Instytut Techniki Budowlanej

Member of EOTA

Autoryzowany
i notyfikowany zgodnie
z art. 10 dyrektywy Rady z 21
grudnia 1988 r. w sprawie zbliżenia
ustaw i aktów wykonawczych państw
członkowskich dotyczących
wyrobów budowlanych
(89/106/EWG)

European Technical Approval

ETA-12/0398

FF1

Plastic anchors for multiple use in concrete and masonry for non-structural applications

Łączniki tworzywowe do wielopunktowych zamocowań niekonstrukcyjnych w podłożu betonowym i murowym

Europejska Organizacja ds. Aprobat Technicznych
European Organisation for Technical Approvals

Europejska aprobata techniczna została opracowana
w Zakładzie Aprobat Technicznych
przez dr inż. Witolda MAKULSKIEGO

Projekt okładki: Ewa Kossakowska

GW I

Wykonano z oryginałów bez opracowania wydawniczego

ISBN 978-83-249-7352-1

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Format pdf Wydano w kwietniu 2014 r. zam. 239/2014

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Autoryzowany i notyfikowany zgodnie z art.10 dyrektywy Rady z 21 grudnia 1988 r. w sprawie zbliżenia ustaw i aktów wykonawczych państw członkowskich dotyczących wyrobów budowlanych (89/106/EWG)

Członek EOTA

European Technical Approval ETA-12/0398

English language translation - the original version is in Polish language

Nazwa handlowa *Trade name*	**FF1** *FF1*
Właściciel aprobaty *Holder of approval*	**RAWLPLUG S.A.** **ul. Kwidzyńska 6** **PL 51-416 Wrocław** **Poland**
Rodzaj i przeznaczenie wyrobu *Generic type and use of construction products*	**Łączniki tworzywowe do wielopunktowych zamocowań niekonstrukcyjnych w podłożu betonowym i murowym** *Plastic anchors for multiple use in concrete and masonry for non-structural applications*
Termin ważności **od** *Valid from*	**26. 06. 2013**
do *to*	**20. 12. 2017**
Zakład produkcyjny *Manufacturing plant*	**Zakład produkcyjny nr 3** *Manufacturing Plant no. 3*
Niniejsza Europejska Aprobata Techniczna zawiera *This European Technical Approval contains*	**27 stron, w tym 12 Załączników** *27 pages including 12 Annexes*
Niniejsza Europejska Aprobata Techniczna zastępuje *This European Technical Approval replaces*	**ETA-12/0398 ważną od 20.12.2012 do 20.12.2017** *ETA-12/0398 ważną od 20.12.2012 do 20.12.2017*

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by Instytut Techniki Budowlanej 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], amended by the Council Directive 93/68/EEC of 22 July 1993[2];
   - ustawa z dnia 16 kwietnia 2004 r. o wyrobach budowlanych (law on construction products from 16th April 2004)[3];
   - rozporządzenie Ministra Infrastruktury z dnia 14 października 2004 r. w sprawie europejskich aprobat technicznych oraz polskich jednostek organizacyjnych upoważnionych do ich wydawania (regulation of Ministry of Infrastructure of 14th October 2004 on the European Technical Approvals and Polish bodies entitled to issue them)[4];
   - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC[5];
   - Guideline for European Technical Approval of „*Plastic anchors for multiple use in concrete and masonry for non-structural applications, ETAG 020*.

2. Instytut Techniki Budowlanej 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 Instytut Techniki Budowlanej, in particular after information by the Commission on the basis of 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 Instytut Techniki Budowlanej. 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 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, 11.02.1989, p. 12
[2] Official Journal of the European Communities № L 220, 30.08.1993, p. 1
[3] Official Journal of Polish Republic № 92/2004, pos. 881
[4] Official Journal of Polish Republic № 237/2004, pos. 2375
[5] Official Journal of the European Communities № L 17, 20.01.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of the product and intended use

1.1 Definition of the construction product

The FF1 anchors are the plastic anchors consisting of a plastic sleeve and an accompanying specific steel screw.

The FF1-10K and FF1-10L anchors are shown in Annexes 1, 2, 3 and 4.

The plastic sleeve are made of polypropylene – FF1 PP or polyamide – FF1-PA (Annex 3).

The accompanying specific screws are made of galvanized steel or stainless steel.

The plastic sleeve is expanded by screwing in the specific screw which presses the sleeve against the wall of the drilled hole.

The installed anchors are shown in Annexes 4 and 5.

1.2 Intended use

The anchors are intended to be used for anchorages for which requirements for safety in use in the sense of the Essential Requirement 4 of Council Directive 89/106/EEC shall be fulfilled and failure of the fixture represents an risk to human life.

The anchors are to be used only for multiple fixing for non-structural applications in concrete and masonry. The base material shall consist of reinforced or unreinforced normal weight concrete of strength class C12/15 at minimum according to EN 206-1 and of masonry walls according to Annex 10. The anchor may be used in cracked and non-cracked concrete. The mortar strength class of the masonry has to be M 2,5 according to EN 998-2 at minimum.

By multiple anchor use it is assumed that in the case of excessive slip or failure of one anchor the load can be transmitted to neighbouring anchors without significantly violating the requirements on the fixing in the serviceability and ultimate limit state.

Therefore the design of the fixing should specify the number n_1 of fixing points to fasten the fixture and the number n_2 of anchors per fixing point. Furthermore by specifying the design value of actions N_{Sd} on a fixing point to a value ≤ n_3 (kN) up to which the strength and stiffness of the fixing are fulfilled and the load transfer in the case of excessive slip or failure of one anchor need not to be taken into account in the design of the fixture.

The following default values for n_1, n_2 and n_3 may by taken:

$n_1 \geq 4$; $n_2 \geq 1$ and $n_3 \leq 4{,}5$ kN or

$n_1 \geq 3$; $n_2 \geq 1$ and $n_3 \leq 3{,}0$ kN.

The anchor may also be used in anchorages in concrete with requirements related to resistance to fire according to 4.2.1.2.

The specific screw made of galvanised steel may only be used in structures subject to dry internal conditions.

The specific screw 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 in 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).

The anchors FF1 PP may be used in the following temperature range: -20°C to +40°C (max long temperature +24°C and max short temperature +40°C).

The anchors FF1 PA may be used in the following temperature range: -30°C to +80°C (max long temperature +50°C and max short temperature +80°C).

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 or by approval body, 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 information given in Annexes 1 to 6. The characteristic material values, dimensions and tolerances of the anchor not given in these Annexes shall correspond to the respective values laid down in the technical documentation[6] of this European Technical Approval.

The characteristic values for the design of the anchorages are given in Annexes 7 to 10.

Each anchor is to be marked with manufacturer identifying mark, the type, the diameter and the length of the anchor sleeve according to Annexes 1 to 3.

The minimum embedment depth for FF1 anchors is indicated on pictures in Annexes 4 and 5.

