Deutsches Institut für Bautechnik
Zulassungsstelle für Bauprodukte und Bauarten
Bautechnisches Prüfamt
Eine vom Bund und den Ländern gemeinsam getragene Anstalt des öffentlichen Rechts

Kolonnenstraße 30 B
D-10829 Berlin
Tel.: +49 30 78730-0
Fax: +49 30 78730-320
E-Mail: dibt@dibt.de
www.dibt.de

Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik
DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-10/0012

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*	fischer Injektionssystem FIS EM *fischer injection system FIS EM*
Zulassungsinhaber *Holder of approval*	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Verbunddübel in den Größen Ø 8 mm bis Ø 40 mm zur Verankerung im Beton *Bonded anchor in the size of Ø 8 mm to Ø 40 mm for use in concrete*
Geltungsdauer: *Validity:* vom *from*	26 June 2013
bis *to*	26 June 2018
Herstellwerk *Manufacturing plant*	fischerwerke

Diese Zulassung umfasst *This Approval contains*	44 Seiten einschließlich 35 Anhänge *44 pages including 35 annexes*
Diese Zulassung ersetzt *This Approval replaces*	ETA-10/0012 mit Geltungsdauer vom 22.06.2012 bis 16.02.2015 *ETA-10/0012 with validity from 22.06.2012 to 16.02.2015*

EOTA

Europäische Organisation für Technische Zulassungen
European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998*[4]*, as amended by Article 2 of the law of 8 November 2011*[5]*;*
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- Guideline for European technical approval of "Metal anchors for use in concrete - Part 5: Bonded anchors", ETAG 001-05.

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.

3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.

4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

[1] Official Journal of the European Communities L 40, 11 February 1989, p. 12
[2] Official Journal of the European Communities L 220, 30 August 1993, p. 1
[3] Official Journal of the European Union L 284, 31 October 2003, p. 25
[4] *Bundesgesetzblatt Teil I 1998*, p. 812
[5] *Bundesgesetzblatt Teil I 2011*, p. 2178
[6] Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

The fischer injection system FIS EM is a bonded anchor consisting of a cartridge with injection mortar fischer FIS EM and a steel element. The steel elements are either

- fischer anchor rods in the range of M8 to M30 or
- fischer internal threaded anchor RG MI in the range of M8 to M20 or
- Reinforcing bar in the range of Ø 8 to Ø 40 or
- fischer rebar anchor FRA in the range of 12 to 24.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

An illustration of the product and intended use is given in Annexes 1 and 2.

1.2 Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106 EEC shall be fulfilled and failure of anchorages made with these products would cause risk to human life and/or lead to considerable economic consequences. Safety in case of fire (Essential Requirement 2) is not covered in this European technical approval.

The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C20/25 at minimum and C50/60 at most according to EN 206:2000-12.

The anchor may be used in cracked or non-cracked concrete.

The anchor with steel elements given in Annex 3 may also be used under seismic action for performance category C1 according to Annex 32.

The anchor may be installed in dry or wet concrete or in flooded holes.

The anchor may be used in the following temperature ranges:

Temperature range I:	-40 °C to +60 °C	(max long term temperature +35 °C and max short term temperature +60 °C)
Temperature range II:	-40 °C to +72 °C	(max long term temperature +50 °C and max short term temperature +72 °C)

<u>Elements made of zinc coated steel:</u>

The element made of zinc plated or hot dipped galvanised steel may only be used in structures subject to dry internal conditions.

<u>Elements made of stainless steel:</u>

The element made of stainless steel may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure (including industrial and marine environment), or exposure to permanently damp internal conditions, if no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Elements made of high corrosion resistant steel:

The element made of high corrosion resistant steel may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions. Such particular aggressive conditions are e. g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Elements made of reinforcing bars:

Post-installed reinforcing bars may be used as anchor designed in accordance with the EOTA Technical Reports TR 029 and TR 045only. Such applications are e.g. concrete overlay or shear dowel connections or the connections of a wall predominantly loaded by shear and compression forces with the foundation, where the reinforcing bars act as dowels to take up shear forces. Connections with post-installed reinforcing bars in concrete structures designed in accordance with EN1992-1-1: 2004 are not covered by this European technical approval.

The provisions made in this European technical approval are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2 Characteristics of the product and methods of verification

2.1 Characteristics of the product

The anchor corresponds to the drawings and provisions given in the Annexes. The characteristic material values, dimensions and tolerances of the anchor not indicated in the Annexes shall correspond to the respective values laid down in the technical documentation[7] of this European technical approval.

The characteristic values for the design of anchorages are given in the Annexes.

The two components of the injection mortar fischer FIS EM are delivered in unmixed condition in side-by side-cartridges of sizes 390 ml, 585 ml, 1100 ml or 1500 ml according to Annex 1.

Each cartridge and each steel element is marked in accordance with the specifications given in the Annexes.

Elements made of reinforcing bars shall comply with the specifications given in Annex 7.

The marking of embedment depth may be done on jobsite.

7 The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

2.2 Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the "Guideline for European technical approval of Metal Anchors for Use in Concrete", Part 1 "Anchors in general" and Part 5 "Bonded anchors", on the basis of Option 1 and ETAG 001 Annex E "Assessment of Metal Anchors under Seismic Action".

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 96/582/EG of the European Commission[8] system 2(i) (referred to as System 1) of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

(a) Tasks for the manufacturer:

- (1) factory production control;
- (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed control plan;

(b) Tasks for the approved body:

- (3) initial type-testing of the product;
- (4) initial inspection of factory and of factory production control;
- (5) continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial/raw/constituent materials stated in the technical documentation of this European technical approval.

[8] Official Journal of the European Communities L 254 of 08.10.1996

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik.[9]

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2 For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial type-testing of the product,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- the number of the guideline for European technical approval,
- use category (ETAG 001, Option 1, in addition: seismic anchor performance category C1 - where applicable),
- size.

9 The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited at Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Design of anchorages

The fitness of the anchor for the intended use is given under the following conditions:

The anchorages are designed in accordance with the EOTA Technical Report TR 029 "Design of bonded anchors"[10] and EOTA Technical Report TR 045 "Design of Metal Anchors under Seismic Action" under the responsibility of an engineer experienced in anchorages and concrete work.

Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastenings in stand-off installation or with a grout layer under seismic action are not covered by this European technical approval.

Post-installed reinforcing bars may be used as anchor designed in accordance with the EOTA Technical Report TR 029 only. The basic assumptions for the design according to anchor theory shall be observed. This includes the consideration of tension and shear loads and the corresponding failure modes as well as the assumption that the base material (concrete structural element) remains essentially in the serviceability limit state (either non-cracked or cracked) when the connection is loaded to failure. Such applications are e.g. concrete overlay or shear dowel connections or the connections of a wall predominantly loaded by shear and compression forces with the foundation, where the reinforcing bars act as dowels to take up shear forces. Connections with reinforcing bars in concrete structures designed in accordance with EN 1992-1-1:2004 (e.g. connection of a wall loaded with tension forces in one layer of the reinforcement with the foundation) are not covered by this European technical approval.

For the fischer internal threaded anchor RG MI fastening screws or threaded rods made of appropriate steel and strength class acc. to Annex 6 shall be specified. The minimum and maximum thread engagement length l_E of the fastening screw or the threaded rod for installation of the fixture shall be met the requirements according to Annex 5, Table 2. The length of the fastening screw or the threaded rod shall be determined depending on thickness of fixture, admissible tolerances, available thread length and minimum and maximum thread engagement length l_E.

Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.

The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.).

[10] The Techncial Report TR 029 "Design of bonded anchors" is published in English on EOTA website www.eota.eu.

4.3 Installation of anchors

The fitness for use of the anchor can only be assumed if the anchor is installed as follows:

- anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site,
- use of the anchor only as supplied by the manufacturer without exchanging the components,
- anchor installation in accordance with the manufacturer's specifications and drawings using the tools indicated in the technical documentation of this European technical approval,
- commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:
  - material, dimensions and mechanical properties of the metal parts according to the specifications given in the Annexes
  - confirmation of material and mechanical properties of the metal parts by inspection certificate 3.1 according to EN 10204:2004, the documents should be stored,
  - marking of the threaded rod with the envisage embedment depth. This may be done by the manufacturer of the rod or the person on jobsite.
- reinforcing bars shall comply with specifications given in Annex 7,
- checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply,
- check of concrete being well compacted, e.g. without significant voids,
- marking and keeping the effective anchorage depth,
- edge distance and spacing not less than the specified values without minus tolerances,
- positioning of the drill holes without damaging the reinforcement,
- drilling by hammer-drilling or diamond drilling,
- in case of aborted drill hole: the drill hole shall be filled with mortar,
- cleaning the drill hole and installation in accordance with Annexes 9 to 11,
- during installation and curing of the chemical mortar the anchor component installation temperature shall be at least 5 °C;
- during curing of the chemical mortar the temperature of the concrete must not fall below +5 °C; observing the curing time according to Annex 6, Table 4 until the anchor may be loaded,
- for installation in bore holes h_0 > 150 mm extension hoses acc. Annex 1 shall be used,
- for overhead installation or in bore hole depth h_0 > 250 mm injection-funnels acc. to Annex 1 shall be used,
- Fastening screw or threaded rods (including nut and washer) must comply with the appropriate material and strength class of the fischer internal threaded anchor RG MI,
- installation torque moments are not required for functioning of the anchor. However, the torque moments given in the Annexes must not be exceeded.

5 Indications to the manufacturer

5.1 Responsibility of the manufacturer

The manufacturer is responsible to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to as well as sections 4.2, 4.3 and 5.2 is given to those who are concerned. This information may be made by reproduction of the respective parts of the European technical approval.

In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

- drill bit diameter,
- hole depth;
- diameter of anchor rod,
- minimum effective anchorage depth;
- information on the installation procedure, including cleaning of the hole with the cleaning equipments, preferably by means of an illustration,
- anchor component installation temperature,
- material and property class of metal parts acc. to Annex 6, Table 3,
- ambient temperature of the concrete during installation of the anchor,
- admissible processing time (open time) of the mortar,
- curing time until the anchor may be loaded as a function of the ambient temperature in the concrete during installation,
- torque moment;
- identification of the manufacturing batch,

All data shall be presented in a clear and explicit form.

