

Promat



PROMATECT®-H E&M Services Enclosure



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.

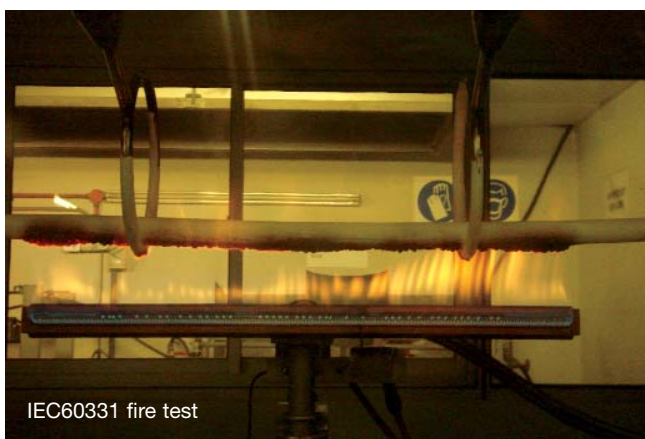
It is worth noting that most electrical services and to some extent mechanical services have a high component of plastic materials such as polyvinylchloride, polypropylene, polyethylene, synthetic rubbers etc. The risks associated with these combustible plastics are such that fire can and will spread 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 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.

6. Access Hatches

For future inspection and installation of cables, a loose lid construction 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. 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.

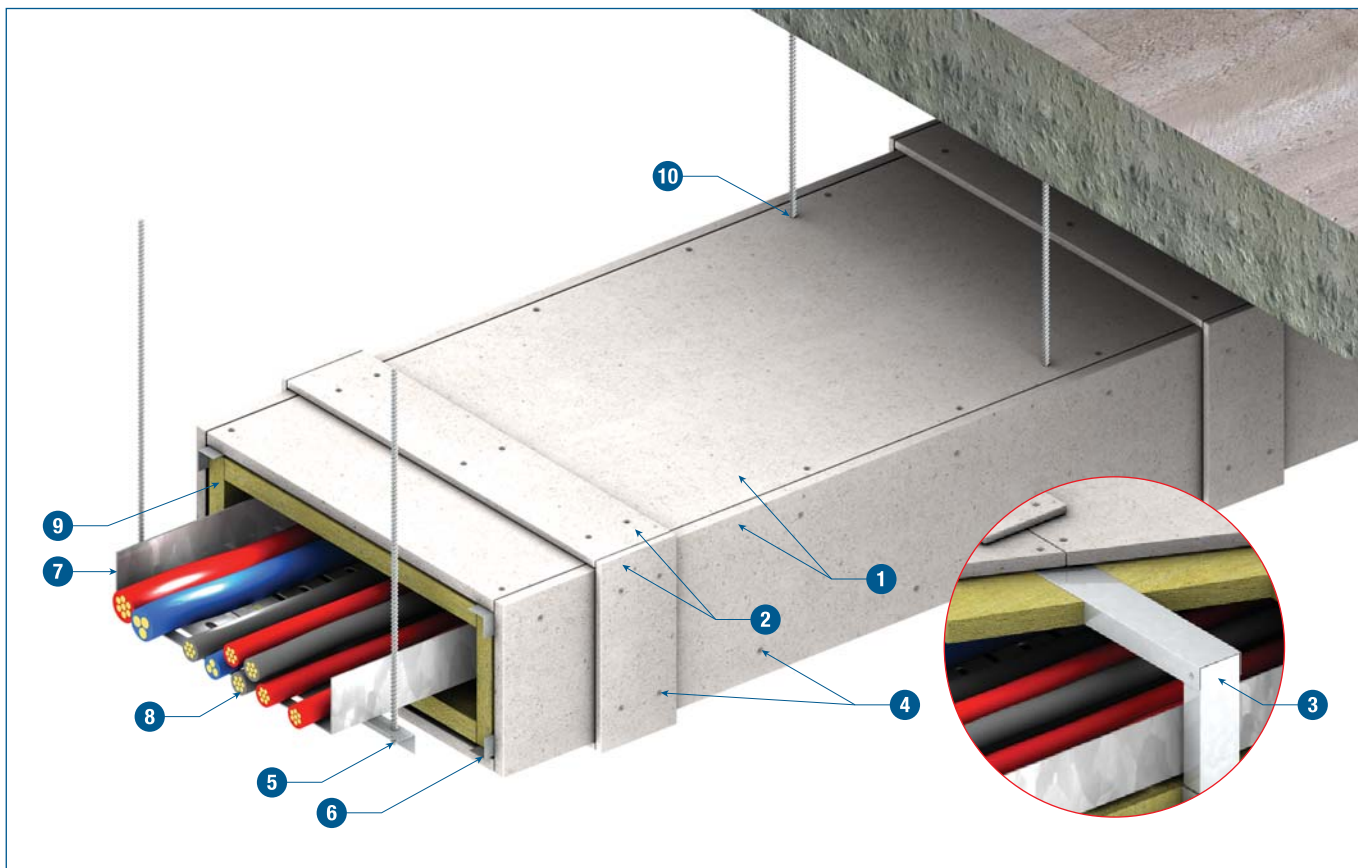
Riser Pipes (Singapore only)

