12X65	0.92	145	0.12	0.21	0.31	0.41	N/A
W10X54	0.92	145	0.12	0.21	0.31	0.41	N/A
W12X50	0.91	147	0.12	0.21	0.31	0.41	N/A
W10X45	0.89	151	0.12	0.21	0.31	0.41	N/A
W18X55	0.85	158	0.12	0.21	0.31	0.41	N/A
W12X53	0.85	157	0.12	0.21	0.31	0.41	N/A
W16X50	0.84	159	0.12	0.21	0.31	0.41	N/A
W10X49	0.84	159	0.12	0.21	0.31	0.41	N/A

For product Alternate Limiting Temperature Table click here: [XR620-1](#)

3a. **Carbon Fiber Mesh** — Nom 3/16 in. by 3/16 in. 3.50 oz/sq yd carbon fiber mesh to cover the entire flange face, flange tips, and 1/2 the depth of the inner flange. The flange mesh shall be applied in a horizontal orientation with adjacent horizontal pieces of mesh overlapped a minimum of 1 in. The mesh shall be applied to the web in a vertical orientation and shall span the width and length of the web. The depth at which the reinforcing mesh is placed shall be in accordance with the table below:

Thickness of Protection Material (in.)	Depth of Placement of Reinforcing Mesh (in.)
0.12 - 0.24	Approximate mid point of
0.24 and greater	0.12

3b. **Steel Mesh** — (As an alternate to item 3a) Nom. 19 ga. welded wire 1/2 in by 1/2 in. by 0.08 in. dia. (12.7 mm. by 12.7mm. by 2 mm. Dia) galvanized mesh to cover the entire flange face, flange tips, and 1/2 the depth of the inner flange. The flange mesh shall be applied in a horizontal orientation with adjacent horizontal pieces of mesh overlapped a minimum of 1 in. The mesh shall be applied to the web in a vertical orientation and shall span the width and length of the web. For thicknesses less than 0.24 in. (6 mm.) the mesh shall be located at the steel surface. For thicknesses greater than 0.24 in. (6 mm.) the mesh shall be located at 0.12 in. (3mm) from the steel surface. Optional, Nominal 12 ga. steel pins may be secured to the surface of the steel to aid in the placement of the mesh.

4. **Top Coat*** — Type Carbomastic 94 TL topcoat applied over mastic and intumescent coating (Item 2) at 0.005 to 0.012 in. thicknesses.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2023-08-01

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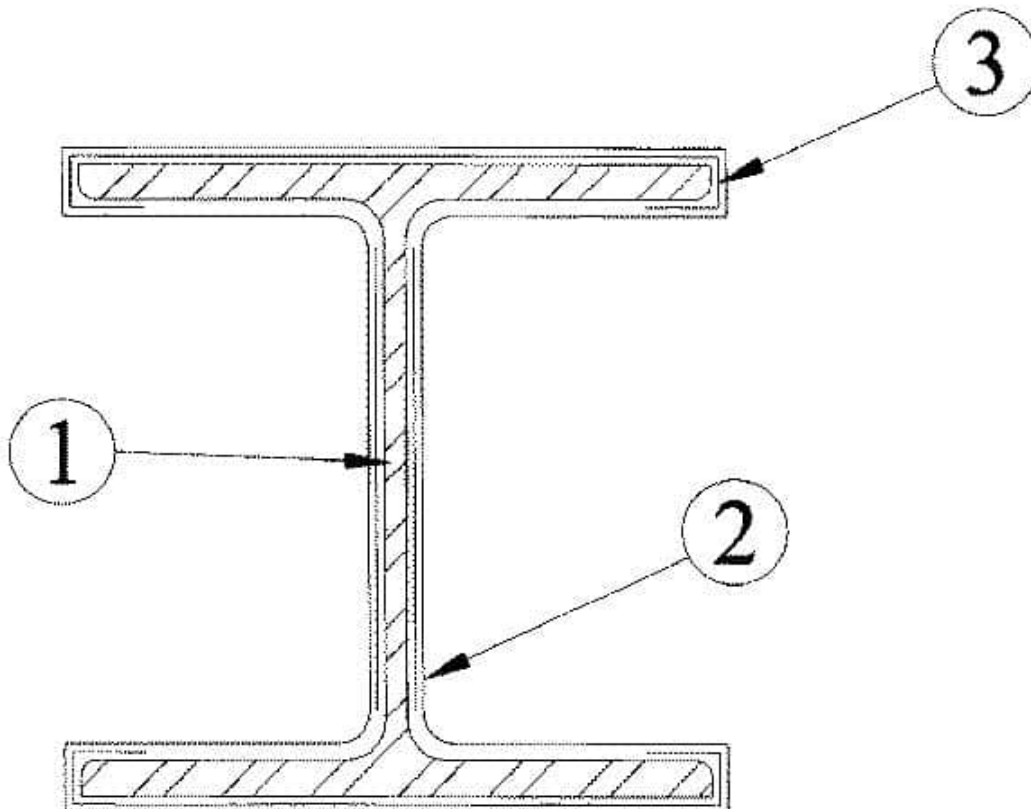
BYBU - Fire-resistance Ratings - ANSI/UL 1709

