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## European Technical Assessment

**ETA 17/0184  
of 14/08/2018**

**Technical Assessment Body issuing the ETA:** Technical and Test Institute  
for Construction Prague

**Trade name of the construction product**

Rawplug R-HPTIIZF Zinc Flake  
Throughbolts

**Product family to which the construction  
product belongs**

Product area code: 33  
Torque controlled expansion anchor  
for use in cracked and uncracked concrete

**Manufacturer**

Rawplug S.A.  
Ul. Kwidzyńska 6  
51-416 Wrocław  
Poland

**Manufacturing plant**

Manufacturing Plant No 2

**This European Technical Assessment  
contains**

12 pages including 10 Annexes which form  
an integral part of this assessment

**This European Technical Assessment is  
issued in accordance with regulation  
(EU) No 305/2011, on the basis of**

EAD 330232-00-0601  
Mechanical fasteners for use in concrete

**This version replaces**

ETA 17/0184 issued on 02/10/2017

**This version is a corrigendum to**

ETA 17/0184 of 14/08/2018

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## 1. Technical description of the product

The Rawlplug R-HPTIIZF Zinc Flake Throughbolts are through-fixing torque-controlled expansion anchors in sizes of M8, M10, M12, M16 and M20. Each type comprises a special bolt with a taper, an expansion sleeve, a hexagonal nut and a washer. The anchors are made from carbon steel finished in zinc/aluminium coating.

The anchor is installed in a drilled hole; tightening the nut draws the cone into the sleeve. The expansion of this sleeve applies the anchorage.

The installed anchor is shown in Annex 1.

## 2. Specification of the intended use in accordance with the applicable EAD

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

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

## 3. Performance of the product and references to the methods used for its assessment

### 3.1 Mechanical resistance and stability (BWR 1)

| Essential characteristic   | Performance   |
|--|---------------|
| Characteristic resistance to tension load (static and quasi-static loading)    | See Annex C 1 |
| Characteristic resistance to shear load (static and quasi-static loading)      | See Annex C 2 |
| Characteristic resistance and displacement for seismic performance category C2 | See Annex C 4 |

### 3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance                      |
|--------------------------|----------------------------------|
| Reaction to fire         | Class A1 according to EN 13501-1 |
| Resistance to fire       | Seen Annex C 3                   |

## 4. Assessment and verification of constancy of performance (AVCP) system applied with reference to its legal base

According to the Decision 97/463/EC of the European Commission<sup>1</sup>, the system 1 of assessment verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) apply.