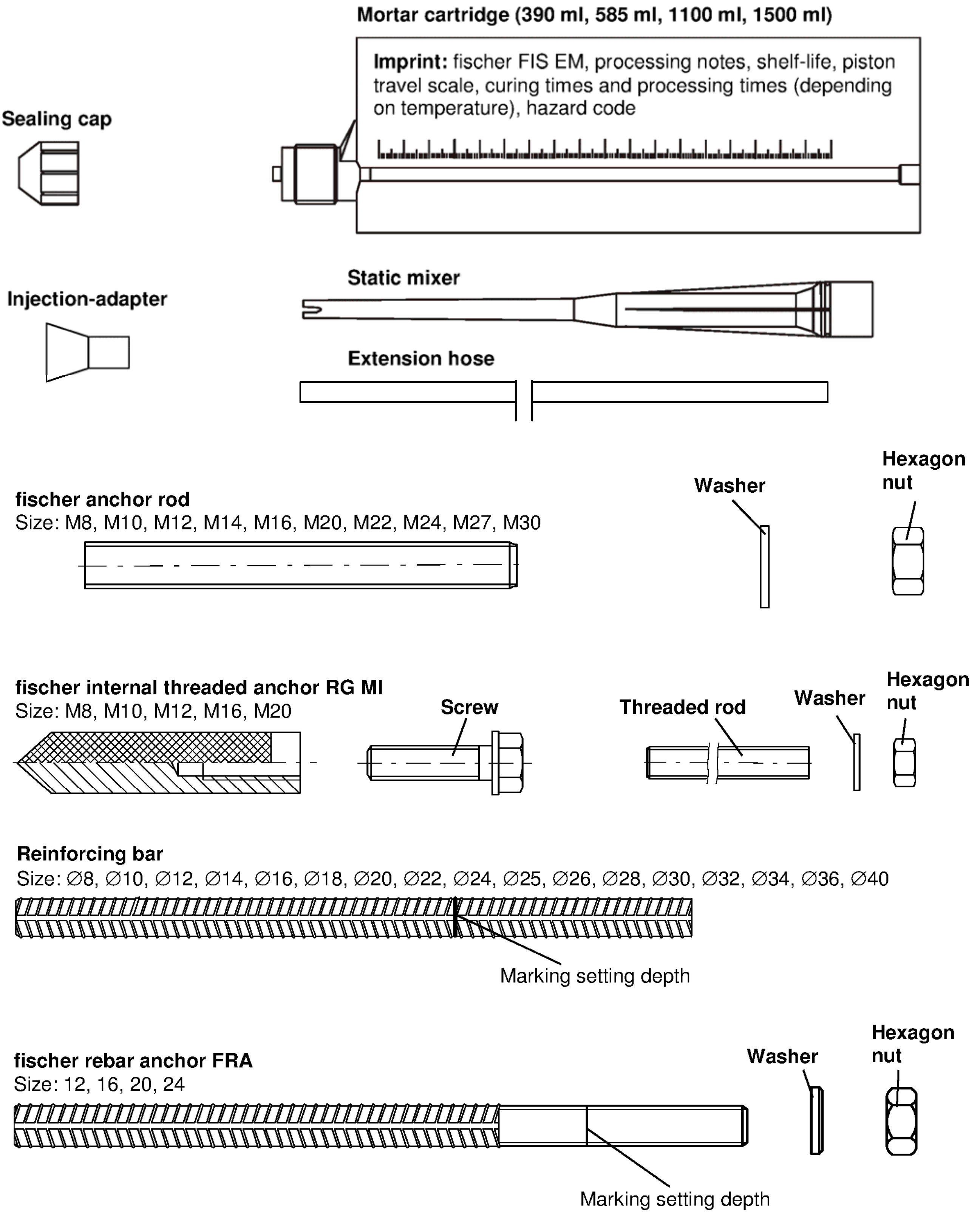
5.2 Packaging, transport and storage

The cartridges shall be protected against sun radiation and shall be stored according to the manufacturer's installation instructions in dry condition at temperatures of at least +5 °C to not more than +30 °C.

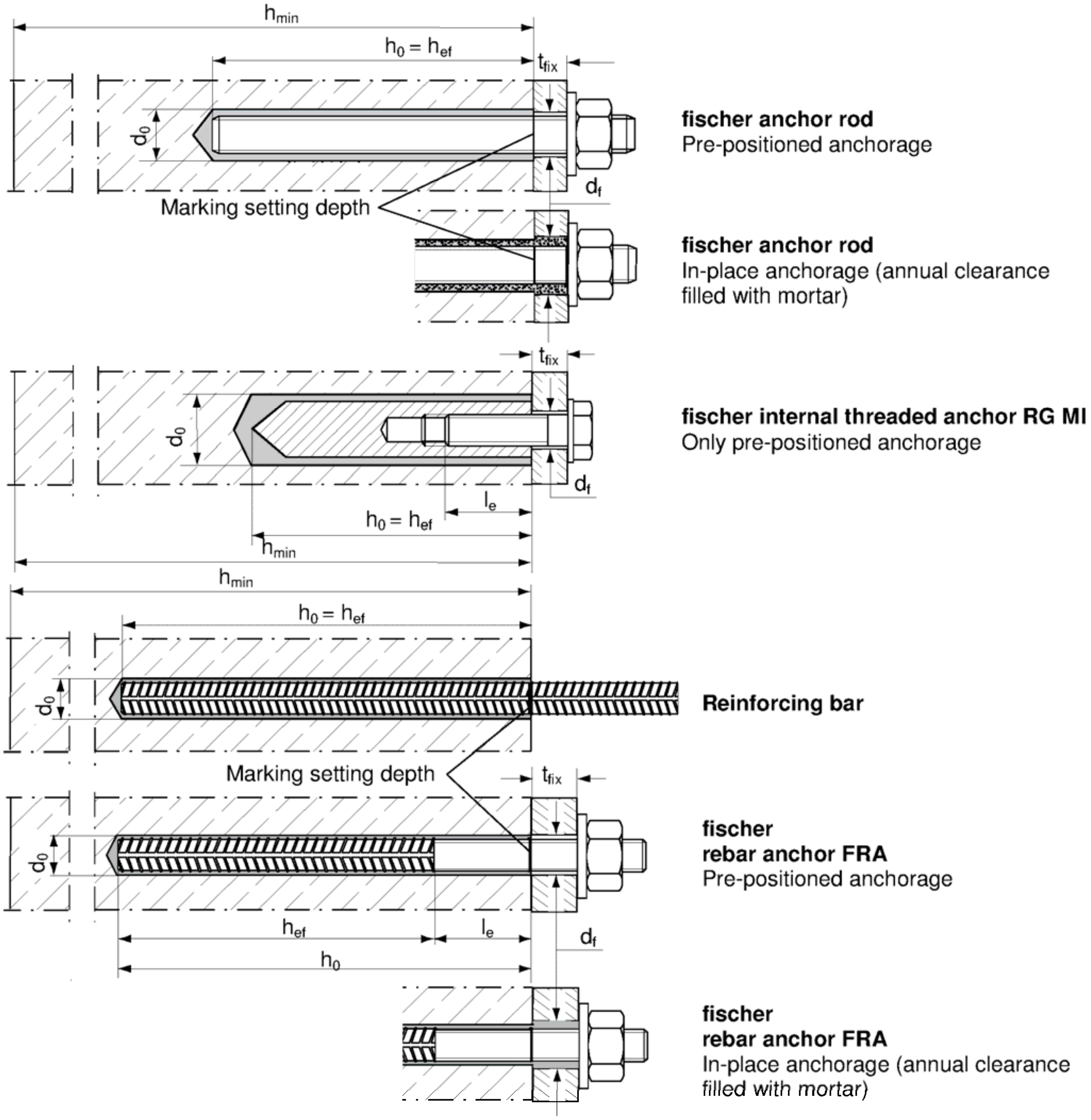
Cartridges with expired shelf life must no longer be used.

Uwe Bender
Head of Department

beglaubigt:
Lange



fischer injection system FIS EM	Annex 1
Product	



fischer injection system FIS EM	**Annex 2**
Application range	

Intended use	**fischer Injection system FIS EM**
Installation in hammer drilled holes; cracked or uncracked concrete	Permitted for all anchors and sizes
Installation in diamond drilled holes; cracked or uncracked concrete	Permitted for all anchors and sizes
Installation in in dry or wet concrete	Permitted for all anchors and sizes
Installation in flooded holes	Permitted for all anchors and sizes

Design methods	
Static and quasi-static action	
Design according to ETAG 001, TR 029	Permitted for all anchors and sizes
Design according to CEN/TS 1992-4-5:2009	Permitted for all anchors and sizes
Seismic action / Performance category C1	
Design according to ETAG 001, TR 045	Permitted for hammer drilled holes with: - fischer anchor rods / Size M10 to M30 - Standard threaded rods / Size M10 to M30 - Reinforcing bars B500B / Size 10 to 32

Temperature range

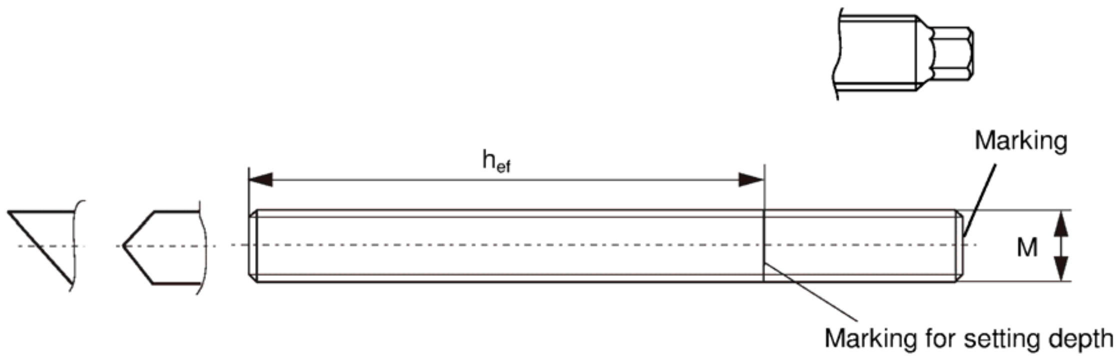
	max. long term temperature	max. short term temperature
Temperature range I: -40°C to +60°C	+35°C	+60°C
Temperature range II: -40°C to +72°C	+50°C	+72°C

fischer injection system FIS EM	**Annex 3**
Intended use, design methods temperature range	

Table 1: Installation parameters for fischer anchor rods

Size			[-]	**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Nominal drill bit diameter		d_0	[mm]	12	14	14	16	18	24	25	28	30	35
Depth of drill hole		h_0	[mm]	$h_0 = h_{ef}$									
Effective anchorage depth		$h_{ef,min}$	[mm]	60	60	70	75	80	90	93	96	108	120
		$h_{ef,max}$	[mm]	160	200	240	280	320	400	440	480	540	600
Minimum spacing and minimum edge distance		$s_{min} = c_{min}$	[mm]	40	45	55	60	65	85	95	105	120	140
Diameter of clearance hole in the fixture	pre-positioned anchorage	d_f	[mm]	9	12	14	16	18	22	24	26	30	33
	In-place anchorage	d_f	[mm]	14	16	16	18	20	26	28	30	33	40
Minimum thickness of concrete member		h_{min}	[mm]	$h_{ef} + 30 \geq 100$			$h_{ef} + 2d_0$						
Maximum torque moment		$T_{inst,max}$	[Nm]	10	20	40	50	60	120	135	150	200	300
Thickness of fixture		$t_{fix,min}$	[mm]	0									
		$t_{fix,max}$	[mm]	3000									

fischer anchor rod:



Marking:

Property class 8.8 or high corrosion-resistant steel, property class 80: •
Stainless steel A4, property class 50 and high corrosion-resistant steel, property class 50: • •

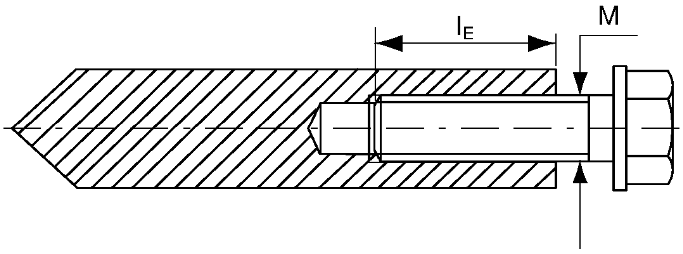
fischer injection system FIS EM	**Annex 4**
fischer anchor rod Installation parameters and dimensions	

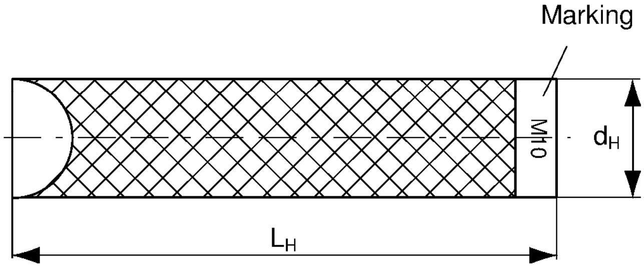
Deutsches Institut für Bautechnik DIBt

Table 2: Installation parameters fischer internal threaded anchors RG MI

Size			**M8**	**M10**	**M12**	**M16**	**M20**
Diameter of anchor	d_H	[mm]	12	16	18	22	28
Nominal drill bit diameter	d_0	[mm]	14	18	20	24	32
Length of anchor	L_H	[mm]	90	90	125	160	200
Effective anchorage depth h_{ef} and drill hole depth h_0	$h_{ef} = h_0$	[mm]	90	90	125	160	200
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$	[mm]	55	65	75	95	125
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Minimum thickness of concrete member	h_{min}	[mm]	120	125	165	205	260
Screw-in depth	$l_{E,min}$	[mm]	8	10	12	16	20
	$l_{E,max}$	[mm]	18	23	26	35	45
Maximum torque moment	$T_{inst,max}$	[Nm]	10	20	40	80	120

fischer internal threaded anchor RG MI





Marking: anchor size
e. g.: **M10**
Stainless steel additional **A4**
e. g.: **M10 A4**
High corrosion-resistant steel additional **C**
e. g.: **M10 C**

fischer injection system FIS EM	**Annex 5**
fischer internal threaded anchors RG MI Installation parameters and dimensions	