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

2.2 Methods of verification

The assessment of the fitness of the anchor for the intended use in relation to the requirements for safety in use in the sense of the Essential Requirement 4 has been made in compliance with the Guideline for European Technical Approval of „*Plastic anchors for multiple use in concrete and masonry for non-structural applications", ETAG 020*,

- Part 1: *"General"*,
- Part 2: *"Plastic anchors for use in normal weight concrete"*,

[6] The technical documentation of this European Technical Approval is deposited at Instytut Techniki Budowlanej and, as far as relevant for the tasks of the approved body involved in the attestation of conformity procedure, may be handed over only to the approved body involved.

- Part 3: *"Plastic anchors for use in solid masonry materials",*
- Part 4: *"Plastic anchors for use in hollow or perforated masonry",*
- Part 5: *"Plastic anchors for use in autoclaved aerated concrete (AAC)",*

based on the use categories a, b, c and d.

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 97/463/EG of the European Commission the system 2(ii) (referred to as system 2+) of attestation of conformity applies.

This system of attestation of conformity is defined as follows.

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

(a) Tasks for the manufacturer:

(1) initial type-testing of the product,

(2) factory production control,

(3) testing of samples taken at the factory in accordance with a prescribed test plan.

(b) Tasks for the approved body:

(4) certification of factory production control on the basis of:

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

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. This production control system shall insure that the product is in conformity with this European Technical Approval.

The manufacturer may only use raw materials stated in the technical documentation of this European Technical Approval.

The factory production control shall be in accordance with the control plan[7] which is part of the technical documentation of this European Technical Approval. The control plan[7] is laid down in the context of the factory production control system operated by the manufacturer and deposited at Instytut Techniki Budowlanej.

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 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 provision of this European Technical Approval.

3.2.2 Tasks for the approved body

The approved body shall perform the:

- 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 factory production control stating the conformity with the factory production control 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 and inform Instytut Techniki Budowlanej without delay.

3.3 CE-marking

The CE-marking shall be affixed on each packaging of the anchor. The symbol „CE" shall be accompanied by the following additional information:

- identification number of the approved body,
- name or identification mark of producer (legal entify 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 the factory production control,
- the number of ETA,
- the number of ETAG,
- use categories a, b, c and d according to ETAG 020.

[7] The control plan has been deposited at Instytut Techniki Budowlanej and may be handed over only to the approved body involved in the conformity attestation procedure.

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

4.1 Manufacturing

The European Technical Approval is issued for the product on the basis of agreed data/information, deposited with Instytut Techniki Budowlanej, which identifies the product that has been assessed and judged. Changes of the product or production process, which could result in this deposited data/information being incorrect, should be notified to Instytut Techniki Budowlanej before the changes are introduced.

Instytut Techniki Budowlanej 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 alterations to the ETA shall be necessary.

4.2 Installation

4.2.1 Design of anchorages

4.2.1.1 General

The anchor is to be used only for multiple fixing for non-structural applications.

By multiple anchor use it is assumed that in the case of excessive slip or failure of one anchor the load can be transmitted to neighbouring anchors without significantly violating the requirements on the fixture in the serviceability and ultimate limit state.

Therefore the design of the fixture may specify the number n_1 of fixing points to fasten the fixture and the number n_2 of anchors per fixing point. Furthermore by specifying the design value of actions N_{Sd} on a fixing point to a value ≤ n_3 (kN) up to which the strength and stiffness of the fixture are fulfilled and the load transfer in the case of excessive slip or failure of one anchor need not to be taken into account in the design of the fixture.

The following default values for n_1, n_2 and n_3 may be taken:

$n_1 \geq 4$; $n_2 \geq 1$ and $n_3 \leq 4{,}5$ kN or

$n_1 \geq 3$; $n_2 \geq 1$ and $n_3 \leq 3{,}0$ kN.

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

- the design of anchorages is carried out in compliance with ETAG 020, Guideline for European Technical Approval of „*Plastic anchors for multiple use in concrete and masonry for non-structural applications", Annex C* under the responsibility of an engineer experienced in anchorages. This design method applies to plastic anchors subject to static or quasi-static actions in tension, shear or combined tension and shear or bending; it is not applicable to plastic anchors loaded in compression or subject to fatigue, impact, or seismic actions,
- verifiable calculation notes and drawings shall be prepared taking account of the loads to be anchored, the nature and strength of the base materials and the dimensions of the anchorage members as well as of the relevant tolerances.

Shear loads acting on an anchor may be assumed to act without lever arm if both of the following conditions are fulfilled:

- the fixture is made of metal and in the area of the anchorage be fixed directly to the base material either without an intermediate layer or with a levelling layer of mortar with a thickness ≤ 3 mm.

– the fixture is in contact with the anchor over its entire thickness. (therefore the diameter of clearance hole in the fixture d_f has to be equal or smaller than the value given in Annex 7, Table 3)

if these two conditions are not fulfilled the lever arm is calculated according to ETAG 020, Annex C. The characteristic bending moment is given in Annex 7, Table 4.

4.2.1.2 Resistance in concrete (use category “a”)

The characteristic values of resistance of the anchor for use in concrete are given in Annex 7 Table 5 and Annex 8, Table 6. The design method is valid for cracked and non-cracked concrete.

According to the EOTA Technical Report TR 020 *“Evaluation of anchorages in concrete concerning resistance to fire”* it can be assumed that for fastening of façade systems the load bearing behaviour of the FF1 anchors have a sufficient resistance to fire at least 90 minutes (R90) if the admissible load [F_{Rk} / ($\gamma_M \cdot \gamma_F$)] is ≤ 0,8 kN (no permanent centric tension load).

4.2.1.3 Resistance in solid masonry (use category “b”)

The characteristic values of resistance of the anchor for use in solid masonry are given in Annex 10, Table 9. These values are independent of the load direction (tension, shear or combined tension and shear) and the mode of failure.

The characteristic resistances given in Annex 10 for use in solid masonry are only valid for the base material and the bricks according to this Annex or larger brick sizes and larger compressive strength of the masonry unit.

If smaller brick sizes are present on the construction site or if the mortar strength is smaller than the required value, the characteristic resistance of the anchor may be determined by job site tests according to 4.2.3.

4.2.1.4 Resistance in hollow or perforated masonry (use category “c")

The characteristic resistances for use in hollow or perforated masonry given in Annex 10 are only valid for the bricks and blocks according this Annex regarding base material, size of the units, compressive strength and configuration of the voids.

These values are independent of the load direction (tension, shear or combined tension and shear) and the mode of failure and are valid for h_{nom} (Annex 7, Table 3) only.

The influence of larger embedment depths h_{nom} and/or different bricks and blocks (according to Annex 10 regarding base material, size of the units, compressive strength and configuration of the voids) has to be detected by job site tests according to 4.2.3.

4.2.1.5 Resistance in non-cracked autoclaved aerated concrete (AAC) elements (use category “d”)

The characteristic values of resistance of the anchor for use in non-cracked autoclaved aerated concrete (AAC) elements are given in Annex 10, Table 9. These values are independent of the load direction (tension, shear or combined tension and shear) and the mode of failure.

The anchor shall not be installed and used in water saturated aerated concrete.

4.2.1.6 Specific conditions for the design method in solid and hollow or perforated masonry and in autoclaved aerated concrete elements

The mortar strength class of the masonry has to be M 2,5 according to EN 998-2 at minimum.

