

# VERMITEX® 'TH'

# SPECIFICATION

## FIRE PROTECTION FOR TUNNEL LININGS & PETRO-CHEMICAL PLANT

## 1.0 **GENERAL**

### 1.1 **SCOPE**

This specification consists of all Labour, Materials, Equipment and Services necessary to complete the supply and installation of all the required spray applied cementitious (cement) fireproofing for structural steel members such as columns, beams, concrete upgrade, joists and metal roof/floor decking assemblies under hydrocarbon fire situation and specified hereinafter, including but not limited to the following:

- (i) Spray-on fireproofing of structural steel and other substrates
- (ii) Protective coat over fireproofing in specific areas (where required)
- (iii) Preparation of surfaces

This specification is to be read in conjunction with drawings and documents referenced in the tender package.

This specification precludes the use of Ceramic, Mineral or Cellulose Fibre, Magnesium Oxychloride or Intumescent coating fireproofing material.

### 1.2 **APPLICABLE STANDARDS**

The following Standards may be referred to in this specification:

AS 1315	Portland Cement;
AS1530: 3 & 4	Methods for Fire Tests on Building Materials, Components and Structures;
AS 3784	Coatings for Fire Protection of Building Elements;
AS 4100	Steel Structures;
BS 476-1987	Fire Tests on Building Materials and Structures. Part 20 – Method for Determination of the Fire Resistance of Elements of Construction (General Principles)
BS 5950:8-1990	Structural Use of Steelwork in Building
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C847-95	Metal Lath
ASTM E736-92	Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ISO 834-1	Fire-resistance tests -- Elements of building construction -- Part 1: General requirements 6.1.1 Heating Curve
AS/NZS 3013: 1995	Electrical installations - Classification of the fire and mechanical performance of wiring systems. Appendix A
AS/NZS 3837: 1998	Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter
AS/NZS ISO 9001-2000	Quality Management Systems - Requirements

All material and installation processes must comply with the applicable provision of the above listed standards.

### 1.3 AUTHORITIES AND LEGISLATION

All materials and workmanship shall comply in all respects with the provisions and the requirements set out by:

- 1) The approved Independent Certifying Authority (such as Lloyds, DNV, Bureau Veritas, Consultant)
- 2) Government body or Building Code (...Insert Code Name )
- 3) Other Regulators under the jurisdiction of Maritime bodies, professional associations etc

The contractor shall have responsibility to perform all the required tests and make all the required submissions in order to obtain all the necessary approvals.

### 1.4 SUBMISSIONS

The following submissions are required:

- (i) Name of Material Manufacturer including a full description of the proposed fireproofing system.
- (ii) Manufacturer's Product Information including design and Installation specification and test data instructions.
- (iii) Proposed material thicknesses for each type of application.
- (iv) Performance Testing:

The following test results for all test procedures shall be submitted with the tender:

- (a) AS 1530 Part 4:  
Fire Resistance Tests of Elements of Building and Construction
- (b) BS 476:20 & BS 476:21 Appendix D  
Fire Tests on Building Materials and Structures. Method for Determination of the Fire Resistance of Elements of Construction (General Principles)
- (c) AS 1012: 9 & 12  
Methods of Testing Concrete
- (d) DCZ 062  
Durability Opinion on VERMITEX® 'TH' when Applied in a Road Tunnel as a Fire Resistance Lining
- (e) A current Certificate of Registration from a JAS-ANZ approved third party accrediting body certifying that the material manufacturer has a Quality Management System in place which complies with AS/NZS ISO 9001:2000.

### 1.5 APPLICATOR QUALIFICATIONS

The Applicator shall be Licensed or otherwise approved by the manufacturer of the fireproofing material. The Applicator(s) shall be familiar with the latest Application Manuals as issued by the manufacturer.

### 1.6 WARRANTIES

The Applicator shall undertake and assume total responsibility for the spray fireproofing to the substrates.

The Applicator shall repair or replace sprayed-on fireproofing which has excessively cracked or dusted, flaked, peeled away from the substrate, or has otherwise failed to fulfil the performance criteria, due to defective materials and/or workmanship.

