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Expert opinion on the use of the fischer TherMax in timber connections

Report no.: 24-045-1(2)

Independent Technical Assessment

Name of product:
TherMax

Type of product:
Stand-off installation system

Manufacturer:
fischerwerke GmbH & Co. KG

14/04/2025

1 Task and Aim

The company fischerwerke GmbH & Co. KG wants to expand the use of their stand-off installation system TherMax [1], in timber using the injection system FIS EM Plus [2].

2 Description of the product

2.1 TherMax

The fischer TherMax consists of an anti-cold cone (called "ACC") in sizes 12-M12 and 16-M12 made of glass-fibre reinforced polyamide, an anchor rod made of galvanised or stainless steel in sizes M12 or M16, the injection anchor sleeve FIS HK and a threaded pin or screw in size M12 optional with reduced cross section to size M10 or M8 (with corresponding washer and hex nut) made of stainless steel.

On the anchorage side, the fischer TherMax is anchored to the structure using the anchor rod and an injection mortar. The injection systems which can be used to install the TherMax are given in the current approval Z-21.8-1837 [1].

The cross section of the fischer TherMax is shown in Figure 2.1.

Note: FIS EM Plus must be used for application in wood.

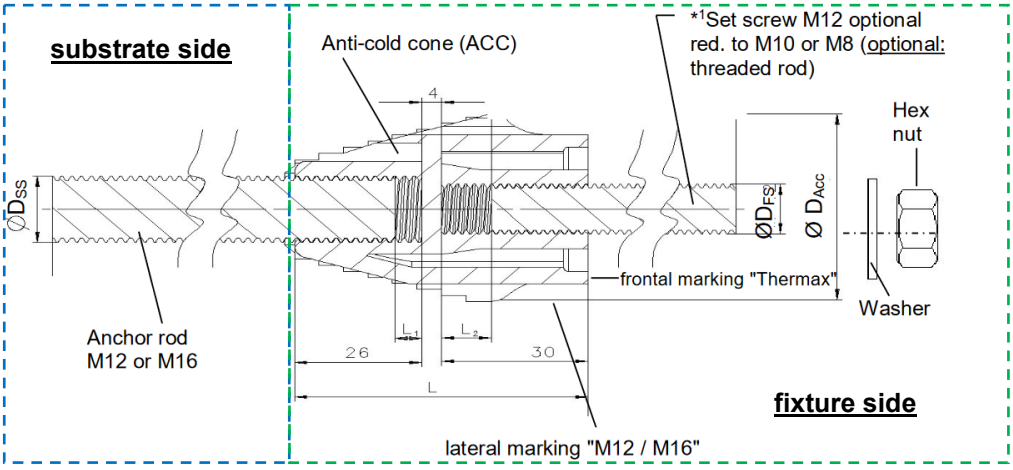

Figure 2.1: Cross section of the fischer TherMax.

Detailed information about the dimensions, materials and installation of fischer TherMax is given in Z-21.8-1837 [1].

2.2 FIS EM Plus

The injection system FIS EM Plus has a European Technical Assessment ETA-19/0657 [2] for use in glued-in timber connections according to EAD 130006-00-0304 [3]. FIS EM Plus is an adhesive system consisting of an adhesive cartridge with the injection mortar fischer FIS EM Plus and a steel rod. The steel rod is inserted into a borehole, whereby the adhesive is either injected into the borehole before the steel rod is inserted (Direct Injection) or the annular gap is then filled with adhesive (By-Pass Injection). Once the adhesive has hardened, the steel rod is permanently anchored by the bond between the steel, adhesive and timber.

An example of the use of the fischer FIS EM Plus in timber connections is shown in Figure 2.2.

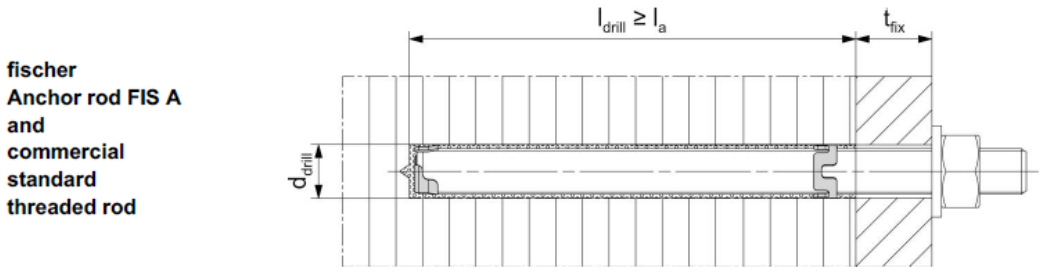

Figure 2.2: Illustration of the concealed installation using Direct Injection (DI).