The characteristic resistance F_{Rk} for a single plastic anchor may also be taken for a group of two or four plastic anchors with a spacing equal or larger than the minimum spacing s_{min}.

The distance between single plastic anchors or a group of anchors should be $s \geq 250$ mm.

If the vertical joints of the wall are designed not to be filled with mortar then the design resistance N_{Rd} has to be limited to 2,0 kN to ensure that a pull-out of one brick out of the wall will be prevented. This limitation can be omitted if interlocking units are used for the wall or when the joints are designed to be filled with mortar.

If the joints of the masonry are not visible the characteristic resistance F_{Rk} has to be reduced with the factor $\alpha_j = 0,5$.

If the joint of the masonry are visible (e.g. unplastered wall) following has to be taken into account:

- the characteristic resistance F_{Rk} may be used only, if the wall is designed such that the joints are to be filled with mortar.
- if the wall is designed such that the joints are not to be filled with mortar then the characteristic resistance F_{Rk} may be used only, if the minimum edge distance c_{min} to the vertical joints is observed. If this minimum edge distance c_{min} can not be observed then the characteristic resistance F_{Rk} has to be reduced with the factor $\alpha_j = 0,5$.

4.2.1.7 Minimum thickness of anchorage member, edge distance and anchor spacing

The minimum thickness of anchorage member, edge distance and anchor spacing according to Table 8 and 11 in Annexes 9 and 12 shall be observed depending on the base material.

4.2.1.8 Displacement behaviour

The displacements under tension and shear loading in concrete and masonry are given in Annex 8, Table 7 and in Annex 11, Table 10.

4.2.2 Installation of anchor

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

- anchor installation carried out by appropriately qualified personnel under the supervision of the person responsible for technical matters on site,
- use of the anchor only as supplied by the manufacturer without exchanging any component of the anchor,
- anchor installation in accordance with the manufacturer's specifications and drawings using the tools indicated in this European Technical Approval,
- checks before placing the anchor, to ensure that the characteristic values of the base material in which the anchor is to be placed, is identical with the values, which the characteristic loads apply for,

- observation of the drill method (drill holes in hollow and perforated masonry and in autoclaved aerated concrete elements may only be drilled using the rotary drill. Other drilling methods may also be used depending of job-site tests according to 4.2.3,
- placing drill holes without damaging the reinforcement,
- holes to be cleaned of drilling dust,
- 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,
- the plastic sleeve is inserted by slight hammer blows and the special screw is screwed in for the length e (Table 3, Annex 7),
- temperature during installation of the anchor ≥ 0°C (plastic sleeve and base material),
- exposure to UV due to solar radiation of the anchor not protected ≤ 6 weeks.

4.2.3 Job site tests according to ETAG 020, Annex B

4.2.3.1 General

In the absence of national requirements the characteristic resistance of the plastic anchor may be determined by job site tests according to 4.2.3, if the plastic anchor has already characteristic values given in Annex 10 for the same base material as it is present on the construction works.

Furthemore job site tests for use in (different) hollow or solid masonry and in autoclaved aerated concrete elements are possible only if the plastic anchor has already characteristic values given in Annex 10 for use in solid masonry.

Job site tests for use in (different) hollow or perforated masonry and in autoclaved aerated concrete elements are possible only if the plastic anchor has already characteristic values given in Annex 10 for use in perforated masonry.

Job site tests are also possible, if another drill method is been used as it is given in Annex 10.

The characteristic resistance to be applied to a plastic anchor should be determined by means of at least 15 pull-out tests carried out on the construction work with a centric tension load acting on the plastic anchor. These tests may also performed in laboratory under equivalent conditions as used on construction work.

Execution and evaluation of the tests as well as issue of the test report and determination of the characteristic resistance should be supervised by the person responsible for execution of works on site and be carried out by competent person.

Number and position of the plastic anchors to be tested should be adapted to the relevant special conditions of the construction work in question and, for example, in the case of blind and larger areas be increased such that a reliable information about the characteristic resistance of the plastic anchor embedded in the base material in question can be derived. The tests should take account of the unfavourable conditions of the practical execution.

4.2.3.2 Assembly

The plastic anchor to be tested shall be installed (e.g. preparation of drill hole, drilling tool to be used, drill bit, type of drilling hammer or rotation, thickness of

fixture) and as far as spacing and edge distances are concerned be distributed in the same way as foreseen for the intended use.

Depending on the drilling tool hard metal hammer drill bits or hard metal percussion drill bits, respectively, according to ISO 5468 should be used. The following drill bits should be used (new drill bits for one test series):

$d_{cut,m}$ = 10,25 mm < d_{cut} ≤ 10,45 mm = $d_{cut,max.}$

4.2.3.3 Execution of test

The test rig used for the pull-out tests shall provide a continuous slow increase of the load, controlled by a calibrated load cell. The load shall apply perpendicular to the surface of the base material and shall be transmitted to the anchor via a hinge. The reaction forces shall be transmitted into the base material such that possible breakout of the masonry is not restricted. This condition is considered as fulfilled, if the support reaction forces are transmitted either in adjacent masonry units or at a distance of at least 150 mm from the plastic anchors. The load shall be increased continuously in a way that the ultimate load is reached after about 1 minute. The load is measured when the ultimate load (N_1) is achieved.

4.2.3.4 Test report

The test report shall include all information necessary to assess the resistance of the tested anchor. It shall be given to the person responsible for the design of the fastening and shall be included in the construction dossier.

The minimum data required are:

- name of product.
- construction site, owner of building, date and place of the tests, air temperature,
- test rig,
- type of structure to be fixed,
- masonry (type of brick, strength class, all dimensions of bricks, mortar group if possible), visual assessment of masonry (flush joints, joint clearance, regularity),
- plastic anchor and special screw,
- value of the cutting diameter of hard metal hammer-drill bits, measured before and after drilling if no new drill bits are used,
- results of tests including the indication of value N_1, mode of failure,
- test carried out or supervised by.., signature.

4.2.3.5 Evaluation of test results

The characteristic resistance F_{Rk1} is derived from the measured values N_1 as follows:

$F_{Rk1} = 0,5 \cdot N_1$

The characteristic resistance F_{Rk1} has to be equal or smaller than the characteristic resistance F_{Rk} which is given in the ETA for similar masonry (bricks or blocks),

N_1 = the mean value of the five smallest measured values at the ultimate load.

In absence of national regulations the partial safety factors for the resistance of the plastic anchor may be taken as γ_M = 2,5 for use in masonry.

5 Indications to the manufacturer

5.1 Responsibility of the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to clauses 1 and 2 including Annexes referred to in clauses 4.2.1, 4.2.2 and 5 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 illustrations.

The minimum data required are:

- base material for the intended use,
- ambient temperature of the base material during installation of the anchor,
- drill bit diameter,
- minimum effective anchorage depth,
- minimum hole depth,
- information on the installation procedure,
- identification of the manufacturing batch.

