



Approval body for construction products and types of construction

#### **Bautechnisches Prüfamt**

An institution established by the Federal and Laender Governments



## European Technical Assessment

## ETA-15/0583 of 1 September 2015

English translation prepared by DIBt - Original version in German language

### **General Part**

Technical Assessment Body issuing the European Technical Assessment:

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of

Deutsches Institut für Bautechnik

Injection system Dana Lim Forankringsmasse 294 for concrete

Bonded anchor for use in non-cracked concrete

Dana Lim A/S Københavnsvej 220 4600 Køge DÄNEMARK

Dana Lim A/S, Plant 1 Germany

23 pages including 3 annexes which form an integral part of this assessment

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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## European Technical Assessment ETA-15/0583

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#### Specific Part

#### 1 Technical description of the product

The "Injection system Dana Lim Forankringsmasse 294 for concrete" is a bonded anchor consisting of a cartridge with injection mortar Dana Lim Forankringsmasse 294 and a steel element. The steel element consist of a commercial threaded rod with washer and hexagon nut in the range of M8 to M30 or a reinforcing bar in the range of diameter 8 to 32 mm.

The steel element 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 for tension loads	See Annex C 1 / C 3 / C 5 / C 7
Characteristic resistance for shear loads	See Annex C 2 / C 4 / C 6 / C 8
Displacements under tension and shear loads	See Annex C 9 / C 10

#### 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.



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# 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 European Assessment Document

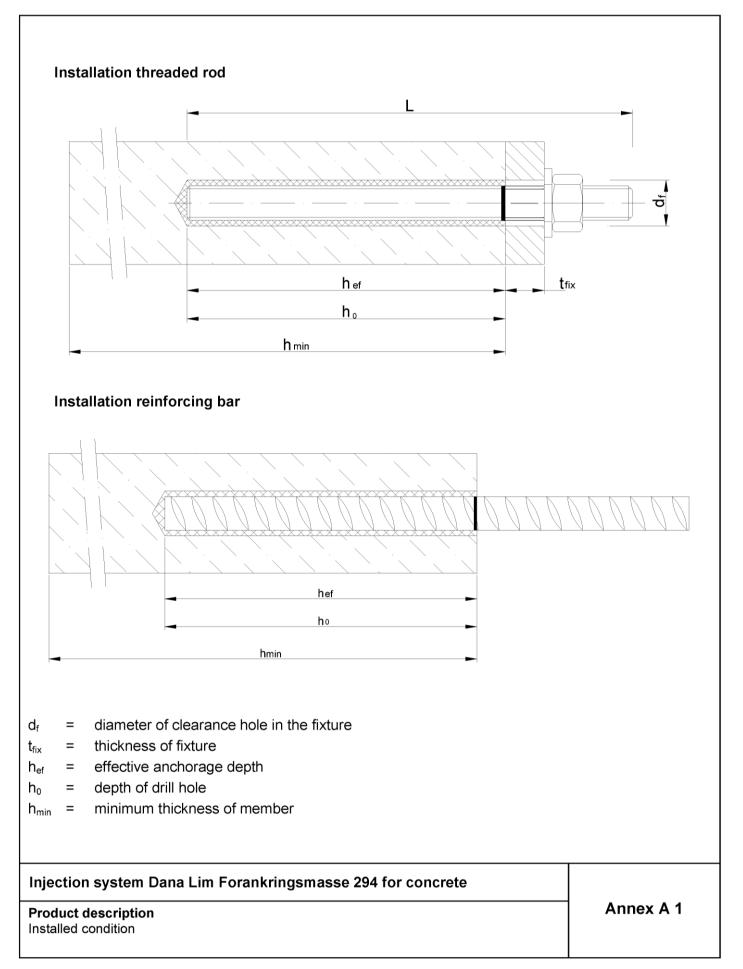
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 1 September 2015 by Deutsches Institut für Bautechnik

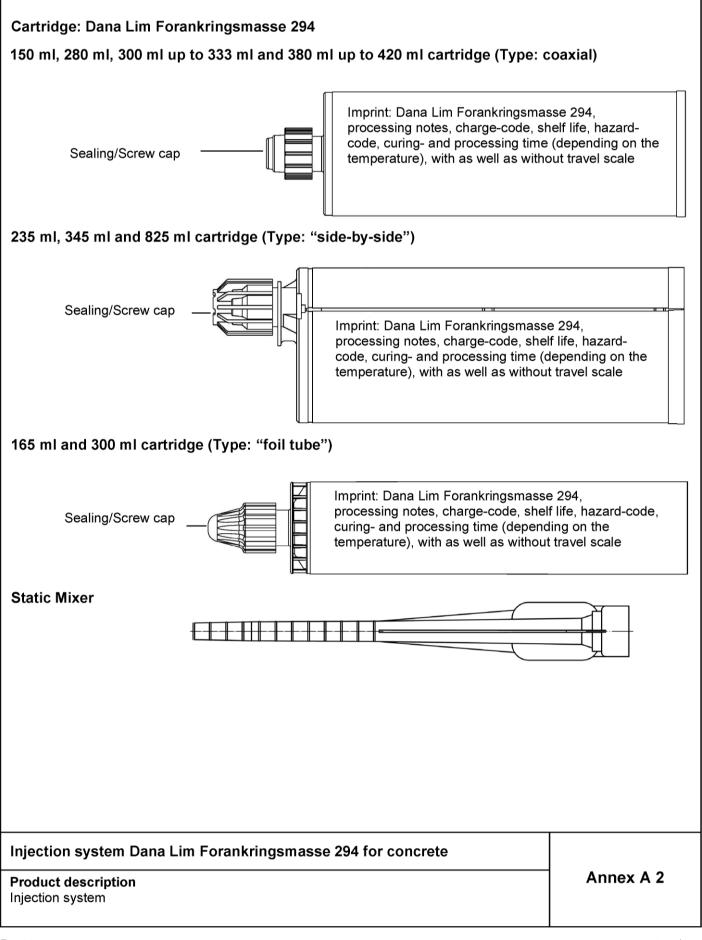
Uwe Bender Head of Department *beglaubigt:* Baderschneider

