Independent

Technical Assessment
on the fire resistance
of FBS 4 and FBS 5

Fastening and Strengthening Solutions for Testing | Technology | Teaching

c/o Institut für Werkstoffe im Bauwesen
Pfaffenwaldring 4
70569 Stuttgart

Product name:
fischer concrete screw FBS 4 and FBS 5

Product type:
Concrete screw

Manufacturer:
fischerwerke GmbH & Co. KG

Validity:
5 years

Assessment based on the documents:
According to EAD 330232-02-0601 and EAD 330747-01-0601

Date:
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1 Introduction

The company fischerwerke GmbH & Co. KG provides a concrete screw with sizes Ø4 mm and Ø5 mm. The concrete screws are qualified for the use in concrete C20/25 to concrete C50/60. The screws were tested (see [1] and [2]) in accordance with EAD 330232 [3] and EAD 330747 [4] to show the suitability. The screws have a technical specification by the manufacturer. The essential characteristics under tension and shear loading and ambient temperatures are given in these technical specifications.

In addition, the company fischerwerke GmbH & Co. KG performed fire tests to derive the characteristic resistances under fire conditions up 120 minutes. The tests were performed at an independent testing laboratory (MPA University Stuttgart) [5]. The results and the derived characteristics are given within this report.

2 Literature

[1] Prüfbericht-Nr. S27-2025: Identifikationsbericht FBS 4/5 gvz P/SK/US/M6, fischerwerke Waldachtal, 18.11.2025

[2] Prüfbericht-Nr. S 28-2025: FBS 4 und 5 Versuche zur Ermittlung empfohlener Lasten in gerissenem und ungerissenen Beton C20/25, fischerwerke Waldachtal, 27.11.2025

[3] EAD 330232-02-0601: Mechanical fasteners for use in concrete, EOTA Sept. 2024

[4] EAD 330747-00-0601: Fasteners for use in concrete for redundant non-structural systems, May 2018.

[5] Test report: Fi 645/01-25/27 , fire test on fischer FBS 4 and FBS 5, MPA University Stuttgart. Test Report fischer concrete screw FBS 4Ø50 P and 5Ø50 SK in concrete.

[6] ISO 834-1:2025-05, Fire-resistance tests-Elements of building construction, Part 1: General requirements, International Organization for Standardization (ISO), Geneva.

[7] EN 1992-4:2018, Eurocode 2-Teil 4: Bemessung von Befestigungen in Beton.

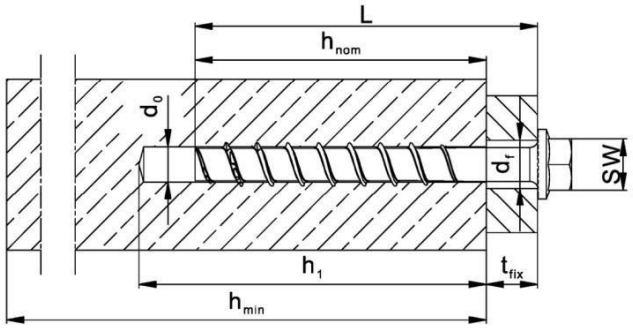
[8] EN 1363-1:2020, Feuerwiderstandsprüfungen-Teil 1: Allgemeine Anforderungen,

Deutsche Fassung EN 1363-1:2020.

3 Description of the product

3.1 Working principles and description

The working principle of the concrete screws FBS 4 and FBS 5 is mechanical interlock. The load is transferred by an internal thread that is cut into the concrete while the installation process. Therefore, the screw is hardened at the surface to be able to cut the thread into the concrete. For this reason, the concrete strength is limited to C50/60 with an average compressive cube strength of maximum 68 N/mm². A properly installed concrete screw is shown in Figure 3-1.



L	= length of the concrete Screw
h_1	= depth of the borehole
h_{min}	= minimum member thickness
d_0	= nominal embedment depth
h_{nom}	= nominal embedment depth
d_f	= hole diameter in the fixture
t_{fix}	= thickness of fixture
SW	= wrench size

Figure 3-1: Installed concrete screw FBS 4 or FBS 5 and nomenclature of the dimensions.

