



**Declaration of Performance**  
**FM 753 crack A4**  
 Throughbolt anchor made of stainless steel INOX A4


**Intended use or uses of the construction product according to ETAG 001 p.1, 2 and TR020\***

|   |   |
|---|---|
| Generic type                                      | Torque controlled expansion anchor throughbolt type   |
| Base material                                     | Cracked and un-cracked concrete C20/25 to C50/60 acc. to EN 206-1   |
| Material  | Stainless steel AISI316 (cl. A4 70 for bolt acc.to EN ISO 3506-1)   |
| Durability  | Internal dry conditions and external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions exist. |
| Loading   | Static and quasi-static   |
| Fire Resistance*                                  | F120  |
| Fire Reaction                                     | A1 according to EN13501-1   |
| ETA-10/0293 issued by                             | ZAG approval body nr.1404   |
| On the basis of                                   | ETAG001 p.1-2   |
| Certificate of Conformity 1404-CPD-1623 issued by | ZAG notified body nr.1404   |
| Under System                                      | 1   |

**Declared performances according to ETA-10/0293 (ETAG 001 p.1, 2 and TR020\*)**
**Design method ETAG 001 Annex C**

| ESSENTIAL CHARACTERISTICS           |  | PERFORMANCE |     |     |      |
|-------------------------------------|--|-------------|-----|-----|------|
| Installation parameters             |  | M8          | M10 | M12 | M16  |
| $d_0$                               | Nominal diameter of drill bit [mm]                             | 8           | 10  | 12  | 16   |
| $h_{nom}$                           | Minimum installation depth [mm]                                | 54          | 67  | 81  | 97   |
| $h_{ef}$                            | Effective anchorage depth [mm]                                 | 48          | 60  | 72  | 86   |
| $h_{min}$                           | Minimum thickness of the concrete member [mm]                  | 100         | 120 | 150 | 170  |
| $T_{inst}$                          | Nominal torque moment [Nm]                                     | 20          | 40  | 60  | 120  |
| $s_{min}$                           | Minimum spacing [mm]   | 50          | 55  | 60  | 70   |
| <b>for <math>c \geq</math></b>      | Edge distance [mm]   | 50          | 70  | 80  | 100  |
| $c_{min}$                           | Minimum edge distance [mm]                                     | 50          | 50  | 60  | 70   |
| <b>for <math>s \geq</math></b>      | Anchor spacing [mm]  | 50          | 110 | 120 | 130  |
| <b>Tension Steel failure mode</b>   |  |             |     |     |      |
| $N_{Rk,s}$                          | Tension Steel characteristic failure [kN]                      | 21          | 34  | 49  | 88   |
| $\gamma_{m,sN}^{1)}$                | Partial safety factor for tension steel failure [-]            | 1,5         |     |     |      |
| <b>Pull-out failure mode</b>        |  |             |     |     |      |
| $N_{Rk,p,cr}$                       | Tension characteristic load in cracked concrete C20/25 [kN]    | 5           | 9   | 12  | 25   |
| $N_{Rk,p,ucr}$                      | Tension characteristic load in un-cracked concrete C20/25 [kN] | 9           | 16  | 20  | 35   |
| $\gamma_2$                          | Partial safety factor [-]                                      | 1,0         |     |     |      |
| $\gamma_{m,c}^{1)}$                 | Partial safety factor [-]                                      | 1,5         |     |     |      |
| $s_{cr,N}$                          | Critical spacing [mm]  | 144         | 180 | 220 | 260  |
| $c_{cr,N}$                          | Critical edge distance [mm]                                    | 72          | 90  | 110 | 130  |
| $\psi_c$ C30/37                     | Increasing factor for concrete C30/37 [-]                      | 1,22        |     |     |      |
| $\psi_c$ C40/50                     | Increasing factor for concrete C40/50 [-]                      | 1,41        |     |     |      |
| $\psi_c$ C50/60                     | Increasing factor for concrete C50/60 [-]                      | 1,55        |     |     |      |
| <b>Splitting failure mode</b>       |  |             |     |     |      |
| $s_{cr,sp}$                         | Critical spacing (splitting) [mm]                              | 144         | 180 | 220 | 260  |
| $c_{cr,sp}$                         | Critical edge distance(splitting) [mm]                         | 72          | 90  | 110 | 130  |
| $\gamma_{m,c}^{1)}$                 | Partial safety factor [-]                                      | 1,5         |     |     |      |
| <b>Displacement on Tension Load</b> |  |             |     |     |      |
| $N_{cr}$                            | Service tension load in cracked concrete C20/25 [kN]           | 2,4         | 4,3 | 5,7 | 11,9 |
| $\delta_{N0,cr}$                    | Short term displacement under tension load [mm]                | 0,7         | 0,6 | 0,7 | 0,7  |
| $\delta_{N\infty,cr}$               | Long term displacement under tension load [mm]                 | 1,4         | 1,5 | 0,9 | 1,4  |
| $N_{ucr}$                           | Service tension load in un-cracked concrete C20/25 [kN]        | 4,3         | 7,6 | 9,5 | 16,7 |
| $\delta_{N0,ucr}$                   | Short term displacement under tension load [mm]                | 0,3         | 0,4 | 0,4 | 0,3  |
| $\delta_{N\infty,ucr}$              | Long term displacement under tension load [mm]                 | 1,4         | 1,5 | 0,9 | 1,4  |

