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fischer frame fixing anchor SXRL 10 under fire exposure

Report No.: 21-009-2(0)

INDEPENDENT TECHNICAL ASSESSMENT

Product name:
SXRL 10

Product type:
Frame fixing anchor

Manufacturer:
fischerwerke GmbH & Co. KG

Validity:
5 Jahre

Assessment based on the documents:
ETA-07/0121, FAST-20-057-R and FAST 20-057-1

16/11/2021

1 INTRODUCTION AND AIM

The company fischerwerke GmbH & Co. KG would like to have the characteristic fire resistance of the fischer SXRL 10 frame fixing tested and evaluated in concrete under shear load and 45° inclined tensile load.

The fire tests were carried out at the MPA of the University of Stuttgart to evaluate the SXRL frame anchor for size 10 (with a screw diameter of d = 7 mm) on the basis of TR 020. The test results are described in the test report FAST-20-057-R dated 18.06.2021 and evaluated in the evaluation report FAST 20-057-1 dated 08.09.2021.

The characteristic fire resistance values are valid for all head types of the anchor SXRL 10 as well as the versions with the associated special screws made of galvanized steel and stainless steel. The anchors shall be exposed to a standard fire defined by the standard temperature time curve (ETK) according to EN1363-1:2020.

2 DESCRIPTION OF THE PRODUCT

2.1 PRODUCT CHARACTERISTICS AND APPLICATION AREA

The fischer frame fixing SXRL 10 consists of a plastic sleeve and a special screw (Figure 2.1). The special screws are available in two head versions: hexagonal head with washer and shank head. The dimensions and materials of both components are listed in Table 2.1 and Table 2.2.

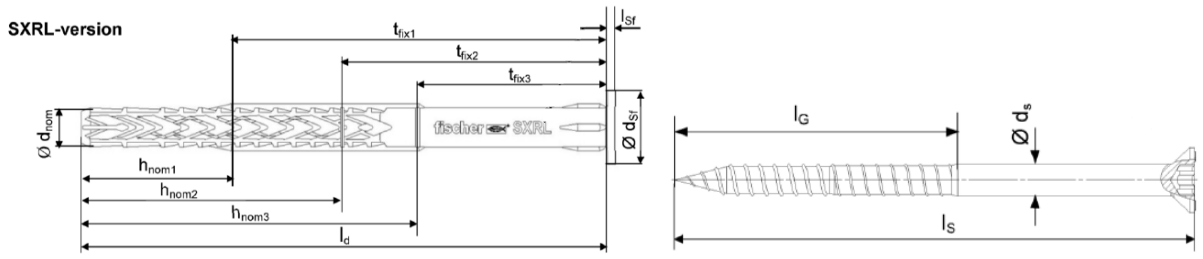

Figure 2.1: Technical drawings of the anchor sleeve and special screw.

Table 2.1: Dimensions and material of the anchor sleeve.

Anchor type	Anchor sleeve									Material
	$h_{nom,1}$ [mm]	$h_{nom,2}$ [mm]	$h_{nom,3}$ [mm]	Φd_{nom} [mm]	t_{fix} [mm]	min. l_d [mm]	max. l_d [mm]	l_{sf} [mm]	Φd_{sf} [mm]	
SXRL 10	50	70	90	10	≥ 1	51	360	2.2	> 18.5	Polyamide PA6 colour grey

Table 2.2: Dimensions and materials of the special screw.

Anchor type	Special screw			Material
	Φd_s [mm]	l_G [mm]	l_s [mm]	
SXRL 10	7.0	≥ 57	≥ l_d+7	- Galvanised steel gvz with Zn5/Ag or Zn5/An in accordance with EN ISO 4042:2018 **or** - Galvanised steel gvz with Zn5/Ag or Zn5/An in accordance with EN ISO 4042:2018 with additional organic layer (Zn5/Ag/T7 or Zn5/An/T7, resp.) in three layers (total layer thickness ≥ 6 µm) **or** - Stainless steel "A2" of corrosion resistance class CRC II in accordance with EN 1993-1-4:2006 + A1:2015 **or** - Stainless steel "A4" or "R" of corrosion resistance class CRC III in accordance with EN 1993-1-4:2006 + A1:2015

The frame fixing SXRL 10 has an European Technical Assessment. Detailed specifications of the intended use is given in ETA-07/0121.