**1.7 MOCK-UP**

*Spec-Note: May include this Article for Large projects only.*

- 1) Apply sample section of [ ... ] m<sup>2</sup> in size to representative substrates on site.
- 2) Comply with project requirements as to thickness, density of application, fire rating, and finish Texture.
- 3) Allow for examination of installation within [one] [ ... ] hour of application to determine variance due to shrinkage, temperature, and humidity.
- 4) Where shrinkage and cracking are evident, adjust water/mixture ratio and method of application as necessary. Refer to Manufacturer's notes on the subject.  
*Spec-Note: Time duration for examination should be determined by expected shrinkage, temperature, and humidity conditions during drying time. Refer to manufacturer for technical assistance.*
- 5) If accepted, mock-up will demonstrate minimum standards for the work. Mock-up may [not] remain as part of the work.

**1.8 TESTING AND INSPECTION BY CLIENT**

- 1) The Client [will] [may] appoint and pay for services of a Testing Agency to verify compliance with specified requirements.
- 2) The Applicator shall correct all deficient spray work and pay for further inspection and testing required to verify compliance with specified requirements.

**2.0 MATERIALS****2.1 DESCRIPTION**

The fireproofing system shall be a surface-adhered spray applied material, to be proposed by the system manufacturer, complying with the fire resistance ratings as required by the Building Authorities and Regulations governing such applications and equal in all respects to VERMITEX® 'TH' as manufactured by L & A Fazzini Manufacturing Pty Ltd.

A 'Primer/Bond-coat' equal to VERMITEX® '7' must be applied before proceeding with the main Fireproofing coating. The Bond coat shall be rough in texture (3-5 mm – i.e. low air pressure) and should cover approximately 50 to 75% of the steel substrate. The Bond-coat is used to prevent slumping of main coatings as well as enhance the stickability to the substrate. Where applicable, a veneer waterproofing coat may be spray-applied over VERMITEX® 'TH' in accordance with manufacturer's specification and recommendation, to achieve a total cover to areas as specified.

**All materials to contain no asbestos or toxic substances.**

**2.2 PERFORMANCE CRITERIA**

The fireproofing material shall comply with the following requirements and be manufactured by a Company which has a current Quality Management System in place in accordance with AS/NZS ISO 9001:2000.

▪ **EARLY FIRE HAZARD PROPERTIES (AS1530, PART 3):**

- |                           |           |
|---------------------------|-----------|
| a) Ignitability Index:    | 0         |
| b) Spread of Flame Index: | 0         |
| c) Heat Developed Index:  | 0         |
| d) Smoke Developed Index: | 1 or less |

▪ **DENSITY (AS 3784):**

The fireproofing material shall not, exceed a dry in-place density of 600 kg/m<sup>3</sup> for exterior use.

▪ **MATERIAL THICKNESS:**

The thickness of the fireproofing material shall be determined from the manufacturer's schedules for the various fire resistance periods and element sizes.

The schedules shall have been derived from the time-temperature data obtained from the standard fire test series conducted by the CSIRO in accordance with AS 1530 Part 4 or BS 476 Part 20 & Part 21 Appendix D. For Steel elements the results shall have been subjected to a least-square regression analysis using the model specified within Section 12 of the Australian Steel Structures Code, AS 4100-1990. Thickness data submitted shall have certification from the CSIRO that it conforms to Australian and British Standards and the applied thicknesses for specific FRL's shall not exceed the following:

**VERMITEX® 'TH' thickness range**

Steel members configuration	3 sided	4 sided
Hp/A Value (m <sup>-1</sup> )	47.1 to 282.6	55 to 439.6
VERMITEX® 'TH' thickness for 60/ - / - FRL	8-11 mm	12-18 mm
VERMITEX® 'TH' thickness for 90/ - / - FRL	8-17 mm	12-24 mm
VERMITEX® 'TH' thickness for 120/ - / - FRL	11-22 mm	12-31 mm
VERMITEX® 'TH' thickness for 180/ - / - FRL	21-34 mm	19-43 mm
VERMITEX® 'TH' thickness for 240/ - / - FRL	30-45 mm	30-56 mm

**No other form of documentary evidence will be accepted as proof of conformance.**

▪ **REINFORCEMENT:**

Mechanical reinforcement is not required for interpolated thickness specified in the Thickness Tables, however when specified by the Client or their representative and especially when the following conditions are encountered mechanical reinforcement should be considered:

- i) Beam Web > 1500 mm deep
- ii) Beam Flange > 1000 mm wide
- iii) Elements subject to continuous severe, Atmospheric Conditions and vibrations
- iv) Thermal or Construction movement is likely

Where mesh is specified by the Client or their representative, the installation of mechanical reinforcement should follow the contour of the element, with the mesh located approximately 2/3 through the spray thickness.

