

INTRODUCTION

Existing or newly installed concrete structures, including beams, columns, walls & slabs, all have an inherent fire resistance, dependent upon their construction. There are, however, instances where the concrete may have been designed inappropriately to meet an existing fire resistance requirement, where the building is undergoing a change of use, and fire resistance needs to be increased or where only the structural requirements have been taken into consideration. This can result in the concrete structure being either of insufficient thickness or with insufficient concrete cover over the reinforcement to meet the appropriate Design Code being applied to the building.

Etex Building Performance have developed a fire tested solution for upgrading the fire performance of existing concrete structures using Promat PROMATECT®-H, a specialist calcium silicate fire protection board. Results from fire tests and assessments show that:

12mm thick PROMATECT-H® board can give the equivalent fire protection of up to 59mm thick concrete when upgrading concrete beams and columns and 64mm when upgrading concrete slabs and walls.

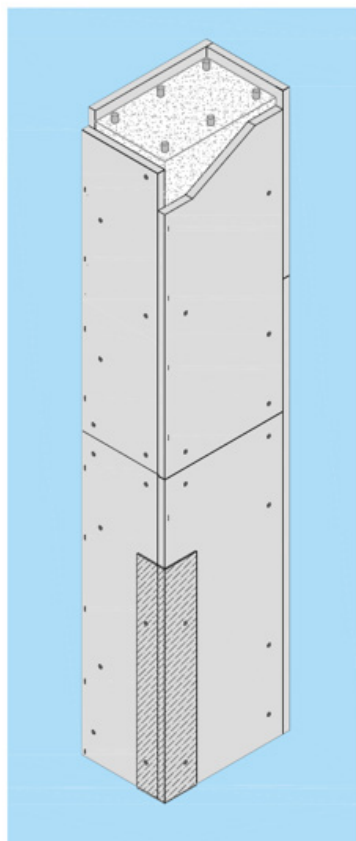
25mm thick PROMATECT®-H board can give the equivalent fire protection of up to 90mm thick concrete when upgrading concrete beams and columns and 101mm when upgrading concrete slabs and walls (board thickness is dependent on the fire protection time required).

Please note that this solution does not increase the structural performance, it is only to upgrade the fire resistance.

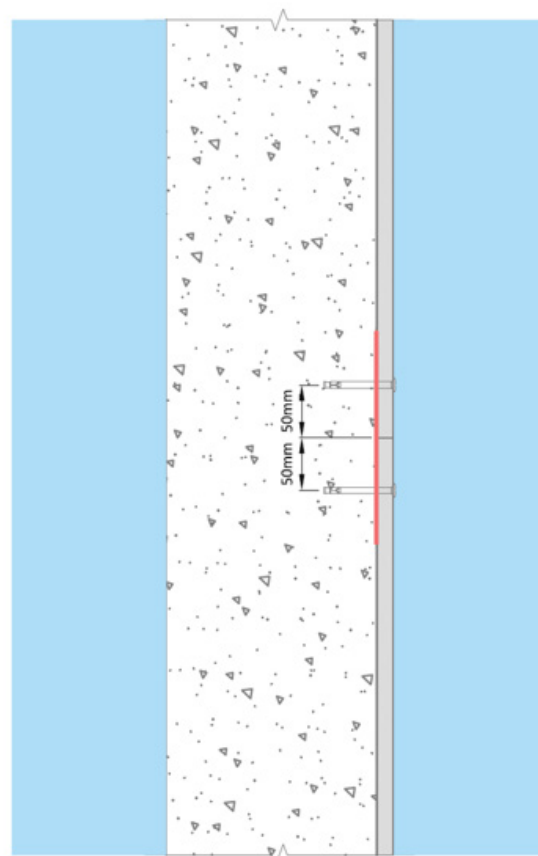
ADVANTAGES

- A fully fire tested solution which has been independently assessed for upgrading concrete structures to provide up to 240 minutes fire resistance. ITB Assessment Report No. 02835.2/15/Z00NZP (beams & columns) & 02835.1/15/Z00NZP (slabs & walls)
- Additional fire protection is applied in a single board layer, giving a space efficient solution with no requirement for wet trades.
- A non-combustible, robust, calcium silicate board that can be installed in semi exposed environments such as within an external cavity, car park or plant room

Concrete Columns



Concrete Walls



- PROMATECT®-H contains no gypsum, inorganic fibres or formaldehyde
- Off-cuts can be disposed of without special handling
- Boards will not rot, deteriorate or decay
- Fast-track, dry installation with no wet trades
- High compressive strength: Galvanized steel partition sections can be installed directly up to the face of the board and through-fixed to the concrete substrate
- Boards can be easily worked and decorated using conventional tools and finishes.

