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**European Technical Assessment Body  
for construction products**



## European Technical Assessment

**ETA-07/0337  
of 27 May 2025**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

CELO Multifunction frame plug MFR

Product family  
to which the construction product belongs

Plastic anchors for redundant non-structural systems in  
concrete and masonry

Manufacturer

CELO Befestigungssysteme GmbH  
Industriestraße 6  
86551 Aichach  
DEUTSCHLAND

Manufacturing plant

CELO Werk I  
Industriestrasse 6  
D-86551 Aichach  
Germany

This European Technical Assessment  
contains

26 pages including 3 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 330284-00-0604, edition 12/2020

This version replaces

ETA-07/0337 issued on 15 September 2023

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## Specific part

### 1 Technical description of the product

The CELO Multifunction frame plug MFR is a plastic anchor consisting of a plastic sleeve made of polyamide and an accompanying specific screw of galvanised steel or of 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 product description is given in Annex A.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document

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 verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchors of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

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

| Essential characteristic | Performance  |
|--------------------------|--------------|
| Reaction to fire         | Class A1     |
| Resistance to fire       | See Annex C3 |

#### 3.2 Mechanical resistance and stability (BWR 4)

| Essential characteristic                                                                 | Performance                |
|------------------------------------------------------------------------------------------|----------------------------|
| Resistance to steel failure under tension loading                                        | See Annex C1               |
| Resistance to steel failure under shear loading                                          | See Annex C1               |
| Resistance to pull-out or concrete failure under tension loading (base material group a) | See Annex C2               |
| Resistance in any load direction without lever arm (base material group b, c, d)         | See Annexes C4 – C6 and C8 |
| Edge distance and spacing (base material group a)                                        | See Annex B3               |
| Edge distance and spacing (base material group b, c, d)                                  | See Annex B4 and B5        |
| Displacements under short-term and long-term loading                                     | See Annex C3, C7, C9       |
| Durability                                                                               | See Annex B1               |

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

In accordance with European Assessment Document EAD 330284-00-0604 the applicable European legal act is: 97/463/EC.

The system to be applied is: 2+

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

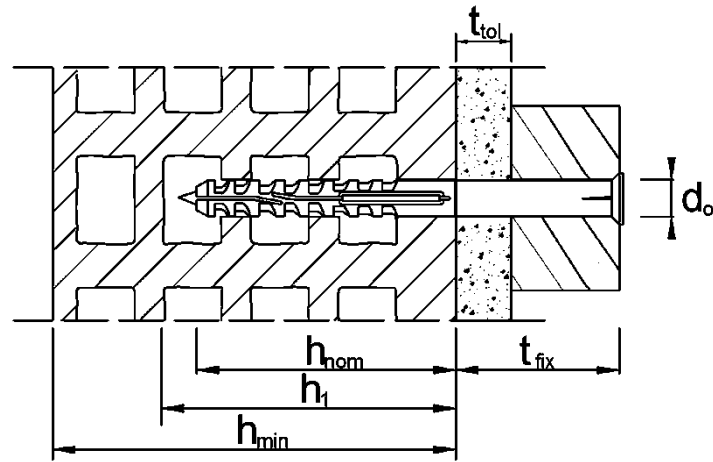
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 27 May 2025 by Deutsches Institut für Bautechnik

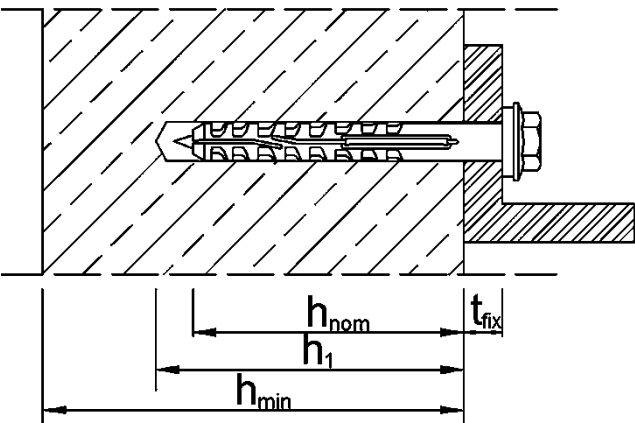
Dipl.-Ing. Beatrix Wittstock  
Head of Section

*beglaubigt:*  
Ziegler

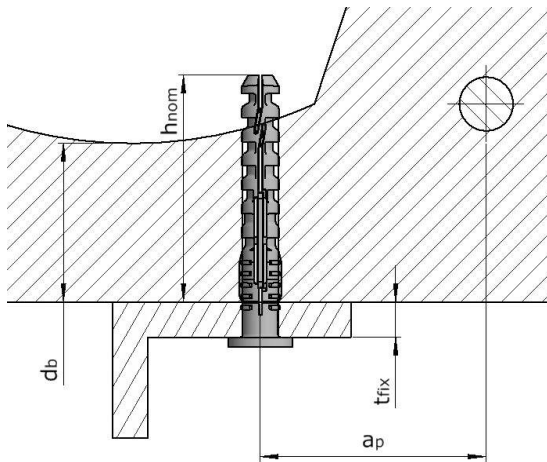
**Intended use in hollow brick**



**Intended use in concrete or solid base material**



**Intended use in precast prestressed hollow core slabs**



- $h_{nom}$  = overall plastic anchor embedment depth in the base material  
 $h_1$  = depth of drilled hole to deepest point  
 $h_{min}$  = Minimum thickness of member  
 $t_{fix}$  = thickness of fixture  
 $t_{tol}$  = thickness of layer or non-load bearing coating  
 $d_b$  = mirror thickness  
 $a_p$  = distance between plug and reinforcement

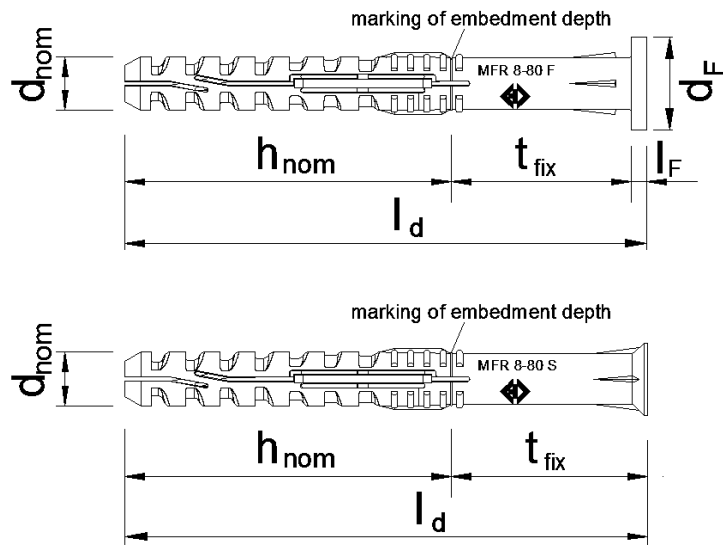
**CELO Multifunction frame plug MFR**

**Product description**  
Installed condition

**Annex A1**

Anchor sleeve MFR 8

Sleeve with flat head (FB) or countersunk head (SB)



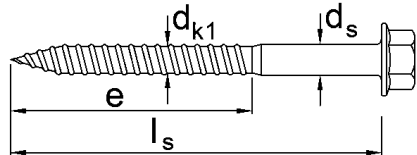
MFR 8 FB

MFR 8 SB

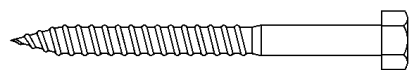
| Marking: | Brand             | Type | diameter (d <sub>nom</sub> ) - length (l <sub>d</sub> ) |      | plug head form (optional)   |
|----------|-------------------|------|---------------------------------------------------------|------|-----------------------------|
| Example: | CELO<br>(or Logo) | MFR  | 8                                                       | - 80 | F or S (F = FB)<br>(S = SB) |

Special screw (for MFR 8)

Screw head with different tool fittings



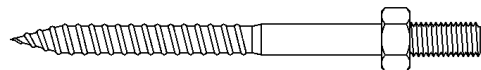
Type SSKS (or SSKS A4)  
galvanised steel or stainless steel (A4)



Type SSK (or SSK A4)  
galvanised steel or stainless steel (A4)



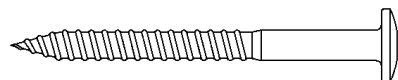
Type TX (or TX A4)  
galvanised steel or stainless steel (A4)



Type E (or E A4)  
galvanised steel or stainless steel (A4)



Type M (or M A4)  
galvanised steel or stainless steel (A4)



Type PT (or PT A4)  
galvanised steel or stainless steel (A4)

| Marking: | Brand  | Code No plug length | manufacturer code | if stainless steel |
|----------|--------|---------------------|-------------------|--------------------|
| Example: | X or C | 12 or 120           | 1                 | A4                 |

CELO Multifunction frame plug MFR

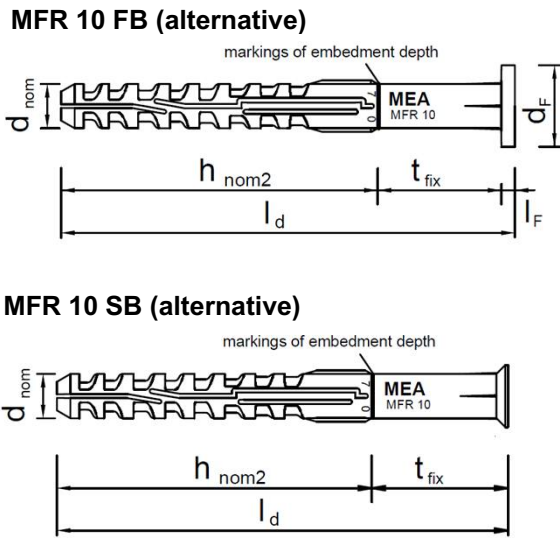
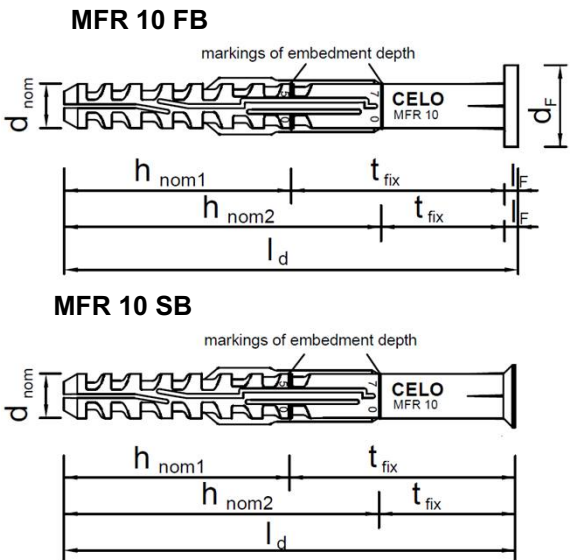
Product description

