Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-13/0222 of 12 February 2025

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS
Product family to which the construction product belongs	Cast-in anchor with internal threaded socket
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld DEUTSCHLAND
Manufacturing plant	Leviat plants
This European Technical Assessment contains	23 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330012-01-0601, Edition 12/ 2022
This version replaces	ETA-13/0222 issued on 5 April 2022

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Specific Part

1 Technical description of the product

The DEMU Fixing anchor T-FIXX in the size of M10, M12, M16 and M20 is an anchor consisting of an internal threaded socket deformed at one end. The socket is made of galvanised steel or stainless steel. The anchorage is characterised by mechanical interlock at the deformed end of the socket.

The HALFEN hexagon plate anchor TWS in the size of M12 and M16 is an anchor consisting of an internal threaded socket made of galvanised steel with an welded plate made of galvanised steel.

The anchors are imbedded surface-flush or sunk in the concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic values for tension loading under static and quasi-static actions and displacements	
- Resistance to steel failure for tension loading	See Annex C1 and C4
- Resistance to pull-out failure	See Annex C1 and C4
- Resistance to concrete cone failure	See Annex C1 and C4
- Resistance to splitting and edge distance to prevent splitting and blow-out failure	See Annex C1 and C4
- Minimum edge distance and spacing	See Annex B5
- Maximum torque moment	See Annex B3 and B4
- Displacements for tension loading	See Annex C2 and C4

Essential characteristic	Performance
Characteristic values for shear loading under static and quasi-static actions and displacements	
- Resistance to steel failure for shear loading	See Annex C2 and C5
- Resistance to concrete edge failure without supplementary reinforcement	See Annex C3 and C5
- Resistance to concrete edge failure with supplementary reinforcement	No performance assessed
- Resistance to pry-out failure	See Annex C3 and C5
- Displacements for shear loading	See Annex C3 and C5
Characteristic values for seismic performance categories C1 and C2 and displacements	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C6

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330012-01-0601, the applicable European legal act is: [96/582/EC].
The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

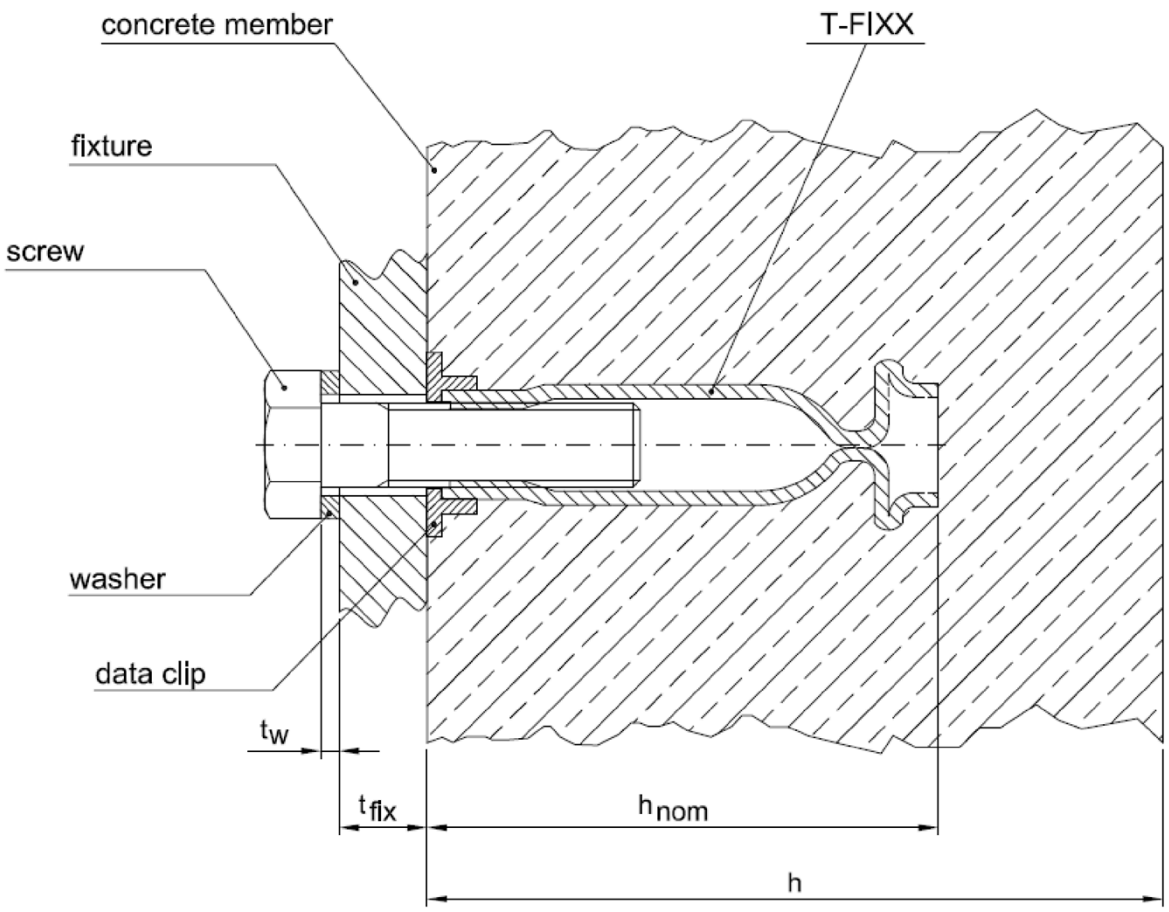
Issued in Berlin on 13 February 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Referatsleiterin

beglaubigt:
Aksünger

Deutsches Institut für Bautechnik DIBt

DEMU T-FIXX



h = thickness of concrete member

t_{fix} = thickness of fixture

t_w = thickness of washer

h_{nom} = embedment depth

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex A1
Product description Installed condition Fixing anchor	