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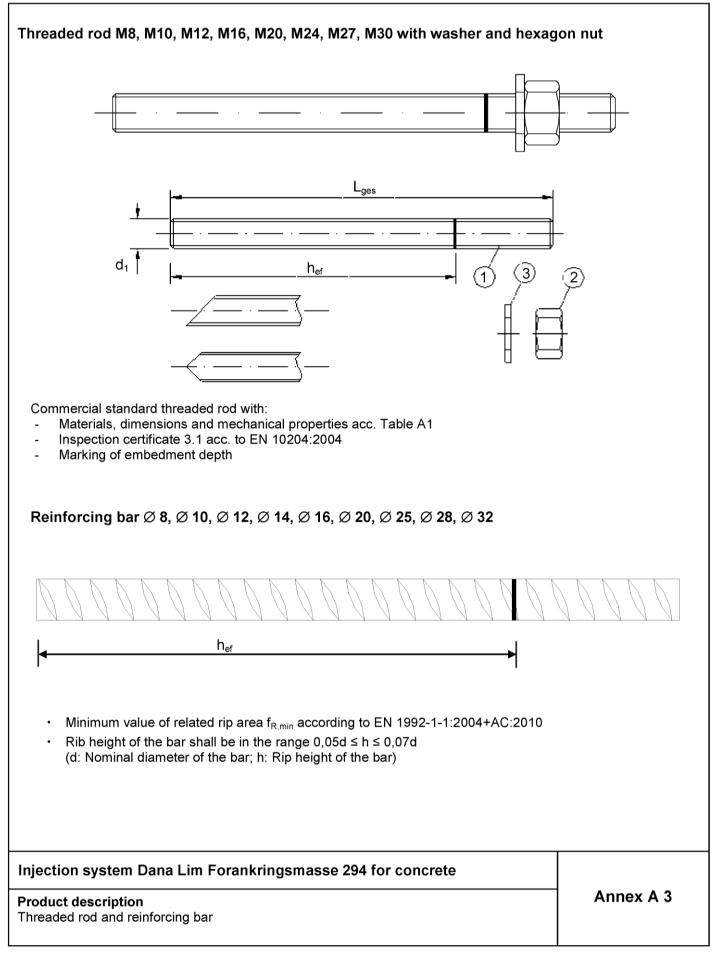














