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National technical approval / General construction technique permit

Number:
Z-9.1-914

Applicant:
fischerwerke GmbH & Co. KG
Otto-Hahn-Straße 15
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Validity
from: **19 February 2024**
to: **19 February 2029**

Subject of decision:
fischer FIS EM Plus injection system for steel rods to be glued into timber members

The subject named above is herewith granted a national technical approval (*allgemeine bauaufsichtliche Zulassung*) / general construction technique permit (*allgemeine Bauartgenehmigung*). This decision contains eleven pages and one annex.

Translation authorised by DIBt

DIBt

I GENERAL PROVISIONS

- 1 This decision confirms the fitness for use and application of the subject concerned within the meaning of the Building Codes of the federal states (*Landesbauordnungen*).
- 2 This decision does not replace the permits, approvals and certificates required by law for carrying out construction projects.
- 3 This decision is granted without prejudice to the rights of third parties, in particular private property rights.
- 4 Notwithstanding further provisions in the 'Special Provisions', copies of this decision shall be made available to the user and installer of the subject concerned. The user and installer of the subject concerned shall also be made aware that this decision must be made available at the place of use or place of application. Upon request, copies of the decision shall be provided to the authorities involved.
- 5 This decision shall be reproduced in full only. Partial publication requires the consent of DIBt. Texts and drawings in promotional material shall not contradict this decision. In the event of a discrepancy between the German original and this authorised translation, the German version shall prevail.
- 6 This decision may be revoked. The provisions contained herein may subsequently be supplemented and amended, in particular if this is required by new technical findings.
- 7 This decision is based on the information and documents provided by the applicant. Alterations to this basis are not covered by this decision and shall be notified to DIBt without delay.

II SPECIAL PROVISIONS

1 Subject concerned and field of use and application

1.1 Subject of approval and field of use

The subject of approval is the FIS EM Plus 2-component epoxy resin adhesive for gluing steel rods into load-bearing timber structures as well as the FIS IG internal threaded anchor.

The fitness for use of the FIS EM Plus adhesive has been verified for gluing steel rods into timber members made of spruce (*Picea abies*), fir (*Abies alba*) or pine (*Pinus sylvestris*).

The FIS EM Plus adhesive may be used for gluing steel rods into load-bearing timber structures in accordance with DIN EN 1995-1-1 in conjunction with DIN EN 1995-1-1/NA, Clauses NCI NA.6.8, NCI NA.11.1 and NCI NA.11.2. The FIS IG internal threaded anchors may be used as steel rods and glued into load-bearing timber structures using the FIS EM Plus 2-component epoxy resin adhesive.

1.2 Subject of the permit and field of application

The subject of the permit are load-bearing timber connections which are produced by gluing in steel rods using the FIS EM Plus adhesive.

The load-bearing timber connections with glued-in steel rods consist of

- the FIS EM Plus 2-component epoxy resin adhesive,
- steel rods
 - ribbed reinforcing steel rods in accordance with DIN EN 10080 or DIN 488-2 with a nominal diameter d of $6 \text{ mm} \leq d \leq 32 \text{ mm}$ or
 - metallic threaded rods with a metric thread made of carbon steel in accordance with DIN 976-1 with strength classes 5.8 to 12.9 in accordance with DIN EN ISO 898-1 or made of stainless steel in accordance with DIN EN ISO 3506-1 or decision no. Z-30.3-6 with a nominal diameter d of $6 \text{ mm} \leq d \leq 30 \text{ mm}$, e.g. the fischer FIS A anchor rod
 - the FIS IG internal threaded anchor in accordance with the technical specification, as deposited with DIBt, with a nominal diameter d of $12 \text{ mm} \leq d \leq 30 \text{ mm}$
- and timber members made of the following timber materials
 - glued laminated timber and glued solid timber in accordance with DIN EN 14080 in conjunction with DIN 20000-3.

Load-bearing timber connections with glued-in steel rods produced using the FIS EM Plus adhesive shall only be used inside buildings and for roofed members where a relative humidity of 85% is only exceeded for a few weeks per year (service classes 1 and 2 in accordance with DIN EN 1995-1-1). The fitness for application of the connections produced with the adhesive has been verified up to a member temperature of 60 °C.