CALCULATING THE ADDITIONAL FIRE PROTECTION REQUIRED

Design considerations

Before the level of additional fire protection can be determined, the following points should be considered when providing the correct specification, to ensure that structural concrete will provide the required fire performance:

Concrete Density

Density not only affects the concrete's strength but also its insulation properties and susceptibility to spalling when exposed to fire.

Concrete Moisture Content

Depending on the concrete type, concrete can spall when exposed to fire if its moisture content is greater than 2-3%

Concrete Thickness and Cover to Reinforcing Bars

The overall concrete dimensions will contribute to the strength and insulation of the structure, but the concrete cover to the closest reinforcing bars to the surface is also critical.

AUTHORITY: ITNB ASSESSMENT REPORT No. 0.2835.2/15/Z00ZP (beams columns) & 0.2835.1/15/Z00ZP (slabs & walls) Test Standard: EN13381-3



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Supporting Steelwork

Care should be taken that any structural steel supporting concrete slabs is also adequately protected against fire.

Protection to reinforced concrete

There are two steps when determining the thickness of Promat board to upgrade the fire protection of concrete structural elements to meet either the design code BS 8110-2: 1985 or EN 1992-1-2: 2004.

Step 1.

The overall size of the beam, column, slab or wall and thickness of concrete cover to the reinforcement are used to meet the fire resistance requirements of reinforced and pre-stressed concrete elements. There are different options on how to calculate these requirements.

BS 8110-2: 1985 or EN 1992-1-2: 2004. give certain "deemed to satisfy" fire performance criteria for concrete elements in relation to the dimensions of the concrete element and the depth of cover to the reinforcement, which are given in 'look up' Tables in either of the Codes. EN 1992-1-2: 2004 also includes an alternative, more complex calculation method, which needs specialist software to complete.

A structural engineer will generally use information given in the Codes to determine the minimum dimensions and the depth of the cover to reinforcement of each element that would be needed to allow the concrete element to meet the required fire protection period. This evaluation should consider the density and condition of the existing concrete and the design load level in a fire situation (e.g. to account for load combinations, compressive strength and bending loads).

The Concrete Class, based on the ITB Assessment, is restricted. The concrete strength is limited to C30/37 or C35/45 according to EN206.

Promat cannot undertake any structural engineering calculations or provide structural engineering advice.

Step 2.

From the evaluation and site data, the structural engineer will calculate any deficiencies in the depth of concrete. Once the deficiency is known, the equivalent thickness of PROMATECT®-H can be determined.

Concrete Beams and Columns

The equivalent concrete thickness is calculated, based on product fire testing using the test standard for materials for protection of concrete EN 13381-3. Part 3 covers applied protection to concrete members.

ITB Assessment Report No. 02835.2/15/Z00NZP (beams & columns) is an assessment to EN 13381-3 and the Report covers single layer protection of either 12mm or 25mm thick.

PROMATECT®-H is fixed using Fisher FNA II - 6 x 30/30 (6 x 65mm) nail anchors. The report determines the equivalent concrete thickness for various fire resistance periods from 30 to 240 minutes. These are given in Table 1 on page 3.

INSTALLATION DETAILS

Before application, the installer is responsible for inspection and preparation of the substrate. The inspection consists of the verification of the condition of existing surface, which should be flat and level. Where required, it may be necessary to scabble the surface to remove any high points.

The PROMATECT®-H boards are fixed to the beam or column using Fisher FNA II - 6 x 30/30 nail anchors and steel staples are used to edge fix the boards to each other at the corners.

