HILTI HLC Sleeve Anchor

MPA Fire Assessment

MPABS-2400987 (30.04.2024)

iBMB MPA TU BRAUNSCHWEIG

Institute of Building Materials, Concrete Construction and Fire Safety | Braunschweig Civil Engineering Materials Testing Institute

Expert Opinion

– Translation –

Document number:	MPABS-2400987 - CM dated 30/04/2024
Client:	Hilti Aktiengesellschaft Approvals and Technical Data Feldkircherstraße 100 9494 Schaan, Liechtenstein
Order date:	26.04.2024
Order ref.:	7100224694 / Gregor.Giessmann@hilti.com
Order received:	26.04.2024
Subject:	Assessment of Hilti HLC sleeve anchors installed in solid structural elements (masonry), with regard to fire resistance under one-side exposure to fire along the standard temperature-time curve (ETK) in accordance with DIN EN 1363-1
Basis for assessment:	Siehe Abschnitt 1

This expert opinion comprises 5 pages including cover sheet as well as 3 annexes.

Materialprüfanstalt f. d. Bauwesen MPA BS 3.1 Braunschweig

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Approved as a civil engineering testing and certifying body as well as notified as a civil engineering testing and certifying body.

1 Anlass und Auftrag

With letter of 26/04/2024, Hilti Aktiengesellschaft, 9494 Schaan, placed the order with MPA Braunschweig for the preparation of an expert opinion for the assessment of Hilti HLC sleeve anchors installed in solid structural elements (masonry)and loaded, with regard to fire resistance under one-side exposure to fire along the standard temperature-time curve (ETK) in accordance with DIN EN 1363-1.

2 Unterlagen und Grundlagen der gutachterlichen Stellungnahme

[1] DIN EN 1363-1 : 2020-05, Fire resistance tests - Part 1: General requirements;

[2] Test Report No. (3093/577/07) dated 10/09/2007, issued for Hilti Aktiengesellschaft, 9494 Schaan;

[3] Hilti HLC sleeve anchors, technical data sheets from Hilti Entwicklungsgesellschaft mbH (HEG), Kaufering.

The assessment for Hilti HLC sleeve anchors is prepared on the basis of the fire tests performed when installed in solid structural elements (masonry). According to Hilti Aktiengesellschaft, 9494 Schaan, there is currently no complete building authority proof (e.g., ETA) for Hilti HLC sleeve anchors, which regulates the case of fire for the construction described here.

3 Description of the constructions

Hilti HLC sleeve anchors are special anchors (see also Annex 1). The loads applied are transferred in a force-controlled way into the anchoring base via the anchor shaft.

Hilti HLC sleeve anchors (standard) consist of an anchor rod with cold-formed cone, an expansion sleeve with corresponding expansion tongues and a hexagon nut with flange (flange nut).

Hilti HLC-H sleeve anchors consist of an anchor rod with cold-formed cone, an expansion sleeve with corresponding expansion tongues and a hexagon nut with washer.

Hilti HLC-L sleeve anchors consist of a raised countersunk screw in connection with a screw-on cone and an expansion sleeve with corresponding expansion tongues.

Hilti HLC-EC sleeve anchors consist of an eyebolt, a screw-on cone and an expansion sleeve with corresponding expansion tongues.

According to the client, for the normal purpose of use, the respective technical parameters for Hilti HLC sleeve anchors can be taken from the related technical data sheets (e.g., assembly instructions) issued by Hilti Aktiengesellschaft, 9494 Schaan, assuming an installation in solid structural elements (masonry).

The assessment in terms of fire protection is limited to mainly static loads (dead loads) in connection with solid structural elements, which have to be classified at least in the fire resistance class corresponding to the fire resistance of the fasteners.

The following table as well as the annexes summarize the design data (manufacturer data) for Hilti HLC sleeve anchors. Further information can be obtained from the technical data sheets (e.g., assembly instructions) and approvals for Hilti HLC sleeve anchors from Hilti Aktiengesellschaft, 9494 Schaan.