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

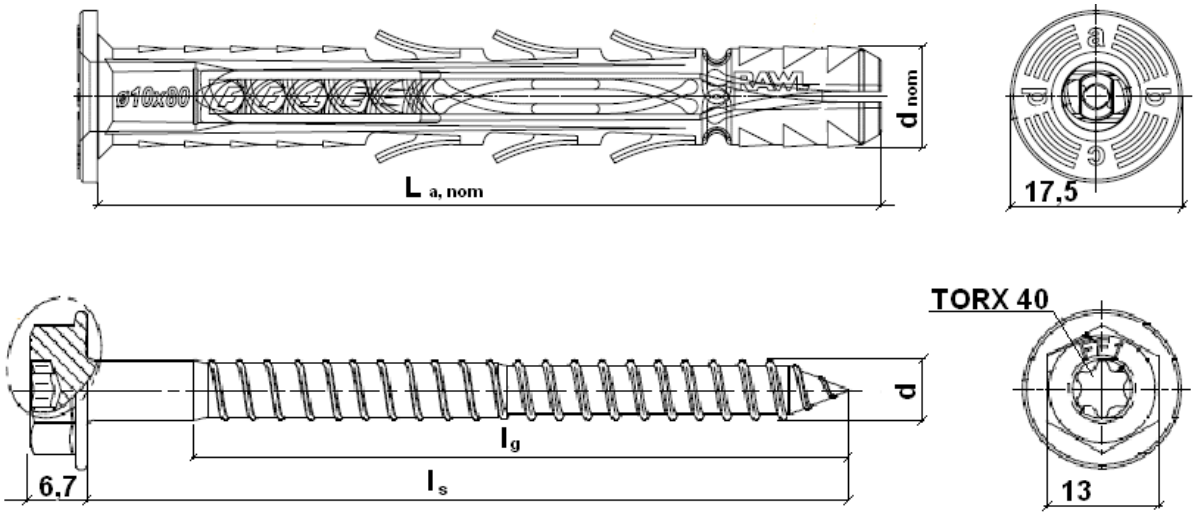
5.2 Recommendations regarding packaging, transport and storage

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

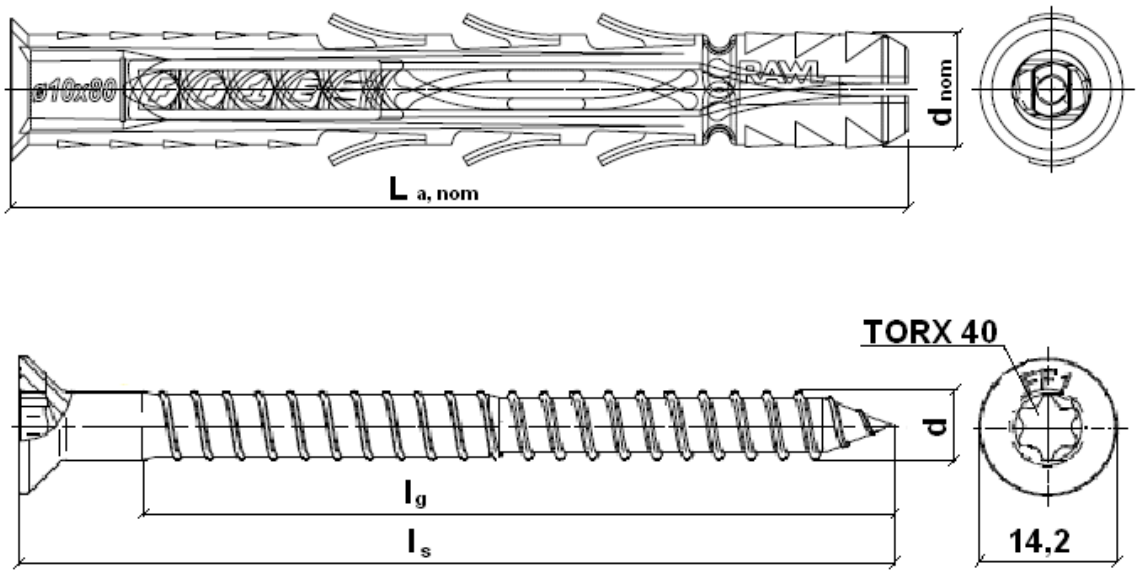
The anchor shall be stored under normal climatic conditions in its original packaging. Before installation, it shall not be extremely dried nor frozen.

On behalf of Instytut Techniki Budowlanej

Jan Bobrowicz
Director of ITB



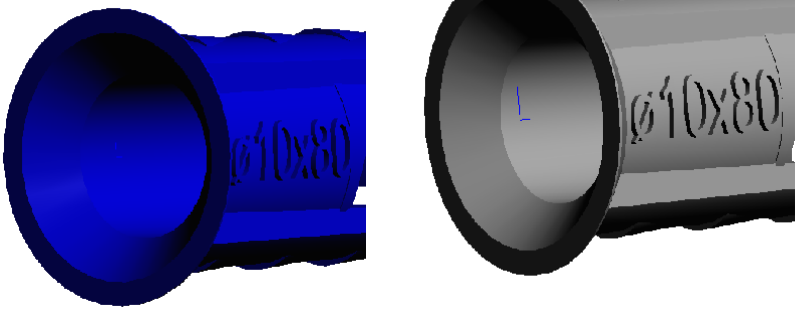
FF1	**Annex 1** of European Technical Approval ETA-12/0398
FF1-10K anchor	



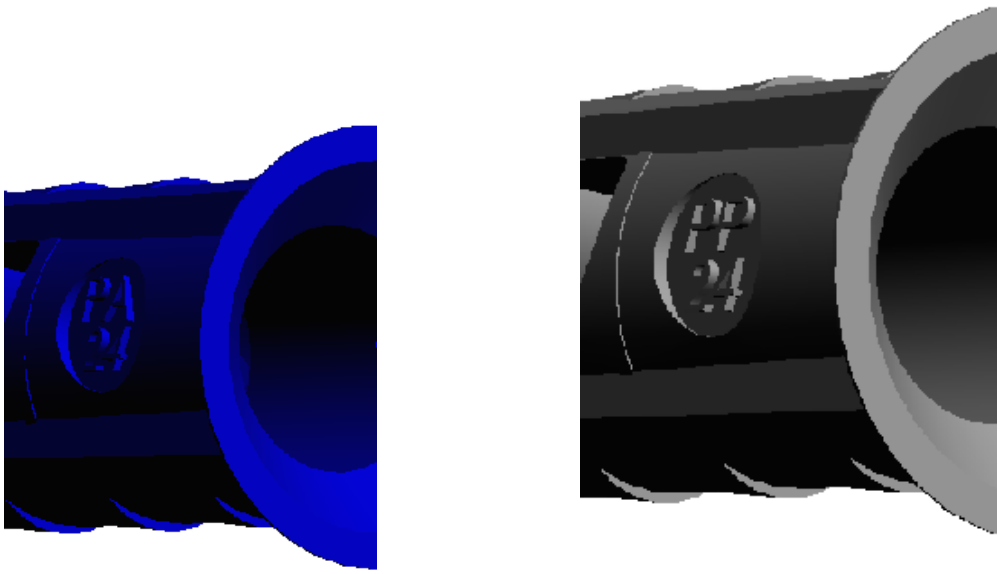
FF1	**Annex 2** of European Technical Approval ETA-12/0398
FF1-10L anchor	