| Shear Steel failure mode                         |  |      | M8   | M10  | M12  | M16  |
|--|--|------|------|------|------|------|
| $V_{Rk,s}$                                       | Shear Steel characteristic failure                     | [kN] | 11,9 | 18,8 | 27,4 | 51,0 |
| $M_{Rk,s}^0$                                     | Bending Moment characteristic failure                  | [Nm] | 24   | 49   | 85   | 216  |
| $\gamma_{m,sV}^1$                                | Partial safety factor for shear steel failure          | [-]  | 1,3  |      |      |      |
| Shear Concrete Pry-out and and Edge failure mode |  |      |      |      |      |      |
| <b>k</b>   | Factor equation (5.6) of ETAG, Annex C, § 5.2.3.3      | [-]  | 1,0  | 2,0  |      |      |
| $l_{ef}$   | Effective anchorage length                             | [mm] | 48   | 60   | 72   | 86   |
| $d_{nom}$  | Nominal diameter of anchor                             | [mm] | 8    | 10   | 12   | 16   |
| $\gamma_m^1$                                     | Partial safety factor ( $\gamma_{m,c}=\gamma_{m,pr}$ ) | [-]  | 1,5  |      |      |      |
| Displacement on Shear Load                       |  |      |      |      |      |      |
| <b>V</b>   | Service shear load in concrete                         | [kN] | 6,5  | 10,4 | 15,1 | 28,0 |
| $\delta_{V0}$                                    | Short term displacement under shear load               | [mm] | 0,8  | 0,9  | 1,2  | 2,5  |
| $\delta_{V\infty}$                               | Long term displacement under shear load                | [mm] | 1,3  | 1,3  | 1,8  | 3,8  |
| Fire Resistance*                                 |  |      |      |      |      |      |
| $N_{Rk,s,fi,30}$                                 | For Tension fire resistance duration = 30 minutes      | [kN] | 0,5  | 1,1  | 1,8  | 3,3  |
| $N_{Rk,s,fi,60}$                                 | For Tension fire resistance duration = 60 minutes      | [kN] | 0,4  | 0,9  | 1,5  | 2,7  |
| $N_{Rk,s,fi,90}$                                 | For Tension fire resistance duration = 90 minutes      | [kN] | 0,3  | 0,7  | 1,2  | 2,2  |
| $N_{Rk,s,fi,120}$                                | For Tension fire resistance duration = 120 minutes     | [kN] | 0,3  | 0,6  | 1,0  | 1,8  |
| $V_{Rk,s,fi,30}$                                 | For Shear fire resistance duration = 30 minutes        | [kN] | 0,7  | 1,5  | 2,5  | 4,7  |
| $V_{Rk,s,fi,60}$                                 | For Shear fire resistance duration = 60 minutes        | [kN] | 0,6  | 1,2  | 2,1  | 3,9  |
| $V_{Rk,s,fi,90}$                                 | For Shear fire resistance duration = 90 minutes        | [kN] | 0,4  | 0,9  | 1,7  | 3,1  |
| $V_{Rk,s,fi,120}$                                | For Shear fire resistance duration = 120 minutes       | [kN] | 0,4  | 0,8  | 1,4  | 2,5  |

<sup>1)</sup> In absence of other national regulations.

We inform you that Friulside is classified in the EC 1907/2006 Reach Directive as a Downstream-user of substances.

The product supplied does not contain substances classified as SVHC according to the Candidate List in a concentration equal or greater than 0.1% (weight / weight). Article 31 is not applicable to the present product.

The above performances apply for the following article numbers:

| d <sup>2)</sup> | L <sup>3)</sup><br>[mm] | t <sub>fix</sub> <sup>4)</sup><br>[mm] | Marking        | ID | Cod.        |
|-----------------|-------------------------|--|----------------|----|-------------|
| M8              | 68                      | 4                                      | FM-C 8/4 A4    | A  | 75350008068 |
|                 | 75                      | 10                                     | FM-C 8/10 A4   | B  | 75350008075 |
|                 | 90                      | 25                                     | FM-C 8/25 A4   | C  | 75350008090 |
|                 | 115                     | 50                                     | FM-C 8/50 A4   | D  | 75350008115 |
|                 | 135                     | 70                                     | FM-C 8/70 A4   | E  | 75350008135 |
|                 | 165                     | 100                                    | FM-C 8/100 A4  | G  | 75350008165 |
| M10             | 90                      | 10                                     | FM-C 10/10 A4  | A  | 75350010090 |
|                 | 105                     | 25                                     | FM-C 10/25 A4  | B  | 75350010105 |
|                 | 115                     | 35                                     | FM-C 10/35 A4  | C  | 75350010115 |
|                 | 135                     | 55                                     | FM-C 10/55 A4  | D  | 75350010135 |
|                 | 155                     | 75                                     | FM-C 10/75 A4  | E  | 75350010155 |
|                 | 185                     | 105                                    | FM-C 10/105 A4 | F  | 75350010185 |
| M12             | 110                     | 10                                     | FM-C 12/10 A4  | A  | 75350012110 |
|                 | 120                     | 20                                     | FM-C 12/20 A4  | B  | 75350012120 |
|                 | 130                     | 30                                     | FM-C 12/30 A4  | P  | 75350012130 |
|                 | 145                     | 45                                     | FM-C 12/45 A4  | C  | 75350012145 |
|                 | 170                     | 70                                     | FM-C 12/70 A4  | D  | 75350012170 |
|                 | 200                     | 100                                    | FM-C 12/100 A4 | E  | 75350012120 |
| M16             | 130                     | 10                                     | FM-C 16/10 A4  | A  | 75350016130 |
|                 | 150                     | 30                                     | FM-C 16/30 A4  | B  | 75350016150 |
|                 | 185                     | 60                                     | FM-C 16/60 A4  | C  | 75350016185 |
|                 | 220                     | 100                                    | FM-C 16/100 A4 | D  | 75350016220 |

<sup>2)</sup> Nominal diameter of thread; <sup>3)</sup> Length of anchor; <sup>4)</sup> Thickness fixture max.

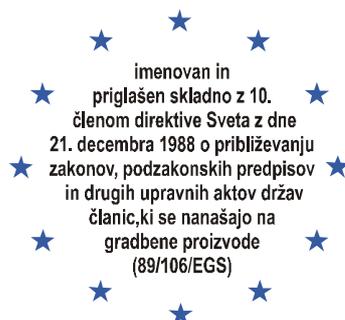
The performances of the product identified by the above identification code are in conformity with the declared performance.

This declaration of performance is issued under the sole responsibility of **Friulside SpA**.