Design No. XR621

December 23, 2021

Rating - 3 Hr

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



1. **Steel Column** — W14 x 342 wide flange steel column.

2. **Mastic and Intumescent Coating** — Spray applied in one or more coats to the required thickness. Column surfaces which must be free of dirt, loose scale and oil. Column surfaces to be primed. Primer thickness approximately 0.0015 in. Coating lightly rolled after final coat with a paint roller. Coating applied in accordance with manufacturer's instruction to a min thickness of 0.29 in.

CARBOLINE CO — Types Thermo-lag 3000-SP, Thermo-Lag 3000-P, Thermo-Lag 3000-SA, Thermo-Lag 3000-A and Thermo-Lag 3000-FC INVESTIGATED FOR UL 2431 CLASSIFICATION CATEGORY I- A and EXTERIOR ENVIRONMENTAL PURPOSE.

3. **Carbon Fiber Mesh** — Nom 3/16 in. by 3/16 in. 3.50 oz/sq yd carbon fiber mesh to cover the entire flange face, flange tips, and 1/2 the depth of the inner flange. The flange mesh shall be applied in a horizontal orientation with adjacent horizontal pieces of mesh overlapped a minimum of 1 in. The mesh shall be applied to the web in a vertical orientation and shall span the width and length of the web. The reinforcing mesh shall be imbedded in the mastic and intumescent coating (Item 2) at a depth of approximately 0.12 in.

4. **Top Coat*** — Type Carbomastic 94 TL topcoat applied over mastic and intumescent coating (Item 2) at 0.005 to 0.012 in. thicknesses.