## Table A1: Materials

Steel         zinc         plated ≥ 5 µm acc. to EN ISO 4042:1999 or           Steel, hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009         Steel, EN 10087:1998 or EN 10263:2001           1         Anchor rod         Property class 4.6, 5.8, 8.8, EN 1993-1-8:2005+AC:200           2         Hexagon nut, EN ISO 4032:2012         Steel acc. to EN 10087:1998 or EN 10263:2001           2         Hexagon nut, EN ISO 4032:2012         Property class 4 (for class 4.6 rod) EN ISO 898-2:2012           3         EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7093:2000 or EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           1         Anchor rod         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 = 45 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 = 45 > 8% fracture elongation           3         EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7093:2000 o	No.         No. <th>Part</th> <th>Designation</th> <th>Material</th> <th></th>	Part	Designation	Material	
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2         Hexagon nut, EN ISO 4032:2012         Property class 4 (for class 4.6 rod) EN ISO 898-2:2012 Property class 5 (for class 5.8 rod) EN ISO 898-2:2012 Property class 8 (for class 5.8 rod) EN ISO 898-2:2012 Property class 8 (for class 8.8 rod) EN ISO 898-2:2012           3         Washer, EN ISO 887:2006, EN ISO 7098:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           5         Anchor rod         Steel, Zinc plated or hot-dip galvanised           1         Anchor rod         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 50 rod) EN ISO 3506	Hexagon nut, EN ISO 4032:2012Property class 4 (for class 4.6 rod) EN ISO 898-2:2012, Property class 5 (for class 5.8 rod) EN ISO 898-2:2012, Property class 8 (for class 5.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012, Property class 50 EN ISO 898-2:2012, Property class 50 EN ISO 3506-1:2009, S M24: Property class 50 EN ISO 3506-1:2009, S M24: Property class 70 EN ISO 3506-1:2009, A5 > 8% fracture elongation, Material 1.4401 / 1.4404 / 1.4571 EN 10088-1:2005, > M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009, S M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009, S M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009, S M24: Property class 70 rod) EN ISO 3506-1:2009, S M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009, S M24: Property class 50 (for class 70 rod) EN				
2         Hexagon nut, EN ISO 4032.2012         Property class 5 (for class 5.8 rod) EN ISO 898-2:2012 Property class 8 (for class 5.8 rod) EN ISO 898-2:2012           3         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           5         Stainless steel         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           3         EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           4         Hexagon rut, EN ISO 887:2006, 3         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           3         EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           4         Hornor rod         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 ION ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506           2         Hexagon nut, EN ISO 4032:2012         M424: Property class 50 (for class 50	Property class 5 (for class 5.8 rod) EN ISO 898-2:2012, Property class 8 (for class 8.8 rod) EN ISO 898-2:2012         Washer, EN ISO 887:2006, EN ISO 7093:2000 or EN ISO 7094:2000       Steel, zinc plated or hot-dip galvanised         Anchor rod       Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 A5 > 8% fracture elongation         Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 A5 > 8% fracture elongation         Washer, EN ISO 887:2006, EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401 / 1.4404 or 1.4571 EN 10088-1:2005, > M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 < M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009				
Property class 8 (for class 8.8 rod) EN ISO 898-2:2012           3         Washer, EN ISO 887:2006, EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           5         Steinless steel         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           3         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005, > M24: Property class 50 (for class 70 rod) EN ISO 3506           4         Anchor rod         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 (EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO	Property class 8 (for class 8.8 rod) EN ISO 898-2:2012           Washer, EN ISO 887:2006, EN ISO 7093:2000 or EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           Steel         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 A5 > 8% fracture elongation           Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009           Washer, EN ISO 887:2006, EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 (EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 FN ISO 3506-1:2009 ≤ M24: Property class 50 FN ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009	2	Hexagon nut, EN ISO 4032:2012		
3         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           4         Anchor rod         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           3         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           4         Material 1.4529 / 1.4565, EN 10088-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506           4         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506	Washer, EN ISO 887:2006, EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Steel, zinc plated or hot-dip galvanised         Anchor rod       Steel, zinc plated or hot-dip galvanised         Anchor rod       × Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-2:2009 A5 > 8% fracture elongation         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 70 rod)				
3         EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           31         Anchor rod         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           3         EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           4         Machor rod         Material 1.4401, 1.4565, EN 10088-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           1         Anchor rod         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 (for class 50 rod) EN ISO 3506	EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Steel, zinc plated or hot-dip galvanised           sss steel         Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           Hexagon nut, EN ISO 4032:2012         Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009           Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           Anchor rod         Material 1.4529 / 1.4565, EN 10088-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 50 EN ISO 3506-1:2009 A5 > 8% fracture elongation           Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 A5 > 8% fracture elongation           Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 EN ISO 7083:2000, EN ISO 7093:2000 or EN ISO 7083:2000, EN ISO 7093:2000 or EN ISO 7083:2000, EN ISO 7093:2000 or EN ISO 7084:2000           material 1.4529 / 1.4565, EN 10088-1:2005         Material 1.4529 / 1.4565, EN 10088-1:2005           For perty class 70 (for class 50 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009 S M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2		Washer EN ISO 887.2006		50 090-2.2012
1       Anchor rod       Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 70 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3500 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3500 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3500 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3500 ≤ M24: Property class 50 EN ISO 7094:2000         High corrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506	Anchor rod       Material 1.4401 / 1.4404 / 1.4571, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer       EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer       EN ISO 7093:2000 o	3	EN ISO 7089:2000, EN ISO 7093:2000 or	Steel, zinc plated or hot-dip galvanised	