Signed for and behalf of the manufacturer by:

| Name and functions                      | Place and date of issue              | Signature   |
|---|--------------------------------------|---|
| Eng. Vittorio Pilla<br>General Director | San Giovanni al Natisone, 09-10-2013 |  |

**Zavod za gradbeništvo  
Slovenije**  
**Slovenian National Building and  
Civil Engineering Institute**  
**Dimičeva 12,**  
**1000 Ljubljana, Slovenija**  
Tel.: +386 (0)1-280 44 72  
Fax: +386 (0)1-436 74 49  
e-mail: [info.ta@zag.si](mailto:info.ta@zag.si)  
<http://www.zag.si>



član EOTA  
Member of EOTA

## European Technical Approval

## ETA-10/0293

[English translation prepared by ZAG – Original version in Slovenian language]

Komercialno ime  
*Trade name*

**FM-753 crack A4**

Imetnik soglasja  
*Holder of approval*

**FRIULSIDER S.p.A.**  
**via Trieste 1**  
**33048 San Giovanni al Natisone (UD)**  
**Italy**

Tip gradbenega proizvoda in  
njegova predvidena uporaba

**Torzijsko kontrolirano zatezno nerjaveče  
kovinsko sidro velikosti M8, M10, M12 in M16 za  
vgradnjo v beton**

*Generic type and use  
of construction product*

*Torque controlled expansion anchor made of stainless steel of  
sizes M8, M10, M12 and M16 for use in concrete*

Veljavnost od  
*Validity from*  
do  
*to*

**05.04.2012**

**19.07.2015**

Proizvodni obrat  
*Manufacturing plant*

**FRIULSIDER S.p.A.**  
**via Trieste 1**  
**33048 San Giovanni al Natisone (UD)**  
**Italy**

To soglasje zamenjuje:  
*This Approval replaces:*

ETA-10/0293 veljavno od 19.07.2010 do  
19.07.2015  
*ETA-10/0293 valids from 19.07.2010 to 19.07.2015*

To Evropsko tehnično soglasje  
vsebuje  
*This European Technical Approval contains*

15 strani vključno s 7 prilogami, ki so sestavni del  
tega soglasja  
*15 pages including 7 annexes, which form an integral part of  
the document*



Evropska organizacija za tehnična soglasja  
European Organisation for Technical Approvals

## I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the Slovenian National Building and Civil Engineering Institute (ZAG) 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<sup>1</sup>, modified by the Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N°1882/2003 of the European Parliament and of the Council<sup>3</sup>,
  - Zakon o gradbenih proizvodih (ZGPro)<sup>4</sup>,
  - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC<sup>5</sup>,
  - Guideline for European Technical Approval of “Metal Anchors for use in Concrete”, Part 1 “Anchors in General” and Part 2: Torque controlled expansion anchors”, ETAG 001, edition October 1997, amended November 2006.
2. The Slovenian National Building and Civil Engineering Institute (ZAG) is authorised 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 with 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 manufacturer 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 the Slovenian National Building and Civil Engineering Institute (ZAG), in particular pursuant to information by the Commission according to Article 5 (1) of the 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 the Slovenian National Building and Civil Engineering Institute (ZAG). 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.

---

<sup>1</sup> Official Journal of the European Communities N° L 40, 11.2.1989, p.12

<sup>2</sup> Official Journal of the European Communities N° L 220, 30.8.1993, p.1

<sup>3</sup> Official Journal of the European Union N° L 284, 31.10.2003, p.1

<sup>4</sup> Official Gazette of the Republic of Slovenia, N° 52/00 and N° 110/02

<sup>5</sup> Official Journal of the European Communities N° L 17, 20.1.1994, p.34

## **II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL**

### **1 Definition of product and intended use**

#### **1.1 Definition of product**

The FM-753 crack A4 in the range of M8, M10, M12 and M16 is an anchor made of stainless steel, which is placed into a drilled hole and anchored by torque-controlled expansion.

For the installed anchor see Figure given in Annex 1.

#### **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 full filled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences. The anchor is to be used only for anchorages subjected to static and quasi-static loading in reinforced or non reinforced normal weight concrete of strength classes from C20/25 to C50/60 according to EN 206-1:2003. It may be anchored in cracked and non-cracked concrete.

The anchor may be used in concrete subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanent damp internal conditions, if no particular aggressive conditions exist.

Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. desulphurization plants or road tunnels where de-icing materials are used).

The anchor may be used for anchorages with requirements related to resistance to fire.

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 manufacturer, 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 product and methods of verification**

### **2.1 Characteristics of product**

The anchor corresponds to the drawings and provisions given in Annexes 1 to 3. The characteristic material values, dimensions and tolerances of the anchor not indicated in these Annexes 2 and 3 shall correspond to the respective values laid down in the technical documentation<sup>6</sup> of this European Technical Approval. The characteristic anchor values for the design of anchorage are given in Annexes 4 and 5. The characteristic

---

<sup>6</sup> The technical documentation of this European Technical Approval is deposited at the Slovenian National Building and Civil Engineering Institute (ZAG) and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over the approved bodies.

anchor values for the design if anchorages regarding resistance to fire are given in Annexes 6 and 7. They are valid for use in a system that is required to provide a specific fire resistance class.

Each anchor is marked with the product name, diameter and thickness of the fixture.

As an example: FM-C 10/10 A4

The anchor shall only be packaged and supplied as a complete unit.

## **2.2 Methods of verification**

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance, stability and safety in use in the sense of the Essential Requirement 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 2 "Torque-controlled expansion anchors", on the basis of Option 1.

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

## **3 Evaluation and attestation of conformity and CE marking**

### **3.1 System of attestation of conformity**

According to the decision 96/582/EC of the European Commission<sup>7</sup> the system 1 of 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 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.

