MFPA Leipzig GmbH
Testing, Inspection and Certification Authority for Construction Products and Construction Types

Leipzig Institute for Materials Research and Testing
Business Division III - Structural Fire Protection
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Work Group 3.2 - Fire Behaviour of Building Components and special Constructions

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Notice of extension of the Expert Opinion No. GS 3.2/11-243-3Ä

1 March 2019
No. Copy 1

Subject matter:	Fire protection assessment of **fischer Superbond**
Client:	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen
Date of order:	21 January 2019
Person in charge:	Dipl.-Ing. S. Bauer

This notice consists of two pages. It is only valid in conjunction with the above-mentioned expert opinion and may only be used in conjunction with it.

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

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

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1 General

MFPA Leipzig GmbH was commissioned on 21 January 2019 to extend the expert opinion no. GS 3.2/11-243-3Ä of 13 March 2014 and to replace the expired European Technical Approval ETA-12/0258 of 8 August 2012 by the newly issued European Technical Assessment ETA-12/0258 of 19 May 2016.

2 Basics

[1] Technical Report TR 020 „Evaluation of Anchorages in Concrete concerning Resistance to Fire" (May 2004) of the European Organisation for Technical Approvals (EOTA),

[2] European Technical Assessment ETA-12/0258 of DIBt Berlin: „fischer Superbond“ dated 19 May 2016,

[3] Expert opinion no. GS 3.2/11-243-3Ä of MFPA Leipzig GmbH dated 13 March 2014,

[4] manufacturer's declaration on the fischer Superbond of fischerwerke GmbH dated 3 January 2019.

3 Validity

This notice extends the period of validity of the expert opinion No. GS 3.2/11-243-3Ä of MFPA Leipzig GmbH dated 13 March 2014.

The validity of the expert opinion is unlimited and ends as soon as technical regulations change or the reference documents become invalid.

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, 1 March 2019

Leipzig GmbH
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Gutachterliche Stellungnahme Nr. GS 3.2/11-243-3 Ä
Ersatz für GS 3.2/11-243-3
vom 13. März 2014
1. Ausfertigung

English translation. Original document in German language.

Subject:	fischer Superbond Fire protection design concept for fischer Superbond
Contracting body:	fischerwerke GmbH & Co.KG Otto-Hahn-Str.15 79211 Denzlingen Germany
Date of order:	13/07/13
Editor:	Dipl.-Ing. S.Hauswaldt,

The validity of this report ends on 13/09/2019. The report consists of 8 ages and 4 annexes.

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

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1 The reason of the order

On the 13th April 2013 fischerwerke GmbH & Co. KG assigned MFPA Leipzig GmbH to prepare an expert opinion on the fire behavior of fischer injection system - fischer Superbond (FIS SB); the test specimens included fischer injection mortar FIS SB in connection with a threaded rod, fischer anchor rod FIS A, fischer anchor with internal thread RG MI and rebars. All specimens are arranged vertical to the surface, unilaterally exposed to fire in slabs and walls.

2 Basics and documents of the expert opinion

For the expert opinion the following documents are taken into account:

[1] Technical report TR 020 from May 2004 of the European Organization for Technical Approvals (EOTA): Evaluation of Anchorages in Concrete concerning Resistance to fire

[2] Technical report TR 020, chapter 4 (draft January 2012) of the European Organization for Technical Approvals (EOTA): Evaluation of Anchorages in Concrete concerning Resistance to fire

[3] European technical approval ETA-12/0258 from 8th august 2012 of DIBt: bonded anchors sizes M8 to M30 for anchoring in concrete

[4] Test report PB 3.2/11-242-1 from 28th June 2012 of MFBA Leipzig GmbH: fischer Superbond - Test according to TR 020 (May 2004) to determine the characteristic steel stress under tensile stress

[5] Test report PB 3.2/12-293-1 from 06th november 2012 of MFPA Leipzig GmbH: fischer Superbond with steel of strength class 8.8 – Test according to TR 020 (May 2014) to determine the characteristic steel stress under tensile stress

[6] Test report PB 3.2/-243-1 from the 24th August 2012 of MFPA Leipzig GmbH: Test of characteristic shear resistance of the connected surfaces under tensile stress at elevated temperatures and

[7] Kordina, K; Meyer-Ottens, C.: Beton Brandschutz Handbuch, publishing company Verlag Bau und Technik, 1999,

[8] Experimental results of the pull-out test at FIS SB by constant temperature of 150°, FIS SB High Speed and FIS SB Low Speed form 7th May 2013

[9] prEN 13381-3:2012- Prüfverfahren zur Bestimmung des Beitrages zum Feuerwiderstand von tragenden Bauteilen – Teil3: Brandschutzmaßnahmen für Betonbauteile.