Gluing steel rods into load-bearing timber structures which have been treated or are treated with chemical wood preservatives or fire retardants is not the subject of this decision.

The load-bearing timber connections produced using the FIS EM Plus adhesive and steel rods shall only be used for static or quasi-static actions. Fatigue-relevant loads shall be excluded.

2 Provisions for the fischer FIS EM Plus injection system

2.1 Properties and composition

2.1.1 2-component epoxy resin adhesive

The formulation of the FIS EM Plus adhesive shall comply with the specifications deposited with DIBt.

The adhesive shall consist of

- 100 parts by volume FIS EM Plus – Component A (mortar) and
- 33 parts by volume FIS EM Plus – Component B (curing agent).

For gluing spruce, fir and pine, the adhesive meets the requirements for adhesive type I in accordance with DIN EN 301.

2.1.2 FIS IG internal threaded anchor

The FIS IG internal threaded anchors shall be made of the following materials:

- steel, strength class 5.8 in accordance with DIN EN ISO 898-1 or
- stainless steel R, strength class 70 in accordance with DIN EN ISO 3506-1 or
- high corrosion resistant steel HCR, strength class 70 in accordance with DIN EN ISO 3506-1.

The shape and dimensions of the FIS IG internal threaded anchors shall correspond to those given in Annex 1. They shall have the strength parameters in accordance with Annex 1.

The FIS IG internal threaded anchors made of galvanised carbon steel with strength class 5.8 shall be either galvanised (electroplated) $\geq 5 \mu\text{m}$ in accordance with DIN EN ISO 4042 or hot dip galvanised $\geq 40 \mu\text{m}$ in accordance with DIN EN ISO 10684.

2.2 Storage, transport, marking

2.2.1 Storage, transport

The storage and transport of the adhesive and the FIS IG internal threaded anchors shall be subject to the manufacturer's instructions.

2.2.2 Marking

The outer packaging of the FIS IG internal threaded anchor and the container and the delivery note of the adhesive shall be marked by the manufacturer with the national conformity mark (*Ü-Zeichen*) in accordance with the Conformity Marking Ordinances (*Übereinstimmungszeichen-Verordnungen*) of the federal states. The mark shall only be applied if the requirements given in Section 2.3 are met.

Furthermore, the FIS IG internal threaded anchor and the container and/or the delivery note shall at least be marked with the following information:

- designation of the subject of approval,
- batch number of the adhesive; the batch number shall include the year and day of production,
- size and corrosion protection of the FIS IG internal threaded anchors.

2.3 Confirmation of conformity

2.3.1 General

2.3.1.1 FIS EM Plus 2-component epoxy resin adhesive

The confirmation of conformity of the adhesive with the provisions of this national technical approval shall be issued for every manufacturing plant in the form of a declaration of conformity by the manufacturer based on factory production control and initial type-testing of the adhesive by a testing laboratory recognised for these purposes.

The declaration of conformity shall be submitted by the manufacturer through marking of the construction products with the national conformity mark (*Ü-Zeichen*), including a statement of the intended use.

2.3.1.2 FIS IG internal threaded anchor

The manufacturer shall confirm for each manufacturing plant that the FIS IG internal threaded anchor complies with the provisions of this national technical approval by way of a declaration of conformity based on factory production control and a certificate of conformity issued by a certification body recognised for these purposes as well as on regular external surveillance carried out by a recognised inspection body in accordance with the following provisions:

To issue the certificate of conformity and for external surveillance, including the associated product testing, the manufacturer shall use a certification body and an inspection body recognised for these purposes.

The declaration of conformity shall be submitted by the manufacturer through marking of the construction products with the national conformity mark including a statement of the intended use.

The manufacturer shall send a copy of the initial type-testing report to DIBt.

2.3.2 Factory production control

A factory production control system shall be set up and implemented in each manufacturing plant. Factory production control is understood to be continuous surveillance of production by the manufacturer to ensure that the products manufactured satisfy the provisions of this national technical approval.

