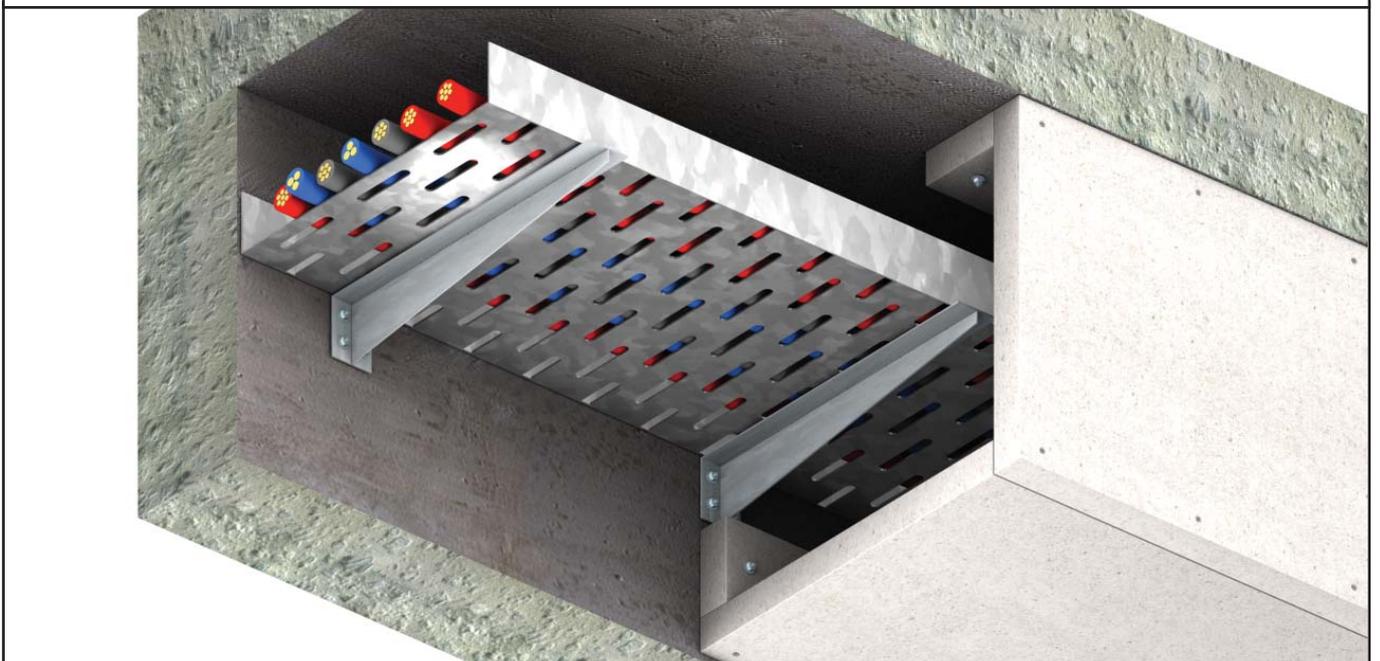
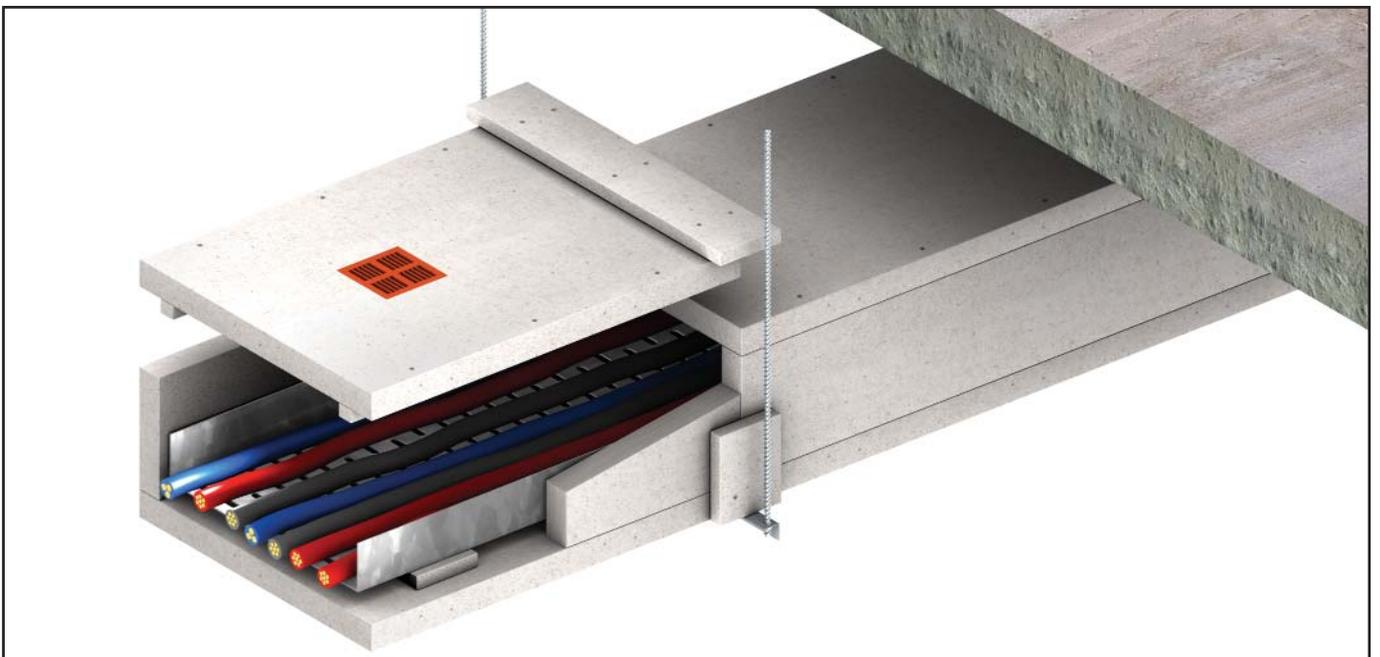