Table 3: Materials: anchor rods, threaded rods, washers, hexagon nuts and screws

Designation	Material		
	Steel, zinc plated	**Stainless steel A4**	**High corrosion-resistant steel C**
Anchor rod	Property class 5.8 or 8.8; EN ISO 20898-1 zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised EN ISO 10684	Property class 50 or 70 EN ISO 3506 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088 or 1.4062 pr EN 10088:2011	Property class 50 or 80 EN ISO 3506 or property class 70 with f_{yk} = 560 N/mm² 1.4529; 1.4565 EN 10088
Washer EN ISO 7089	Zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised EN ISO 10684	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088	1.4529; 1.4565 EN 10088
Hexagon nut according to EN 24032	Property class 5.8 or 8.8; EN ISO 20898-1 zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised EN ISO 10684	Property class 50 or 70 EN ISO 3506 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088	Property class 50, 70 or 80 EN ISO 3506 1.4529; 1.4565 EN 10088
Screw or threaded rod for internal threaded anchor RG MI	Property class 5.8 or 8.8; EN ISO 20898-1 zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised EN ISO 10684	Property class 70 EN ISO 3506 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088	Property class 70 EN ISO 3506 1.4529; 1.4565 EN 10088

Table 4: Maximum permissible processing times and minimum curing times

System temperature [°C]	Max. processing time [minutes]	Minimum curing time[1)] [hours]
+5 to +10	120	40
≥ +10 to +20	30	18
≥ +20 to +30	14	10
≥ +30 to +40	7	5

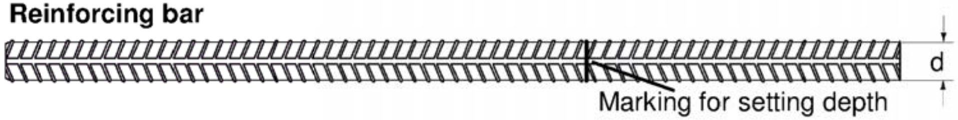
[1)] In wet concrete or flooded holes the curing times must be doubled.

fischer injection system FIS EM	**Annex 6**
Materials Processing times, curing times	

Table 5: Installation parameters reinforcing bars

Nominal bar size	**Ø d [mm]**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Nominal drill bit diameter	d_0 [mm]	12	14	16	18	20	25	25	30	30	30	35	35	40	40	40	45	55
Drill hole depth	h_0 [mm]	$h_0 = h_{ef}$																
Effective anchorage depth	$h_{ef,min}$ [mm]	60	60	70	75	80	85	90	94	98	100	104	112	120	128	136	144	160
	$h_{ef,max}$ [mm]	160	200	240	280	320	360	400	440	480	500	520	560	600	640	680	720	800
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$ [mm]	40	45	55	60	65	75	85	95	105	110	120	130	140	160	170	180	200
Minimum thickness of concrete member	h_{min} [mm]	$h_{ef} + 30$ ≥ 100		$h_{ef} + 2d_0$														

Reinforcing bar



Properties of reinforcement: refer to EN 1992-1-1 Annex C, Table C.1 and C.2N

Product form		**Non-zinc-plated bars and de-coiled rod**	
Class		B	C
Characteristic yield strength	f_{yk} or $f_{0,2k}$ [MPa]	400 to 600	
Minimum value of $k = (f_t / f_{yk})$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force	ε_{uk} [%]	≥ 5,0	≥ 7,5
Bentability		Bend / Rebend test	
Maximum deviation from nominal mass (individual bar) [%]	Nominal bar size [mm] ≤ 8 > 8	± 6,0 ± 4,5	
Bond: minimum relative rib area, $f_{R,min}$ (determination according to EN 15630)	Nominal bar size [mm] 8 bis 12 > 12	0,040 0,056	

Rib height h:
The rib height h must be $0{,}05 \bullet d \le h \le 0{,}07 \bullet d$
d = nominal bar size

fischer injection system FIS EM

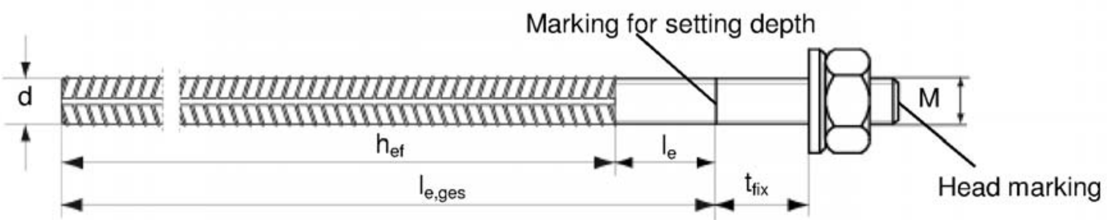
Reinforcing bars
Installation parameters
Materials

Annex 7

Table 6: Installation parameters fischer rebar anchor FRA

Threaded diameter				**M12**	**M16**	**M20**	**M24**
Nominal bar size		d	[mm]	12	16	20	25
Nominal drill bit diameter		d_0	[mm]	16	20	25	30
Depth of drill hole ($h_0 = l_{ges}$)		h_0	[mm]	$h_{ef} + l_e$			
Effective anchorage depth		$h_{ef,min}$	[mm]	70	80	90	96
		$h_{ef,max}$	[mm]	140	220	300	380
Distance concrete surface to welded join		l_e	[mm]	100			
Minimum spacing and minimum edge distance		$s_{min}=c_{min}$	[mm]	55	65	85	105
Diameter of clearance hole in the fixture	pre-positioned anchorage	d_f	[mm]	14	18	22	26
	in-place anchorage	d_f	[mm]	18	22	26	32
Minimum thickness of concrete member		h_{min}	[mm]	$h_0 + 30$ ≥ 100	$h_0 + 2d_0$		
Maximum torque moment		$T_{inst,max}$	[Nm]	40	60	120	150
Thickness of the fixture	minimum	t_{fix}	[mm]	0			
	maximum	t_{fix}	[mm]	3000			

fischer rebar anchor FRA

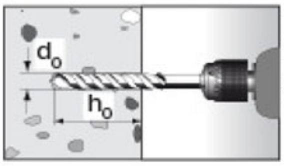


Head marking e.g.: FRA (for stainless steel);
FRA C (for high corrosion-resistant steel)

fischer injection system FIS EM	Annex 8
fischer rebar anchor FRA Installation parameters	

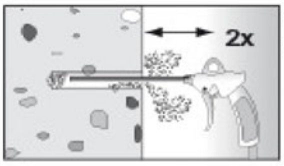
Drilling and cleaning the hole (hammer-drilling)

1



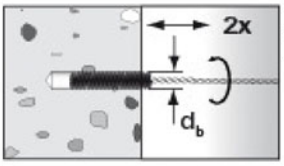
Drill the hole.
Drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables 1, 2, 5 or 6**.

2



Clean the drill hole: Blow out the drill hole two times, using oil-free compressed air (P > 6bar)

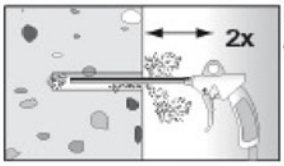
3



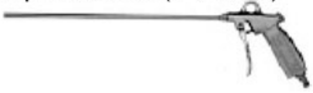
Brush the drill hole two times. For drill hole ≥ 30 mm use a power drill.
For deep holes use an extension.

d_0[mm	12	14	16	18	20	24	25	28	30	32	35	40	45	55
d_b[mm]	14	16	20		25	26	27	30	40			42	47	58

4

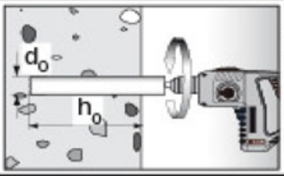


Clean the drill hole: Blow out the drill hole two times, using oil-free compressed air (P > 6bar)

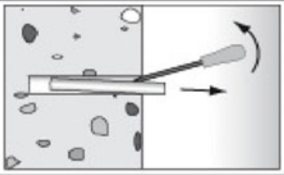


Drilling and cleaning the hole (diamond-drilling)

1

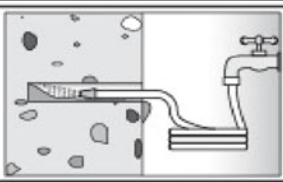


Drill the hole.
Drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables 1, 2, 5 or 6**



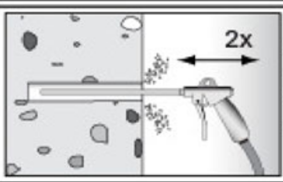
Break the drill core and draw it out.

2



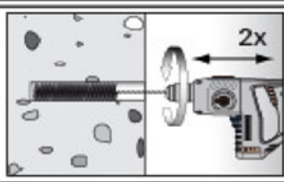
Flush the drill hole until the water comes clear.

3



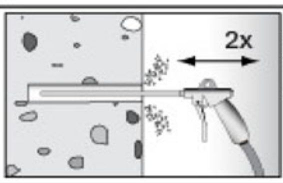
Blow out the drill hole two times, using oil-free compressed air (P > 6bar)

4



Brush the drill hole two times using a power drill. Corresponding brushes see "hammer-drilling"

5

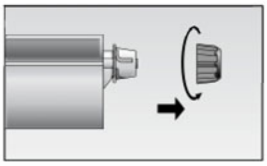


Blow out the drill hole two times, using oil-free compressed air (P > 6bar)

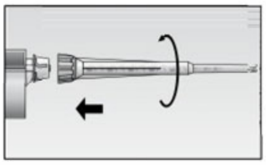
fischer injection system FIS EM	**Annex 9**
Installation instructions Part 1	

Preparing the cartridge

6

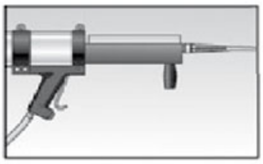


Twist off the sealing cap



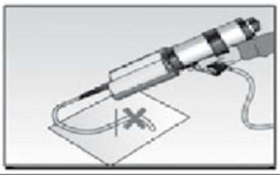
Twist on the static mixer (the spiral in the static mixer must be clearly visible).

7



Place the cartridge into the applicator gun.

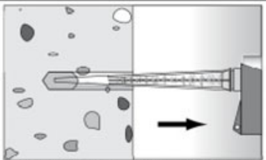
8



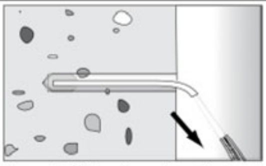
Press approx. 10 cm of material out until the resin is evenly grey in colour. Don`t use mortar that is not uniformly grey.

Injection of the mortar

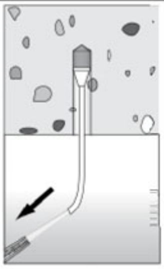
9



Fill approx. 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles.



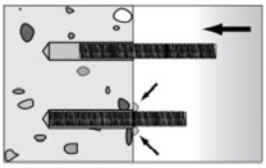
For drill hole depth ≥ 150 mm use an extension hose.

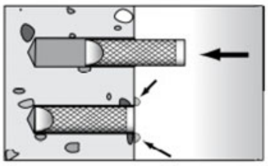


For overhead installation, deep holes h_0 > 250 mm or drill hole diameter d_0 ≥ 40 mm use an injection-adapter.

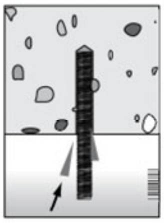
Installation fischer anchor rods or internal threaded anchors RG MI

10

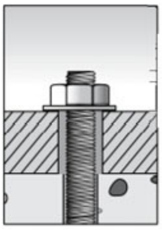




Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. Press the anchor rod or internal threaded anchor down to the bottom of the hole, turning it slightly while doing so. After inserting the anchor element, excess mortar must emerge from the mouth of the drill hole.