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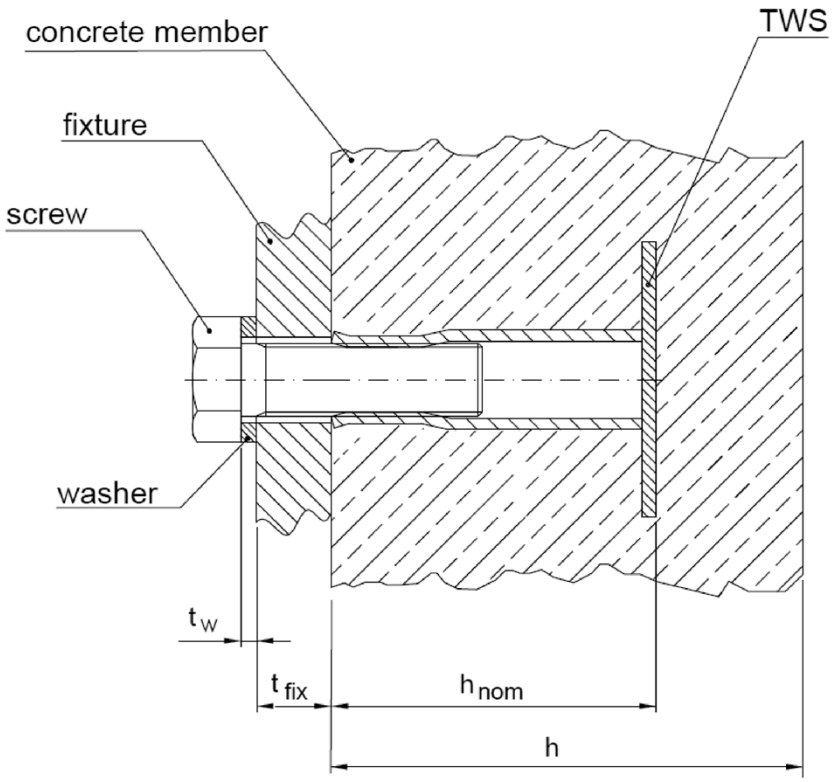
HALFEN TWS



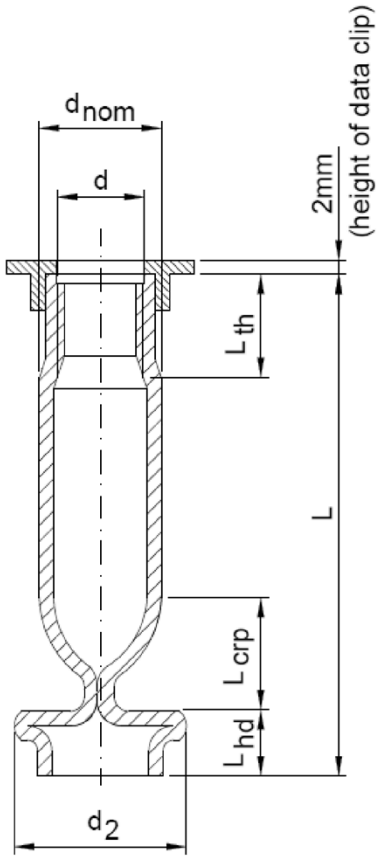
h = thickness of concrete member

t_{fix} = thickness of fixture

t_w = thickness of washer

h_{nom} = embedment depth

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex A2
Product description Installed condition Hexagon plate anchor	



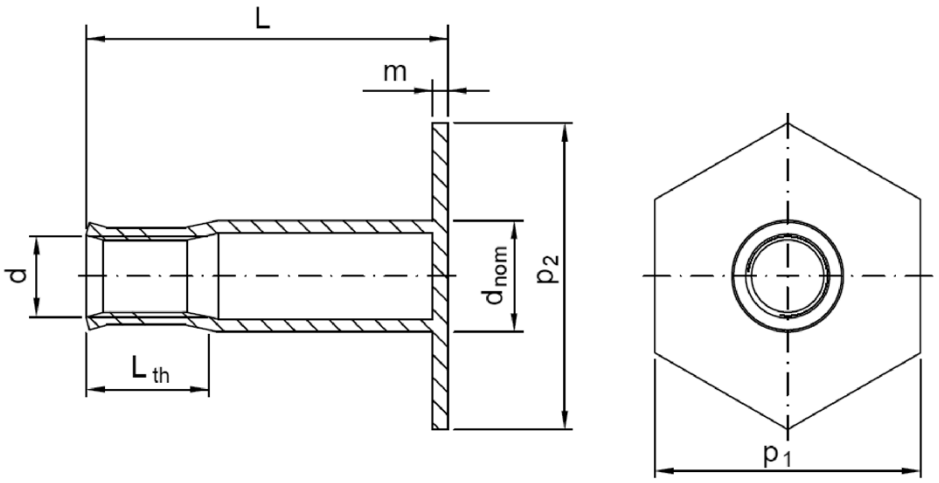
There are two different materials available for the DEMU Fixing anchor T-FIXX:

Material 1: Fixing anchor in galvanised steel

Material 2: Fixing anchor in stainless steel

Table A1: **Dimensions of DEMU Fixing anchor T-FIXX**

d	d_{nom}		L_{th}	L_{hd}	L_{crp}	d_2		L	
Thread	Material 1	Material 2	Material 1 + 2	Material 1 + 2	Material 1 + 2	Material 1	Material 2	Material 1	Material 2
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
M10	13,5	13,5	10,4 - 13,6	8,3	15,5	18,1	17,3	50 / 75	50 / 65
M12	17,0	17,2	12,5 - 16,1	9,5	16,0	23,0	23,0	50 / 70 / 95	50 / 70 / 115
M16	21,3	21,3	16,1 - 22,1	10,7	16,0	29,1	28,0	60 / 100 / 125	60 / 80 / 110
M20	26,9	26,9	20,2 - 27,6	10,8	16,0	34,7	33,5	70 / 100 / 145	70 / 100 / 125

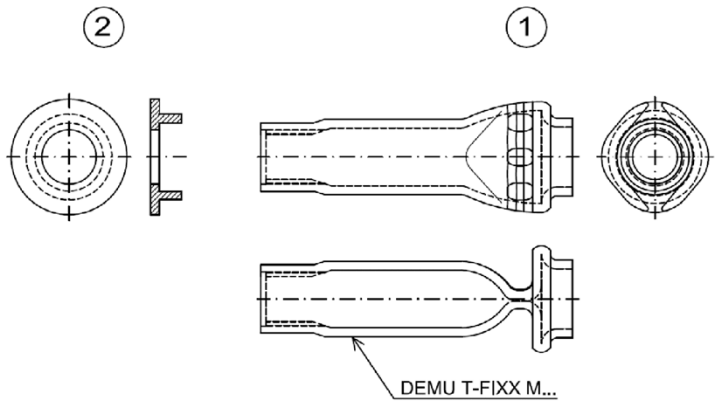


There is one material available for the HALFEN Hexagon plate anchor TWS:

Material 1: Hexagon plate anchor in galvanised steel

Table A2: **Dimensions of HALFEN Hexagon plate anchor TWS**

d	d_{nom}	L_{th}	m	p_1	p_2	L
Thread	Material 1	Material 1	Material 1	Material 1	Material 1	Material 1
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
M12	17,0	12,0	3,0	52,0	60,0	40 / 70
M16	22,0	16,0	3,0	60,0	70,0	43 / 80



Marking:

e.g.: DEMU T-FIXX M10x50 GV

DEMU: identifying mark of the producer

T-FIXX: name of the anchor

M10x50: size

GV: material

Material:

GV: galvanised steel

A4: stainless steel

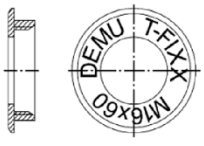
Table A3: **Specification and material of fixing anchor**