Promat



PROMATECT®-H/L/L500 Electrical Cable Enclosure (External Fire)



Introduction

Electrical and mechanical (E&M) services require fire protection for the following reasons:

- To maintain function of certain essential electrical and/or mechanical systems and services,
- To prevent fire, smoke and toxic fume propagation from one building compartment to another.

It is necessary to ensure the continued function of essential electrical systems and services is maintained during fire, for a specified period of time, until all the building occupants have escaped. Electrical systems that need protection from fire may include:

- Electrical operated fire alarms,
- Emergency escape route lighting,
- Electrical operated extinguishing systems,
- Smoke extraction vent systems,
- Power supply for fire service elevators in high-rise buildings,
- Water mains supply and pumps servicing sprinkler systems,
- Essential life support and/or computer, communication or information technology networks.

It is worth noting that most electrical services and to some extent mechanical services have a high component of plastic materials such as polyvinylchloride, polypropylene, polyethylene, synthetic rubbers etc. The risks associated with these combustible plastics are such that fire can and will spread or propagate through the services. Intensive combustion also means that plastics frequently release toxic and corrosive fumes that can include particulates, unburned fuel, carbon dioxide and carbon monoxide which are not only harmful to the building and its contents but also to its occupants. Such fires can also cause the following problems:

- Production of corrosive and extremely toxic gases,
- Long term destruction of construction and related equipment,
- Smoke development and toxic gases in corridors and escape routes,
- Difficult evacuation,
- Impede fire rescue activities by fire fighters.

Reliability Of Fire Resistant Cables

Typical uses of cables to, in and from Electrical and Mechanical enclosures include fire alarms, emergency lighting, addressable alarm systems, CCTV systems, emergency power supplies and smoke and fire shutters. These cables are normally designed to meet the standards for Fire Detection and Alarm Systems in BS5839: Part 1 and Codes of Practice for Emergency Lighting in BS5266: Part 1.

Most fire resistant cables have been subjected to tests in accordance with BS6387: 1994 "Specification for performance requirements for cables required to maintain circuit integrity under fire conditions" and/or IEC60331-11, 21, 23 & 25 "Test for electric cables under fire conditions – circuit integrity".



Unfortunately, these standards only test single cables, without any support system, exposed to a small gas flame by means of an elongated Bunsen burner. The heat applied during the test is localised to a small area. While such a test may be adequate for small cables carefully secured directly to a fire resisting wall or floor, it is arguably not suitable to assess the fire performance of larger cables or bunches of cables, exposed to a fully developed fire on all sides, particularly if they are supported on a suspended cable tray which may pass through compartment walls or floors.

Although the cables may achieve the highest classification of the standard, they may not survive as expected if they are exposed on all sides to a fully developed fire, for example, the ISO834 time-temperature fire curve.

Fire Resistance Test Standards For Cable Protection Systems

The German standards DIN4102, "Fire behaviour of building materials and building components", Parts 11 and 12 specify fire resistance test for cable protection systems that simulate a fully developed fire scenario.

DIN 4102: Part 11 assesses the encasement system when exposed to a fully developed internal fire. The integrity of the encasement, and any penetrations through walls and floors, is measured, as well as the temperature on the outer surface of the duct (140°C mean rise, 180°C maximum rise). The heating curve for DIN 4102: Part 11 is the same as that used in BS476: Part 20 and AS1530: Part 4 and the failure criteria for integrity and insulation are identical. The systems detailed herein have been successfully tested and assessed and are approved for use to provide a performance in accordance with BS476: Part 20 and AS1530: Part 4 in terms of compartmentation.

