

MFPA Leipzig GmbH

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Construction Products and Construction Types

Center for Innovation and Calculation

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Advisory Opinion No. GS6.1/19-009-2

05.04.2019

Object: Assessment of the load bearing behaviour of bonded anchors HAS-D with injection system Hilti HIT-HY 200 under tensile loading and one-sided fire loading according to the standard-time-temperature-curve - steel failure, abbreviated version

Client: **Hilti Aktiengesellschaft**
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This document covers 8 pages, including 0 appendices.

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I Objective and request

MFPA Leipzig GmbH was ordered by Hilti AG to assess the load bearing behaviour of bonded anchors HAS-D with injection system Hilti HIT-HY 200 under tensile loading and one-sided fire loading according to the standard-time-temperature-curve (STTC) according to [N1]. The assessment bases on results of fire tests for the failure mode "steel failure".

The document at hand summarizes the characteristic tensile load bearing capacities. For details, please see [G1].

II Description of the construction

The injection system Hilti HIT-HY 200 is a bonded anchor for use in concrete constructions, consisting of a mortar cartridge, an anchor rod with cones as well as a hexagon nut and a washer. Figure 1 shows a principle picture of the anchor geometry.

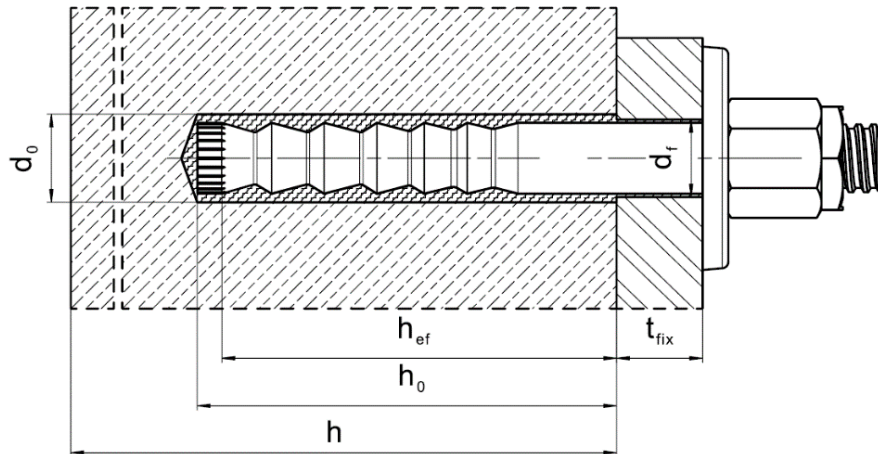


Figure 1: Injection system Hilti HIT-HY 200 with anchor rod HAS-D: On-site geometry

Load transmission mainly occurs due to the mechanical tothing of the cones within the injection mortar as well as, in addition, a combination of cohesion and friction forces in the anchorage. The bonded anchors are approved for the use under static, quasi-static and fatigue loading in reinforced and unreinforced normal concrete of the strength class of at least C20/25 and at most C50/60 according to [N2]. The required diameter and depth of the drill hole as well as the minimum component thickness are specified for each anchor in [P1, P2]. In the course of installation of the bonded anchors, the manufacturers' instructions have to be obeyed (see [P1, P2]).

According to [P1, P2], the anchor rods are produced using galvanized steel according to [N3]. For a detailed product description and further information with respect to the scope of application, please see [P1, P2].

III References

1 Utilized guidelines, rules and standards

The analyses are based on the following guidelines, rules and standards:

- [N1] DIN EN 1363-1:2012-10: Fire resistance tests - Part 1: General Requirements; German version EN 1363-1:2012
- [N2] DIN EN 206:2017-01: Concrete - Specification, performance, production and conformity; German version EN 206:2013+A1:2016
- [N3] DIN EN 10087:1999-01: Free-cutting steels - Technical delivery conditions for semi-finished products, hot-rolled bars and rods; German version EN 10087:1998
- [N4] TR 020: Evaluation of Anchorages in Concrete concerning Resistance to Fire; 05/2004
- [N5] EAD 330232-00-0601: Mechanical fasteners for use in concrete; 10/2016
- [N6] DIN EN 1992-1-2:2010-12: Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design; German version EN 1992-1-2:2004 + AC:2008

2 Reference documents

The analyses are based on the following additional documents:

2.1 Verifications of applicability

- [P1] ETA-18/0972: Hilti Injektionssystem HIT-HY 200 mit HAS-D nach EAD 330499
- [P2] ETA-18/0978: Hilti Injektionssystem HIT-HY 200 mit HAS-D nach EAD 330250

2.2 Assessment and test reports

- [G1] Advisory Opinion No. GS6.1/19-009-1: Assessment of the load bearing behaviour of bonded anchors HAS-D with injection system Hilti HIT-HY 200 under tensile loading and one-sided fire loading according to the standard-time-temperature-curve - steel failure – MFPA Leipzig GmbH; 04.04.2019

IV Assessment of the performance

1 Steel failure

Basing on experimental results and respective evaluations (see [G1]), Table 1 shows the characteristic tensile load bearing capacities $N_{Rk,s,fi}(t)$ for steel failure.

	fire duration [min]			
	30	60	90	120
HAS-D 100 M12	5.80	3.80	1.81	0.81
HAS-D 125 M16	7.62	5.81	4.01	3.11
HAS-D 170 M20	13.02	9.75	6.48	4.84

Table 1: Injection system Hilti HIT-HY 200 with anchor rod HAS-D (galvanized steel): Characteristic tensile load bearing capacity $N_{Rk,s,fi}(t)$ [kN] for steel failure

V Special notes

The assessment at hand is valid for bonded anchors HAS-D with injection system Hilti HIT-HY 200 manufactured by Hilti AG which are installed according to the manufacturers' instructions in [P1, P2]. The mechanical loading may not exceed the load bearing capacity in ambient climate specified in [P1, P2].

The load bearing capacities specified in the framework of the document at hand are determined for one-sided fire loading according to the standard-time-temperature-curve. According to [N4], the values may also be used for multilateral fire loading when the edge distance of the anchor is $c \geq 300mm$ and $c \geq 2 \cdot h_{ef}$.

The load bearing capacities specified in the framework of the document at hand are determined for central tensile loading in the anchors longitudinal direction. According to [N5], the values may be transferred to tensile loading perpendicular and diagonal to the axis of the anchor on the safe side.

The assessment at hand is valid for constructions of reinforced or unreinforced normal concrete of the strength class $\geq C20/25$ and $\leq C50/60$ according to [N2], which exhibit at least the same fire resistance class as the utilized anchors. The design of the concrete construction has to be carried out according to [N6].

The load bearing capacities specified in the framework of the document at hand are determined assuming that no explosive concrete spalling occurs and are only valid under this condition. Evidence on the prevention of explosive concrete spalling is given in [N6], chapter 4.5.

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

Leipzig, 05.04.2019

A handwritten signature in blue ink, appearing to read 'S. Reichel', written over a horizontal line.

Dr.-Ing. S. Reichel

Head of Business Division

Bauteil: V Special notes

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