Deutsches Institut für Bautechnik

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Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment ETA-15/0892 of 8 August 2016

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	DYWIDAG DUOFIX
Product family to which the construction product belongs	Bonded anchor for use in concrete
Manufacturer	DYWIDAG-Systems International GmbH Destouchesstraße 68 80796 München DEUTSCHLAND
Manufacturing plant	DYWIDAG-Systems International GmbH Pfriemsdorfer Weg 11 06366 Köthen DEUTSCHLAND
This European Technical Assessment contains	16 pages including 3 annexes
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	Guideline for European technical approval of "Metal anchors for use in concrete", ETAG 001 Part 5: "Bonded anchors", April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.

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Specific Part

1 Technical description of the product

The "DYWIDAG DUOFIX" is a bonded anchor consisting of a cartridge with DYWIDAG DUOFIX adhesive and a DUOFIX anchor rod of size 15 mm with a special thread made of stainless steel.

The DYWIDAG DUOFIX anchor rod is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and 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 resistance under static and quasi-static loading	See Annex C 1 to C 2
Displacements	See Annex C 3

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply..

3.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 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.

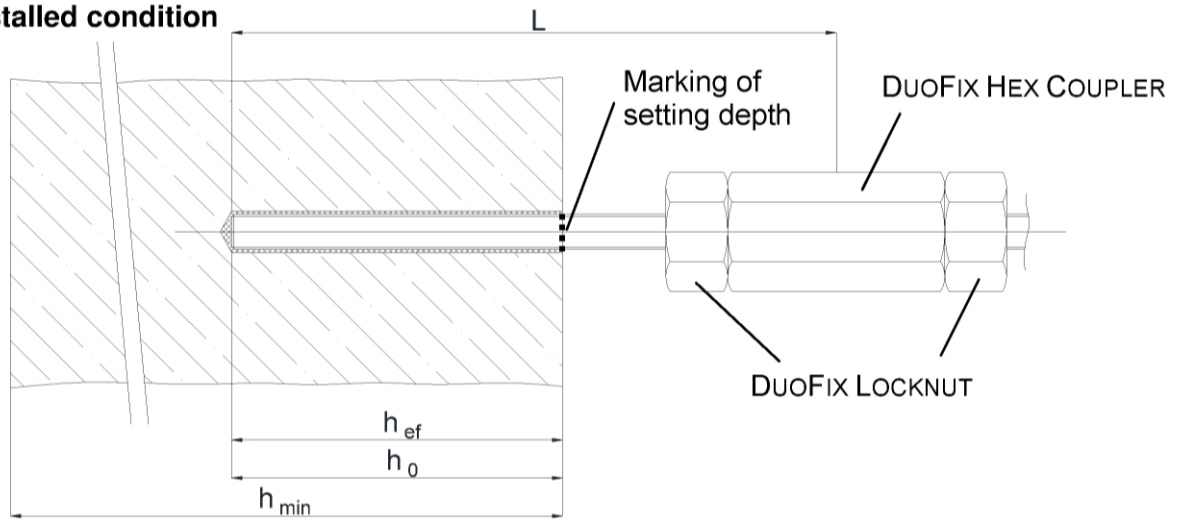
Issued in Berlin on 8 August 2016 by Deutsches Institut für Bautechnik