▪ **CORROSION:**

The fireproofing material shall have a non corrosive effect on steel.

### 2.3 DESIGN CRITERIA

Fire rating spray fireproofing shall be applied to meet the requirements of the Authority [..Insert name] or Building Code of [..... insert Country], on all exposed surfaces to provide the required fire resistance level (FRL) as set out below.

*Spec-Note: Example of Design Criteria Table*

<b>PROJECT: THE GRAND HOTEL</b>			
<b>Area</b>	<b>Element</b>	<b>FRL (Hours)</b>	<b>Protection Required</b>
Ground Floor	Floor Beams & Framing	4	Waterproof Protective Overcoat
Level 2	Floor Beams & Framing	3	Nil

## **2.4 HANDLING, STORAGE, AND PROTECTION**

All fireproofing materials shall be delivered in original unopened packages bearing the name of the manufacturer, the brand together with proper approvals and instructions for its use on site.

The material shall be kept dry until ready for use. The material shall be kept off the ground under cover and away from sweating walls and other damp surfaces. All bags that have been exposed to water before use shall be discarded. Stock of material is to be rotated and used prior to its expiration date.

## **3.0 INSTALLATION OF FIREPROOFING MATERIAL**

### **3.1 INSPECTION**

Prior to the application of the fireproofing material, an inspection shall be carried out to ensure that all surfaces and the work environment are acceptable for work to commence.

Ensure that all other attachments, such as clips, sleeves, angles etc. have been installed by others as required prior to the application of the Fireproofing materials.

Ducts, piping, conduits or other suspended equipment that interfere with the uniform application of the fireproofing material shall be positioned after the application of the sprayed fireproofing.

### **3.2 PREPARATION**

#### ▪ GENERAL:

All surfaces to receive sprayed fireproofing shall be free of oil, grease, paints and primers, loose mill scale, dirt and other foreign substances which may impair proper adhesion of the fireproofing to the substrate. Where necessary, the cleaning of surfaces shall be the responsibility of the General Contractor, as outlined in other parts of the relevant specifications.

Consult the fireproofing manufacturer for compatibility of VERMITEX® 'TH' with primer coatings to be applied over the steel elements.

#### ▪ PRICK-UP COAT:

When not employing mechanical reinforcement a 'Primer/Bond-coat' equal to VERMITEX® '7' must be applied before proceeding with the main Fireproofing coating. The Bond coat shall be rough in texture (3-5 mm – i.e. low air pressure) and should cover approximately 50 to 75% of the steel substrate. The Bond-coat is used to prevent slumping of main coatings as well as enhance the stickability to the substrate.

#### ▪ MECHANICAL REINFORCEMENT:

As referred in Section 2.2 and where specified by the Client mechanical retention in the form of galvanised wire netting (25mm x 25mm x 1mm) or galvanised expanded metal lath (1.84 kg/m<sup>2</sup>) shall be used. For exterior conditions preference should be given to hot dip galvanised square mesh. Plastic fastenings may be used when they act as a temporary fixing only to assist location of retaining mesh.

#### ▪ CURING COMPOUNDS FOR CEMENT BASED SPRAYS:

On dry, windy days, or during periods when adverse weather conditions could result in plastic shrinkage cracking, application of a curing compound immediately after final finishing and before all free water on the surface has evaporated will help prevent the formation of cracks. Liquid membrane-forming compounds consisting of waxes, resins, chlorinated rubber, and other materials can be used to retard or reduce evaporation of moisture from cement based coatings. Curing compounds should be able to maintain the relative humidity of the concrete surface above 80% for seven days to sustain cement hydration.