Pilot holes should be pre-drilled not less than 50 mm from the edge of the concrete and boards fixed to the concrete using Fisher FNA II - 6 x 30/30 nail anchors spaced at 400mm centres. Pre-drilled holes need to allow for a minimum effective anchorage depth of 30mm. The anchors are pushed through the board and hammer fixed using 2 to 4 blows.

Steel staples at 150mm centres are then used to edge fix the boards at the corners. Staple size 30/10.5/1.4mm for 12mm thick board and 50/10.5/1.4mm for 25mm boards.

Boards joints must be filled with Promat Moisture Resistant Ready-Mixed Joint Filler.

For columns, where there is a risk of minor impact, metal angles must be fixed up to the appropriate height to protect the corners. Angles must be anchored to the concrete substrate and ideally sized so that the anchors coincide with the fixing points for the Promat boards, minimising the number of fixings.

CUTTING AND FINISHING DETAILS

PROMATECT®-H boards can be cut using a jigsaw or a hand-held circular saw with either a diamond tipped or a tungsten carbide-tipped blade. Although a tungsten carbide-tipped saw blade has a shorter life span, a cleaner edge is achieved.

A tungsten carbide-tipped saw can be sharpened by a skilled professional to increase the life of the blade.

A rasp or surform can be used for edge finishing, where necessary, to trim away rough edges. For optimum finishing, the edges can be dressed with glass or paper edge tape.

Etex Building Performance recommends that all cutting be carried out in well ventilated spaces using dust extraction facilities, following the guidance given in the product Safety Information Sheet (SIS).

PROMATECT®-H boards can be either painted or plastered, following application of a suitable priming system. Please see our technical datasheet TDS 056 – Promat Board Finishes for further information.

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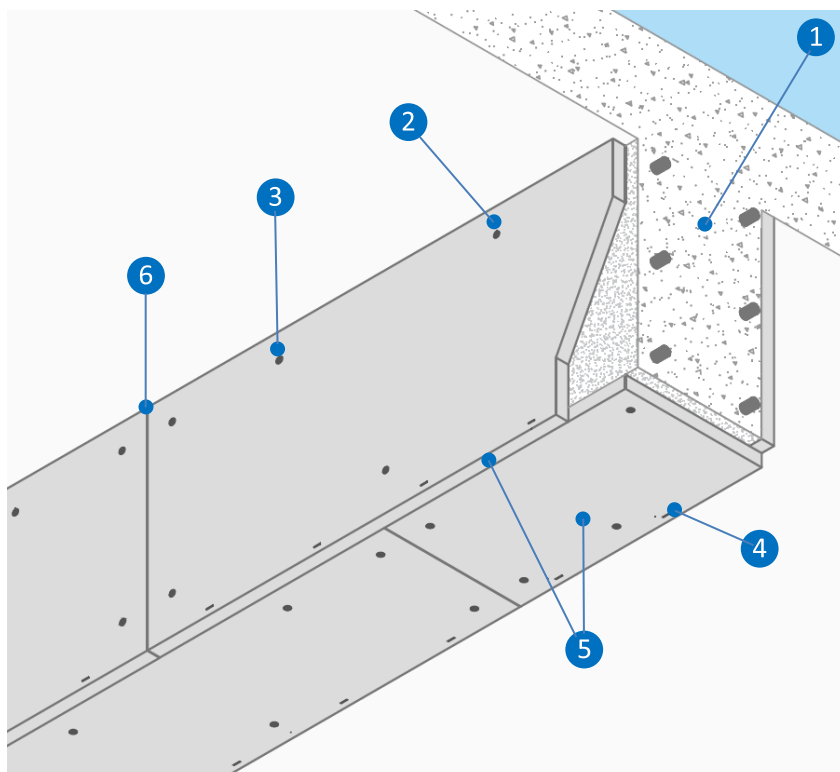
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Table 1 – Report Assessment No. 02835.2/15/Z00NZP PROMATECT®-H
Equivalent concrete thickness for 12mm and 25mm thick PROMATECT®H for various fire periods.