## 5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Technical and Test Institute for Construction Prague.

Issued in Prague on 14.08.2018

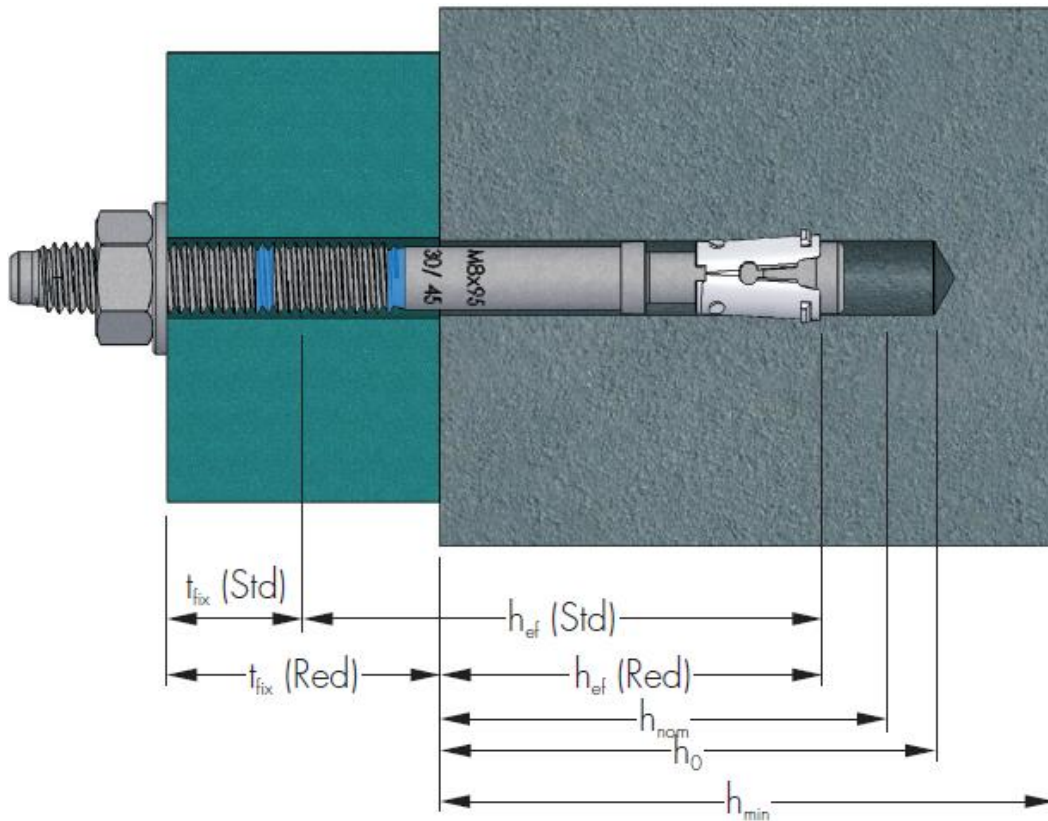
By

**Ing. Mária Schaan**

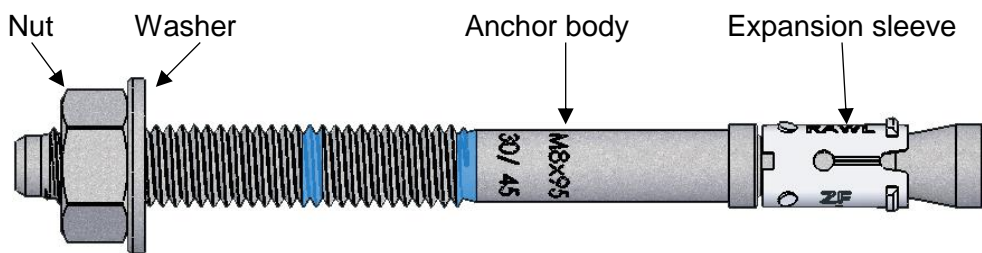
Head of the Technical Assessment Body

<sup>1</sup> Official Journal of the European Communities L 198/31 25.7.1997

**Rawlplug R-HPTIIZF Zinc Flake Throughbolts - Installed anchor**



**Rawlplug R-HPTIIZF Zinc Flake Throughbolts - components**



**Rawlplug R-HPTIIZF Zinc Flake Throughbolts**

**Product description**  
Installed conditions and components

**Annex A 1**

**Table A1 - Materials**

|                  |   |
|------------------|---|
| Component        | Material  |
| Anchor body      | Steel rod on coil cold forged bolts                             |
| Expansion sleeve | Steel grade DC03, M8-M12 C590, M16-M20 C490, according EN 10139 |
| Hexagonal nut    | according DIN 934   |
| Washer           | according DIN 125A or DIN 9021                                  |

**Table A2 – Material properties**

|                             |      |           |           |
|-----------------------------|------|-----------|-----------|
|                             |      | M8 - M12  | M16 - M20 |
| Expansion sleeve – hardness | [HV] | 185 - 215 | 155 - 185 |

**Table A3 – Marking**

| <b>M8</b>        |      |      |       |       |       |       |         |         |        |         |         |         |         |         |         |         |         |         |
|------------------|------|------|-------|-------|-------|-------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Bolt length [mm] | 60   | 65   | 75    | 80    | 85    | 90    | 95      | 100     | 105    | 115     | 120     | 140     | 150     | 160     |         |         |         |         |
| Head marking     | B    | b    | C     | d     | D     | e     | E       | F       | f      | G       | H       | K       | L       | M       |         |         |         |         |
| Bolt marking     | -/10 | -/15 | 10/25 | 15/30 | 20/35 | 25/40 | 30/45   | 35/50   | 40/55  | 50/65   | 55/70   | 75/90   | 85/100  | 95/110  |         |         |         |         |
| <b>M10</b>       |      |      |       |       |       |       |         |         |        |         |         |         |         |         |         |         |         |         |
| Bolt length [mm] | 65   | 80   | 85    | 90    | 95    | 115   | 120     | 130     | 140    | 150     | 180     |         |         |         |         |         |         |         |
| Head marking     | B    | D    | d     | e     | E     | G     | H       | J       | K      | L       | P       |         |         |         |         |         |         |         |
| Bolt marking     | -/5  | -/20 | 5/25  | 10/30 | 15/35 | 35/55 | 40/60   | 50/70   | 60/80  | 70/90   | 100/120 |         |         |         |         |         |         |         |
| <b>M12</b>       |      |      |       |       |       |       |         |         |        |         |         |         |         |         |         |         |         |         |
| Bolt length [mm] | 80   | 100  | 105   | 110   | 115   | 120   | 125     | 135     | 140    | 150     | 160     | 180     | 200     | 220     | 240     | 250     | 260     | 280     |
| Head marking     | D    | F    | f     | G     | g     | h     | H       | J       | K      | L       | M       | P       | R       | S       | T       | U       | V       | X       |
| Bolt marking     | -/5  | 5/25 | 10/30 | 15/35 | 20/40 | 25/45 | 30/50   | 40/60   | 45/65  | 55/75   | 65/85   | 85/105  | 105/125 | 125/145 | 145/165 | 155/175 | 165/185 | 185/205 |
| <b>M16</b>       |      |      |       |       |       |       |         |         |        |         |         |         |         |         |         |         |         |         |
| Bolt length [mm] | 100  | 105  | 125   | 130   | 140   | 150   | 160     | 180     | 200    | 220     | 250     | 280     | 300     |         |         |         |         |         |
| Head marking     | F    | f    | H     | J     | K     | L     | M       | P       | R      | S       | U       | X       | Y       |         |         |         |         |         |
| Bolt marking     | -/5  | -/10 | 5/25  | 10/30 | 20/40 | 30/50 | 40/60   | 60/80   | 80/100 | 100/120 | 130/150 | 160/180 | 180/200 |         |         |         |         |         |
| <b>M20</b>       |      |      |       |       |       |       |         |         |        |         |         |         |         |         |         |         |         |         |
| Bolt length [mm] | 125  | 140  | 160   | 165   | 180   | 200   | 250     | 300     |        |         |         |         |         |         |         |         |         |         |
| Head marking     | H    | K    | M     | m     | P     | R     | U       | Y       |        |         |         |         |         |         |         |         |         |         |
| Bolt marking     | -/5  | -/20 | 20/40 | 24/45 | 40/60 | 60/80 | 110/130 | 160/180 |        |         |         |         |         |         |         |         |         |         |

**Rawlplug R-HPTIIF Zinc Flake Throughbolts**

**Product description**  
 Materials  
 Marking

**Annex A 2**

## Specifications of intended use

### **Anchorage subject to:**

- Static and quasi-static load
- Fire exposure
- Seismic actions category C2 (max w = 0,8 mm), size M10, M12, M16, only standard embedment

### **Base materials**

- Cracked or uncracked concrete.
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206-1:2000-12.

### **Use conditions (Environmental conditions)**

- Structures subject to dry internal conditions.

### **Design:**

- The anchorages are designed in accordance with the FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016 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.
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016.
- Anchorages under fire exposure have to be designed in accordance with FprEN 1992-4:2016 and EOTA Technical Report TR 055, December 2016.

### **Installation:**

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without exchanging any components of the anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings using the appropriate tools.
- Effective anchoring depth, edge distance and spacing not less than the specified values without minus tolerance.
- In case of aborted drill 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 in the direction of load application.