Table 1: Hilti HLC sleeve anchors

Hilti sleeve anchor	**Size of anchor rod (tensile stress area A_s [mm])**					
HLC type	**M5** (14.2)	**M6** (21.06)	**M8** (36.6)	**M10** (58.0)	**M12** (84.3)	**M16** (157.0)
Hilti HLC sleeve anchor (standard) with flange nut (strength class 5.8)	6.5 (M5)	8 (M6)	10 (M8)	12 (M10)	16 (M12)	20 (M16)
Hilti HLC-H sleeve anchor with nut and washer (strength class 8.8)	-	8 (M6)	10 (M8)	12 (M10)	16 (M12)	20 (M16)
Hilti HLC-L sleeve anchor with raised head (strength class 8.8)	-	-	10 (M8)	-	-	-
Hilti HLC-EC sleeve anchor with eyebolt connector ring (strength class 5.8)	-	-	8	10	16	-

Instead of a more detailed description of the system here, reference is made to Annex 1 and the technical data sheets for Hilti HLC sleeve anchors from Hilti Aktiengesellschaft, 9494 Schaan.

4 Assessment of Hilti HLC sleeve anchors combined with solid structural elements

The subject matter of this fire-safety-related assessment is the load-bearing behaviour of Hilti HLC sleeve anchors in conjunction with undergrounds made of of solid lime-sand masonry with lime-sand bricks in accordance with DIN V 106 (DIN EN 771-2): lime-sand bricks (≥ KS 12-1.4- NF) and bricks in accordance with DIN 105-100 (DIN EN 771-1): bricks (≥ Mz 12-1.8- NF) with a fire stress according to DIN EN 1363-1.

If, for normal purposes of use, lower loads apply according to the technical data sheets [3] from Hilti Aktiengesellschaft, 9494 Schaan, these shall be binding. Regardless of the fire-safety-related assessment, the suitability of the anchors must have been proven for the underground and type of application, also for the cold as-installed condition.

Regarding the load-bearing behaviour under exposure to fire, it can be distinguished between steel failure and failure of the underground.

For the anchors assessed here, the failure of the Hilti HLC sleeve anchors (steel failure) was relevant. This means that with regard to fire safety, it can be assumed with reasonable certainty that a failure of the underground examined here will not be relevant in the event of fire.

The centre distance of the Hilti HLC sleeve anchors that is relevant under exposure to fire has to be that distance where a failure of the underground can be excluded and where a steel failure of the fasteners will thus be relevant. In addition, the centre distances must adhere at least to the distances required for the cold as-installed condition according to the technical data sheets [3] from Hilti Aktiengesellschaft, 9494 Schaan. Further parameters, like geometry, moisture, shell spalling, eccentricity, position within the structural element, and other influencing variables, will have to be considered separately, if required.

The load-bearing capacity (steel failure) under exposure to fire of the systems described above was determined on the basis of the fire tests performed with solid structural elements (masonry).

$F_{fire(t)}$ $\Rightarrow$ rated value for Hilti HLC sleeve anchors

The load applied onto the anchors can be applied as centric tensile load (N), shear load (V), or as a combination of both (oblique tensile load).

The assessment proposals for Hilti HLC sleeve anchors under tensile load and exposure to fire on one side in accordance with DIN EN 1363-1 can be taken from Annexes 2 and 3.

5 Special notes

5.1 This Expert Opinion is not subject to notification and is no substitute for a classification report.

5.2 This Expert Opinion is no proof of usability for use in a building control procedure. The expert opinion can be used, for example, for general preliminary planning or to support in the assessment of the principles of execution / the construction. The manufacturer/erector of the construction is obliged to furnish the respective proof

5.3 When applying for a project-related design approval (vBG), the preparation of a project-related expert opinion will be required, taking the individually prevailing boundary conditions for planning into account.

5.4 This Expert Opinion applies only for the described fasteners in conjunction with solid structural elements (masonry), taking the boundary conditions of the technical data sheets from Hilti Aktiengesellschaft, 9494 Schaan, into account.

5.5 This Expert Opinion applies only for one-side exposure to fire along the standard temperature-time curve in accordance with DIN EN 1363-1. The underground must have at least the same fire resistance as the related fasteners.

5.6 The executing company shall be exclusively responsible for the proper execution.

5.7 The validity of the Expert Opinion will end on 30/04/2029 at the latest. The validity can be extended as a function of the state of the art.

This document is the translated version of Gutachterliche Stellungnahme Nr. MPABS-2400987 dated 30/04/2024. The legally binding text is the aforementioned Gutachterliche Stellungnahme.