### **3.2 Responsibilities**

#### **3.2.1 Tasks of the manufacturer**

##### **3.2.1.1 Factory production control**

The manufacturer shall exercise permanent internal control of production of concerned product. All the elements, requirements and provisions adopted by the manufacturer are

---

<sup>7</sup> Official Journal of the European Communities L 198/31 of 25.7.1997

documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system ensures that the product is in conformity with the European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials shall include control of the inspection documents presented by the manufacturer of the raw materials (comparison with nominal values) by verifying dimensions and determining the material properties, e.g. tensile strength, hardness, surface finish

The manufactured components of the anchor shall be subjected to the following tests:

- Dimensions of the component parts:
  - bolt (diameters, lengths, thread, geometry of the cone, marking);
  - sleeve (length, thickness, catch size);
  - hexagonal nut (proper running wrench size across flat);
  - washer (diameter, thickness).
- Material properties:
  - bolt (yielding and ultimate tensile strength);
  - sleeve (ultimate tensile strength or hardness);
  - hexagonal nut (proof load);
  - washer (hardness).
- Visual control of correct assembly and of completeness of the anchor.

The factory production control shall be in accordance with the “Control Plan” relating to the European technical approval ETA–10/0293 issued on 05.04.2012, 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 the Slovenian National Building and Civil Engineering Institute (ZAG).

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 of the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in a section 3.1 in the field of torque-controlled expansion anchors in order to undertake the actions laid down in section 3.3. 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 or bodies involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval ETA–10/0293 issued on 05.04.2012.

#### 3.2.2 Tasks of notified bodies

The notified 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 corresponding “Control plan”, which is the part of technical documentation of this European technical approval.

The notified 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 notified certification body involved by the manufacturer shall issue an EC certificate of conformity control 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 the Slovenian National Building and Civil Engineering Institute (ZAG) without delay.

### **3.3 CE-Marking**

The CE marking shall be affixed on each packaging of anchors. The symbol "CE" shall be followed by the identification number of the certification body, and be accompanied by the following additional information:

- identification number of the certification body;
- name and identifying mark of the producer and manufacturing plant;
- the last two digits of the year in which CE – marking was affixed;
- number of the EC certificate of conformity;
- number of the European Technical Approval;
- use category ETAG 001 – 2 (Option 1);
- size of the anchor.

## **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 with the Slovenian National Building and Civil Engineering Institute (ZAG), 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 the Slovenian National Building and Civil Engineering Institute (ZAG) before the changes are introduced. The Slovenian National Building and Civil Engineering Institute (ZAG) will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alternations to the ETA, shall be necessary.

### **4.2 Installation**

#### **4.2.1 Design of anchorages**

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

The anchorages are designed in accordance with the "Guideline for European Technical Approval of Metal Anchors for use in Concrete", Annex C, Method A for torque controlled expansion anchors under the responsibility of an engineer experienced in anchorages and concrete work.

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 support, etc.).

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The relevant characteristic anchor values are given in Annex 6 Table 9 for resistance to fire under tension loads and in Annex 7 Table 10 for resistance to fire under shear loads. The design method covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only if edge distance of the anchor is  $c \geq 300$  mm.

#### 4.2.2 Installation of anchors

The fitness for use of the anchor can only be assumed if the following conditions are met:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on the site.
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings using the appropriate tools.
- Thickness of the fixture corresponding to the range of required thickness values for the type of anchor.
- 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 for.
- Check of concrete being well compacted, e.g. without significant voids.
- Cleaning of the hole of drilling dust.
- Anchor installation ensuring the specified embedment depth.
- Keeping of the edge distance and spacing to the specified values without minus tolerances.
- Positioning of the drill holes without damaging the reinforcement.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not to the anchor in the direction of load application.
- Application of the torque moment given in Annex 3 using a calibrated torque wrench.

#### 4.2.3 Responsibility for the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to 4.2.1, 4.2.2 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 packaging and/or on an enclosed instruction sheet, preferably using illustration.

The minimum data required are:

- drill bit diameter;
- thread diameter;
- maximum thickness of the fixture;
- minimum installation depth;
- torque moment;
- information on the installation procedure, including cleaning of the hole, preferably by means of an illustration;
- reference to any special installation equipment needed;
- identification of the manufacturing batch.

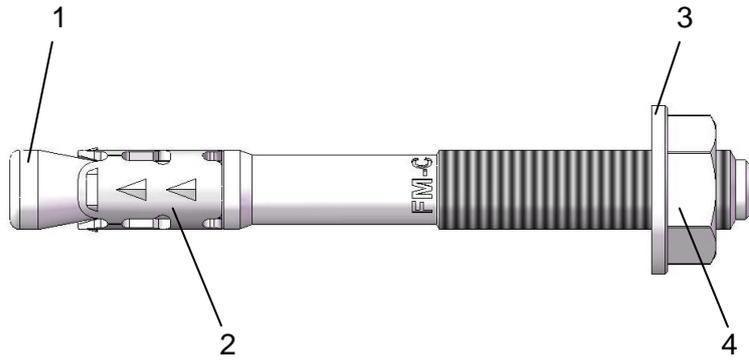
All data shall be presented in a clear and explicit form.

Leading expert:

Duška Drobnič, M.Sc., Research Engineer

Service for Technical Approvals:

Franc Capuder, M.Sc.



