MFPA Leipzig GmbH

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Object: Assessment of the load bearing behaviour of Walraven expansion anchors WT7 under tension load and one-sided fire loading according to the standard temperature-time curve in combination with concrete members - abbreviated version

Client: **J. van Walraven holding B.V.**
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This document covers 9 pages, including 0 appendices.

Contents

1 Objective and request

MFPA Leipzig GmbH was ordered by J. van Walraven holding B.V. to assess the load bearing behaviour of Walraven expansion anchors WT7 under tension load and one-sided fire loading according to the standard temperature-time curve (STTC, see [N1]) in combination with concrete members. The assessment bases on results of fire tests and includes the failure mode "steel failure". Considering the failure modes of the concrete substrate, reference to the acknowledged rules of technology is given. The document at hand summarizes the design concept in case of fire and the corresponding characteristic load bearing capacities. For the detailed derivation of the values, please see [G1] in conjunction with [S1].

2 Description of the construction

The advisory opinion at hand covers expansion anchors WT7 for anchorage in concrete structures, consisting of an anchor body, expansion clip, nut and washer.
Anchorage is produced by means of torque-controlled expansion of the expansion clip within the predrilled cylindrical hole. The range of application is limited to static and quasi-static loading as well as reinforced and unreinforced uncracked normal concrete of the strength class of at least C20/25 and at most C50/60 according to [N2].
With [P1], a valid European Technical Assessment basing on [N3] is available for Walraven expansion anchors WT7 which specifies the performance characteristics under ambient temperature.
The geometry of the anchors is specified in Figure 1, in Figure 2 installation parameters are given. In the course of installation of the anchors, the manufacturers' instructions have to be obeyed.