In addition to these documents, extensive experience in testing of the MFPA Leipzig concerning the fire behavior of fastenings and reinforced concrete constructions incorporates the fire protection assessment.

In accordance with [9], the expert opinion is based on temperature curves of the behavior of reinforced concrete made of normal concrete with quartzitic aggregates. Picture 1 shows the temperature of components unilaterally exposed to fire.

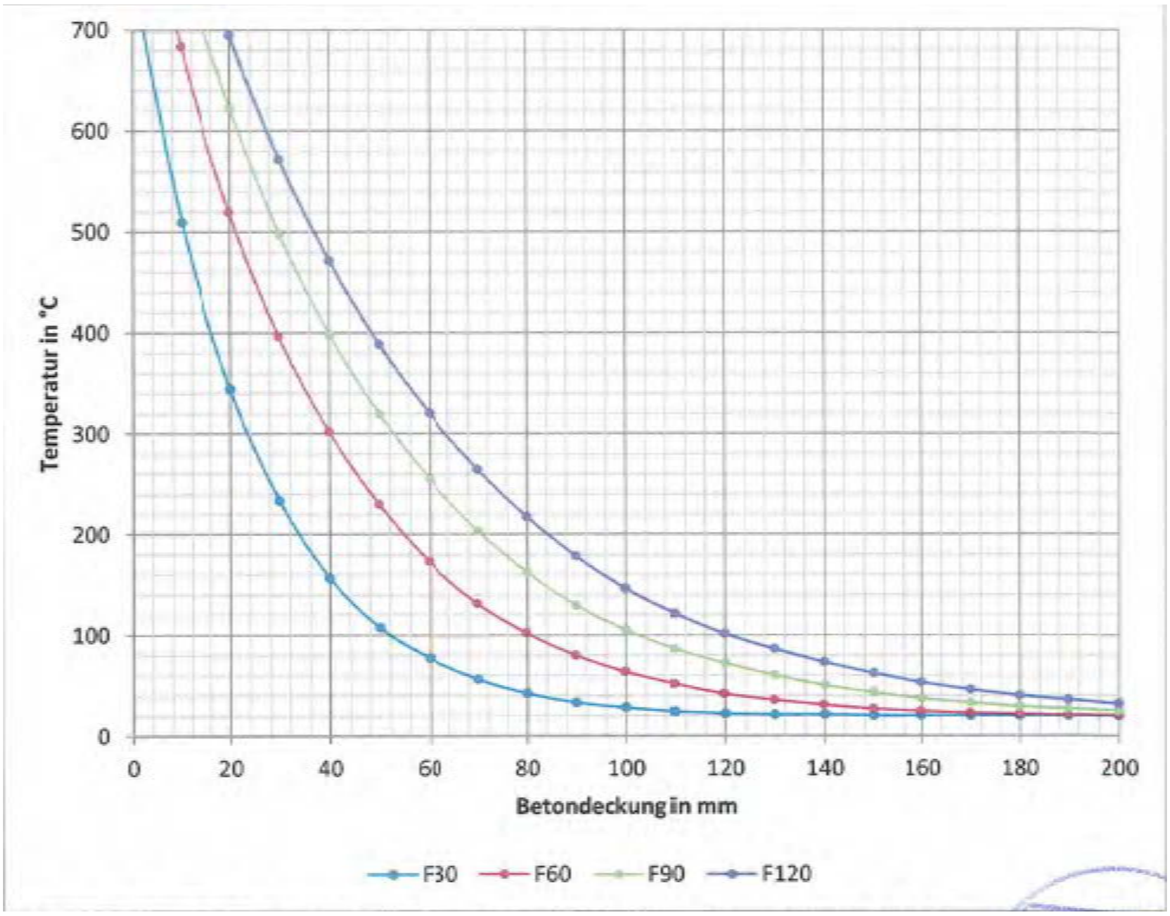

Figure 1: Temperatures in reinforced concrete members after 30, 60, 90, and 120 min with single-sided fire exposure according to EN 1363-1, values of [9]