The factory production control shall at least include the following measures:

- Description and verification of the starting material and the components
- Checks and tests to be carried out during production
The checks and tests deposited with DIBt shall be carried out.
- Verifications and tests carried out on the finished product
The checks and tests deposited with DIBt shall be carried out.

Verification of the required material properties of the FIS IG internal threaded anchor as specified in Section 2.1 shall be provided through an inspection certificate 'type 3.1' in accordance with DIN EN 10204. The conformity of the information in the inspection certificate with the specifications of Section 2.1 shall be checked.

Compliance with the corrosion protection requirements specified in Section 2.1 shall be checked.

The results of factory production control shall be recorded and evaluated. The records shall include at least the following information:

- designation of the adhesive and of the FIS IG internal threaded anchor,
- type of check or test,
- date of manufacture and the testing of the adhesive and the FIS IG internal threaded anchor,
- results of the checks and tests as well as, if applicable, comparison with requirements,
- signature of the person responsible for factory production control.

The records shall be kept for at least five years. They shall be submitted to DIBt and the competent supreme building authority upon request.

If the test result is unsatisfactory, the manufacturer shall immediately take the necessary measures to resolve the defect. Construction products which do not meet the requirements shall be handled in such a way that they cannot be confused with compliant products. After the defect has been remedied, the relevant test shall be repeated immediately – where technically feasible and necessary to show that the defect has been eliminated.

2.3.3 Initial type-testing of the adhesive by a recognised testing laboratory

The tests required within the scope of initial type-testing are deposited with DIBt.

2.3.4 External surveillance for the FIS IG internal threaded anchor

In each manufacturing plant, the plant and the factory production control system shall be inspected regularly, i.e. at least once a year, by means of external surveillance.

Initial type-testing of the construction products shall be carried out within the scope of external surveillance. Samples for random testing may also be taken. Sampling and testing shall be the responsibility of the recognised inspection body. The tests to be performed shall at least include the tests provided for in Section 2.3.2 for the factory production control.

The results of certification and external surveillance shall be kept for at least five years. They shall be presented by the certification or inspection body to DIBt and the competent supreme building authority upon request.

3 Provisions for planning, design and execution

3.1 Planning and design

3.1.1 General

Unless otherwise specified below, the Technical Building Rules, in particular DIN EN 1995-1-1 in conjunction with DIN EN 1995-1-1/NA, Clauses NCI NA.6.8, NCI NA.11.1 and NCI NA.11.2, shall apply to the planning and design of load-bearing timber connections that are executed using the FIS EM Plus adhesive. Where FIS IG internal threaded anchors are used as steel rods, the provisions in DIN EN 1995-1-1/NA, Clauses NCI NA.6.8, NCI NA.11.1 and NCI NA.11.2 shall apply accordingly. For FIS IG internal threaded anchors, the provisions for metallic threaded rods with metric threads in accordance with DIN 976-1 shall apply.

Where FIS IG internal threaded anchors made of stainless steel are used as steel rods, the Technical Building Rules, in particular DIN EN 1993-1-4 in conjunction with DIN EN 1993-1-4/NA and the provisions of decision no. Z-30.3-6 shall apply depending on the environmental conditions. The stainless steel R, from which the FIS IG internal threaded anchors are made, may be assigned to corrosion resistance class CRC III in accordance with DIN EN 1993-1-4. The stainless steel HCR, from which the FIS IG internal threaded anchors are made, may be assigned to corrosion resistance class CRC V in accordance with DIN EN 1993-1-4.

The calculated values for the characteristic strength of glue lines between the steel rod and the borehole wall shall be determined in accordance with DIN EN 1995-1-1/NA, Table NA.12. Simplified, the connection of steel rods glued into load-bearing timber structures may be considered a rigid connection.

The value resulting from equation (1) is the maximum value for the effective bonding length or anchoring length of the steel rods that may be applied in the calculation.

$$l_{ad,max} = \min(40 \cdot d; 1000) \quad \text{in mm} \quad (1)$$

The minimum bonding length or anchoring length of the steel rods resulting from equation (2) shall be maintained.

$$l_{ad,min} = \max(10 \cdot d; 100) \quad \text{in mm} \quad (2)$$

Where:

d nominal diameter of the steel rods in mm.