**Rawlplug R-HPTIIZF Zinc Flake Throughbolts**

**Intended use**  
Specifications

**Annex B 1**

**Table B1 - Installation parameters**

| Size | Drill hole diameter | Bolt length | Thread length       | Hole diameter in fixture | Standard embedment  |                         |                           |                        | Reduced embedment   |                         |                           |                        | Installation torque     |
|------|---------------------|-------------|---------------------|--------------------------|---------------------|-------------------------|---------------------------|------------------------|---------------------|-------------------------|---------------------------|------------------------|-------------------------|
|      |                     |             |                     |                          | Min. hole depth     | Nominal embedment depth | Effective embedment depth | Max. fixture thickness | Min. hole depth     | Nominal embedment depth | Effective embedment depth | Max. fixture thickness |                         |
|      | d <sub>0</sub> [mm] | l [mm]      | l <sub>G</sub> [mm] | d <sub>f</sub> [mm]      | h <sub>0</sub> [mm] | h <sub>nom</sub> [mm]   | h <sub>ef</sub> [mm]      | t <sub>fix</sub> [mm]  | h <sub>0</sub> [mm] | h <sub>nom</sub> [mm]   | h <sub>ef</sub> [mm]      | t <sub>fix</sub> [mm]  | T <sub>inst</sub> [N.m] |
| M8   | 8                   | 60          | 25                  | 9                        | -                   | -                       | -                         | -                      | 50                  | 40                      | 32                        | 10                     | 10                      |
|      |                     | 65          | 30                  | 9                        | -                   | -                       | -                         | -                      | 50                  | 40                      | 32                        | 15                     |                         |
|      |                     | 75          | 35                  | 9                        | 65                  | 55                      | 47                        | 10                     | 50                  | 40                      | 32                        | 25                     |                         |
|      |                     | 80          | 40                  | 9                        | 65                  | 55                      | 47                        | 15                     | 50                  | 40                      | 32                        | 30                     |                         |
|      |                     | 85          | 45                  | 9                        | 65                  | 55                      | 47                        | 20                     | 50                  | 40                      | 32                        | 35                     |                         |
|      |                     | 90          | 50                  | 9                        | 65                  | 55                      | 47                        | 25                     | 50                  | 40                      | 32                        | 40                     |                         |
|      |                     | 95          | 55                  | 9                        | 65                  | 55                      | 47                        | 30                     | 50                  | 40                      | 32                        | 45                     |                         |
|      |                     | 100         | 60                  | 9                        | 65                  | 55                      | 47                        | 35                     | 50                  | 40                      | 32                        | 50                     |                         |
|      |                     | 105         | 65                  | 9                        | 65                  | 55                      | 47                        | 40                     | 50                  | 40                      | 32                        | 55                     |                         |
|      |                     | 115         | 75                  | 9                        | 65                  | 55                      | 47                        | 50                     | 50                  | 40                      | 32                        | 65                     |                         |
|      |                     | 120         | 80                  | 9                        | 65                  | 55                      | 47                        | 55                     | 50                  | 40                      | 32                        | 70                     |                         |
| 140  | 100                 | 9           | 65                  | 55                       | 47                  | 75                      | 50                        | 40                     | 32                  | 90                      |                           |                        |                         |
| 150  | 100                 | 9           | 65                  | 55                       | 47                  | 85                      | 50                        | 40                     | 32                  | 100                     |                           |                        |                         |
| 160  | 100                 | 9           | 65                  | 55                       | 47                  | 95                      | 50                        | 40                     | 32                  | 110                     |                           |                        |                         |
| M10  | 10                  | 65          | 21                  | 11                       | -                   | -                       | -                         | -                      | 59                  | 49                      | 39                        | 5                      | 20                      |
|      |                     | 80          | 31                  | 11                       | -                   | -                       | -                         | -                      | 59                  | 49                      | 39                        | 20                     |                         |
|      |                     | 85          | 36                  | 11                       | 79                  | 69                      | 59                        | 5                      | 59                  | 49                      | 39                        | 25                     |                         |
|      |                     | 90          | 41                  | 11                       | 79                  | 69                      | 59                        | 10                     | 59                  | 49                      | 39                        | 30                     |                         |
|      |                     | 95          | 46                  | 11                       | 79                  | 69                      | 59                        | 15                     | 59                  | 49                      | 39                        | 35                     |                         |
|      |                     | 115         | 66                  | 11                       | 79                  | 69                      | 59                        | 35                     | 59                  | 49                      | 39                        | 55                     |                         |
|      |                     | 120         | 71                  | 11                       | 79                  | 69                      | 59                        | 40                     | 59                  | 49                      | 39                        | 60                     |                         |
|      |                     | 130         | 81                  | 11                       | 79                  | 69                      | 59                        | 50                     | 59                  | 49                      | 39                        | 70                     |                         |
|      |                     | 140         | 91                  | 11                       | 79                  | 69                      | 59                        | 60                     | 59                  | 49                      | 39                        | 80                     |                         |
| 150  | 101                 | 11          | 79                  | 69                       | 59                  | 70                      | 59                        | 49                     | 39                  | 90                      |                           |                        |                         |
| 180  | 100                 | 11          | 79                  | 69                       | 59                  | 100                     | 59                        | 49                     | 39                  | 120                     |                           |                        |                         |
| M12  | 12                  | 80          | 30                  | 13                       | -                   | -                       | -                         | -                      | 70                  | 60                      | 48                        | 5                      | 40                      |
|      |                     | 100         | 40                  | 13                       | 90                  | 80                      | 68                        | 5                      | 70                  | 60                      | 48                        | 25                     |                         |
|      |                     | 105         | 45                  | 13                       | 90                  | 80                      | 68                        | 10                     | 70                  | 60                      | 48                        | 30                     |                         |
|      |                     | 110         | 50                  | 13                       | 90                  | 80                      | 68                        | 15                     | 70                  | 60                      | 48                        | 35                     |                         |
|      |                     | 115         | 55                  | 13                       | 90                  | 80                      | 68                        | 20                     | 70                  | 60                      | 48                        | 40                     |                         |