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 board
 For FRL of 60/60/60* 9mm thick
 For FRL of 120/120/120 15mm thick
 For FRL of 240/240/240 20mm thick
- 2** 1 layer of PROMATECT®-H cover strip 100mm wide x 9mm thick
- 3** Steel channel collar 50mm x 50mm x 0.9mm thick at nominal 1220mm centres to coincide with joints between boards. See more details on page 6.
- 4** Self-tapping drywall type screws at nominal 200mm centres

Board thickness	Screw length to frame	Screw length to cover fillets
9mm	25mm	20mm
15mm	32mm	25mm
20mm	35mm	25mm
- 5** Threaded rod hanger
 For FRL of 60/60/60* Stress not to exceed 15N/mm²
 For FRL of 120/120/120 Stress not to exceed 10N/mm²
 For FRL of 240/240/240 Stress not to exceed 6N/mm²
- 6** Steel angle, minimum 50mm x 50mm x 3mm thick for 1, 2 or 3-sided construction at corner joints, or minimum 30mm x 30mm x 0.7mm thick for 4-sided construction at corner joints.
- 7** Steel cable tray
- 8** General E&M services, e.g. cable trunking, steel pipes etc.
- 9** Mineral wool
 For FRL of 60/60/60* 50mm x 60kg/m³
 For FRL of 120/120/120 50mm x 80kg/m³
 For FRL of 240/240/240 100mm x 100kg/m³
- 10** PROMASEAL® AN Acrylic Sealant
 For FRL of 60/60/60* 100mm x 9mm thick
 For FRL of 120/120/120 100mm x 15mm thick
 For FRL of 240/240/240 100mm x 20mm thick

*Not applicable for Australia.

Where the enclosure passes through a fire compartment wall, the penetration must be properly sealed. 1 layer of L-shaped PROMATECT®-H collar, sized as follows, is required to be fitted around the enclosure on both sides on the wall. See details on page 7.

The provision of fire resisting construction to general building services in accordance with the performance criteria of BS476: Part 20 and AS1530: Part 4.