Concrete beams/columns	Equivalent thickness (mm)					
Thickness of Board (mm)	Exposure time (minutes)					
	30	60	90	120	180	240
12	47	56	59	58	-	-
25	58	83	90	89	89	87

Concrete Beams



KEY

- 1 Concrete strength is equal to or one strength higher than tested: C30/37 and C35/45 according to EN 206
- 2 Fisher FNA II - 6 x 30.30 nail anchors fixed into pre-drilled pilot holes spaced at 400mm centres, depth to allow for a minimum anchorage of 30mm
- 3 Pre-drilled pilot holes must be no less than 50mm from the edge of the concrete and boards
- 4 Edge fix steel staples. Minimum 30mm/10.5mm/ 1.4mm Galvanised Chisel Staples for 12mm thick boards fixed at less than 150mm centres. Minimum 50mm/10.5mm/ 1.4mm Galvanised Chisel Staples for 25mm thick boards fixed at less than 150mm centres
- 5 PROMATECT®-H
- 6 Board joints to be finished using PROMAT Moisture Resistant Ready-Mixed Joint Filler

Fisher FNA II anchor



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Concrete slabs and walls

The equivalent concrete thickness is calculated, based on product fire testing using the test standard for materials for protection of concrete EN 13381-3. Part 3 covers applied protection to concrete members.

ITB Assessment Report No. 02835.1/15/Z00NZP (slabs & walls) is an assessment to EN 13381-3 and the Report covers single layer protection of either 12mm or 25mm thick.

PROMATECT®-H is fixed using Fisher FNA II - 6 x 30/30 (6 x 65mm) nail anchors. The report determines the equivalent concrete thickness for various fire resistance periods from 30 to 240 minutes. These are given in Table 2 below.

INSTALLATION DETAILS

Before application, the installer is responsible for inspection and preparation of the substrate. The inspection consists of the verification of the condition of existing surface, which should be flat and level. Where required, it may be necessary to scabble the surface to remove any high points.

The PROMATECT®-H boards are fixed to the slab or wall using Fisher FNA II - 6 x 30/30 nail anchors and 100mm diameter PROMAT PROMACOL® K84/500 dabs between boards and concrete at the nail anchor locations.

Pilot holes should be pre-drilled not less than 50 mm from the edge of the boards and concrete. 100mm diameter PROMAT PROMACOL® K84/500 dabs are applied to the substrate. Boards are fixed to the concrete using Fisher FNA II - 6 x 30/30 nail anchors: 1 anchor per 0.4m² of board (minimum 8 fixings per board). Pre-drilled holes need to allow for a minimum effective anchorage depth of 30mm. The anchors are pushed through the board and hammer fixed using 2 to 4 blows.

Boards joints must be filled with Promat Moisture Resistant Ready-Mixed Joint Filler.

CUTTING AND FINISHING DETAILS

PROMATECT®-H boards can be cut using a jigsaw or a hand-held circular saw with either a diamond tipped or a tungsten carbide-tipped blade. Although a tungsten carbide-tipped saw blade has a shorter life span, a cleaner edge is achieved.

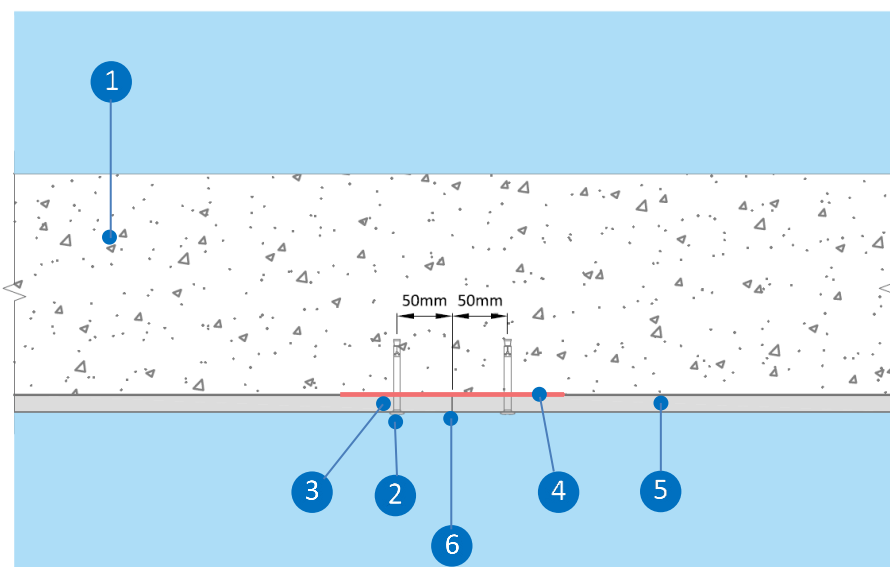
A tungsten carbide-tipped saw can be sharpened by a skilled professional to increase the life of the blade.