Detailed information about the dimensions, materials and installation of fischer FIS EM Plus is given in ETA-19/0657 [2].

3 Summary

The load applied to the TherMax is transferred through the threaded rod and fixture into the anti-cold cone, finally reaching the steel threaded rod in the anchorage ground. The threaded rod is installed in the anchorage ground using the injection system FIS EM Plus. The load is thus transferred through chemical interlock (bond) into the anchorage ground.

Therefore, the performance of the stand-off installation system TherMax is limited by the behaviour of the steel component including mortar in the anchorage ground and the behaviour of the anti-cold cone TherMax on the fixture side (see Figure 2.1).

The performance of the anti-cold cone TherMax is summarised in the approval Z-21.8-1837 dated 25.02.2025 [1]. In the approval, the characteristic resistance under tension and pressure loading are specified. Furthermore, the maximum shear load which can be applied to the TherMax outside the anchorage ground, depending on the lever arm and the corresponding displacements are given. These values are determined through experiments in concrete and in masonry.

The performance of the anchoring with FIS EM Plus in timber is specified in the ETA-19/0657 dated 13.09.2024 [2]. In the European Technical Assessment, the essential characteristics of the adhesive in timber such as the bond strength in longitudinal shear strength, the effect of wood shrinkage on the shear strength, the bond shear strength of glued-in steel rods etc. are given.

To summarise, the overall performance of TherMax in timber connections under tension and pressure loading is limited by the essential characteristics given in the Z-21.8-1837 [1] for the fixture side and ETA-19/0657 [2] for the anchorage side. The design The shear bond strength $f_{vr,k}$ given in the ETA-19/0657 [2] can be used for the verification of pull-out failure under tension in the anchorage ground (timber).

The performance under shear load with lever arm in the approval Z-21.8-1837 [1] was defined with tests in concrete and masonry. According to the European Technical Assessment of the Injection system, the fischer TherMax can be used in masonry bricks with a minimum compressive strength of 2 N/mm^2. According to ETA-19/0657 [2], FIS EM Plus can only be used in glued laminated timber and glued solid timber in accordance with EN 14080 [4]. According to EN 14080 [4], the minimum compressive strength for glued laminated timber and glued solid timber is $f_{c,0,g,k}$ = 18,5 N/mm^2 for loading in the fibre direction and $f_{c,90,g,k}$ = 2,5 N/mm^2 for loading perpendicular to the fibre direction. Therefore, it can be assumed that the values given in Z-21.8-1837 [1] regarding the performance under shear load with lever arm, including the corresponding displacements, are valid for the application in glued laminated timber and glued solid timber in accordance with EN 14080 [4].

The required edge and spacing distances for timber structures are regulated according to DIN EN 1995-1-1/NA [5].

The companies that glue steel rods into load-bearing timber components in accordance with this decision in Germany must be in possession of a certificate of suitability for gluing steel rods into load-bearing timber components in accordance with DIN 1052-10, Section 5 [6].

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Literature

[1] Z-21.8-1837, ‘fischer TherMax zur Verankerung von Abstandskonstruktionen in Beton und Mauerwerk’. Deutsches Institut für Bautechnik, Feb. 25, 2025.
[2] ETA-19/0657, ‘fischer injection system FIS EM Plus. Glued-in rods for timber connections’. Deutsches Institut für Bautechnik, Sep. 13, 2024.
[3] EAD 130006-00-0304, ‘Glued-in rods for timber connections’. EOTA, Apr. 2019.
[4] DIN EN 14080, ‘Holzbauweke - Brettschichtholz und Balkenschichtholz - Anforderungen’. Sep. 2013.
[5] DIN EN 1995-1-1/NA, ‘Nationaler Anhang - National festgelegte Parameter - Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-1: Allgemeines - Allgemeine Regeln und Regeln für den Hochbau’. DIN Media GmbH, Aug. 2013.
[6] DIN 1052-10, ‘Holzbauwerke - Herstellung und Ausführung von Holzbauwerken - Teil 10: Ergänzende Bestimmungen zu Verbindungsmitteln und nicht europäisch geregelten geklebten Produkten und Bauarten’. DIN Media GmbH, Dec. 2024.