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## CERTIFICATE OF APPROVAL

### No CF 5616

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This is to certify that, in accordance with  
TS00 General Requirements for Certification of Fire Protection Products  
The undermentioned products of

## TECRESA PROTECCION PASIVA, S.L.

C/Maragarita Salas, 6. 28919, Leganes (Madrid)  
Tel: 0034 914282260

Have been assessed against the requirements of the Technical Schedule(s)  
denoted below and are approved for use subject to the conditions  
appended hereto:

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#### CERTIFIED PRODUCT

Tecresa Protection Pasiva LTD  
Tecbor B24mm Fire Protection  
Systems for Tunnel Linings

#### TECHNICAL SCHEDULE

TS58 Fire Protection Systems  
for Tunnel Linings

Signed and sealed for and on behalf of Exova (UK) Limited trading as  
Warrington Certification



Paul Duggan  
Certification Manager



Issued: 15<sup>th</sup> December 2017  
Valid to: 14<sup>th</sup> December 2022



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### TECRESA PROTECCION PASIVA, S.L.

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#### **Tecresa Protection Pasiva LTD – Tecbor B24mm Fire Protection Systems for Tunnel Linings**

1. This approval relates to the use of the above protection systems for tunnel linings such that they will maintain their performance in terms of Integrity and Insulation, as defined by the RWS Standard. Subject to the undermentioned conditions, the protection systems for tunnel linings will meet the relevant requirements of TNO report No. 1998-CVB-R1161 (rev 1): Fire protection for tunnels: Part 1: Fire test procedures, for periods of up to 120 minutes (dependant upon design limitations) when used in accordance with the provisions therein.
2. This certification is designed to demonstrate compliance of the product or system for the intended use of providing fire protection to tunnels. The system is intended to provide the fire protection to the tunnel over a reasonable working life and for this reason the requirements for evaluating the durability of the primary material is also included. If compliance is required to other regulatory or guidance documents there may be additional considerations or conflict to be taken into account.'
3. The protection systems for tunnel linings are approved on the basis of:
  - i) Initial type testing
  - ii) Audit testing at the frequency specified in TS58
  - iii) A design appraisal against TS58
  - iv) Certification of quality management system to ISO 9001: 2000.
  - v) Inspection and surveillance of factory production control
4. The protection systems comprise Tecbor B24mm board installed within the concrete tunnel linings using the 'post-fixed' method.
5. This approval is applicable to horizontal (ceiling), vertical (wall) and sloping reinforced concrete tunnel linings as described within this Certificate.
6. The concrete tunnel lining shall have a minimum strength category of C28/35 and have been professionally designed to meet the structural and other design requirements. The minimum depth of cover to the first steel reinforcement behind the protection shall be 30mm.
7. The approval relates to ongoing production. Product is identified with the manufacturers, Tecresa Protection Pasiva LTD, as the 2 Tecbor B24 board for Tunnel lining propose.

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#### **Tecresa Protection Pasiva LTD – Tecbor B24mm Fire Protection Systems for Tunnel Linings**

This approval relates to the ability of Tecbor B24mm fire protection systems for reinforced concrete tunnel linings to maintain their performance in terms of Integrity and Insulation as defined in TNO report No. 1998-CVB-R1161 (rev 1): Fire protection for tunnels: Part 1: Fire test procedures, for periods of up to 120 minutes, when subjected to the RWS temperature/time furnace heating conditions.

The performance criteria described within the test procedure are as follows:

- During the 120-minute heating period the protection material must not fall away as a result of failure of the fixing system.
- During the 120-minute heating period the following temperatures shall not be exceeded:
  - a) 380°C for each measuring point at the interface of the concrete and the protection material.
  - b) 250°C for each measuring point located 30mm above the bottom of the concrete slab (thermocouples fixed to the underside of the reinforcement).

#### Post-fixed method

For wall and ceiling applications the Tecbor B24mm boards may be installed after the concrete tunnel walls and roofs have been constructed. The boards are fastened to the concrete with Fischer FNA 6x30/30 A4 stainless steel anchors (or equivalent). The FNA II 6x30.30 anchors are installed in combination with a circular washer of 8.4x30, stainless steel (grade A4). For wall and ceiling applications the screws are fitted at a minimum rate of 7 to 8 anchors per m<sup>2</sup>. The anchors are positioned as evenly as possible across the boards and along the boards, with the anchors adjacent to the edges of the boards being 100mm from the edge.