MARKING:

– size



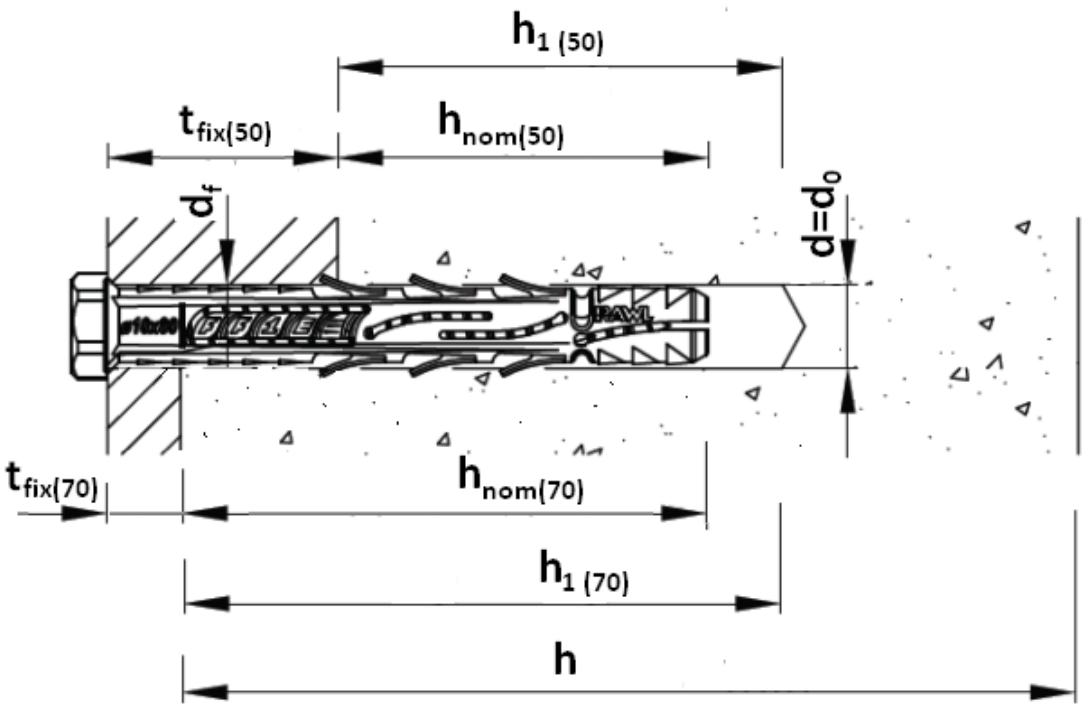
– material



Polyamide (PA), colour blue or grey

Polypropylene (PP), colour grey

FF1	**Annex 3** of European Technical Approval ETA-12/0398
Anchor marking	



Intended Use

Fixing in concrete and different kinds of masonry

Legend

$d(d_o)$ = sleeve diameter (drill hole diameter)

h_{nom} = overall plastic anchor embedment depth in the base material (embedment depth 50 or 70 mm, see Table 3)

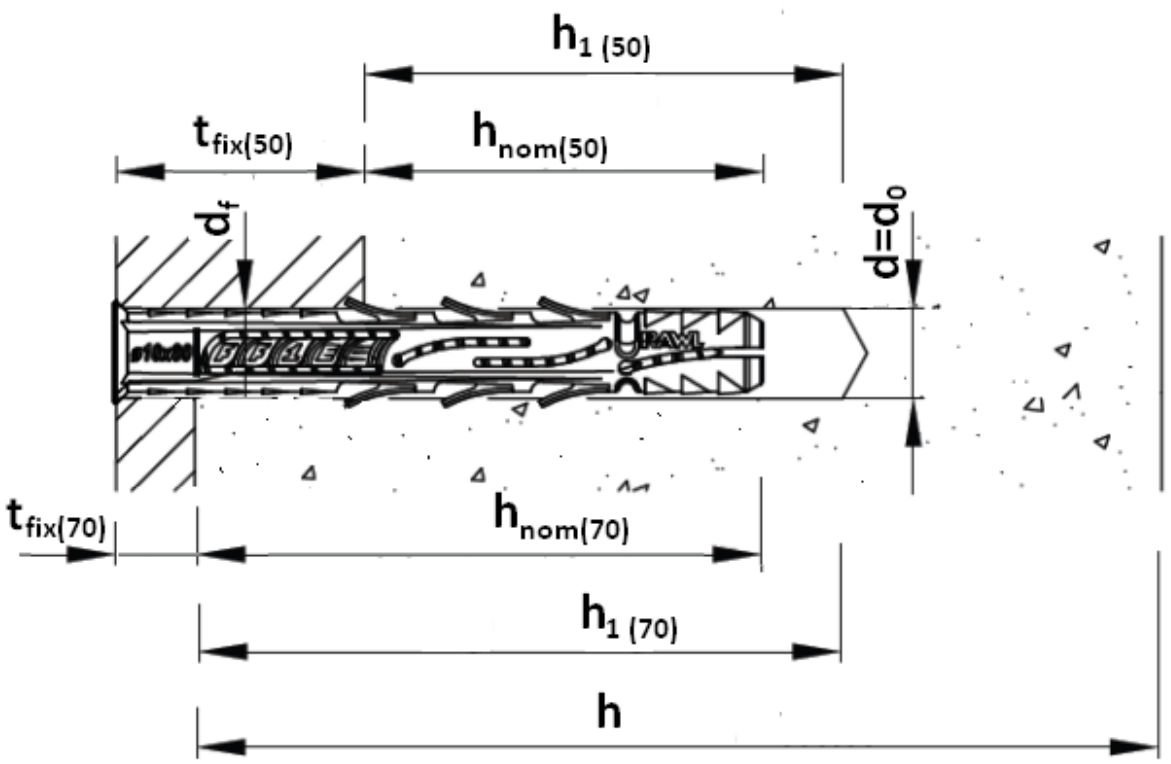
h_1 = depth of drill hole to deepest point (embedment depth 50 or 70 mm, see Table 3)

h = thickness of member (wall)

t_{fix} = thickness of fixture (embedment depth 50 or 70 mm, see Table 3)

d_f = diameter of clearance hole in the fixture

FF1	**Annex 4** of European Technical Approval ETA-12/0398
Intended use – FF1-10K	



Intended Use

Fixing in concrete and different kinds of masonry

Legend

$d(d_o)$ = sleeve diameter (drill hole diameter)

h_{nom} = overall plastic anchor embedment depth in the base material (embedment depth 50 or 70 mm, see Table 3)

h_1 = depth of drill hole to deepest point (embedment depth 50 or 70 mm, see Table 3)

h = thickness of member (wall)

t_{fix} = thickness of fixture (embedment depth 50 or 70 mm, see Table 3)

d_f = diameter of clearance hole in the fixture

FF1	**Annex 5** of European Technical Approval ETA-12/0398
Intended use – FF1-10L	