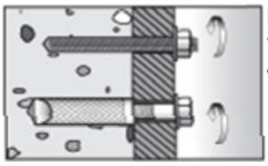
For overhead installations support the anchor rod with wedges.



For in-place anchorage fill the annual clearance with mortar.

11

Wait for the specified curing time, t_{cure} see **Table 4**.

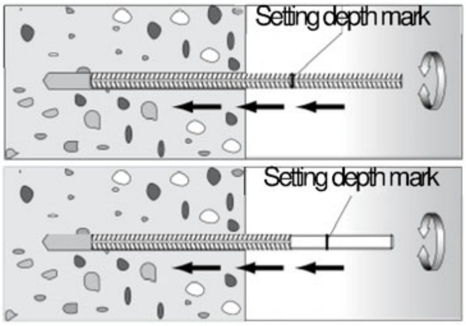


Mounting the fixture $T_{inst,max}$ see **Table 1 or 2**

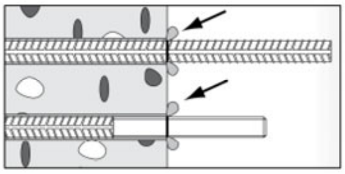
fischer injection system FIS EM	**Annex 10**
Installation instructions Part 2	

Installation reinforcing bars and fischer FRA

10



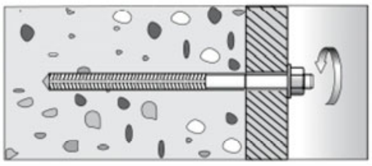
Only use clean and oil-free rebars. Mark the setting depth of the reinforcing bar. Using a turning movement, push the reinforcement bar or the FRA vigorously into the filled hole up to the insertion depth marking.



When reaching the setting depth mark, excess mortar must emerge from the mouth of the drill hole.

11

Wait for the specified curing time t_{cure} see **Table 4**.



Mounting the fixture $T_{inst,max}$ see **Table 6.**

Deutsches Institut für Bautechnik DIBt

Table 7: Design of Bonded Anchors acc. to TR 029
Characteristic values to tension load of fischer anchor rods and standard rods

Size					**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Steel failure														
Characteristic resistance $N_{Rk,s}$		Property class	5.8	[kN]	19	29	43	58	79	123	152	177	230	281
			8.8	[kN]	30	47	68	92	126	196	243	282	368	449
	Stainless steel A4	Property class	50	[kN]	19	29	43	58	79	123	152	177	230	281
			70	[kN]	26	41	59	81	110	172	212	247	322	393
	High corrosion resistant steel C	Property class	50	[kN]	19	29	43	58	79	123	152	177	230	281
			70[5)]	[kN]	26	41	59	81	110	172	212	247	322	393
			80	[kN]	30	47	68	92	126	196	243	282	368	449
Partial safety factor $\gamma_{Ms,N}$ [1)]		Property class	5.8	[-]	1,50									
			8.8	[-]	1,50									
	Stainless steel A4	Property class	50	[-]	2,86									
			70	[-]	1,87									
	High corrosion resistant steel C	Property class	50	[-]	2,86									
			70[5)]	[-]	1,50									
			80	[-]	1,60									
Combined pullout and concrete failure														
Diameter of calculation			d	[mm]	8	10	12	14	16	20	22	24	27	30
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (dry and wet concrete)														
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	16	16	15	14	14	13	13	13	12	12
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	13	12	12	12	11	11
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (flooded hole)														
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	16	16	15	13	13	11	11	10	10	9
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	12	11	10	10	9	9
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (dry and wet concrete)														
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	16	15	13	12	12	10	10	10	9	9
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	15	14	12	11	11	10	9	9	8	8
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (flooded hole)														
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	16	15	13	12	12	10	10	10	9	9
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	15	14	12	11	11	10	9	9	8	8
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)]	Dry and wet concrete			[-]	1,5[2)]						1,8[3)]			
	Flooded hole			[-]	2,1[4)]									

[1)] If no other national regulations exist.
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included.
[5)] f_{uk} = 700 N/mm² ; f_{yk} = 560 N/mm²

fischer injection system FIS EM	**Annex 12**
Design of Bonded Anchors acc. to TR 029 fischer anchor rods Characteristic values to tension load	

Deutsches Institut für Bautechnik DIBt

Table 7.1: Design of Bonded Anchors acc. to TR 029
Characteristic values to tension load of fischer anchor rods and standard rods

Size			**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Characteristic bond resistance in cracked concrete C20/25 Hammer and diamond drilling (dry and wet concrete)												
Temperature range I (60 °C/35 °C)	$\tau_{Rk,cr}$	[N/mm²]	7	7	7	7	6	6	7	7	7	7
Temperature range II (72 °C/50 °C)	$\tau_{Rk,cr}$	[N/mm²]	7	7	7	7	6	6	7	7	7	7
Characteristic bond resistance in cracked concrete C20/25 Hammer and diamond drilling (flooded hole)												
Temperature range I (60 °C/35 °C)	$\tau_{Rk,cr}$	[N/mm²]	6	7,5	7,5	7	6	6	7	6	6	6
Temperature range II (72 °C/50 °C)	$\tau_{Rk,cr}$	[N/mm²]	6	7	7	7	6	6	6	6	6	6
Increasing factor for τ_{Rk}	Ψ_c	C25/30 [-]	1,02									
		C30/37 [-]	1,04									
		C35/45 [-]	1,06									
		C40/50 [-]	1,07									
		C45/55 [-]	1,08									
		C50/60 [-]	1,09									
Splitting failure												
Edge distance $c_{cr,sp}$ [mm]		$h / h_{ef} \geq 2,0$	$1,0\ h_{ef}$									
		$2,0 > h / h_{ef} > 1,3$	$4,6\ h_{ef} - 1,8\ h$									
		$h / h_{ef} \leq 1,3$	$2,26\ h_{ef}$									
Spacing		$s_{cr,sp}$ [mm]	$2\ c_{cr,sp}$									
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1]	Dry and wet concrete	[-]	1,5[2]						1,8[3]			
	Flooded hole	[-]	1,8[3]				2,1[4]					

[1] If no other national regulations exist.
[2] The partial safety factor $\gamma_2 = 1,0$ is included.
[3] The partial safety factor $\gamma_2 = 1,2$ is included.
[4] The partial safety factor $\gamma_2 = 1,4$ is included.

Table 8: Design of Bonded Anchors acc. to TR 029
Characteristic values to shear load of fischer anchor rods and standard rods

Size					M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Steel failure without lever arm														
Characteristic resistance $V_{Rk,s}$		Property class	5.8	[kN]	9	15	21	29	39	61	76	89	115	141
			8.8	[kN]	15	23	34	46	63	98	122	141	184	225
	Stainless steel A4	Property class	50	[kN]	9	15	21	29	39	61	76	89	115	141
			70	[kN]	13	20	30	40	55	86	107	124	161	197
	High corrosion resistant steel C	Property class	50	[kN]	9	15	21	29	39	61	76	89	115	141
			70 3)	[kN]	13	20	30	40	55	86	107	124	161	197
			80	[kN]	15	23	34	46	63	98	122	141	184	225
Steel failure with lever arm														
Characteristic bending moment $M^0_{Rk,s}$		Property class	5.8	[Nm]	19	37	65	104	166	324	447	560	833	1123
			8.8	[Nm]	30	60	105	167	266	519	716	896	1333	1797
	Stainless steel A4	Property class	50	[Nm]	19	37	65	104	166	324	447	560	833	1123
			70	[Nm]	26	52	92	146	232	454	626	784	1167	1573
	High corrosion resistant steel C	Property class	50	[Nm]	19	37	65	104	166	324	447	560	833	1123
			70 3)	[Nm]	26	52	92	146	232	454	626	784	1167	1573
			80	[Nm]	30	60	105	167	266	519	716	896	1333	1797
Partial safety factor														
$\gamma_{Ms,V}$ 1)		Property class	5.8	[-]	1,25									
			8.8	[-]	1,25									
	Stainless steel A4	Property class	50	[-]	2,38									
			70	[-]	1,56									
	High corrosion resistant steel C	Property class	50	[-]	2,38									
			70 3)	[-]	1,25									
			80	[-]	1,33									
Concrete pryout failure														
Factor k in Equation (5.7) of Technical Report TR 029, Section 5.2.3.3			k	[-]	2,00									
Partial safety factor			γ_{Mcp} 1)	[-]	1,5 2)									
Concrete edge failure					See Technical Report TR 029, Section 5.2.3.4									
Partial safety factor			γ_{Mc} 1)	[-]	1,5 2)									

1) In absence of other national regulations.
2) The partial safety factor γ_2 = 1,0 is included.
3) f_{uk} = 700 N/mm²; f_{yk} = 560 N/mm²

Table 9: Displacements of fischer anchor rods and standard rods to tension load

Size			M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Non-cracked and cracked concrete; temperature range I and II												
Displacement	δ_{N0}	[mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10	0,11	0,11	0,12	0,12	0,13
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19

Calculation of characteristic displacement with $\delta_N = (\delta_{N0} \bullet \tau_{Sd}) / 1,4$

Table 10: Displacements of fischer anchor rods and standard rods to shear load

Size			M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Displacement	δ_{V0}	[mm/kN]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05
Displacement	$\delta_{V\infty}$	[mm/kN]	0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07

Calculation of characteristic displacement with $\delta_V = (\delta_{V0} \bullet V_{Sd}) / 1,4$

fischer injection system FIS EM

Design of Bonded Anchors acc. to TR 029 fischer anchor rods
Characteristic values to shear load
Displacements

Annex 14

Table 11: Design of Bonded Anchors acc. to TR 029
Characteristic values to tension load of fischer internal threaded anchors RG MI

Size					**M 8**	**M 10**	**M 12**	**M 16**	**M 20**
Steel failure									
Characteristic resistance with screw	$N_{Rk,s}$	Property class	5.8	[kN]	19	29	43	79	123
			8.8	[kN]	29	47	68	108	179
		Property class 70	A4	[kN]	26	41	59	110	172
			C	[kN]	26	41	59	110	172
Partial safety factor	$\gamma_{Ms,N}$ [1)]	Property class	5.8	[-]	1,50				
			8.8	[-]	1,50				
		Property class 70	A4	[-]	1,87				
			C	[-]	1,87				
Combined pullout and concrete failure									
Diameter of calculation			d_H	[mm]	12	16	18	22	28
Effective anchorage depth			h_{ef}	[mm]	90	90	125	160	200
Characteristic bond resistance in non-cracked concrete C20/25, hammer-drilling (dry and wet concrete)									
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	12
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	14	13	13	12	11
Characteristic bond resistance in non-cracked concrete C20/25, hammer-drilling (flooded hole)									
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	14	12	12	11	10
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	13	12	11	10	9
Characteristic bond resistance in non-cracked concrete C20/25, diamond-drilling (dry and wet concrete)									
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	13	12	11	10	9
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	12	11	10	9	8
Characteristic bond resistance in non-cracked concrete C20/25, diamond-drilling (flooded hole)									
Temperature range I (60°C/35°C)			$\tau_{Rk,ucr}$	[N/mm²]	13	12	11	10	9
Temperature range II (72°C/50°C)			$\tau_{Rk,ucr}$	[N/mm²]	12	11	10	9	8
Characteristic bond resistance in cracked concrete C20/25. Hammer and diamond drilling (dry and wet concrete)									
Temperature range I (60°C/35°C)			$\tau_{Rk,cr}$	[N/mm²]	7	6	6	7	7
Temperature range II (72°C/50°C)			$\tau_{Rk,cr}$	[N/mm²]	7	6	6	7	7
Characteristic bond resistance in cracked concrete C20/25. Hammer and diamond drilling (flooded hole)									
Temperature range I (60°C/35°C)			$\tau_{Rk,cr}$	[N/mm²]	7	6,5	6	7	6
Temperature range II (72°C/50°C)			$\tau_{Rk,cr}$	[N/mm²]	7	6	6	6	6
Increasing factors for N_{Rk}	Ψ_c		C25/30	[-]	1,02				
			C30/37	[-]	1,04				
			C35/45	[-]	1,06				
			C40/50	[-]	1,07				
			C45/55	[-]	1,08				
			C50/60	[-]	1,09				
Splitting failure									
Edge distance	$c_{cr,sp}$ [mm]		$h / h_{ef} \geq 2{,}0$		$1{,}0\ h_{ef}$				
			$2{,}0 > h / h_{ef} > 1{,}3$		$4{,}6\ h_{ef} - 1{,}8\ h$				
			$h / h_{ef} \leq 1{,}3$		$2{,}26\ h_{ef}$				
Spacing			$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$				
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)]	dry and wet concrete			[-]	1,5[2)]			1,8[3)]	
	flooded hole			[-]	1,8[3)]			2,1[4)]	

