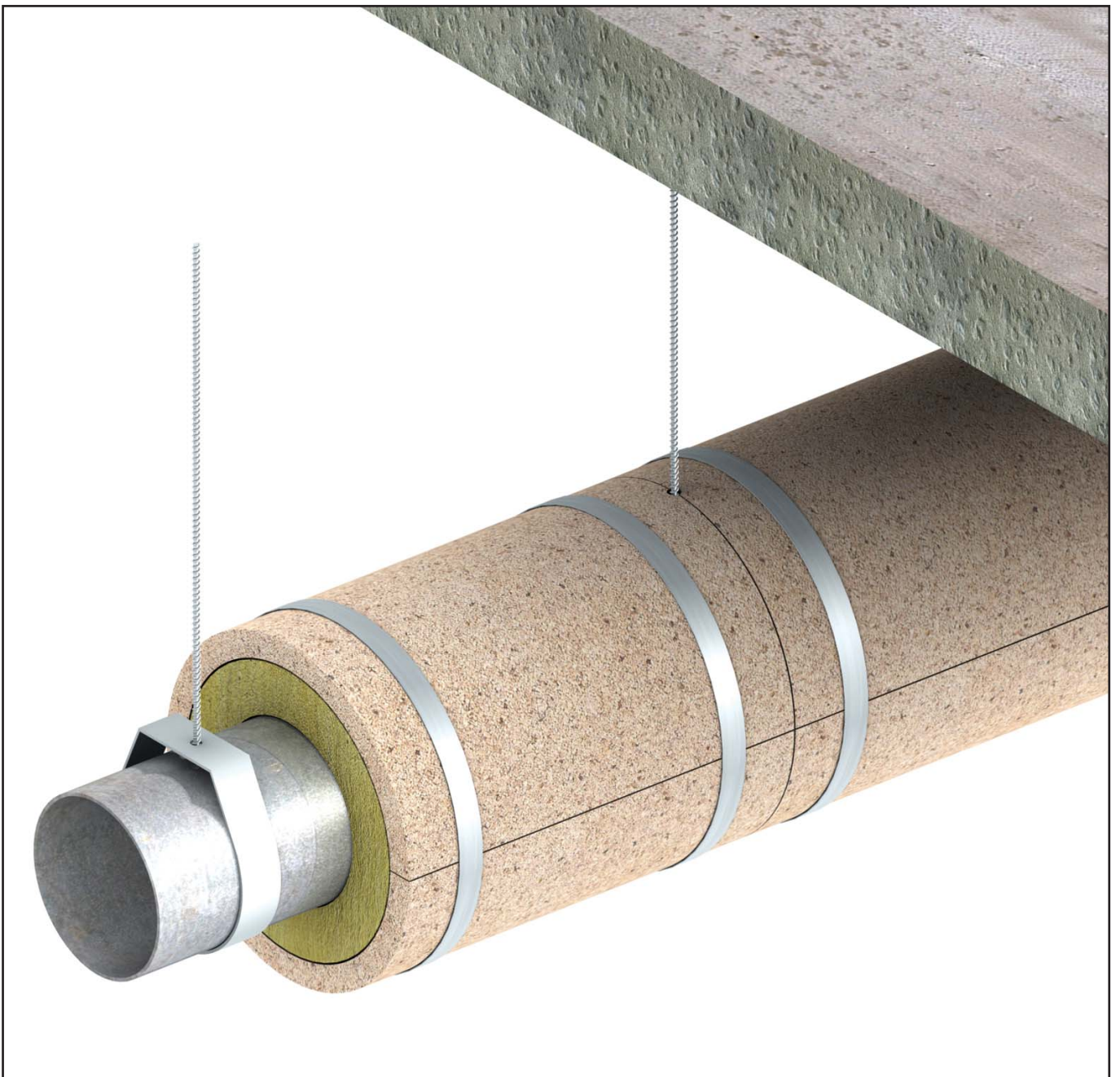


Promat



VICUCLAD[®]
Riser Pipes 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.