DIN 4102 Part 12 assesses the encasement system when exposed to a fully developed external fire. In addition to the requirement to maintain the integrity of the encasement and any penetrations through walls or floors, the standard requires that:

- (a) The cables continue to function for the duration of the exposure period,
- (b) The temperature on the cable jacket should not exceed 150°C.

The tested encasement system protects a wide range of different cable types. Power is passed through the cables throughout the test. As an added safety factor, the system described on [page 4](#) will ensure that the temperature on the cable jacket does not exceed 120°C.

The Australian/New Zealand standard AS/NZS 3013 "Electrical installations – Classification of the fire and mechanical performance of wiring systems" describes the level of protection of a wiring system against fire and/or accidental mechanical damage. The tests methods described within this standard call for wiring systems to maintain circuit integrity when subjected to fire test, mechanical damage tests, and fire and water tests. The resistance to fire test is to determine the ability of a wiring system to maintain circuit integrity under fire conditions for a specified period of time of up to 120 minutes. The wiring system shall be tested in a horizontal furnace complying with AS1530: Part 4, which also employs the ISO834 heating conditions.

Mechanical damage tests are to determine the degree of mechanical impact and cutting load to which the wiring system can be subjected without losing its circuit integrity. The tests are carried out separately from the fire test.

Fire and water tests assess the ability of a wiring system in maintaining its circuit integrity when subjected to fire conditions followed by hosing with water.

DIN 4102: Part 12 and AS/NZS 3013 are designed to test the functionality of cables under fully exposed fire conditions, unlike the IEC60331 test regime. The systems detailed herein relate to maintaining compartmentation only and should not be used where full function of the cables is to be maintained. For such systems compliant with DIN 4102: Part 12 and AS/NZS 3013, please consult Promat.

General Design Considerations

In the event of fire performance to internal and external fire, it has been established that an enclosure fabricated from fire resistant boards is one of the best solutions. Such systems have been tested successfully with ducts constructed from fire protective boards such as PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500. These well established board systems are the only systems which currently fulfil all performance requirements, especially to the DIN4102 standards.

A suitably designed duct will:

- Prevent the propagation of fire from one building compartment to another,
- Assist in maintaining escape routes,
- Ensure the continuing operation of other services within a common service shaft,
- Reduce damage to localised area,
- Contain smoke and toxic fumes from burning cables.
- Ensure cable maintain their function when exposed to a fully developed fire.

Following are some of the factors to consider when determining the correct specification to ensure the enclosure system provides the required fire performance. Further advice can be obtained from the Promat Technical Department.

1. Required Fire Exposure

The specification of the enclosure system will depend on whether it is expected to resist external fire or internal fire or both.

2. Required Fire Performance

Generally, the most onerous requirement is to maintain the functional integrity of the circuit(s) when the system is exposed to external fire. If this is not needed, the performance requirements may be reduced by the approval authority to provide only stability, integrity and insulation of the enclosure system and/or wall and floor penetrations. On some occasions, further relaxations may be approved, e.g. a reduced insulation performance can sometimes be acceptable if no combustible materials or personnel are likely to be in contact with the duct.

3. Supporting Structure

The supporting hangers and their fixings should be capable of bearing the load of the complete enclosure system including any applied insulation material or other services suspended from it. Chemical anchors are generally not suitable. It is usually not advisable to employ unprotected hangers if the stress exceeds 6N/mm² for up to 240 minutes fire exposure and 10N/mm² for up to 120 minutes fire exposure and/or if the hanger lengths exceed 2m. The hanger centres should not exceed the distance limits given for the relevant Promat system.

4. Penetrations Through Walls & Floors

Care should be taken to ensure that movement of the cable system in ambient or in fire conditions does not adversely affect the performance of the wall, partition or floor or any penetration seal.

5. Ventilation Openings

Heat is generated as current flows through cable core conductors. The greater the electrical flow, the hotter the conductor will get. Excessive current flow will cause overheating and may result in overload, short circuit or ground fault. The material of the cable sheath, usually made from material such as PVC, polyurethane or polyethylene, usually has a self-ignition temperature between 340°C to 490°C.

In general, the heat generated by cables is negligible. However, a ventilation opening at appropriate intervals is recommended along a cable duct to prevent the build up of excessive heat. Ventilation openings must have a self-enclosing capability in the event of fire so as to prevent fire spread via such openings. See [page 6](#) for PROMASEAL® Ventilation Grille and Promat Ventbox.