MFR 8 – Anchor types, screw specification, marking

Annex A2

Anchor sleeve MFR 10

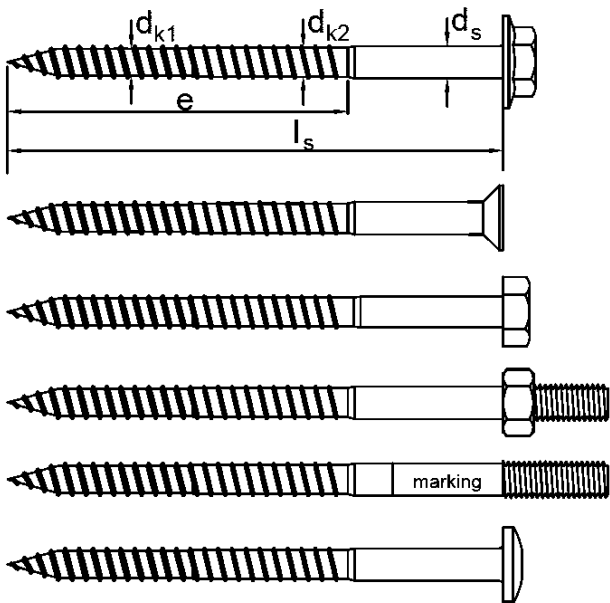
Sleeve with flat head (FB) or countersunk head (SB)



| Marking: | Brand                    | Type | diameter ( $d_{nom}$ ) - length ( $l_d$ ) |     | plug head form (optional)   |
|----------|--------------------------|------|-------------------------------------------|-----|-----------------------------|
| Example: | CELO<br>(or MEA or Logo) | MFR  | 10                                        | 100 | F or S (F = FB)<br>(S = SB) |

Special screw (for MFR 10)

Screw head with different tool fittings



|  |                                                                    |
|--|--------------------------------------------------------------------|
|  | Type SSKS (or SSKS A4)<br>galvanised steel or stainless steel (A4) |
|  | Type TX (or SSK A4)<br>galvanised steel or stainless steel (A4)    |
|  | Type SSK (or SSK A4)<br>galvanised steel or stainless steel (A4)   |
|  | Type E (or E A4)<br>galvanised steel or stainless steel (A4)       |
|  | Type M (or M A4)<br>galvanised steel or stainless steel (A4)       |
|  | Type PT (or PT A4)<br>galvanised steel or stainless steel (A4)     |

| Marking: | Brand  | Code No plug length | manufacturer code | if stainless steel |
|----------|--------|---------------------|-------------------|--------------------|
| Example: | X or C | 12 or 115           | 1                 | A4                 |

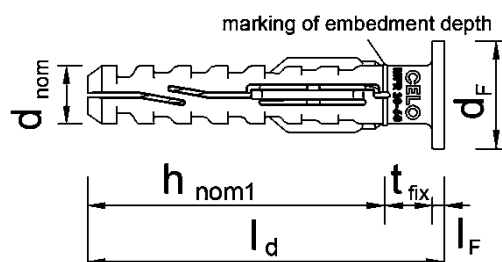
CELO Multifunction frame plug MFR

**Product description**  
MFR 10 – Anchor types, screw specification, marking

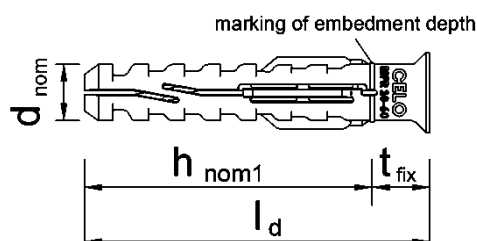
Annex A3

### Anchor sleeve MFR 10-60

Sleeve with flat head (FB) or countersunk head (SB)



MFR 10-60 FB

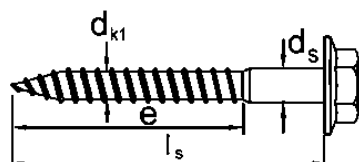


MFR 10-60 SB

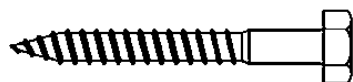
| Marking: | Brand             | Type | diameter ( $d_{nom}$ ) | length ( $l_d$ ) | plug head form (optional)   |
|----------|-------------------|------|------------------------|------------------|-----------------------------|
| Example: | CELO<br>(or Logo) | MFR  | 10                     | 60               | F or S (F = FB)<br>(S = SB) |

### Special screw (for MFR 10-60)

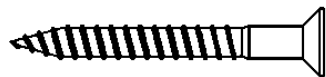
Screw head with different tool fittings



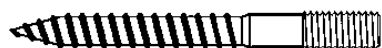
Type SSKS (or SSKS A4)  
galvanised steel or stainless steel (A4)



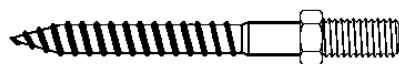
Type SSK (or SSK A4)  
galvanised steel or stainless steel (A4)



Type TX (or TX A4)  
galvanised steel or stainless steel (A4)



Type M (or M A4)  
galvanised steel or stainless steel (A4)



Type E (or E A4)  
galvanised steel or stainless steel (A4)

| Marking: | Brand  | Code No plug length | manufacturer code | if stainless steel |
|----------|--------|---------------------|-------------------|--------------------|
| Example: | X or C | 6 or 60             | 1                 | A4                 |

### CELO Multifunction frame plug MFR

#### Product description

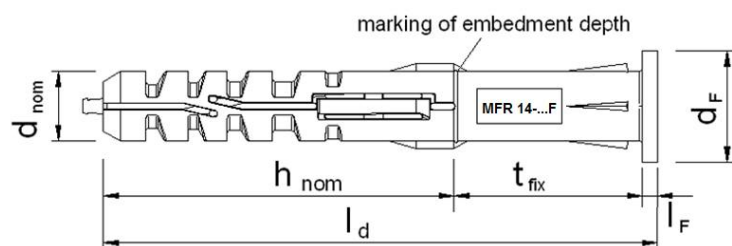
MFR 10-60 – Anchor types, screw specification, marking

Annex A4

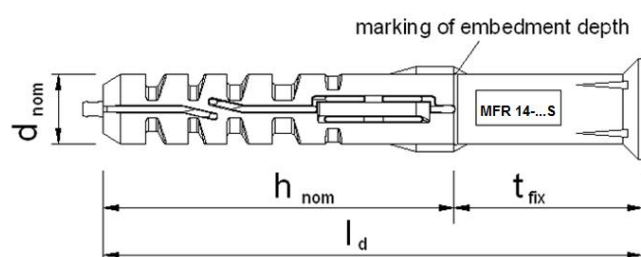


### Anchor sleeve MFR 14

Sleeve with flat head (FB) or countersunk head (SB)



MFR 14 FB

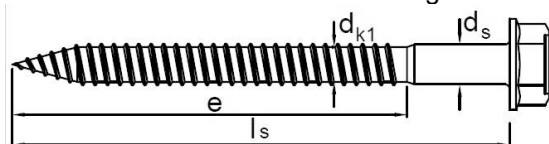


MFR 14 SB

| Marking: | Brand                    | Type | diameter ( $d_{nom}$ ) - length ( $l_d$ ) | plug head form (optional)   |
|----------|--------------------------|------|-------------------------------------------|-----------------------------|
| Example: | MEA<br>(or CELO or Logo) | MFR  | 14 - 110                                  | F or S (F = FB)<br>(S = SB) |

### Special screw (for MFR 14)

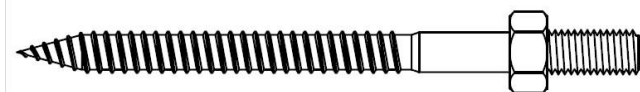
Screw head with different tool fittings



Type SSKS (or SSKS A4)  
galvanised steel or stainless steel (A4), optional with glide coating



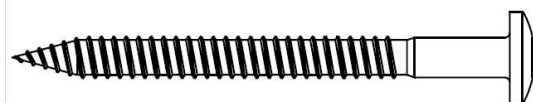
Type TX (or TX A4)  
galvanised steel or stainless steel (A4)  
optional with glide coating



Type E (or E A4)  
galvanised steel or stainless steel (A4)  
optional with glide coating



Type M (or M A4)  
galvanised steel or stainless steel (A4)  
optional with glide coating



Type PT (or PT A4)  
galvanised steel or stainless steel (A4)  
optional with glide coating

| Marking: | Brand  | Code No plug length | manufacturer code | if stainless steel |
|----------|--------|---------------------|-------------------|--------------------|
| Example: | X or C | 11 or 110           | 1                 | A4                 |