3 Description of the tested construction

In the European technical approval [2] the system fischer Superbond is described in detail. For the sections of reinforcing steel and threaded rods, variable anchor depths are permitted. The system can be mounted with injection mortar FIS SB, FIS SB Low Speed, FIS SB High Speed, and mortar cartridge RSB. For further descriptions, see ETA [2]

4 Fire protection design concept

The determination of the characteristic resistance values in case of fire was prepared for the pullout failure $N_{Rk,p,fi(t)}$ and steel failure $N_{Rk,s,fi(t)}$. The bases for this are the results of steel failure at high temperature (see test report PB 3.2/11-242-1 [4] and PB 3.2/12-293-1 [5]) and the lost of the bonding quality (see test report PB 3.2/11-243-1 [6]).

4.1 Installation of fischer anchor rod FIS A and fischer internal threaded anchors RG MI with fischer system fischer Superbond

The characteristic parameters for steel failure by centric tension are shown in table 1 and 2. Differing from TR 020, the figures for the fire resistance designed for duration of 30 minutes were increased in accordance to the available test results. The increased F30-values of steel failure resulted from the average of the figures from the design straight line and the design curve. The averaged figures are conservative results which have been proven through conducted tets with a longer fire exposure time.

Table 1: Characteristic tension load $N_{Rk,s,fi(t)}$ in kN for steel failure fischer Superbond, under the centric tension for threaded rod of the strength category 5.8, values of [4]

fischer Superbond		M8	M10	M12	M16	M20	M24	M30
30 min	$N_{Rk,s,fi(30)}$	0.9	1.6	2.6	6.4	10.1	14.5	23.1
60 min	$N_{Rk,s,fi(60)}$	0.6	1.1	1.8	4.7	7.3	10.6	16.8
90 min	$N_{Rk,s,fi(90)}$	0.4	0.8	1.4	3.8	5.9	8.6	13.6
120 min	$N_{Rk,s,fi(120)}$	0.4	0.7	1.2	3.3	5.2	7.6	12.0

Table 2: Characteristic tension load $N_{Rk,s,fi(t)}$ in kN for steel failure fischer Superbond, under the centric tension for threaded rod of the strength category 8.8, values of [5]

fischer *Superbond*		M8	M10	M12	M16	M20	M24	M30
30 min	$N_{Rk,s,fi(30)}$	1.5	2.8	4.7	12.0	18.8	27.0	43.0
60 min	$N_{Rk,s,fi(60)}$	1.0	1.8	3.0	7.7	12.0	17.3	27.6
90 min	$N_{Rk,s,fi(90)}$	0.7	1.3	2.2	5.5	8.6	12.5	19.8
120 min	$N_{Rk,s,fi(120)}$	0.6	1.0	1.7	4.4	6.9	10.0	16.0

The characteristic resistance of the anchorage against pull out force is determined with the calculation:

$$N_{Rk,p,fi(t)} = h_{ef} * d * \pi * \tau_{Rk,p,fi(t)}$$

h_{ef}	=	effective anchorage depth
d	=	thread diameter
$\tau_{Rk,p,fi(t)}$	=	shear resistance

The shear resistance can be calculated with the formula:

$$\tau_{Rk,p,fi}(\theta) = 9083\ \theta_{c,d}^{-1,587}$$

described in [5] as a function of the concrete temperature $\theta_{c,d}$.

The equivalence of the variants FIS SB Low Speed and FIS SB High Speed is proved in [8]. But this figure is limited by the characteristic bond strengths given in the ETA for rods with diameter M30 with 10 N/mm².

If the concrete temperature is known, the characteristic tensile load can be obtained with:

$$N_{Rk,p,fi\ t} = h_{ef} \cdot d \cdot \pi \cdot 9083\ \theta_{c,d}^{-1,587}$$

as a function of temperature

The characteristic values of steel failure, respectively pull-out failure have to be calculated in relative to the setting depth. The design of the injection system fischer Superbond was established according to TR 020 (Calculation 2.1). The safety factor of the resistance under fire exposure is $\tau_{M,fi} = 1{,}0$. For the design, the smaller resistance:

$$N_{Rd,fi(t)} = \min(N_{Rk,p,fi(t)}, N_{Rk,s,fi(t)})$$

of the two failure modes, steel failure and pull-out failure, has to be considered.