1       Anchor rod       > M24: Property class 50 EN ISO 3506-1:2009         2       Material 1.4401 / 1.4571 EN 10088:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005,         3       Washer, EN ISO 887:2006,       Material 1.4401, 1.4404 / 1.4571, EN 10088:2005,         3       Washer, EN ISO 887:2006,       Material 1.4401, 1.4404 or 1.4571, EN 10088:1:2005         3       Washer, EN ISO 887:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         High corrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         4       Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506	Anchor rod       > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009       A5 > 8% fracture elongation         Material 1.4401 / 1.4501 EN 10088:2005,       > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         Vasher, EN ISO 887:2006,       EN ISO 7089:2000, EN ISO 7093:2000 or         EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         Orrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         Anchor rod       ≤ M24: Property class 70 EN ISO 3506-1:2009         45 > 8% fracture elongation       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         45 > 8% fracture elongation       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         45 > 8% fracture elongation       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         45 > 8% fracture elongation       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer, EN ISO 887:2006, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         SN 180 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         FN ISO 7089:2000, EN ISO 7093	Stain	less steel		
1       Anchor rod       > M24: Property class 50 EN ISO 3506-1:2009         2       Material 1.4401 / 1.4571 EN 10088:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005,         3       Washer, EN ISO 887:2006,       > M24: Property class 50 (for class 50 rod) EN ISO 3506         3       Washer, EN ISO 887:2006,       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         3       EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         High corrosion resistance steel         1       Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         4       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         5       M24: Property class 70 EN ISO 3506-1:2009         6       M24: Property class 70 EN ISO 3506-1:2009         6       M24: Property class 50 EN ISO 3506-1:2009         7       Anchor rod       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         8       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         9       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506         9       Hexago	Anchor rod       > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009       A5 > 8% fracture elongation         Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4401 / 1.4571 EN 10088:2005,         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         Matcrial 1.4529 / 1.4565, EN 10088-1:2005       Material 1.4529 / 1.4565, EN 10088-1:2005,         Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2009,         Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005,         Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2009,         45 > 8% fracture elongation       Material 1.4529 / 1.4565, EN 10088-1:2009,         45 > 8% fracture elongation       Material 1.4529 / 1.4565, EN 10088-1:2009,         45 > 8% fracture elongation       Material 1.4529 / 1.4565, EN 10088-1:2005,         Washer, EN ISO 887:2006, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005,         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005,         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer, EN ISO 887:2006, EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         Folge 11:00794:2000       Froperty class 50 (for class 50 rod) EN ISO 3506-2:2009			Material 1.4401 / 1.4404 / 1.4571, EN 10	088-1:2005.
1       Anchor rod       ≤ M24: Property class 70 EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005,         3       Washer, EN ISO 887:2006,       > M24: Property class 70 (for class 50 rod) EN ISO 3506         3       EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         High corrosion resistance steel         1       Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565, EN 10088-1:2009,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,	Anchor rod       ≤ M24: Property class 70 EN ISO 3506-1:2009         A5 > 8% fracture elongation       Material 1.4401 / 1.4571 EN 10088:2005,         Hexagon nut, EN ISO 4032:2012       > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,       Material 1.4401 / 1.4404 / or 1.4571, EN 10088-1:2005         EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         orrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005,         Anchor rod       Material 1.4529 / 1.4565 EN 10088-1:2009,         Exagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         Washer, EN ISO 887:2006,       Material 1.4529 / 1.4565 EN 10088-1:2005,         Hexagon nut, EN ISO 4032:2012       > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ✓ Masher, EN ISO 887:2006,       > M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ✓ Masher, EN ISO 887:2006,       > M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ✓ Masher, EN ISO 887:2006,       Material 1.4529 / 1.4565, EN 10088-1:2005,         N ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         Kiso 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         Fiso 7094:2000       Sar and de-coiled rods class B or C         fyk and k according to NDP or NCL o				
A5 > 8% fracture elongation         2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 350 ≤ M24: Property class 70 (for class 70 rod) EN ISO 350         3       Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         High corrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         1       Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 70 EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506	A5 > 8% fracture elongation           Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005,           Hexagon nut, EN ISO 4032:2012           × M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009           ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009           × Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           Washer, EN ISO 887:2000, EN ISO 7093:2000 or           EN ISO 7094:2000           orrosion resistance steel           Anchor rod           Anchor rod           × M24: Property class 50 EN ISO 3506-1:2009           × M24: Property class 50 EN ISO 3506-1:2009           × M24: Property class 50 EN ISO 3506-1:2009           × M24: Property class 70 EN ISO 3506-2:2009           × M24: Property class 70 end EN ISO 3506-2:2009           × M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009           × M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009           × M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009           × M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009           × M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009           × M24: Prop	1	Anchor roa		
2       Hexagon nut, EN ISO 4032:2012       Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005, > M24: Property class 50 (for class 50 rod) EN ISO 350 ≤ M24: Property class 70 (for class 70 rod) EN ISO 350 ≤ M24: Property class 70 (for class 70 rod) EN ISO 350         3       Washer, EN ISO 887:2006, EN ISO 7093:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         4       High corrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506	Material 1.4401 / 1.4404 / 1.4571 EN 10088:2005,         > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,         EN ISO 7089:2000, EN ISO 7093:2000 or         EN ISO 7094:2000         orrosion resistance steel         Anchor rod         Material 1.4529 / 1.4565, EN 10088-1:2005,         > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009         ≤ M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009			A5 > 8% fracture elongation	
≤ M24: Property class 70 (for class 70 rod) EN ISO 350           3         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000         Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005           High corrosion resistance steel         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506	≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7093:2000 or EN ISO 7094:2000         orrosion resistance steel         Anchor rod         Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009         ≤ M24: Property class 50 for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7093:2000 or EN ISO 7093:2000 or EN ISO 7094:2000         wreing bars         Bars and de-coiled rods class B or C fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013			Material 1.4401 / 1.4404 / 1.4571 EN 10	,