### CELO Multifunction frame plug MFR

#### Product description

MFR 14 – Anchor types, screw specification, marking

Annex A5

**Table A5.1: Dimensions [mm]**

|           | Anchor sleeve |                       |                       |                       |            |            |            |                   |
|-----------|---------------|-----------------------|-----------------------|-----------------------|------------|------------|------------|-------------------|
|           | $l_d$         | $\varnothing d_{nom}$ | $t_{fix \text{ min}}$ | $t_{fix \text{ max}}$ | $h_{nom1}$ | $h_{nom2}$ | $l_F^{2)}$ | $\varnothing d_F$ |
| MFR 8     | $\geq 60$     | 8                     | $\geq 1$              | 150                   | 50         |            | 2,3        | 14                |
| MFR 10    | $\geq 80$     | 10                    | $\geq 1$              | 500                   | 50         | 70         | 3          | 18                |
| MFR 10-60 | 60            | 10                    | $\geq 1$              | 10                    | 50         |            | 2          | 18                |
| MFR 14    | $\geq 80$     | 14                    | $\geq 1$              | 500                   | 70         |            | 3          | 22                |

|               | Special screw |                   |                      |                      |           |
|---------------|---------------|-------------------|----------------------|----------------------|-----------|
|               | $l_s^{1)}$    | $\varnothing d_s$ | $\varnothing d_{k1}$ | $\varnothing d_{k2}$ | e         |
| for MFR 8     | $\geq 65$     | 6                 | 5,2                  | -                    | $\leq 48$ |
| for MFR 10    | $\geq 85$     | 7                 | 5,8                  | 6,3                  | $\leq 67$ |
| for MFR 10-60 | 65            | 7                 | 5,8                  | -                    | $\leq 48$ |
| for MFR 14    | $\geq 85$     | 10                | 8,4                  | -                    | $\leq 75$ |

<sup>1)</sup> To insure, that the screw penetrates the anchor sleeve,  $l_s$  must be  $\geq l_d + 5 \text{ mm}$

<sup>2)</sup> only valid for plan head version

**Table A5.2: Materials**

| Designation                           | Material                                                                                                                                                                                                                |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| anchor sleeve                         | Polyamid PA 6                                                                                                                                                                                                           |
| special screw<br>(steel, zinc plated) | Steel, zinc plated galvanised $\geq 5 \mu\text{m}$ acc. EN ISO 4042:2022<br>$f_{yk} \geq 480 \text{ N/mm}^2$ , $f_{uk} \geq 600 \text{ N/mm}^2$ ( $\geq 6.8$ screw)                                                     |
| special screw<br>(stainless steel)    | Stainless steel A4 of corrosion resistance class CRC III<br>according EN 1993-1-4:2006+A1:2015<br>material 1.4401 or 1.4571<br>$f_{yk} \geq 450 \text{ N/mm}^2$ , $f_{uk} \geq 700 \text{ N/mm}^2$<br>strength class 70 |

**CELO Multifunction frame plug MFR**

**Product description**  
Dimensions and materials

**Annex A6**

### **Specifications of intended use**

#### **Anchorage subject to:**

- Static and quasi-static loads.
- Redundant non-structural systems.

#### **Base materials:**

- Reinforced or unreinforced normal weight concrete without fibres with strength classes  $\geq C12/15$  (base material group a) according to EN 206:2013+A1:2016, Annex C2 and Annex C3.
- Precast prestressed hollow core slabs with strength classes  $\geq C20/25$  (base material group a) according to EN 206:2013+A1:2016, see Annex C2
- Solid brick masonry (base material group b) according to EN 771-1/-2/-3:2011+A1:2015, see Annex C4-C6  
Note: The characteristic resistance is also valid for larger brick sizes and higher compressive strength of the masonry unit.
- Hollow brick masonry (base material group c) according to EN 771-1/-2/-3:2011+A1:2015, see Annex C4-C6
- Autoclaved aerated concrete (base material group d) according to EN 771-4:2011+A1:2015, see Annex C8
- Mortar strength class of the masonry  $\geq M2,5$  according to EN 998-2:2010.
- For other base materials of the base material groups a, b, c or d the characteristic resistance of the anchor may be determined by job site tests according to EOTA TR 051:2018-04.

#### **Temperature Range for use:**

- a:  $-40^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  (max. short term temperature  $+40^{\circ}\text{C}$  and max long term temperature  $+24^{\circ}\text{C}$ )
- b:  $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$  (max. short term temperature  $+80^{\circ}\text{C}$  and max long term temperature  $+50^{\circ}\text{C}$ )

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

- Structures subject to dry internal conditions (screw made of zinc coated steel, stainless steel)
- The specific screw made of galvanised steel may also be used in structures to external atmospheric exposure, if the area of the head of the screw is protected against moisture and driving rain after mounting of the fixing unit in this way, that intrusion of moisture into the anchor shaft is prevented. Therefore there shall be an external cladding or a ventilated rainscreen mounted in front of the head of the screw and the head of the screw itself shall be coated with a soft plastic, permanently elastic bitumen-oil-combination coating (e. g. undercoating or body cavity protection for cars)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (screw made of stainless steel of corrosion resistance class CRC III).

Note: 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).

#### **Design:**

- The anchorages are to be designed in accordance with EOTA TR 064:2018-05 under the responsibility of an engineer experienced in anchorages and masonry work.
- 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. The position of the anchor is indicated on the design drawings.

#### **Installation:**

- Hole drilling by the drill methods according to Annex C4, C5 or C6 for base material group b and c and according to Annex C8 for base material group d, hammer drilling is to be used for base material group a.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Temperature of the plug at installation from  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .
- Exposure to UV due to solar radiation of the anchor not protected  $\leq 6$  weeks.
- No ingress of water in the borehole at temperatures  $< 0^{\circ}\text{C}$

**CELO Multifunction frame plug MFR**

**Intended use**  
Specifications

**Annex B1**

**Table B2.1: Installation parameter in concrete, masonry and autoclaved aerated concrete**

| Anchor type                                                                   |                |      | MFR 8 | MFR 10-60/<br>MFR 10 | MFR 10 | MFR 14 |
|-------------------------------------------------------------------------------|----------------|------|-------|----------------------|--------|--------|
| Overall plastic anchor embedment depth in the base material <sup>1), 2)</sup> | $h_{nom} \geq$ | [mm] | 50    | 50                   | 70     | 70     |
| Drill hole diameter                                                           | $d_0 <$        | [mm] | 8     | 10                   |        | 14     |
| Cutting diameter of drill bit                                                 | $d_{cut} \leq$ | [mm] | 8,45  | 10,45                |        | 14,50  |
| Depth of drill hole to the deepest point <sup>1)</sup>                        | $h_1 \geq$     | [mm] | 60    | 60                   | 80     | 90     |
| Diameter of clearance hole in the fixture                                     | $d_f \leq$     | [mm] | 9,0   | 11                   |        | 15     |

<sup>1)</sup> See Annex A1

<sup>2)</sup> For hollow and perforated masonry the influence of

$h_{nom} > 50$  mm (MFR 8)

$h_{nom1} > 50$  mm respectively  $h_{nom2} > 70$  mm (MFR 10)

$h_{nom} > 70$  mm (MFR 14)

has to be detected by job site tests according to EOTA TR 051

**Table B2.2: Installation parameter in precast prestressed hollow core slabs**

| Anchor type                                                 |                |      | MFR 8 | MFR 10-60/ MFR 10 | MFR 10 |
|-------------------------------------------------------------|----------------|------|-------|-------------------|--------|
| Overall plastic anchor embedment depth in the base material | $h_{nom} \geq$ | [mm] | 50    | 50                | 70     |
| Drill hole diameter                                         | $d_0 <$        | [mm] | 8     | 10                | 10     |
| Cutting diameter of drill bit                               | $d_{cut} \leq$ | [mm] | 8,45  | 10,45             | 10,45  |
| Depth of drill hole to the deepest point <sup>1)</sup>      | $h_1 \geq$     | [mm] | 60    | 60                | 80     |
| Diameter of clearance hole in the fixture                   | $d_f \leq$     | [mm] | 9,0   | 11                | 11     |
| Bottom flange thickness                                     | $d_b \geq$     | [mm] | 35    | 35                | 35     |
| Distance between plug position and prestressing steel       | $a_p \geq$     | [mm] | 50    | 50                | 50     |

<sup>1)</sup> See Annex A1

**CELO Multifunction frame plug MFR**

**Intended use**

Installation parameters in concrete, masonry, autoclaved aerated concrete and hollow core slabs

**Annex B2**

**Table B3.1: Minimum thickness of member, edge distance and anchor spacing in concrete**

|                                                        | Minimum member thickness<br>$h_{min}$<br>[mm] | Characteristic edge distance<br>$c_{cr,N}$<br>[mm] | Characteristic spacing<br>$s_{cr,N}$<br>[mm] | Minimum edge distance<br>$c_{min}$<br>[mm] | Minimum spacing<br>$s_{min}$<br>[mm] |
|--------------------------------------------------------|-----------------------------------------------|----------------------------------------------------|----------------------------------------------|--------------------------------------------|--------------------------------------|
| <b>MFR 8</b>                                           |                                               |                                                    |                                              |                                            |                                      |
| Beton $\geq$ C16/20                                    | 100                                           | 50                                                 | 55                                           | 60                                         | 50                                   |
| Beton C12/15                                           | 100                                           | 70                                                 | 80                                           | 85                                         | 70                                   |
| <b>MFR 10-60/ MFR 10 <math>h_{nom1} = 50</math> mm</b> |                                               |                                                    |                                              |                                            |                                      |
| Beton $\geq$ C16/20                                    | 100                                           | 50                                                 | 75                                           | 50                                         | 50                                   |
| Beton C12/15                                           | 100                                           | 70                                                 | 105                                          | 70                                         | 70                                   |
| <b>MFR 10 <math>h_{nom2} = 70</math> mm</b>            |                                               |                                                    |                                              |                                            |                                      |
| Beton $\geq$ C16/20                                    | 110                                           | 70                                                 | 75                                           | 60                                         | 50                                   |
| Beton C12/15                                           | 110                                           | 100                                                | 105                                          | 85                                         | 70                                   |
| <b>MFR 14</b>                                          |                                               |                                                    |                                              |                                            |                                      |
| Beton $\geq$ C16/20                                    | 120                                           | 80                                                 | 100                                          | 100                                        | 100                                  |
| Beton C12/15                                           | 120                                           | 112                                                | 140                                          | 140                                        | 140                                  |