Picture 1 illustrates the temperature distribution of a reinforced concrete sample subjected to single sided fire at 30, 60, 90, and 120 min. By graphical evaluation of the figure, the characteristic tensile load $N_{Rk,p,fi\ t}$ is calculated for different anchorage depths. The values are then compared with the characteristic tension resistance $N_{Rk,s,fi\ t}$ of the steel failure. The values for steel grade A4-70 and C70 were determined by the attenuation of the defined steel tensile strength of the strength class 8.8. In annexes 2, 3, and 4, the resulting maximum tension resistance is assembled as a function of the anchorage depths for anchoring rods, respectively internal threaded anchor. The characteristic values of the concrete cone failure have to be calculated in relation to the variable anchorage depths using the calculation 2.11 and 2.12 according to TR 020.

4.2 Rebar connection with fischer injection system FIS SB - proof of reinforcement steel as anchor application.

The determination of the characteristic values of fire resistance for pull-out failure $N_{Rk,p,fi(t)}$ using reinforcement steel as anchor application is also based on the integration of the critical temperature-dependent bond strength with respect to the setting depth of the rebar h_{ef} and the duration exposed to heat. In figure 2, the function of the anchor application is explained. The anchorage of the rebar is vertical to the fire exposed surface and has different temperature areas.

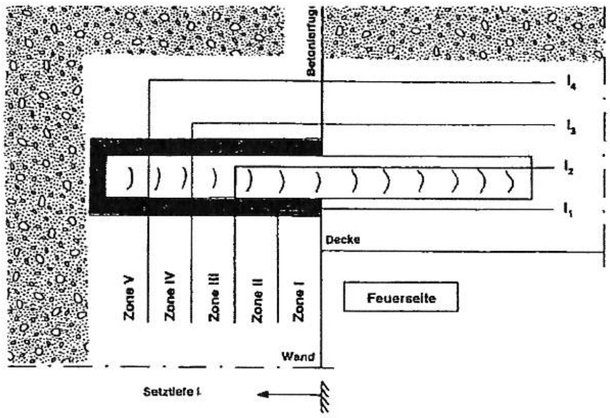

Bild 4: Schematische Darstellung der Bewehrungsanschlussvariante „Verankerung"

The design concept … ield strength of 400MPa to 500MPa, diamete … 120min. The partial safety factor for the …

The characteristic values against pullout are listed in annex 1 for BSt 500. The characteristic fire resistance values for steel failure limit the values for pullout failure and are marked in gray. It is allowed to interpolate interim values. An extrapolation is not allowed. The given values are valid for the following load direction: centric tension, shear tension, and oblique tension acting at every single angle.

Steel failure and concrete failure were not considered. The attached member must have the same fire resistance as the anchor application.

5 Special hints

This evaluation was made for the fischer Superbond in cracked and not-cracked concrete .Products are to be installed in accordance with the installation codes found in the above mentioned European technical approval [3]

This evaluation was made under the aspect of a single-side fire exposure. In the case of a multilateral fire exposure, this calculation method is only valid when the edge distance of the rod is $c \geq 300mm \geq 2\,h_{ef}$.

A transfer from the allowable loads determined at steel of the minimum strength class 8.8 to the injection system fischer Superbond with reinforcement steel BSt 500 S and on internal threaded anchor rod RG MI or anchor rod made of stainless steel (1.4401, 1.4571, and 1.4404) is possible due to their better high temperature behavior and the existing testing experience. All annexes of the characteristic tension resistance values are valid for the installation with injection mortar as well as for other options, including FIS SB; FIS SB Low Speed and FIS SB High Speed, and also with mortar cartridge RSB

From this principle, the stated loads are also valid for shear and/or oblique-tension.

This assessment is only valid in combination with reinforced concrete slabs, with strength $\geq C\,20/25$ and $\leq C50/60$ by EN 206-1: 2000-12 that corresponds to the minimum fire resistance class of the rod. To avoid concrete spalling, guidelines can be found in DIN EN 1992-1-2 (section4.5). The moisture content therefore has to amount to less than 3 weight-percent (4% according to national appendix).