6. Access Hatches

For future inspection and installation of cables, a loose lid construction, described on [page 4](#), can be considered. Alternatively, the lid can be fixed and the inspection openings with hatches can be provided in the side walls of the duct, as shown on [page 6](#). The hatch is secured completely to the duct using threaded inserts such as “Tecserts” (Armstrong Fastening Systems) at maximum 200mm centres.

7. Selection of Board Type

The Promat system can be based on PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500. PROMATECT®-L or PROMATECT®-L500 are lighter than PROMATECT®-H and would probably be used in most applications. PROMATECT®-H offers a particularly robust system which is also highly resistant to impact and abrasion. Although both products are water tolerant, PROMATECT®-S would generally be preferred for more onerous conditions.

For tunnel environments and higher performance requirements, please consult Promat Technical Department.

8. Other Requirements

Acoustic performance, thermal insulation, water tolerance, strength and appearance can also be important considerations (see BS8313: 1997 Code of practice for accommodation of building services in ducts).

Fibre Optics

Fibre optic cables have a lower failure temperature due to the fact that the conductor is made of bundles of optical fibres that can be as thin as a human hair. Fibre optic cables are widely used for IT networking in many industries, especially in financial and healthcare services. For example, large banks depend on their network cabling systems for most of their routine business transactions. If fire occurs and even one metre of cabling is destroyed, it could cost the company millions of dollars each day their systems remain inoperative. These are problems that businessmen do not want to face and one reason why it is necessary to protect sensitive, strategically important cables against fire risk. The Promat Technical Department should be consulted to determine the required board thickness and construction details.

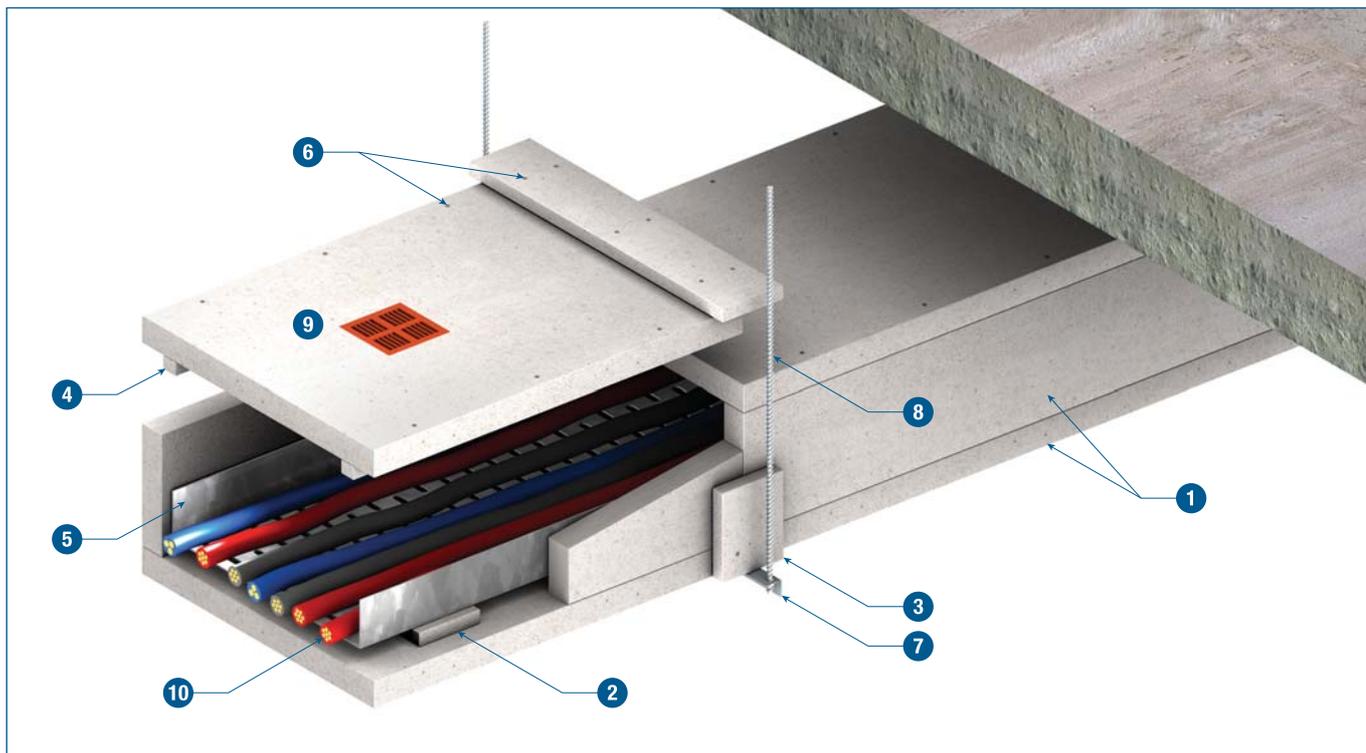
Riser Pipes (Singapore only)

The Fire Safety Bureau of Singapore requires that piping for a rising main is adequately protected to prevent collapse and reduction of water pressure at the point of water egress in the event of a fire. In addition, fire will heat up the water conveyed through the piping system. It is conceivable that water in the pipe could reach a stage of boiling. This would result in additional pressure being placed upon the pipe system as water will expand considerably (1:1700) as it turns to steam. This will result in premature failure of the pipes and joints transporting the water, leading to a loss of pressure and consequential inability to fight or extinguish the fire.