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Last Updated on 2021-12-23

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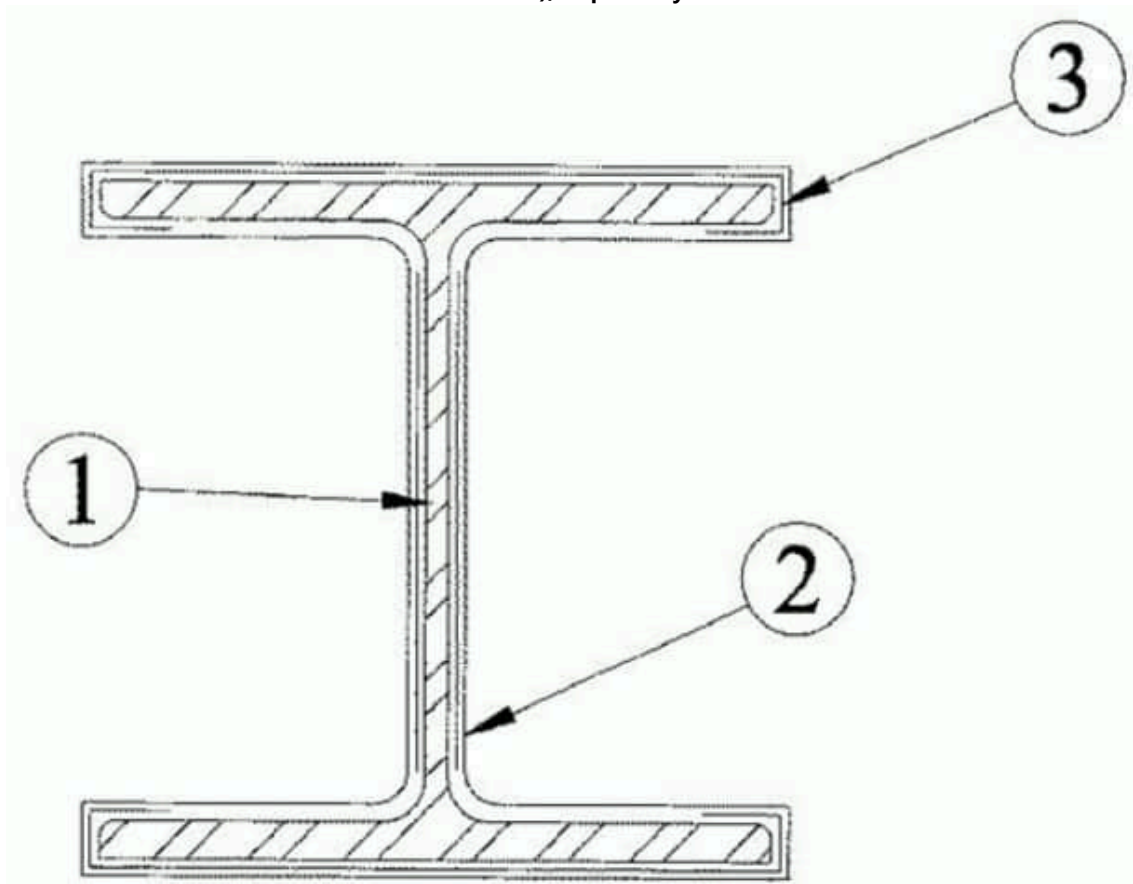
BYBU - Fire-resistance Ratings - ANSI/UL 1709

Design No. XR649

December 23, 2021

Rating — 3-1/2 Hr

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



1. **Steel Column** — Min W10X49 wide flanged steel column. Hot dipped galvanized steel per ASTM A123. The column surfaces shall be prepared in accordance with the manufacturer's recommendations for galvanized steel and then primed with 3.5 mils of a cross-linked epoxy primer.

2. **Mastic and Intumescent Coating*** — Spray applied in one or more coats to the thickness shown in the table below over the primer coat. Coating lightly rolled after final coat with a paint roller.

Rating Hr	Min Thkns In.
3-1/2	0.664

CARBOLINE CO — Types Thermo-Lag 3000-SP, Thermo-Lag 3000-P, Thermo-Lag 3000-SA, Thermo-Lag 3000-A and Thermo-Lag 3000-FC. INVESTIGATED FOR UL 2431 CLASSIFICATION CATEGORY I- A and EXTERIOR ENVIRONMENTAL PURPOSE.

3. **Glass Fiber Mesh** — Nom 3/16 in. by 3/16 in. glass fiber mesh identified as FP-Fiberglass Mesh applied over each flange with additional mesh placed in each web covering the entire web area. The mesh shall be placed at approximately 0.12 in. from the column surface.

4. **Top Coat* - (Not shown)** — Type Carbomastic 94 TL topcoat applied over mastic and intumescent coating (Item 2) at 0.005 to 0.012 in. thicknesses.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2021-12-23