Washer, EN ISO 887:2006,       EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         High corrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005,         Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2009         ≤ M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009         Anchor rod         2         Hexagon nut, EN ISO 4032:2012	Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         orrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         waterial 1.4529 / 1.4565, EN 10088-1:2005       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         Bars and de-coiled rods class B or C fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013	2	Hexagon nut, EN ISO 4032:2012		
3       EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         High corrosion resistance steel         1       Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506	EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4401, 1.4404 or 1.4571, EN 10088-1:2005         orrosion resistance steel       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009         Anchor rod       ≤ M24: Property class 70 EN ISO 3506-1:2009         4       × Property class 70 EN ISO 3506-1:2009         5       > 8% fracture elongation         Material 1.4529 / 1.4565 EN 10088-1:2005,         > M24: Property class 70 EN ISO 3506-1:2009         45       > 8% fracture elongation         Material 1.4529 / 1.4565 EN 10088-1:2005,         > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,         EN ISO 7093:2000 or         EN ISO 7094:2000         wrcing bars         Rebar         EN 1992-1-1:2004+4C:2010, Apper C			$\leq$ M24: Property class 70 (for class 70 rc	od) EN ISO 3506-2:2009
1       Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005, > M24: Property class 50 EN ISO 3506-1:2009 ≤ M24: Property class 70 EN ISO 3506-1:2009 A5 > 8% fracture elongation         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506	Anchor rod       Material 1.4529 / 1.4565, EN 10088-1:2005,         > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009         As > 8% fracture elongation         Material 1.4529 / 1.4565 EN 10088-1:2005,         > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ≤ M24: Property class 50 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,         EN ISO 7089:2000, EN ISO 7093:2000 or         EN ISO 7094:2000         wreing bars         Bars and de-coiled rods class B or C         fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013	3	EN ISO 7089:2000, EN ISO 7093:2000 or	Material 1.4401, 1.4404 or 1.4571, EN 7	10088-1:2005
1         Anchor rod         > M24: Property class 50 EN ISO 3506-1:2009           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Hexagon nut, EN ISO 4032:2012           4         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           3         M24: Property class 50 (for class 50 rod) EN ISO 350           4         M24: Property class 70 (for class 70 rod) EN ISO 350	Anchor rod       > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009          As > 8% fracture elongation       Material 1.4529 / 1.4565 EN 10088-1:2005,         Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         Washer, EN ISO 887:2006,       > M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         Washers       Bars and de-coiled rods class B or C         fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013	High	corrosion resistance steel		
1         Anchor rod         > M24: Property class 50 EN ISO 3506-1:2009           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Hexagon nut, EN ISO 4032:2012           4         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Material 1.4529 / 1.4565 EN 10088-1:2005,           3         M24: Property class 50 (for class 50 rod) EN ISO 350           4         M24: Property class 70 (for class 70 rod) EN ISO 350	Anchor rod       > M24: Property class 50 EN ISO 3506-1:2009         ≤ M24: Property class 70 EN ISO 3506-1:2009          As > 8% fracture elongation       Material 1.4529 / 1.4565 EN 10088-1:2005,         Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         Washer, EN ISO 887:2006,       > M24: Property class 70 (for class 50 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,       Material 1.4529 / 1.4565, EN 10088-1:2005         Washer, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         Washers       Bars and de-coiled rods class B or C         fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013			Material 1 4529 / 1 4565, EN 10088-1:20	005
1       Anchor rod       ≤ M24: Property class 70 EN ISO 3506-1:2009         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,         2       Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005,	Anchor rod       ≤ M24: Property class 70 EN ISO 3506-1:2009         A5 > 8% fracture elongation       Material 1.4529 / 1.4565 EN 10088-1:2005,         Hexagon nut, EN ISO 4032:2012       > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009         ✓ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ✓ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         ✓ Washer, EN ISO 887:2006,         EN ISO 7089:2000, EN ISO 7093:2000 or         EN ISO 7094:2000         Procing bars         Bars and de-coiled rods class B or C         Fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013				
A5 > 8% fracture elongation           2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 350 ≤ M24: Property class 70 (for class 70 rod) EN ISO 350	A5 > 8% fracture elongation         Material 1.4529 / 1.4565 EN 10088-1:2005,         Hexagon nut, EN ISO 4032:2012         Washer, EN ISO 4032:2012         Washer, EN ISO 887:2006,         EN ISO 7089:2000, EN ISO 7093:2000 or         EN ISO 7094:2000         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Material 1.4529 / 1.4565, EN 10088-1:2005         Material 1.4529 / 1.4565, EN 10088-1:2005         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Material 1.4529 / 1.4565, EN 10088-1:2005         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Material 1.4529 / 1.4565, EN 10088-1:2005         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Material 1.4529 / 1.4565, EN 10088-1:2005         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Material 1.4529 / 1.4565, EN 10088-1:2005         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Property class 70 (for class 70 rod	1	Anchor rod		
2         Hexagon nut, EN ISO 4032:2012         Material 1.4529 / 1.4565 EN 10088-1:2005,           2         Hexagon nut, EN ISO 4032:2012         > M24: Property class 50 (for class 50 rod) EN ISO 350           ≤         M24: Property class 70 (for class 70 rod) EN ISO 350	Hexagon nut, EN ISO 4032:2012       Material 1.4529 / 1.4565 EN 10088-1:2005, > M24: Property class 50 (for class 50 rod) EN ISO 3506-2:2009 ≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         washers       Material 1.4529 / 1.4565, EN 10088-1:2005         Precing bars       Bars and de-coiled rods class B or C fyk and k according to NDP or NCL of EN 1992-1-1/NA:2013				
≤ M24: Property class 70 (for class 70 rod) EN ISO 350	≤ M24: Property class 70 (for class 70 rod) EN ISO 3506-2:2009         Washer, EN ISO 887:2006,         EN ISO 7089:2000, EN ISO 7093:2000 or         Material 1.4529 / 1.4565, EN 10088-1:2005         ISO 7094:2000         Incing bars         Rebar         EN 1992-1-1:2004+4C:2010, Apper C			Material 1.4529 / 1.4565 EN 10088-1:20	
	Washer, EN ISO 887:2006,       Material 1.4529 / 1.4565, EN 10088-1:2005         EN ISO 7094:2000       Material 1.4529 / 1.4565, EN 10088-1:2005         ercing bars       Bars and de-coiled rods class B or C         Febar       Bars and de-coiled rods class B or C         FN 1992-1-1:2004+4C:2010       Appex C	2	Hexagon nut, EN ISO 4032:2012		,
Washer, EN ISO 887:2006.	EN ISO 7089:2000, EN ISO 7093:2000 or       Material 1.4529 / 1.4565, EN 10088-1:2005         EN ISO 7094:2000       Image: Comparison of the second se			$\leq$ M24: Property class 70 (for class 70 rc	od) EN ISO 3506-2:2009
	Rebar EN 1992-1-1:2004+AC:2010, Appex C Bars and de-coiled rods class B or C f <sub>yk</sub> and k according to NDP or NCL of EN 1992-1-1/NA:2013	3	EN ISO 7089:2000, EN ISO 7093:2000 or	Material 1.4529 / 1.4565, EN 10088-1:20	005
Reinforcing bars	Find the second	Reinf	orcing bars		
	Find the second				
1 Rebar 1 EN 1992-1-1:2004+4C:2010 Appex C f <sub>yk</sub> and k according to NDP or NCL of EN 1992-1-1/NA:		1		fykand k according to NDP or NCL of EN	l 1992-1-1/NA:2013
		-		asse 294 for concrete	Annex A 4
Injection system Dana Lim Forankringsmasse 294 for concrete		Prod Mate	luct description rials		ATTICK A 4