Therefore it is required that rising main piping is adequately protected to:

- Prevent collapse of the piping system,
- Maintain the fire integrity and insulation of the compartment wall or floor where the piping penetrates,
- Prevent water passing through the piping system from reaching its boiling temperature. The temperature at any point on the pipe external surface, measured on the fire-exposed side, must not exceed 75°C above the initial temperature for at least the first 30 minutes of exposure to fire.

The fire resistance test procedure is described in FSB/PSB/001/00 dated 8 November 2000.



TECHNICAL DATA

- 1 1 layer of PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 board, thickness in accordance with Table 1 or 2 below.
- 2 1 layer of PROMATECT®-H or L500 internal cover strip 100mm x 20mm thick, located between tray and base of duct only. Strips positioned at maximum 625mm centres and coinciding with board joints and supports 8.
- 3 1 layer of PROMATECT®-H or L500 external cover strip to top and side joints only. Not required for multi-layer construction providing the joints between the layers are staggered by at least 80mm and fixed to each other.
For FRL of 30 100mm x 20mm thick
For FRL of 60 100mm x 20mm thick
For FRL of 90 100mm x 25mm thick
For FRL of 120 100mm x 25mm thick
- 4 PROMATECT®-H or L500 batten, 25mm x 20mm thick fixed to loose fit lid. Not required for fixed lid option.
- 5 Steel cable tray, required for systems exposed to external fire.
- 6 Fixings in accordance with the table on page 5. Screws should be deep-threaded, self-tapping, drywall type, e.g. Buildex HILO. Alternatively, steel wire staples can be used.
- 7 Support angle or channel, size will depend on load. Maximum permissible bending stress 6N/mm². Supports should be at maximum 1250mm centres and should coincide with an internal cover strip 2. The cable duct should be supported not more than 500mm from either side of any wall or floor through which it passes.
- 8 Threaded steel hanger rod, minimum diameter 8mm at maximum 1250mm centres, ensure maximum stress does not exceed 6N/mm². Note that when calculating the stress on the support system, the weight of the cables must be considered.
- 9 PROMASEAL® Ventilation Grille or Promat Ventbox
- 10 Electrical cables. For Fibre Optics, cables will have a lower failure temperature. Please consult Promat Technical Department to determine the required board thickness.

Internal Cross Section Table 1:
Equal or smaller than 110mm x 100mm

Lid type	Thickness of board for different Fire Resistance Levels (minutes)				Board type
	30	60	90	120	
Fixed	24mm	45mm	60mm	75mm	PROMATECT®-H
Fixed	25mm	40mm	60mm	80mm	PROMATECT®-L or PROMATECT®-L500
Loose fit	25mm	45mm	60mm	80mm	

Internal Cross Section Table 2:
Equal or greater than 110mm x 100mm / Equal or smaller than 520mm x 250mm

Lid type	Thickness of board for different Fire Resistance Levels (minutes)				Board type
	30	60	90	120	
Fixed	20mm	40mm	50mm	65mm	PROMATECT®-H
Fixed	20mm	35mm	50mm	70mm	PROMATECT®-L or PROMATECT®-L500
Loose fit	20mm	40mm	60mm	70mm	

The board thicknesses given in the above tables will ensure that when the duct is exposed to a fully developed cellulosic external fire (BS476 curve), the cable jacket temperature rise will not exceed 120°C and the cables will remain functional. If the cables are not required to maintain circuit integrity it may be possible to reduce the board thickness after consultation with the Promat Technical Department. Promat can also advise on specifications for larger duct sizes. The board thickness is dependent on the internal dimensions of the duct and whether the duct has a loose fit lid or a fixed lid.

System Specification

Electrical cable enclosures are to be constructed using PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 matrix engineered mineral boards all in accordance with the Architectural Specification in the manufacturer's handbook. Relevant constructions are to be selected according to the required FRL of 30/60/90/120 minutes of the selected elements. All printed installation details are to be followed to ensure approval to BS476: Part 20 or AS1530: Part 4. All work to be certified by installer in an approved manner.