|      |                     | 120         | 60                  | 13                       | 90                  | 80                      | 68                        | 25                     | 70                  | 60                      | 48                        | 45                     |                         |
|      |                     | 125         | 65                  | 13                       | 90                  | 80                      | 68                        | 30                     | 70                  | 60                      | 48                        | 50                     |                         |
|      |                     | 135         | 75                  | 13                       | 90                  | 80                      | 68                        | 40                     | 70                  | 60                      | 48                        | 60                     |                         |
|      |                     | 140         | 80                  | 13                       | 90                  | 80                      | 68                        | 45                     | 70                  | 60                      | 48                        | 65                     |                         |
|      |                     | 150         | 90                  | 13                       | 90                  | 80                      | 68                        | 55                     | 70                  | 60                      | 48                        | 75                     |                         |
|      |                     | 160         | 100                 | 13                       | 90                  | 80                      | 68                        | 65                     | 70                  | 60                      | 48                        | 85                     |                         |
|      |                     | 180         | 100                 | 13                       | 90                  | 80                      | 68                        | 85                     | 70                  | 60                      | 48                        | 105                    |                         |
|      |                     | 200         | 100                 | 13                       | 90                  | 80                      | 68                        | 105                    | 70                  | 60                      | 48                        | 125                    |                         |
|      |                     | 220         | 100                 | 13                       | 90                  | 80                      | 68                        | 125                    | 70                  | 60                      | 48                        | 145                    |                         |
| 240  | 100                 | 13          | 90                  | 80                       | 68                  | 145                     | 70                        | 60                     | 48                  | 165                     |                           |                        |                         |
| 250  | 100                 | 13          | 90                  | 80                       | 68                  | 155                     | 70                        | 60                     | 48                  | 175                     |                           |                        |                         |
| 260  | 100                 | 13          | 90                  | 80                       | 68                  | 165                     | 70                        | 60                     | 48                  | 185                     |                           |                        |                         |
| 280  | 100                 | 13          | 90                  | 80                       | 68                  | 185                     | 70                        | 60                     | 48                  | 205                     |                           |                        |                         |
| M16  | 16                  | 100         | 30                  | 18                       | -                   | -                       | -                         | -                      | 90                  | 80                      | 65                        | 5                      | 100                     |
|      |                     | 105         | 35                  | 18                       | -                   | -                       | -                         | -                      | 90                  | 80                      | 65                        | 10                     |                         |
|      |                     | 125         | 45                  | 18                       | 110                 | 100                     | 85                        | 5                      | 90                  | 80                      | 65                        | 25                     |                         |
|      |                     | 130         | 50                  | 18                       | 110                 | 100                     | 85                        | 10                     | 90                  | 80                      | 65                        | 30                     |                         |
|      |                     | 140         | 60                  | 18                       | 110                 | 100                     | 85                        | 20                     | 90                  | 80                      | 65                        | 40                     |                         |
|      |                     | 150         | 70                  | 18                       | 110                 | 100                     | 85                        | 30                     | 90                  | 80                      | 65                        | 50                     |                         |
|      |                     | 160         | 80                  | 18                       | 110                 | 100                     | 85                        | 40                     | 90                  | 80                      | 65                        | 60                     |                         |
|      |                     | 180         | 100                 | 18                       | 110                 | 100                     | 85                        | 60                     | 90                  | 80                      | 65                        | 80                     |                         |
|      |                     | 200         | 100                 | 18                       | 110                 | 100                     | 85                        | 80                     | 90                  | 80                      | 65                        | 100                    |                         |
|      |                     | 220         | 100                 | 18                       | 110                 | 100                     | 85                        | 100                    | 90                  | 80                      | 65                        | 120                    |                         |
| 250  | 100                 | 18          | 110                 | 100                      | 85                  | 130                     | 90                        | 80                     | 65                  | 150                     |                           |                        |                         |
| 280  | 100                 | 18          | 110                 | 100                      | 85                  | 160                     | 90                        | 80                     | 65                  | 180                     |                           |                        |                         |
| 300  | 100                 | 18          | 110                 | 100                      | 85                  | 180                     | 90                        | 80                     | 65                  | 200                     |                           |                        |                         |
| M20  | 20                  | 125         | 50                  | 22                       | -                   | -                       | -                         | -                      | 110                 | 100                     | 80                        | 5                      | 180                     |
|      |                     | 140         | 50                  | 22                       | -                   | -                       | -                         | -                      | 110                 | 100                     | 80                        | 20                     |                         |
|      |                     | 160         | 61                  | 22                       | 129                 | 119                     | 99                        | 20                     | 110                 | 100                     | 80                        | 40                     |                         |
|      |                     | 165         | 66                  | 22                       | 129                 | 119                     | 99                        | 25                     | 110                 | 100                     | 80                        | 45                     |                         |
|      |                     | 180         | 81                  | 22                       | 129                 | 119                     | 99                        | 40                     | 110                 | 100                     | 80                        | 60                     |                         |
|      |                     | 200         | 100                 | 22                       | 129                 | 119                     | 99                        | 60                     | 110                 | 100                     | 80                        | 80                     |                         |
|      |                     | 250         | 100                 | 22                       | 129                 | 119                     | 99                        | 110                    | 110                 | 100                     | 80                        | 130                    |                         |
| 300  | 100                 | 22          | 129                 | 119                      | 99                  | 160                     | 110                       | 100                    | 80                  | 180                     |                           |                        |                         |