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APPLICATION MANUAL

THERMO-LAG® 3000-SP



APPENDIX D: MESH REINFORCEMENT DETAILS

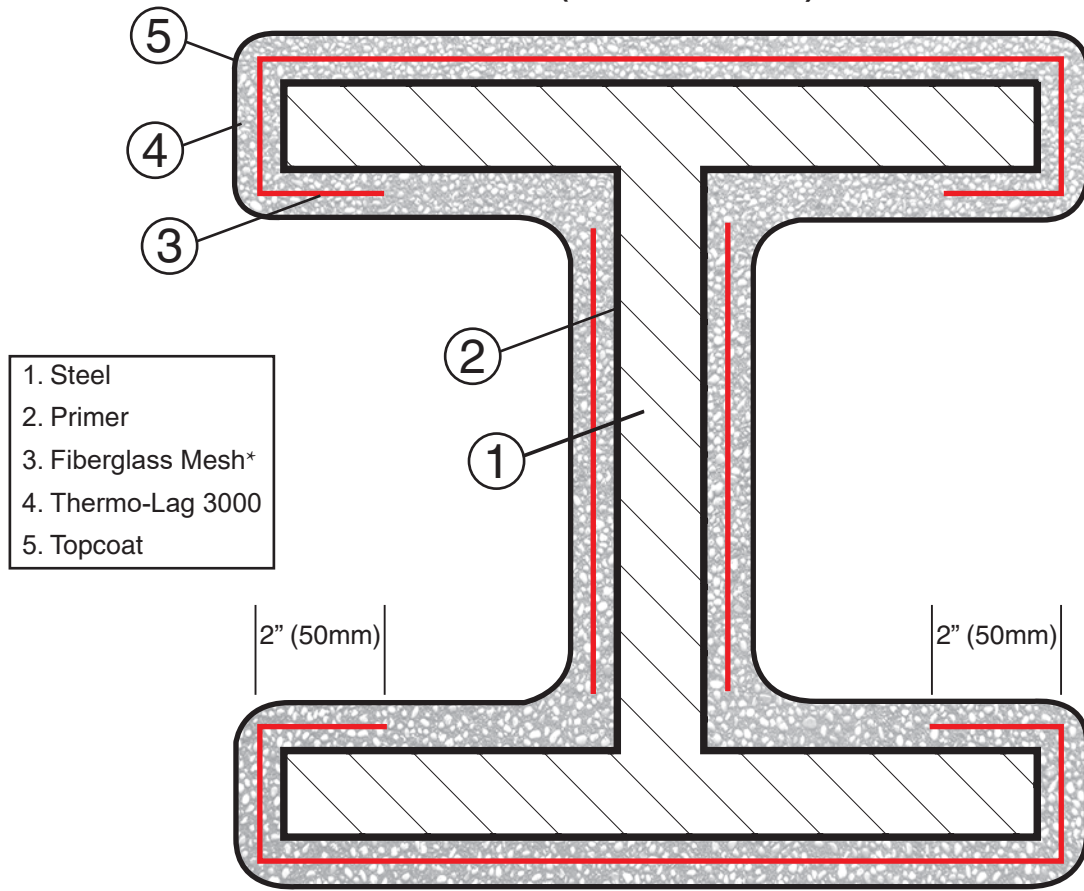
Document No.	Document Title	Revision	Date	Page
032921-IFRM-3000SP-	Thermo-Lag 3000-SP	A	04.21.25	27

THERMO-LAG 3000

APPLICATION PROCEDURES

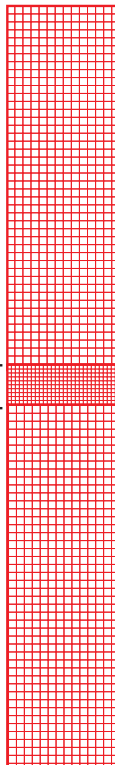
FOR WIDE FLANGE SECTIONS

(UL 1709 XR618)



* Nom 3/16 in. by 3/16 in. glass fiber mesh applied over each flange for the 1 through 4 hr ratings. In addition, the 1-1/2 hr through 3-1/2 hr shall have mesh placed in each web covering the whole web area. The mesh shall be placed at approximately mid-depth of the coating for the 1 and 1-1/2 hr ratings and at 0.12 in. for the remaining ratings.