- 1 Anchor bolt (body)
- 2 Expansion sleeve
- 3 Washer
- 4 Hexagonal nut

Figure 1: FM-753 crack A4 anchor

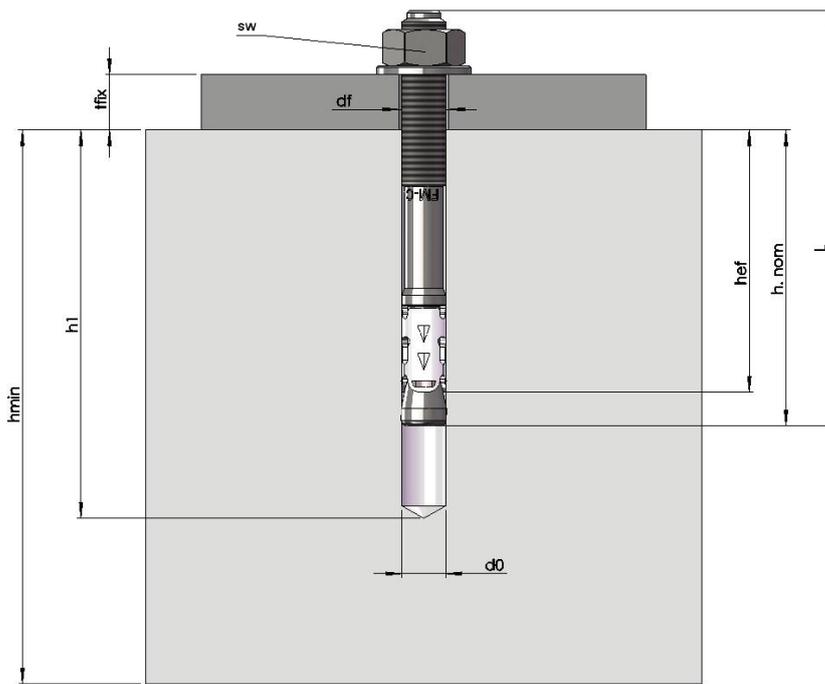
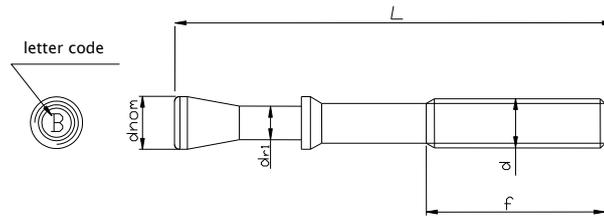


Figure 2: Installed FM-753 crack A4 anchor

|                          |  |
|--------------------------|--|
| <b>FM-753 crack A4</b>   | <b>Annex 1</b><br>of the European Technical Approval<br><b>ETA-10/0293</b> |
| Product and intended use |  |



**Table 1: Dimensions**

|     | dxL     | Marking        | Letter code ID | L (mm) | d <sub>nom</sub> (mm) | d <sub>r1</sub> (mm) | f (mm) |
|-----|---------|----------------|----------------|--------|-----------------------|----------------------|--------|
| M8  | M8x68   | FM-C 8/4 A4    | A              | 68     | 8                     | 5,8                  | 30     |
|     | M8x75   | FM-C 8/10 A4   | B              | 75     |                       |                      | 30     |
|     | M8x90   | FM-C 8/25 A4   | C              | 90     |                       |                      | 40     |
|     | M8x115  | FM-C 8/50 A4   | D              | 115    |                       |                      | 60     |
|     | M8x135  | FM-C 8/70 A4   | E              | 135    |                       |                      | 80     |
|     | M8x165  | FM-C 8/100 A4  | G              | 165    |                       |                      | 80     |
| M10 | M10x90  | FM-C 10/10 A4  | A              | 90     | 10                    | 7,4                  | 40     |
|     | M10x105 | FM-C 10/25 A4  | B              | 105    |                       |                      | 55     |
|     | M10x115 | FM-C 10/35 A4  | C              | 115    |                       |                      | 55     |
|     | M10x135 | FM-C 10/55 A4  | D              | 135    |                       |                      | 85     |
|     | M10x155 | FM-C 10/75 A4  | E              | 155    |                       |                      | 85     |
|     | M10x185 | FM-C 10/105 A4 | F              | 185    |                       |                      | 85     |
| M12 | M12x110 | FM-C 12/10 A4  | A              | 110    | 12                    | 8,8                  | 65     |
|     | M12x120 | FM-C 12/20 A4  | B              | 120    |                       |                      | 65     |
|     | M12x130 | FM-C 12/30 A4  | P              | 130    |                       |                      | 65     |
|     | M12x145 | FM-C 12/45 A4  | C              | 145    |                       |                      | 85     |
|     | M12x170 | FM-C 12/70 A4  | D              | 170    |                       |                      | 85     |
|     | M12x200 | FM-C 12/100 A4 | E              | 200    |                       |                      | 85     |
| M16 | M16x130 | FM-C 16/10 A4  | A              | 130    | 16                    | 11,8                 | 65     |
|     | M16x150 | FM-C 16/30 A4  | B              | 150    |                       |                      | 85     |
|     | M16x185 | FM-C 16/60 A4  | C              | 185    |                       |                      | 85     |
|     | M16x220 | FM-C 16/100 A4 | D              | 220    |                       |                      | 85     |

**Table 2: Materials**

| Part | Component          | Material  | Coating                              |
|------|--------------------|---|--------------------------------------|
| 1    | Anchor body (bolt) | Stainless steel X2CrNiMo17-12-2 acc. to EN 10088-3 (wr. 1.4404)                                   |                                      |
| 2    | Expansion sleeve   | Stainless steel X2CrNiMo17-12-2 acc. to EN 10088-2 (wr. 1.4404) ;                                 | zincplated A1K according to ISO 4042 |
| 3    | Washer             | DIN 125/1 A4 (normal), DIN 9021 A4 (large)<br>Stainless steel AISI 316 similar acc. to EN 10088-2 |                                      |
| 4    | Hexagonal nut      | DIN 934 A4-80<br>Stainless Steel AISI 316 similar acc. to ISO 3506-2                              |                                      |