The load transfer mechanism of concrete screws primarily relies on mechanical interlock and friction between the screw threads and the base material. Axial tension is transferred as the threads of the screw bear against concrete. The screw resists pull-out by the friction and mechanical interlock along the embedded length. Shear forces are carried by the steel's shear strength and the concrete's bearing resistance surrounding the screw. The concrete screws are available with different head shapes. The shapes of the screws are:

- Metric thread (M6)
- Panhead (P)
- Counter sunk (SK)
- Hexagonal nut with washer (US)

The different shapes of the concrete screw heads are shown in Figure 3-2.

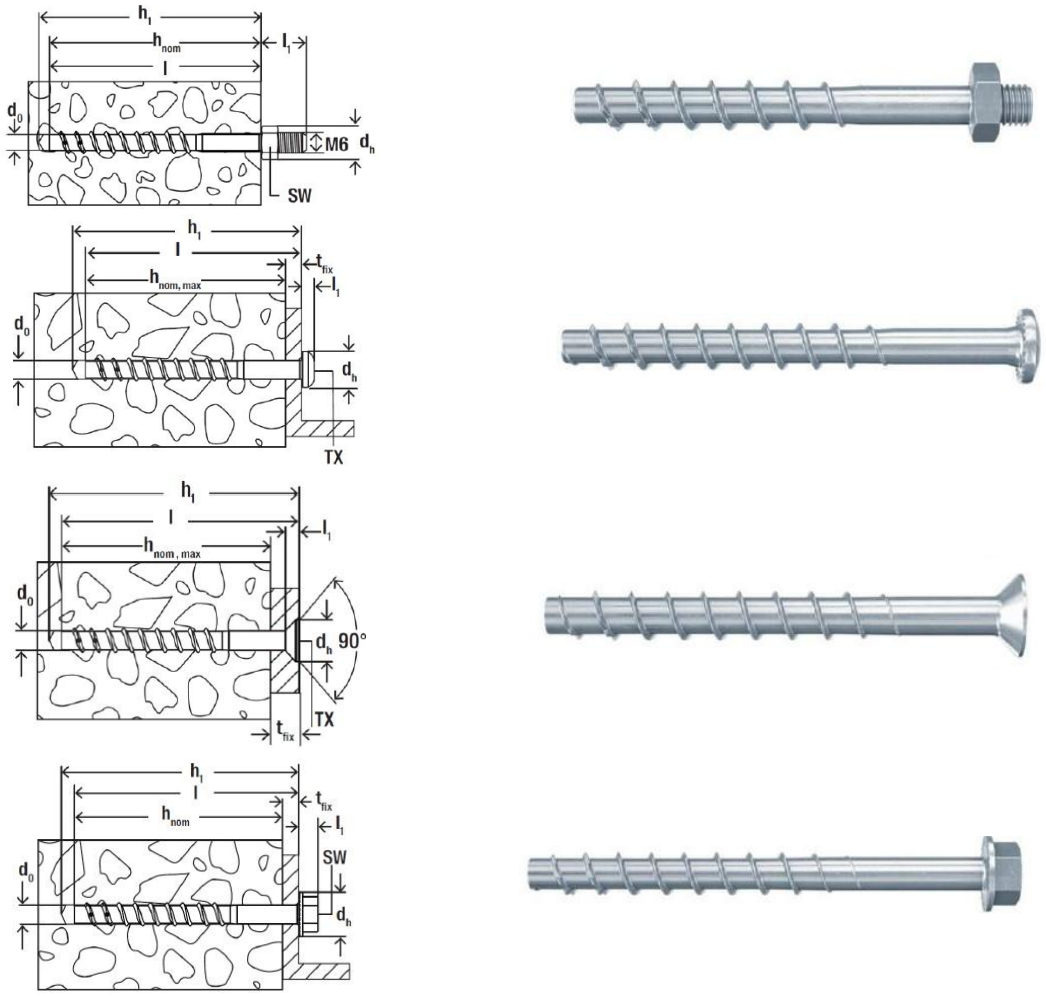


Figure 3-2: Installed concrete screw with different head shapes (left) and photo of the screws (right).

