MFPA Leipzig GmbH

Testing, Inspection and Certification Authority for
Construction Products and Construction Types

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Notice of extension of the validity of the advisory opinion no. GS 3.2/16-352-1 from 7th February 2017

27th September 2021

No. Copy 1

Subject matter:	fischer Highbond anchors FHB II and FHB II Inject Fire protection assessment of the characteristic steel stresses under tension stress based on the Technical Report TR 020 "Evaluation of Anchorages in Concrete concerning Resistance to Fire" (May 2004).
Client:	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 D-79211 Denzlingen
Person in charge:	Dipl.-Ing. S. Bauer
Validity:	6th February 2027

This notice extends the period of validity of the advisory opinion no. GS 3.2/16-352-1 from 7th February 2017.

This notice is only valid in conjunction with the advisory opinion no. GS 3.2/16-352-1 from 7th February 2017 and may only be used in conjunction with it.

The results of the tests exclusively relate to the items tested. This document does not replace a certificate of conformity or suitability according to national and European building codes.

Leipzig, 27th September 2021

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MFPA Leipzig GmbH III SAC 02 NB 0800

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Advisory Opinion No. GS 3.2/16-352-1

7 February 2017
No. Copy 1

Subject matter:	fischer Highbond anchors FHB II and FHB II Inject Fire protection assessment of the characteristic steel stresses under tension stress based on the Technical Report TR 020 "Evaluation of anchorages in concrete concerning Resistance to Fire" (May 2004).
Client:	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen Germany
Date of order:	27 October 2016
Person in charge:	Dipl.-Wirtsch.-Ing. S. Kramer
Validity:	6 February 2022

This advisory opinion consists of 5 text pages and 6 enclosures.

Gesellschaft für Materialforschung und Prüfungsanstalt für das Bauwesen Leipzig mbH (MFPA Leipzig GmbH)

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1 Objective and request

On 27 October 2016, MFPA Leipzig GmbH was commissioned by fischerwerke GmbH & Co. KG to assess the fischer Highbond anchors FHB II and FHB II Inject under one-sided fire exposure and anchored in a reinforced concrete base to determine the characteristic parameters for a load under tension stress.

2 Description of the tested structure

The fischer Highbond anchors FHB II and FHB II Inject are bonded fasteners with torque-controlled expansion in accordance with ETA-05/0164 [1] and ETA-16/0637 [2] which consist of FIS HB injection mortar or an FHB II – P(F) capsule and anchor rods with cones and thread as well as a hexagon nut with washer made of galvanized carbon steel, stainless steel or the highly corrosion resistant steel 1.4529. The load is transferred into the anchor base via mechanical interlock of several cones in the composite mortar and a combination of bond strength and friction forces.

There are two types of anchor rods. While the FHB II – AL version is optimized for anchoring in the tensile area and is produced in sizes M8 to M24, the FHB II – AS version is optimized for a higher shear load-bearing capacity and is used in sizes M10 to M24. The FHB II – AS has two cones in all sizes; the FHB II – AL has two cones in size M8, three in sizes M10 to M16 and four in sizes M20 and M24. A detailed description of the FHB II - AL anchor rod is shown in enclosure 1, for FHB II - AS anchor rod in enclosure 4.

The dowel is only intended for anchoring under mainly static and quasi-static load in reinforced and non-reinforced standard concrete with a strength class between C20/25 and C50/60 in accordance with DIN EN 206-1: 2000-12 [3]. The fastener may be used in cracked and uncracked concrete.

The difference between FHB II and FHB II Inject is that the FHB II Inject has only been approved for installation using the FIS HB injection mortar. Installation using a mortar capsule is not admissible. This means that the roof-like cutting edge at the tip of the anchor rod and the hexagonal drive at the end of the thread can be omitted which slightly reduces the borehole depth. For an image of the FHB II Inj - AL anchor rod, refer to enclosure 2. The FHB II Inj – AS anchor rod is shown in enclosure 5.

A detailed description of these two products is not given here. Please refer to ETA-05/0164 [1] and ETA-16/0637 [2].

The tests of the fischer Highbond anchor FHB II, the results of which are summarized in the following, were performed using sizes M8, M10 and M16 of the galvanized version with minimum tensile strength class 8.8. The test set-up and the results of this series of tests are included in test report PB III/B-06-065 [4].

3 Test analysis and evaluation

The test analysis for steel failure was performed based on TR 020: 2004-05 [5]. As an exception, all results were included in the analysis, independent of the type of failure. A graphical analysis of the test results can be found in enclosure 3.

The determination of the characteristic parameters for other failure types (e.g. "pulling out", or "concrete break-out") was not the subject of the tests; these parameters can be determined according to the simplified design method described in TR 020: 2004-05 [5] or experimentally according to the method described in TR 020: 2004-05 [5].

To determine the characteristic tensile stresses, the values for FHB II – AL M8 and M12 as well as FHB II – AS M10 and M12 were analysed based on the test results. The results for FHB II – AL M10 were calculated by the interpolation of the values for sizes FHB II – AL M8 and M12 based on the steel cross section. For the bonded fasteners > M12, the cross-sectional stress of size M12 was transferred to determine the results for steel failure. To determine the bond failure values, the average bond strength of the smallest relevant tested fastener was transferred. In each case, the lower failure resistance is decisive and is indicated in the tables below.

Despite the slightly reduced anchoring depths of FHB II Inject, the test results for FHB II can also apply to FHB II Inject since there are no differences regarding the installation parameters, in particular fastener geometry, borehole diameter and effective anchoring depth.

This means that the following characteristic parameters for load under centric tension can be specified for the fischer Highbond anchors FHB II and FHB II Inject (table 1 for AL and table 3 for AS). The results for load under shear stress are indicated in table 2 for AL and in table 4 for AS.