**FM-753 crack A4**

Dimensions of anchors and materials

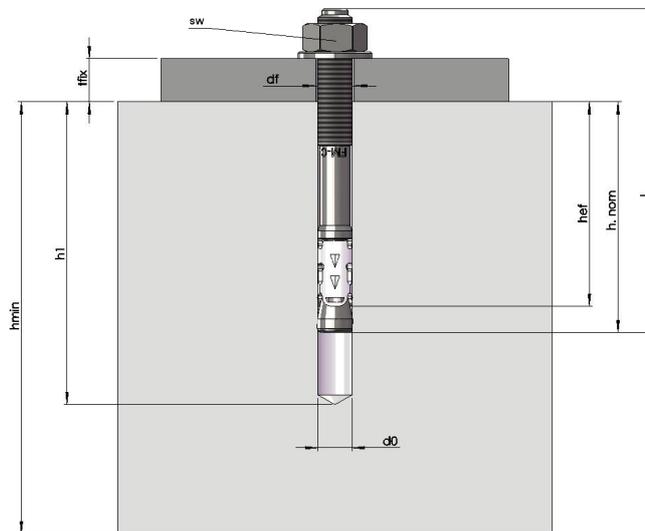
**Annex 2**

of the European Technical Approval

**ETA-10/0293**

**Table 3: Installation data**

|            | dxL     | ID | t <sub>fix</sub><br>(mm) | d <sub>0</sub><br>(mm) | h <sub>1</sub><br>(mm) | h <sub>nom</sub><br>(mm) | h <sub>ef</sub><br>(mm) | d <sub>f</sub><br>(mm) | h <sub>min</sub><br>(mm) | T <sub>inst</sub><br>(Nm) | sw<br>(mm) | Marking        |
|------------|---------|----|--------------------------|------------------------|------------------------|--------------------------|-------------------------|------------------------|--------------------------|---------------------------|------------|----------------|
| <b>M8</b>  | M8x68   | A  | 4                        | 8                      | 70                     | 54                       | 48                      | 9                      | 100                      | 20                        | 13         | FM-C 8/4 A4    |
|            | M8x75   | B  | 10                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 8/10 A4   |
|            | M8x90   | C  | 25                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 8/25 A4   |
|            | M8x115  | D  | 50                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 8/50 A4   |
|            | M8x135  | E  | 70                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 8/70 A4   |
|            | M8x165  | G  | 100                      |                        |                        |                          |                         |                        |                          |                           |            | FM-C 8/100 A4  |
| <b>M10</b> | M10x90  | A  | 10                       | 10                     | 80                     | 67                       | 60                      | 12                     | 120                      | 40                        | 17         | FM-C 10/10 A4  |
|            | M10x105 | B  | 25                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 10/25 A4  |
|            | M10x115 | C  | 35                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 10/35 A4  |
|            | M10x135 | D  | 55                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 10/55 A4  |
|            | M10x155 | E  | 75                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 10/75 A4  |
|            | M10x185 | F  | 105                      |                        |                        |                          |                         |                        |                          |                           |            | FM-C 10/105 A4 |
| <b>M12</b> | M12x110 | A  | 10                       | 12                     | 100                    | 81                       | 72                      | 14                     | 150                      | 60                        | 19         | FM-C 12/10 A4  |
|            | M12x120 | B  | 20                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 12/20 A4  |
|            | M12x130 | P  | 30                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 12/30 A4  |
|            | M12x145 | C  | 45                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 12/45 A4  |
|            | M12x170 | D  | 70                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 12/70 A4  |
|            | M12x200 | E  | 100                      |                        |                        |                          |                         |                        |                          |                           |            | FM-C 12/100 A4 |
| <b>M16</b> | M16x130 | A  | 10                       | 16                     | 115                    | 97                       | 86                      | 18                     | 170                      | 120                       | 24         | FM-C 16/10 A4  |
|            | M16x150 | B  | 30                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 16/30 A4  |
|            | M16x185 | C  | 60                       |                        |                        |                          |                         |                        |                          |                           |            | FM-C 16/60 A4  |
|            | M16x220 | D  | 100                      |                        |                        |                          |                         |                        |                          |                           |            | FM-C 16/100 A4 |



**FM-753 crack A4**

Installation data

**Annex 3**

of the European Technical Approval

**ETA-10/0293**

**Table 4: Characteristic values of resistance to tension loads of design method A**

|  |                    |      | <b>M8</b>         | <b>M10</b> | <b>M12</b> | <b>M16</b> |
|--|--------------------|------|-------------------|------------|------------|------------|
| <b>Steel failure</b>                                       |                    |      |                   |            |            |            |
| Characteristic resistance                                  | $N_{Rk,s}$         | [kN] | 21                | 34         | 49         | 88         |
| Partial safety factor                                      | $\gamma_{Ms}^{1)}$ | [-]  | 1,5               |            |            |            |
| <b>Pullout failure</b>                                     |                    |      |                   |            |            |            |
| Characteristic resistance in non – cracked concrete C20/25 | $N_{Rk,p}$         | [kN] | 9                 | 16         | 20         | 35         |
| Characteristic resistance cracked concrete C20/25          | $N_{Rk,p}$         | [kN] | 5                 | 9          | 12         | 25         |
| Partial safety factor                                      | $\gamma_{Mp}^{1)}$ | [-]  | 1,5 <sup>2)</sup> |            |            |            |

**Concrete cone failure and splitting failure**

|                              |                                   |      |                   |    |    |    |
|------------------------------|-----------------------------------|------|-------------------|----|----|----|
| Effective anchorage depth    | $h_{ef}$                          | [mm] | 48                | 60 | 72 | 86 |
| Characteristic spacing       | $s_{cr,N} = s_{cr,sp}$            | [mm] | 3 x $h_{ef}$      |    |    |    |
| Characteristic edge distance | $c_{cr,N} = c_{cr,sp}$            | [mm] | 1,5 x $h_{ef}$    |    |    |    |
|                              | $\gamma_{Mc} = \gamma_{MSP}^{1)}$ | [-]  | 1,5 <sup>2)</sup> |    |    |    |

<sup>1)</sup> In absence of other national regulation

<sup>2)</sup> The partial safety factor is including  $\gamma_2 = 1,0$

|  |                 |     | <b>M8</b> | <b>M10</b> | <b>M12</b> | <b>M16</b> |
|--|-----------------|-----|-----------|------------|------------|------------|
| <i>Increasing factor for pull-out and concrete cone failure for cracked and non-cracked concrete</i> | $\psi_c$ C30/37 | [-] | 1,22      |            |            |            |
|  | $\psi_c$ C40/50 | [-] | 1,41      |            |            |            |
|  | $\psi_c$ C50/60 | [-] | 1,55      |            |            |            |