[1)] If no other national regulations exist.
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included

fischer injection system FIS EM	**Annex 15**
Design of Bonded Anchors acc. to TR 029 fischer internal threaded anchors RG MI Characteristic values to tension load	

Table 12: Design of Bonded Anchors acc. to TR 029
Characteristic values to shear load of fischer internal threaded anchors RG MI

Size					M 8	M 10	M 12	M 16	M 20
Steel failure without lever arm									
Characteristic resistance	$V_{Rk,s}$	Property class	5.8	[kN]	9,2	14,5	21,1	39,2	62
			8.8	[kN]	14,6	23,2	33,7	54,0	90
		Property class 70	A4	[kN]	12,8	20,3	29,5	54,8	86
			C	[kN]	12,8	20,3	29,5	54,8	86
Partial safety factor	$\gamma_{Ms,V}$ 1)	Property class	5.8	[-]	1,25				
			8.8	[-]	1,25				
		Property class 70	A4	[-]	1,56				
			C	[-]	1,56				
Steel failure with lever arm									
Characteristic bending moment	$M^0_{Rk,s}$	Property class	5.8	[Nm]	20	39	68	173	337
			8.8	[Nm]	30	60	105	266	519
		Property class 70	A4	[Nm]	26	52	92	232	454
			C	[Nm]	26	52	92	232	454
Partial safety factor	$\gamma_{Ms,V}$	Property class	5.8	[-]	1,25				
			8.8	[-]	1,25				
		Property class 70	A4	[-]	1,56				
			C	[-]	1,56				
Concrete pryout failure									
Factor k in Equation (5.7) of Technical Report TR 029, Section 5.2.3.3			k	[-]	2,0				
Partial safety factor			γ_{Mcp} 1)	[-]	1,5 2)				
Concrete edge failure					See Technical Report TR 029, Section 5.2.3.4				
Partial safety factor			γ_{Mc} 1)	[-]	1,5 2)				

1) In absence of other national regulations.
2) The partial safety factor $\gamma_2 = 1{,}0$ is included.

Table 13: Displacements of fischer internal threaded anchors RG MI to tension load

Size		M 8	M 10	M 12	M 16	M 20
Non-cracked concrete and cracked concrete; temperature range I and II						
Displacement	δ_{N0} [mm/(N/mm²)]	0,09	0,10	0,10	0,11	0,13
Displacement	$\delta_{N\infty}$ [mm/(N/mm²)]	0,13	0,15	0,15	0,17	0,19

Calculation of characteristic displacement with $\delta_N = (\delta_{N0} \bullet \tau_{Sd}) / 1{,}4$

Table 14: Displacements of fischer internal threaded anchors RG MI to shear load

Size		M 8	M 10	M 12	M 16	M 20
Displacement	δ_{V0} [mm/kN]	0,12	0,09	0,08	0,07	0,05
Displacement	$\delta_{V\infty}$ [mm/kN]	0,18	0,14	0,12	0,10	0,08

Calculation of characteristic displacement with $\delta_V = (\delta_{V0} \bullet V_{Sd}) / 1{,}4$

Table 15: Design of Bonded Anchors acc. to TR 029; Characteristic values to tension load of reinforcing bars

Size	Ø d	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Steel failure																		
Characteristic resistance Reinforcing bars	$N_{Rk,s}$ [kN]	28	44	63	85	111	140	173	209	249	270	292	339	389	443	499	560	691
Partial safety factor	$\gamma_{Ms,N}$ [1] [-]	1,4																
Combined pullout and concrete failure																		
Diameter for calculation	d [mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (dry and wet concrete)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$ [N/mm²]	16	16	15	14	14	14	13	13	13	13	13	13	12	12	12	12	12
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$ [N/mm²]	15	14	14	13	13	13	12	12	12	12	11	11	11	11	11	11	10
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (flooded hole)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$ [N/mm²]	16	16	14	13	12	12	11	11	10	10	10	10	9	9	9	8	8
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$ [N/mm²]	15	14	13	12	11	12	11	10	10	9	9	9	9	8	8	8	8
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (dry and wet concrete)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$ [N/mm²]	16	15	13	12	12	10	10	10	10	9	9	9	9	8	8	8	7
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$ [N/mm²]	15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (flooded hole)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$ [N/mm²]	16	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$ [N/mm²]	15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Partial safety factor $\gamma_{Mp}=\gamma_{Mc}=\gamma_{Msp}$ [1] – Dry and wet concrete	[-]	1,5[2]							1,8[3]									
Partial safety factor $\gamma_{Mp}=\gamma_{Mc}=\gamma_{Msp}$ [1] – Flooded hole	[-]	1,8[3]						2,1[4]										

The values given in Table 15. are values for reinforcing bars B500B with f_{uk} = 550 N/mm² and f_{yk} = 500 N/mm². Other reinforcing bars have to be calculated according to TR 029, Equation (5.1).

[1] In absence of other national regulations.

[2] The partial safety factor γ_2 = 1,0 is included.

[3] The partial safety factor γ_2 = 1,2 is included

[4] The partial safety factor γ_2 = 1,4 is included

fischer injection system FIS EM

Design of Bonded Anchors acc. to TR 029
Reinforcing bars
Characteristic values to tension load

Annex 17

Table 15.1: Design of Bonded Anchors acc. to TR 029; Characteric values to tension load of reinforcing bars

Size	**∅ d**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Characteristic bond resistance in cracked concrete C20/25. Hammer and diamond drilling (dry and wet concrete)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$ [N/mm²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$ [N/mm²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Characteristic bond resistance in cracked concrete C20/25. Hammer and diamond drilling (flooded hole)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$ [N/mm²]	6	7,5	6,5	6,5	6,5	6	6	7	6	6	6	6	6	5	5	5	5
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$ [N/mm²]	6	7	7	6	6	6	6	6	6	6	6	6	6	5	5	5	5
Increasing factors for τ_{Rk} Ψ_c	C25/30 [-]	1,02																
	C30/37 [-]	1,04																
	C35/45 [-]	1,06																
	C40/50 [-]	1,07																
	C45/55 [-]	1,08																
	C50/60 [-]	1,09																
Splitting failure																		
Edge distance $c_{cr,sp}$ [mm]	$h / h_{ef} \geq 2,0$	$1,0\ h_{ef}$																
	$2,0 > h / h_{ef} > 1,3$	$4,6\ h_{ef} - 1,8\ h$																
	$h / h_{ef} \leq 1,3$	$2,26\ h_{ef}$																
Spacing	$s_{cr,sp}$ [mm]	$2\ c_{cr,sp}$																
Partial safety factor $\gamma_{Mp}=\gamma_{Mc}=\gamma_{Msp}$ [1)]	Dry and wet concrete [-]	1,5[2)]							1,8[3)]									
	Flooded hole [-]	1,8[3)]						2,1[4)]										

The values given in Table 15.1 are values for reinforcing bars B500B with f_{uk} = 550 N/mm² and f_{yk} = 500 N/mm².
Other reinforcing bars have to be calculated according to TR 029, Equation (5.1).

1) In absence of other national regulations.
2) The partial safety factor γ_2 = 1,0 is included.
3) The partial safety factor γ_2 = 1,2 is included.
4) The partial safety factor γ_2 = 1,4 is included.

fischer injection system FIS EM

Design of Bonded Anchors acc. to TR 029
Reinforcing bars
Characteristic values to tension load

Annex 18

Table 16: Design of Bonded Anchors acc. to TR 029; Characteristic values to shear load of reinforcing bars

Size Ø d	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Steel failure without lever arm																	
Characteristic resistance $V_{Rk,s}$ [kN]	13,8	21,6	31,1	42,4	55,3	70	87	105	125	135	146	170	195	221	250	280	346
Partial safety factor $\gamma_{Ms,V}$ 1) [-]	1,5																
Steel failure with lever arm																	
Characteristic bending moment $M^0_{Rk,s}$ [Nm]	33	65	112	178	265	378	518	690	896	1012	1139	1422	1749	2123	2547	3023	4147
Partial safety factor $\gamma_{Ms,V}$ 1) [-]	1,5																
Concrete pryout failure																	
Factor k in Equation (5.7) of Technical Report TR 029, Section 5.2.3.3 k [-]	2,0																
Partial safety factor γ_{Mcp} 1) [-]	1,5 2)																
Concrete edge failure	See Technical Report TR 029, Section 5.2.3.4																
Partial safety factor γ_{Mc} 1) [-]	1,5 2)																

The values given in Table 16 are values for reinforcing bars with f_{uk} = 550 N/mm² and f_{yk} = 500 N/mm².
Other reinforcing bars have to be calculated according to TR 029, Equation (5.1).

1) In absence of other national regulations.
2) The partial safety factor γ_2 = 1,0 is included.

Table 17: Displacements of reinforcing bars to tension load

Size Ø d	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Non-cracked and cracked concrete; temperature range I and II																	
Displacement δ_{N0} [mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10	0,10	0,11	0,11	0,12	0,12	0,12	0,13	0,13	0,13	0,14	0,14	0,15
Displacement $\delta_{N\infty}$ [mm/(N/mm²)]	0,11	0,12	0,13	0,14	0,15	0,16	0,16	0,17	0,18	0,18	0,18	0,19	0,19	0,20	0,20	0,21	0,22

Calculation of characteristic displacement with $\delta_N = (\delta_{N0} \bullet \tau_{Sd}) / 1,4$

Table 18: Displacement of reinforcing bars to shear load

Size Ø d	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Displacement δ_{V0} [mm/kN]	0,18	0,15	0,12	0,10	0,09	0,08	0,07	0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,05	0,05	0,04
Displacement $\delta_{V\infty}$ [mm/kN]	0,27	0,22	0,18	0,16	0,14	0,12	0,11	0,10	0,09	0,09	0,08	0,08	0,07	0,06	0,06	0,06	0,05

Calculation of characteristic displacement with $\delta_V = (\delta_{V0} \bullet V_{Sd}) / 1,4$

fischer injection system FIS EM

Design of Bonded Anchors acc. to TR 029
Reinforcing bars
Characteristic values to shear load

Annex 19

Table 19: Design of Bonded Anchors acc. to TR 029
Characteristic values to tension load of fischer rebar anchors FRA

Size			M12	M16	M20	M24
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	63	111	173	270
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]	1,4			
Combined pullout and concrete failure						
Diameter of calculation	d	[mm]	12	16	20	25
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (dry and wet concrete)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	15	14	13	13
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	14	13	12	12
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (flooded hole)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	15	13	11	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	14	12	11	10
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (dry and wet concrete)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	13	12	10	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	12	11	10	9
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (flooded hole)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	13	12	10	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	12	11	10	9
Characteristic bond resistance in cracked concrete C20/25. Hammer and diamond drilling (dry and wet concrete)						
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	7
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	7
Characteristic bond resistance in cracked concrete C20/25. Hammer and diamond drilling (flooded hole)						
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	6
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	6
Increasing factors for τ_{Rk}	Ψ_c	C25/30 [-]	1,02			
		C30/37 [-]	1,04			
		C35/45 [-]	1,06			
		C40/50 [-]	1,07			
		C45/55 [-]	1,08			
		C50/60 [-]	1,09			
Splitting failure						
Edge distance	$c_{cr,sp}$ [mm]	$h / h_{ef} \geq 2,0$	$1,0\ h_{ef}$			
		$2,0 > h / h_{ef} > 1,3$	$4,6\ h_{ef} - 1,8\ h$			
		$h / h_{ef} \leq 1,3$	$2,26\ h_{ef}$			
Spacing	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$			
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)]	dry and wet concrete	[-]	1,5[2)]			1,8[3)]
	flooded hole	[-]	1,8[3)]			2,1[4)]

[1)] In absence of other national regulations.
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included.