**Rawlplug R-HPTIIF Zinc Flake Throughbolts**

**Intended use**  
Installation parameters

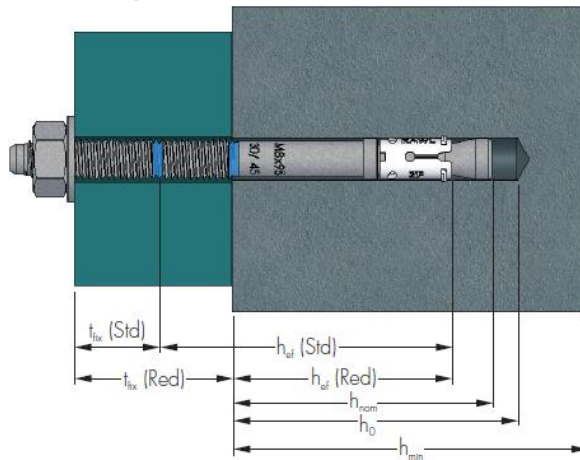
**Annex B 2**

**Table B2 - Installation parameters – Minimum spacing and edge distance**

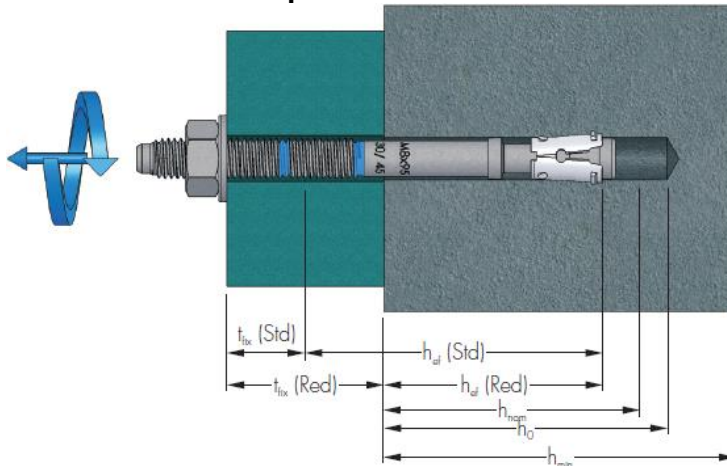
| Size   |                | M8                |     | M10               |     | M12 |     | M16 |     | M20 |     |
|--|----------------|-------------------|-----|-------------------|-----|-----|-----|-----|-----|-----|-----|
|  |                | Red <sup>1)</sup> | Std | Red <sup>1)</sup> | Std | Red | Std | Red | Std | Red | Std |
| Minimum thickness of concrete member                           | $h_{min}$ [mm] | 100               | 100 | 100               | 120 | 100 | 140 | 130 | 170 | 160 | 200 |
| <b>Minimum spacing and edge distance in cracked concrete</b>   |                |                   |     |                   |     |     |     |     |     |     |     |
| Minimum spacing  | $s_{min}$ [mm] | 55                | 50  | 75                | 70  | 150 | 90  | 190 | 160 | 300 | 180 |
| for edge distance $c \geq$                                     | [mm]           | 45                | 50  | 60                | 65  | 100 | 80  | 125 | 130 | 200 | 150 |
| Minimum edge distance  | $c_{min}$ [mm] | 40                | 40  | 50                | 45  | 80  | 65  | 110 | 90  | 120 | 100 |
| for spacing $s \geq$   | [mm]           | 80                | 80  | 100               | 100 | 180 | 150 | 280 | 240 | 260 | 220 |
| <b>Minimum spacing and edge distance in uncracked concrete</b> |                |                   |     |                   |     |     |     |     |     |     |     |
| Minimum spacing  | $s_{min}$ [mm] | 55                | 50  | 75                | 70  | 150 | 90  | 190 | 160 | 300 | 180 |
| for edge distance $c \geq$                                     | [mm]           | 45                | 50  | 60                | 65  | 100 | 80  | 125 | 130 | 200 | 150 |
| Minimum edge distance  | $c_{min}$ [mm] | 45                | 40  | 60                | 50  | 70  | 65  | 100 | 85  | 160 | 100 |
| for spacing $s \geq$   | [mm]           | 55                | 100 | 75                | 110 | 150 | 180 | 190 | 240 | 300 | 225 |

<sup>1)</sup> Use restricted to anchoring statically indeterminate structural components

**Pre-torque installation**



**Post-torque installation**



**Rawlplug R-HPTIIF Zinc Flake Throughbolts**

**Intended use**  
Installation parameters

**Annex B 3**

**Installation instructions**

1. Drill a hole of required diameter and depth



2. Clear the hole of drilling dust and debris (using blowpump or equivalent method)



3. Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached



4. Tighten to the recommended torque



5. Assembled condition of anchor



**Rawlplug R-HPTIIZF Zinc Flake Throughbolts**

**Intended use**  
Installation instructions

**Annex B 4**



**Table C1 – Characteristic resistance under tension load**

| Steel failure             |               |      | M8                |     | M10               |     | M12  |     | M16  |     | M20  |     |
|---------------------------|---------------|------|-------------------|-----|-------------------|-----|------|-----|------|-----|------|-----|
|                           |               |      | Red <sup>1)</sup> | Std | Red <sup>1)</sup> | Std | Red  | Std | Red  | Std | Red  | Std |
| Size                      |               |      |                   |     |                   |     |      |     |      |     |      |     |
| Characteristic resistance | $N_{Rk,s}$    | [kN] | 11,0              |     | 17,5              |     | 25,8 |     | 45,8 |     | 70,0 |     |
| Partial safety factor     | $\gamma_{Ms}$ | [-]  | 1,4               |     | 1,4               |     | 1,4  |     | 1,4  |     | 1,4  |     |

| Pull-out failure                                       |                 |          |      |      |      |      |      |      |                 |      |                 |                 |
|--|-----------------|----------|------|------|------|------|------|------|-----------------|------|-----------------|-----------------|
| Characteristic resistance in cracked concrete C20/25   | $N_{Rk,p}$      | [kN]     | 3,0  | 5,0  | 6,0  | 9,0  | 9,0  | 12,0 | 16,0            | 20,0 | - <sup>2)</sup> | 30,0            |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$      | [kN]     | 7,5  | 9,0  | 9,0  | 12,0 | 12,0 | 20,0 | - <sup>2)</sup> | 35,0 | - <sup>2)</sup> | - <sup>2)</sup> |
| Installation safety factor                             | $\gamma_{inst}$ | [-]      | 1,2  | 1,2  | 1,2  | 1,0  | 1,0  | 1,0  | 1,0             | 1,0  | 1,0             | 1,0             |
| Increasing factor                                      |                 |          |      |      |      |      |      |      |                 |      |                 |                 |
| Cracked and uncracked concrete                         | C30/37          |          | 1,20 | 1,12 | 1,16 | 1,22 | 1,22 | 1,00 | 1,11            | 1,14 | 1,12            | 1,07            |
|  | C40/50          | $\psi_c$ | 1,40 | 1,22 | 1,33 | 1,44 | 1,44 | 1,00 | 1,22            | 1,28 | 1,26            | 1,14            |
|  | C50/60          |          | 1,60 | 1,33 | 1,50 | 1,67 | 1,67 | 1,00 | 1,33            | 1,43 | 1,39            | 1,21            |