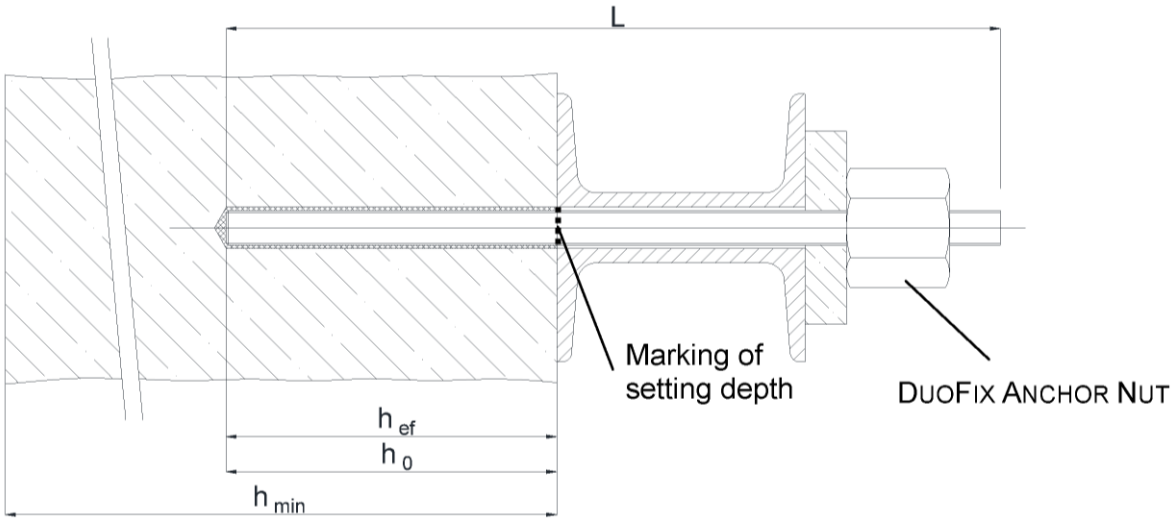
Uwe Bender
Head of Department

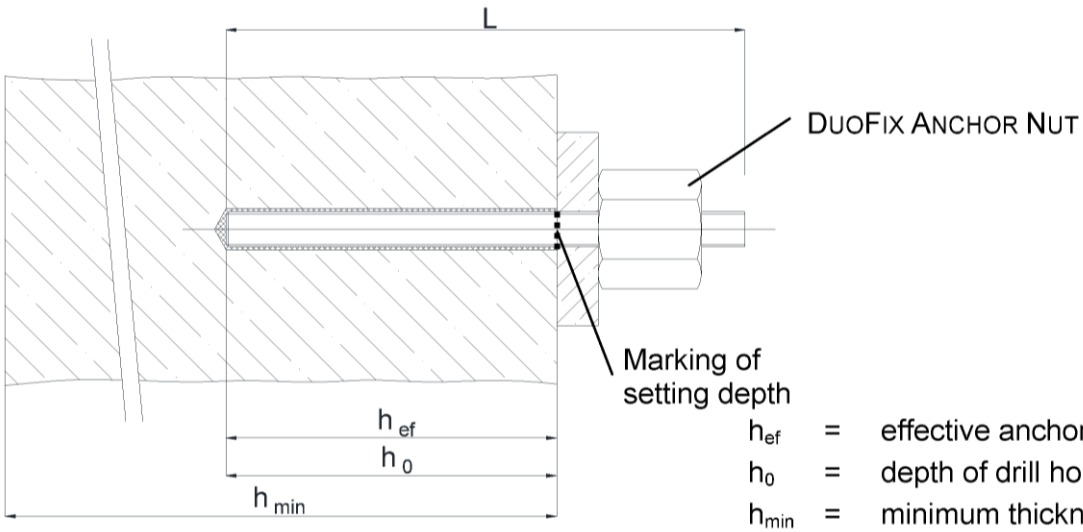
beglaubigt:
Lange

Deutsches Institut für Bautechnik DIBt

Installed condition







h_{ef} = effective anchorage depth
h_0 = depth of drill hole
h_{min} = minimum thickness of member
L = Length of the anchor bar