This test results exclusively concerns the described test specimen and are not applicable to any other products. This document does not replace a certificate of compliance or usability according to the building code (national/European).

			R30	R60	R90	R120
8	10 oder 12	60	3,79	1,33	0,80	0,61
		70	6,30	2,11	1,21	0,89
		80	8,82	3,31	1,80	1,27
		90	11,33	5,09	2,64	1,79
		100	13,84	7,60	3,83	2,50
		110	16,35	10,12	5,48	3,47
		120	18,87	12,63	7,70	4,76
		130	21,38	15,14	10,22	6,47
		140	23,89	17,66	12,73	8,67
		150	25,13	20,17	15,24	11,18
		160	25,13	22,68	17,76	13,69
		170	25,13	25,13	20,27	16,21
		180	25,13	25,13	22,78	18,72
		190	25,13	25,13	25,13	21,23
		200	25,13	25,13	25,13	23,75
		210	25,13	25,13	25,13	25,13

Table A 1.2: fischer Superbond 10. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	**R60**	**R90**	**R120**
		60	4,74	1,66	1,00	0,76
		70	7,88	2,64	1,51	1,11
		80	11,02	4,14	2,25	1,59
		90	14,16	6,36	3,30	2,24
		100	17,30	9,50	4,79	3,13
		110	20,44	12,65	6,85	4,33
		120	23,59	15,79	9,63	5,95
		130	[illegible]	[illegible]	[illegible]	[illegible]
		140	[illegible]	[illegible]	[illegible]	[illegible]
10	12 oder 14	150	[illegible]	[illegible]	[illegible]	[illegible]
		160	[illegible]	[illegible]	[illegible]	[illegible]
		170	[illegible]	[illegible]	[illegible]	[illegible]
		180	39,27	34,64	28,48	23,40
		190	39,27	37,78	31,62	26,54
		200	39,27	39,27	34,76	29,68
		210	39,27	39,27	37,90	32,82
		220	39,27	39,27	39,27	35,97
		230	39,27	39,27	39,27	39,11
		240	39,27	39,27	39,27	39,27

Outdated

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.3: fischer Superbond 12. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
12	14 oder 16	70	9,45	3,17	1,82	1,33
		80	13,22	4,97	2,70	1,90
		90	16,99	7,63	3,96	2,68
		100	20,76	11,40	5,75	3,75
		110	24,53	15,17	8,22	5,20
		120	28,30	18,94	11,56	7,14
		130	32,07	22,71	15,33	9,70
		140	[illegible]	[illegible]	[illegible]	[illegible]
		150	[illegible]	[illegible]	[illegible]	[illegible]
		160	[illegible]	[illegible]	[illegible]	[illegible]
		170	[illegible]	[illegible]	[illegible]	[illegible]
		180	[illegible]	[illegible]	[illegible]	[illegible]
		190	54,69	45,33	37,95	31,85
		200	56,55	49,10	41,72	35,62
		210	56,55	52,87	45,49	39,39
		220	56,55	56,55	49,26	43,16
		230	56,55	56,55	53,03	46,93
		240	56,55	56,55	56,55	50,70
		250	56,55	56,55	56,55	54,47
		260	56,55	56,55	56,55	56,55

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Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.4: fischer Superbond 14. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
14	18	70	11,03	3,70	2,12	1,56
		80	15,43	5,80	3,15	2,22
		90	19,82	8,91	4,62	3,13
		100	24,22	13,31	6,71	4,38
		110	28,62	17,70	9,59	6,07
		120	33,02	22,10	13,48	8,34
		130	37,42	26,50	17,88	11,31
		140	[illegible]	[illegible]	[illegible]	[illegible]
		150	[illegible]	[illegible]	[illegible]	[illegible]
		160	[illegible]	[illegible]	[illegible]	[illegible]
		170	[illegible]	[illegible]	[illegible]	[illegible]
		180	[illegible]	[illegible]	[illegible]	[illegible]
		190	63,81	52,89	44,27	37,16
		200	68,21	57,29	48,67	41,56
		210	72,60	61,69	53,07	45,95
		220	76,97	66,08	57,46	50,35
		230	76,97	70,48	61,86	54,75
		240	76,97	74,88	66,26	59,15
		250	76,97	76,97	70,66	63,55
		260	76,97	76,97	75,06	67,95
		270	76,97	76,97	76,97	72,34
		280	76,97	76,97	76,97	76,74
		290	76,97	76,97	76,97	76,97