| Concrete cone failure                                   |                 |      |      |     |     |     |     |     |     |     |     |     |
|---|-----------------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Factor for concrete cone failure for cracked concrete   | $k_{cr,N}$      | [-]  | 7,7  |     |     |     |     |     |     |     |     |     |
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$     | [-]  | 11,0 |     |     |     |     |     |     |     |     |     |
| Installation safety factor                              | $\gamma_{inst}$ | [-]  | 1,2  | 1,2 | 1,2 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 |
| Effective anchorage depth                               | $h_{ef}$        | [mm] | 32   | 47  | 39  | 59  | 48  | 68  | 65  | 85  | 80  | 99  |
| Spacing   | $s_{cr,N}$      | [mm] | 96   | 141 | 117 | 177 | 144 | 204 | 195 | 255 | 240 | 297 |
| Edge distance   | $c_{cr,N}$      | [mm] | 48   | 71  | 59  | 89  | 72  | 102 | 98  | 128 | 120 | 149 |

| Splitting failure          |                 |      |     |     |     |     |     |     |     |     |     |     |
|----------------------------|-----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Spacing                    | $s_{cr,sp}$     | [mm] | 170 | 220 | 200 | 300 | 250 | 340 | 320 | 430 | 410 | 530 |
| Edge distance              | $c_{cr,sp}$     | [mm] | 85  | 110 | 100 | 150 | 125 | 170 | 160 | 215 | 205 | 265 |
| Installation safety factor | $\gamma_{inst}$ | [-]  | 1,2 | 1,2 | 1,2 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 |

- <sup>1)</sup> Use restricted to anchoring statically indeterminate structural components
- <sup>2)</sup> Pull-out failure mode is not decisive

**Table C2 – Displacement under tension load**

| Size                               |                    |      | M8                |     | M10               |     | M12 |     | M16  |      | M20  |      |
|------------------------------------|--------------------|------|-------------------|-----|-------------------|-----|-----|-----|------|------|------|------|
|                                    |                    |      | Red <sup>1)</sup> | Std | Red <sup>1)</sup> | Std | Red | Std | Red  | Std  | Red  | Std  |
| Tension load in cracked concrete   | N                  | [kN] | 1,2               | 2,0 | 2,4               | 4,3 | 4,3 | 5,7 | 7,6  | 9,5  | 12,3 | 14,3 |
| Displacement                       | $\delta_{N0}$      | [mm] | 0,6               | 0,8 | 0,3               | 1,0 | 0,5 | 0,7 | 0,3  | 0,4  | 0,4  | 0,4  |
|                                    | $\delta_{N\infty}$ | [mm] | 1,0               | 0,9 | 1,1               | 1,4 | 1,0 | 0,9 | 0,8  | 1,1  | 1,3  | 0,7  |
| Tension load in uncracked concrete | N                  | [kN] | 3,0               | 3,6 | 3,6               | 5,7 | 5,7 | 9,5 | 12,6 | 16,7 | 17,2 | 23,6 |
| Displacement                       | $\delta_{N0}$      | [mm] | 0,1               | 0,3 | 0,3               | 0,3 | 0,1 | 0,6 | 0,5  | 0,2  | 0,1  | 0,6  |
|                                    | $\delta_{N\infty}$ | [mm] | 1,0               | 0,9 | 1,1               | 1,4 | 1,0 | 0,9 | 0,8  | 1,1  | 1,3  | 0,7  |

- <sup>1)</sup> Use restricted to anchoring statically indeterminate structural components

|   |                  |
|---|------------------|
| <b>Rawplug R-HPTIIZF Zinc Flake Throughbolts</b>                                | <b>Annex C 1</b> |
| <b>Performances</b>   |                  |
| Characteristic resistance under tension load<br>Displacement under tension load |                  |

**Table C3 – Characteristic resistance under shear load**

| Steel failure without lever arm |                   |  | M8                |     | M10               |     | M12  |     | M16  |     | M20  |     |
|---------------------------------|-------------------|--|-------------------|-----|-------------------|-----|------|-----|------|-----|------|-----|
|                                 |                   |  | Red <sup>1)</sup> | Std | Red <sup>1)</sup> | Std | Red  | Std | Red  | Std | Red  | Std |
| Size                            |                   |  |                   |     |                   |     |      |     |      |     |      |     |
| Characteristic resistance       | $V^0_{Rk,s}$ [kN] |  | 9,1               |     | 15,7              |     | 23,7 |     | 47,1 |     | 60,6 |     |
| Ductility factor                | $k_7$ [-]         |  | 0,8               |     | 0,8               |     | 0,8  |     | 0,8  |     | 0,8  |     |
| Partial safety factor           | $\gamma_{Ms}$ [-] |  | 1,25              |     | 1,25              |     | 1,25 |     | 1,25 |     | 1,25 |     |

| Steel failure with lever arm |                   |  | M8   |  | M10  |  | M12  |  | M16  |  | M20  |  |
|------------------------------|-------------------|--|------|--|------|--|------|--|------|--|------|--|
| Characteristic resistance    | $M^0_{Rk,s}$ [Nm] |  | 22   |  | 45   |  | 79   |  | 200  |  | 389  |  |
| Partial safety factor        | $\gamma_{Ms}$ [-] |  | 1,25 |  | 1,25 |  | 1,25 |  | 1,25 |  | 1,25 |  |

| Concrete pry-out failure   |                     |  |     |     |     |     |     |     |     |     |     |     |
|----------------------------|---------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Factor                     | $k_8$ [-]           |  | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 |
| Installation safety factor | $\gamma_{inst}$ [-] |  | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 |

| Concrete edge failure      |                     |  |     |     |     |     |     |     |     |     |     |     |
|----------------------------|---------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Effective length of anchor | $l_f$ [mm]          |  | 32  | 47  | 39  | 59  | 48  | 68  | 65  | 85  | 80  | 99  |
| Anchor diameter            | $d_{nom}$ [mm]      |  | 8   |     | 10  |     | 12  |     | 16  |     | 20  |     |
| Installation safety factor | $\gamma_{inst}$ [-] |  | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 |