DYWIDAG DUOFIX	**Annex A 1**
Product description Installed condition	

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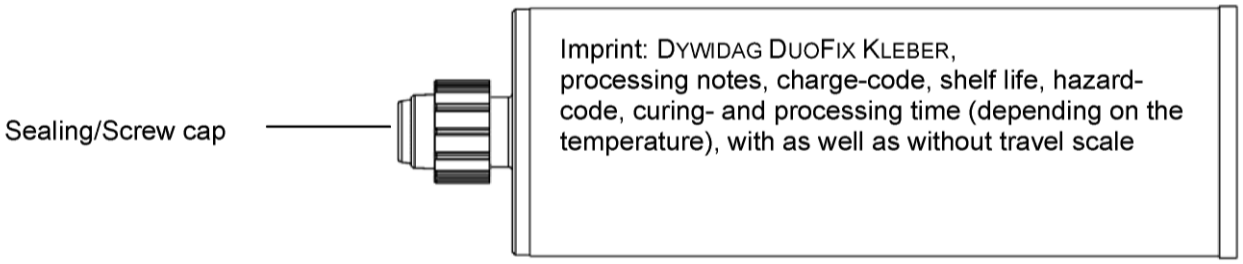
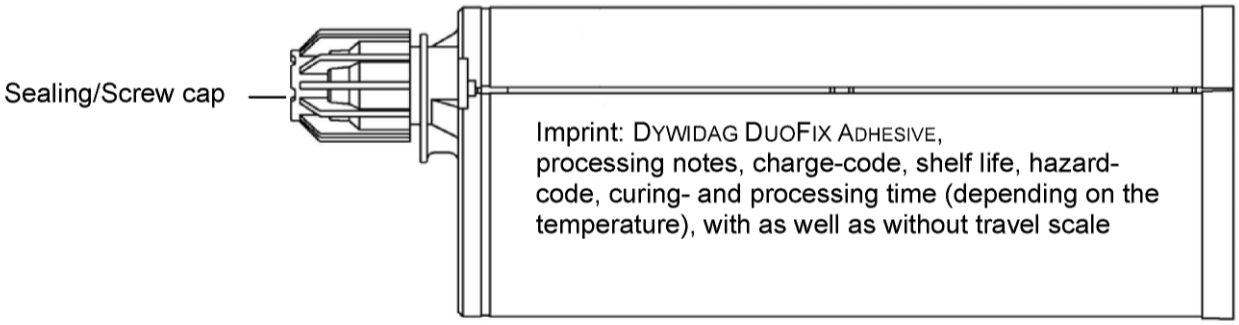
Cartridge: DYWIDAG DUOFIX ADHESIVE

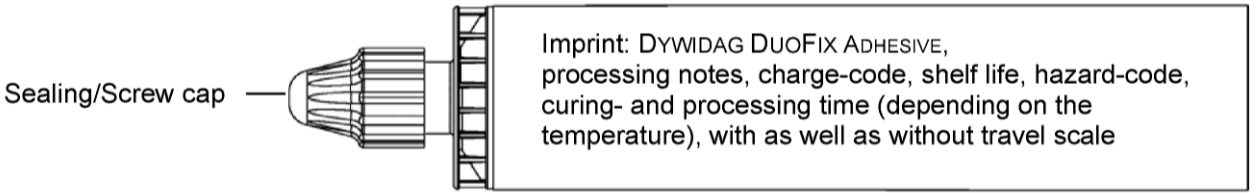
150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml cartridge (Type: coaxial)



235 ml, 345 ml up to 360 ml and 825 ml cartridge (Type: "side-by-side")



165 ml and 300 ml cartridge (Type: "foil tube")



Static Mixer

DYWIDAG DUOFIX	**Annex A 2**
Product description Injection system	

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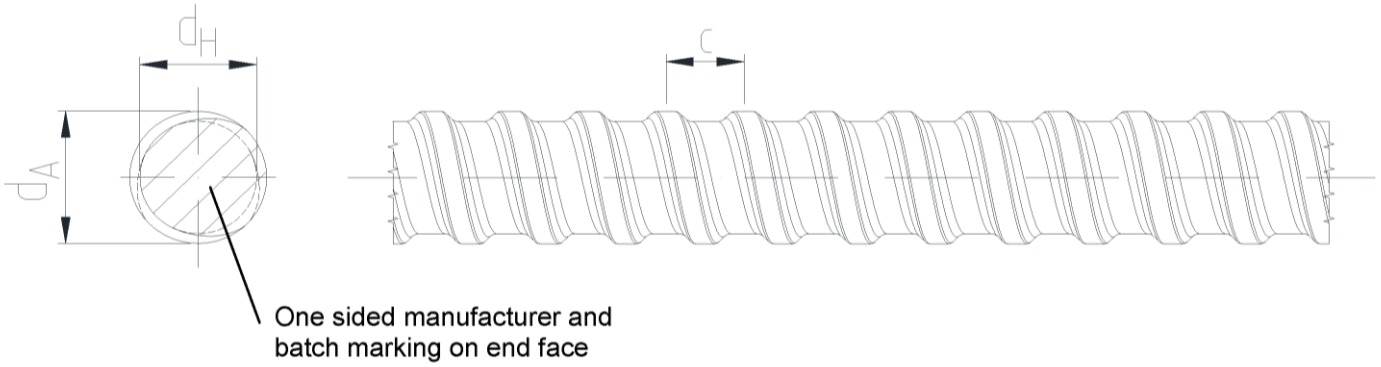
DUOFIX THREAD BAR



Nominal diameter	Nominal weight	Nominal cross section	Dimensions		
Ø [mm]	g [Kg/m]	A_s [mm²]	d_A [mm]	d_H [mm]	c [mm]
15	1,50	193	17	15	10

Material

stainless steel according to DIN EN 10088-3, cold-rolled

DYWIDAG DUOFIX

Product description
DUOFIX THREAD BAR

Annex A 3

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Specifications of intended use

Anchorages subject to:
- Static and quasi-static loads.