Table 1: Anchor types and dimensions

Anchor type	Anchor sleeve[1)]		Screw		
	d_{nom} [mm]	$l_{a,\ nom}$ [mm]	$l_{s,\ min}$ [mm]	$l_{g,\ min}$ [mm]	d_s [mm]
FF1-10K 080	$9{,}8_{\pm 0{,}1}$	$80_{\pm 1{,}0}$	$89_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10K 100	$9{,}8_{\pm 0{,}1}$	$100_{\pm 1{,}0}$	$109_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10K 120	$9{,}8_{\pm 0{,}1}$	$120_{\pm 1{,}0}$	$129_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10K 140	$9{,}8_{\pm 0{,}1}$	$140_{\pm 1{,}0}$	$149_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10K 160	$9{,}8_{\pm 0{,}1}$	$160_{\pm 1{,}0}$	$169_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10K 200	$9{,}8_{\pm 0{,}1}$	$200_{\pm 1{,}5}$	$209_{\pm 1{,}5}$	$75_{\pm 3{,}0}$	$7_{-0{,}5}$
FF1-10K 240	$9{,}8_{\pm 0{,}1}$	$240_{\pm 1{,}5}$	$249_{\pm 1{,}5}$	$75_{\pm 3{,}0}$	$7_{-0{,}5}$
FF1-10K 300	$9{,}8_{\pm 0{,}1}$	$300_{\pm 1{,}5}$	$309_{\pm 1{,}5}$	$75_{\pm 3{,}0}$	$7_{-0{,}5}$
FF1-10L 080	$9{,}8_{\pm 0{,}1}$	$80_{\pm 1{,}0}$	$87_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10L 100	$9{,}8_{\pm 0{,}1}$	$100_{\pm 1{,}0}$	$107_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10L 120	$9{,}8_{\pm 0{,}1}$	$120_{\pm 1{,}0}$	$127_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10L 140	$9{,}8_{\pm 0{,}1}$	$140_{\pm 1{,}0}$	$147_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10L 160	$9{,}8_{\pm 0{,}1}$	$160_{\pm 1{,}0}$	$167_{\pm 1{,}0}$	$75_{\pm 1{,}5}$	$7_{-0{,}5}$
FF1-10L 200	$9{,}8_{\pm 0{,}1}$	$200_{\pm 1{,}5}$	$207_{\pm 1{,}5}$	$75_{\pm 3{,}0}$	$7_{-0{,}5}$
FF1-10L 240	$9{,}8_{\pm 0{,}1}$	$240_{\pm 1{,}5}$	$247_{\pm 1{,}5}$	$75_{\pm 3{,}0}$	$7_{-0{,}5}$
FF1-10L 300	$9{,}8_{\pm 0{,}1}$	$300_{\pm 1{,}5}$	$307_{\pm 1{,}5}$	$75_{\pm 3{,}0}$	$7_{-0{,}5}$

[1)] The anchor (plastic sleeve and special screw) shall only be packaged and supplied as a complete unit (compare 2.1).

Table 2: Materials

Element	Material	
	FF1 PP	FF1 PA
Anchor sleeve	Polypropylene, colour grey	Polyamide, PA6, colour grey or blue
Special screw	Steel grade 4.8 according to EN ISO 898-1 ($f_{y,k} \geq 415$ MPa, $f_{u,k} \geq 520$ MPa) galvanized ≥ 5 µm according to EN ISO 4042 or stainlees steel grade 1,4578 according to EN 10088 ($f_{y,k} \geq 380$ MPa, $f_{u,k} \geq 600$ MPa)	

FF1	**Annex 6** of European Technical Approval ETA-12/0398
Anchor types, dimensions and materials	

Table 3: Installation parameters

Anchor type (embedment depth)		FF1 PA (50)	FF1 PA (70)	FF1 PP (50)	FF1 PP (70)
Nominal drill hole diameter	d_o = [mm]	10	10	10	10
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	10,45	10,45	10,45	10,45
Depth of drill hole to deepest point	$h_1 \geq$ [mm]	60	80	60	80
Overall plastic anchor embedment depth in the base material	$h_{nom} \geq$ [mm]	50	70	50	70
Diameter of clearance hole in the fixture	d_f [mm]	10 ÷ 10,5	10 ÷ 10,5	10 ÷ 10,5	10 ÷ 10,5
Thickness of fixture – minimum	$t_{fix,\,min} \geq$ [mm]	≥ 1	≥ 1	≥ 1	≥ 1
Thickness of fixture – maximum	$t_{fix,\,max} \leq$ [mm]	250	230	250	230
Installation temperature	[°C]	0 ÷ 20°C	0 ÷ 20°C	0 ÷ 20°C	0 ÷ 20°C
Application temperature	[°C]	-30 ÷ 80°C	-30 ÷ 80°C	-20 ÷ 50°C	-20 ÷ 50°C

Table 4: Characteristic bending resistance of the screw in concrete

Anchor type (embedment depth)		FF1 PP (50)	FF1 PP (70)	FF1 PA (50)[1)]
Characteristic bending resistance	$M_{Rk,s}$ [Nm]	13,96[1)] (16,10)[2)]	13,96[1)] (16,10)[2)]	13,96[1)] (16,10)[2)]
Partial safety factor	Υ_{Ms}[3)]	1,25 (1,59)	1,25 (1,59)	1,25 (1,59)

[1)] galvanized steel
[2)] stainless steel
[3)] in absence of other national regulations

Table 5: Characteristic resistance of the screw for use in concrete failure of expansion element (special screw)

Anchor type (embedment depth)		FF1 PP (50)	FF1 PP (70)	FF1 PA (50)[1)]
Characteristic tension resistance	$N_{Rk,s}$ [kN]	13,08[1)] (15,09)[2)]	13,08[1)] (15,09)[2)]	13,08[1)] (15,09)[2)]
Partial safety factor	Υ_{Ms}[3)]	1,5[1)] (1,9)[2)]	1,5[1)] (1,9)[2)]	1,5[1)] (1,9)[2)]
Characteristic shear resistance	$V_{Rk,s}$ [kN]	7,62[1)] (8,79)[2)]	7,62[1)] (8,79)[2)]	7,62[1)] (8,79)[2)]
Partial safety factor	Υ_{Ms}[3)]	1,25[1)] (1,59)[2)]	1,25[1)] (1,59)[2)]	1,25[1)] (1,59)[2)]

[1)] galvanized steel
[2)] stainless steel
[3)] in absence of other national regulations

FF1	**Annex 7** of European Technical Approval ETA-12/0398
Installation parameters, characteristic resistance of the screw	

Table 6: Characteristic resistance for use in concrete pull-out failure (plastic sleeve)

Anchor type (embedment depth)		FF1 PP (50)	FF1 PP (70)	FF1 PA (50)[1)]
Temperature range		0 ÷ 20°C -20 ÷ 50°C	0 ÷ 20°C -20 ÷ 50°C	0 ÷ 20°C -30 ÷ 80°C
Concrete ≥ C16/20				
Characteristic resistance	$N_{Rk,p}$ [kN]	0,9	1,2	1,5
Partial safety factor	γ_{Mc} [2)]	1,8		
Concrete C12/15				
Characteristic resistance	$N_{Rk,p}$ [kN]	0,5	0,9	0,9
Partial safety factor	γ_{Mc} [2)]	1,8		
Concrete cone failure and concrete edge failure for single anchor and anchor group				