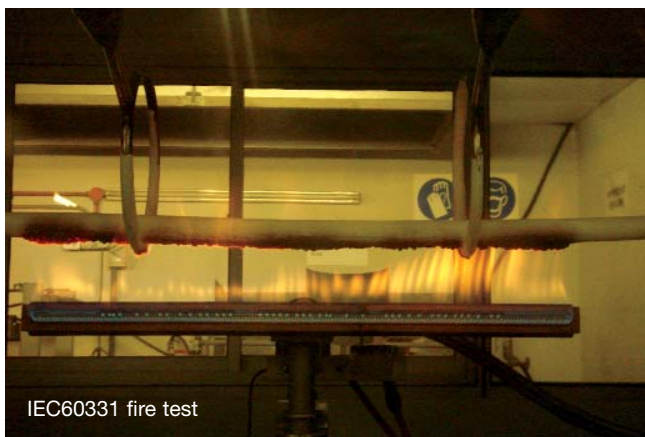
It is worth noting that most electrical services and to some extent mechanical services have a high component of plastic materials such as polyvinylchloride, polypropylene, polyethylene, synthetic rubbers etc. The risks associated with these combustible plastics are such that fire can and will spread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

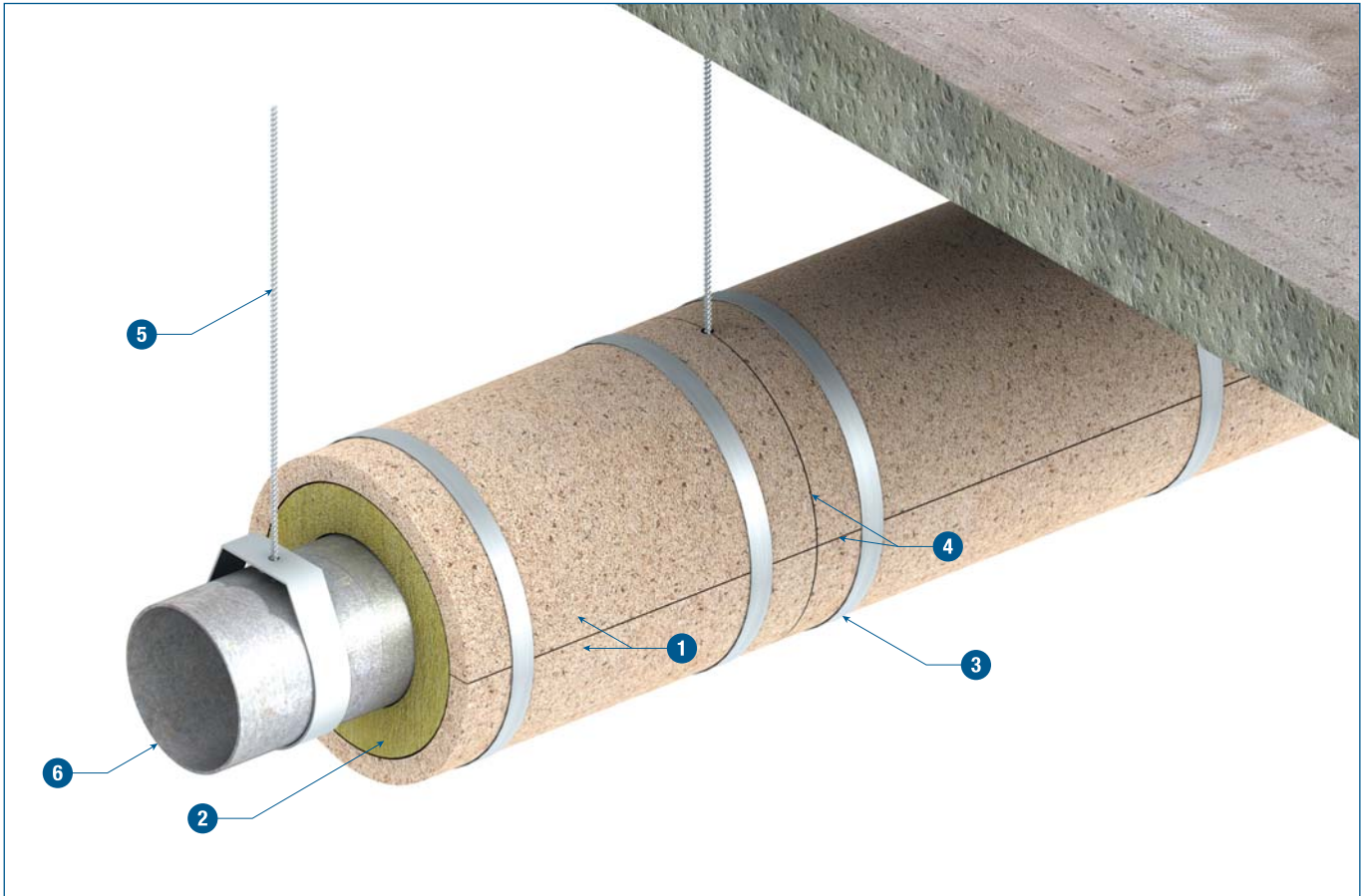
Riser Pipes (Singapore only)