Outdated

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.5: fischer Superbond 16. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
16	20	80	17,63	6,63	3,60	2,54
		90	22,66	10,18	5,28	3,58
		100	27,68	15,21	7,67	5,00
		110	32,71	20,23	10,96	6,93
		120	37,74	25,26	15,41	9,53
		130	42,76	30,29	20,43	12,93
		140	47,79	35,31	25,46	17,33
		150	[illegible]	[illegible]	[illegible]	[illegible]
		160	[illegible]	[illegible]	[illegible]	[illegible]
		170	[illegible]	[illegible]	[illegible]	[illegible]
		180	[illegible]	[illegible]	[illegible]	[illegible]
		190	[illegible]	[illegible]	[illegible]	[illegible]
		200	77,95	65,47	55,62	47,49
		210	82,98	70,50	60,65	52,52
		220	88,00	75,52	65,67	57,55
		230	93,03	80,55	70,70	62,57
		240	98,05	85,58	75,73	67,60
		250	100,53	90,60	80,75	72,63
		260	100,53	95,63	85,78	77,65
		270	100,53	100,53	90,81	82,68
		280	100,53	100,53	95,83	87,71
		290	100,53	100,53	100,53	92,73
		300	100,53	100,53	100,53	97,76
		310	100,53	100,53	100,53	100,53

Outdated

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.6: fischer Superbond 20. BSt 500 as bolting application (steel not exposed to fire)

Outdated

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
20	25	90	28,32	12,72	6,61	4,47
		100	34,60	19,01	9,59	6,25
		110	40,89	25,29	13,70	8,67
		120	47,17	31,57	19,26	11,91
		130	53,45	37,86	25,54	16,16
		140	59,74	44,14	31,83	21,67
		150	66,02	50,42	38,11	27,95
		160	[illegible]	[illegible]	[illegible]	[illegible]
		170	[illegible]	[illegible]	[illegible]	[illegible]
		180	[illegible]	[illegible]	[illegible]	[illegible]
		190	[illegible]	[illegible]	[illegible]	[illegible]
		200	[illegible]	[illegible]	[illegible]	[illegible]
		210	103,72	88,12	75,81	65,65
		220	110,00	94,41	82,09	71,93
		230	116,29	100,69	88,38	78,22
		240	122,57	106,97	94,66	84,50
		250	128,85	113,26	100,94	90,78
		260	135,14	119,54	107,23	97,07
		270	141,42	125,82	113,51	103,35
		280	147,70	132,10	119,79	109,63
		290	153,98	138,39	126,07	115,92
		300	157,08	144,67	132,36	122,20
		310	157,08	150,95	138,64	128,48
		320	157,08	157,08	144,92	134,76
		330	157,08	157,08	151,21	141,05
		340	157,08	157,08	157,08	147,33
		350	157,08	157,08	157,08	153,61
		360	157,08	157,08	157,08	157,08

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.7: fischer Superbond 25. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
25	30	100	43,00	23,58	11,98	7,81
		110	50,85	31,43	17,13	10,83
		120	58,71	39,29	24,08	14,89
		130	66,56	47,14	31,93	20,20
		140	74,41	55,00	39,78	27,08
		150	82,27	62,85	47,64	34,94
		160	90,12	70,70	55,49	42,79
		170	[illegible]	[illegible]	[illegible]	[illegible]
		180	[illegible]	[illegible]	[illegible]	[illegible]
		190	[illegible]	[illegible]	[illegible]	[illegible]
		200	[illegible]	[illegible]	[illegible]	[illegible]
		210	[illegible]	[illegible]	[illegible]	[illegible]
		220	137,25	117,83	102,62	89,92
		230	145,10	125,68	110,47	97,77
		240	152,95	133,54	118,32	105,62
		250	160,81	141,39	126,18	113,48
		260	168,66	149,24	134,03	121,33
		270	176,52	157,10	141,89	129,19
		280	184,37	164,95	149,74	137,04
		290	192,22	172,81	157,59	144,89
		300	200,08	180,66	165,45	152,75
		310	207,93	188,51	173,30	160,60
		320	215,79	196,37	181,16	168,46
		330	223,64	204,22	189,01	176,31
		340	231,49	212,07	196,86	184,16
		350	239,35	219,93	204,72	192,02
		360	245,44	227,78	212,57	199,87
		370	245,44	235,64	220,43	207,73
		380	245,44	243,49	228,28	215,58
		390	245,44	245,44	236,13	223,43
		400	245,44	245,44	243,99	231,29
		450	245,44	245,44	245,44	245,44