Item	Component	Material 1 Fixing anchor in galvanised steel (GV)	Material 2 Fixing anchor in stainless steel (A4)
1	Fixing anchor	1.0308 (E235), 1.0122, 1.0038 (S235), 1.0225 (E275), 1.0044 (S275), 1.0533 (E295), 1.0570 (S355), 1.0580 (E355), 1.0255 (P235TR2) acc. EN 10305-1, -2 or -3:2016, all delivery condition +N, galvanised [1)]	Stainless steel: CRC III: 1.4401, 1.4404, 1.4571, 1.4362, 1.4578, 1.4062, 1.4162, 1.4662, CRC IV: 1.4439, 1.4462, 1.4539, CRC V: 1.4565, 1.4529, 1.4547 in accordance with EN 10217-7:2014
2	Data clip	for fixing anchor made of material 1: for fixing anchor made of material 2:	HDPE / RAL 7035 / (light-) grey HDPE / RAL 9003 / (signal-) white

Table A4: **Specification and material of fixing components / suppl. reinforcement (not included with the fixing system)**

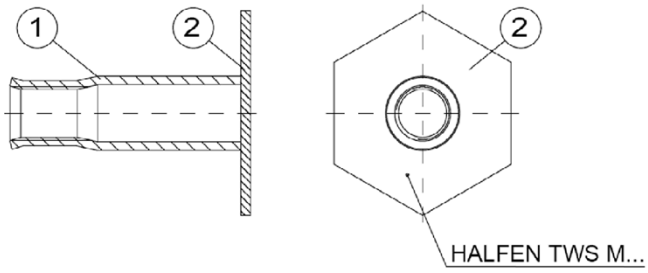
Appr. Component	Material for use with fixing anchors made of material 1	Material for use with fixing anchors made of material 2
Washer	Steel acc. EN 10025:2004, galvanised [1)]	Stainless steel: CRC III: 1.4401, 1.4404, 1.4571, 1.4362, 1.4578, 1.4062, 1.4162, 1.4662, CRC IV: 1.4439, 1.4462, 1.4539, CRC V: 1.4565, 1.4529, 1.4547 in accordance with EN 10088:2009
	Dimensions acc. EN ISO 7089:2000/7093-1:2000	
Screw	Steel acc. EN ISO 898-1:2013, galvanised [1)], strength grade 4.6, 5.6 or 8.8	Stainless steel: CRC III: 1.4401, 1.4404, 1.4571, 1.4362, 1.4578, 1.4062, 1.4162, 1.4662, CRC IV: 1.4439, 1.4462, 1.4539, CRC V: 1.4565, 1.4529, 1.4547 in accordance with EN ISO 3506-1:2009, strength grade A4-50, A4-70 or A4-80
Suppl. reinforcement	B500A or B500B	Stainless reinforcement steel B500A or B500B meeting the requirements for concrete cover c_{nom} in accordance with EN1992-1:2019
	in accordance with EN 1992-4:2019	

[1)] thickness of coating ≥ 5µm acc. EN ISO 4042:2018



Data clip: section and top view (with example for marking)

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex A5
Product description Marking and materials Fixing anchor	



Marking:

e.g.: HALFEN TWS M12x40 GV

HALFEN: identifying mark of the producer

TWS: name of the anchor

M12x40: size

GV: material

Material:

GV: galvanised steel

Table A5: **Specification and material of hexagon plate anchor**

Item	Component	Material 1 Hexagon plate anchor in galvanised steel (GV)
1	Sleeve	1.0308 (E235), 1.0122, 1.0038 (S235), 1.0225 (E275), 1.0044 (S275), 1.0533 (E295), 1.0570 (S355), 1.0580 (E355), 1.0255 (P235TR2) acc. EN 10305-1, -2 or -3:2016, all delivery condition +N, galvanised [1)]
2	Hexagon plate	1.0570 (S355), 1.0580 (E355), all delivery condition +N, galvanised [1)]

Table A6: **Specification and material of fixing components / suppl. reinforcement (not included with the fixing system)**

Appr. Component	Material for use with hexagon plate anchors made of material 1
Washer	Steel acc. EN 10025:2004, galvanised [1)]
	Dimensions acc. EN ISO 7089:2000/7093-1:2000
Screw	Steel acc. EN ISO 898-1:2013, galvanised [1)], strength grade 4.6, 5.6 or 8.8
Suppl. reinforcement	B500A or B500B
	in accordance with EN 1992-4:2019

[1)] thickness of coating ≥ 5µm acc. EN ISO 4042:2018

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex A6
Product description Marking and materials Hexagon plate anchor	

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Specifications of Intended use

Anchorages subject to:

- Static and quasi-static loads.
- Fire exposure: only for concrete C20/25 to C50/60.

Base material:

- Reinforced or unreinforced compacted normal weight concrete without fibers in accordance with EN 206:2013+A1:2016
- Strength classes C20/25 to C90/105 in accordance with EN 206:2013+A1:2016
- Cracked or uncracked concrete

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (material 1 and 2 in accordance with Annexes A5 and A6)
- Structures subject to internal conditions with usual humidity (e.g. kitchen, bath and laundry in residential buildings, exceptional permanently damp conditions and applications under water. (material 2 in accordance with Annex A5)
- In accordance with EN 1993-1-4:2015 according to the Corrosion Resistance Class – see Annex A5 Table A3 and A4 (Material 2).

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static actions are designed in accordance with:
  - EN 1992-4:2019
- Anchorages under fire exposure are designed in accordance with:
  - EN 1992-4:2019, Annex C6

  (local spalling of the concrete cover must be avoided)
- Requirements for the screw:
  - Material in accordance with Annex A5, Table A4 and Annex A6, Table A6
  - Strength class in accordance with Annexes C1 and C2, and C4 and C5
  - Length in accordance with Annex B3, Table B1 and Annex B4, Table B2

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex B1
Intended use Specifications	

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Installation:

- Anchor installation carried out by appropriately quantified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without any manipulation or exchanging the components.
- The anchors are fixed on the formwork so that no movement of the anchors will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- Adequate compaction close to the anchor particularly at head of eth bolt, e.g. without significant voids. The cast-in anchor is protected against ingress of concrete into the threaded socket.
- The installation torques given in Annexes B3 and B4 are not exceeded.
- The inner area of the socket of the anchor made of galvanised steel has to be protected against ingress water.