## Specifications of intended use

#### Anchorages subject to:

Static and quasi-static loads: M8 to M30, Rebar Ø8 to Ø32.

#### **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.
- Non-cracked concrete: M8 to M30, Rebar Ø8 to Ø32.

#### 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 (zinc coated steel, stainless steel or high corrosion resistant 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 or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (high corrosion resistant steel).

Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

#### 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: M8 to M30, Rebar Ø8 to Ø32.
- Flooded holes (not sea water): M8 to M16, Rebar Ø8 to Ø16.
- 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.

### Injection system Dana Lim Forankringsmasse 294 for concrete

## Intended Use

Specifications

Annex B 1



Anchor size		M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30		
Nominal drill hole diameter	d <sub>0</sub> [mm] =	10	12	14	18	24	28	32	35		
Effective encharges donth	h <sub>ef,min</sub> [mm] =	60	60	70	80	90	96	108	120		
Effective anchorage depth	h <sub>ef,max</sub> [mm] =	160	200	240	320	400	480	540	600		
Diameter of clearance hole in the fixture	d <sub>f</sub> [mm] ≤	9	12	14	18	22	26	30	33		
Diameter of steel brush	d <sub>b</sub> [mm] ≥	12	14	16	20	26	30	34	37		
Torque moment	T <sub>inst</sub> [Nm]≤	10	20	40	80	120	160	180	200		
Thickness of fixture	t <sub>fix,min</sub> [mm] >	0									
Thickness of fixture	t <sub>fix,max</sub> [mm] <	1500									
Minimum thickness of member	h <sub>min</sub> [mm]	m] $\begin{array}{c c} h_{ef} + 30 \text{ mm} \\ \geq 100 \text{ mm} \end{array}$ $h_{ef} + 2d_0$									
Minimum spacing	s <sub>min</sub> [mm]	40	50	60	80	100	120	135	150		
Minimum edge distance	c <sub>min</sub> [mm]	40	50	60	80	100	120	135	150		

## Table B2: Installation parameters for rebar

Rebar size		Ø <b>8</b>	Ø 10	Ø 12	Ø 14	Ø 16	Ø <b>20</b>	Ø 25	Ø 28	Ø 32	
Nominal drill hole diameter	d <sub>0</sub> [mm] =	12	14	16	18	20	24	32	35	40	
Effective encharge donth	h <sub>ef,min</sub> [mm] =	60	60	70	75	80	90	100	112	128	
Effective anchorage depth	h <sub>ef,max</sub> [mm] =	160	200	240	280	320	400	480	540	640	
Diameter of steel brush	d <sub>♭</sub> [mm] ≥	14	16	18	20	22	26	34	37	41,5	
Minimum thickness of member	h <sub>min</sub> [mm]		30 mm 0 mm	h <sub>ef</sub> + 2d <sub>0</sub>							
Minimum spacing	s <sub>min</sub> [mm]	40	50	60	70	80	100	125	140	160	
Minimum edge distance	c <sub>min</sub> [mm]	40	50	60	70	80	100	125	140	160	