Table 1 *Characteristic resistance for the fischer Highbond anchors FHB II and FHB II Inject – version AL (galvanized, strength class ≥ 8.8) under tension load*

FHB II – AL and FHB II Inj. - AL			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Anchorage depth	h_{ef}	[mm]	60	95	100 120	125 145 160	210	210
30 min	$N_{Rk,s,fi(30)}$	[kN]	2.3	3.6	5.1	9.5	14.9	21.5
60 min	$N_{Rk,s,fi(60)}$	[kN]	1.8	2.7	3.8	7.0	11.0	15.8
90 min	$N_{Rk,s,fi(90)}$	[kN]	1.2	1.8	2.4	4.5	7.1	10.2
120 min	$N_{Rk,s,fi(120)}$	[kN]	0.9	1.4	1.7	3.3	5.2	7.4

Table 2 *Characteristic resistance for the fischer Highbond anchors FHB II and FHB II Inject – version AL (galvanized, strength class ≥ 8.8) under shear load*

FHB II – AL and FHB II Inj. - AL			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Anchorage depth	h_{ef}	[mm]	60	95	100 120	125 145 160	210	210
30 min	$N_{Rk,s,fi(30)}$	[kN]	2.8	4.3	6.1	11.4	17.8	25.7
60 min	$N_{Rk,s,fi(60)}$	[kN]	2.1	3.3	4.9	9.1	14.2	20.4
90 min	$N_{Rk,s,fi(90)}$	[kN]	1.4	2.4	3.6	6.8	10.6	15.5
120 min	$N_{Rk,s,fi(120)}$	[kN]	1.0	1.9	3.0	5.6	8.8	12.7

Table 3 *Characteristic resistance for the fischer Highbond anchors FHB II and FHB II Inject – version AS (galvanized, strength class ≥ 8.8) under tension load*

FHB II – AS and FHB II Inj. - AS			**M10**	**M12**	**M16**	**M20**	**M24**
Anchorage depth	h_{ef}	[mm]	60 75	75	95	170	170
30 min	$N_{Rk,s,fi(30)}$	[kN]	3.4	4.4	8.3	12.9	18.7
60 min	$N_{Rk,s,fi(60)}$	[kN]	2.4	3.5	6.1	10.2	14.8
90 min	$N_{Rk,s,fi(90)}$	[kN]	1.4	2.6	4.4	7.5	10.9
120 min	$N_{Rk,s,fi(120)}$	[kN]	0.9	2.1	3.6	6.1	8.9

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Table 4 *Characteristic resistance for the fischer Highbond anchors FHB II and FHB II Inject – version AS (galvanized, strength class ≥ 8.8) under shear load*

FHB II – AS and FHB II Inj. - AS			**M10**	**M12**	**M16**	**M20**	**M24**
Anchorage depth	h_{ef}	[mm]	60 75	75	95	170	170
30 min	$N_{Rk,s,fi(30)}$	[kN]	4.1	4.9	9.2	14.4	20.8
60 min	$N_{Rk,s,fi(60)}$	[kN]	2.9	4.0	7.5	11.7	17.0
90 min	$N_{Rk,s,fi(90)}$	[kN]	1.8	3.1	5.9	9.3	13.3
120 min	$N_{Rk,s,fi(120)}$	[kN]	1.2	2.7	5.0	7.8	11.4

The values were determined for use in uncracked reinforced concrete. The characteristic resistances against pulling out were determined using the simplified verification procedure according to TR 020: 2004-05 [5], section 2.2.1.2. This means that even if the determined bond strengths are reduced to 70%, steel failure is still decisive. For this reason, the results can be transferred to use in cracked reinforced concrete.

4 Special notes

The evaluation above only applies to fischer Highbond anchors FHB II and FHB II Inject which are installed in compliance with the installation instructions of fischerwerke GmbH & Co. KG.

For the dimensioning of the fischer Highbond anchors FHB II and FHB II Inject, the characteristic steel stresses at normal temperature must also be taken into account; the lower load bearing capacity is decisive.

The assessment only applies if the FIS HB two-component injection mortar or the FHB II – P capsule system and the FHB II – PF cartridge for shorter curing periods are used.

Furthermore, the assessment only applies to bonded anchors made of galvanized steel with a minimum strength class of ≥ 8.8, stainless steel A4 or highly corrosion-resistant steel 1.4529 in uncracked and cracked reinforced concrete.

The assessment applies in general to a one-sided fire exposure of the structural elements. In the event of a fire load on several sides, the verification procedure can only be applied if the edge distance of the anchor is c ≥ 300 mm and ≥ 2 h_{ef}.

The assessment only applies in combination with reinforced concrete ceilings of strength class ≥ C 20/25 and ≤ C 50/60 acc. to EN 206-1: 2000-12 [3], which have at least the fire-resistance rating which corresponds to the fire-resistance period of the anchors. In addition, the notes contained in DIN EN 1992-1 [6] (see section 4.5) on the avoidance of concrete spallation also apply. This means that the moisture content must be less than three % by weight (or four according to the National Annex).

This document does not replace a certificate of conformity or suitability according to national and European building codes.

Leipzig, 7 February 2017

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List of enclosures

Enclosure 1	Installation parameters of fischer Highbond anchor FHB II - AL
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Enclosure 6	Graphical analysis of the test results of FHB II – AS according to TR 020: 2004-05 [4]

Related documents

[1] European Technical Assessment ETA-05/0164 *trade name: fischer Highbond anchor FHB II; product family: Torque controlled bonded anchor for use in concrete*, DIBt: 24 January 2017, fischerwerke GmbH & Co. KG

[2] European Technical Assessment ETA-16/0637 *trade name: fischer Highbond anchor FHB II Inject; product family: Torque controlled bonded anchor for use in concrete*, DIBt: 24 January 2017, fischerwerke GmbH & Co. KG

[3] DIN EN 206-1: 2000-12 *Concrete - Specification, performance, production and conformity*

[4] Test report PB III/B-06-065 *fischer Highbond anchor FHB II - Testing in accordance with the Technical Report TR 020 for determining the fire resistance duration as a function of the centric tensile load or the shear load*, MFPA Leipzig GmbH: 18 April 2006, fischerwerke GmbH & Co. KG

[5] TR 020: 2004-05 *Evaluation of Anchorages in Concrete concerning Resistance to Fire*

[6] DIN EN 1992-1-2: 2010-12 *Design of concrete structures - Part 1-2: General rules - Structural fire design*