The resistances listed below for failure due to pull-out are only valid for applications in normal concrete C20/25 to C50/60 according to EN 206:2017.

2.2 CONDITIONS OF USE

The environmental conditions of the screws are as follows:

- Dry internal condition: special screw made of zinc coated steel, stainless steel A2 or A4/R and CRC II or CRC III.
- External atmospheric exposure: the specific screw made of galvanized steel or galvanized steel with an additional Duplex-coating, 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.
- External atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive condition exist: Special screw made of stainless steel A4/R or CRC III.

The allowed temperature range of the applications is between - 20 °C to + 80 °C for the design at ambient temperatures. The installation temperature ranges between - 20 °C to + 40 °C. For the design under fire conditions, the maximum temperatures should be lower than those of the ETK fire curve.

Exposure to UV due to solar radiation of the not protected anchor must not exceed 6 weeks.

The design load for the fire condition must not exceed the maximum design load for the "cold" design condition.

Other influences such as spalling of the concrete cover or larger cracks and/or overall plastic anchor embedment depths (h_{nom}) smaller than 70 mm are not considered in the assessment.

Otherwise, the intended use specified in ETA-07/0121 applies.

2.3 INSTALLATION OF THE PRODUCT

The anchors are installed according to the manufacturer's installation instructions, taking into account the installation parameters given in Table 2.3.

Table 2.3: Installation parameter for fischer SXRL 10.

Anchor type				SXRL 10
Drill hole diameter	d_0	=	[mm]	10
Cutting diameter of drill bit	d_{cut}	≤	[mm]	10.45
Overall plastic anchor embedment depth in the base material	$h_{nom,1}$	≥	[mm]	50[1]
	$h_{nom,2}$	≥	[mm]	70
	$h_{nom,3}$	≥	[mm]	90
Depth of drill hole to deepest point	$h_{1,1}$	≥	[mm]	60[1]
	$h_{1,2}$	≥	[mm]	80
	$h_{1,3}$	≥	[mm]	100
Diameter of clearance hole in the fixture	d_f	≤	[mm]	10.5 / 12.5

The drill hole must be drilled perpendicular to the surface of the anchoring base. The drill bits must comply with the requirements of the Technical Specifications. The dust must always be removed from the drill hole. The depth of the holes must be at least 10 mm deeper than the target overall plastic anchor embedment depths h_{nom}.

The plastic sleeve of the frame fixing SXRL 10 is to be driven into a predrilled hole together with the partially inserted screw. Then the screw is rotated inwards until the screw head touches the sleeve. Through this motion, the plastic sleeve expands against the wall of the drilled hole (Figure 2.2).

[1] Not allowed for fire exposure conditions.