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex B2
Intended use Specifications	

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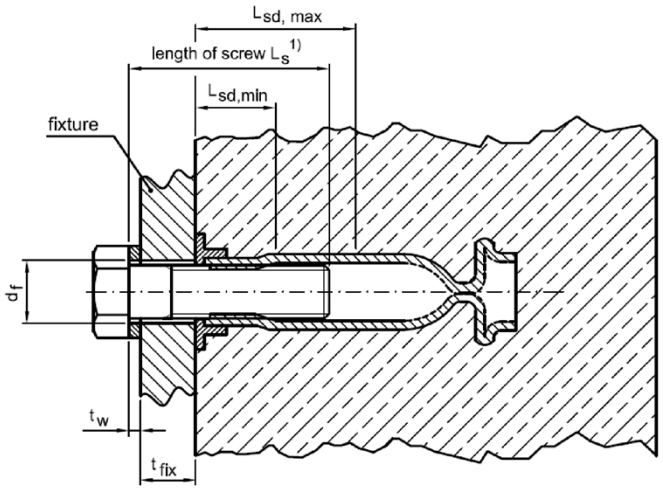
Direct contact between fixture and data clip

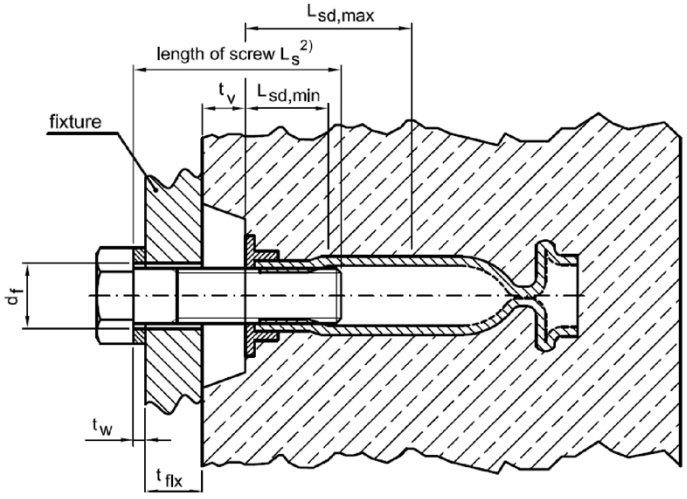
The fixture is braced to the data clip, if necessary by suitable washers.



1) $t_w + t_{fix} + l_{sd,min} \leq l_s \leq t_w + t_{fix} + l_{sd,max}$

General application

The fixture is braced to the concrete, the fixing anchor being embedded flush or recessed in the concrete.



2) $t_w + t_{fix} + t_v + l_{sd,min} \leq l_s \leq t_w + t_{fix} + t_v + l_{sd,max}$

Table B1: **Installation parameters**

Thread	d	[mm]	M10	M12	M16	M20
Maximum torque moment	max. T_{inst}	[Nm]	≤ 8	≤ 10	≤ 30	≤ 60
Minimum screw-in length	$l_{sd,min}$	[mm]	17,0	20,0	26,0	32,0
Maximum screw-in length	$l_{sd,max}$	[mm]	32,0	M12x50: 30,0	M16x60: 32,0	M20x70: 44,0
				M12x ≥70: 38,0	M16x ≥80: 50,0	M20x ≥100: 62,0
Diameter of clearance hole in fixture	d_f	[mm]	12,0	14,0	18,0	22,0

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS

Intended use
Positions of the fixture, installation parameters Fixing anchor

Annex B3

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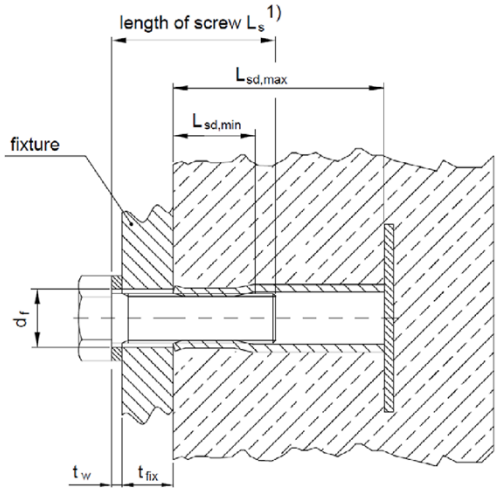
Direct contact between fixture and hexagon plate anchor

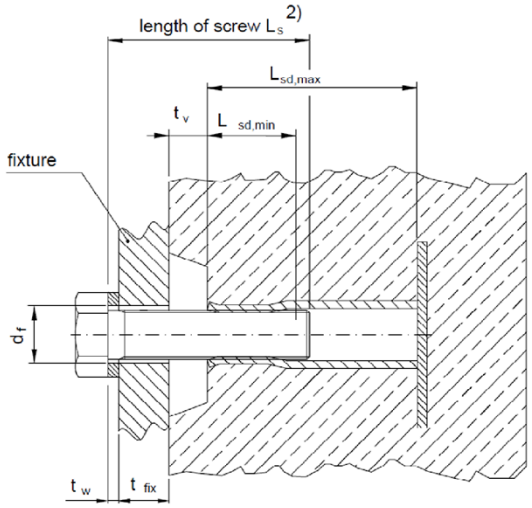
The fixture is braced to the hexagon plate anchor, if necessary by suitable washers.



1) $t_w + t_{fix} + L_{sd,min} \leq L_s \leq t_w + t_{fix} + L_{sd,max}$

General application

The fixture is braced to the concrete, the hexagon plate anchor being embedded flush or recessed in the concrete.



2) $t_w + t_{fix} + t_v + L_{sd,min} \leq L_s \leq t_w + t_{fix} + t_v + L_{sd,max}$