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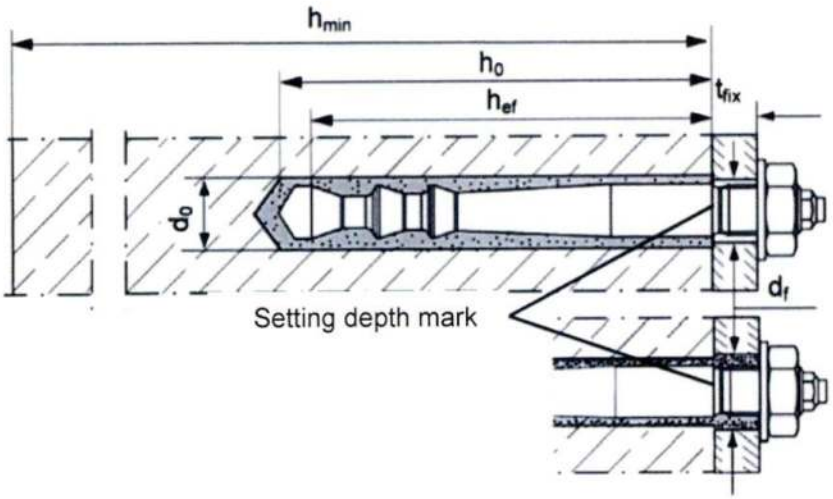
Enclosure 1 Installation parameters of fischer Highbond anchor FHB II - AL



Highbond anchor
FHB II – A L
pre-positioned installation

Highbond anchor
FHB II – A L
push-through installation
(not with mortar capsule)
annular gap filled with mortar

Figure A1.1 Illustration of the fischer Highbond anchors FHB II - AL in installed condition

Table A1.1 Installation parameters of fischer Highbond anchor FHB II - AL

Anchor rod FHB II – A L		**Thread**		**M8x**	**M10x**	**M12x**		**M16x**			**M20x**	**M24x**
				60	**95**	**100**	**120**	**125**	**145**	**160**	**210**	**210**
Correspondending mortar capsules **FHB II-P** or **FHB II-PF**			[-]	8x 60	10x 95	12x 100	12x 120	16x 125	16x 145	16x 160	20x 210	24x 210
Cone diameter		d_k	[mm]	9,4	10,7	12,5		16,8			23,0	
Width across flats		SW		13	17	19		24			30	36
Nominal drill hole diameter		d_0		10	12	14		18			25	
Drill hole depth		h_0		75	110	115	135	140	160	175	235	
Effective anchorage depth		h_{ef}		60	95	100	120	125	145	160	210	
Minimum spacing and minimum edge distance		$s_{min} = c_{min}$		40		50		55	60	70	90	
Diameter of clearance hole in the fixture[1]	pre-positioned anchorage	$d_f \leq$		9	12	14		18			22	26
	push through anchorage[2]	$d_f \leq$		11	14	16		20			26	
Min. thickness of concrete member		h_{min}		100	140		170		190	220	280	
Installation torque		T_{inst}	[Nm]	15	20	40		60			100	
Thickness of fixure		$t_{fix} \leq$	[mm]	1500								
fischer filling disk FFD[3]		$\geq d_a$		-	26	30		38			46	54
		t_s		-	6	6		7			8	10

[1] For larger clearance holes in the fixture see EOTA ETAG 001 Annex C, 08/2010 or CEN/TS 1992-4-:2009
[2] Only with mortar cartridge system FIS HB
[3] Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

Provided by the client.

Enclosure 2 Installation parameters of fischer Highbond anchor FHB II Inj.- AL

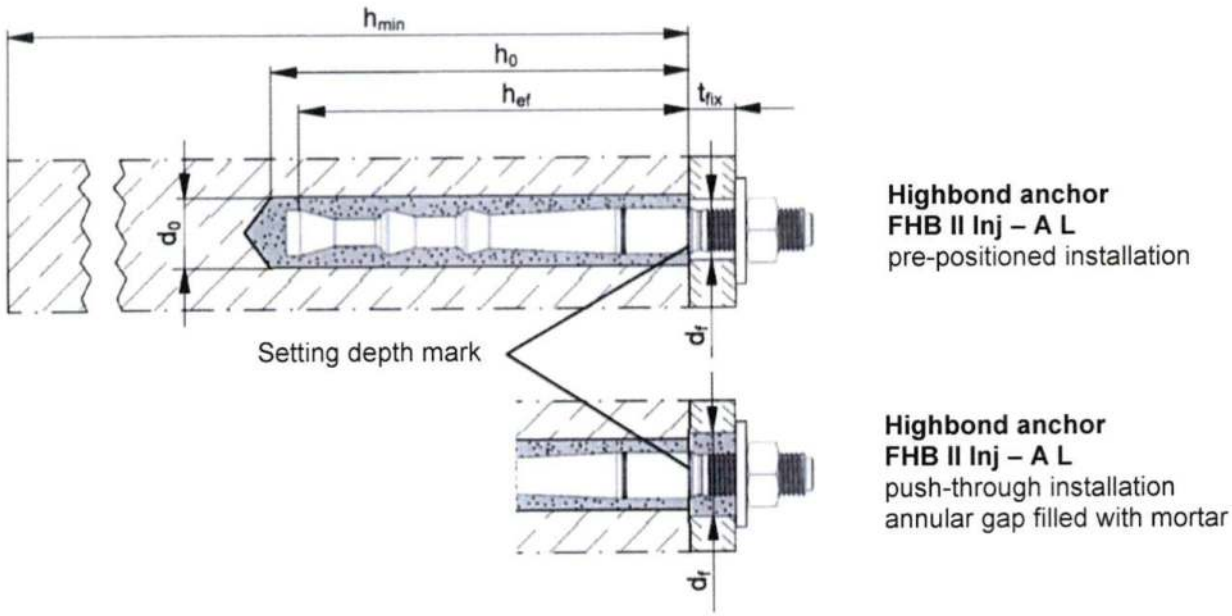


Figure A2.2 Illustration of the fischer Highbond anchors FHB II Inj. - AL in installed condition

Table A2.2 Installation parameters of fischer Highbond anchor FHB II Inj. - AL

Anchor rod FHB II Inject– A L		**Thread**		**M8x**	**M10x**	**M12x**		**M16x**			**M20x**	**M24x**
				60	**95**	**100**	**120**	**125**	**145**	**160**	**210**	**210**
Cone diameter		d_k	[mm]	9,4	10,7	12,5		16,8			23,0	
Width across flats		SW		13	17	19		24			30	36
Nominal drill hole diameter		d_0		10	12	14		18			25	
Drill hole depth		h_0		66	101	106	126	131	151	166	216	
Effective anchorage depth		h_{ef}		60	95	100	120	125	145	160	210	
Minimum spacing and minimum edge distance		$s_{min} = c_{min}$		40		50		55	60	70	90	
Diameter of clearance hole in the fixture[1]	pre-positioned anchorage	$d_f \leq$		9	12	14		18			22	26
	push through anchorage	$d_f \leq$		11	14	16		20			26	
Min. thickness of concrete member		h_{min}		100	140		170		190	220	280	
Installation torque		T_{inst}	[Nm]	15	20	40		60			100	
Thickness of fixure		$t_{fix} \leq$	[mm]	1500								
fischer filling disk FFD[2]		$\geq d_a$		-	26	30		38			46	54
		t_s		-	6	6		7			8	10