Base materials:
- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C50/60 according to EN 206-1:2000.
- Uncracked or cracked concrete.

Temperature Range:
- I: - 40 °C to +40 °C (max long term temperature +24 °C and max short term temperature +40 °C)
- II: - 40 °C to +80 °C (max long term temperature +50 °C and max short term temperature +80 °C)
- III: - 40 °C to +120 °C (max long term temperature +72 °C and max short term temperature +120 °C)

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions (steel, stainless steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel).

Design:
- 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 are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Anchorages under static or quasi-static actions are designed in accordance with:
  - EOTA Technical Report TR 029 "Design of bonded anchors", Edition September 2010 or
  - CEN/TS 1992-4:2009

Installation:
- Dry or wet concrete.
- Hole drilling by hammer or compressed air drill mode.
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

DYWIDAG DUOFIX	Annex B 1
Intended Use Specifications	

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Table B1: Installation parameters for DYWIDAG DUOFIX THREAD BAR

DYWIDAG DUOFIX THREAD BAR		Ø 15
Nominal drill hole diameter	d_0 [mm] =	20
Effective anchorage depth	$h_{ef,min}$ [mm] =	75
	$h_{ef,max}$ [mm] =	300
Diameter of clearance hole in the fixture	d_f [mm] ≤	18
Diameter of steel brush	d_b [mm] ≥	22
Torque moment	T_{inst} [Nm] ≤	80
Minimum thickness of member	h_{min} [mm]	$h_{ef} + 2d_0$
Minimum centre distance	s_{min} [mm]	75
Minimum edge distance	c_{min} [mm]	75

DYWIDAG DUOFIX	Annex B 2
Intended Use Installation parameters	

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Steel brush

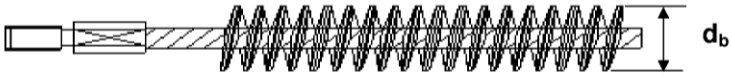
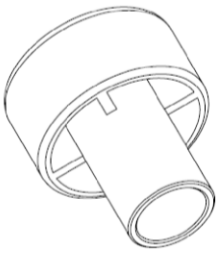


Table B2: Parameter cleaning and setting tools

DYWIDAG DUOFIX THREAD BAR	d_0 Drill bit - Ø	d_b Brush - Ø	$d_{b,min}$ min. Brush - Ø	Piston plug
(mm)	(mm)	(mm)	(mm)	(No.)
Ø15	20	22	20,5	# 20 recommended

Hand pump (volume 750 ml)
Drill bit diameter (d_0):
10 mm to 20 mm – uncracked concrete

Recommended compressed air tool (min 6 bar)
Drill bit diameter (d_0): 20 mm in non-cracked concrete and cracked concrete



Piston plug for overhead or horizontal installation
Drill bit diameter (d_0): 20 mm

DYWIDAG DUOFIX	Annex B 3
Intended Use Cleaning and setting tools	

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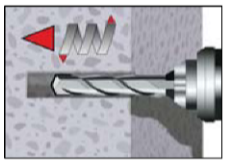
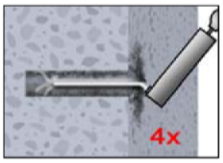
Installation instructions



1. Drill with hammer drill a hole into the base material to the size and embedment depth required by the selected anchor (d_o=20mm). In case of aborted drill hole: the drill hole shall be filled with mortar.



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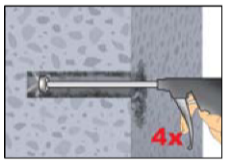

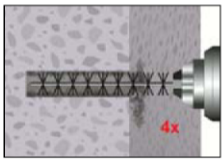

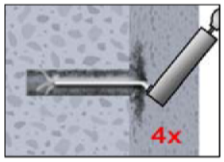

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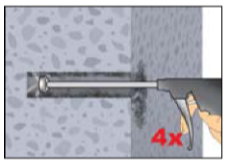


Attention! Standing water in the bore hole must be removed before cleaning..