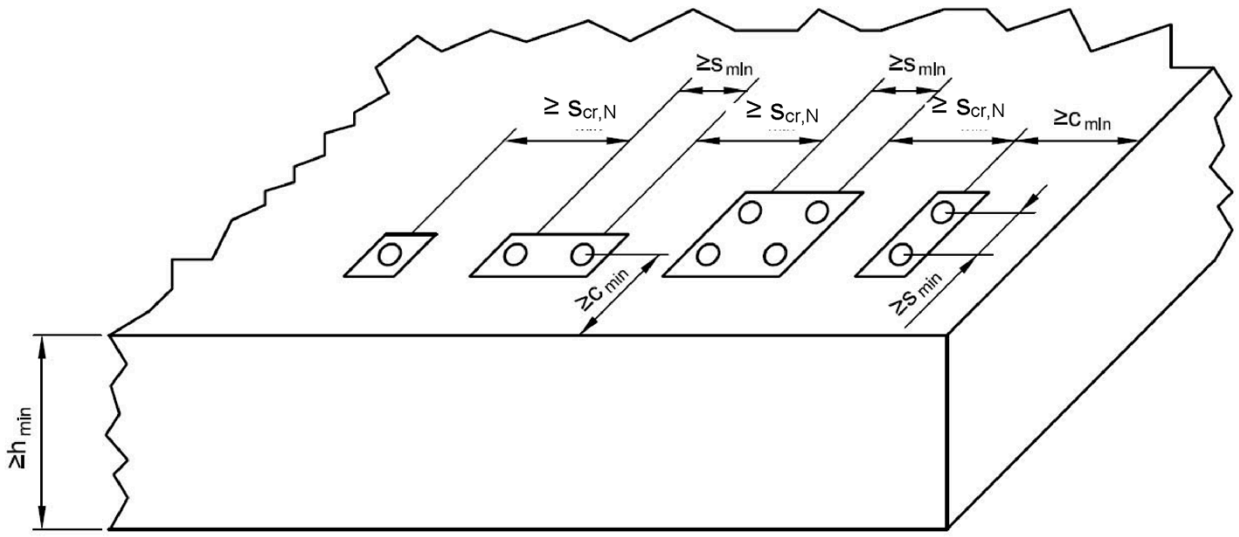
Table B2: **Installation parameters**

Thread	d	[mm]	M12	M16
Maximum torque moment	max. T_{inst}	[Nm]	≤ 27	≤ 54
Minimum screw-in length	$L_{sd,min}$	[mm]	16,0	20,0
Maximum screw-in length	$L_{sd,max}$	[mm]	M12x40: 30,0 M12x ≥70: 60,0	M16x43: 33,0 M16x ≥80: 70,0
Diameter of clearance hole in fixture	d_f	[mm]	14,0	18,0

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS

Intended use
Positions of the fixture, installation parameters Hexagon plate anchor

Annex B4



The mentioned spacings, edge distances and member thicknesses apply also for fixing anchors or hexagon plate anchors installed in the front edge.

Table B3: **Min. thickness of concrete member, min. edge distances and spacing**

Thread	d	[mm]	M10	M12[2)]	M16[2)]	M20
Minimium spacing	s_{min}	[mm]	100	100	100	120
Minimum edge distance	c_{min}	[mm]	50	50	50	60
Minimum thickness of concrete member	h_{min}	[mm]	h_{nom} + c_{nom} [1)]			

[1)] c_{nom} in accordance with EN 1992-1:2004+AC 2010 with $c_{nom} \geq 20$ mm
For fixing anchors made of stainless steel a minimum concrete cover $c_{nom} = 20$ mm is sufficient.

[2)] applies also to Hexagon plate anchors TWS

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex B5
Intended use Arrangement of fixing anchors and member thickness	

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Installation instruction - part 1

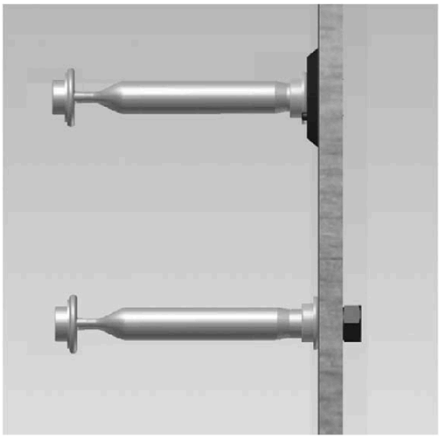
1. Scope of delivery

1) Selection of fixing anchor or hexagon plate anchor in accordance with the planning documents.

1a) DEMU T-FIXX made of galvanised steel (GV) or stainless steel (A4), or HALFEN TWS made of galvanised steel (GV)

1b) Data clip for T-FIXX GV,
colour: grey
Data clip for T-FIXX A4,
colour: white

2. Fixing of the anchor to the formwork



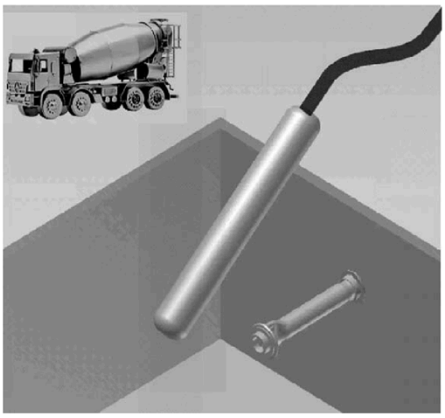
1) Attach data clip to the fixing anchor.

2) Fix the anchor (DEMU T-FIXX or HALFEN TWS) to the formwork with the help of DEMU assembly accessories (e. g. nailing plate) or alternatively by hexagon bolts.

→ The inside of the threaded socket must be protected against ingress of dirt and water.

3) If necessary, supplementary reinforcement has to be placed according to the planning documents.

3. Pouring and compacting of concrete



1) Pour concrete carefully, make sure the anchor stays in place!

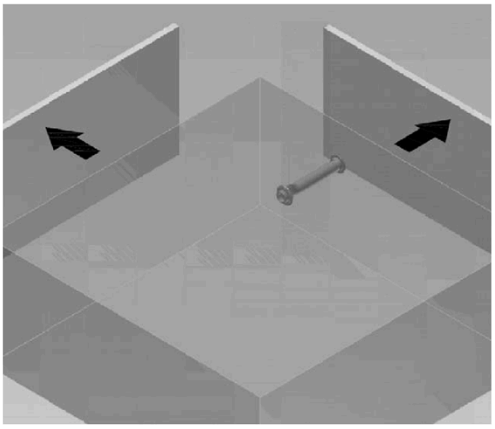
2) Compact concrete carefully, avoid direct contact between compacting device and anchor.

→ The anchor must not be moved by force or damaged!

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS	Annex B6
Intended use Installation instruction – part 1	

Installation instruction - part 2

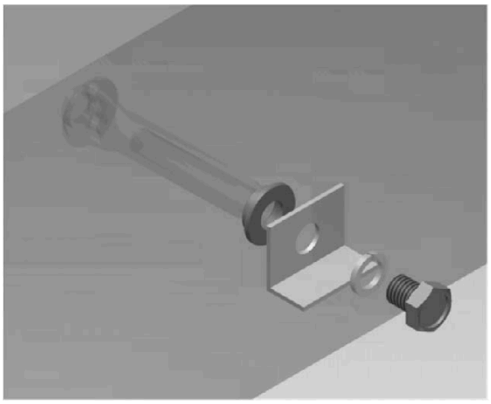
4. Hardening of the concrete, striking the formwork



1) Remove assembly accessories and formwork.

2) Check if the inside of the threaded socket is free from dirt, otherwise clean it;
further protection against ingress of water, dirt, etc. until required for use.

5. Mounting of fixture

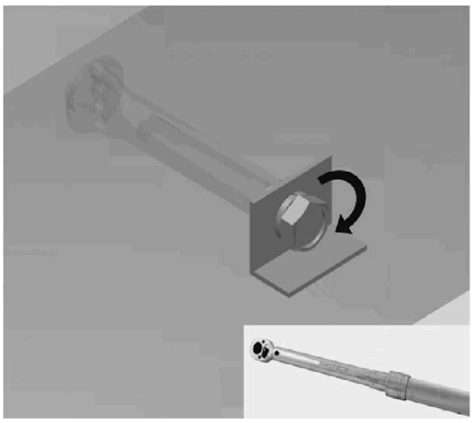


1) Make sure that the concrete has reached its final strength.