Fixing of Boards

The Promat cable protection system is fabricated from PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 boards with thickness according to the tables on page 4. The boards can be fixed together with steel staples at maximum centres of 100mm or screws at maximum centres of 200mm in accordance with to the table below. Up to three layers of boards can be used to fabricate the required thickness.

This is a self-supporting system and does not require any internal steel framework (subject to width and height of the enclosure not exceeding set limits).

Board thickness	Screws at 200mm centres	Staples at 100mm centres
9mm	25mm x No.6	28/10/1.2
15mm	30mm x No.6	32/10/1.2
20mm	38mm x No.6	50/11/1.5
25mm	50mm x No.6	63/11/1.5
30mm	63mm x No.8	63/11/1.5
35mm	63mm x No.8	70/12/2
40mm	75mm x No.8	80/12/2
50mm	100mm x No.10	80/12/2
60mm	100mm x No.10	90/12/2
75mm	Multi-layer	Fix layer 1 with screws
100mm	Multi-layer	Fix layer 1 with screws

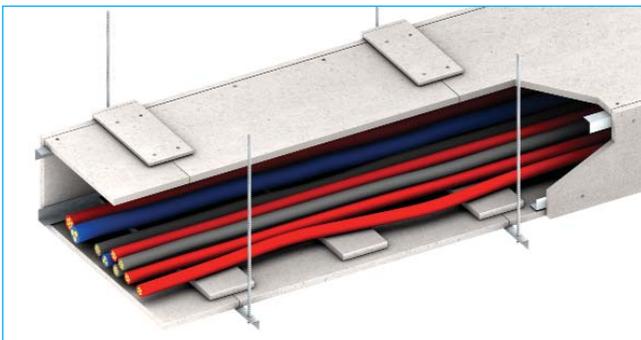
Joints between the sections of enclosure are reinforced with external cover strips of PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 board, each 100mm wide and a minimum of 9mm thick. The cover strips are fixed with steel staples or screws.

Internal Cross Section Dimension

The internal cross section of the enclosure system shall not be less than 110mm wide x 100mm high and shall not be more than 1000mm wide x 500mm high. Please consult Promat Technical Department for cross sections not within this range.

Cables & Enclosure Support

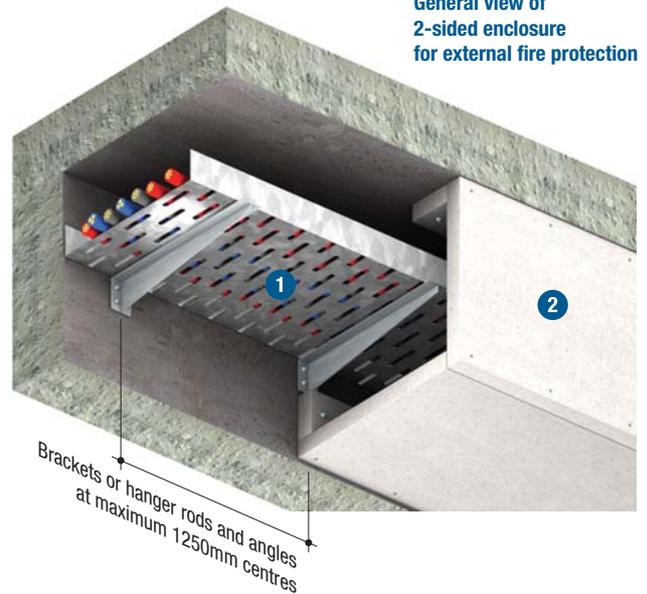
Cables are normally supported on steel cable trays within the enclosure but these are not always required when the enclosures are subject to internal fire exposure only.



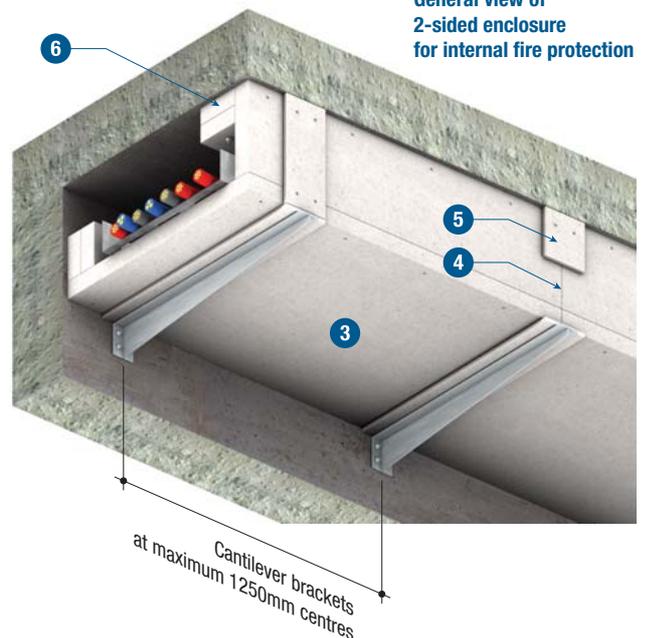
The enclosure system must be supported, either by direct fixing to other structural elements with suitable proprietary steel fixings or by hangers at maximum centres of 1250mm. The hanger supports should coincide with the joints in the enclosure. The hangers consist of steel threaded rods and a steel angle bearer section under the protection system. The tensile and bending stresses of the unprotected hangers and bearers must not exceed 6N/mm² for up to two hours fire rating.