**Table 5: Minimum thickness of concrete member, spacing and edge distances**

|                                      |              |      | <b>M8</b> | <b>M10</b> | <b>M12</b> | <b>M16</b> |
|--------------------------------------|--------------|------|-----------|------------|------------|------------|
| Minimum thickness of concrete member | $h_{min}$    | [mm] | 100       | 120        | 150        | 170        |
| Minimum spacing                      | $s_{min}$    | [mm] | 50        | 55         | 60         | 70         |
|                                      | for $c \geq$ | [mm] | 50        | 70         | 80         | 100        |
| Minimum edge distance                | $c_{min}$    | [mm] | 50        | 50         | 60         | 70         |
|                                      | for $s \geq$ | [mm] | 50        | 110        | 120        | 130        |

**Table 6: Displacement under tension load**

|                             |                    |      | <b>C20/25</b> |            |            |            | <b>C50/60</b> |            |            |            |
|-----------------------------|--------------------|------|---------------|------------|------------|------------|---------------|------------|------------|------------|
| <b>Non cracked concrete</b> |                    |      | <b>M8</b>     | <b>M10</b> | <b>M12</b> | <b>M16</b> | <b>M8</b>     | <b>M10</b> | <b>M12</b> | <b>M16</b> |
| Tension load                | N                  | [kN] | 4,3           | 7,6        | 9,5        | 16,7       | 6,6           | 11,8       | 14,8       | 25,9       |
| Short term displacement     | $\delta_{N0}$      | [mm] | 0,3           | 0,4        | 0,4        | 0,3        | 0,3           | 0,4        | 0,4        | 0,6        |
| Long term displacement      | $\delta_{N\infty}$ | [mm] | 1,4           | 1,5        | 0,9        | 1,4        | 1,4           | 1,5        | 0,9        | 1,4        |
| <b>Cracked concrete</b>     |                    |      | <b>M8</b>     | <b>M10</b> | <b>M12</b> | <b>M16</b> | <b>M8</b>     | <b>M10</b> | <b>M12</b> | <b>M16</b> |
| Tension load                | N                  | [kN] | 2,4           | 4,3        | 5,7        | 11,9       | 3,7           | 6,7        | 8,8        | 18,5       |
| Short term displacement     | $\delta_{N0}$      | [mm] | 0,7           | 0,6        | 0,7        | 0,7        | 0,6           | 0,8        | 0,9        | 1,1        |
| Long term displacement      | $\delta_{N\infty}$ | [mm] | 1,4           | 1,5        | 0,9        | 1,4        | 1,4           | 1,5        | 0,9        | 1,4        |

**FM-753 crack A4**

Design method A: characteristic values of resistance to tension loads and displacements

**Annex 4**

of the European Technical Approval

**ETA-10/0293**

**Table 7: Characteristic values of resistance to shear loads of design method A**

|   |                        | <b>M8</b>         | <b>M10</b> | <b>M12</b> | <b>M16</b> |
|---|------------------------|-------------------|------------|------------|------------|
| <b>Steel failure without lever arm</b>                |                        |                   |            |            |            |
| Characteristic resistance                             | $V_{Rk,s}$ [kN]        | 11,9              | 18,8       | 27,4       | 51,0       |
| Partial safety factor                                 | $\gamma_{Ms}^{1)}$ [-] | 1,3               |            |            |            |
| <b>Steel failure with lever arm</b>                   |                        |                   |            |            |            |
| Characteristic resistance                             | $M_{Rk,s}^0$ [Nm]      | 24                | 49         | 85         | 216        |
| Partial safety factor                                 | $\gamma_{Ms}^{1)}$ [-] | 1,3               |            |            |            |
| <b>Concrete pry - out failure</b>                     |                        |                   |            |            |            |
| Factor in equation (5.6) of ETAG, Annex C, § 5.2.3.3. | k [-]                  | 1,0               | 2,0        |            |            |
|   | $\gamma_{Mc}^{1)}$     | 1,5 <sup>2)</sup> |            |            |            |
| <b>Concrete edge failure</b>                          |                        |                   |            |            |            |
| Effective length of anchor in shear loading           | $l_f$ [mm]             | 48                | 60         | 72         | 86         |
| Diameter of the anchor                                | d [mm]                 | 8                 | 10         | 12         | 16         |
| Partial safety factor                                 | $\gamma_{Mc}^{1)}$ [-] | 1,5 <sup>2)</sup> |            |            |            |

<sup>1)</sup> In absence of other national regulations.

<sup>2)</sup> The partial safety factor is including  $\gamma_2 = 1,0$ .

**Table 8: Displacement under shear load**

|                        |                         | <b>M8</b> | <b>M10</b> | <b>M12</b> | <b>M16</b> |
|------------------------|-------------------------|-----------|------------|------------|------------|
| Shear load             | V [kN]                  | 6,5       | 10,4       | 15,1       | 28,0       |
| Short tem displacement | $\delta_{N0}$ [mm]      | 0,8       | 0,9        | 1,2        | 2,5        |
| Long tem displacement  | $\delta_{N\infty}$ [mm] | 1,3       | 1,3        | 1,8        | 3,8        |

**FM-753 crack A4****Annex 5**

Design method A: characteristic values of resistance to shear loads and displacements

of the European Technical Approval

**ETA-10/0293**

**Table 9: Characteristic tension resistance in cracked and non-cracked concrete C20/25 to C50/60 under fire exposure - Design Method A**