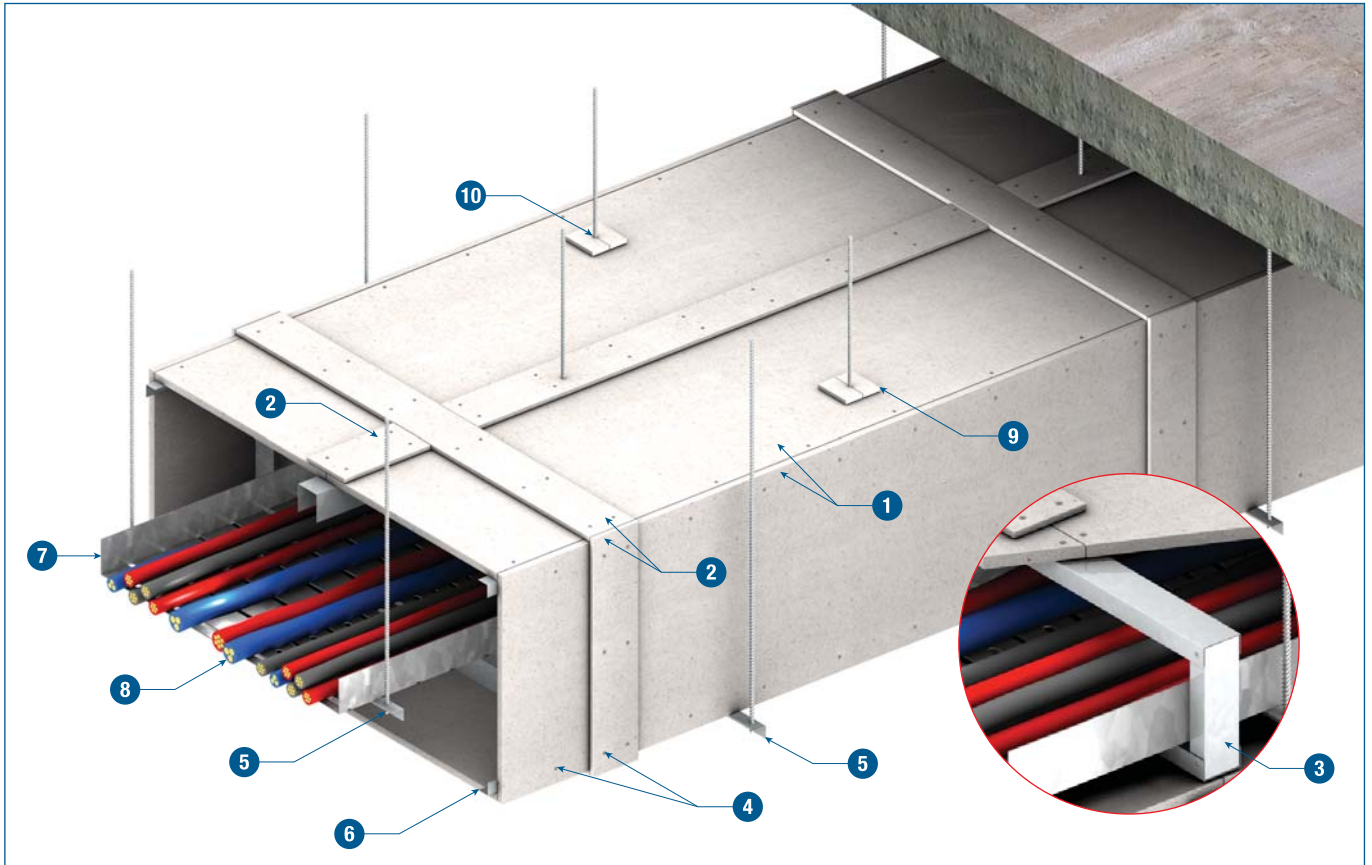
General building services include mechanical and electrical services typically used in normal buildings; such as small steel ducts, metal and plastic pipes, electrical and telecommunications cables. As no specific British Standard exists for such application, Promat constructions have been tested in accordance with the criteria of German DIN or British Standard BS476: Part 24, and appraised to BS476: Part 20.

The appraisals include allowance for both internal and external fire. The integrity and where pertinent the insulation performance of the enclosure, and any penetrations through the compartment walls and floors, is measured.

Circuit integrity of electrical cables, or ability of the services to function are not measured and do not constitute part of the failure criteria. Where circuit integrity of electrical cables are required. For the provision of a protection system that ensures other services remain functional in the event of fire, e.g. fuel pipes, please consult the Promat Technical Department.

System Specification

General E&M services enclosures are to be constructed using PROMATECT®-H 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 60, 120 or 240 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.