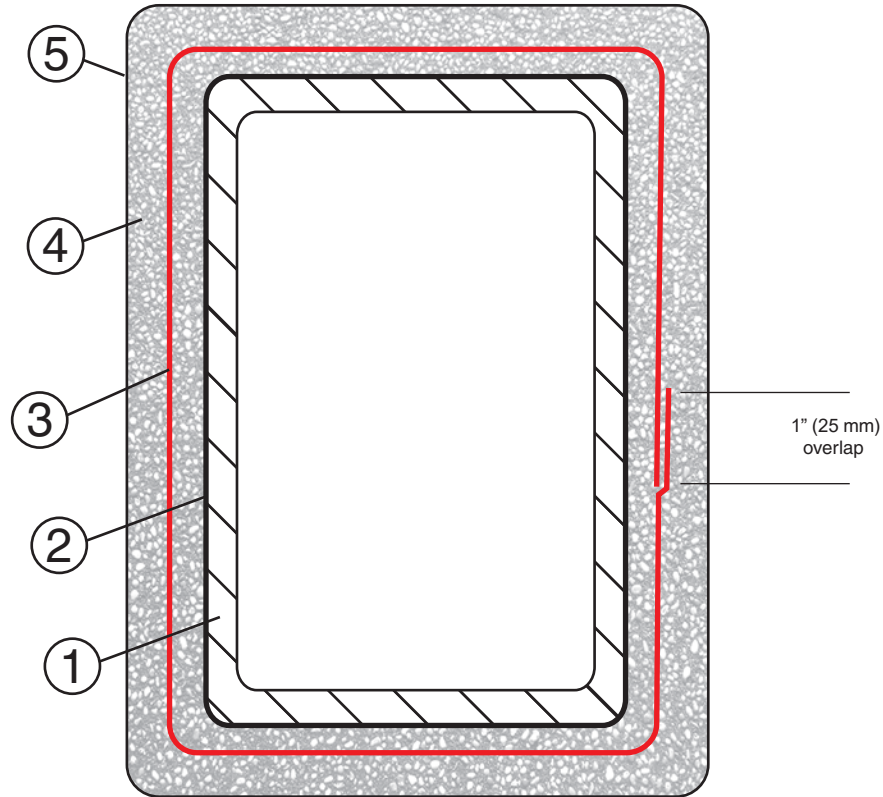
1" Overlap



THERMO-LAG 3000

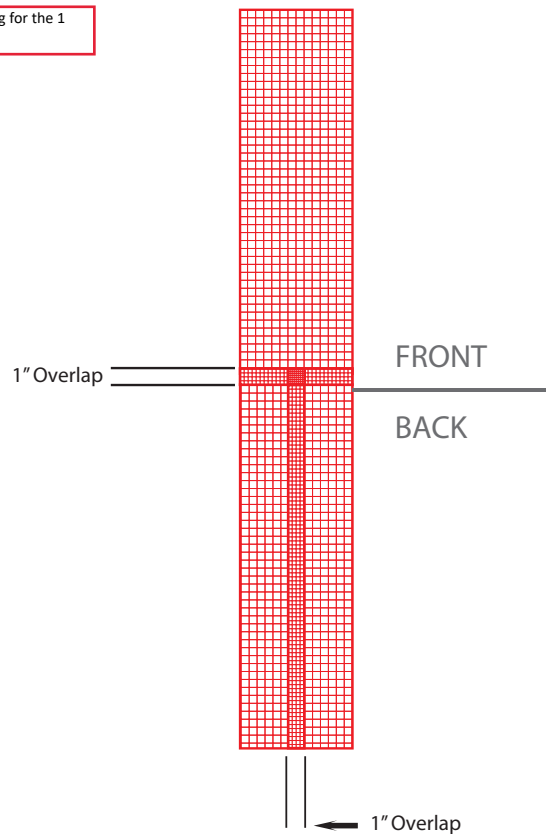
APPLICATION PROCEDURES FOR RECTANGULAR HOLLOW SECTIONS

(UL 1709 XR618)



- 1. Steel
- 2. Primer
- 3. Fiberglass Mesh*
- 4. Thermo-Lag 3000
- 5. Topcoat

* The mesh shall be placed at approximately mid-depth of the coating for the 1 and 1-1/2 hr ratings and at 0.12 in. for the remaining ratings.



THERMO-LAG 3000

APPLICATION PROCEDURES FOR ROUND HOLLOW SECTIONS

(UL 1709 XR618)