Tension loads [3)]

$$N_{Rk,c} = 7{,}2 \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1,5} \cdot \frac{c}{c_{cr,N}} = N_{Rk,p} \cdot \frac{c}{c_{cr,N}} \qquad \text{with:} \quad h_{ef}^{1,5} = \frac{N_{Rk,p}}{7{,}2 \cdot \sqrt{f_{ck,cube}}}$$

$$\frac{c}{c_{cr,N}} \le 1$$

Shear load [3)]

$$V_{Rk,c} = 0{,}45 \cdot \sqrt{d_{nom}} \cdot (h_{nom}/d_{nom})^{0,2} \cdot \sqrt{f_{ck,cube}} \cdot c_1^{1,5} \cdot \left(\frac{c_2}{1{,}5c_1}\right)^{0,5} \cdot \left(\frac{h}{1{,}5c_1}\right)^{0,5} \qquad \text{with:} \quad \left(\frac{c_2}{1{,}5c_1}\right)^{0,5} \le 1$$

$$\left(\frac{h}{1{,}5c_1}\right)^{0,5} \le 1$$

c_1 Edge distance closest to the edge In loading direction
c_2 Edge distance perpendicular to direction 1
$f_{ck,cube}$ Nominal characteristic concrete compression strength (based on cubes) value for C50/60 at maximum

Partial safety factor	γ_{Mc} [2)]	1,8

[1)] colour grey and blue
[2)] in absence of other national regulations
[3)] the design method according to ETAG 020, Annex C is to be used

Table 7: Displacements under tension and shear loading in concrete[1), 2)]

Anchor type (embedment depth)	Tension load			Shear load		
	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]
FF1 PP (50)	0,36	0,38	0,30	0,51	0,11	0,16
FF1 PP (70)	0,47	0,55	0,21	0,51	0,11	0,16
FF1 PA (50)[3)]	0,59	0,26	0,16	0,85	0,07	0,11

[1)] valid for all ranges of temperatures
[2)] intermediate values by linear interpolation
[3)] color grey and blue

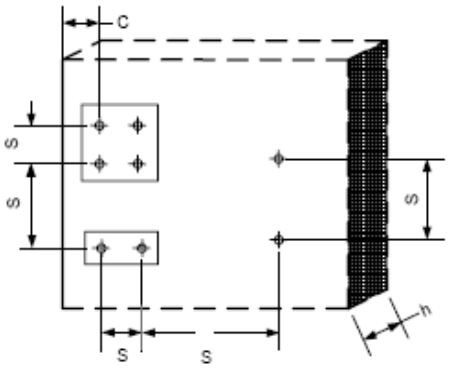
FF1	Annex 8 of European Technical Approval ETA-12/0398
Characteristic resistance in concrete (use category a), displacements in concrete	

Table 8: Minimum thickness of member, edge distance and anchor spacing in concrete

Anchor type	Base material	h_{min} [mm]	$c_{cr,N}$ [mm]	c_{min} [mm]	s_{min} [mm]
FF1 PP	Concrete ≥ C16/20	100	70	60	60
	Concrete C12/15	100	100	85	85
FF1 PA[1)]	Concrete ≥ C16/20	100	90	80	90
	Concrete C12/15	100	125	115	125

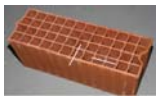
[1)] color grey and blue

Scheme of distances and spacing in concrete



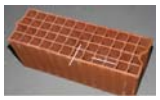
FF1	Annex 9 of European Technical Approval ETA-12/0398
Minimum thickness of member, edge distance and anchor spacing in concrete	

Table 9: Characteristic resistance F_{Rk} in masonry

Base material / anchor type (embedment depth)	Bulk density class [kg/dm^3]	Compressive strength class [N/mm^2]	Picture	Drill method	F_{Rk} [1)] [kN]
FF1 PP (50)					
Clay brick HD[2)]	> 1,80	≥ 50		hammer	1,2
Sand – lime brick HD[3)]	> 1,90	≥ 30		hammer	0,9
FF1 PP (70)					
Clay brick HD[2)]	>1,80	≥ 50		hammer	2,5
Hollow ceramic brick[4)]	> 0,60	≥ 7,5		rotary drilling only	0,3
Perforated ceramic brick[5)]	> 0,91	≥ 15		rotary drilling only	0,6
Perforated ceramic brick[6)]	> 0,90	≥ 12		rotary drilling only	0,5
Calcium silicate hollow block[7)]	> 1,60	≥ 20		rotary drilling only	0,75
Hollow lightweight aggregate concrete element[8)]	> 0,80	≥ 2		rotary drilling only	0,3
Perforated ceramic brick[9)]	> 0,80	≥ 15		rotary drilling only	0,5
Perforated ceramic brick[10)]	> 0,80	≥ 15		rotary drilling only	0,6

FF1	**Annex 10** of European Technical Approval ETA-12/0398
Characteristic resistance in masonry (use categories b, c and d)	

Extension of Table 9

Base material / anchor type (embedment depth)	Bulk density class [kg/dm^3]	Compressive strength class [N/mm^2]	Picture	Drill method	F_{Rk} [1)] [kN]
FF1 PA (50)[11)]					
Sand – lime brick HD[3)]	> 1,90	≥ 30		hammer	1,2
FF1 PA (70)[11)]					
Clay brick HD[2)]	> 1,80	≥ 50		hammer	4,5
Hollow ceramic brick[4)]	> 0,60	≥ 7,5		rotary drilling only	0,6
Perforated ceramic brick[5)]	> 0,91	≥ 15		rotary drilling only	0,6
Perforated ceramic brick[6)]	> 0,90	≥ 12		rotary drilling only	0,6
Calcium silicate hollow block[7)]	> 1,60	≥ 20		rotary drilling only	2,0
Hollow lightweight aggregate concrete element[8)]	> 0,80	≥ 2		rotary drilling only	0,6
Perforated ceramic brick[9)]	> 0,80	≥ 15		rotary drilling only	0,9
Perforated ceramic brick[10)]	> 0,80	≥ 15		rotary drilling only	0,9

FF1	**Annex 10** of European Technical Approval ETA-12/0398
Characteristic resistance in masonry (use categories b, c and d)	

Extension of Table 9

Base material / anchor type (embedment depth)	Bulk density class [kg/dm^3]	Compressive strength class [N/mm^2]	Picture	Drill method	F_{Rk} [1)] [kN]
FF1 PP (70)					
Autoclaved aerated concrete AAC 2[12)]	> 0,35	≥ 2	–	rotary drilling only	0,4
Autoclaved aerated concrete AAC 6[12)]	> 0,65	≥ 6	–	rotary drilling only	0,9
FF1 PA (70)[12)]					
Autoclaved aerated concrete AAC 2[12)]	> 0,35	≥ 2	–	rotary drilling only	0,3
Autoclaved aerated concrete AAC 6[12)]	> 0,65	≥ 6	–	rotary drilling only	0,9
Partial safety factor γ_{Mn}[13)]	2,5 / 2,0				

1) Characteristic resistance F_{Rk} for tension, shear or combined tension and shear loading.
The characteristic resistance is valid for single plastic anchor or for a group of two or four plastic anchors with a spacing equal or larger than the minimum spacing s_{min} according to Table 11 (Annex 12).
The specific conditions for the design method have to be considered according to 4.2.1.5 of the ETA.