In deviation from equation (1), the provision in accordance with DIN EN 1995-1-1/NA, Clause NCI NA.6.8.5 (NA.3) shall apply to the effective bonding length or anchoring length l_{ad} to be applied in the calculation in case of strengthening in accordance with DIN EN 1995-1-1/NA, Clause NCI NA.6.8.6 – Strengthening for complete transfer of tensile stresses for double tapered beams, curved and pitched cambered beams.

For gluing in steel rods into timber member areas under tension, the reduction in the cross-sectional area of the timber members resulting from drilled holes shall be taken into account by the structural analysis (see DIN EN 1995-1-1, Clause 5.2)

Where groups of steel rods are glued in parallel to the grain of the timber members and subjected to tension in the grain direction, a verification of the connection with regard to block shear failure shall be performed in accordance with EOTA Technical Report TR 070, Section 4.1.7.

When installing FIS IG internal threaded anchors in combination with steel fasteners incorporated into the internal thread, the failure for each fastener as well as the timber-steel and steel-steel connection shall be verified separately in accordance with the Technical Building Rules, including DIN EN 1992-4. For characteristic strength parameters of the Fischer FIS IG internal threaded anchors, see Annex 1.

3.1.2 Reaction to fire

When the minimum distances between the steel rod axis and the timber edge of $2.5 \cdot d$ are observed, the load-bearing timber connections with steel rods that have been glued into timber members using the FIS EM Plus adhesive meet the reaction to fire requirements for flammable (*normalentflammbar*) building materials and may be used where the regulatory requirements for flammable (*normalentflammbar*) building materials apply.

3.2 Execution

3.2.1 General

Unless otherwise specified below, the Technical Building Rules, in particular DIN EN 1995-1-1 in conjunction with DIN EN 1995-1-1/NA, Clauses NCI NA.6.8, NCI NA.11.1 and NCI NA.11.2, as well as DIN 1052-10, Section 6 shall apply to the execution of load-bearing timber connections that are executed using the FIS EM Plus adhesive.

In consultation with the approval testing laboratory, the adhesive manufacturer shall prepare processing guidelines taking the specific properties of the adhesive into account. They shall be supplied to the adhesive user for consideration.

A copy of the processing guidelines shall be sent to DIBt by the manufacturer.

Companies that glue steel rods into load-bearing timber structures in accordance with this decision shall have a certificate verifying their suitability for gluing steel rods into load-bearing timber structures in accordance with DIN 1052-10, Section 5.

For metallic threaded rods and FIS IG internal threaded anchors, the diameter of the borehole shall be at least 2.0 mm but no more than 4.0 mm larger than the nominal diameter of the steel rods or than the external diameter of the FIS IG internal threaded anchors.

From a slimmess of the metallic threaded rods and FIS IG internal threaded anchors of $l_{ad}/d > 30$, the borehole diameter shall be at least 3 mm but no more than 4 mm larger than the nominal diameter of the steel rods.

For ribbed reinforcing steel rods, the diameter of the borehole shall correspond to the values in Table 1, unless measurements made on the ribbed reinforcing steel rods used show smaller external diameters. If this is the case, the following shall apply:

External diameter of the ribbed reinforcing steel rod + 2.0 mm up to + 4.0 mm, but not more than nominal diameter + 5.5 mm for nominal diameters > 25 mm.

Table 1 Borehole diameter for ribbed reinforcing steel rods

Nominal diameter d of the ribbed reinforcing steel rods in mm	Borehole diameter in mm
$6 \leq d \leq 16$	$d + 3 -0.5/+1$
$16 < d \leq 20$	$d + 3.5 \pm 0.5$
$20 < d \leq 27$	$d + 4.5 \pm 0.5$
$27 < d \leq 32$	$d + 5.5$

By using suitable structural measures (e.g. spacers) it shall be ensured that the steel rods are centrically glued into the borehole.