[1] For larger clearance holes in the fixture see EOTA ETAG 001 Annex C, 08/2010 or CEN/TS 1992-4-:2009
[2] Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

Enclosure 3 Graphical analysis of the test results of FHB II – AL according to TR 020: 2004-05 [4]

Diagram 3.1 Graphical analysis of FHB II – AL under tension load in size M8

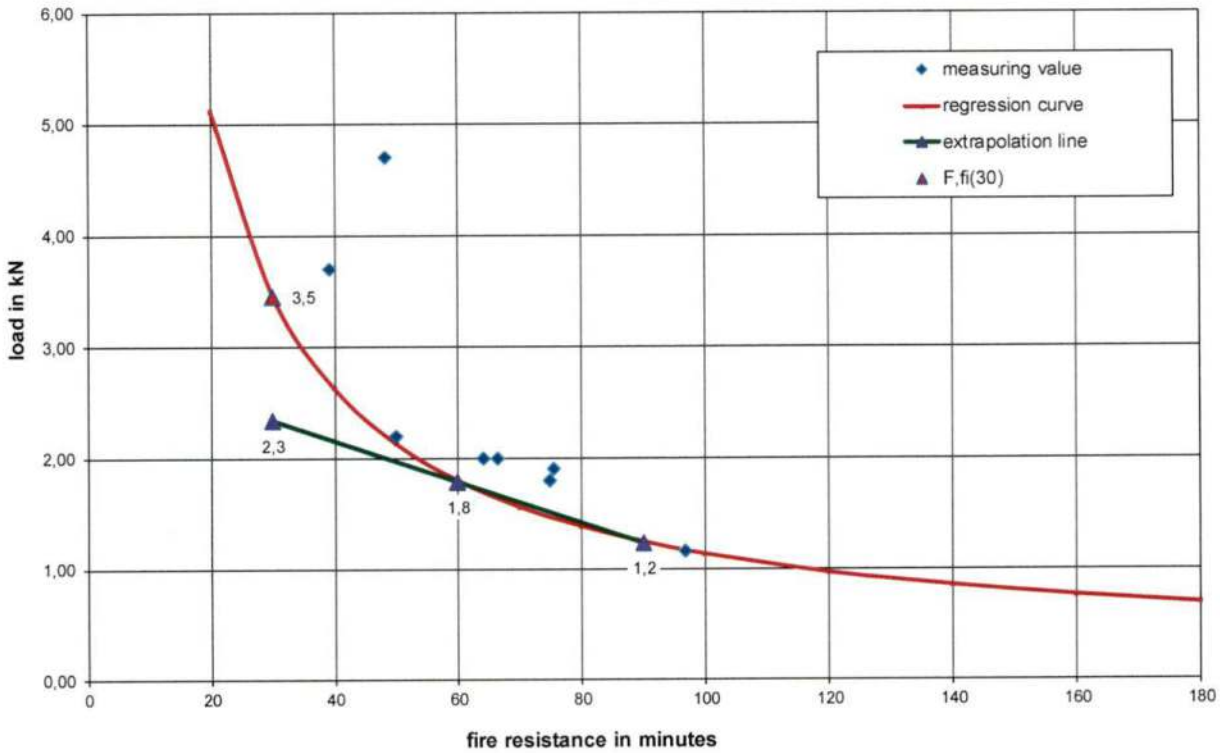


Diagram 3.2 Graphical analysis of FHB II – AL under tension load in size M12

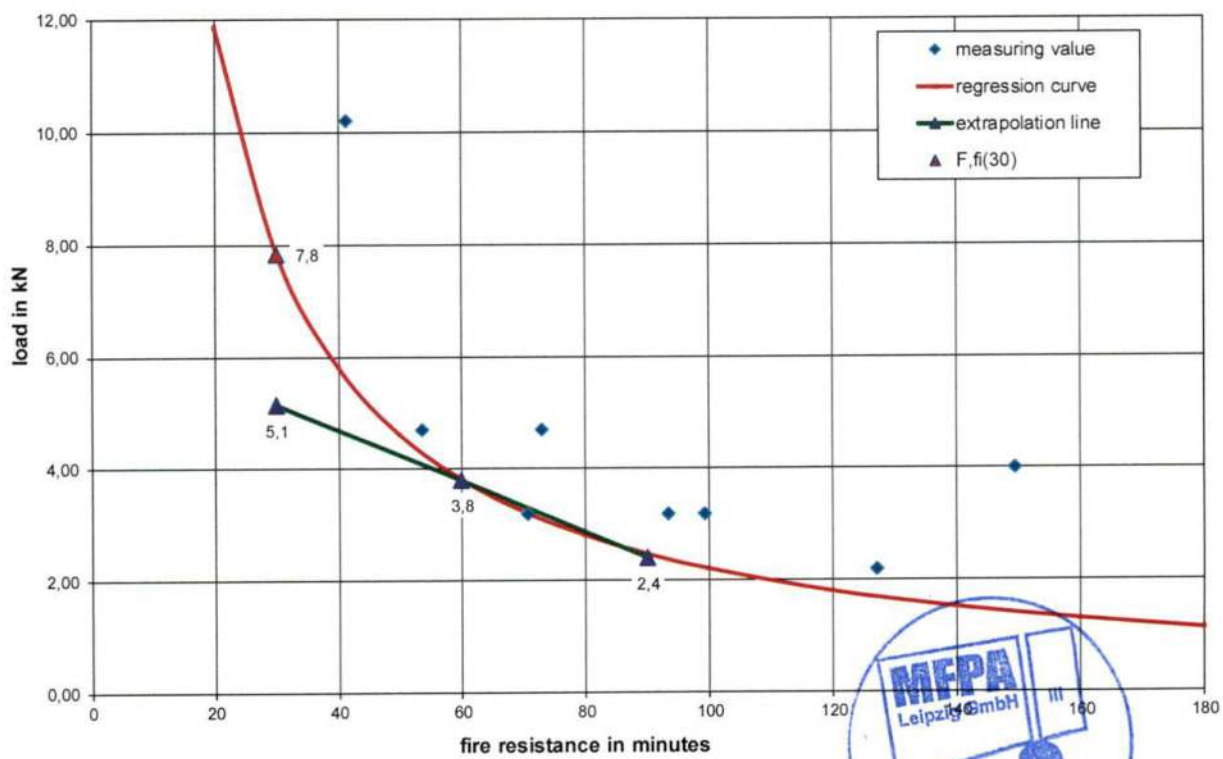


Diagram 3.3 Graphical analysis of FHB II – AL under shear load in size M8

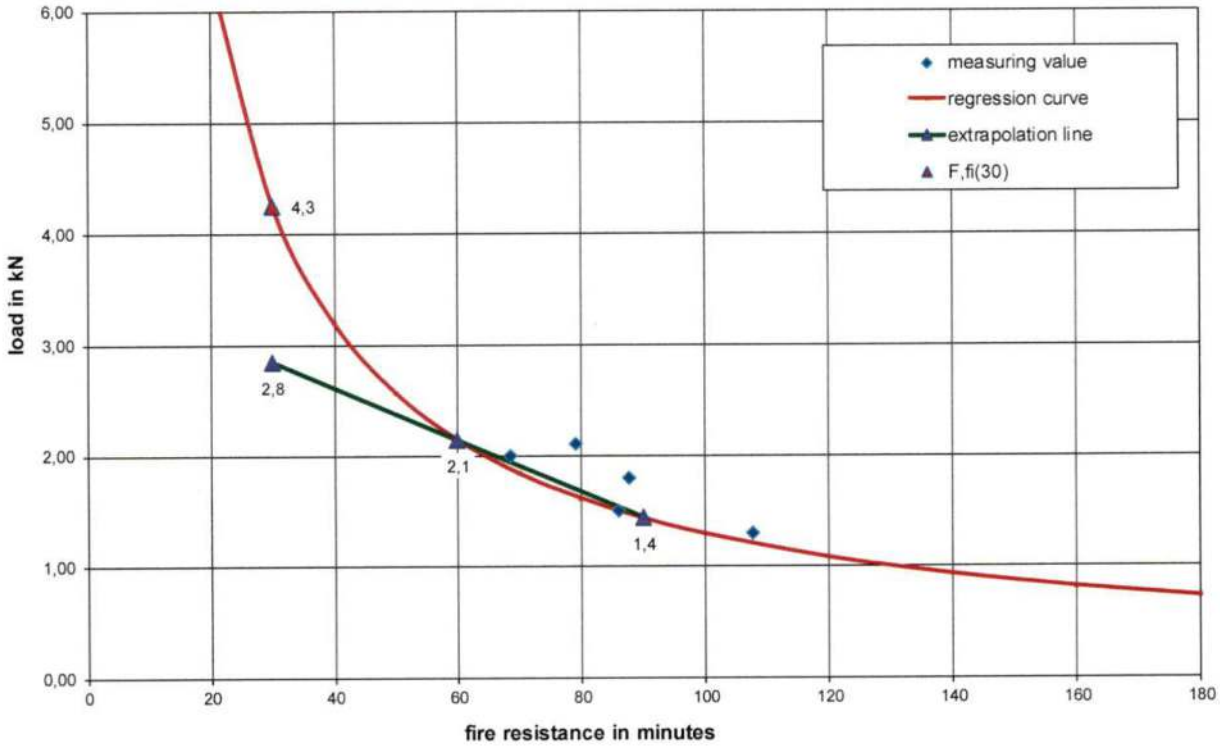
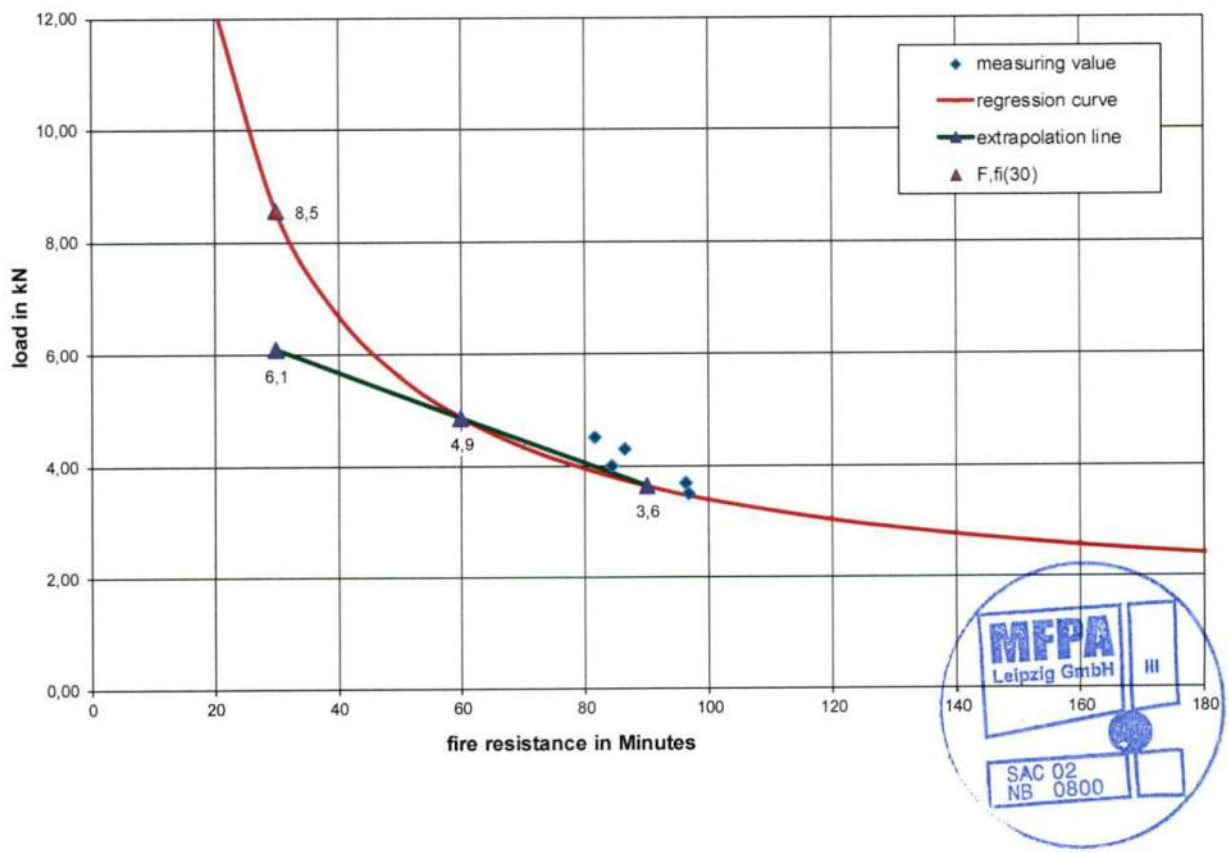
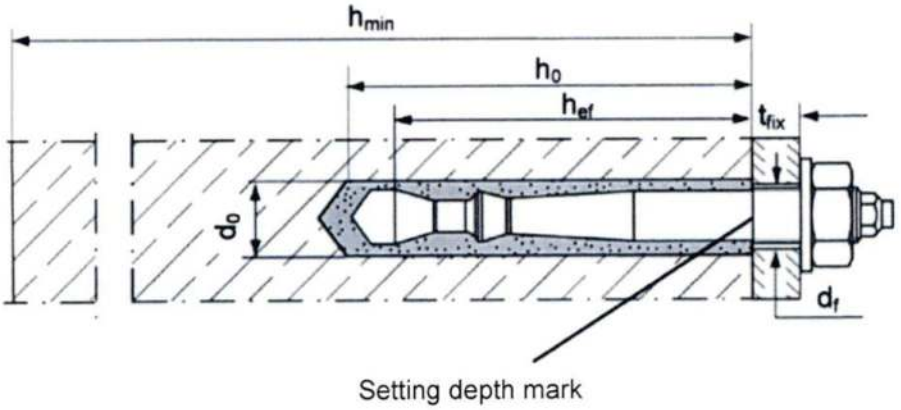