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Technical data of the Hilti HLC sleeve anchor

Anchor version		
	HLC	Standard sleeve anchor
	HLC-H	Sleeve anchor with hexagon head
	HLC-L	Sleeve anchor with Torx raised head
	HLC-EC	Sleeve anchor with closed eye

Table 1: Material data

Name		**Material**
Anchor	HLC HLC-EC	Carbon steel minimum tensile strength 500N/mm²; galvanized with min. 5 µm
	HLC-H HLC-L	Steel grade 8.8, galvanized with min. 5 µm

Table 2: HLC setting details

Thread Diameter		d	[mm]	**6.5 (M5)**	**8 (M6)**	**10 (M8)**	**12 (M10)**	**16 (M12)**	**20 (M16)**
Nominal diameter of drill bit		d_o	[mm]	6.5 (1/4")	8	10	12	16	20
Cutting diameter of drill bit		$d_{cut} \leq$	[mm]	6.4	8.45	10.45	12.5	16.5	20.55
Depth of drill hole		$h_1 \geq$	[mm]	30	40	50	65	75	85
Width across flats	HLC	SW	[mm]	8	10	13	15	19	24
	HLC-H	SW	[mm]				17		
	HLS-L	Torx		-	-	T 40	-	-	-
Diameter of clearance hole in the attachment part		$d_f \leq$	[mm]	7	10	12	14	18	21
Effective anchor depth		h_{ef}	[mm]	16	26	31	33	41	41
Max. tightening torque		T_{inst}	[Nm]	5	8	25	40	50	80

Assessment proposals for Hilti HLC sleeve anchors under tensile stress and exposure to fire in accordance with DIN EN 1363-1

Table 3: Assessment proposal for Hilti HLC standard sleeve anchor in undergrounds made of lime-sand bricks KS (≥ KS 12-2.0-2DF) according to DIN 106 and DIN V 106-100 (EN 771-2) and bricks Mz (≥ Mz 12-2.0-2DF) according to DIN 105 and DIN 105-100 (EN 771-1)

Hilti HLC standard sleeve anchor					
Fire resistance in minutes [min]	Maximum tensile loading max. F[1)] [kN]				
	HLC 6.5 (M5)	HLC 8 (M6)	HLC 10 (M8)	HLC 12 (M10)	HLC 16 (M12)
30	0.37	0.65	1.31	2.08	3.02
60	0.29	0.51	0.99	1.57	2.28
90	0.21	0.37	0.67	1.07	1.55
120	0.17	0.28	0.51	0.81	1.18

1) It is to be checked whether the admissible cold loads are relevant. Attachment parts are to be proven separately, if required.

Table 4: Assessment proposal for Hilti HLC-H sleeve anchors in undergrounds made of lime-sand bricks KS (≥ KS 12-2.0-2DF) according to DIN 106 and DIN V 106-100 (EN 771-2) and bricks Mz (≥ Mz 12-2.0-2DF) according to DIN 105 and DIN 105-100 (EN 771-1)

Hilti HLC-H sleeve anchor				
Fire resistance in minutes [min]	Maximum tensile loading max. F[1)] [kN]			
	HLC-H 8 (M6)	HLC-H 10 (M8)	HLC-H 12 (M10)	HLC-H 16 (M12)
30	0.65	1.31	2.08	3.02
60	0.51	0.99	1.57	2.28
90	0.37	0.67	1.07	1.55
120	0.28	0.51	0.81	1.18

1) It is to be checked whether the admissible cold loads are relevant. Attachment parts are to be proven separately, if required.

Table 5: Assessment proposal for Hilti HLC-L sleeve anchors in undergrounds made of lime-sand bricks KS (≥ KS 12-2.0-2DF) according to DIN 106 and DIN V 106-100 (EN 771-2) and bricks Mz (≥ Mz 12-2.0-2DF) according to DIN 105 and DIN 105-100 (EN 771-1)

Hilti HLC-L sleeve anchor	
Fire resistance in minutes	Maximum tensile loading max. F[1)] [kN]
[min]	HLC-L 10 (M8)
30	1.31
60	0.99
90	0.67
120	0.51

1) It is to be checked whether the admissible cold loads are relevant. Attachment parts are to be proven separately, if required.

Table 6: Assessment proposal for Hilti HLC-EC sleeve anchors in undergrounds made of lime-sand bricks KS (≥ KS 12-2.0-2DF) according to DIN 106 and DIN V 106-100 (EN 771-2) and bricks Mz (≥ Mz 12-2.0-2DF) according to DIN 105 and DIN 105-100 (EN 771-1)

Hilti HLC-EC sleeve anchor			
Fire resistance in minutes	Maximum tensile loading max. F[1)] [kN]		
[min]	HLC-EC 8	HLC-EC 10	HLC-EC 16
30	0.65	1.31	2.05
60	0.51	0.99	1.55
90	0.37	0.67	1.05
120	0.28	0.51	0.80

1) It is to be checked whether the admissible cold loads are relevant. Attachment parts are to be proven separately, if required.