Table 20: Design of Bonded Anchors acc. to TR 029
Characteristic values to shear load of fischer rebar anchors FRA

Size			**M12**	**M16**	**M20**	**M24**
Steel failure						
Characteristic resistance	$V_{Rk,s}$	[kN]	30	55	86	124
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,56			
Steel failure with lever arm						
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	92	233	454	785
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,56			
Concrete pryout failure						
Factor k in Equation (5.7) of Technical Report TR 029, Section 5.2.3.3	k	[-]	2,0			
Partial safety factor	γ_{Mcp} [1)]	[-]	1,5[2)]			
Concrete edge failure			See Technical Report TR 029, Section 5.2.3.4			
Partial safety factor	γ_{Mc} [1)]	[-]	1,5[2)]			

[1)] In absence of other national regulations.
[2)] The partial safety factor γ_2 = 1,0 is included.

Table 21: Displacements of fischer rebar anchors FRA to tension load

Size	**∅**	**12**	**16**	**20**	**24**
Non-cracked and cracked concrete; temperature range I and II					
Displacement	δ_{N0} [mm/(N/mm²)]	0,09	0,10	0,11	0,12
Displacement	$\delta_{N\infty}$ [mm/(N/mm²)]	0,13	0,15	0,16	0,18

Calculation of characteristic displacement with $\delta_N = (\delta_{N0} \bullet \tau_{Sd}) / 1,4$

Table 22: Displacements of fischer rebar anchors FRA to shear load

Size	**∅**	**12**	**16**	**20**	**24**
Displacement	δ_{V0} [mm/kN]	0,12	0,09	0,07	0,06
Displacement	$\delta_{V\infty}$ [mm/kN]	0,18	0,14	0,11	0,09

Calculation of characteristic displacement with $\delta_V = (\delta_{V0} \bullet V_{Sd}) / 1,4$

Table 23: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to tension load of fischer anchor rods and standard rods

Size				**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Steel failure													
Characteristic resistance $N_{Rk,s}$	Property class	5.8	[kN]	19	29	43	58	79	123	152	177	230	281
		8.8	[kN]	30	47	68	92	126	196	243	282	368	449
	Stainless steel A4, Property class	50	[kN]	19	29	43	58	79	123	152	177	230	281
		70	[kN]	26	41	59	81	110	172	212	247	322	393
	High corrosion resistant steel C, Property class	50	[kN]	19	29	43	58	79	123	152	177	230	281
		70[5)]	[kN]	26	41	59	81	110	172	212	247	322	393
		80	[kN]	30	47	68	92	126	196	243	282	368	449
Partial safety factor $\gamma_{Ms,N}$ [1)]	Property class	5.8	[-]	1,50									
		8.8	[-]	1,50									
	Stainless steel A4, Property class	50	[-]	2,86									
		70	[-]	1,87									
	High corrosion resistant steel C, Property class	50	[-]	2,86									
		70[5)]	[-]	1,50									
		80	[-]	1,60									
Combined pullout and concrete failure													
Diameter of calculation		d	[mm]	8	10	12	14	16	20	22	24	27	30
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (dry and wet concrete)													
Temperature range I (60°C/35°C)		$\tau_{Rk,ucr}$	[N/mm²]	16	16	15	14	14	13	13	13	12	12
Temperature range II (72°C/50°C)		$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	13	12	12	12	11	11
Characteristic bond resistance in non-cracked concrete C20/25 hammer-drilling (flooded hole)													
Temperature range I (60°C/35°C)		$\tau_{Rk,ucr}$	[N/mm²]	16	16	15	13	13	11	11	10	10	9
Temperature range II (72°C/50°C)		$\tau_{Rk,ucr}$	[N/mm²]	15	14	14	13	12	11	10	10	9	9
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (dry and wet concrete)													
Temperature range I (60°C/35°C)		$\tau_{Rk,ucr}$	[N/mm²]	16	15	13	12	12	10	10	10	9	9
Temperature range II (72°C/50°C)		$\tau_{Rk,ucr}$	[N/mm²]	15	14	12	11	11	10	9	9	8	8
Characteristic bond resistance in non-cracked concrete C20/25 diamond-drilling (flooded hole)													
Temperature range I (60°C/35°C)		$\tau_{Rk,ucr}$	[N/mm²]	16	15	13	12	12	10	10	10	9	9
Temperature range II (72°C/50°C)		$\tau_{Rk,ucr}$	[N/mm²]	15	14	12	11	11	10	9	9	8	8
Factor for non-cracked concrete		$k_8 = k_{ucr}$	[-]	10,1									
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)]	Dry and wet concrete		[-]	1,5[2)]						1,8[3)]			
	Flooded hole		[-]	2,1[4)]									

[1)] If no other national regulations exist.
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included.
[5)] f_{uk} = 700 N/mm² ; f_{yk} = 560 N/mm²

fischer injection system FIS EM

Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
fischer anchor rods
Characteristic values to tension load

Annex 22

Deutsches Institut für Bautechnik DIBt

Table 23.1: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to tension load of fischer anchor rods and standard rods

Size			M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Characteristic bond resistance in cracked concrete C20/25 Hammer and diamond drilling (dry and wet concrete)												
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$	[N/mm²]	7	7	7	7	6	6	7	7	7	7
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$	[N/mm²]	7	7	7	7	6	6	7	7	7	7
Characteristic bond resistance in cracked concrete C20/25 Hammer and diamond drilling (flooded hole)												
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$	[N/mm²]	6	7,5	7,5	7	6	6	7	6	6	6
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$	[N/mm²]	6	7	7	7	6	6	6	6	6	6
Factor for cracked concrete	$k_8=k_{cr}$	[-]	7,2									
Increasing factor for τ_{Rk}	Ψ_c	C25/30 [-]	1,02									
		C30/37 [-]	1,04									
		C35/45 [-]	1,06									
		C40/50 [-]	1,07									
		C45/55 [-]	1,08									
		C50/60 [-]	1,09									
Splitting failure												
Edge distance $c_{cr,sp}$ [mm]		$h / h_{ef} \geq 2,0$	$1,0\ h_{ef}$									
		$2,0 > h / h_{ef} > 1,3$	$4,6\ h_{ef} - 1,8\ h$									
		$h / h_{ef} \leq 1,3$	$2,26\ h_{ef}$									
Spacing		$s_{cr,sp}$ [mm]	$2\ c_{cr,sp}$									
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ 1)	Dry and wet concrete	[-]	1,5 2)						1,8 3)			
	Flooded hole	[-]	1,8 3)					2,1 4)				

1) If no other national regulations exist.
2) The partial safety factor $\gamma_2 = 1,0$ is included.
3) The partial safety factor $\gamma_2 = 1,2$ is included.
4) The partial safety factor $\gamma_2 = 1,4$ is included.

Displacements see Annex 14

Table 24: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to shear load of fischer anchor rods and standard rods

Size					**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Steel failure without lever arm														
Characteristic resistance $V_{Rk,s}$		Property class	5.8	[kN]	9	15	21	29	39	61	76	89	115	141
			8.8	[kN]	15	23	34	46	63	98	122	141	184	225
	Stainless steel A4	Property class	50	[kN]	9	15	21	29	39	61	76	89	115	141
			70	[kN]	13	20	30	40	55	86	107	124	161	197
	High corrosion resistant steel C	Property class	50	[kN]	9	15	21	29	39	61	76	89	115	141
			70[3]	[kN]	13	20	30	40	55	86	107	124	161	197
			80	[kN]	15	23	34	46	63	98	122	141	184	225
Steel failure with lever arm														
Characteristic bending moment $M^0_{Rk,s}$		Property class	5.8	[Nm]	19	37	65	104	166	324	447	560	833	1123
			8.8	[Nm]	30	60	105	167	266	519	716	896	1333	1797
	Stainless steel A4	Property class	50	[Nm]	19	37	65	104	166	324	447	560	833	1123
			70	[Nm]	26	52	92	146	232	454	626	784	1167	1573
	High corrosion resistant steel C	Property class	50	[Nm]	19	37	65	104	166	324	447	560	833	1123
			70[3]	[Nm]	26	52	92	146	232	454	626	784	1167	1573
			80	[Nm]	30	60	105	167	266	519	716	896	1333	1797
Ductility factor		k_2		[-]	0,8									
Partial safety factor														
$\gamma_{Ms,V}$ [1]		Property class	5.8	[-]	1,25									
			8.8	[-]	1,25									
	Stainless steel A4	Property class	50	[-]	2,38									
			70	[-]	1,56									
	High corrosion resistant steel C	Property class	50	[-]	2,38									
			70[3]	[-]	1,25									
			80	[-]	1,33									
Concrete pryout failure														
Factor in Equation (27) CEN/TS 1992-4-5, Section 6.3.3		k_3		[-]	2,00									
Partial safety factor		γ_{Mcp} [1]		[-]	1,5[2]									
Concrete edge failure					See CEN/TS 1992-4-5, Section 6.3.4									
Partial safety factor		γ_{Mc} [1]		[-]	1,5[2]									

[1] In absence of other national regulations.
[2] The partial safety factor $\gamma_2 = 1{,}0$ is included.
[3] $f_{uk} = 700\ N/mm^2$; $f_{yk} = 560\ N/mm^2$

Displacements see Annex 14

Table 25: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to tension load of fischer internal threaded anchors RG MI

Size					**M 8**	**M 10**	**M 12**	**M 16**	**M 20**
Steel failure									
Characteristic resistance with screw	$N_{Rk,s}$	Property class	5.8	[kN]	19	29	43	79	123
			8.8	[kN]	29	47	68	108	179
		Property class 70	A4	[kN]	26	41	59	110	172
			C	[kN]	26	41	59	110	172
Partial safety factor	$\gamma_{Ms,N}$ [1)]	Property class	5.8	[-]	1,50				
			8.8	[-]	1,50				
		Property class 70	A4	[-]	1,87				
			C	[-]	1,87				
Combined pullout and concrete failure									
Diameter of calculation	d_H			[mm]	12	16	18	22	28
Effective anchorage depth	h_{ef}			[mm]	90	90	125	160	200
Characteristic bond resistance in non-cracked concrete C20/25, hammer-drilling (dry and wet concrete)									
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$			[N/mm²]	15	14	14	13	12
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$			[N/mm²]	14	13	13	12	11
Characteristic bond resistance in non-cracked concrete C20/25, hammer-drilling (flooded hole)									
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$			[N/mm²]	14	12	12	11	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$			[N/mm²]	13	12	11	10	9
Characteristic bond resistance in non-cracked concrete C20/25, diamond-drilling (dry and wet concrete)									
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$			[N/mm²]	13	12	11	10	9
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$			[N/mm²]	12	11	10	9	8
Characteristic bond resistance in non-cracked concrete C20/25, diamond-drilling (flooded hole)									
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$			[N/mm²]	13	12	11	10	9
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$			[N/mm²]	12	11	10	9	8
Factor for non-cracked concrete	k_{ucr}			[-]	10,1				
Characteristic bond resistance in cracked concrete C20/25, hammer and diamond drilling (dry and wet concrete)									
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$			[N/mm²]	7	6	6	7	7
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$			[N/mm²]	7	6	6	7	7
Characteristic bond resistance in cracked concrete C20/25, hammer and diamond drilling (flooded hole)									
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$			[N/mm²]	7	6,5	6	7	6
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$			[N/mm²]	7	6	6	6	6
Factor for cracked concrete	$k_8 = k_{cr}$			[-]	7,2				
Increasing factors for N_{Rk}	Ψ_c		C25/30	[-]	1,02				
			C30/37	[-]	1,04				
			C35/45	[-]	1,06				
			C40/50	[-]	1,07				
			C45/55	[-]	1,08				
			C50/60	[-]	1,09				
Splitting failure									
Edge distance	$c_{cr,sp}$ [mm]		$h / h_{ef} \geq 2,0$		**$1,0\ h_{ef}$**				
			$2,0 > h / h_{ef} > 1,3$		**$4,6\ h_{ef} - 1,8\ h$**				
			$h / h_{ef} \leq 1,3$		**$2,26\ h_{ef}$**				
Spacing	$s_{cr,sp}$			[mm]	**$2\ c_{cr,sp}$**				
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)]	dry and wet concrete			[-]	**1,5** [2)]			**1,8** [3)]	
	flooded hole			[-]	**1,8** [3)]			**2,1** [4)]	