A rasp or surform can be used for edge finishing, where necessary, to trim away rough edges. For optimum finishing, the edges can be dressed with glass or paper edge tape.

Etex Building Performance recommends that all cutting be carried out in well ventilated spaces using dust extraction facilities, following the guidance given in the product Safety Information Sheet (SIS).

PROMATECT®-H boards can be either painted or plastered, following application of a suitable priming system. Please see our technical datasheet TDS 056 – Promat Board Finishes for further information.

Concrete Slabs



KEY

- | | |
|---|---|
| 1 | Concrete slab strength is equal to or one strength higher than tested: C30/37 and C35/45 according to EN 206 |
| 2 | Fischer FNA II 6x30/30 (6x65mm) galvanised steel nail anchors fixed into pre-drilled pilot holes. 1 anchor per 0.4m ² of board (minimum 8 fixings per board) |
| 3 | Pre-drilled pilot holes must be no less than 50mm from the edge of the boards |
| 4 | 100mm diameter PROMAT PROMACOL® K84/500 dabs between boards and concrete at the nail anchor locations |
| 5 | PROMATECT®-H |
| 6 | Board joints to be finished using PROMAT Moisture Resistant Ready-Mixed Joint Filler |

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Table 2 – Assessment Report No. 02835.1/15/Z00NZP PROMATECT®H

Equivalent concrete thickness for 12mm and 25mm thick PROMATECT®H for various fire periods

Concrete slab/wall	Equivalent thickness (mm)					
Board thickness (mm)	Exposure time (minutes)					
	30	60	90	120	180	240
12	43	56	62	64	38	-
25	52	74	86	92	98	101

Please contact the Promat Technical Services Team where site conditions fall outside of the scope of this Technical Data Sheet

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Technical Characteristics

Typical Mechanical Properties

Flexural Strength Longitudinal (N/mm ²)	7.6
Flexural Strength Transversal (N/mm ²)	4.8
Tensile Strength Longitudinal (N/mm ²)	4.8
Tensile Strength Transversal (N/mm ²)	2.6
Compressive Strength (N/mm ²)	9.3
Modulus of elasticity Longitudinal (N/mm ²)	4200
Modulus of elasticity Transversal (N/mm ²)	2900

General Technical Data

Designation	Calcium Silicate
Combustibility	Non-combustible with Reaction to Fire classification A1
Nominal dry density (average) kg/m ³	940
Alkalinity (approximately) pH	12
Thermal conductivity at 20°C (approximately) W/mK	0.17
Nominal moisture content (ambient) %	6
Moisture movement (ambient to saturated) %	≥0.1
Dimensional stability	Dimensionally stable
Thickness tolerance of standard boards (mm)	12mm (±0.5) 25mm (±1.5)
Water vapour resistivity MNs/g	98
Water vapour diffusion resistance factor (μ)	20
Length x Width tolerance of standard boards (mm)	±3
Surface condition Front face Back face	Smooth, un-sanded Sanded
Basic durability assessment	The product has an expected working life of at least 25 years for the intended use Z ₂ (Internal use), Z ₁ (Internal use high humidity conditions), Y (external semi-exposed)

Board Format Data

Thickness (mm)	Length x Width (mm x mm)	Edge	Approx. Weight (Dry, kg/m ²)	Approx. Weight (6% moisture, kg/m ²)
12	2500 x 1250	Square edge	11.3	12.0
25	2500 x 1250	Square edge	23.5	25.0

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