2) Check the length of the required bolt.
→ Maximum / minimum screw-in length in accordance with Annexes B3 or B4!

3) Mounting of the fixture
→ Use fixing components according Annex A5, Table A4 or Annex A6, Table A6.
→ Maximum torque moments, see table below!
→ Take additionally care of assembly advices for the fixture.

6. Maximum torque moments



Apply torque moment with the help of a torque wrench.
T_{inst} must not be exceeded.

Maximum installation torque moment T_{inst}

Thread	d	[mm]	M10	M12	M16	M20
DEMU T-FIXX	max. T_{inst}	[Nm]	≤ 8	≤ 10	≤ 30	≤ 60
HALFEN TWS			-	≤ 27	≤ 54	-

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS

Intended use
Installation instruction – part 2

Annex B7

Table C1: **Characteristic values for tension loads** (T-FIXX)

Thread		d	[mm]	**M10**	**M12**	**M16**	**M20**
Steel failure, fixing anchor and screw (min. steel strength 4.6) made of galvanised steel							
Characteristic resistance		$N_{Rk,s}$	[kN]	17,5	29,2	47,4	61,4
Partial factor		γ_{Ms} [1)]	[-]	1,74			
Steel failure, fixing anchor and screw (min. steel strength A4-50) made of stainless steel							
Characteristic resistance		$N_{Rk,s}$	[kN]	24,9	42,2	69,7	90,3
Partial factor		γ_{Ms} [1)]	[-]	2,79	2,86	2,79	
Steel failure, fixing anchor and screw (min. steel strength A4-70) made of stainless steel							
Characteristic resistance		$N_{Rk,s}$	[kN]	24,9	43,5	69,7	90,3
Partial factor		γ_{Ms} [1)]	[-]	2,79			
Pull-out failure							
Fixing anchor electrolytically galvanised							
Char. resistance in cr. concrete	C20/25	$N_{Rk,p}$	[kN]	17,1	28,3	46,3	56,6
Char. resistance in uncr. concrete	C20/25	$N_{Rk,p}$	[kN]	24,0	39,6	64,8	79,2
Fixing anchor in stainless steel							
Char. resistance in cr. concrete	C20/25	$N_{Rk,p}$	[kN]	13,8	27,5	38,9	47,0
Char. resistance in uncr. concrete	C20/25	$N_{Rk,p}$	[kN]	19,3	38,5	54,5	65,7
Increasing factors for $N_{Rk,p}$ = $N_{Rk,p(C20/25)} \bullet \Psi c$ in cracked and uncracked concrete	C25/30	Ψ_c	[-]	1,25			
	C30/37	Ψ_c	[-]	1,50			
	C35/45	Ψ_c	[-]	1,75			
	C40/50	Ψ_c	[-]	2,00			
	C45/55	Ψ_c	[-]	2,25			
	C50/60	Ψ_c	[-]	2,50			
Partial factor		γ_{Mp} [1)]	[-]	1,50			
Concrete cone failure				**M10**	**M12**	**M16**	**M20**
Effective anchorage depth		h_{ef}	[mm]	.x50: 43,7 .x65 [2)]: 58,7 .x75 [3)]: 68,7 L ≥ 50: h_{ef} [4)]	.x50: 42,5 .x70: 62,5 .x95 [3)]: 87,5 .x115 [2)]: 107,5 L ≥ 50: h_{ef} [4)]	.x60: 51,3 .x80 [2)]: 71,3 .x100 [3)]: 91,3 .x110 [2)]: 101,3 .x125 [3)]: 116,3 L ≥ 60: h_{ef} [4)]	.x70: 61,2 .x100: 91,2 .x125 [2)]: 116,2 .x145 [3)]: 136,2 L ≥ 70: h_{ef} [4)]
Factor to take into account the influence of load transfer mechanisms in cracked and uncracked concrete		k_1	[-]	8,9			
			[-]	12,7			
Characteristic spacing		$s_{cr,N}$	[mm]	$3,0 \bullet h_{ef}$			
Characteristic edge distance		$c_{cr,N}$	[mm]	$1,5 \bullet h_{ef}$			
Partial factor		γ_{Mc} [1)]	[-]	1,50			
Splitting							
Characteristic resistance		$N^0_{Rk,sp}$	[kN]	$N^0_{Rk,sp} = \min \{N^0_{Rk,c}; N_{Rk,p}\}$ [5)]			
Minimum thickness of concrete member		h ≥	[mm]	$2,0 \bullet h_{ef}$			
Characteristic spacing		$s_{cr,sp}$	[mm]	$3,0 \bullet h_{ef}$			
Characteristic edge distance		$c_{cr,sp}$	[mm]	$1,5 \bullet h_{ef}$			
Partial factor		γ_{Msp} [1)]	[-]	1,50			

[1)] in absence of other national regulations; [2)] only stainless steel; [3)] only galvanised steel; [4)] h_{ef} = L - Lhd + 2 [mm];
[5)] $N^0_{Rk,c}$ according to EN 1992-4:2018

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS

Performances
Characteristic values for tension loads of T-FIXX

Annex C1

Table C2: **Displacements under tension loads** (T-FIXX)

Thread	d	[mm]	M10	M12	M16	M20
Tension load	N	[kN]	7	12	19	25
Short-term displacements	δ_{N0}	[mm]	0,3	0,5	0,3	0,2
Long-term displacements	$\delta_{N\infty}$	[mm]	0,6	1,0	0,6	0,4

Table C3: **Characteristic values for shear loads** - steel failure (T-FIXX)

Thread	d	[mm]	**M10**	**M12**	**M16**	**M20**
Shear loads without lever arm						
Group factor (EN 1992-4:2019, 7.2.2.3.1)	k_7	[-]	1,0			
Steel failure, fixing anchor and screw (min. steel strength 4.6) made of galvanised steel						
Characteristic resistance	$V_{Rk,s}$	[kN]	8,8	14,6	23,7	30,7
Partial factor	γ_{Ms} [1)]	[-]	1,45			
Steel failure, fixing anchor and screw (min. steel strength A4-50) made of stainless steel						
Characteristic resistance	$V_{Rk,s}$	[kN]	12,5	21,1	34,8	45,1
Partial factor	γ_{Ms} [1)]	[-]	2,33	2,38	2,33	
Steel failure, fixing anchor and screw (min. steel strength A4-70) made of stainless steel						
Characteristic resistance	$V_{Rk,s}$	[kN]	12,5	21,8	34,8	45,1
Partial factor	γ_{Ms} [1)]	[-]	2,33			
Shear loads with lever arm						
Steel failure, fixing anchor and screw (min. steel strength 4.6) made of galvanised steel						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	29,9	52,4	133,2	259,6
Partial factor	γ_{Ms} [1)]	[-]	1,67			
Steel failure, fixing anchor and screw (min. steel strength 5.6) made of galvanised steel						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	37,4	65,5	166,5	324,5
Partial factor	γ_{Ms} [1)]	[-]	1,67			
Steel failure, fixing anchor and screw (min. steel strength 8.8) made of galvanised steel						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	68,9	104,8	263,8	541,4
Partial factor	γ_{Ms} [1)]	[-]	1,45	1,25	1,45	
Steel failure, fixing anchor and screw (min. steel strength A4-50) made of stainless steel						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	37,4	65,5	166,5	324,5
Partial factor	γ_{Ms} [1)]	[-]	2,38			
Steel failure, fixing anchor and screw (min. steel strength A4-70) made of stainless steel						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	52,3	91,7	233,1	454,4
Partial factor	γ_{Ms} [1)]	[-]	1,56			
Steel failure, fixing anchor and screw (min. steel strength A4-80) made of stainless steel						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	101,3	104,8	388,0	796,2
Partial factor	γ_{Ms} [1)]	[-]	2,33	1,33	2,33	