| Fire resistance duration = 30 minutes  |                   |      | M8  | M10 | M12 | M16  |
|--|-------------------|------|---|-----|-----|------|
| <b>Steel failure</b>                   |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,s,fi,30}$  | [kN] | 0,5   | 1,1 | 1,8 | 3,3  |
| <b>Pullout failure</b>                 |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,p,fi,30}$  | [kN] | 1,3   | 2,3 | 3,0 | 6,3  |
| <b>Concrete cone failure</b>           |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,c,fi,30}$  | [kN] | 2,9   | 5,0 | 7,9 | 12,3 |
| Fire resistance duration = 60 minutes  |                   |      | M8  | M10 | M12 | M16  |
| <b>Steel failure</b>                   |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,s,fi,60}$  | [kN] | 0,4   | 0,9 | 1,5 | 2,7  |
| <b>Pullout failure</b>                 |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,p,fi,60}$  | [kN] | 1,3   | 2,3 | 3,0 | 6,3  |
| <b>Concrete cone failure</b>           |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,c,fi,60}$  | [kN] | 2,9   | 5,0 | 7,9 | 12,3 |
| Fire resistance duration = 90 minutes  |                   |      | M8  | M10 | M12 | M16  |
| <b>Steel failure</b>                   |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,s,fi,90}$  | [kN] | 0,3   | 0,7 | 1,2 | 2,2  |
| <b>Pullout failure</b>                 |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,p,fi,90}$  | [kN] | 1,3   | 2,3 | 3,0 | 6,3  |
| <b>Concrete cone failure</b>           |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,c,fi,90}$  | [kN] | 2,9   | 5,0 | 7,9 | 12,3 |
| Fire resistance duration = 120 minutes |                   |      | M8  | M10 | M12 | M16  |
| <b>Steel failure</b>                   |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,s,fi,120}$ | [kN] | 0,3   | 0,6 | 1,0 | 1,8  |
| <b>Pullout failure</b>                 |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,p,fi,120}$ | [kN] | 1,0   | 1,8 | 2,4 | 5,0  |
| <b>Concrete cone failure</b>           |                   |      |   |     |     |      |
| Characteristic tension resistance      | $N_{Rk,c,fi,120}$ | [kN] | 2,3   | 4,0 | 6,3 | 9,9  |
| <b>Spacing</b>                         | $s_{cr,N}$        | [mm] | 4 $h_{ef}$  |     |     |      |
|  | $s_{min}$         | [mm] | 50  | 50  | 60  | 70   |
| <b>Edge distance</b>                   | $c_{cr,N}$        | [mm] | 2 $h_{ef}$  |     |     |      |
|  | $c_{min}$         | [mm] | $c_{min} = 2 h_{ef}$ ;<br>if fire attack from more than one side, the edge distance of the anchor has to be $\geq 300\text{mm}$ and $\geq 2 h_{ef}$ |     |     |      |

In absence of other national regulation the partial safety factor for resistance under fire exposure  $\gamma_{M,fi} = 1,0$  is recommended.

**FM-753 crack A4**

Design method A: characteristic values of resistance of tension load under fire exposure

**Annex 6**

of the European Technical Approval

**ETA-10/0293**

**Table 10: Characteristic shear resistance in cracked and non-cracked concrete C20/25 to C50/60 under fire exposure - Design Method A**

| Fire resistance duration = 30 minutes  |                         | M8  | M10 | M12 | M16  |
|--|-------------------------|-----|-----|-----|------|
| <b>Steel failure without lever arm</b> |                         |     |     |     |      |
| Characteristic shear resistance        | $V_{Rk,s,fi,30}$ [kN]   | 0,7 | 1,5 | 2,5 | 4,7  |
| <b>Steel failure with lever arm</b>    |                         |     |     |     |      |
| Characteristic bending resistance      | $M_{Rk,s,fi,30}^0$ [Nm] | 0,7 | 1,9 | 3,9 | 10,0 |

| Fire resistance duration = 60 minutes  |                         | M8  | M10 | M12 | M16 |
|--|-------------------------|-----|-----|-----|-----|
| <b>Steel failure without lever arm</b> |                         |     |     |     |     |
| Characteristic shear resistance        | $V_{Rk,s,fi,60}$ [kN]   | 0,6 | 1,2 | 2,1 | 3,9 |
| <b>Steel failure with lever arm</b>    |                         |     |     |     |     |
| Characteristic bending resistance      | $M_{Rk,s,fi,60}^0$ [Nm] | 0,6 | 1,5 | 3,3 | 8,3 |

| Fire resistance duration = 90 minutes  |                         | M8  | M10 | M12 | M16 |
|--|-------------------------|-----|-----|-----|-----|
| <b>Steel failure without lever arm</b> |                         |     |     |     |     |
| Characteristic shear resistance        | $V_{Rk,s,fi,90}$ [kN]   | 0,4 | 0,9 | 1,7 | 3,1 |
| <b>Steel failure with lever arm</b>    |                         |     |     |     |     |
| Characteristic bending resistance      | $M_{Rk,s,fi,90}^0$ [Nm] | 0,4 | 1,2 | 2,6 | 6,7 |

| Fire resistance duration = 120 minutes |                          | M8  | M10 | M12 | M16 |
|--|--------------------------|-----|-----|-----|-----|
| <b>Steel failure without lever arm</b> |                          |     |     |     |     |
| Characteristic shear resistance        | $V_{Rk,s,fi,120}$ [kN]   | 0,4 | 0,8 | 1,4 | 2,5 |
| <b>Steel failure with lever arm</b>    |                          |     |     |     |     |
| Characteristic bending resistance      | $M_{Rk,s,fi,120}^0$ [Nm] | 0,4 | 1,0 | 2,1 | 5,3 |

| <b>Concrete pry out failure</b>  |   |     |     |     |  |
|--|---|-----|-----|-----|--|
| k factor   | k | [-] | 1,0 | 2,0 |  |
| In Equation (5.6) of ETAG 001 Annex C 5.2.3.3, the above values k factor and the relevant values of $N_{Rk,c,fi}$ from Table 12.6 have to be considered in the design. |   |     |     |     |  |

| <b>Concrete edge failure</b>   |  |  |  |  |  |
|--|--|--|--|--|--|
| The characteristic resistance $V_{0Rk,c,fi}$ in C20/25 to C50/60 concrete is determined by:<br>$V_{0Rk,c,fi} = 0,25 \times V_{0Rk,c} (\leq R90)$ and $V_{0Rk,c,fi} = 0,20 \times V_{0Rk,c} (R120)$<br>with $V_{0Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature according to ETAG 001, Annex C, 5.2.3.4. |  |  |  |  |  |

In absence of other national regulation the partial safety factor for resistance under fire exposure  $\gamma_{M,fi} = 1,0$  is recommended.

**FM-753 crack A4**

Design method A: characteristic values of resistance of shear load under fire exposure

**Annex 7**

of the European Technical Approval

**ETA-10/0293**