If the borehole is filled with adhesive beforehand and the steel rod is subsequently inserted from above, it shall be considered that there may be a delay in the release of trapped bubbles. In this case, refilling is necessary. Introducing the adhesive into the borehole by means of injection largely avoids the inclusion of bubbles. It shall be ensured that the adhesive does not escape while curing. If the adhesive escapes from the borehole, refilling is necessary. Refilling shall take place within the times specified in Table 2, Line 2.

The total glue-in length of the steel rods l_{glue} shall not exceed 3,000 mm; the rod slimmess shall be $l_{glue}/d < 110$.

Where:

d Nominal diameter of the steel rods in mm.

When gluing-in the FIS IG internal threaded anchors, the installation parameters given in Annex 1 shall be observed.

The steel rods shall only be glued into timber members that have a moisture content of 6 % to 18 %. During the gluing process, the temperature of the timber members, the steel rods and the adhesive shall be at least 17 °C. The fitness for use of the adhesive has been verified up to a temperature of 40 °C of the timber members into which the steel rods are to be inserted using the adhesive. The room temperature during gluing and curing shall be at least 17 °C.

To avoid condensation, adequate air conditioning shall be provided for all components, explicitly for the steel members to be installed.

The executing company shall provide a declaration of conformity in accordance with Section 16a (5) in conjunction with Section 21 (2) of the Model Building Code to confirm the conformity of the construction technique with this general construction technique permit.

3.2.2 Application properties

During the installation process, the respective period of time for introducing and aligning the steel rod as well as the period of time during which the members with glued-in steel rods must not be moved shall be observed in accordance with Table 2.

Table 2 Period of time for introducing and aligning the steel rod as well as period of time during which the members with glued-in steel rods must not be moved, depending on the room temperature and the temperature of the timber members

Room temperature and temperature of the timber members with glued-in steel rods during installation	17 to < 20 °C	20 to < 30 °C	30 to ≤ 40 °C
Maximum period of time for introducing the steel rod into the borehole filled with adhesive and aligning it after filling of the borehole has been started	30 min	14 min	7 min
Period of time during which the members with the glued-in steel rods must not be moved	18 h	10 h	5 h

The requirements of Table 3 for the earliest point in time at which mechanical stress may be applied and for the period of time until the adhesive has reached its final joint strength shall be complied with.

Table 3 Period of time until the adhesive has reached its final joint strength depending on the room temperature and the temperature of the timber members

Room temperature and temperature of the timber members with glued-in steel rods during curing	17 to < 20 °C	20 to < 30 °C	30 to ≤ 40 °C
Period of time until the adhesive has reached its final joint strength at T ≤ 60 °C ¹	36 h	18 h	12 h
¹ After this period of time, the maximum member temperature to which the load-bearing connections with glued-in steel rods may be exposed is 60 °C.			

References

The following standards and references are referred to in this decision:

DIN 488-2:2009-08	Reinforcing steels - Reinforcing steel rods
DIN 976-1:2016-09	Stud bolts - Part 1: Metric thread

DIN EN 10080:2023-02	Steel for the reinforcement of concrete - Weldable reinforcing steel - General
DIN EN 1995-1-1:2010-12+A2:2014-07	Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings
DIN EN 1995-1-1/NA:2013-08	National Annex – Nationally determined parameters – Eurocode 5: Design and construction of timber structures – Part 1-1: General – Common rules and rules for buildings
DIN EN 1992-4:2019-04	Eurocode 2 - Design of concrete structures - Part 4: Design of fastenings for use in concrete
DIN EN 14080:2013-09	Timber structures - Glued laminated timber and glued solid timber - Requirements
DIN 20000-3:2022-02	Application of construction products in structures– Part 3: Glued laminated timber and glued solid timber in accordance with DIN EN 14080
DIN EN 301:2018-01	Adhesives, phenolic and aminoplastic, for load-bearing timber structures – Classification and performance requirements
DIN EN 1995-2:2010-12	Design of timber structures – Part 2: Bridges
DIN EN 1995-2/NA:2021-06	National Annex – Nationally determined parameters – Eurocode 5: Design of timber structures – Part 2: Bridges
DIN 1052-10:2012-05	Design of timber structures – Part 10: Additional provisions
DIN EN ISO 898-1:2013-05	Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs with specified property classes
DIN EN ISO 3506-1:2020-08	Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs with specified grades and property classes
DIN EN 10204:2005-01	Metallic products - Types of inspection documents
DIN EN 1993-1-4:2015-10	Eurocode 3: Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels
DIN EN 1993-1-4/NA:2020-11	National Annex - Nationally determined parameters – Eurocode 3: Design of steel structures – Part 1-4: General design rules – Supplementary rules for stainless steels
DIN EN ISO 4042:2022-11	Fasteners - Electroplated coating systems