<sup>1)</sup> Use restricted to anchoring statically indeterminate structural components

**Table C4 – Displacement under shear load**

| Size   |                         |  | M8                |     | M10               |     | M12  |      | M16  |      | M20  |      |
|--|-------------------------|--|-------------------|-----|-------------------|-----|------|------|------|------|------|------|
|  |                         |  | Red <sup>1)</sup> | Std | Red <sup>1)</sup> | Std | Red  | Std  | Red  | Std  | Red  | Std  |
| Shear load in cracked and uncracked concrete | $V$ [kN]                |  | 5,8               | 5,8 | 9,2               | 9,2 | 13,3 | 13,3 | 24,5 | 24,5 | 38,5 | 38,5 |
| Displacement                                 | $\delta_{V0}$ [mm]      |  | 1,2               | 1,2 | 1,5               | 1,5 | 2,0  | 2,0  | 2,4  | 2,4  | 2,6  | 2,6  |
|  | $\delta_{V\infty}$ [mm] |  | 1,8               | 1,8 | 2,3               | 2,3 | 3,0  | 3,0  | 3,6  | 3,6  | 3,9  | 3,9  |

<sup>1)</sup> Use restricted to anchoring statically indeterminate structural components

|  |                  |
|--|------------------|
| <b>Rawplug R-HPTIIZF Zinc Flake Throughbolts</b>   | <b>Annex C 2</b> |
| <b>Performances</b><br>Characteristic resistance under shear load<br>Displacement under shear load |                  |

**Table C5 – Characteristic values of resistance to tension load under fire exposure<sup>1)</sup>**

| Size   | M8                 |   | M10               |     | M12 |     | M16 |     | M20  |      |      |
|--|--------------------|---|-------------------|-----|-----|-----|-----|-----|------|------|------|
|  | Red <sup>2)</sup>  | Std   | Red <sup>2)</sup> | Std | Red | Std | Red | Std | Red  | Std  |      |
| Characteristic fire resistance duration at 30 minutes  |                    |   |                   |     |     |     |     |     |      |      |      |
| Steel failure  | $N_{Rk,s,fi}$ [kN] | 0,4   |                   | 0,9 |     | 1,7 |     | 3,1 |      | 4,9  |      |
| Pull-out failure                                       | $N_{Rk,p,fi}$ [kN] | 0,8   | 1,3               | 1,5 | 2,3 | 2,3 | 3,0 | 4,0 | 5,0  | -    | -    |
| Concrete cone failure                                  | $N_{Rk,c,fi}$ [kN] | 1,0   | 2,7               | 1,7 | 4,8 | 2,9 | 6,9 | 6,1 | 12,0 | 10,3 | 17,6 |
| Characteristic fire resistance duration at 60 minutes  |                    |   |                   |     |     |     |     |     |      |      |      |
| Steel failure  | $N_{Rk,s,fi}$ [kN] | 0,3   |                   | 0,8 |     | 1,3 |     | 2,4 |      | 3,7  |      |
| Pull-out failure                                       | $N_{Rk,p,fi}$ [kN] | 0,8   | 1,3               | 1,5 | 2,3 | 2,3 | 3,0 | 4,0 | 5,0  | -    | -    |
| Concrete cone failure                                  | $N_{Rk,c,fi}$ [kN] | 1,0   | 2,7               | 1,7 | 4,8 | 2,9 | 6,9 | 6,1 | 12,0 | 10,3 | 17,6 |
| Characteristic fire resistance duration at 90 minutes  |                    |   |                   |     |     |     |     |     |      |      |      |
| Steel failure  | $N_{Rk,s,fi}$ [kN] | 0,3   |                   | 0,6 |     | 1,1 |     | 2,0 |      | 3,2  |      |
| Pull-out failure                                       | $N_{Rk,p,fi}$ [kN] | 0,8   | 1,3               | 1,5 | 2,3 | 2,3 | 3,0 | 4,0 | 5,0  | -    | -    |
| Concrete cone failure                                  | $N_{Rk,c,fi}$ [kN] | 1,0   | 2,7               | 1,7 | 4,8 | 2,9 | 6,9 | 6,1 | 12,0 | 10,3 | 17,6 |
| Characteristic fire resistance duration at 120 minutes |                    |   |                   |     |     |     |     |     |      |      |      |
| Steel failure  | $N_{Rk,s,fi}$ [kN] | 0,2   |                   | 0,5 |     | 0,8 |     | 1,6 |      | 2,5  |      |
| Pull-out failure                                       | $N_{Rk,p,fi}$ [kN] | 0,6   | 1,0               | 1,2 | 1,8 | 1,8 | 2,4 | 3,2 | 4,0  | -    | -    |
| Concrete cone failure                                  | $N_{Rk,c,fi}$ [kN] | 0,8   | 2,2               | 1,4 | 3,9 | 2,3 | 5,5 | 4,9 | 9,6  | 8,2  | 14,0 |
| Spacing  | $s_{cr,N}$ [mm]    | 4 x $h_{ef}$  |                   |     |     |     |     |     |      |      |      |
|  | $s_{min}$ [mm]     | 55  | 50                | 75  | 70  | 150 | 90  | 190 | 160  | 300  | 180  |
| Edge distance  | $c_{cr,N}$ [mm]    | 2 x $h_{ef}$  |                   |     |     |     |     |     |      |      |      |
|  | $c_{min}$ [mm]     | $c_{min} = 2 \times h_{ef}$ however if the fire attack is from more than one side, the edge distance of the anchor has to be $\geq 300$ mm and $\geq 2 \times h_{ef}$ |                   |     |     |     |     |     |      |      |      |