1, 2 or 3-sided Protection

1-sided, 2-sided and 3-sided enclosures are acceptable where the other sides of the rectangle are formed from an adjoining wall and floor/ceiling of a fire resistance at least equal to that of the enclosure system, and where under fire conditions the substrates will suffer no deflection or excessive movement.



General view of 2-sided enclosure for external fire protection



General view of 2-sided enclosure for internal fire protection

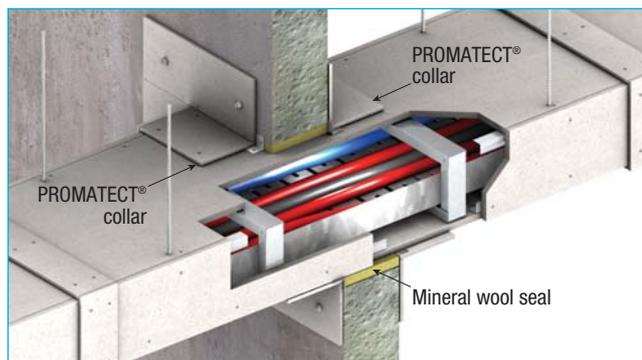
- 1 Cable tray supported independently within the duct on brackets or hangers
- 2 1 layer of PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 board, thickness in accordance with Table 1 or 2 on page 4.
- 3 1 layer of PROMATECT®-L or PROMATECT®-L500 board, thickness in accordance with Table 1 or 2 on separate PDF.
- 4 Board joints to coincide with bracket positions
- 5 Board joints covered with PROMATECT®-H cover strip 100mm x 9mm thick
- 6 PROMATECT®-L or PROMATECT®-L500 cover strip or light steel angle



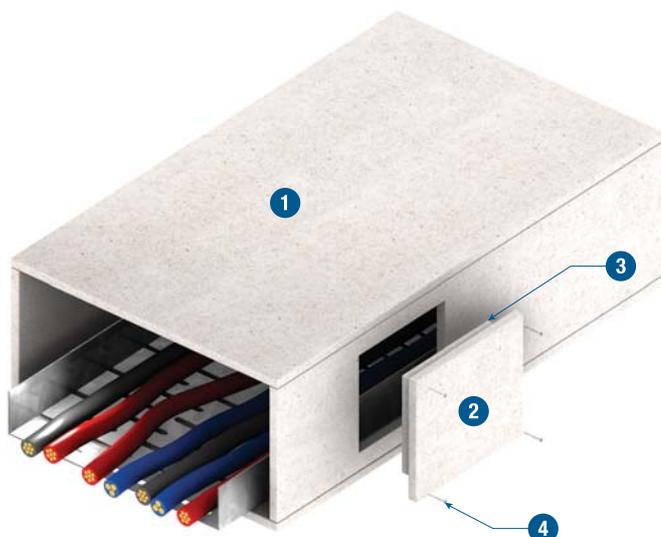
Fire-Stops

The enclosure system, where it passes through a fire compartment wall, has to be fire stopped. At this penetration, gaps up to 20mm wide may be sealed with mineral wool and PROMASEAL® AN Acrylic Sealant. For wider gaps, a PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 collar is required on both sides of the wall. The minimum collar dimensions should be 150mm x 20mm thick. Please refer to illustration at right.

Access hatches have to be properly constructed to maintain the fire resistance level of the enclosure system. Hatches generally are comprised of an inner board stapled or secured to the outer board. The inner board should be a close fit to the opening and should be the same thickness as the wall of the enclosure. The outer board should be at least 20mm thick and overlap the opening by at least 50mm on all sides.



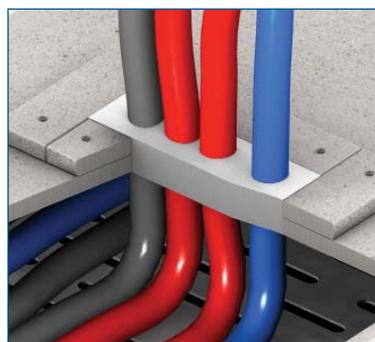
When the cables exit the enclosure, the opening made must be stiffened with PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 board of at least 50mm wide x 20mm thick. The gaps in the opening must be fully sealed with PROMASEAL® AN Acrylic Sealant for the full depth of the board and the thickness of the stiffener board. See illustration below.