## Injection system Dana Lim Forankringsmasse 294 for concrete

Intended Use Installation parameters Annex B 2



#### Steel brush Table B3: Parameter cleaning and setting tools d<sub>b.min</sub> Piston Threaded $d_{b}$ d₀ Rebar min. Rod Drill bit - Ø Brush - Ø plug Brush - Ø (mm) (mm) (mm) (No.) (mm) (mm) M8 10 12 10.5 M10 12 14 8 12,5 No M12 10 14 16 14.5 piston plug 12 16 18 16,5 required 14 20 M16 18 18.5 16 20 22 20,5 M20 20 24 26 # 24 24,5 M24 28 30 28,5 # 28 M27 25 32 34 32,5 # 32

35

40



28

32



35,5

40,5

Recommended compressed air tool (min 6 bar) Drill bit diameter ( $d_0$ ): 10 mm to 40 mm

Hand pump (volume 750 ml) Drill bit diameter (d<sub>0</sub>): 10 mm to 20 mm



**Piston plug for overhead or horizontal installation** Drill bit diameter (d<sub>0</sub>): 24 mm to 40 mm

## Injection system Dana Lim Forankringsmasse 294 for concrete

## Intended Use

Z66244.15

M30

Cleaning and setting tools

Annex B 3

# 35

# 38

37

41,5



Installation inst	ructions
	1. Drill with hammer drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1 or Table B2). In case of aborted drill hole: the drill hole shall be filled with mortar
	Attention! Standing water in the bore hole must be removed before cleaning.
4x	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.
or	The hand-pump can be used for anchor sizes up to bore hole diameter 20 mm.
4x	For bore holes larger than 20 mm or deeper 240 mm, compressed air (min. 6 bar) <b>must</b> be used.
<u>₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩</u>	<ul> <li>2b. Check brush diameter (Table B3) and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush &gt; d<sub>b,min</sub> (Table B3) a minimum of four times.</li> <li>If the bore hole ground is not reached with the brush, a brush extension shall be used (Table B3).</li> </ul>
or	2C Finally blow the hole clean again 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 be used for anchor sizes up to bore hole diameter 20 mm. For bore holes larger than 20 mm or deeper 240 mm, compressed air (min. 6 bar) <u>must</u> be used.
4x	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 repeated has to be 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. For every working interruption longer than the recommended working time (Table B4) as well as for new cartridges, a new static-mixer shall be used.
(na supervised as a supervised	Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
min. 3 full stroke	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 is must be discarded a minimum of six full strokes.
Injection system [	Dana Lim Forankringsmasse 294 for concrete

Intended Use Installation instructions Annex B 4



Installation inst	ructions (continuation)
	6 Starting from the bottom or back of the cleaned anchor hole fill the hole 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 B4.
	Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor should be free of dirt, grease, oil or other foreign material.
	8. Be 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).
+20°C	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 B4).
	10. After full curing, the add-on part can be installed with the max. torque (Table B2) by using a calibrated torque wrench.

#### Table B4: Minimum curing time

Concrete temperature	Gelling- / working time	Minimum curing time in dry concrete <sup>2)</sup>
$\geq$ -10 °C <sup>1)</sup>	90 min	24 h
≥ -5 °C	90 min	14 h
≥ 0 °C	45 min	7 h
≥ + 5 °C	25 min	2 h
≥ +10 °C	15 min	80 min
≥ +20 °C	6 min	45 min
≥ + 30 °C	4 min	25 min
≥ +35 °C	2 min	20 min
≥ +40 °C	1,5 min	15 min

<sup>1)</sup> Cartridge temperature <u>must</u> be at min. +15°C <sup>2)</sup> In wet concrete the curing time <u>must</u> be doubled

## Injection system Dana Lim Forankringsmasse 294 for concrete

### Intended Use Installation instructions (continuation)

Curing time

Annex B 5



	d			M 8	M 10	M 12	M 16	M 20	M24	M 27	M 30	
Steel failure												
Characteristic tension resis Steel, property class 4.6	stance,	N <sub>Rk,s</sub>	[kN]	15	23	34	63	98	141	184	224	
Characteristic tension resis	stance,	N <sub>Rk,s</sub>	[kN]	18	29	42	78	122	176	230	280	
Steel, property class 5.8 Characteristic tension resis	stance,	N <sub>Rk,s</sub>	[kN]	29	46	67	125	196	282	368	449	
Steel, property class 8.8 Characteristic tension resis Stainless steel A4 and HC property class 50 (>M24) a	R,	N <sub>Rk,s</sub>	[kN]	26	41	59	110	171	247	230	281	
Combined pull-out and c												
Characteristic bond resista		crete C20/2	25									
	dry and wet concrete	$\tau_{\rm Rk,ucr}$	[N/mm <sup>2</sup> ]	10	12	12	12	12	11	10	9	
Гетреrature range I: ł0°С/24°С	flooded bore hole		[N/mm <sup>2</sup> ]	7,5 8,5 8,5 8,5						nissible		
		τ <sub>Rk,ucr</sub>				, 						
Femperature range II: 30°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	7,5	9	9	9	9	8,5	7,5	6,5	
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5		not adr	nissible		
Cemperature range III:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0	
120°C/72°C	flooded bore hole	$\tau_{\text{Rk,ucr}}$	[N/mm²]	4,0	5,0	5,0	5,0		not adr	nissible		
		C30/37					1,	04				
creasing factors for concrete		C40/50					1,	08				
		C50/60					1,	10				
Splitting failure												
Edge distance		C <sub>cr,sp</sub>	[mm]	$1.0 \times h_{ef} \le 2 \times h_{ef} \left(2.5 - \frac{h}{h_{ef}}\right) \le 2.4 \times h_{ef}$					Դ <sub>ef</sub>			
Axial distance		S <sub>cr,sp</sub>	[mm]				2 0	cr,sp				
nstall safety factor (dry an	d wet concrete)	γ2		1,0				1,2				
nstall safety factor (floode	d bore hole)	γ2		1,4					not admissible			