[1)] in absence of other national regulations

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS

Performances
Displacements under tension loads and characteristic values for shear loads of T-FIXX

Annex C2

Table C4: **Characteristic values for shear loads** - concrete failure (T-FIXX)

Pry-out failure			**M10**	**M12**	**M16**	**M20**
Factor	k_8	[-]	.x50: 1,0	.x50: 1,0	.x60: 1,0	.x70: 2,0
			.x65[2]: 1,0	.x70: 2,0	.x80[2]: 2,0	.x100: 2,0
			.x75[3]: 2,0	.x95[3]: 2,0	.x100[3]: 2,0	.x125[2]: 2,0
				.x115[2]: 2,0	.x110[2]: 2,0	.x145[3]: 2,0
					.x125[3]: 2,0	
			h_{ef} < 60 mm: 1,0; h_{ef} ≥ 60 mm: 2,0			
Partial factor	γ_{Mcp} [1]	[-]	1,50			

Concrete edge failure (without suppl. reinf.)			**M10**	**M12**	**M16**	**M20**
Effective length of fixing anchor (for shear loads)	l_f	[mm]	.x50: 28,2	.x50: 26,5	.x60: 35,3	.x70: 45,2
			.x65[2]: 43,2	.x70: 46,5	.x80[2]: 55,3	.x100: 75,2
			.x75[3]: 53,2	.x95[3]: 71,5	.x100[3]: 75,3	.x125[2]: 100,2
				.x115[2]: 91,5	.x110[2]: 85,3	.x145[3]: 120,2
					.x125[3]: 100,3	
			L ≥ 50: l_f [5]	L ≥ 50: l_f [5]	L ≥ 60: l_f [5]	L ≥ 70: l_f [5]
Effective outside diameter	d_{nom}	[mm]	13,5	17,0 / 17,2 [4]	21,3	26,9
Partial factor	γ_{Mce} [1]	[-]	1,50			

[1] in absence of other national regulations; [2] only stainless steel; [3] only galvanized steel;
[4] higher value applies for stainless steel; [5] $l_f = h_{ef} - L_{crp}$

Table C5: **Displacements under shear loads** (T-FIXX)

Thread	d	[mm]	M10	M12	M16	M20
Shear load	V	[kN]	13	19	24	28
Short - term displacements	δ_{V0}	[mm]	2,0	2,0	2,0	3,0
Long - term displacements	$\delta_{V\infty}$	[mm]	3,0	3,0	3,0	4,5

Table C6: **Characteristic values for tension loads** (TWS)

Thread		d	[mm]	**M12**	**M16**
Steel failure, hexagon plate anchor and screw (min. steel strength 4.6) made of galvanised steel					
Characteristic resistance		$N_{Rk,s}$	[kN]	34,0	63,0
Partial factor		γ_{Ms} [1)]	[-]	2,01	
Steel failure, hexagon plate anchor and screw (min. steel strength 5.6) made of galvanised steel					
Characteristic resistance		$N_{Rk,s}$	[kN]	39,0	63,0
Partial factor		γ_{Ms} [1)]	[-]	2,01	
Pull-out failure					
Characteristic resistance in cracked concrete	C20/25	$N_{Rk,p}$	[kN]	110,3	131,5
Characteristic resistance in uncracked concrete	C20/25	$N_{Rk,p}$	[kN]	154,4	184,1
Increasing factors for $N_{Rk,p} = N_{Rk,p(C20/25)} \cdot \Psi c$ in cracked and uncracked concrete	C25/30	Ψ_c	[-]	1,25	
	C30/37	Ψ_c	[-]	1,50	
	C35/45	Ψ_c	[-]	1,75	
	C40/50	Ψ_c	[-]	2,00	
	C45/55	Ψ_c	[-]	2,25	
	C50/60	Ψ_c	[-]	2,50	
Partial factor		γ_{Mp} [1)]	[-]	1,50	
Concrete cone failure				**M12**	**M16**
Effective anchorage depth		h_{ef}	[mm]	M12x40: 37,0 M12x70: 67,0	M16x43: 40,0 M16x80: 77,0
				L ≥ 40: h_{ef} [2)]	L ≥ 80: h_{ef} [2)]
Factor to take into account the influence of load transfer mechanisms in cracked and uncracked concrete		k_1	[-]	8,9	
			[-]	12,7	
Characteristic spacing		$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$	
Characteristic edge distance		$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$	
Partial factor		γ_{Mc} [1)]	[-]	1,50	
Splitting					
Characteristic resistance		$N^0_{Rk,sp}$	[kN]	$N^0_{Rk,sp} = \min \{N^0_{Rk,sp}; N^0_{Rk,sp}\}$	
Minimum thickness of concrete member		$h \geq$	[mm]	$2,0 \cdot h_{ef}$	
Characteristic spacing		$s_{cr,sp}$	[mm]	$3,0 \cdot h_{ef}$	
Characteristic edge distance		$c_{cr,sp}$	[mm]	$1,5 \cdot h_{ef}$	
Partial factor		γ_{Msp} [1)]	[-]	1,50	

[1)] in absence of other national regulations; [2)] $h_{ef} = L - m$ [mm]; [3)] $N^0_{RK,c}$ in accordance with EN 1992-4:2018 [mm]

Table C7: **Displacements under tension loads** (TWS)

Thread	d	[mm]	M12	M16
Tension load	N	[kN]	6	7
Short - term displacements	δ_{N0}	[mm]	0,3	0,1
Long - term displacements	$\delta_{N\infty}$	[mm]	0,5	0,2