[1)] If no other national regulations exist.
[2)] The partial safety factor $\gamma_2 = 1,0$ is included.
[3)] The partial safety factor $\gamma_2 = 1,2$ is included.
[4)] The partial safety factor $\gamma_2 = 1,4$ is included

Displacements see Annex 16

fischer injection system FIS EM

Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
fischer internal threaded anchors RG MI
Characteristic values to tension load

Annex 25

Deutsches Institut für Bautechnik DIBt

Table 26: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to shear load of fischer internal threaded anchors RG MI

Size					**M 8**	**M 10**	**M 12**	**M 16**	**M 20**
Steel failure without lever arm									
Characteristic resistance	$V_{Rk,s}$	Property class	5.8	[kN]	9,2	14,5	21,1	39,2	62
			8.8	[kN]	14,6	23,2	33,7	54,0	90
		Property class 70	A4	[kN]	12,8	20,3	29,5	54,8	86
			C	[kN]	12,8	20,3	29,5	54,8	86
Partial safety factor	$\gamma_{Ms,V}$ [1)]	Property class	5.8	[-]	1,25				
			8.8	[-]	1,25				
		Property class 70	A4	[-]	1,56				
			C	[-]	1,56				
Steel failure with lever arm									
Characteristic bending moment	$M^0_{Rk,s}$	Property class	5.8	[Nm]	20	39	68	173	337
			8.8	[Nm]	30	60	105	266	519
		Property class 70	A4	[Nm]	26	52	92	232	454
			C	[Nm]	26	52	92	232	454
Partial safety factor	$\gamma_{Ms,V}$	Property class	5.8	[-]	1,25				
			8.8	[-]	1,25				
		Property class 70	A4	[-]	1,56				
			C	[-]	1,56				
Ductility factor			k_2	[-]	2,0				
Concrete pryout failure									
Factor in Equation (27) of CEN/TS 1992-4-5, Section 6.3.3			k_3	[-]	2,0				
Partial safety factor			γ_{Mcp} [1)]	[-]	1,5[2)]				
Concrete edge failure					See CEN/TS 1992-4-5, Section 6.3.4				
Partial safety factor			γ_{Mc} [1)]	[-]	1,5[2)]				

1) In absence of other national regulations.
2) The partial safety factor $\gamma_2 = 1{,}0$ is included.

Displacements see Annex 16

fischer injection system FIS EM

Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
fischer internal threaded anchors RG MI
Characteristic values to shear load

Annex 26

Table 27: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009;
Characteristic values to tension load of reinforcing bars

Size $\varnothing$ **d**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Steel failure																	
Characteristic resistance Reinforcing bars $N_{Rk,s}$ [kN]	28	44	63	85	111	140	173	209	249	270	292	339	389	443	499	560	691
Partial safety factor $\gamma_{Ms,N}$ 1) [-]	1,4																
Combined pullout and concrete failure																	
Diameter for calculation d [mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Characteristic bond resistance in non-cracked concrete C20/25; hammer-drilling (dry and wet concrete)																	
Temperature range I (60°C/35°C) $\tau_{Rk,ucr}$ [N/mm²]	16	16	15	14	14	14	13	13	13	13	13	13	12	12	12	12	12
Temperature range II (72°C/50°C) $\tau_{Rk,ucr}$ [N/mm²]	15	14	14	13	13	13	12	12	12	12	11	11	11	11	11	11	10
Characteristic bond resistance in non-cracked concrete C20/25; hammer-drilling (flooded hole)																	
Temperature range I (60°C/35°C) $\tau_{Rk,ucr}$ [N/mm²]	16	16	14	13	12	12	11	11	10	10	10	10	9	9	9	8	8
Temperature range II (72°C/50°C) $\tau_{Rk,ucr}$ [N/mm²]	15	14	13	12	11	12	11	10	10	9	9	9	9	8	8	8	8
Characteristic bond resistance in non-cracked concrete C20/25; diamond-drilling (dry and wet concrete)																	
Temperature range I (60°C/35°C) $\tau_{Rk,ucr}$ [N/mm²]	16	15	13	12	12	10	10	10	10	9	9	9	9	8	8	8	7
Temperature range II (72°C/50°C) $\tau_{Rk,ucr}$ [N/mm²]	15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Characteristic bond resistance in non-cracked concrete C20/25; diamond-drilling (flooded hole)																	
Temperature range I (60°C/35°C) $\tau_{Rk,ucr}$ [N/mm²]	16	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
Temperature range II (72°C/50°C) $\tau_{Rk,ucr}$ [N/mm²]	15	14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Factor non-cracked concrete $k_8=k_{ucr}$ [-]	10,1																
Partial safety factor $\gamma_{Mp}=\gamma_{Mc}=\gamma_{Msp}$ 1) — Dry and wet concrete [-]	1,5 2)							1,8 3)									
Partial safety factor $\gamma_{Mp}=\gamma_{Mc}=\gamma_{Msp}$ 1) — Flooded hole [-]	2,1 4)																

The values given in Table 27. are values for reinforcing bars B500B with f_{uk} = 550 N/mm² and f_{yk} = 500 N/mm².
Other reinforcing bars have to be calculated according to TR 029, Equation (5.1).

1) In absence of other national regulations.
2) The partial safety factor γ_2 = 1,0 is included.
3) The partial safety factor γ_2 = 1,2 is included
4) The partial safety factor γ_2 = 1,4 is included

Displacements see Annex 19

fischer injection system FIS EM

Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Reinforcing bars
Characteristic values to tension load

Annex 27

Table 27.1: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009; Characteristic values to tension load of reinforcing bars

Size	**Ø d**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Characteristic bond resistance in cracked concrete C20/25; hammer and diamond drilling (dry and wet concrete)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$ [N/mm²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$ [N/mm²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Characteristic bond resistance in cracked concrete C20/25; hammer and diamond drilling (flooded hole)																		
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$ [N/mm²]	6	7,5	6,5	6,5	6,5	6	6	7	6	6	6	6	6	5	5	5	5
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$ [N/mm²]	6	7	7	6	6	6	6	6	6	6	6	6	6	5	5	5	5
Factor for cracked concrete	$k_8 = k_{cr}$ [-]	7,2																
Increasing factors for τ_{Rk} Ψ_c	C25/30 [-]	1,02																
	C30/37 [-]	1,04																
	C35/45 [-]	1,06																
	C40/50 [-]	1,07																
	C45/55 [-]	1,08																
	C50/60 [-]	1,09																
Splitting failure																		
Edge distance $c_{cr,sp}$ [mm]	$h / h_{ef} \geq 2,0$	$1,0 \, h_{ef}$																
	$2,0 > h / h_{ef} > 1,3$	$4,6 \, h_{ef} - 1,8 \, h$																
	$h / h_{ef} \leq 1,3$	$2,26 \, h_{ef}$																
Spacing	$s_{cr,sp}$ [mm]	$2 \, c_{cr,sp}$																
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)	Dry and wet concrete [-]	1,5[2)							1,8[3)									
	Flooded hole [-]	1,8[3)						2,1[4)										

The values given in Table 15.1 are values for reinforcing bars B500B with f_{uk} = 550 N/mm² and f_{yk} = 500 N/mm².
Other reinforcing bars have to be calculated according to TR 029, Equation (5.1).

1) In absence of other national regulations.
2) The partial safety factor γ_2 = 1,0 is included.
3) The partial safety factor γ_2 = 1,2 is included.
4) The partial safety factor γ_2 = 1,4 is included.

Displacements see Annex 19

fischer injection system FIS EM

Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Reinforcing bars
Characteristic values to tension load

Annex 28

Deutsches Institut für Bautechnik

Table 28: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009; Characteristic values to shear load of reinforcing bars

Size ∅ d	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**
Steel failure without lever arm																	
Characteristic resistance $V_{Rk,s}$ [kN]	13,8	21,6	31,1	42,4	55,3	70	87	105	125	135	146	170	195	221	250	280	346
Partial safety factor $\gamma_{Ms,V}$ 1) [-]									1,5								
Steel failure with lever arm																	
Characteristic bending moment $M^0_{Rk,s}$ [Nm]	33	65	112	178	265	378	518	690	896	1012	1139	1422	1749	2123	2547	3023	4147
Partial safety factor $\gamma_{Ms,V}$ 1) [-]									1,5								
Ductility factor k_2 [-]									0,8								
Concrete pryout failure																	
Factor in Equation (27) of CEN/TS 1992-4-5, Section 6.3.3 k_3 [-]									2,0								
Partial safety factor γ_{Mcp} 1) [-]									1,5 2)								
Concrete edge failure									See CEN/TS 1992-4-5, Section 6.3.4								
Partial safety factor γ_{Mc} 1) [-]									1,5 2)								

The values given in Table 16 are values for reinforcing bars with f_{uk} = 550 N/mm² and f_{yk} = 500 N/mm². Other reinforcing bars have to be calculated according to TR 029, Equation (5.1).

1) In absence of other national regulations.

2) The partial safety factor γ_2 = 1,0 is included.

Displacements see Annex 19

fischer injection system FIS EM

Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Reinforcing bars
Characteristic values to shear load

Annex 29

Table 29: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to tension load of fischer rebar anchors FRA

Size			M12	M16	M20	M24
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	63	111	173	270
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]	1,4			
Combined pullout and concrete failure						
Diameter of calculation	d	[mm]	12	16	20	25
Characteristic bond resistance in non-cracked concrete C20/25; hammer-drilling (dry and wet concrete)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	15	14	13	13
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	14	13	12	12
Characteristic bond resistance in non-cracked concrete C20/25; hammer-drilling (flooded hole)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	15	13	11	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	14	12	11	10
Characteristic bond resistance in non-cracked concrete C20/25; diamond-drilling (dry and wet concrete)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	13	12	10	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	12	11	10	9
Characteristic bond resistance in non-cracked concrete C20/25; diamond-drilling (flooded hole)						
Temperature range I (60°C/35°C)	$\tau_{Rk,ucr}$	[N/mm²]	13	12	10	10
Temperature range II (72°C/50°C)	$\tau_{Rk,ucr}$	[N/mm²]	12	11	10	9
Factor for non-cracked concrete	k_{ucr}	[-]	10,1			
Characteristic bond resistance in cracked concrete C20/25. ; hammer and diamond drilling (dry and wet concrete)						
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	7
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	7
Characteristic bond resistance in cracked concrete C20/25; hammer and diamond drilling (flooded hole)						
Temperature range I (60°C/35°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	6
Temperature range II (72°C/50°C)	$\tau_{Rk,cr}$	[N/mm²]	7	6	6	6
Factor for cracked concrete	$k_8=k_{cr}$	[-]	7,2			
Increasing factors for τ_{Rk}	Ψ_c	C25/30 [-]	1,02			
		C30/37 [-]	1,04			
		C35/45 [-]	1,06			
		C40/50 [-]	1,07			
		C45/55 [-]	1,08			
		C50/60 [-]	1,09			
Splitting failure						
Edge distance	$c_{cr,sp}$ [mm]	$h / h_{ef} \geq 2,0$	$1,0\ h_{ef}$			
		$2,0 > h / h_{ef} > 1,3$	$4,6\ h_{ef} - 1,8\ h$			
		$h / h_{ef} \leq 1,3$	$2,26\ h_{ef}$			
Spacing	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$			
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1)]	dry and wet concrete	[-]	1,5[2)]			1,8[3)]
	flooded hole	[-]	1,8[3)]			2,1[4)]

[1)] In absence of other national regulations.
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included.