Outdated

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.8: fischer Superbond 28. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
28	35	110	56,95	35,21	19,18	12,13
		120	65,75	44,00	26,96	16,67
		130	74,55	52,80	35,76	22,63
		140	83,34	61,59	44,56	30,33
		150	92,14	70,39	53,35	39,13
		160	100,94	79,19	62,15	47,93
		170	109,73	87,98	70,95	56,72
		180	[illegible]	[illegible]	[illegible]	[illegible]52
		190	[illegible]	[illegible]	[illegible]	[illegible]32
		200	[illegible]	[illegible]	[illegible]	[illegible]11
		210	[illegible]	[illegible]	[illegible]	[illegible]91
		220	153,72	131,97	114,93	100,71
		230	162,51	140,76	123,73	109,50
		240	171,31	149,56	132,52	118,30
		250	180,11	158,36	141,32	127,10
		260	188,90	167,15	150,12	135,89
		270	197,70	175,95	158,91	144,69
		280	206,49	184,75	167,71	153,48
		290	215,29	193,54	176,50	162,28
		300	224,09	202,34	185,30	171,08
		310	232,88	211,13	194,10	179,87
		320	241,68	219,93	202,89	188,67
		330	250,48	228,73	211,69	197,47
		340	259,27	237,52	220,49	206,26
		350	268,07	246,32	229,28	215,06
		360	276,87	255,12	238,08	223,86
		370	285,66	263,91	246,88	232,65
		380	294,46	272,71	255,67	241,45
		390	303,26	281,51	264,47	250,25
		400	307,88	290,30	273,27	259,04
		450	307,88	307,88	307,88	303,02
		500	307,88	307,88	307,88	307,88

Outdated

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 1.9: fischer Superbond 32. BSt 500 as bolting application (steel not exposed to fire)

Rod diameter	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
		130	85,20	60,34	40,87	25,86
		140	95,25	70,39	50,92	34,67
		150	105,30	80,45	60,98	44,72
		160	115,36	90,50	71,03	54,77
		170	125,41	100,55	81,08	64,83
		180	135,46	110,61	91,14	74,88
		190	145,52	120,66	101,19	84,93
		200	[illegible]	[illegible]	[illegible]	[illegible]
		210	[illegible]	[illegible]	[illegible]	[illegible]
		220	[illegible]	[illegible]	[illegible]	[illegible]
		230	[illegible]	[illegible]	[illegible]	[illegible]
		240	195,78	170,93	151,45	135,20
		250	205,83	180,98	161,51	145,25
		260	215,89	191,03	171,56	155,30
		270	225,94	201,08	181,61	165,36
32	40	280	235,99	211,14	191,67	175,41
		290	246,05	221,19	201,72	185,46
		300	256,10	231,24	211,77	195,52
		310	266,15	241,30	221,83	205,57
		320	276,21	251,35	231,88	215,62
		330	286,26	261,40	241,93	225,68
		340	296,31	271,46	251,98	235,73
		350	306,37	281,51	262,04	245,78
		360	316,42	291,56	272,09	255,84
		370	326,47	301,62	282,14	265,89
		380	336,52	311,67	292,20	275,94
		390	346,58	321,72	302,25	286,00
		400	356,63	331,77	312,30	296,05
		450	402,12	382,04	362,57	346,31
		500	402,12	402,12	402,12	396,58
		550	402,12	402,12	402,12	402,12

Outdated

Note fischer: Tables concerning post installed Rebar Connections outdated. For values see Expert Report GS 3.2/15-128-2-r1 dated 6.June 2019 MFPA Leipzig