**Table B3.2: Minimum thickness of member, edge distance and anchor spacing in precast prestressed hollow core slabs**

|                                                      | Minimum thickness<br>$h_{min}$<br>[mm] | Characteristic edge distance<br>$c_{cr,N}$<br>[mm] | Minimum edge distances<br>$c_{min}$<br>[mm] | Minimum spacing<br>$s_{min}$<br>[mm] |
|------------------------------------------------------|----------------------------------------|----------------------------------------------------|---------------------------------------------|--------------------------------------|
| <b>MFR 8</b>                                         |                                        |                                                    |                                             |                                      |
| Concrete $\geq$ C45/55                               | 200                                    | 50                                                 | 60                                          | 50                                   |
| <b>MFR 10/ MFR 10-60 <math>h_{nom1}=50</math> mm</b> |                                        |                                                    |                                             |                                      |
| Concrete $\geq$ C20/25                               | 200                                    | 70                                                 | 60                                          | 50                                   |
| <b>MFR 10 <math>h_{nom2}=70</math> mm</b>            |                                        |                                                    |                                             |                                      |
| Concrete $\geq$ C45/55                               | 200                                    | 70                                                 | 60                                          | 50                                   |

**CELO Multifunction frame plug MFR**

**Intended use**

Minimum thickness, spacing, edge distance in concrete and hollow core slabs

**Annex B3**

**Table B4: Minimum thickness of member, edge distance and anchor spacing in masonry**

| Base material <sup>1)</sup>                                | Minimum thickness of member | Minimum edge distance | Minimum spacing   |                                                   |                                              |
|------------------------------------------------------------|-----------------------------|-----------------------|-------------------|---------------------------------------------------|----------------------------------------------|
|                                                            |                             |                       | Single anchor     | Anchor Group <sup>2)</sup>                        |                                              |
|                                                            | $h_{min}$<br>[mm]           | $c_{min}$<br>[mm]     | $a_{min}$<br>[mm] | perpendicular to free edge<br>$s_{1,min}$<br>[mm] | parallel to free edge<br>$s_{2,min}$<br>[mm] |
| <b>MFR 8</b>                                               |                             |                       |                   |                                                   |                                              |
| Clay brick <b>Mz-1.8 – NF</b>                              | 115                         | 100                   | 3)                | 200                                               | 400                                          |
| Sand-lime solid brick <b>KS – 2DF</b>                      | 115                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 12-1.0 - 12DF</b>                 | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 1</b> (Gero Tochana)              | 125                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 2</b> (Gero Tejala)               | 135                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow light concrete block <b>Hbl 7</b> (Bloque hormigon) | 200                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow sand-lime brick <b>KSL 12-1.4 - 3DF</b>             | 175                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow light concrete block <b>Hbl 2-0.8-16DF</b>          | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow concrete block <b>Hbn 1.4 - 12DF</b>                | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| <b>MFR 10-60/ MFR 10</b> $h_{nom1} = 50$ mm                |                             |                       |                   |                                                   |                                              |
| Clay brick <b>Mz-1.8 2DF</b>                               | 115                         | 100                   | 3)                | 200                                               | 400                                          |
| Sand-lime solid brick <b>KS - 3DF</b>                      | 175                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 12-1.0 - 12DF</b>                 | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 1</b> (Gero Tochana)              | 125                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 2</b> (Gero Tejala)               | 135                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow light concrete block <b>Hbl 7</b> (Bloque hormigon) | 200                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow sand-lime brick <b>KSL 12-1.4 - 8DF</b>             | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow concrete block <b>Hbn 1.4 - 12DF</b>                | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| <b>MFR 10</b> $h_{nom2} = 70$ mm                           |                             |                       |                   |                                                   |                                              |
| Clay brick <b>Mz-1.8 - 2DF</b>                             | 115                         | 100                   | 3)                | 200                                               | 400                                          |
| Sand-lime solid brick <b>KS - 3DF</b>                      | 175                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 12-1.0 - 12DF</b>                 | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow sand-lime brick <b>KSL 12-1.4 - 8DF</b>             | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick Brique Creuse <b>C 3-0.7</b>             | 200                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow concrete block <b>Hbn 1.4 - 12DF</b>                | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| <b>MFR 14</b>                                              |                             |                       |                   |                                                   |                                              |
| Clay brick <b>Mz-1.8 NF</b>                                | 115                         | 100                   | 3)                | 200                                               | 400                                          |
| Sand-lime solid brick <b>KS - 8DF</b>                      | 240                         | 100                   | 3)                | 200                                               | 400                                          |
| Sand-lime solid brick <b>KS - 2DF</b>                      | 115                         | 100                   | 3)                | 200                                               | 400                                          |
| Hollow clay brick <b>HLz 12-1.0 - 2DF</b>                  | 115                         | 120                   | 3)                | 240                                               | 480                                          |
| Hollow sand-lime brick <b>KSL 12-1.4 - 8DF</b>             | 240                         | 100                   | 3)                | 200                                               | 400                                          |

<sup>1)</sup> Information for base material masonry: see Annex C4, Table C4

<sup>2)</sup> The design method is valid for single anchors and anchor groups with two or four anchors.

<sup>3)</sup>  $a_{min} = \max(250 \text{ mm}; s_{1,min}; s_{2,min})$

**CELO Multifunction frame plug MFR**

**Intended use**

Minimum thickness, spacing, edge distance in masonry

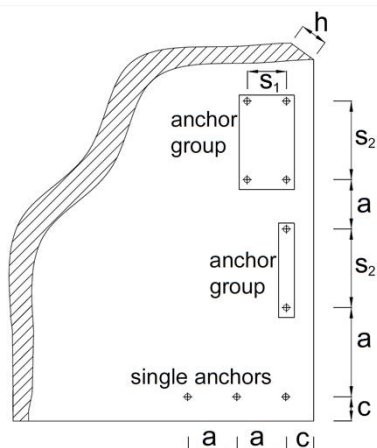
**Annex B4**

**Table B5: Minimum thickness of member, edge distance and anchor spacing in autoclaved aerated concrete**

|                                                                                  | Minimum thickness of member | Minimum edge distance | Minimum spacing   |                            |                       |
|----------------------------------------------------------------------------------|-----------------------------|-----------------------|-------------------|----------------------------|-----------------------|
|                                                                                  |                             |                       | Single anchor     | Anchor Group <sup>1)</sup> |                       |
|                                                                                  |                             |                       |                   | perpendicular to free edge | parallel to free edge |
| Autoclaved aerated concrete with mean compressive strength according to EN 771-4 | $h_{min}$<br>[mm]           | $c_{min}$<br>[mm]     | $a_{min}$<br>[mm] | $s_{1,min}$<br>[mm]        | $s_{2,min}$<br>[mm]   |
| <b>MFR 8</b><br>$h_{nom1} = 50 \text{ mm}$                                       |                             |                       |                   |                            |                       |
| $f_{cm,decl} \geq 2 \text{ N/mm}^2$                                              | 240                         | 50                    | 2)                | 200                        | 400                   |
| $f_{cm,decl} \geq 3,5 \text{ N/mm}^2$                                            | 240                         | 90                    | 2)                | 200                        | 400                   |
| $f_{cm,decl} \geq 6 \text{ N/mm}^2$                                              | 240                         | 150                   | 2)                | 200                        | 400                   |
| <b>MFR 10</b><br>$h_{nom2} = 70 \text{ mm}$                                      |                             |                       |                   |                            |                       |
| $f_{cm,decl} \geq 2 \text{ N/mm}^2$                                              | 240                         | 65                    | 2)                | 100                        | 200                   |
| $f_{cm,decl} \geq 4 \text{ N/mm}^2$                                              | 240                         | 95                    | 2)                | 150                        | 300                   |
| $f_{cm,decl} \geq 6 \text{ N/mm}^2$                                              | 240                         | 120                   | 2)                | 200                        | 400                   |
| <b>MFR 14</b><br>$h_{nom2} = 70 \text{ mm}$                                      |                             |                       |                   |                            |                       |
| $f_{cm,decl} \geq 2 \text{ N/mm}^2$                                              | 100                         | 50                    | 2)                | 100                        | 200                   |
| $f_{cm,decl} \geq 4 \text{ N/mm}^2$                                              | 100                         | 75                    | 2)                | 150                        | 300                   |
| $f_{cm,decl} \geq 6 \text{ N/mm}^2$                                              | 100                         | 150                   | 2)                | 200                        | 400                   |

<sup>1)</sup> The design method is valid for single anchors and anchor groups with two or four anchors.