2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) or a hand pump (Annex B 3) a minimum of four times. If the bore hole ground is not reached an extension shall be used.

The hand-pump can **only** be used for anchor sizes in uncracked concrete up to bore hole diameter 20mm or embedment depth up to 240mm.

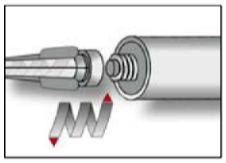
Compressed oil-free air (min. 6 bar) can be used for all sizes in cracked and uncracked concrete.

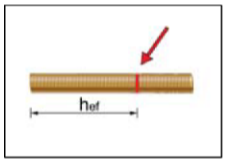
2b. Check brush diameter (Table B2) and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B2) a minimum of four times.

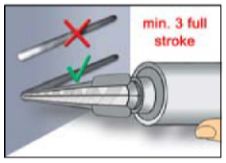
If the bore hole ground is not reached with the brush, a brush extension shall be used.

2c. Finally blow the hole clean again acc. to Annex B 3 with compressed air (min. 6 bar) or a hand pump (Annex B 3) a minimum of four times. If the bore hole ground is not reached an extension shall be used. The hand-pump can **only** be used for anchor sizes in uncracked concrete up to bore hole diameter 20mm or embedment depth up to 240mm. Compressed oil-free air (min. 6 bar) can be used for all sizes in cracked and uncracked concrete.

After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.







3. Attach a supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. Cut off the foil tube clip before use. Cut off the foil tube clip before use. For every working interruption longer than the recommended working time (Table B3) as well as for any new cartridge, a new static-mixer shall be used.

4. Prior to inserting the adhesive, the required embedment depth shall be marked on the thread bar.

5. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour. For foil tube cartridges a minimum of six full strokes shall be discarded.

DYWIDAG DUOFIX

Intended Use
Installation instructions

Annex B 4

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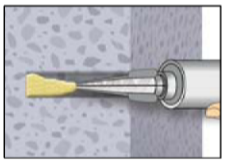
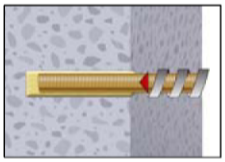
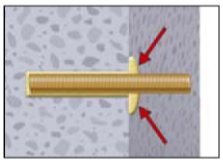
Installation instructions (continuation)





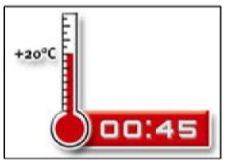


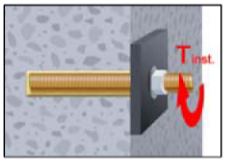
6. Starting from the bottom or back of the cleaned anchor hole fill it up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. For embedment larger than 190 mm an extension nozzle shall be used. For overhead and horizontal installation a piston plug (Annex B 3) and extension nozzle shall be used. Observe the gel-/ working times given in Table B3.

7. Push the thread bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

   The thread bar should be free of dirt, grease, oil or other foreign material.

8. Make sure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead application the anchor rod should be fixed (e.g. wedges).





9. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B3).

10. After full curing, the add-on part can be installed with the max. torque (Table B1) by using a calibrated torque wrench.

DYWIDAG DUOFIX

Intended Use
Installation instructions (continuation)

Annex B 5

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Table B3: Maximum Working time and minimum curing time
DYWIDAG DUOFIX ADHESIVE

Concrete temperature	Gelling- / working time	Minimum curing time in dry concrete [1]
-10 °C to -6°C	90 min[2]	24 h[2]
-5 °C to -1°C	90 min	14 h
0 °C to +4°C	45 min	7 h
+5 °C to +9°C	25 min	2 h
+ 10 °C to +19°C	15 min	80 min
+ 20 °C to +29°C	6 min	45 min
+ 30 °C to +34°C	4 min	25 min
+ 35 °C to +39°C	2 min	20 min
≥ + 40 °C	1,5 min	15 min
Cartridge temperature	+5°C to +40°C	

[1] In wet concrete the curing time must be doubled.
[2] Cartridge temperature must be at min. +15°C.