2) According to EN 771-1

3) According to EN 771-2

4) For example hollow ceramic Optibrick according to EN 771-1

5) For example perforated ceramic brick Doppio Uni according to EN 771-1

6) For example perforated ceramic brick HLZ 12 according to EN 771-1

7) For example calcium silicate hollow block KSL 6DF according to DIN 106 and EN 771-2

8) For example hollow lightweight aggregate concrete element Hbl according to EN 771-3

9) For example perforated brick MAX according to EN 771-1

10) For example perforated brick PW25 according to EN 771-1

11) Colour grey and blue

12) According to EN 771-4

13) Partial safety factor for use in masonry γ_{Mm} = 2,5 and partial safety factor for use in autoclaved aerated concrete γ_{MAAC} = 2,0 in absence of other national regulations

FF1	Annex 10 of European Technical Approval ETA-12/0398
Characteristic resistance in masonry (use categories b, c and d)	

Table 10: Displacements under tension and shear loading in masonry

Base material / anchor type (embedment depth)	Tension load			Shear load		
	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]
FF1 PP (50)						
Clay brick HD[1)]	0,34	0,16	0,32	0,34	0,28	0,42
Sand – lime brick HD[2)]	0,26	0,34	0,68	0,26	0,22	0,33
FF1 PP (70)						
Clay brick HD[1)]	0,71	0,51	1,02	0,71	0,59	0,88
Hollow ceramic brick[3)]	0,09	0,07	0,14	0,09	0,08	0,12
Perforated ceramic brick[4)]	0,21	0,11	0,22	0,21	0,17	0,26
Perforated ceramic brick[5)]	0,14	0,19	0,38	0,14	0,12	0,18
Calcium silicate hollow block[6)]	0,21	0,18	0,36	0,21	0,17	0,26
Hollow lightweight aggregate concrete element[7)]	0,09	0,10	0,20	0,09	0,08	0,12
Perforated ceramic brick[8)]	0,14	0,08	0,16	0,14	0,12	0,18
Perforated ceramic brick[9)]	0,14	0,11	0,22	0,14	0,12	0,18
FF1 PA (50)[10)]						
Sand – lime brick HD[2)]	0,34	0,31	0,62	0,34	0,28	0,42
FF1 PA (70)[10)]						
Clay brick HD[1)]	1,28	0,94	1,88	1,28	1,06	1,59
Hollow ceramic brick[3)]	0,17	0,33	0,66	0,17	0,14	0,21
Perforated ceramic brick[4)]	0,17	0,16	0,32	0,17	0,14	0,21
Perforated ceramic brick[5)]	0,17	0,18	0,36	0,17	0,14	0,21
Calcium silicate hollow block[6)]	0,57	0,19	0,38	0,57	0,47	0,70
Hollow lightweight aggregate concrete element[7)]	0,17	0,13	0,26	0,17	0,14	0,21
Perforated ceramic brick[8)]	0,26	0,18	0,38	0,26	0,22	0,33
Perforated ceramic brick[9)]	0,26	0,35	0,70	0,26	0,22	0,33

FF1	**Annex 11** of European Technical Approval ETA-12/0398
Displacements in masonry	

Extension of Table 10

Base material / anchor type (embedment depth)	Tension load			Shear load		
	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]
FF1 PP (70)						
Autoclaved aerated concrete AAC 2[11)]	0,14	0,05	0,10	0,14	0,28	0,42
Autoclaved aerated concrete AAC 6[11)]	0,32	0,27	0,54	0,32	0,64	0,96
FF1 PA (70)[10)]						
Autoclaved aerated concrete AAC 2[11)]	0,11	0,08	0,16	0,11	0,22	0,33
Autoclaved aerated concrete AAC 6[11)]	0,32	0,18	0,36	0,32	0,64	0,96

1) According to EN 771-1
2) According to EN 771-2
3) For example hollow ceramic Optibrick according to EN 771-1
4) For example perforated ceramic brick Doppio Uni according to EN 771-1
5) For example perforated ceramic brick HLZ 12 according to DIN 105 and EN 771-1
6) For example calcium silicate hollow block KSL 6DF according to DIN 106 and EN 771-2
7) For example hollow lightweight aggregate concrete element Hbl according to EN 771-3
8) For example perforated brick MAX according to EN 771-1
9) For example perforated brick PW25 according to EN 771-1
10) Colour grey and blue
11) According to EN 771-4

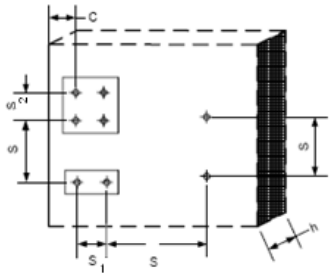
FF1	**Annex 11** of European Technical Approval ETA-12/0398
Displacements in masonry	

Table 11: Minimum thickness of member, edge distance and anchor spacing in masonry

Anchor type (embedment depth)	Base material	Type of element	Single anchor			Anchor group[1]	
			h_{min} [mm]	c_{min} [mm]	s_{min} [mm]	s_{min1}[2] [mm]	s_{min2}[3] [mm]
FF1 PP (50)	masonry made of ceramic, sand-lime, calcium silicate and lightweight aggregate concrete elements	solid	115	100	–	200	400
		perforated or hollow	115	100	–	200	400
	masonry made of autoclaved aerated concrete elements	–	–	–	–	–	–
FF1 PP (70)	masonry made of ceramic, sand-lime, calcium silicate and lightweight aggregate concrete elements	solid	115	100	–	200	400
		perforated or hollow	115	100	–	200	400
	masonry made of autoclaved aerated concrete elements	–	100	100	–	200	400
FF1 PA (50)	masonry made of ceramic, sand-lime, calcium silicate and lightweight aggregate concrete elements	solid	115	100	–	200	400
		perforated or hollow	115	100	–	200	400
	masonry made of autoclaved aerated concrete elements	–	–	–	–	–	–
FF1 PA (70)	masonry made of ceramic, sand-lime, calcium silicate and lightweight aggregate concrete elements	solid	115	100	–	200	400
		perforated or hollow	115	100	–	200	400
	masonry made of autoclaved aerated concrete elements	–	100	100	–	200	400

1) The design method valid for single anchor and anchor groups with two or four anchors
2) In direction perpendicular to free edge
3) In direction parallel to free edge

Scheme of distances and spacing in masonry



FF1	**Annex 12** of European Technical Approval ETA-12/0398
Minimum thickness of member, edge distance and anchor spacing in masonry	

Instytut Techniki Budowlanej

ISBN 978-83-249-7352-1