Displacements see Annex 21

fischer injection system FIS EM	**Annex 30**
Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009 Fischer rebar anchors FRA Characteristic values to tension load	

Table 30: Design of Bonded Anchors acc. to CEN/TS 1992-4-5:2009
Characteristic values to shear load of fischer rebar anchors FRA

Size			**M12**	**M16**	**M20**	**M24**
Steel failure						
Characteristic resistance	$V_{Rk,s}$	[kN]	30	55	86	124
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,56			
Steel failure with lever arm						
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	92	233	454	785
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,56			
Ductility factor	k_2	[-]	0,8			
Concrete pryout failure						
Factor in Equation (27) of CEN/TS 1992-4-5, Section 6.3.3	k_3	[-]	2,0			
Partial safety factor	γ_{Mcp} [1)]	[-]	1,5 [2)]			
Concrete edge failure			See CEN/TS 1992-4-5, Section 6.3.4			
Partial safety factor	γ_{Mc} [1)]	[-]	1,5 [2)]			

[1)] In absence of other national regulations.
[2)] The partial safety factor γ_2 = 1,0 is included.

Displacements see Annex 21

Seismic design according TR045 “Design of metal anchors under seismic action”

The recommended seismic performance categories are given in Table 31. The value of a_g or that of the product $a_g \cdot S$ used in a Member State to define thresholds for the seismicity classes may be found in its National Annex of EN 1998-1:2004 and may be different to the values given in Table 31. Furthermore, the assignment of the seismic performance categories C1 and C2 to the seismicity level and building importance classes is in the responsibility of each individual Member State.

Table 31: Recommended seismic performance categories for anchors

Seismicity level[1)]		Importance Class acc. to EN 1998-1:2004,4.2.5			
Class	$a_g \cdot S$[3)]	**I**	**II**	**III**	**IV**
Very low[2)]	$a_g \cdot S \leq 0{,}05$ g	No additional requirement			
Low[2)]	$0{,}05$ g $< a_g \cdot S \leq 0{,}1$ g	C1	C1[4)] or C2[5)]		C2
> low	$a_g \cdot S > 0{,}1$ g	C1	C2		

[1)] The values defining the seismicity levels are may be found in the National Annex of EN 1988-1:2004.
[2)] Definition according to EN 1998-1:2004, 3.2.1.
[3)] a_g = design ground acceleration on Type A ground (EN 1998-1:2004, 3.2.1).
[4)] C1 for fixing non-structural elements to structures
[5)] C2 for fixing structural elements to structures

The seismic design resistance $R_{d,seis}$ of a fastening shall be determined as follows:

$$R_{d,seis} = R_{k,seis} / \gamma_{M,seis}$$

The characteristic seismic design resistance $R_{k,seis}$ of a fastening shall be determined as follows:

$$R_{k,seis} = \alpha_{gap} \times \alpha_{seis} \times R^0_{k,seis}$$

The basic characteristic seismic resistance $R^0_{k,seis}$ for “steel failure”, “combined pull-out and concrete cone failure” under tension load and “steel failure” under shear load shall be taken from table 33. For all other failure modes $R^0_{k,seis}$ shall be determined as for static and quasi-static action according to tables 8,12 and 16.
The reduction factors α_{seis} and α_{gap} are given in table 32.

Table 32: Reduction factors α_{seis} and α_{gap}

Loading	**Failure mode**	α_{seis}		α_{gap}	
		Single fastener	**Fastener group**	**Connections with hole clearance[1)]**	**Connections without hole clearance**
Tension	Steel failure	1,0	1,0	1,00	1,00
	Combined pull-out and concrete failure	1,0	0,85		
	Concrete cone failur	0,85	0,75		
	Splitting failure	1,0	0,85		
Shear	Steel failure	1,0	0,85	0,50	
	Concrete edge failure	1,0	0,85		
	Concrete pry-out failure	0,85	0,75		

[1)] Connections with hole clearance according to CEN/TS 1992-4-4: 2009, table 1

fischer injection system FIS EM

Recommended performance categories and reduction factors for loads under seismic action

Annex 32

Deutsches Institut für Bautechnik DIBt

Table 33A: Characteristic values for seismic action valid for performance category C1 of fischer anchor rods with **FIS EM** in **hammer drilled hole**

Size				**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Characteristic resistance tension load, steel failure													
$N_{Rk,s,seis}$ [kN]		Property class	5.8	-	29	43	58	79	123	152	177	230	281
			8.8	-	47	68	92	126	196	243	282	368	449
	Stainless steel A4 and steel C	Property class	50	-	29	43	58	79	123	152	177	230	281
			70	-	41	59	81	110	172	212	247	322	393
			80	-	47	68	92	126	196	243	282	368	449
$\gamma_{M,s,seis}$ [1)] [-]		Property class	5.8	1,50									
			8.8	1,50									
	Stainless steel A4 and steel C	Property class	50	2,86									
			70	1,50[2)] / 1,87									
			80	1,6									
Characteristic bond resistance, combined pullout and concrete cone failure (dry and wet concrete)													
Temperature range I (60°C/35°C)		$\tau_{Rk,seis}$	[N/mm²]	-	7,0	7,0	6,7	5,7	5,7	6,7	6,7	6,7	6,7
Temperature range II (72°C/50°C)		$\tau_{Rk,seis}$	[N/mm²]	-	7,0	7,0	6,7	5,7	5,7	6,7	6,7	6,7	6,7
Characteristic bond resistance, combined pullout and concrete cone failure (flooded hole)													
Temperature range I (60°C/35°C)		$\tau_{Rk,seis}$	[N/mm²]	-	7,5	7,5	6,5	5,7	5,7	6,7	5,7	5,7	5,7
Temperature range II (72°C/50°C)		$\tau_{Rk,seis}$	[N/mm²]	-	6,8	6,8	6,5	5,7	5,7	5,7	5,7	5,7	5,7
$\gamma_{M,p,seis}$ [1)]		dry and wet	[-]	1,5[3)]						1,8[4)]			
		flooded hole	[-]	1,8[4)]						2,1[5)]			
Characteristic resistance shear load, steel failure without lever arm													
$V_{Rk,s,seis}$ [6)] [kN]		Property class	5.8	-	15	21	29	39	61	76	89	115	141
			8.8	-	23	34	46	63	98	122	141	184	225
	Stainless steel A4 and steel C	Property class	50	-	15	21	29	39	61	76	89	115	141
			70	-	20	30	40	55	86	107	124	161	197
			80	-	23	34	46	63	98	122	141	184	225
$\gamma_{M,s,seis}$ [1)] [-]		Property class	5.8	1,25									
			8.8	1,25									
	Stainless steel A4 and steel C	Property class	50	2,38									
			70	1,25[2)] / 1,56									
			80	1,33									

1) In absence of other national regulations
2) For steel C with f_{uk} = 700 N/mm^2 and f_{yk} = 560 N/mm^2
3) The partial safety factor γ_2 = 1,0 is included
4) The partial safety factor γ_2 = 1,2 is included
5) The partial safety factor γ_2 = 1,4 is included
6) For fischer treaded rods FIS A / RGM the factor for steel ductility is 1,0

fischer injection system FIS EM	**Annex 33**
Hammer-drill Characteristic values for loads under seismic action categories C1 Fischer anchor rods FIS A und RGM	

Table 33B: Characteristic values for seismic action valid for performance category C1 of standard threaded rods with mortar **FIS EM** in **hammer drilled hole**

Size				**M8**	**M10**	**M12**	**M14**	**M16**	**M20**	**M22**	**M24**	**M27**	**M30**
Characteristic resistance tension load, steel failure													
Steel failure				See table 33A									
Characteristic bond resistance, combined pullout and concrete cone failure				See table 33A									
Characteristic resistance shear load, steel failure without lever arm													
$V_{Rk,s,seis}$ [kN]		Property class	5.8	-	10,5	14,7	20,3	27,3	42,7	53,2	62,3	80,5	98,7
			8.8	-	16,1	23,8	32,2	44,1	68,6	85,4	98,7	128,8	157,5
	Stainless steel A4 and steel C	Property class	50	-	10,5	14,7	20,3	27,3	42,7	53,2	62,3	80,5	98,7
			70	-	14,0	21,0	28,0	38,5	60,2	74,9	86,8	112,7	137,9
			80	-	16,1	23,8	32,2	44,1	68,6	85,4	98,7	128,8	157,5
$\gamma_{M,s,seis}$ [1)] [-]		Property class	5.8	1,25									
			8.8	1,25									
	Stainless steel A4 and steel C	Property class	50	2,38									
			70	1,56									
			80	1,33									

[1)] In absence of other national regulations

fischer injection system FIS EM

Hammer-drill
Characteristic values for loads under seismic action categories C1
standard threaded rods

Annex 34

Table 33C: Characteristic values for seismic action valid for performance category C1 of reinforcing bars with mortar **FIS EM** in **hammer drilled hole**

Rebar B500B		**size**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**
Characteristic resistance tension load, steel failure											
$N_{Rk,s,seis}$		[kN]	-	44	63	85	111	140	173	209	249
$\gamma_{M,s,seis}$ 1)		[-]	1,4								
Characteristic bond resistance, combined pullout and concrete cone failure (dry and wet concrete)											
Temperature range I (60°C/35°C)	$\tau_{Rk,s,seis}$	[N/mm²]	-	7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7
Temperature range II (72°C/50°C)	$\tau_{Rk,s,seis}$	[N/mm²]	-	7,0	7,0	6,7	5,7	5,7	5,7	6,7	6,7
Characteristic bond resistance, combined pullout and concrete cone failure (flooded hole)											
Temperature range I (60°C/35°C)	$\tau_{Rk,s,seis}$	[N/mm²]	-	7,5	7,0	6,5	5,7	5,7	5,7	6,7	5,7
Temperature range II (72°C/50°C)	$\tau_{Rk,s,seis}$	[N/mm²]	-	6,8	6,8	5,8	5,8	5,7	5,7	5,7	5,7
$\gamma_{M,p,seis}$ 1)	dry and wet	[-]	-	1,5 2)						1,8 3)	
	flooded hole	[-]	-	1,8 3)					2,1 4)		
Characteristic resistance shear load, steel failure without lever arm											
$V_{Rk,s,seis}$		[kN]	-	15,1	21,8	29,7	38,7	49,0	60,9	73,5	87,5
$\gamma_{M,s,seis}$ 1)		[-]	-	1,5							

Rebar B500B		**size**	**25**	**26**	**28**	**30**	**32**	**34**	**36**	**40**	
Characteristic resistance tension load, steel failure											
$N_{Rk,s,seis}$		[kN]	270	292	339	389	443	-	-	-	
$\gamma_{M,s,seis}$ 1)		[-]	1,4					-	-	-	
Characteristic bond resistance, combined pullout and concrete cone failure (dry and wet concrete)											
Temperature range I (60°C/35°C)	$\tau_{Rk,s,seis}$	[N/mm²]	6,7	6,7	6,7	6,7	4,8	-	-	-	
Temperature range II (72°C/50°C)	$\tau_{Rk,s,seis}$	[N/mm²]	6,7	6,7	6,7	6,7	4,8	-	-	-	
Characteristic bond resistance, combined pullout and concrete cone failure (flooded hole)											
Temperature range I (60°C/35°C)	$\tau_{Rk,s,seis}$	[N/mm²]	5,7	5,7	5,7	5,7	5,7	-	-	-	
Temperature range II (72°C/50°C)	$\tau_{Rk,s,seis}$	[N/mm²]	5,7	5,7	5,7	5,7	4,8	-	-	-	
$\gamma_{M,p,seis}$ 1)	dry and wet	[-]	1,8 3)					-	-	-	
	flooded hole	[-]	2,1 4)					-	-	-	
Characteristic resistance shear load, steel failure without lever arm											
$V_{Rk,s,seis}$		[kN]	94,5	102,2	119,0	136,5	154,7	-	-	-	
$\gamma_{M,s,seis}$ 1)		[-]	1,5 2)					-	-	-	

1) In absence of other national regulations
2) The partial safety factor γ_2 = 1,0 is included
3) The partial safety factor γ_2 = 1,2 is included
4) The partial safety factor γ_2 = 1,4 is included

fischer injection system FIS EM	Annex 35
Hammer-drill Characteristic values for loads under seismic action categories C1 reinforcing bars	