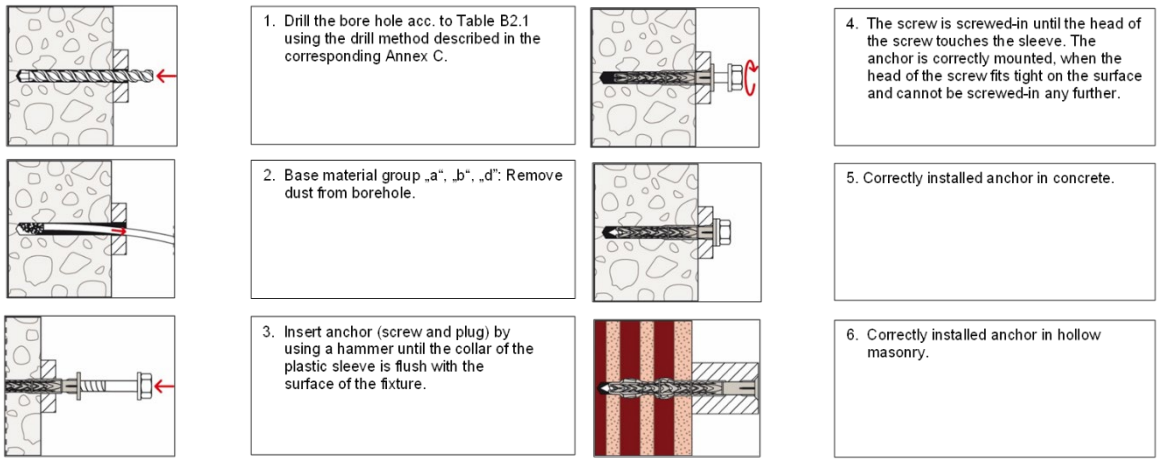

Figure 2.2: Installation instructions for the fischer SXRL frame fixing.

2.4 PROVISIONS FOR PLANNING AND DESIGNING

When installing anchors, a competent person entrusted with the installation of the anchors must be present on the construction site. This person must ensure that the work is carried out properly.

If the fire loading does not exceed the specified resistances, then the proof of immediate load transmission in concrete under fire loading has been provided.

The transmission of the loads to be anchored in the structural member shall be additionally verified, also for the design under fire conditions. The anchorages shall be designed in such a way that the verification for the design under ambient temperature condition is fulfilled.

3 PERFORMANCE OF THE PRODUCT

3.1 CHARACTERISTIC FIRE RESISTANCE

Table 3.1 summarises the characteristic fire resistances under shear loading for frame fixing SXRL 10.

Table 3.1: Characteristic fire resistance under 90° shear load for frame fixing SXRL 10.

Characteristic fire resistance under 90° shear load			**SXRL 10**	
			galvanised steel	**stainless steel**
Nominal embedment depth	$h_{nom} \geq$	[mm]	70	
Characteristic resistance under shear load without lever arm $V_{Rk,fi}$	R30	[kN]	1.86	
	R60		1.47	
	R90		1.08	
	R120		0.89	
Characteristic resistance under shear load with lever arm $M^0_{Rk,fi}$	R30	[Nm]	1.95	
	R60		1.54	
	R90		1.14	
	R120		0.93	

Table 3.2 summarises the characteristic fire resistances for the frame fixing SXRL 10 under 45° inclined load.

Table 3.2: Characteristic fire resistance under 45° inclined load for frame fixing SXRL 10.

Characteristic fire resistance under 45° inclined load			**SXRL 10**	
			galvanised steel	**stainless steel**
Nominal embedment depth	$h_{nom} \geq$	[mm]	70	
Characteristic resistance under 45° inclined load without lever arm $F_{Rk,fi,45}$	R30	[kN]	1.86 (2.56)[2]	
	R60		0.88	
	R90		0.32	
	R120		0.11	

[2] The characteristic resistance at R30 under 45° inclined load is limited to the characteristic resistance at R30 under shear loading (1.86 kN).

3.2 INTERACTION OF THE FIRE VALUES FOR APPLICATION ANGELS BETWEEN 45° AND 90°

The evaluation report FAST 20-057-1 shows that with increasing increasing load angle, the characteristic resistance frame fixing SXRL 10 increases. A characteristic resistance of 0.8 kN is achieved when the loading angle is larger than 75° (dominant shear load without lever arm).

According to TR 020, a characteristic fire resistance of 0.8 kN for a duration of 90 minutes can be assumed for fastenings of facade elements with SXRL 10 if no permanent centric tension load and shear load without lever arm is present.

Table 3.3: Fire resistance as a function of the load angle.

Angle [°]	Fire resistance F_{RK} [kN]			
	R30	R60	R90	R120
0	0	0	0	0
45	1.86	0.88	0.32	0.11
60	1.86	1.08	0.57	0.37
75	1.86	1.27	0.83	0.63
90	1.86	1.47	1.08	0.89

The fire resistances R30 to R120 derived in the report FAST 20-057-1 are independent of the application, since the tests were carried out according to the general requirements of TR 020.

A loading between 45° and 90° is allowed if the characteristic load resistances given in Table 3.3 are considered. The resistances are therefore lower in some cases than the fire resistance of 0.8 kN according to TR 020, but are not necessarily limited to facade applications.

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