DYWIDAG DUOFIX	Annex B 6
Intended Use Curing time	

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Table C1: Characteristic values of resistance under tension loads

DYWIDAG DUOFIX THREAD BAR				**Ø 15**
Installation safety factor (dry and wet concrete)		$\gamma_2 = \gamma_{inst}$		1,2
Steel failure				
Characteristic tension resistance		$N_{Rk,s}$	[kN]	140
Installation safety factor		$\gamma_{Ms,N}$		1,4
Combined pull-out and concrete failure				
Characteristic bond resistance in non-cracked concrete C20/25				
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	12
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	9
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	6,5
Characteristic bond resistance in cracked concrete C20/25				
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,5
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,0
Increasing factors for concrete (only static or quasi-static actions) ψ_c		C25/30		1,02
		C30/37		1,04
		C35/45		1,07
		C40/50		1,08
		C45/55		1,09
		C50/60		1,10
Factor according to CEN/TS 1992-4-5 Section 6.2.2.3	Non-cracked concrete	k_8	[-]	10,1
	Cracked concrete			7,2
Betonausbruch				
Factor according to CEN/TS 1992-4-5 Section 6.2.3.1	Non-cracked concrete	k_{ucr}	[-]	10,1
	Cracked concrete	k_{cr}		7,2
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}
Centre distance		$s_{cr,N}$	[mm]	3,0 h_{ef}
Splitting				
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$

DYWIDAG DUOFIX

Performances
Characteristic values of resistance under tension loads

Annex C 1

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic values of resistance under shear loads

DYWIDAG DUOFIX THREAD BAR			Ø 15
Steel failure without lever arm			
Characteristic shear resistance	$V_{Rk,s}$	[kN]	70
Installation safety factor	$\gamma_{Ms,V}$		1,5
Duktilitätsfaktor gemäß CEN/TS 1992-4-5 Kapitel 6.3.2.1	k_2		0,8
Steel failure with lever arm			
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	318
Installation safety factor t	$\gamma_{Ms,V}$ [1)]		1,5
Concrete failure (pry-out)			
Factor k_3 in equation (27) of CEN/TS 1992-4-5 Section 6.3.3 Factor k in equation (5.7) of Technical Report TR 029 Section 5.2.3.3	$k_{(3)}$		2,0
Concrete edge failure			
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$
Outside diameter of anchor	d_{nom}	[mm]	17

DYWIDAG DUOFIX

Performances
Characteristic values of resistance under shear loads

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3: Displacements under tension load[1)]

DYWIDAG DUOFIX THREAD BAR			Ø 15
Non-cracked concrete C20/25			
Temperature range I: 40°C/24°C	δ_{N0}- factor	[mm/(N/mm²)]	0,031
	$\delta_{N\infty}$- factor	[mm/(N/mm²)]	0,045
Temperature range II: 80°C/50°C	δ_{N0}- factor	[mm/(N/mm²)]	0,075
	$\delta_{N\infty}$- factor	[mm/(N/mm²)]	0,108
Temperature range III: 120°C/72°C	δ_{N0}- factor	[mm/(N/mm²)]	0,075
	$\delta_{N\infty}$- factor	[mm/(N/mm²)]	0,108
Cracked concrete C20/25			
Temperature range I: 40°C/24°C	δ_{N0}- factor	[mm/(N/mm²)]	0,070
	$\delta_{N\infty}$- factor	[mm/(N/mm²)]	0,105
Temperature range II: 80°C/50°C	δ_{N0}- factor	[mm/(N/mm²)]	0,170
	$\delta_{N\infty}$- factor	[mm/(N/mm²)]	0,245
Temperature range III: 120°C/72°C	δ_{N0}- factor	[mm/(N/mm²)]	0,170
	$\delta_{N\infty}$- factor	[mm/(N/mm²)]	0,245

[1)] Calculation of the displacement
$\delta_{N0} = \delta_{N0}$- factor $\cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}$- factor $\cdot \tau$;

Table C4: Displacements under shear load[1)]

DYWIDAG DUOFIX THREAD BAR			Ø 15
Non-cracked concrete C20/25			
All temperature ranges	δ_{V0}- factor	[mm/(kN)]	0,04
	$\delta_{V\infty}$- factor	[mm/(kN)]	0,06
Cracked concrete C20/25			
All temperature ranges	δ_{V0}- factor	[mm/(kN)]	0,10
	$\delta_{V\infty}$- factor	[mm/(kN)]	0,15

[1)] Calculation of the displacement
$\delta_{V0} = \delta_{V0}$-factor $\cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}$-factor $\cdot V$;

DYWIDAG DUOFIX

Performances
Displacements

Annex C 3