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

- | | |
|--|---|
| <p>1 1 layer of VICUTUBE® board
For FRL of -/120/120 30mm thick
For FRL of -/240/240 40mm thick</p> | <p>4 Joints to be fully filled with VICUBOND® WR</p> |
| <p>2 Mineral wool
For FRL of -/120/120 25mm x 80kg/m³
For FRL of -/240/240 25mm x 40kg/m³</p> | <p>5 Steel hanger rods, diameter sized to limit stress.
For FRL of -/120/120 Limit stress not to exceed 10N/mm²
For FRL of -/240/240 Limit stress not to exceed 6N/mm²</p> |
| <p>3 Steel strap 25mm wide x 0.5mm thick
at approximately 600mm intervals</p> | <p>6 Riser pipe</p> |

System Specification

Riser pipes enclosures are to be constructed using VICUTUBE® vermiculite 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 and FSB/PSB/001/00. All work to be certified by installer in an approved manner.



Architectural Specification

Following is the standard Architectural Specification for riser pipes enclosure system using VICUTUBE®. 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

Up to 240 minutes fire rating, integrity and insulation in accordance with the criteria of **BS476: Part 20: 1987** and **FSB/PSB/001/00**.

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 VICUTUBE® vermiculite boards as manufactured by Promat International (Asia Pacific) Ltd.

Type of Fixing

The riser pipes will be suspended with hanger rods with Hanger diameter sized to limit stress = 10N/mm² and = 6N/mm² for 2-hour and 4-hour fire exposure respectively. Galvanised steel frame made of steel angles, minimum size 50mm x 25mm x 0.5mm thick or 50mm x 50mm x 0.5mm thick, depending on the thickness of mineral wool used, are folded around the pipe to form collars at 1000mm maximum centres. G.I angles 30mm x 30mm x 0.6mm thick are fastened to the angle collars. Internal framing is not required for enclosure constructed with VICUTUBE®. However, steel strap 25mm wide x 0.5mm thick located at 600mm centres are used to hold the VICUTUBE® sections. VICUBOND® WR adhesive are used at all joints between VICUTUBE® sections.

Mineral wool in accordance with the system specification will be filled around the existing pipes, i.e. between the gap of boards and the pipes.

No screwing for VICUTUBE® enclosure.

Tests & Standards

The complete system along with material and framing is tested and/or assessed to meet the requirements of BS476: Part 20 FSB/PSB/001/00.

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 appropriate board thickness taken from which system detailed on [pages 259 and 260](#).
- ^{(2), (3), (4), (5)} 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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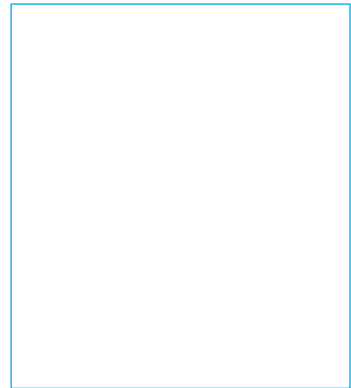
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