Diagram 3.4 Graphical analysis of FHB II – AL under shear load in size M12



Enclosure 4 Installation parameters of fischer Highbond anchor FHB II - AS



Highbond anchor
FHB II – A S
pre-positioned installation and push-through installation

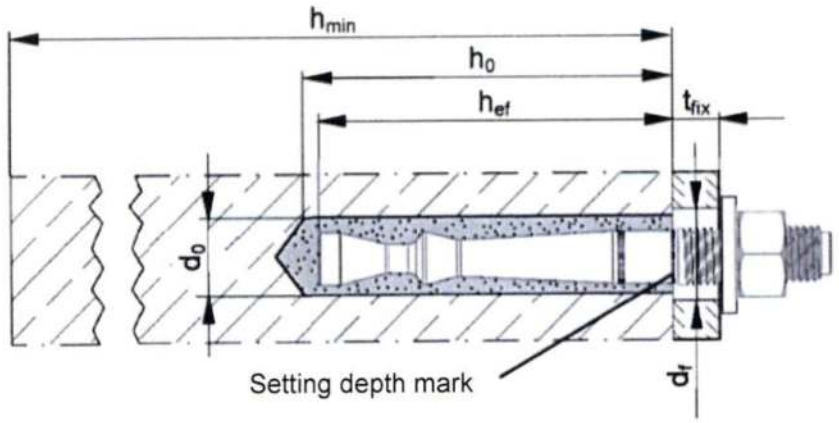
Figure A4.3 Illustration of the fischer Highbond anchors FHB II - AS in installed condition

Table A4.3 Installation parameters of fischer Highbond anchor FHB II - AS

Anchor rod FHB II – A S		**Thread**		**M10x**		**M12x**	**M16x**	**M20x**	**M24x**
				60	**75**	**75**	**95**	**170**	**170**
Correspondending mortar capsules **FHB II-P** or **FHB II-PF**			[-]	10x60	10x75	12x75	16x95	20x170	24x170
Cone diameter		d_k	[mm]	9,4		11,3	14,5	23,0	
Width across flats		SW		17		19	24	30	36
Nominal drill hole diameter		d_0		10		12	16	25	
Drill hole depth		h_0		75	90	90	110	190	
Effective anchorage depth		h_{ef}		60	75	75	95	170	
Minimum spacing and minimum edge distance		$s_{min} = c_{min}$		40			50	80	
Diameter of clearance hole in the fixture[1]	pre-positioned anchorage	$d_f \leq$		12		14	18	22	26
	push through anchorage	$d_f \leq$		12		14	18	26	
Min. thickness of concrete member		h_{min}		100	120		150	240	
Installation torque		T_{inst}	[Nm]	15		30	50	100	
Thickness of fixure		$t_{fix} \leq$	[mm]	1500					
fischer filling disk FFD[2]		$\geq d_a$		26		30	38	46	54
		t_s		6		6	7	8	10

[1] For larger clearance holes in the fixture see EOTA ETAG 001 Annex C, 08/2010 or CEN/TS 1992-4-1:2009
[2] Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

Enclosure 5 Installation parameters of fischer Highbond anchor FHB II Inj.- AS



Highbond anchor
FHB II Inj – A S
pre-positioned installation
and push-through
installation

Figure A5.4 Illustration of the fischer Highbond anchors FHB II Inj.- AS in installed condition

Table A5.4 Installation parameters of fischer Highbond anchor FHB II Inj. - AS

Anchor rod FHB II Inject – A S	**Thread**		**M10x**		**M12x**	**M16x**	**M20x**	**M24x**
			60	**75**	**75**	**95**	**170**	**170**
Cone diameter	d_k	[mm]	9,4		11,3	14,5	23,0	
Width across flats	SW		17		19	24	30	36
Nominal drill hole diameter	d_0		10		12	16	25	
Drill hole depth	h_0		66	81	81	101	176	
Effective anchorage depth	h_{ef}		60	75	75	95	170	
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		40			50	80	
Diameter of clearance hole in the fixture[1] pre-positioned anchorage	$d_f \leq$		12		14	18	22	26
Diameter of clearance hole in the fixture[1] push through anchorage	$d_f \leq$		12		14	18	26	
Min. thickness of concrete member	h_{min}		100	120		150	240	
Installation torque	T_{inst}	[Nm]	15		30	50	100	
Thickness of fixure	$t_{fix} \leq$	[mm]	1500					
fischer filling disk FFD[2]	$\geq d_a$		26		30	38	46	54
	t_s		6		6	7	8	10

[1] For larger clearance holes in the fixture see EOTA ETAG 001 Annex C, 08/2010 or CEN/TS 1992-4-:2009
[2] Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

