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**Business Division III – Fire Protection for Buildings**

Head of Business Division: Dr.-Ing. Peter Nause

**Working Group 3.2 – Fire Characteristics of Components**

# Expert Opinion

GSIII/08-103

20.01.2009 First Copy

| | |
|---|---|
| Subject: | Expert opinion on the fire characteristics of reinforced-concrete walls in combination with KE double-wall transport anchors with respect to fire resistance for 90 minutes |
| Client: | H-Bau Technik GmbH |
| | Am Güterbahnhof |
| | D-79771 Klettgau |
| Date of order: | 04.12.2008 |
| Project manager: | Dr. Nause |

This expert opinion comprises 6 pages.

## 1 Order/reason for order

With your e-mail of 04.12.2008, you commissioned MFPA Leipzig to draw up an expert opinion on the fire characteristics of load bearing or non load bearing reinforced-concrete walls for the construction of closed spaces when used in combination with permanently embedded KE double-wall transport anchors, with respect to fire resistance for 90 minutes.

This expert opinion is made necessary by the fact that the planned design of reinforced-concrete wall structures combined with KE double-wall transport anchors is not covered directly by DIN 4102-4 or any other general tests used in the regulation of the construction industry.

## 2 Basis of this expert opinion and related documents

This expert opinion is based, on the one hand, on the requirements of construction-industry regulations, which require classification of reinforced-concrete wall structures combined with KE double-wall transport anchors to form a fire-resistant structure and, on the other hand, on the following additional information and documents:

- DIN 4102-2,

- DIN 4102-4,

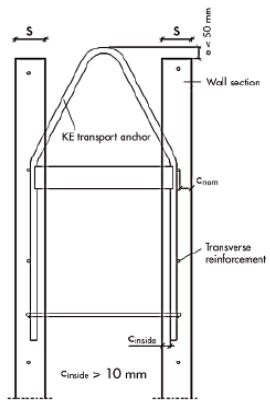
- Technical data sheets supplied by H-Bau Technik GmbH, relating to KE double-wall transport anchors.

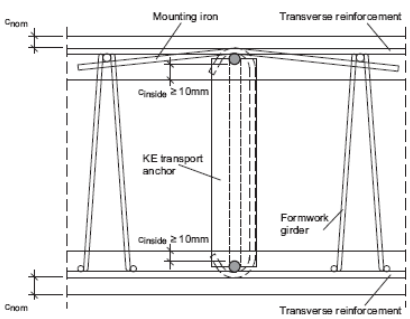
This assessment draws not only on the above materials but also on the extensive experience of MFPA Leipzig GmbH in testing the fire characteristics of reinforced-concrete structures.

## 3 Description of the structure

KE double-wall transport anchors are used for righting and transporting prefabricated reinforced-concrete double walls both at the prefabrication plant and on construction sites. They are composed of concrete reinforcing steel and a compression member made of wood and, after concreting, they remain in the continuous solid wall, which is at least 180 mm thick. According to the information you provided, the minimum outside concrete coverage of the round steel bar of the transport anchor (minimum bar diameter for KE I = 10 mm) is 20 mm, giving a minimum concrete coverage of the wooden compression member embedded in the concrete of about 25 mm. Figure 1 below shows the design of the KE double-wall transport anchor in schematic form.

Figure 1: Design of KE double-wall transport anchors in schematic form



No further description of the KE double-wall transport anchor will be given, attention being drawn to the information in the following figure 2 since it is shown in sufficient detail there.

Figure 2: Dimensions of the KE double-wall transport anchor

| Type | KE I* | | KE III | | KE IV* | |
|---|---|---|---|---|---|---|
| | Dimensions [mm] | | Dimensions [mm] | | Dimensions [mm] | |
| | w | l | w | l | w | l |
| 120 | 120 | 370 | 120 | 515 | 120 | 750 |
| 130 | 130 | 370 | 130 | 515 | 130 | 750 |
| 140 | 140 | 370 | 140 | 515 | 140 | 750 |
| 150 | 150 | 370 | 150 | 515 | 150 | 750 |
| 160 | 160 | 370 | 160 | 515 | 160 | 750 |
| 170 | 170 | 370 | 170 | 515 | 170 | 750 |
| 180 | 180 | 405 | 180 | 565 | 180 | 800 |
| 190 | 190 | 405 | 190 | 565 | 190 | 800 |
| 200 | 200 | 405 | 200 | 565 | 200 | 800 |
| 210 | 210 | 405 | 210 | 565 | 210 | 800 |
| 220 | 220 | 405 | 220 | 565 | 220 | 800 |
| 230 | 230 | 405 | 230 | 565 | 230 | 800 |

| Type | KE I* | | KE III | | KE IV* | |
|---|---|---|---|---|---|---|
| | Dimensions [mm] | | Dimensions [mm] | | Dimensions [mm] | |
| | w | l | w | l | w | l |
| 240 | 240 | 405 | 240 | 565 | 240 | 800 |
| 250 | 250 | 440 | 250 | 615 | 250 | 850 |
| 260 | 260 | 440 | 260 | 615 | 260 | 850 |
| 270 | 270 | 440 | 270 | 615 | 270 | 850 |
| 280 | 280 | 440 | 280 | 615 | 280 | 850 |
| 290 | 290 | 440 | 290 | 615 | 290 | 850 |
| 300 | 300 | 440 | 300 | 615 | 300 | 850 |
| 310 | 310 | 460 | 310 | 645 | 310 | 880 |
| 320 | 320 | 460 | 320 | 645 | 320 | 880 |
| 330 | 330 | 460 | 330 | 645 | 330 | 880 |
| 340 | 340 | 460 | 340 | 645 | 340 | 880 |
| 350 | 350 | 460 | 350 | 645 | 350 | 880 |

| Concrete covering on the outside $c_{nom}$ [mm] | Concrete covering on the inside $c_{innen}$ [mm] | Minimum shuttering thickness min s* [mm] |
|---|---|---|
| 20 | ≥ 10 mm<br>≥ 20 mm [4] | 50 |
| 25 | | 55 |
| 30 | | 60 |

[4] Only applies to KE IV transport anchors with 200 mm widths per side in the anchor region.

## 4 Expert opinion

The solid reinforced-concrete walls described in section 3, combined with KE double-wall transport anchors, were assessed with respect to fire protection on the basis of DIN 4102-4 and extensive experience in the testing of such structures, to determine whether they meet the protection targets required by building regulations (maintenance of load-bearing capacity, sealing of enclosed space and insulation) when subjected to fire for 90 minutes on one side in accordance with the standard temperature-time curve specified in DIN 4102-4.

On condition that minimum wall thicknesses of 180 mm and the specified 25-mm minimum concrete coverage of the wooden compression member are maintained, it is sufficiently certain that there need be no reservations about assigning the reinforced-concrete walls, combined with the KE double-wall transport anchors that remain throughout their cross section, to fire resistance class F90 since, on the one hand, the minimum wall thicknesses specified in DIN 4102-4 are significantly exceeded and, on the other hand, ignition and, furthermore, burning through in this partial area within 90 minutes can be excluded.

It can therefore be stated with sufficient certainty that the fire protection targets specified by DIN 4102-2: 09-1977 will be achieved by reinforced-concrete walls with the specified minimum thickness of 180 mm combined with the permanently embedded KE double-wall transport anchors, as regards maintenance of

- sealing of the enclosed space,
- insulation and
- stability

when subjected to fire for 90 minutes on one side in accordance with the standard temperature-time curve given in DIN 4102-2.