3.2 Installation of the product

The concrete screw may be installed and loaded when the required characteristic compressive strength C20/25 of the concrete has been achieved, the minimum cylinder strength is 20 N/mm². The concrete screws may only be used as part of a redundant system according to EAD 330747 [4], such as suspended ceilings.

The location of the drill hole must be coordinated with the reinforcement in a way that damage to the reinforcement is avoided. The drill hole must be made at right angles to the concrete surface using a hammer drill.

The cutting diameter has to be in a range of 4,2 mm to 4,35 mm for the FBS 4 and in a range of 5,2 mm and 5,35 mm for the FBS 5. The different steps for the installation procedure are given in the pictograms of Figure 3-3.

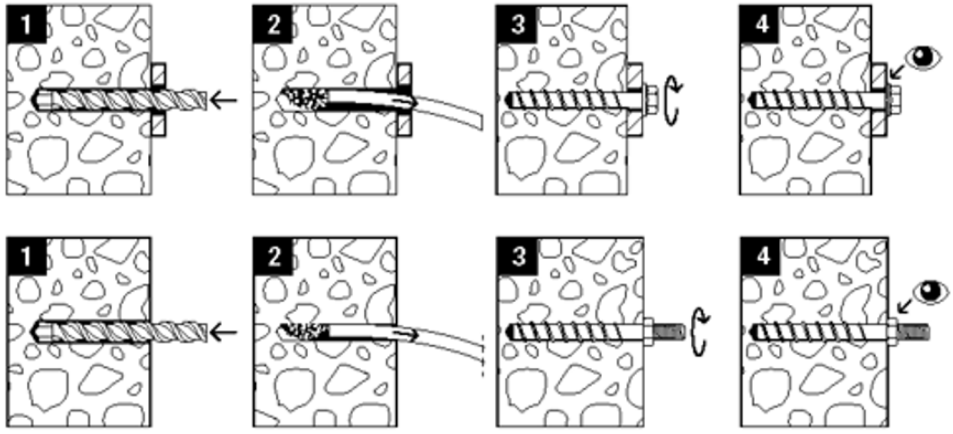


Figure 3-3: Installation of the concrete screw according to the manufacturer installation instruction (top: push through installation, bottom: predrilled installation).

The drill dust must be removed. In the event of a misdrill, a new drill hole must be made at a distance of at least 2 x the depth of the misdrill. If the missdrilled borehole is filled with high strength mortar (e.g. FIS V Plus or FIS VL) the distance can be reduced. The concrete screws are correctly installed if

- the attachment to be fastened is screwed against the concrete over its entire surface without a spacer,
- the head of the concrete screw rests on the baseplate,
- it is not possible to turn the concrete screw slightly further,
- the setting depth h_{nom} is achieved.

A properly installed concrete screw can be loaded immediately. The general installation parameters are given in Table 3-1, the minimum edge distance and spacing are given in Table 3-2.

Installation parameters for FBS 4 and FBS 5						
			FBS 4		**FBS 5**	
Nominal embedment depth	h_{nom}	[mm]	30	35	35	45
Effective embedment depth	h_{ef}	[mm]	24	28	28	36
Effective drill diameter	d_0	[mm]	4	4	5	5
Clearance hole diameter	d_f	[mm]	5,5	5,5	6,5	6,5
Minimum member thickness	h_{min}	[mm]	80	80	80	80
Maximum installation torque	Max. T_{inst}	[Nm]	4		15	
Maximum torque for impact screwdriver	$T_{imp,max}$	[Nm]	65		65	

Table 3-1: Summary of the installation parameters for FBS 4 and FBS 5 mm.