Enclosure 6 Graphical analysis of the test results of FHB II – AS according to TR 020: 2004-05 [4]

Diagram 6.1 Graphical analysis of FHB II – AS under tension load in size M10

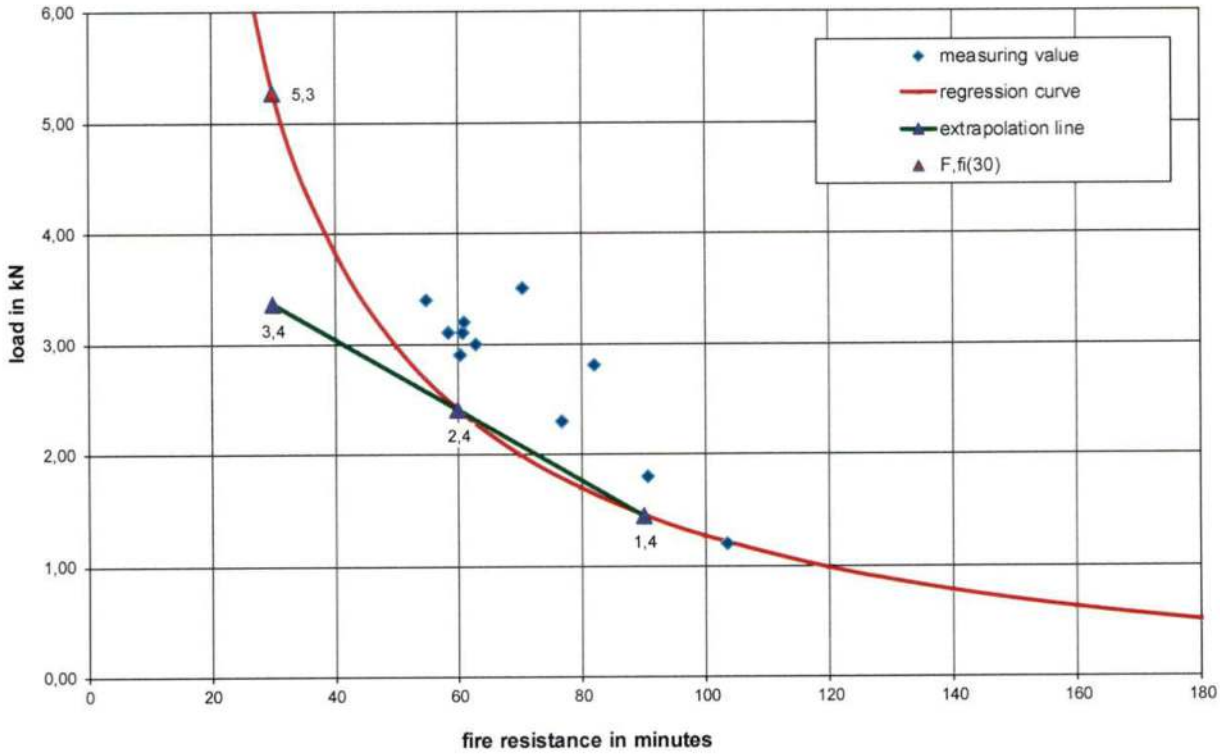


Diagram 6.2 Graphical analysis of FHB II – AS under tension load in size M12