TECHNICAL DATA

- | | |
|--|---|
| <p>1 1 layer of PROMATECT®-H board
For FRL of 120/120/- 9mm thick
For FRL of 240/240/- 12mm thick</p> <p>2 1 layer of PROMATECT®-H cover strip
For FRL of 120/120/- 100mm x 9mm thick
For FRL of 240/240/- 100mm x 12mm thick</p> <p>3 Steel channel collar 50mm x 25mm x 0.5mm thick at nominal 1220mm centres. All board joints to coincide with a framing member. See more details on page 6.</p> <p>4 25mm self-tapping drywall type screws at nominal 200mm centres</p> <p>5 Services steel hanger at nominal 1250mm centres
For FRL of 120/120/- Stress not to exceed 10N/mm²
For FRL of 240/240/- Stress not to exceed 6N/mm²</p> <p>6 Steel angle minimum 30mm x 30mm x 0.5mm thick at corner joints</p> | <p>7 Steel cable tray</p> <p>8 General E&M services, e.g. cable trunking, steel pipes etc.</p> <p>9 1 layer of PROMATECT®-H cover board where hangers penetrate the enclosure
For FRL of 120/120/- 75mm x 75mm x 9mm thick
For FRL of 240/240/- 75mm x 75mm x 12mm thick</p> <p>10 PROMASEAL® AN Acrylic Sealant</p> <p>Where the enclosure passes through a fire compartment wall, the penetration must be properly sealed. 1 layer of L-shaped PROMATECT®-H collar, sized as follows, is required to be fitted around the enclosure on both sides of the wall. See details on page 7.</p> <p>For FRL of 120/120/- 100mm x 9mm thick
For FRL of 240/240/- 100mm x 12mm thick</p> |
|--|---|

PROMATECT®-H enclosures provide protection against fire to general building services in accordance with the relevant criteria of BS476: Part 20, for both internal and external fire.

The PROMATECT®-H system featured above ensures integrity of fire compartments.

System Specification

General E&M services enclosures are to be constructed using PROMATECT®-H 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 120 or 240 minutes of the selected elements. All printed installation details are to be followed to ensure approval to BS476: Part 20. All work to be certified by installer in an approved manner.

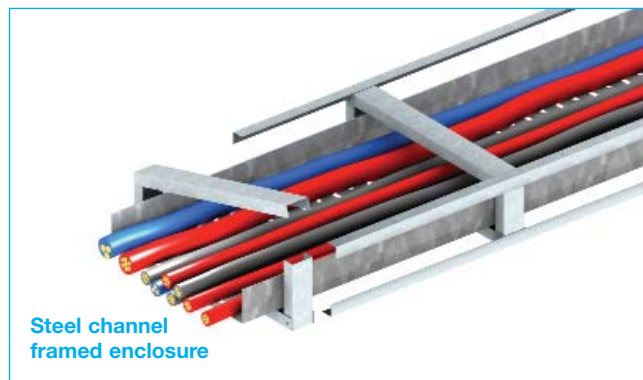


Internal Steel Framework

The corner junctions of the enclosure are reinforced with internal steel angles, minimum size according to system specification. These corner angles are not necessary if boards of thickness 20mm and above are used, as the boards can be fixed to each other using deep thread drywall type screws or steel wire staples.



Four-sided steel channel collars are positioned at approximately 1220mm centres to support the boards. The steel channels are of minimum size 50mm x 50mm x 0.9mm thick or 50mm x 25mm x 0.5mm depending on the system specification.



Fixing of Boards & Mineral Wool

The type of board and thickness shall be selected according to the system specification and the required fire resistance level. The boards are fastened to the channel frames and corner angles with self-tapping screws of appropriate length at 200mm nominal centres.

For systems where corner angles are not used, i.e. for 20mm or thicker boards, the boards are to be fastened at the corners with steel self-tapping screws at 200mm nominal centres or steel staples at 100mm nominal centres as per the table below.