<sup>2)</sup>  $a_{min} = \max (250 \text{ mm}; s_{1,min}; s_{2,min})$



**CELO Multifunction frame plug MFR**

**Intended use**

Minimum thickness, spacing, edge distance in autoclaved aerated concrete

**Annex B5**



**Table B6: Geometry of stones**

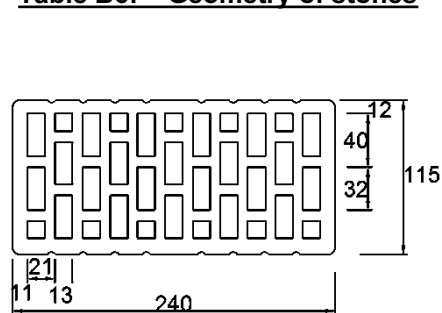


Figure 1 HLz 12 2DF

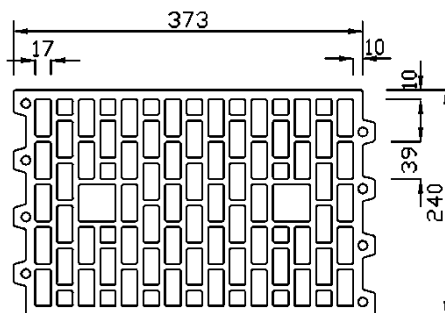


Figure 2 HLz 12 12DF

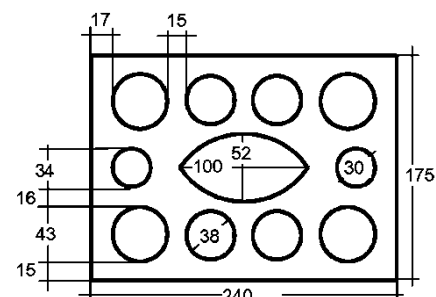


Figure 3 KSL 12-1.4- 3DF

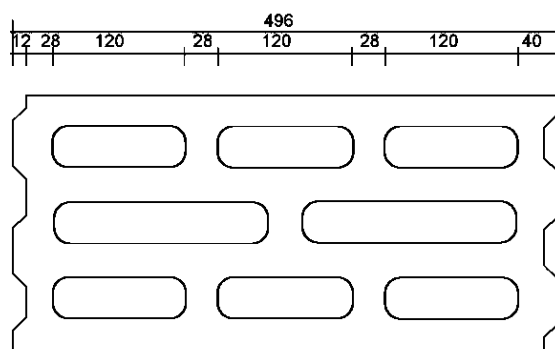
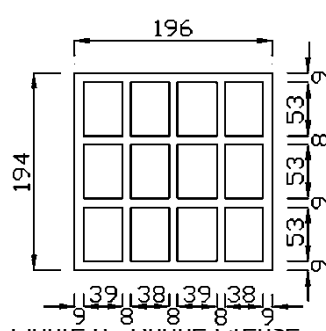
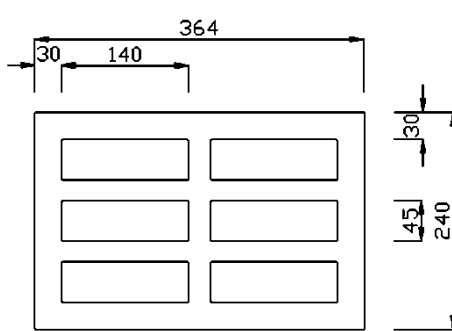
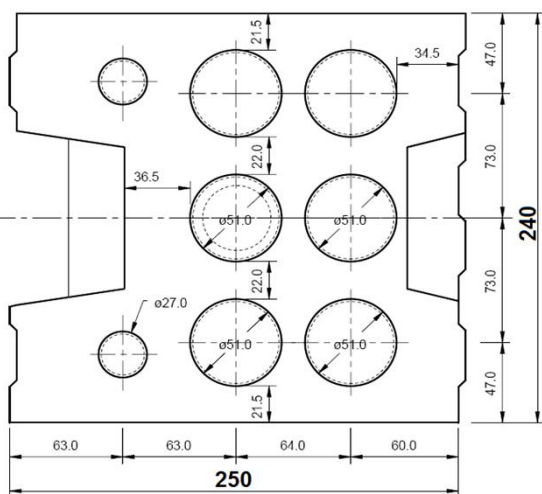


Figure 7 Hbl 2-0,8 16DF

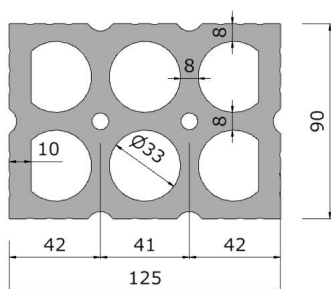


Fig. 8 HLz 1 brick with round holes  
block

(Gero Tochana)

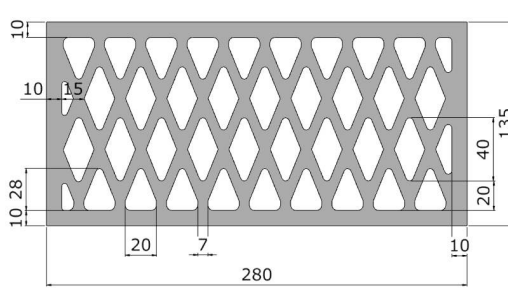


Fig. 9 HLz 2 brick with rhomb holes

(Gero Tejala)

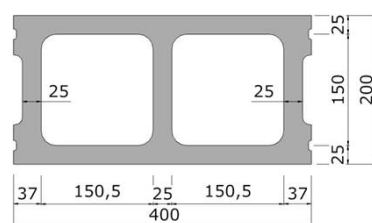


Fig 10 Hbl 7 hollow concrete

(Bloque hormigon)

**CELO Multifunction frame plug MFR**

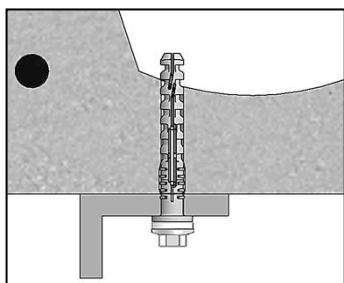
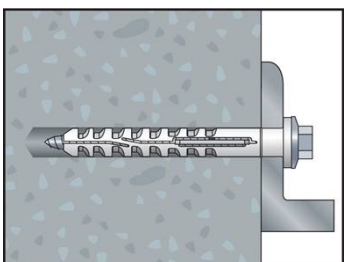
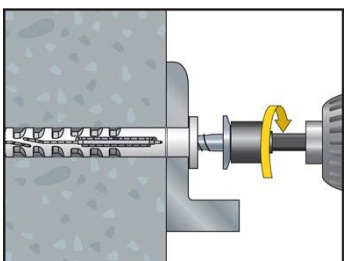
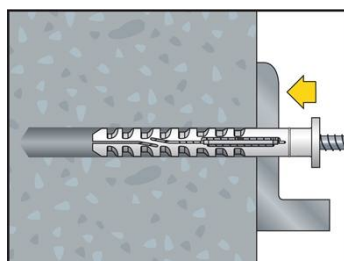
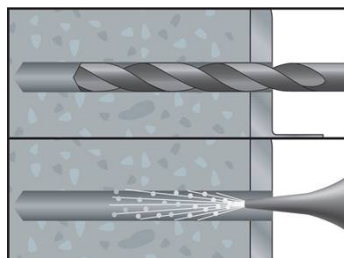
**Intended use**  
Geometry of stones

**Annex B6**

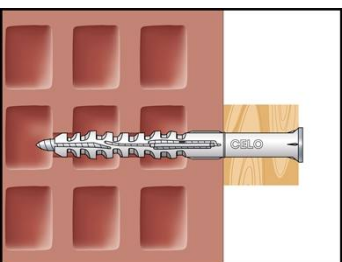
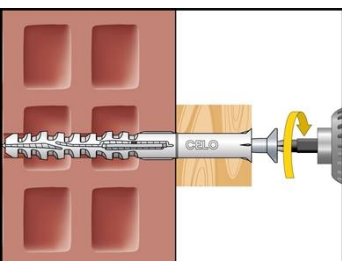
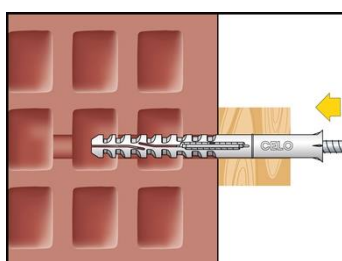
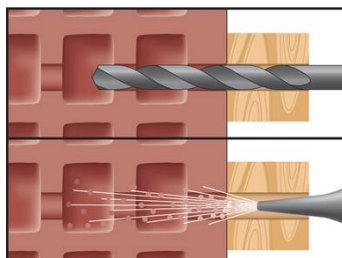


## Installation instruction MFR

in concrete or in  
hollow core slabs



in masonry



1. Drill the borehole and clean the hole.  
Drilling method:  
Concrete: hammer drill  
Masonry: According Table C4, C5, C6

2. Hammer in the plug slightly through the fixture part till the plug is flush to this. Minimum setting depth (50 mm or 70 mm) must be observed.

3. Tighten the screw with screw driver till the screw touches the collar of the sleeve. The screw must fit tight on the surface of the fixture part.

4. Correctly installed plug with screw in concrete or in masonry.

4. Correctly installed plug with screw in hollow concrete core slab.

## CELO Multifunction frame plug MFR

Intended use  
Installation instruction

Annex B7

**Table C1.1: Characteristic bending resistance of the screws**

| <b>Screw Ø 6 mm for MFR 8</b>                                         |                    | galvanised steel 6.8 | stainless steel |
|-----------------------------------------------------------------------|--------------------|----------------------|-----------------|
| Characteristic bending resistance                                     | $M_{Rk,s}$ [Nm]    | 14,1                 | 16,5            |
| Partial safety factor                                                 | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |
| <b>Screw Ø 7 mm for MFR 10-60/ MFR 10 <math>h_{nom2}=50</math> mm</b> |                    | galvanised steel 6.8 | stainless steel |
| Characteristic bending resistance                                     | $M_{Rk,s}$ [Nm]    | 15,3                 | 17,8            |
| Partial safety factor                                                 | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |
| <b>Screw Ø 7 mm for MFR 10 <math>h_{nom1}=70</math> mm</b>            |                    | galvanised steel 6.8 | stainless steel |
| Characteristic bending resistance                                     | $M_{Rk,s}$ [Nm]    | 22,7                 | 26,5            |
| Partial safety factor                                                 | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |
| <b>Screw Ø 10 mm for MFR 14</b>                                       |                    | galvanised steel 6.8 | stainless steel |
| Characteristic bending resistance                                     | $M_{Rk,s}$ [Nm]    | 36,7                 | 42,9            |
| Partial safety factor                                                 | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |

<sup>1)</sup> in absence of other national regulations

**Table C1.2: Characteristic resistance of the screws**

| <b>Failure of expansion element (special screw)</b> |                    |                      |                 |
|-----------------------------------------------------|--------------------|----------------------|-----------------|
| <b>Special screw Ø 6 mm for MFR 8</b>               |                    | galvanised steel 6.8 | stainless steel |
| Characteristic tension resistance                   | $N_{Rk,s}$ [kN]    | 11,7                 | 13,7            |
| Partial safety factor                               | $\gamma_{Ms}^{1)}$ | 1,5                  | 1,87            |
| Characteristic shear resistance                     | $V_{Rk,s}$ [kN]    | 8,1                  | 9,4             |
| Partial safety factor                               | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |
| <b>Special screw Ø 7 mm for MFR 10-60/ MFR 10</b>   |                    | galvanised steel 6.8 | stainless steel |
| Characteristic tension resistance                   | $N_{Rk,s}$ [kN]    | 14,3                 | 16,6            |
| Partial safety factor                               | $\gamma_{Ms}^{1)}$ | 1,5                  | 1,87            |
| Characteristic shear resistance                     | $V_{Rk,s}$ [kN]    | 11,1                 | 12,9            |
| Partial safety factor                               | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |
| <b>Special screw Ø 10 mm for MFR 14</b>             |                    | galvanised steel 6.8 | stainless steel |
| Characteristic tension resistance                   | $N_{Rk,s}$ [kN]    | 30,5                 | 35,5            |
| Partial safety factor                               | $\gamma_{Ms}^{1)}$ | 1,5                  | 1,87            |
| Characteristic shear resistance                     | $V_{Rk,s}$ [kN]    | 15,2                 | 17,8            |
| Partial safety factor                               | $\gamma_{Ms}^{1)}$ | 1,25                 | 1,56            |

<sup>1)</sup> in absence of other national regulations

**CELO Multifunction frame plug MFR**

**Performances**

Characteristic resistance and characteristic bending resistance of the screws

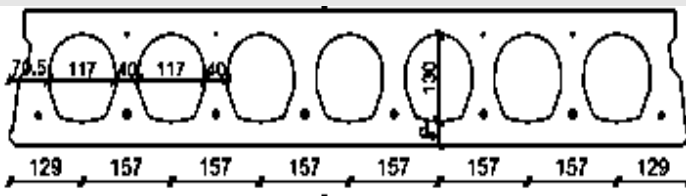
**Annex C1**

**Table C2.1: Characteristic resistance for use in cracked and uncracked concrete**  
(base material group "a")

| Pull-out failure (plastic sleeve)                      |                    |      | Concrete $\geq$ C16/20 |          | Concrete C12/15 |          |
|--------------------------------------------------------|--------------------|------|------------------------|----------|-----------------|----------|
| $\vartheta =$                                          |                    |      | 24/40 °C               | 50/80 °C | 24/40 °C        | 50/80 °C |
| <b>MFR 8</b>                                           |                    |      |                        |          |                 |          |
| Characteristic resistance                              | $N_{Rk,p}$         | [kN] | 2,5                    | 2,5      | 1,5             | 1,5      |
| Partial safety factor                                  | $\gamma_{Mc}^{1)}$ |      | 1,8                    | 1,8      | 1,8             | 1,8      |
| <b>MFR 10-60/ MFR 10 <math>h_{nom1} = 50</math> mm</b> |                    |      |                        |          |                 |          |
| Characteristic resistance                              | $N_{Rk,p}$         | [kN] | 2,5                    | 2,0      | 1,5             | 1,5      |
| Partial safety factor                                  | $\gamma_{Mc}^{1)}$ |      | 1,8                    | 1,8      | 1,8             | 1,8      |
| <b>MFR 10 <math>h_{nom2} = 70</math> mm</b>            |                    |      |                        |          |                 |          |
| Characteristic resistance                              | $N_{Rk,p}$         | [kN] | 4,0                    | 3,5      | 3,0             | 2,5      |
| Partial safety factor                                  | $\gamma_{Mc}^{1)}$ |      | 1,8                    | 1,8      | 1,8             | 1,8      |
| <b>MFR 14</b>                                          |                    |      |                        |          |                 |          |
| Characteristic resistance                              | $N_{Rk,p}$         | [kN] | 4,5                    | 3,0      | 3,0             | 2,0      |
| Partial safety factor                                  | $\gamma_{Mc}^{1)}$ |      | 1,8                    | 1,8      | 1,8             | 1,8      |

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

**Table C2.2: Characteristic resistance for use in precast prestressed hollow core slabs**  
(base material group "a"), temperature range a (+24°/ +40°) and b (+50°/ +80°)

| Pull-out failure (plastic sleeve)                                                   |                    |      | Precast prestressed hollow core slabs                                   |     |
|-------------------------------------------------------------------------------------|--------------------|------|-------------------------------------------------------------------------|-----|
|  |                    |      | Producer: DW Systembau, D-29640<br>Schneverdingen<br>or ANC TEC Leipzig |     |
| <b>MFR 8</b>                                                                        |                    |      | Bottom flange thickness                                                 |     |
| <b>Concrete <math>\geq</math> C45/55</b>                                            |                    |      |                                                                         |     |
| Characteristic resistance                                                           | $N_{Rk,p}$         | [kN] | $d_b \geq 35$ mm                                                        | 3,5 |
| Partial safety factor                                                               | $\gamma_{Mc}^{1)}$ |      |                                                                         | 1,8 |
| <b>MFR 10-60/ MFR 10 <math>h_{nom1} = 50</math> mm</b>                              |                    |      |                                                                         |     |
| <b>Concrete <math>\geq</math> C20/25</b>                                            |                    |      |                                                                         |     |
| Characteristic resistance                                                           | $N_{Rk,p}$         | [kN] | $d_b \geq 35$ mm                                                        | 2,0 |
| Partial safety factor                                                               | $\gamma_{Mc}^{1)}$ |      |                                                                         | 1,8 |
| <b>MFR 10 <math>h_{nom2} = 70</math> mm</b>                                         |                    |      |                                                                         |     |
| <b>Concrete <math>\geq</math> C45/55</b>                                            |                    |      |                                                                         |     |
| Characteristic resistance                                                           | $N_{Rk,p}$         | [kN] | $d_b \geq 35$ mm                                                        | 1,2 |
| Partial safety factor                                                               | $\gamma_{Mc}^{1)}$ |      |                                                                         | 1,8 |

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

#### CELO Multifunction frame plug MFR

#### Performances

Characteristic resistance for use in concrete and in precast hollow core slabs

#### Annex C2

**Table C3.1: Displacements under tension and shear loading in concrete for both temperature ranges**

|                                      | Tension<br>load | Displacement  |                    | Shear<br>load   | Displacement  |                    |
|--------------------------------------|-----------------|---------------|--------------------|-----------------|---------------|--------------------|
| Concrete $\geq$ C16/20               | N <sup>1)</sup> | $\delta_{N0}$ | $\delta_{N\infty}$ | V <sup>1)</sup> | $\delta_{V0}$ | $\delta_{V\infty}$ |
|                                      | [kN]            | [mm]          | [mm]               | [kN]            | [mm]          | [mm]               |
| MFR 8                                | 0,99            | 0,25          | 0,05               | 2,47            | 0,80          | 1,20               |
|                                      |                 |               |                    |                 |               |                    |
| MFR 10-60/ MFR 10 $h_{nom1} = 50$ mm | 0,99            | 0,17          | 0,34               | 1,04            | 0,81          | 1,22               |
|                                      |                 |               |                    |                 |               |                    |
| MFR 10 $h_{nom2} = 70$ mm            | 1,59            | 0,22          | 0,44               | 1,59            | 0,52          | 0,78               |
|                                      |                 |               |                    |                 |               |                    |
| MFR 14                               | 1,79            | 0,30          | 0,60               | 6,04            | 2,50          | 3,75               |

<sup>1)</sup> Intermediate values by linear interpolation

**Table C 3.2: Values under fire exposure in concrete C20/25 to C50/60 in any load direction, no permanent centric tension load and without lever arm, fastening of facade systems**

| Anchor type | Fire resistance class | $F_{Rk,fi,90}$ | $\gamma_{M,fi}$ <sup>1)</sup> |
|-------------|-----------------------|----------------|-------------------------------|
| MFR 10      | R 90                  | 0,8 kN         | 1,0                           |
| MFR 14      | R 90                  | 0,8 kN         | 1,0                           |

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

**CELO Multifunction frame plug MFR**

**Performances**

Displacements under tension and shear loading in concrete  
Values under fire exposure

**Annex C3**

**Table C4: Characteristic resistance  $F_{Rk}$  [kN] in solid and hollow or perforated masonry**  
**(base material group "b" + "c") for MFR 8**