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Table C8: **Characteristic values for shear loads** - steel failure (TWS)				
Thread	d	[mm]	**M12**	**M16**
Shear loads without lever arm				
Group factor (EN 1992-4:2019, 7.2.2.3.1)	k_7	[-]	1,0	
Steel failure, hexagon plate anchor and screw (min. steel strength 4.6) made of galvanised steel				
Characteristic resistance	$V_{Rk,s}$	[kN]	20,2	37,7
Partial factor	γ_{Ms} [1)]	[-]	1,67	
Steel failure, hexagon plate anchor and screw (min. steel strength 5.6) made of galvanised steel				
Characteristic resistance	$V_{Rk,s}$	[kN]	23,2	37,7
Partial factor	γ_{Ms} [1)]	[-]	1,67	
Shear loads with lever arm				
Steel failure, hexagon plate anchor and screw (min. steel strength 4.6) made of galvanised steel				
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	47,1	129,3
Partial factor	γ_{Ms} [1)]	[-]	1,67	
Steel failure, hexagon plate anchor and screw (min. steel strength 5.6) made of galvanised steel				
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	58,9	161,6
Partial factor	γ_{Ms} [1)]	[-]	1,67	
[1)] in absence of other national regulations				

Table C9: **Characteristic values for shear loads** - concrete failure (TWS)				
Pry-out failure			**M12**	**M16**
Factor	k_8	[-]	M12x40: 1,0 M12x70: 2,0 h_{ef} < 60 mm: 1,0; h_{ef} ≥ 60 mm: 2,0	M16x43: 1,0 M16x80: 2,0
Partial factor	γ_{Mcp} [1)]	[-]	1,50	
Concrete edge failure (without supplimentary reinforcement)			**M12**	**M16**
Effective length of hexagon plate anchor (for shear loads)	l_f	[mm]	M12x40: 37,0 M12x70: 67,0 L ≥ 40: l_f [2)]	M16x43: 40,0 M16x80: 77,0 L ≥ 43: l_f [2)]
Effective outside diameter	d_{nom}	[mm]	17,0	22,0
Partial factor	γ_{Mce} [1)]	[-]	1,50	
[1)] in absence of other national regulations; [2)] $l_f = h_{ef}$				

Table C10: **Displacements under shear loads** (TWS)				
Thread	d	[mm]	M12	M16
Shear load	V	[kN]	3	3
Short - term displacements	δ_{V0}	[mm]	0,3	0,3
Long - term displacements	$\delta_{V\infty}$	[mm]	0,5	0,4

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Performances
Characteristic values and displacements under shear loads of TWS

Annex C5

Table C11: **Characteristic values for resistance to fire**

Thread size		d	[mm]	**M10**	**M12**[2]	**M16**[2]	**M20**
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$), fixing anchor and screw made of galvanised steel[2]							
Characteristic resistance	R30	$F_{Rk,s,fi}$	[kN]	0,8	1,7	2,8	3,6
	R60	$F_{Rk,s,fi}$	[kN]	0,7	1,3	2,1	2,7
	R90	$F_{Rk,s,fi}$	[kN]	0,5	1,1	1,8	2,3
	R120	$F_{Rk,s,fi}$	[kN]	0,4	0,8	1,4	1,8
Partial factor		$\gamma_{Ms,fi}$ [1]	[-]	1,00			
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,1	2,6	6,7	13,0
	R60	$M^0_{Rk,s,fi}$	[Nm]	1,0	2,0	5,0	9,7
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,7	4,3	8,4
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6	1,3	3,3	6,5
Partial factor		$\gamma_{Ms,fi}$ [1]	[-]	1,00			
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$), fixing anchor and screw made of stainless steel							
Characteristic resistance	R30	$F_{Rk,s,fi}$	[kN]	1,2	2,5	4,2	5,4
	R60	$F_{Rk,s,fi}$	[kN]	1,0	2,1	3,5	4,5
	R90	$F_{Rk,s,fi}$	[kN]	0,8	1,7	2,8	3,6
	R120	$F_{Rk,s,fi}$	[kN]	0,7	1,3	2,2	2,9
Partial factor		$\gamma_{Ms,fi}$ [1]	[-]	1,00			
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,9	3,9	10,0	19,5
	R60	$M^0_{Rk,s,fi}$	[Nm]	1,5	3,3	8,3	16,2
	R90	$M^0_{Rk,s,fi}$	[Nm]	1,2	2,6	6,7	13,0
	R120	$M^0_{Rk,s,fi}$	[Nm]	1,0	2,1	5,3	10,4
Partial factor		$\gamma_{Ms,fi}$ [1]	[-]	1,00			
Pull-out failure							
Characteristic resistance	R90	$N_{Rk,p,fi}$	[kN]	$N_{Rk,p,fi(90)} = 0,25 \cdot N_{Rk,p}$			
	R120	$N_{Rk,p,fi}$	[kN]	$N_{Rk,p,fi(120)} = 0,20 \cdot N_{Rk,p}$			
Partial factor		$\gamma_{Mp,fi}$ [1]	[-]	1,00			
Concrete cone failure							
Characteristic resistance	R90	$N_{Rk,c,fi}$	[kN]	$N^0_{Rk,c,fi(90)} = h_{ef}/200 \cdot N^0_{Rk,c} \le N^0_{Rk,c}$			
	R120	$N_{Rk,c,fi}$	[kN]	$N^0_{Rk,c,fi(120)} = 0,8 \cdot h_{ef}/200 \cdot N^0_{Rk,c} \le N^0_{Rk,c}$			
Characteristic spacing		$s_{cr,N,fi}$	[mm]	$4,0 \cdot h_{ef}$			
Characteristic edge distance		$c_{cr,N,fi}$	[mm]	$2,0 \cdot h_{ef}$			
Partial factor		$\gamma_{Mc,fi}$ [1]	[-]	1,00			
Concrete pry-out failure							
Characteristic resistance	R90	$V_{Rk,cp,fi}$	[kN]	$V_{Rk,cp,fi(90)} = k_3 \cdot N_{Rk,c,fi(90)}$			
	R120	$V_{Rk,cp,fi}$	[kN]	$V_{Rk,cp,fi(120)} = k_3 \cdot N_{Rk,c,fi(120)}$			
Partial factor		$\gamma_{Mc,fi}$ [1]	[-]	1,00			
Concrete edge failure							
Characteristic resistance	R90	$V_{Rk,c,fi}$	[kN]	$V^0_{Rk,c,fi(90)} = 0,25 \cdot V^0_{Rk,c}$			
	R120	$V_{Rk,c,fi}$	[kN]	$V^0_{Rk,c,fi(120)} = 0,20 \cdot V^0_{Rk,c}$			
Partial factor		$\gamma_{Mc,fi}$ [1]	[-]	1,00			

[1] in absence of other national regulations; [2] applies also to Hexagon plate anchors TWS

DEMU Fixing anchor T-FIXX and HALFEN Hexagon plate anchor TWS

Performances
Characteristic values for resistance to fire

Annex C6