Board thickness	Screws at 200mm centres	Staples at 100mm centres
9mm	25mm x No.6	–
15mm	30mm x No.6	35/10/0.8
20mm	38mm x No.6	63/10/1.0
50mm	100mm x No.10	80/12/2.0

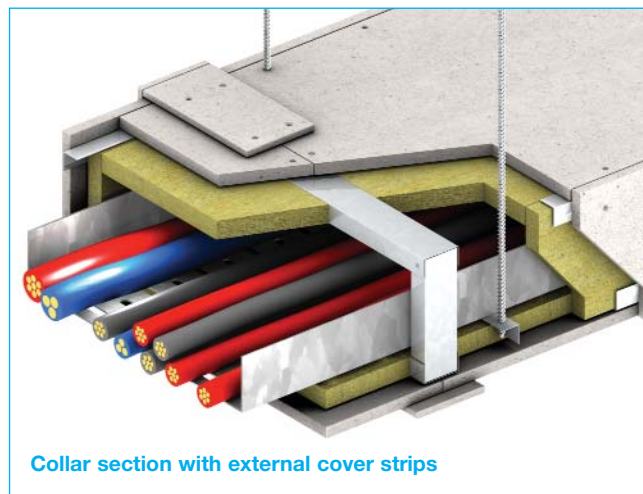
Longitudinal joints in the boards (other than the corner joints) must be backed by a steel channel. All butt joints, as required by the system specification, are covered with 100mm x 9mm thick PROMATECT®-H cover strips that may be placed either externally or internally.

The cavity between the boards and the building services is filled with mineral wool with thickness and density corresponding to the system's requirement. The steel channels are also filled with the same mineral wool. See [Collar section with external/internal cover strips](#).

Building Services & Enclosure Support

The hangers used to support the building services enclosure must have tensile and bending stresses not exceeding 15N/mm², 10N/mm² and 6N/mm² for fire ratings of up to 60, 120 and 240 minutes respectively. If these stress levels are exceeded then the size of the hanger members must be increased or, alternatively, the spacing of the hangers reduced.

The fixings used to fasten the threaded hanger rods to concrete soffits must be all-steel expanding anchors with at least 80mm penetration into the concrete of at least 40mm for 120 minutes fire resistance and 60mm for 240 minutes fire resistance. The anchors must match the size of the threaded rods, be of sufficient strength to support the weight of the enclosure and be fitted in accordance with the manufacturer's specification. When the hanger rods are suspended from protected structural steel beams, the rods must be protected for at least 300mm from the beams with the same levels of protection as the structural beams.



Where the hangers exceed 2000mm in length, the hangers should be clad with a material of similar thickness to the enclosure to prevent excessive thermal expansion.

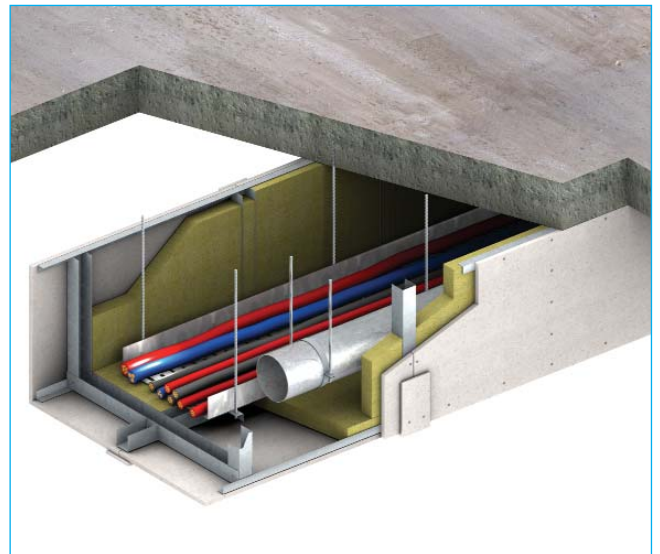
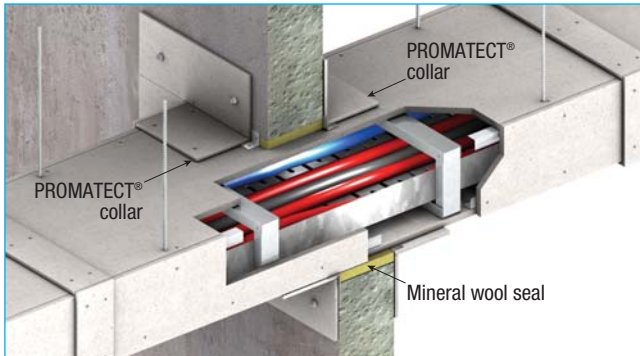
Where the hanger rods emerge from the PROMATECT® enclosure, the hole/slot must be sealed with PROMASEAL® AN Acrylic Sealant and a PROMATECT® cover plate.