- a) Tecbor Tunnel Board should be prepared for installation prior to site delivery. This include cutting to size and edge beveling. Cut panels according to requirements of the ceiling plan.
- b) Using a pre-designed template, mark position of anchors points on the TECBOR Tunnel Board.
- c) Referencing approved tunnel drawings mark out boards setting lines. Install the panels outward, from inner tunnel wall towards the outer tunnel wall.
- d) If the depth of the concrete cover has been verified to exceed 50mm, then predrill anchor holes ready for securing of anchors. For anchors length exceeding rebar depth, marks the anchor points and only drill after site verification with rebar detector.
- e) Visually inspect the concrete soffit surface and clean off any lumps or irregularities of the concrete surface, if possible.
- f) Using a panel hoist, lift the panels up with the black painted face facing downward until the panels are flat against the concrete substrate.
- g) Check the position of the anchor points with rebar detector to determine the points are free of rebar or adequate concrete cover. Adjust anchor points 50mm distance from original points if required to avoid rebars.

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- h) Using appropriate drill bit size and depth gauge, drill through the boards and into the concrete. Ensure sufficient depth into concrete cover. Refer to anchor's manufacturer specification for drill-bit diameter, depth into concrete, and torque recommendation. To minimize over-drilling, always use depth gauge attached to the hammer drill.
- i) Insert anchors into the pre-drilled holes, and knock them into position using rubber or wooden mallets until the anchor washers are in tight contact with surface of TECBOR Tunnel Board. Screw in the anchor nut, keeping to the recommended torque from the anchor manufacturer. DO NOT OVER TIGHTEN anchors.
- j) Inspect the anchor visually, and if required, use a force gauge to check that the anchors are securely fastened. Any dislodged anchors shall be replaced.

#### **Bevel (Angle) Joints**

- a) When the concrete soffit changes angle, the edge of the board should be beveled to provide a close fitting joint.

#### Tunnel expansion joints

- a) In order to accommodate structural movement and movement in the panels itself due to thermal or moisture, expansion joint every 10 linear metre of panels are good practice. The expansion joint is a gap of 5 mm width filled with Tecsel Intumescent Mastic;
- b) In order to accommodate structural joints in the concrete substrate, a cover overlapping strip, 30mm thick with a minimum 200mm overlap fixed on one end using anchors of sufficient lengths, or M4 screws if there is no coinciding anchor points, and 150mm overlap on the panel on the opposite side of the gap.

#### **Acceptable Limits**

- a) TECBOR Tunnel Board is tested with butt joints. Due to inconsistencies in the concrete substrate surface, it may not always be possible to obtain a tight or level butt joint finish.
- b) It is acceptable to have a gap or step between butt joints not exceeding 3mm. Joints Gaps Exceeding 3mm;
- c) In the circumstance where the gap joint is more than 3mm, but less than 6mm, the gap must be filled with Tecsel Intumescent Mastic;
- d) When a gap exceeding 6 mm is discovered, it must be rectified with the gap filled with Tecsel Intumescent Mastic and a cover strip of the same board and thickness, 100mm wide screw fixed to the backing board;

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#### **Level Steps Exceeding 3mm**

- a) When the substrate is uneven, care should be taken when tightening the anchors as not to over tighten and subsequently crack the boards;
- b) Shims or spacers made from TECBOR to appropriate thicknesses can be used to fill unevenness in the concrete substrate in the event that the step height exceeds 3mm as shown below. When the step level increases, shims can be used;
- c) If the step level decrease, shim can be used

#### Repair of minor damage

1. The damage area should be removed by cutting right angles;
2. Cleaning the area;
3. Replacing the removed part by a new board of the same size;
4. Fixing the new board the system with stainless steel anchors (or equivalent). The number of anchors should be met the minimum number of fixation as described in post fixing method section;
5. Tecsel mastic should be applied in case the gap joint is  $\geq 3$  mm.

#### Smoke and toxicity

Tecbor B board has been tested with the test procedures defined in NF X10702 for smoke NF F16-101 and for optical smoke density determination the product tested in accordance with NF X70-100 for gas toxicity. The results classified in line with NF F 16101 and the product classified as F2.

#### Durability

Evidence of durability is based on tests conducted in accordance with EN 12467. The following test evidence has been presented for Tecbor B24mm board:

- Resistance to deterioration caused by water – No claim has been made.
- Resistance to soak/dry – No claim has been made.
- Resistance to freeze/thaw – No claim has been made.
- Resistance to heat/rain – No claim has been made.