DIN EN ISO 10684:2011-09

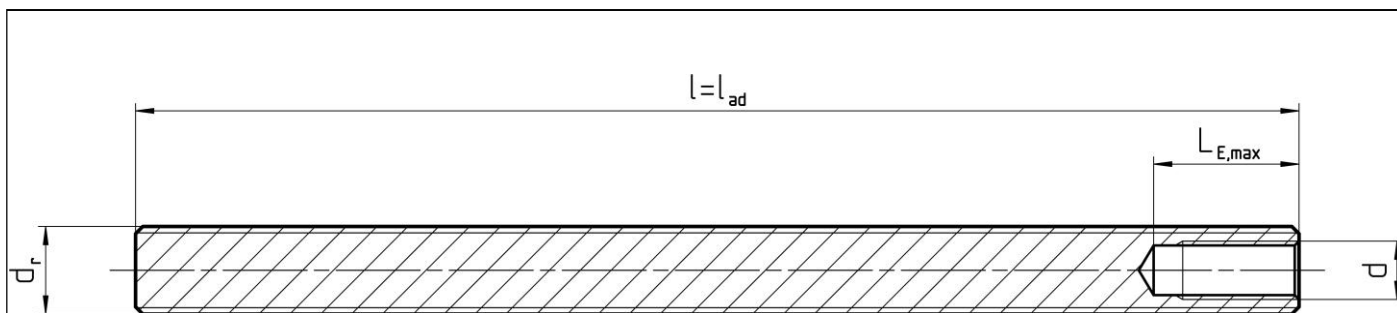
Fasteners - Hot dip galvanized coatings

EOTA Technical Report TR 070:2019

"Design of glued-in Rods for Timber Connections"

Anja Dewitt
Head of Section

Drawn up by
Vössing



Design values								
fischer FIS internal threaded anchor			IG8	IG10	IG12	IG16	IG20	
Internal thread	d	[mm]	M8	M10	M12	M16	M20	
External diameter	d _r		12	16	20	24	30	
Anchor length	l = l _{ad}		120	160	200	240	300	
Stress area	A _{s,FIS IG}	[mm ²]	44.4	94.2	154.4	186.5	301.6	
fischer FIS IG internal threaded anchor								
Characteristic tensile strength	f _{u,k}	5.8	[N/mm ²]	520				
Characteristic yield strength	f _{y,k}	5.8	[N/mm ²]	420				
Characteristic tensile strength	f _{u,k}	R	[N/mm ²]	700				
Characteristic yield strength	f _{y,k}	R	[N/mm ²]	450				
Characteristic tensile strength	f _{u,k}	HCR	[N/mm ²]	700				
Characteristic yield strength	f _{y,k}	HCR	[N/mm ²]	560				
Installation parameters								
fischer FIS IG internal threaded anchor	FIS IG	Screw		M8	M10	M12	M16	M20
Maximum screw-in depth	L _{E,max}	5.8 / R / HCR	5.8 / 6.8 / 8.8 / 10.9 / 12.9 / R / HCR / A4-70	20	25	30	40	50
Minimum screw-in depth	L _{E,min}	5.8	5.8	7	9	11	14	17
			6.8	8	10	12	15	19
			8.8	10	12	14	19	23
			10.9	11	14	16	22	27
			12.9	13	16	19	25	31
			R / HCR	R / HCR / A4-70	6	8	9	12
fischer FIS EM Plus injection system for steel rods to be glued into timber members							Annex 1	
fischer FIS IG internal threaded anchor – Strength parameters and installation parameters								