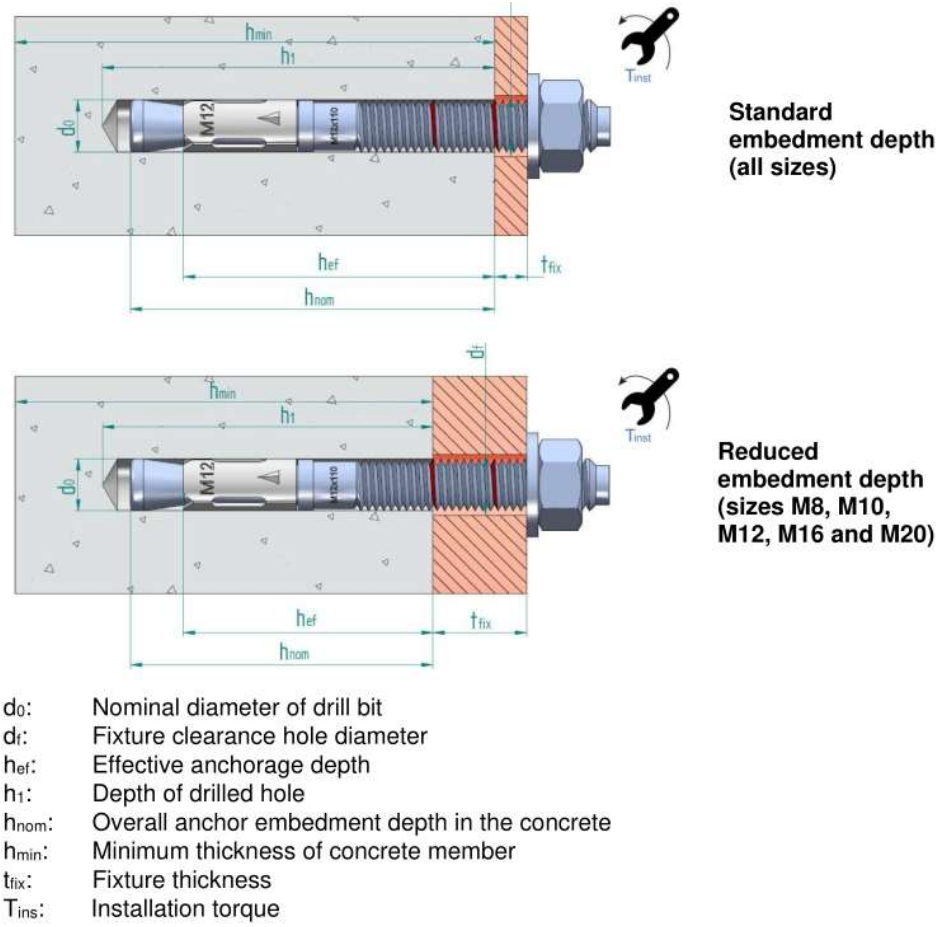

Figure 1: Walraven expansion anchors WT7: On-site geometry, from [P1]

WT7: GALVANISED ANCHOR Installation parameters			Performances						
			M6	M8	M10	M12	M14	M16	M20
d_0	Nominal diameter of drill bit:	[mm]	6	8	10	12	14	16	20
d_f	Fixture clearance hole diameter:	[mm]	7	9	12	14	16	18	22
T_{inst}	Nominal installation torque:	[Nm]	7	20	35	60	90	120	240
Standard embedment depth									
L_{min}	Minimum length of the bolt:	[mm]	60	75	85	100	115	125	160
h_{min}	Minimum thickness of concrete member:	[mm]	100	100	110	130	150	168	206
h_1	Depth of drilled hole ≥	[mm]	55	65	75	85	100	110	135
h_{nom}	Overall anchor embed depth in concrete:	[mm]	49.5	59.5	66.5	77	91	103.5	125
$h_{ef,std}$	Effective anchorage depth:	[mm]	40	48	55	65	75	84	103
t_{fix}	Thickness of fixture for DIN 125 washer ≤	[mm]	L-58	L-70	L-80	L-92	L-108	L-122	L-147
t_{fix}	Thickness of fixture for DIN 9021 or DIN 440 washer ≤	[mm]	L-58	L-71	L-80	L-94	L-108	L-124	L-149
s_{min}	Minimum allowable spacing:	[mm]	35	40	50	70	80	90	135
c_{min}	Minimum allowable distance:	[mm]	35	40	50	70	80	90	135
Reduced embedment depth									
L_{min}	Minimum length of the bolt:	[mm]	--	60	70	80	--	110	130
h_{min}	Minimum thickness of concrete member:	[mm]	--	100	100	100	--	130	150
h_1	Depth of drilled hole:	[mm]	--	50	60	70	--	90	107
h_{nom}	Overall anchor embed depth in concrete:	[mm]	--	46.5	53.5	62	--	84.5	97
$h_{ef,red}$	Effective anchorage depth:	[mm]	--	35	42	50	--	65	75
t_{fix}	Thickness of fixture for DIN 125 washer ≤	[mm]	--	L-57	L-67	L-77	--	L-103	L-121
t_{fix}	Thickness of fixture for DIN 9021 or DIN 440 washer ≤	[mm]	--	L-58	L-67	L-79	--	L-105	L-123
s_{min}	Minimum allowable spacing:	[mm]	--	40	50	70	--	90	135
c_{min}	Minimum allowable distance:	[mm]	--	40	50	70	--	90	135

Figure 2: Walraven expansion anchors WT7: Installation parameters, from [P1]

The Walraven expansion anchors WT7 are manufactured using galvanised carbon steel. In addition, the variants

- WT7 SST/A2: stainless steel A2 and
- WT7 SST/A4: stainless steel A4

are available. Each type is produced in sizes M6, M8, M10, M12, M16 and M20. For WT7 made of galvanised carbon steel, size M14 is additionally available.
For further information, please see [P1].