Table A 2.1: Maximal Tensile load in relation to fire exposure of the fischer Superbond with anchor rods of the strength class 5.8,made of stainless steel of the material quality A4-50 or highly corrosion resistant steel C50

Thread	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
M8	10	60	0,90	0,60	0,40	0,40
M10	12	60	1,60	1,10	0,80	0,70
M12	14	70	2,60	1,80	1,40	1,20
M16	18	80	6,40	4,70	3,60	2,54
		90	6,40	4,70	3,80	3,30
M20	24	90	10,10	7,30	5,90	4,47
		100	10,10	7,30	5,90	5,20
M24	28	90	14,50	10,50	7,93	5,37
		100	14,50	10,50	8,60	7,50
		110	14,50	10,50	8,60	7,60
M30	35	120	23,10	16,80	13,60	12,00

Table 2.2: Maximal Tensile load in relation to fire exposure of the fischer Superbond with internal threaded anchor rod RG MI of the strength class 5.8

Thread	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
M8	14	90	0,90	0,60	0,40	0,40
M10	18	90	1,60	1,10	0,80	0,70
M12	20	125	2,60	1,80	1,40	1,20
M16	24	160	6,40	4,70	3,80	3,30
M20	32	200	10,10	7,30	5,90	5,20

Table 3.2: Maximal Tensile load in relation to fire exposure of the fischer Superbond with anchor rods made of stainless high-grade steel A4 – A70 or highly corrosion resistant steel C50

Thread	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	**R60**	**R90**	**R120**
M8	10	60	1,31	0,88	0,61	0,53
M10	12	60	2,45	1,45	0,87	0,67
		70	2,45	1,58	1,14	0,88
M12	14	70	4,11	2,63	1,59	1,17
		80	4,11	2,63	1,93	1,49
M16	18	80	10,50	5,80	3,15	2,22
		90	10,50	6,74	4,62	3,13
		100	10,50	6,74	4,81	3,85
M20	24	90	16,45	10,50	5,78	3,91
		100	16,45	10,50	7,53	5,47
		110	16,45	10,50	7,53	6,04
M24	28	100	23,63	15,14	10,07	6,56
		110	23,63	15,14	10,94	8,75
M30	35	120	37,63	24,15	17,33	14,00

Table 3.2: Maximal Tensile load in relation to fire exposure of the fischer Superbond with internal threaded anchor rod made of stainless high-grade steel A4 – A70 or highly corrosion resistant steel C50

Thread	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	**R60**	**R90**	**R120**
M8	14	90	1,31	0,88	0,61	0,53
M10	18	90	2,45	1,58	1,14	0,88
M12	20	125	4,11	2,63	1,93	1,49
M16	24	160	10,50	6,74	4,81	3,85
M20	32	200	16,45	10,50	7,53	6,04

Table 4.1: Maximal Tensile load in relation to fire exposure of the fischer Superbond with anchor rods made of steel of the strength class 8.8, of stainless steel of the material quality A4-80 or highly corrosion resistant steel C80

Thread	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
M8	10	60	1,50	1,00	0,70	0,60
M10	12	60	2,80	1,66	1,00	0,76
		70	2,80	1,80	1,30	1,00
M12	14	70	4,70	3,00	1,82	1,33
		80	4,70	3,00	2,20	1,70
M16	18	80	12,00	6,63	3,60	2,54
		90	12,00	7,70	5,28	3,58
		100	12,00	7,70	5,50	4,40
M20	24	90	18,80	12,00	6,61	4,47
		100	18,80	12,00	8,60	6,25
		110	18,80	12,00	8,60	6,90
M24	28	100	27,00	17,30	11,50	7,50
		110	27,00	17,30	12,50	10,00
M30	35	120	43,00	27,60	19,80	16,00

Table 4.2: Maximal Tensile load in relation to fire exposure of the fischer Superbond with internal threaded anchor rod made of steel of the strength class 8.8

Thread	Drill nominate diameter	Anchor depth in mm	Characteristic tensile load in relation of the fire resistance time in kN			
			R30	R60	R90	R120
M8	14	90	1,50	1,00	0,70	0,60
M10	18	90	2,80	1,80	1,30	1,00
M12	20	125	4,70	3,00	2,20	1,70
M16	24	160	12,00	7,70	5,50	4,40
M20	32	200	18,80	12,00	8,60	6,90