If the building service being encased is a plastic pipe, external hangers and angles will be required to independently support the enclosure.



Wall Penetrations

Where the enclosure passes through a fire compartment wall, the penetration must be properly sealed. The space between the enclosure and the reveal of the opening in the wall is filled with mineral wool of minimum 110kg/m³ density. One layer of L-shaped PROMATECT®-H collar is required to be fitted around the enclosure on both sides of the wall. See page 4 to 5 for thicknesses suitable for different types of enclosure and requirements of FRL.

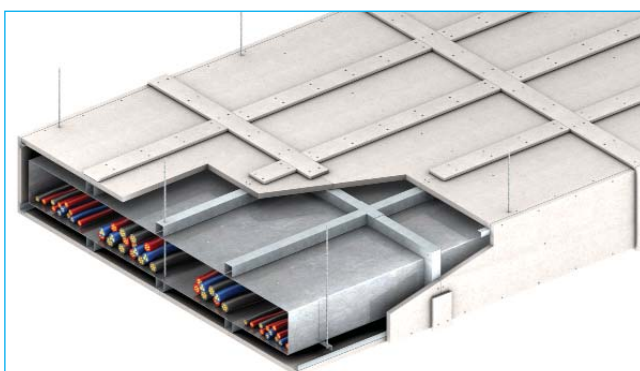
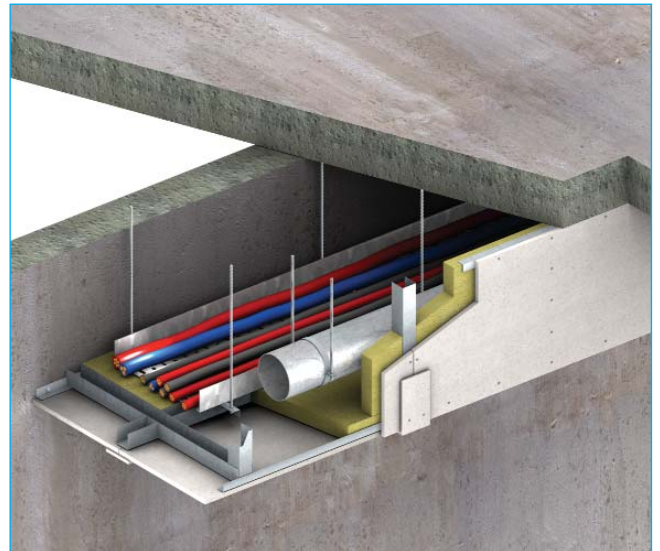


Internal Cross Section Dimension (more than 1500mm x 1500mm)

The maximum approved internal dimensions of the enclosure is 6000mm wide x 2500mm high. For enclosures with internal dimensions greater than 1500mm x 1500mm, additional threaded rods are fitted at each hanger position, at 1220mm maximum centres across the width of the enclosure. These threaded rods pass through the enclosure and support the horizontal hanger support element beneath the enclosure. The rods also support the top of the enclosure using a nut and large steel washer, this prevents bowing under fire conditions of wide enclosure systems.

As the width of the enclosure system increases, the spacing of the channel collars must be reduced so that the maximum area of unsupported board does not exceed 1.5m².

The penetrations of the rods through the enclosure are sealed with PROMASEAL® AN Acrylic Sealant.



Example of enclosure up to 6000mm wide x 2500mm high
Please note, the requirements for additional hanger support within the duct for greater width, e.g. 6000mm duct, will require two central supports at maximum 1220mm centres.