| MFR 8                                                              | Minimum DF<br>or<br>minimum size<br>(L x W x H) | figure/<br>geometry   | Bulk<br>density<br>$\rho$ | Mean com-<br>pressive<br>strength<br>according<br>EN 771 | drill<br>method<br>H= hammer<br>R= rotary | Characteristic<br>resistance<br>$F_{Rk}$ <sup>1)</sup>         |
|--------------------------------------------------------------------|-------------------------------------------------|-----------------------|---------------------------|----------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------|
| Base material                                                      | [mm]                                            |                       | [kg/dm <sup>3</sup> ]     | [N/mm <sup>2</sup> ]                                     |                                           | [kN]                                                           |
|                                                                    |                                                 |                       |                           |                                                          |                                           | $\vartheta = 24/40\text{ °C}$<br>$\vartheta = 50/80\text{ °C}$ |
| Clay brick <b>Mz</b><br>EN 771-1:2011+A1:2015                      | NF<br>(240*115*71)                              |                       | $\geq 1,8$                | $\geq 20$                                                | H                                         | <b>1,5</b>                                                     |
|                                                                    |                                                 |                       |                           | $\geq 10$<br>< 20                                        | H                                         | <b>0,9</b>                                                     |
| Sand-lime solid brick <b>KS</b><br>EN 771-2:2011+A1:2015           | 2DF<br>(240*115*113)                            |                       | $\geq 1,8$                | $\geq 20$                                                | H                                         | <b>3,0</b>                                                     |
|                                                                    |                                                 |                       |                           | $\geq 10$<br>< 20                                        | H                                         | <b>2,0</b>                                                     |
| Hollow clay brick <b>HLz</b><br>EN 771-1:2011+A1:2015              | 12 DF<br>(373*240*249)                          | Annex B6<br>figure 2  | $\geq 1,0$                | $\geq 15$                                                | R<br>only                                 | <b>0,5</b>                                                     |
|                                                                    |                                                 |                       |                           | $\geq 12$                                                |                                           | <b>0,4</b>                                                     |
| Hollow clay brick <b>HLz 1</b><br>(Gero Tochana)                   | (285*125*90)                                    | Annex B6<br>figure 8  | $\geq 0,8$                | $\geq 3$                                                 | R<br>only                                 | <b>0,9</b>                                                     |
| Hollow clay brick <b>HLz 2</b><br>(Gero Tejala)                    | (280*135*90)                                    | Annex B6<br>figure 9  | $\geq 1,0$                | $\geq 6,0$                                               | R<br>only                                 | <b>0,9</b>                                                     |
|                                                                    |                                                 |                       |                           |                                                          |                                           | <b>0,75</b> <sup>3)</sup>                                      |
| Hollow Sand-lime brick <b>KSL</b><br>EN 771-2:2011+A1:2015         | 3 DF<br>(240*175*113)                           | Annex B6<br>figure 3  | $\geq 1,4$                | $\geq 17$                                                | R                                         | <b>1,2</b>                                                     |
|                                                                    |                                                 |                       |                           | $\geq 12$                                                |                                           | <b>0,75</b>                                                    |
| Hollow light concrete block<br><b>Hbl</b><br>EN 771-3:2011+A1:2015 | 16 DF<br>(500*240*248)                          | Annex B6<br>figure 7  | $\geq 0,8$                | $\geq 1,2$                                               | R                                         | <b>0,3</b>                                                     |
| Hollow light concrete block<br><b>Hbl 7</b> (Bloque hormigon)      | (400*200*200)                                   | Annex B6<br>figure 10 | $\geq 1,0$                | $\geq 6$                                                 | R                                         | <b>0,9</b>                                                     |
| Hollow concrete block <b>Hbn</b><br>EN 771-3:2011+A1:2015          | 12 DF<br>(365*240*238)                          | Annex B6<br>figure 5  | $\geq 1,4$                | $\geq 25$                                                | H                                         | <b>1,2</b>                                                     |
| Partial safety factor <sup>2)</sup>                                | $\gamma_{Mm}$                                   |                       |                           |                                                          |                                           | <b>2,5</b>                                                     |

<sup>1)</sup> Characteristic resistance for tension, shear or combined tension and shear loading

<sup>2)</sup> In absence of other national regulations

<sup>3)</sup> For temperature range 50/80°C

**CELO Multifunction frame plug MFR**

**Performances**

MFR 8 – Characteristic resistance for use in masonry

**Annex C4**

**Table C5: Characteristic resistance  $F_{Rk}$  [kN] in solid and hollow or perforated masonry**  
**(base material group "b" + "c") for MFR 10 and MFR 10-60**

| MFR 10-60/ MFR 10                                                                            | Minimum DF<br>or<br>minimum<br>size<br>(L x W x H) | figure/<br>geo-<br>metry | Bulk<br>density<br>$\rho$ | Mean com-<br>pressive<br>strength<br>accord-<br>ing<br>EN 771 | drill<br>method<br>H=<br>hammer<br>R =<br>rotary | Characteristic<br>resistance<br>$F_{Rk}^{1)}$<br>$h_{nom1} = 50 \text{ mm}$ |                            | Characteristic<br>resistance<br>$F_{Rk}^{1)}$<br>$h_{nom2} = 70 \text{ mm}$ |                     |
|----------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------|---------------------------|---------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------|---------------------|
|                                                                                              |                                                    |                          |                           |                                                               |                                                  | [kN]                                                                        | [kN]                       | [kN]                                                                        | [kN]                |
| Base material                                                                                | [mm]                                               |                          | [kg/dm <sup>3</sup> ]     | [N/mm <sup>2</sup> ]                                          |                                                  | $\eta =$<br>24/40°C                                                         | $\eta =$<br>50/80°C        | $\eta =$<br>24/40°C                                                         | $\eta =$<br>50/80°C |
| Clay brick <b>Mz</b><br>EN 771-1:2011+A1:2015                                                | 2DF<br>(240*115*113)                               |                          | $\geq 1,8$                | $\geq 20$                                                     | H                                                | <b>3,0</b>                                                                  | <b>2,5</b>                 | <b>4,0</b>                                                                  | <b>4,0</b>          |
|                                                                                              |                                                    |                          |                           | $\geq 10$<br>$< 20$                                           | H                                                | <b>2,0</b>                                                                  | <b>1,5</b>                 | <b>3,0</b>                                                                  | <b>3,0</b>          |
| Sand-lime solid brick <b>KS</b><br>EN 771-2:2011+A1:2015                                     | 3DF<br>(240*175*113)                               |                          | $\geq 1,8$                | $\geq 20$                                                     | H                                                | <b>4,0</b>                                                                  | <b>3,5</b>                 | <b>4,0</b>                                                                  | <b>4,0</b>          |
|                                                                                              |                                                    |                          |                           | $\geq 10$<br>$< 20$                                           | H                                                | <b>2,5</b>                                                                  | <b>2,5</b>                 | <b>3,0</b>                                                                  | <b>3,0</b>          |
| Hollow clay brick <b>HLz</b><br>EN 771-1:2011+A1:2015                                        | 12 DF<br>(373*240*249)                             | Annex B6<br>figure 2     | $\geq 1,0$                | $\geq 12$                                                     | R<br>only                                        | <b>1,2</b>                                                                  | <b>0,9</b>                 | <b>1,5</b>                                                                  | <b>1,2</b>          |
| Hollow clay brick <b>HLz 1</b><br>(Gero Tochana)                                             | (285*125*90)                                       | Annex B6<br>figure 8     | 0,8                       | $\geq 3$                                                      | R<br>only                                        | <b>1,2</b>                                                                  | <b>0,9</b>                 | <sup>3)</sup>                                                               | <sup>3)</sup>       |
| Hollow clay brick <b>HLz 2</b><br>(Gero Tejala)                                              | (280*135*90)                                       | Annex B6<br>figure 9     | 1,0                       | $\geq 5,9$                                                    | R<br>only                                        | <b>0,75</b>                                                                 | <b>0,6</b>                 | <sup>3)</sup>                                                               | <sup>3)</sup>       |
| Hollow sandlime brick<br><b>KSL</b><br>EN 771-2:2011+A1:2015                                 | 8 DF<br>(250*240*237)                              | Annex B6<br>figure 4     | $\geq 1,4$                | $\geq 12$                                                     | R                                                | <b>1,5</b>                                                                  | <b>1,2</b>                 | <b>1,5</b>                                                                  | <b>1,2</b>          |
| Hollow concrete block<br><b>Hbn</b><br>EN 771-3:2011+A1:2015                                 | 12 DF<br>(365*240*238)                             | Annex B6<br>figure 5     | $\geq 1,4$                | $\geq 15$                                                     | H                                                | <b>2,5</b>                                                                  | <b>2,0</b>                 | <b>2,0</b>                                                                  | <b>1,5</b>          |
| Hollow light concrete<br>block <b>Hbl 7</b><br>(Bloque hormigon)                             | (400*200*200)                                      | Annex B6<br>figure 10    | $\geq 1,0$                | $\geq 6$                                                      | R                                                | <b>0,6</b><br>MFR<br>10-60                                                  | <b>0,5</b><br>MFR<br>10-60 | <sup>3)</sup>                                                               | <sup>3)</sup>       |
|                                                                                              |                                                    |                          |                           |                                                               |                                                  | <b>0,75</b><br>MFR 10                                                       | <b>0,6</b><br>MFR 10       | <sup>3)</sup>                                                               | <sup>3)</sup>       |
| Hollow clay brick<br>Brique Creuse C<br><b>LD 3-0,7-500x200x200</b><br>EN 771-1:2011+A1:2015 | (496*196*194)                                      | Annex B6<br>figure 6     | $\geq 0,7$                | $\geq 3$                                                      | R<br>only                                        | <sup>3)</sup>                                                               | <sup>3)</sup>              | <b>0,3</b>                                                                  | <b>0,3</b>          |
| Partial safety factor <sup>2)</sup>                                                          | $\gamma_{Mm}$                                      |                          |                           |                                                               |                                                  |                                                                             |                            | <b>2,5</b>                                                                  |                     |

1) Characteristic resistance for tension, shear or combined tension and shear loading

2) In absence of other national regulations

3) No performance assessed

4) If shear loading is not in direction to the free edge

**CELO Multifunction frame plug MFR**

**Performances**

MFR 10 – Characteristic resistance for use in masonry

**Annex C5**

**Table C6: Characteristic resistance  $F_{Rk}$  [kN] in solid and hollow or perforated masonry**  
**(base material group "b" + "c") for MFR 14**