Installation parameters for minimum edge distance, spacings for FBS 4 and FBS 5						
			FBS 4		FBS 5	
Nominal embedment depth [mm]			30	35	35	45
Minimum edge distance c_{min} for spacings s						
Spacing	s	[mm]	25	55	55	65
Minimum edge distance	c_{min}	[mm]	25	35	35	35
Minimum spacing s_{min} for edge distance c						
Edge distance	c	[mm]	25	55	55	65
Minimum spacing	s_{min}	[mm]	25	35	35	35

Table 3-2: Summary of the minimum edge distance and spacing for FBS 4 and FBS 5.

3.3 Intended use and environmental conditions

The concrete screws with size Ø4 and Ø5 can only be used in concrete for redundant non-structural systems.

Redundant non-structural systems mean applications in which multiple fastener support elements that allow to redistribute the load to neighboring fasteners without violating the requirements on the fixture in the serviceability and ultimate limit state. This shall be ensured in the case of excessive slip or failure of one fastener. The definition of redundant non-structural systems is given in terms of the number of fixing points n_1 to fasten the fixture and the number of fasteners per fixing point n_2. Furthermore, the design load for a fixing point is limited to $F_{Ed} \leq 2{,}0$ kN according to [4].

The covered temperature range in the base material for mechanical fasteners during working life is within the range -40 °C to +80 °C. The thickness of the concrete member in which the mechanical fastener is installed must be at least h ≥ 80 mm. The concrete screws can be used for applications under fire exposure up to maximum 120 minutes. The use in case of fire is limited to an exposure of one concrete surface. In addition, the temperature increase according to the standard ISO 834 [6] fire temperature curve is assumed. Other fire curves are not covered by the tests.

4 Performance under fire exposure of the product

4.1 Performed tests and test results

The tests were performed according to EAD 330232-02-0601 [3]. The characteristic resistances under fire are summarised in Table 4-1 for tension and shear loading.

After installation of the concrete screws in the concrete slab of the furnace, the screws were loaded using hydraulic jacks outside the chamber. This ensures a constant loading with F_{Fire} for the whole duration of the fire tests. The burner in the furnace was controlled such that the standard temperature-time curve [5] was ensured. The temperature was measured with thermocouples according to EN 1363-1 [8] and continuously monitored to control the temperature in the furnace according to the specifications.

According to EAD 330232-02-0601 [3] the steel stress resistance is derived for fire durations of 30 min, 60 min, 90 min and 120 min.

4.2 Characteristic resistance under fire exposure

The characteristic resistances for tension, shear or inclined loading considering all failure modes under fire exposure are summarised in Table 4-1.

Anchor size				**FBS 4**		**FBS 5**	
Nominal embedment depth [mm]				**30**	**35**	**35**	**45**
All load directions (Resistance F_{Rk} per anchor in a group of anchors with s and c = 1,5 h_{ef})							
Characteristic resistance (cracked concrete) for C20/25	R30	$F_{Rk,p,cr,fi}$[1]	[kN]	0,11	0,11	0,30	0,46
	R60			0,11	0,11	0,30	0,46
	R90			0,11	0,11	0,30	0,46
	R120			0,09	0,09	0,24	0,37
Partial safety factor	$\gamma_{M,fi}$		[-]	1,0			
All load directions (Resistance F_{Rk} per anchor in a group of anchors with s_{min} or c_{min} as given in Table 3-2)							
Characteristic resistance (cracked concrete) for C20/25	R30	$F_{Rk,p,cr,fi}$[1]	[kN]	0,08	0,11	0,14	0,14
	R60			0,08	0,11	0,14	0,14
	R90			0,08	0,11	0,14	0,14
	R120			0,07	0,09	0,11	0,12
Partial safety factor	$\gamma_{M,fi}$		[-]	1,0			

Table 4-1: Characteristic tension resistance under fire exposure for FBS 4 and FBS 5.

[1] Values in cracked concrete can only be used in conjunction with the regulations of redundant systems.