Top to bottom: 3-sided, 2-sided and 1-sided E&M services enclosures using PROMATECT® boards.

1, 2 & 3-sided Enclosures

3-sided, 2-sided and 1-sided enclosures are constructed in the same way as 4-sided enclosures. Steel angles of 50mm x 50mm x 0.9mm thick and 3mm thick for up to 120 and 240 minutes fire protection respectively, are fastened to the floor soffit or wall with M8 all steel expanding anchors at 500mm nominal centres. The PROMATECT® boards forming the walls of the protection to the building services are then fastened to the angles with steel self-tapping drywall type screws in appropriate length at 200mm nominal centres. The services are independently supported.



Vertical Enclosures

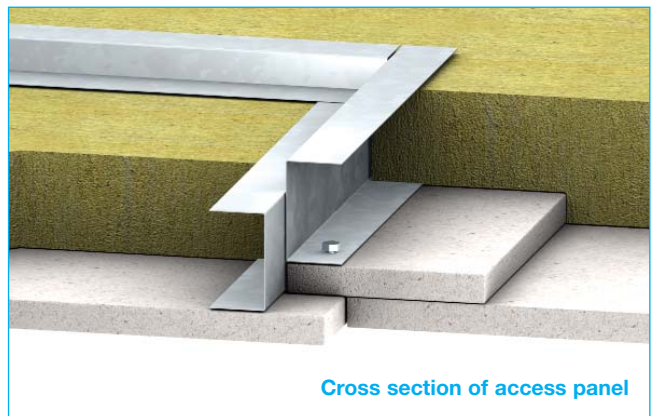
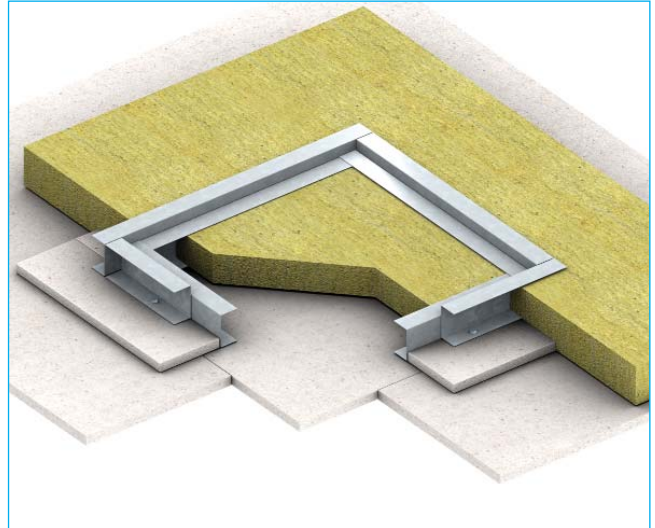
The construction of vertical enclosures is the same as for the horizontal enclosures. Where a vertical enclosure is located adjacent to a wall, the enclosure should be restrained back to the wall with threaded rods and support sections.



The weight of the PROMATECT® enclosure assembly must be taken at each floor level. Steel angles may be fitted to the enclosure at floor penetration level and sit upon the floor slab, supporting the weight of the PROMATECT® enclosure.

Access Panels

The maximum allowable dimension of the access panels is 600mm x 600mm. The panels are fixed to the enclosure through steel channels using steel bolts and nuts at nominal 200mm centres. The thickness of the boards and the mineral wool specifications should be according to the system's requirement. The mineral wool can be encapsulated within the C-channel sections which in turn are fixed to the access panel by means of steel self-tapping screws.