| MFR 14                                                     | Minimum DF<br>or<br>minimum size<br>(L x W x H) | figure/<br>geometry  | Bulk<br>density<br>$\rho$ | Mean com-<br>pressive<br>strength<br>according<br>EN 771 | drill<br>method<br>H= hammer<br>R= rotary | Characteristic<br>resistance<br>$F_{Rk}$ <sup>1)</sup> |                        |
|------------------------------------------------------------|-------------------------------------------------|----------------------|---------------------------|----------------------------------------------------------|-------------------------------------------|--------------------------------------------------------|------------------------|
| Base material                                              | [mm]                                            |                      | [kg/dm <sup>3</sup> ]     | [N/mm <sup>2</sup> ]                                     |                                           | [kN]                                                   |                        |
|                                                            |                                                 |                      |                           |                                                          |                                           | $\vartheta = 24/40$ °C                                 | $\vartheta = 50/80$ °C |
| Clay brick <b>Mz</b><br>EN 771-1:2011+A1:2015              | NF<br>(240*116*71)                              |                      | $\geq 1,8$                | $\geq 20$                                                | H                                         | 4,5                                                    | 3,0                    |
|                                                            |                                                 |                      |                           | $\geq 10$<br>< 20                                        | H                                         | 3,0                                                    | 2,0                    |
| Sand-lime solid brick <b>KS</b><br>EN 771-2:2011+A1:2015   | 8 DF<br>(250*240*237)                           |                      | $\geq 1,8$                | $\geq 15$                                                | H                                         | 4,5                                                    | 4,5                    |
|                                                            |                                                 |                      |                           | $\geq 10$<br>< 20                                        | H                                         | 3,5                                                    | 3,0                    |
| Sand-lime solid brick <b>KS</b><br>EN 771-2:2011+A1:2015   | 2 DF<br>(240*115*113)                           |                      | $\geq 1,8$                | $\geq 20$                                                | H                                         | 4,5                                                    | 4,0                    |
|                                                            |                                                 |                      |                           | $\geq 10$<br>< 20                                        | H                                         | 3,0                                                    | 2,5                    |
| Hollow clay brick <b>HLz</b><br>EN 771-1:2011+A1:2015      | 2 DF<br>(235*115*113)                           | Annex B6<br>figure 1 | $\geq 1,0$                | $\geq 12$                                                | R<br>only                                 | 0,75                                                   | 0,5                    |
| Hollow sand-lime brick <b>KSL</b><br>EN 771-2:2011+A1:2015 | 8 DF<br>(250*240*237)                           | Annex B6<br>figure 4 | $\geq 1,4$                | $\geq 12$                                                | R                                         | 1,2                                                    | 0,6                    |
| Partial safety factor <sup>2)</sup>                        | $\gamma_{Mm}$                                   |                      |                           |                                                          |                                           | 2,5                                                    |                        |

<sup>1)</sup> Characteristic resistance for tension, shear or combined tension and shear loading

<sup>2)</sup> In absence of other national regulations

**CELO Multifunction frame plug MFR**

**Performances**

MFR 14 – Characteristic resistance for use in masonry

**Annex C6**

**Table C7: Displacements under tension and shear loading in masonry for both temperature ranges  
(base material group “b” and “c”)**

|                                                        | Tension<br>load | Displacements |                    | Shear<br>load | Displacements |                    |
|--------------------------------------------------------|-----------------|---------------|--------------------|---------------|---------------|--------------------|
|                                                        | N               | $\delta_{N0}$ | $\delta_{N\infty}$ | V             | $\delta_{V0}$ | $\delta_{V\infty}$ |
|                                                        | [kN]            | [mm]          | [mm]               | [kN]          | [mm]          | [mm]               |
| <b>MFR 8</b>                                           | 0,57            | 0,33          | 0,66               | 0,57          | 0,48          | 0,72               |
|                                                        |                 |               |                    |               |               |                    |
| <b>MFR 10-60/ MFR 10 <math>h_{nom1} = 50</math> mm</b> | 0,71            | 0,29          | 0,58               | 0,71          | 0,62          | 0,93               |
|                                                        |                 |               |                    |               |               |                    |
| <b>MFR 10 <math>h_{nom2} = 70</math> mm</b>            | 0,57            | 0,12          | 0,24               | 1,86          | 1,55          | 2,33               |
|                                                        |                 |               |                    |               |               |                    |
| <b>MFR 14</b>                                          | 1,43            | 0,20          | 0,40               | 1,43          | 1,19          | 1,79               |

**CELO Multifunction frame plug MFR**

**Performances**

Displacements for use in masonry

**Annex C7**



## Base material solid masonry: Autoclaved Aerated Concrete

**Table C8.1: Brick Data**

| Description of brick                               |                       | Autoclaved aerated concrete              |
|----------------------------------------------------|-----------------------|------------------------------------------|
| Type of brick                                      |                       | unreinforced autoclaved aerated concrete |
| Bulk density $\rho \geq$                           | [kg/dm <sup>3</sup> ] | 0,35                                     |
| European Standard                                  |                       | EN 771-4:2011+A1:2015                    |
| Minimum thickness of member MFR 8 $h_{\min} =$     | [mm]                  | 240                                      |
| Minimum thickness of member MFR 10/14 $h_{\min} =$ | [mm]                  | 240                                      |

Installation parameters see Annex B2

**Table C8.2: Characteristic resistance  $F_{Rk}$  [kN] in autoclaved aerated concrete (base material group "d")**

| Base material                               | mean compressive strength according to EN 771-4:2011 +A1:2015 $f_{cm,decl}$ | Drill method     | Characteristic resistance $F_{Rk}$ <sup>1)</sup> |                        |
|---------------------------------------------|-----------------------------------------------------------------------------|------------------|--------------------------------------------------|------------------------|
|                                             | [N/mm <sup>2</sup> ]                                                        |                  | [kN]                                             |                        |
|                                             |                                                                             |                  | $\vartheta = 24/40$ °C                           | $\vartheta = 50/80$ °C |
| <b>MFR 8 <math>h_{nom} = 50</math> mm</b>   |                                                                             |                  |                                                  |                        |
| Autoclaved aerated concrete                 | $\geq 2$                                                                    | Rotary drilling  | <b>0,3</b>                                       | <b>0,3</b>             |
|                                             | $\geq 3,5$                                                                  | Rotary drilling  | <b>1,2</b>                                       | <b>0,9</b>             |
|                                             | $\geq 6$                                                                    | Rotary drilling  | <b>2,0</b>                                       | <b>1,5</b>             |
| <b>MFR 10 <math>h_{nom2} = 70</math> mm</b> |                                                                             |                  |                                                  |                        |
| Autoclaved aerated concrete                 | $\geq 2$                                                                    | Rotary drilling  | <b>0,5</b>                                       | <b>0,4</b>             |
|                                             | $\geq 4$                                                                    | Rotary drilling  | <b>1,5</b>                                       | <b>1,5</b>             |
|                                             | $\geq 6$                                                                    | Rotary drilling  | <b>2,5</b>                                       | <b>2,5</b>             |
| <b>MFR 14 <math>h_{nom} = 70</math> mm</b>  |                                                                             |                  |                                                  |                        |
| Autoclaved aerated concrete                 | $\geq 2$                                                                    | Rotary drilling  | <b>0,3</b>                                       | <b>0,3</b>             |
|                                             | $\geq 4$                                                                    | Rotary drilling  | <b>1,2</b>                                       | <b>1,2</b>             |
|                                             | $\geq 6$                                                                    | Rotary drilling  | <b>2,0</b>                                       | <b>2,0</b>             |
| Partial safety factor <sup>2)</sup>         |                                                                             | $\gamma_{M,AAC}$ | <b>2,0</b>                                       |                        |

<sup>1)</sup> Characteristic resistance  $F_{Rk}$  for tension, shear or combined tension and shear loading

<sup>2)</sup> In absence of other national regulations

<sup>3)</sup> If shear loading is not in direction to the free edge

### CELO Multifunction frame plug MFR

#### Performances

MFR 8/10/14 – Characteristic resistance for use in autoclaved aerated concrete

**Annex C8**

**Table C9: Displacements under tension and shear loading in autoclaved aerated concrete  
for both temperature ranges**

| Autoclaved aerated concrete<br>with mean compressive strength<br>according to<br>EN 771-4:2011 +A1:2015 | Tension<br>load<br>N<br>[kN] | Displacements         |                            | Shear<br>load<br>V<br>[kN] | Displacements         |                            |
|---------------------------------------------------------------------------------------------------------|------------------------------|-----------------------|----------------------------|----------------------------|-----------------------|----------------------------|
|                                                                                                         |                              | $\delta_{N0}$<br>[mm] | $\delta_{N\infty}$<br>[mm] |                            | $\delta_{V0}$<br>[mm] | $\delta_{V\infty}$<br>[mm] |
| <b>MFR 8 <math>h_{nom} = 50</math> mm</b>                                                               |                              |                       |                            |                            |                       |                            |
| $f_{cm,decl} \geq 2$ N/mm <sup>2</sup>                                                                  | 0,11                         | 0,04                  | 0,09                       | 0,11                       | 0,11                  | 0,16                       |
| $f_{cm,decl} \geq 3,5$ N/mm <sup>2</sup>                                                                | 0,43                         | 0,05                  | 0,10                       | 0,43                       | 0,33                  | 0,50                       |
| $f_{cm,decl} \geq 6$ N/mm <sup>2</sup>                                                                  | 0,71                         | 0,19                  | 0,38                       | 0,71                       | 0,55                  | 0,82                       |
| <b>MFR 10 <math>h_{nom2} = 70</math> mm</b>                                                             |                              |                       |                            |                            |                       |                            |
| $f_{cm,decl} \geq 2$ N/mm <sup>2</sup>                                                                  | 0,18                         | 0,06                  | 0,13                       | 0,18                       | 0,15                  | 0,23                       |
| $f_{cm,decl} \geq 4$ N/mm <sup>2</sup>                                                                  | 0,55                         | 0,11                  | 0,22                       | 0,55                       | 0,69                  | 1,04                       |
| $f_{cm,decl} \geq 6$ N/mm <sup>2</sup>                                                                  | 0,89                         | 0,11                  | 0,22                       | 0,89                       | 1,19                  | 1,79                       |
| <b>MFR 14</b>                                                                                           |                              |                       |                            |                            |                       |                            |
| $f_{cm,decl} \geq 2$ N/mm <sup>2</sup>                                                                  | 0,11                         | 0,10                  | 0,20                       | 0,11                       | 0,20                  | 0,30                       |
| $f_{cm,decl} \geq 4$ N/mm <sup>2</sup>                                                                  | 0,43                         | 0,10                  | 0,20                       | 0,43                       | 0,90                  | 1,30                       |
| $f_{cm,decl} \geq 6$ N/mm <sup>2</sup>                                                                  | 0,71                         | 0,10                  | 0,20                       | 0,71                       | 1,40                  | 2,10                       |

**CELO Multifunction frame plug MFR**

**Performances**

MFR 8/10/14 – Displacements for use in autoclaved aerated concrete under tension and shear load

**Annex C9**