3 References

3.1 Utilized guidelines, rules and standards

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

[N1] DIN EN 1363-1:2020-05: Fire resistance tests - Part 1: General requirements; German version EN 1363-1:2020

[N2] DIN EN 206:2021-06: Concrete - Specification, performance, production and conformity; German version EN 206:2013+A2:2021

[N3] EAD 330232-01-0601: Mechanical fasteners for use in concrete; 10/2016

[N4] DIN EN 1992-4:2019-04: Eurocode 2 - Design of concrete structures - Part 4: Design of fastenings for use in concrete; German version EN 1992-4:2018

[N5] 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

3.2 Reference documents

The analyses are based on the following additional documents:

3.2.1 ETAs and verifications of applicability

[P1] ETA-21/0366: WT7, WT7 SST/A2, WT7 SST/A4, Torque controlled expansion anchor made of galvanised steel or stainless steel of sizes M6, M8, M10, M12, M14, M16 and M20 for use in non-cracked concrete. – Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc), 23.04.2021

3.2.2 Assessment and test reports

[G1] Advisory Opinion No. GS 3.2/16-368-2 – MFPA Leipzig GmbH; 27.01.2017

3.2.3 Miscellaneous

[S1] Letters of confirmation; 23.10.2025

4 Assessment of the performance

4.1 Design concept

The characteristic load bearing capacity of an expansion anchor in case of fire under tension load has to be determined as the minimum value of the load bearing capacities for the failure modes steel failure, pull-out failure and concrete cone failure

$$N_{Rk,fi}(t) = min\left[N_{Rk,s,fi}(t), \quad N_{Rk,p,fi}(t), \quad N_{Rk,c,fi}(t)\right]. \tag{1}$$

In case of a shear load, the characteristic load bearing capacity has to be determined as the minimum value of the load bearing capacities for the failure modes steel failure, concrete pry-out failure and concrete edge failure

$$V_{Rk,fi}(t) = min\left[V_{Rk,s,fi}(t), \quad V_{Rk,cp,fi}(t), \quad V_{Rk,c,fi}(t)\right]. \tag{2}$$

4.2 Load bearing capacity for steel failure

In Table 1, the characteristic load bearing capacities $N_{Rk,s,fi}(t)$ $[kN]$ and $V_{Rk,s,fi}(t)$ $[kN]$ for steel failure are specified. The values are to be limited by the load bearing capacity in ambient climate according to the manufacturers' instructions.

	fire duration $[min]$			
	30	60	90	120
M6	NPA	NPA	NPA	NPA
M8	0.80	0.66	0.52	0.45
M10	1.53	1.24	0.95	0.80
M12	2.42	1.95	1.47	1.24
M14	3.30	2.65	2.01	1.69
M16	4.50	3.62	2.74	2.30
M20	7.03	5.65	4.28	3.59

Table 1: Walraven expansion anchors WT7, steel failure: Characteristic load bearing capacities $N_{Rk,s,fi}(t)$ $[kN]$ and $V_{Rk,s,fi}(t)$ $[kN]$

5 Special notes

The advisory opinion at hand is valid for Walraven expansion anchors WT7 according to the specifications in [P1] for anchorage in concrete structures which are installed according to the manufacturer's instructions. The mechanical loading must not exceed the load bearing capacity in ambient climate.

The load bearing capacities specified in the framework of the document at hand are determined for one-sided fire loading according to the standard-temperature-time-curve. According to [N4], Appendix D.1(5) 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 valid for expansion anchors WT7 made of galvanised carbon steel with strength class $\geq$ 5.8. Due to the better high-temperature behaviour of stainless steel, transferability to expansion anchors WT7 SST/A2 made of stainless steel A2 and expansion anchors WT7 SST/A4 made of stainless steel A4 is given.

The load bearing capacities for steel failure specified in the framework of the document at hand are valid for tensile loading, shear loading as well as diagonal tension at every angle. Failure modes of the substrate are not investigated within the document at hand and have to be verified separately (see [N4], Annex D).

The assessment at hand is valid for constructions of reinforced or unreinforced uncracked 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 expansion anchors. The design of the concrete construction has to be carried out according to [N5].

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 [N5], Chapter 4.5.

6 Signatures

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

Leipzig, 12.11.2025

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