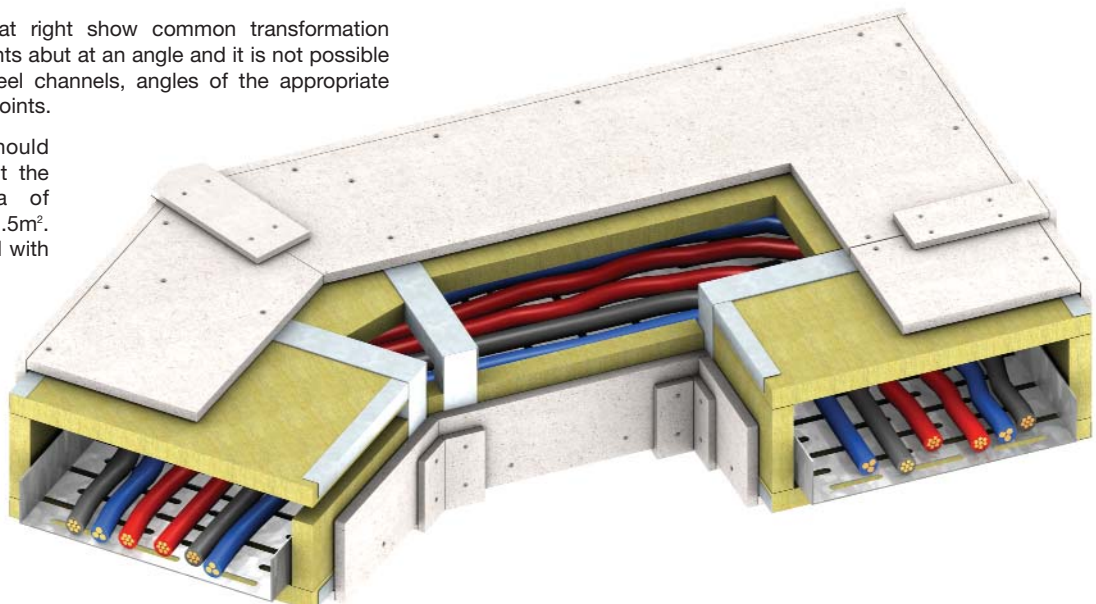


Cross section of access panel

Transformation Sections

The figures below and at right show common transformation sections. Where board joints abut at an angle and it is not possible to back the joint with steel channels, angles of the appropriate degree are used at these joints.

The steel channels should always be placed to limit the total unsupported area of board to a maximum of 1.5m². Bends must be supported with hangers at mid-span.





Architectural Specification

Following is the standard Architectural Specification for general building services enclosure system constructed using PROMATECT®-H. The designer must determine the suitability of the design to the application and 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 & Internal Fire

_____ minutes integrity and _____ minutes 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 _____mm⁽¹⁾ thick PROMATECT®-H 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®-H boards, where applicable, are secured to the enclosure over the board joints.

Type of Fixing

Galvanised steel frame made of channel sections 50mm x 50mm x 0.9mm thick or 50mm x 25mm x 0.5mm thick depending on the system specification, at 1220mm centres or at every butt joint of boards, with corner angles 30mm x 30mm with thickness of 0.5mm or 0.7mm, depending on the system specification, are fixed to the channel collars at the corners. The services will be suspended with hanger rods with hanger diameter sized to limit stress, _____N/mm² ⁽²⁾.

PROMATECT®-H boards will be screw-fixed to the frame with _____mm⁽³⁾ self-tapping screws at 200mm centres. Where applicable, butt joints should be covered with 100mm wide x 9mm thick PROMATECT®-H cover strips. Mineral wool in accordance with the system specification will be tightly filled around the existing services, i.e. between the gap of boards and the services.

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. ⁽⁴⁾

Joints filled in preparation for painting. ⁽⁵⁾

Joints filled and taped in preparation for decoration. ⁽⁶⁾

Follow-on Trades

Surface of boards to be prepared for painting/plastering/tiling⁽⁷⁾ in accordance with manufacturer's recommendations.

NOTES:

- ⁽¹⁾ insert appropriate board thickness taken from which system detailed on [pages 4 to 5](#).
- ⁽²⁾ insert hanger stress limits by not exceeding 15N/mm² for 60 minutes, 10N/mm² for 120 minutes or 6N/mm² for 240 minutes.
- ⁽³⁾ insert screw length as appropriate taken from which system detailed on [pages 4 to 5](#).
- ^{(4), (5), (6), (7)} 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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