General view of construction of inspection opening for external or internal fire protection



General view of PROMASEAL® Ventilation Grille and Promat Ventbox



Ventilation openings if required must also be fitted with PROMASEAL® Ventilation Grille or Promat Ventbox. These fittings will ensure that the fire resistance level of the enclosure system is maintained in case of a fire.

PROMASEAL® Ventilation Grille

- Standard grille size is 93mm x 93mm overall. Can be combined in multiples to create a larger free area.
- Free area of one grille is 0.0035m².
- Friction fit grille in aperture. Use VICU-BOND® WR adhesive if loose fit.

- Grilles supplied in various thicknesses as follows: 35mm (for 30 minutes), 60mm or 2 x 35mm (for 60 minutes), 75mm (for 90 minutes) and 75 + 35mm (for 120 minutes).
- Secure 50mm wide cover strips if necessary to ensure grille fully surrounded by board.
- The grille is supported on the inside of the duct by a perforated steel plate (supplied) secured to the duct wall.

Promat Ventbox

- The ventbox consists of an integral outer frame and collar and an automatically operated closing lid which is activated by a thermal link in the event of a fire.
- Free area 0.021m².
- Outer dimensions of frame and collar are 515mm x 130mm.
- Insert ventbox frame into aperture, 465mm x 80mm, and screw down to the board through the collars.

- 1 PROMATECT®-H, PROMATECT®-L or PROMATECT®-L500 electrical cable enclosure.
- 2 Outer board sized 50mm larger all around than inner and 20mm thick
- 3 Inner board stapled to outer board, sized to fit opening and same thickness as side wall of duct.
- 4 "Tecserts" or similar at maximum 200mm centres
- 5 PROMASEAL® Ventilation Grille as detailed on this page
- 6 Promat Ventbox as detailed on this page



Architectural Specification

Following is the standard Architectural Specification for electrical cable enclosure system using PROMATECT®-H/PROMATECT®-L/PROMATECT®-L500.^(*) The designer must determine the suitability of the design to the application and performance requirements before undertaking or constructing any works relating to the specifications and where in doubt should obtain the advice of a suitably qualified engineer.

External Fire For Circuit Integrity

Up to 120 minutes fire rating, integrity and insulation in accordance with the criteria of **AS1530: Part 4: 2005** and **BS476: Part 20: 1987**.

Supporting Structure

Care should be taken that any structural element by which the enclosure system is supported, e.g. a beam, floor or wall, has at least equivalent fire resistance.

Lining Boards

Single-layer/Multi-layer^(*) _____mm⁽¹⁾ thick PROMATECT®-H/PROMATECT®-L/PROMATECT®-L500^(*) matrix engineered mineral boards as manufactured by Promat International (Asia Pacific) Ltd. Internal and external cover strips made of 100mm wide and a minimum of 9mm thick PROMATECT® boards, where applicable, are secured to the enclosure over the board joints.

Type of Fixing

The boards can be fixed together with steel staples at maximum 100mm or screws at maximum centres of 200mm according to the manufacturer's recommendations.

The complete enclosure system will be suspended with hangers at maximum centres of 1250mm with threaded rods, whole support system to have less than 6N/mm² of stress.

Tests & Standards

The complete system along with material and framing is tested and/or assessed to meet the requirements of AS1530: Part 4 and/or BS476: Part 20.

Jointing

Plain butt joints between machined edges of boards. ⁽²⁾
 Joints filled in preparation for painting. ⁽³⁾
 Joints filled and taped in preparation for decoration. ⁽⁴⁾

Follow-on Trades

Surface of boards to be prepared for painting/plastering/tiling⁽⁵⁾ in accordance with manufacturer's recommendations.

NOTES:

- ⁽¹⁾ insert thickness as appropriate taken from **Table 1 or 2** on **page 4**.
- ^{(2), (3), (4), (5), (6)} delete as appropriate.
- Perimeter gaps will be filled with fire resistant PROMASEAL® AN Acrylic Sealant.

For latest information of the Promat Asia Pacific organisation, please refer to www.promat-ap.com

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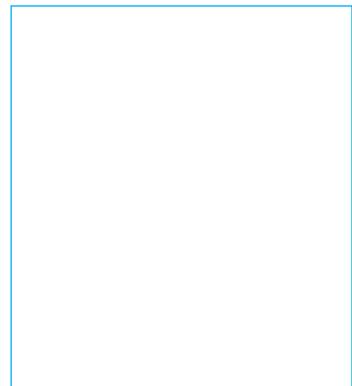
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