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

<sup>2)</sup> Use restricted to anchoring statically indeterminate structural components

**Table C6 – Characteristic values of resistance to shear load under fire exposure**

| Size   | M8   |     | M10               |     | M12 |     | M16 |     | M20 |      |
|--|--|-----|-------------------|-----|-----|-----|-----|-----|-----|------|
|  | Red <sup>1)</sup>  | Std | Red <sup>1)</sup> | Std | Red | Std | Red | Std | Red | Std  |
| Characteristic fire resistance duration at 30 minutes  |  |     |                   |     |     |     |     |     |     |      |
| Steel failure without lever arm                        | $V_{Rk,s,fi}$ [kN]   | 0,4 |                   | 0,9 |     | 1,7 |     | 3,1 |     | 4,9  |
| Steel failure with lever arm                           | $M_{Rk,s,fi}$ [Nm]   | 0,4 |                   | 1,1 |     | 2,6 |     | 6,7 |     | 13,0 |
| Characteristic fire resistance duration at 60 minutes  |  |     |                   |     |     |     |     |     |     |      |
| Steel failure without lever arm                        | $V_{Rk,s,fi}$ [kN]   | 0,3 |                   | 0,8 |     | 1,3 |     | 2,4 |     | 3,7  |
| Steel failure with lever arm                           | $M_{Rk,s,fi}$ [Nm]   | 0,3 |                   | 1,0 |     | 2,0 |     | 5,0 |     | 9,7  |
| Characteristic fire resistance duration at 90 minutes  |  |     |                   |     |     |     |     |     |     |      |
| Steel failure without lever arm                        | $V_{Rk,s,fi}$ [kN]   | 0,3 |                   | 0,6 |     | 1,1 |     | 2,0 |     | 3,2  |
| Steel failure with lever arm                           | $M_{Rk,s,fi}$ [Nm]   | 0,3 |                   | 0,7 |     | 1,7 |     | 4,3 |     | 8,4  |
| Characteristic fire resistance duration at 120 minutes |  |     |                   |     |     |     |     |     |     |      |
| Steel failure without lever arm                        | $V_{Rk,s,fi}$ [kN]   | 0,2 |                   | 0,5 |     | 0,8 |     | 1,6 |     | 2,5  |
| Steel failure with lever arm                           | $M_{Rk,s,fi}$ [Nm]   | 0,2 |                   | 0,6 |     | 1,3 |     | 3,3 |     | 6,5  |
| Concrete pry-out failure                               |  |     |                   |     |     |     |     |     |     |      |
| Factor <sup>2)</sup>                                   | $k_8$ [-]  | 1,0 | 1,0               | 1,0 | 1,0 | 1,0 | 2,0 | 2,0 | 2,0 | 2,0  |
| Concrete edge failure                                  | The characteristic resistance $V_{Rk,c,fi}^0$ in concrete C20/25 to C50/60 is determined by:<br>$V_{Rk,c,fi}^0 = 0,25 \times V_{Rk,c}^0$ and<br>$V_{Rk,c,fi}^0 = 0,20 \times V_{Rk,c}^0$<br>with the initial value of the characteristic resistance $V_{Rk,c}^0$ in cracked concrete C20/25 under normal temperature |     |                   |     |     |     |     |     |     |      |

<sup>1)</sup> Use restricted to anchoring statically indeterminate structural components

<sup>2)</sup> The values of factor  $k_8$  and relevant values of  $N_{Rk,c,fi}$  given in the Table C5 have to be considered in the design

|  |                  |
|--|------------------|
| <b>Rawplug R-HPTIIZF Zinc Flake Throughbolts</b>                               | <b>Annex C 3</b> |
| <b>Performances</b><br>Characteristic values of resistance under fire exposure |                  |

**Table C7 – Characteristic values of resistance under seismic action category C2**

| Size   |                        | M10      | M12  | M16  |
|--|------------------------|----------|------|------|
|  |                        | Standard |      |      |
| <b>Tension load</b>                          |                        |          |      |      |
| <b>Steel failure</b>                         |                        |          |      |      |
| Characteristic resistance                    | $N_{Rk,s,eq,C2}$ [kN]  | 17,5     | 25,8 | 45,8 |
| Partial safety factor                        | $\gamma_{Ms,eq}$ [-]   | 1,4      | 1,4  | 1,4  |
| <b>Pull-out failure</b>                      |                        |          |      |      |
| Characteristic resistance in concrete C20/25 | $N_{Rk,p,eq,C2}$ [kN]  | 3,4      | 7,0  | 10,9 |
| Installation safety factor                   | $\gamma_{inst,eq}$ [-] | 1,0      | 1,0  | 1,0  |
| <b>Shear load</b>                            |                        |          |      |      |
| <b>Steel failure without lever arm</b>       |                        |          |      |      |
| Characteristic resistance                    | $V_{Rk,s,eq,C2}$ [kN]  | 9,2      | 11,1 | 28,2 |
| Partial safety factor                        | $\gamma_{Ms,eq}$ [-]   | 1,25     | 1,25 | 1,25 |
| Factor for annular gap                       | $\alpha_{gap}$ [-]     | 0,5      |      |      |

**Table C8 – Displacement under tensile and shear load - seismic category C2**

| Size                 |      | M10 | M12  | M16  |
|----------------------|------|-----|------|------|
| $\delta_{N,eq}(DLS)$ | [mm] | 2,8 | 3,0  | 4,2  |
| $\delta_{N,eq}(ULS)$ | [mm] | 9,3 | 12,2 | 13,0 |
| $\delta_{V,eq}(DLS)$ | [mm] | 4,5 | 4,3  | 5,8  |
| $\delta_{V,eq}(ULS)$ | [mm] | 7,0 | 7,0  | 10,2 |

**Rawplug R-HPTIIZF Zinc Flake Throughbolts**

**Performances**  
Reduction factors for seismic design

**Annex C 4**