Curing compounds should be applied by hand-operated or power-driven spray equipment immediately after final spraying of the cementitious compound. The surface should be damp when the coating is applied. Power-driven spray equipment is recommended for uniform application of curing compounds on large area projects. Normally only one smooth, even coat is applied at a typical rate of 3 to 4 m<sup>2</sup> per litre; but products may vary, so manufacturers recommended application rates should be followed. Complete coverage of the surface must be attained because small holes in the membrane will allow the evaporation of moisture from the sprayed material.

Curing compounds might prevent bonding between subsequent coatings; consequently they should not be used when multiple coatings are necessary. Curing compound manufacturers should be consulted to determine if their product is suitable for the intended application. Curing compounds should conform to ASTM C309.

#### ▪ WORK SEQUENCE:

Where the sprayed-on fireproofing material will be subject to heavy traffic or consequential damage by other trades; such as around temporary construction openings, the fireproofing works shall be scheduled at the final phase of the construction program. Where this is inappropriate, measures shall be taken to minimise damage by physically protecting the fireproofing materials during the course of construction.

### 3.3 APPLICATION

The sprayed fireproofing material, protective overcoat, curing compounds, and prick-up coat are to be mixed and applied in accordance with the manufacturer's written instructions.

Installation shall only be carried out by an approved applicator with experience in the spraying of contoured fireproofing materials. Exercise care to instate material completely into inverted corners, and to build up work to full thickness at projecting corners. Cover substrate in a monolithic blanket of uniform density and texture.

Application shall be made by trowel or other approved methods in confined areas, such as on surfaces close to walls or other obstructions.

Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work. Where specified any protective coatings shall be applied over fireproofing strictly in accordance with the manufacturer's recommendations and instructions.

Provide masking protection to immediate areas as much as possible to limit over spray. Remove excess spray and spillage promptly. Where sprayed fireproofing is damaged by other trades it shall be Repaired and Patched under this section and paid for by the trade(s) causing the damage.

### 3.4 PRECAUTIONS

No fireproofing shall be applied prior to the placement of concrete has been completed. Temperature and enclosure conditions shall be as required by the fireproofing manufacturer.

Provisions shall be made for ventilation (but not excessively) to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation may have to be provided by the

Main Contractor. Refer to Section 3.2 - CURING COMPOUNDS FOR CEMENT BASED SPRAYS for advice on Dryouts surface shrinkage.

Portland cement based materials are alkaline and may have a corrosive effect on aluminium and aluminium based coated materials. Use suitable protective means to prevent the VERMITEX® 'TH' coming into contact with these materials.

### **3.5 CLEANUP**

Upon completion of the works, remove from site all equipment and legally dispose off all unused packaging, materials, containers, equipment, and the like. Remove all excess material and over spray from walls and other adjacent surfaces that may have received over spray.

All exposed wall and floor areas shall be left in a broom-clean condition.

### **4.0 QUALITY ASSURANCE**

Before commencement of any work the Client's Representative shall be presented with a copy of the current Certificate of Registration from a JAS-ANZ approved third party accrediting body certifying that the material manufacturer has a Quality Management System in place which complies with AS/NZS ISO 9001: 2000.

The architect may designate a qualified Project Quality Inspector who shall have the duties listed below and adhering to the guidelines set out in "Inspection Procedure for Field Applied Sprayed Fire Protection Materials":

- Check all conditions of application and approve same prior to commencing application of any area.
- Resolve, with the Main Contractor, any difficult application conditions (obstructed areas).
- Monitor the application of the fireproofing to ensure compliance with all requirements and Works Method Statement.
- Check all fireproofing progressively for compliance with thickness requirements.
- Maintain a daily log of all quality assurance inspections, noting any defects and corrective work.
- Submit a quality assurance inspection report at the completion of works, or section as required, attaching copies of the daily log.

### **REJECTIONS:**

Defective material or workmanship shall be rejected. All rejected work or materials shall be repaired or replaced by the Applicator at their own expense and to the satisfaction of the Main Contractor. No extension of time shall be granted for any delays caused by rejection.

All reports shall be inspected by an authorised person prior to a formal rejection letter being issued.