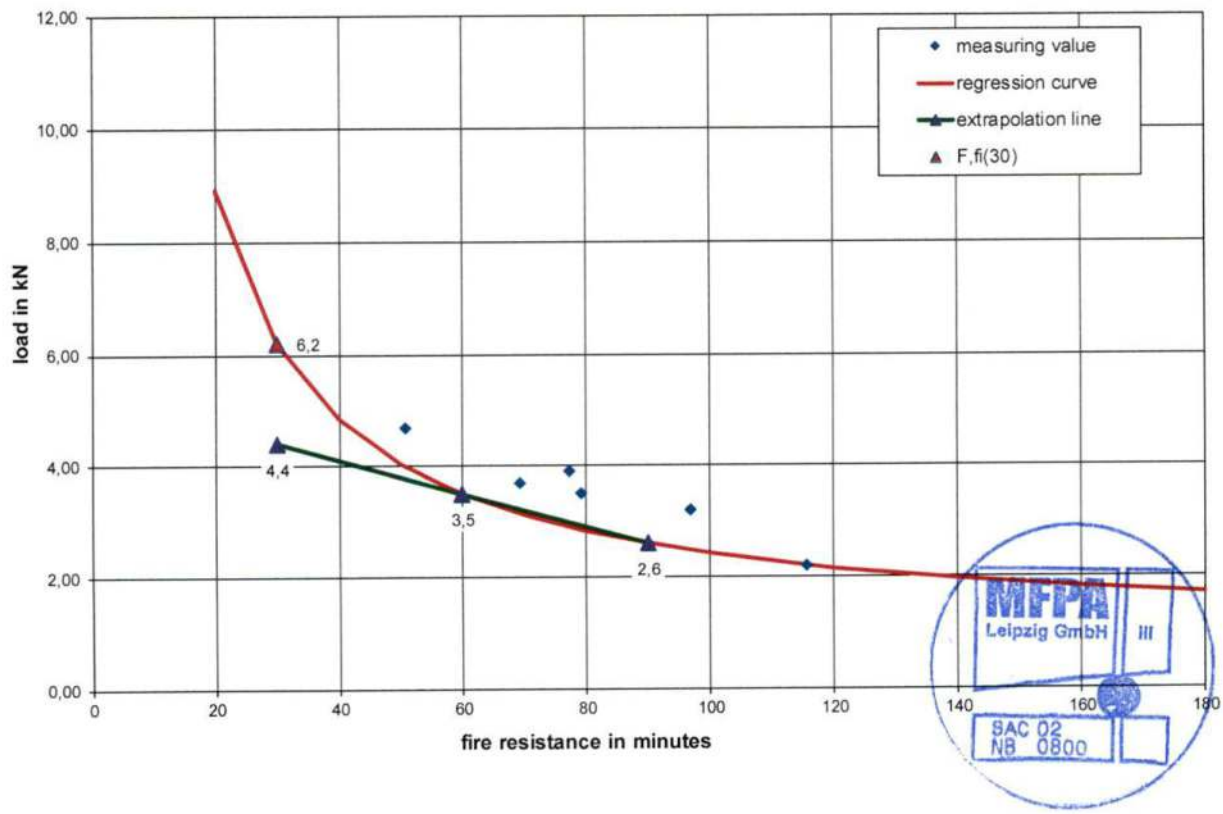


Diagram 6.3 Graphical analysis of FHB II – AS under shear load in size M10

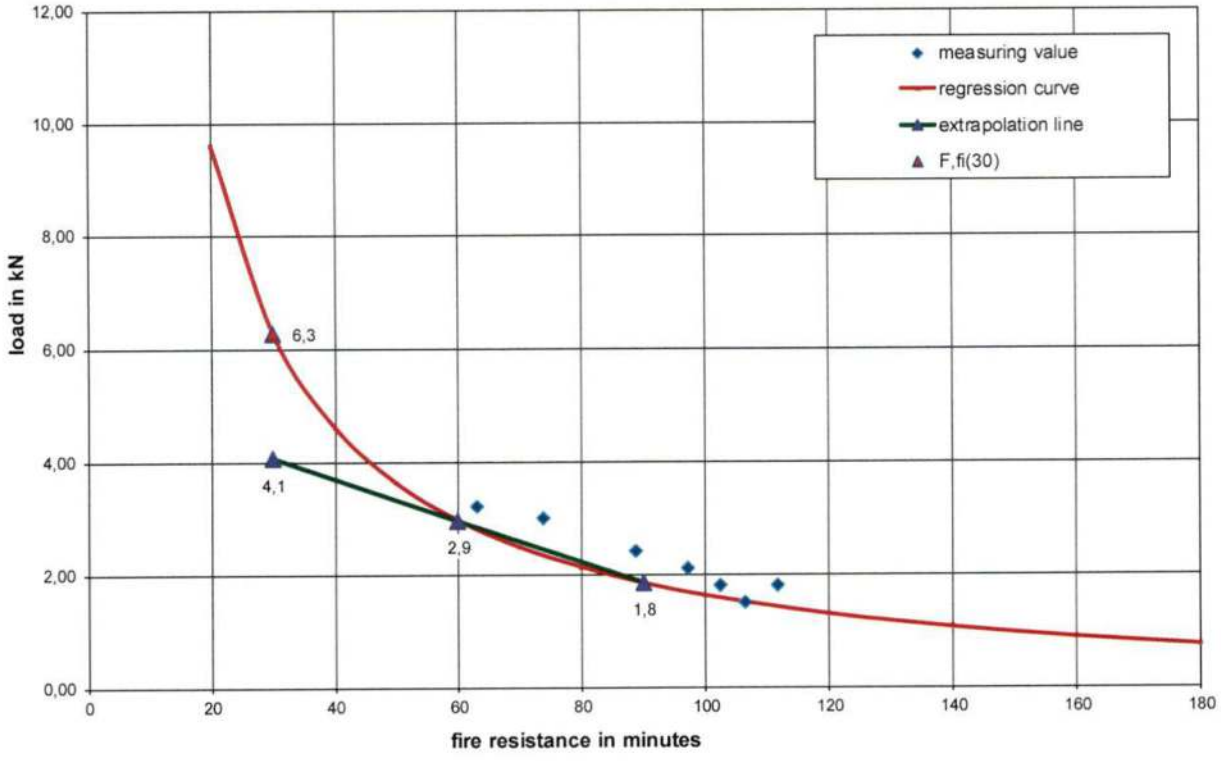
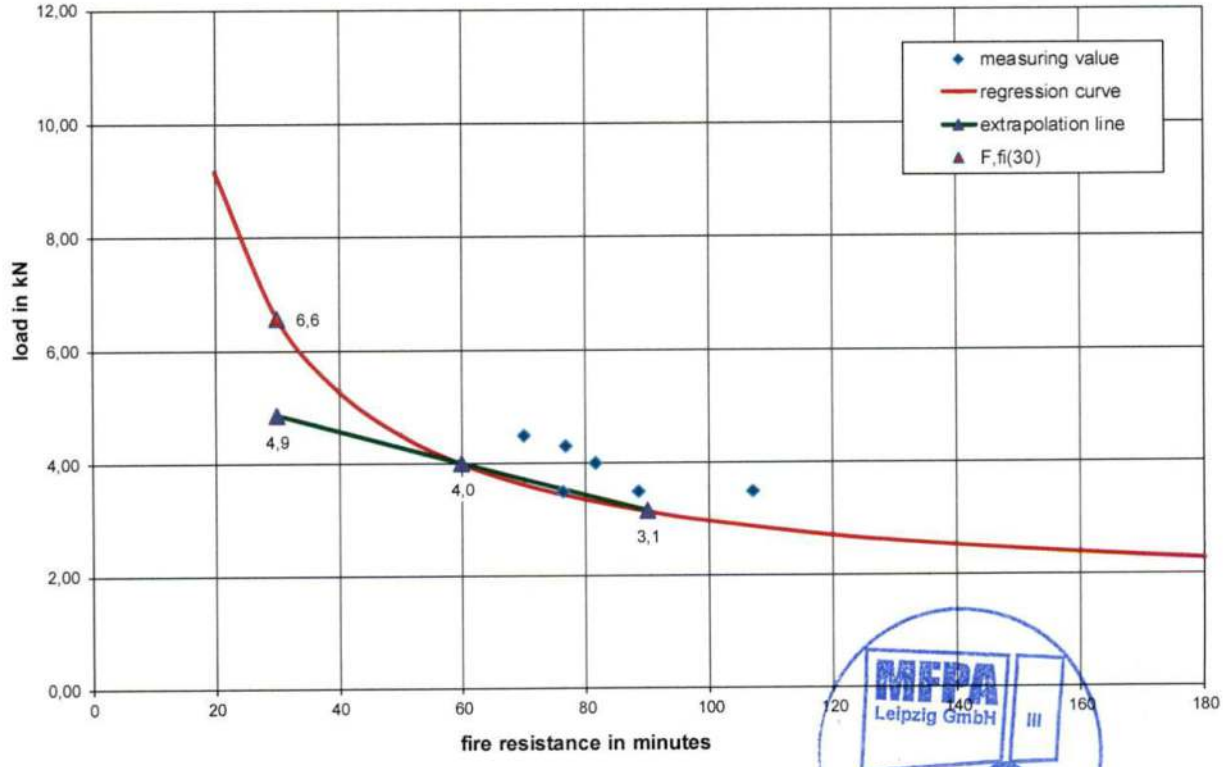


Diagram 6.4 Graphical analysis of FHB II – AS under shear load in size M12



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