Performances

Characteristic values of resistance for threaded rods under tension loads in non-cracked concrete (Design according to TR 029)



	istic values of resistance for threaded rods under shear loads in red concrete (Design according to TR 029)										
Anchor size threaded rod			M 8	M 10	M 12	M 16	M 20	M24	M 27	M 30	
Steel failure without lever arm											
Characteristic shear resistance, Steel, property class 4.6	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112	
Characteristic shear resistance, Steel, property class 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140	
Characteristic shear resistance, Steel, property class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224	
Characteristic shear resistance, Stainless steel A4 and HCR, property class 50 (>M24) and 70 (≤ M24)	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	115	140	
Steel failure with lever arm											
Characteristic bending moment, Steel, property class 4.6	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	15	30	52	133	260	449	666	900	
Characteristic bending moment, Steel, property class 5.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	19	37	65	166	324	560	833	1123	
Characteristic bending moment, Steel, property class 8.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	30	60	105	266	519	896	1333	1797	
Characteristic bending moment, Stainless steel A4 and HCR, property class 50 (>M24) and 70 (≤ M24)	$\mathbf{M}^{O}_{Rk,s}$	[Nm]	26	52	92	232	454	784	832	1125	
Concrete pry-out failure											
Factor k in equation (5.7) of Technical Report TR 029 for the design of Bonded Anchors	k	[-]				2	,0				
Installation safety factor	γ2					1	,0				
Concrete edge failure											
Installation safety factor	γ2					1	,0				

### Injection system Dana Lim Forankringsmasse 294 for concrete

Performances

Characteristic values of resistance for threaded rods under shear loads in non-cracked concrete, (Design according to TR 029 or TR 045)



				es of resistance for rebar under tension loads in ete (Design according to TR 029)									
Anchor size reinfor	cing ba	r			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic tension	n resista	ince	N <sub>Rk,s</sub>	[kN]					$A_{s} \boldsymbol{\cdot} f_{uk}$				
Combined pull-out	and cor	icrete cone failure											
Characteristic bond r	esistanc	e in uncracked concr	rete C20/25										
Temperature range I:	:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	12	11	10	8,5
40°C/24°C		flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	8,5		not adı	missible	
Temperature range II	l:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	9	8,0	7,0	6,0
80°C/50°C		flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5 6,5 6,5 6,5 no			not adı	tadmissible				
Temperature range II	II:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5
120°C/72°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	5,0		not adı	missible		
			C30/37			1			1,04				
Increasing factors for $\Psi_c$	r concret	te	C40/50						1,08				
			C50/60	1,10									
Splitting failure													
Edge distance			C <sub>cr,sp</sub>	[mm]		1	,0 ×h <sub>ef</sub>	≤ 2 ×h <sub>e</sub>	f (2,5 -	$\left(\frac{h}{h_{ef}}\right) \leq$	2,4 ×h <sub>e</sub>	f	
Axial distance			S <sub>cr,sp</sub>	[mm]					2 C <sub>cr,sp</sub>				
Installation safety fac	ctor (dry	and wet concrete)	γ2		1,0	0 1,2							
Installation safety fac	ctor (floo	ded bore hole)	γ2		1,4					not admissible			

### Injection system Dana Lim Forankringsmasse 294 for concrete

**Performances** Characteristic values of resistance for rebar under tension loads in non-cracked concrete (Design according to TR 029)



			c values of resistance for rebar under shear loads in non- crete (Design according to TR 029)											
Anchor size reinforci	ng bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32		
Steel failure without l	ever arm													
Characteristic shear re	sistance	$V_{Rk,s}$	[kN]				0,	50 • A <sub>s</sub> •	f <sub>uk</sub>					
Steel failure with leve	r arm													
Characteristic bending	moment	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]				1.	2 ∙ W <sub>el</sub> ∙	f <sub>uk</sub>					
Concrete pry-out failu														
Factor k in equation (5. Report TR 029 for the o anchors	7) of Technical design of bonded	k	[-]	2,0										
Installation safety facto	stallation safety factor y <sub>2</sub>							1,0						
Concrete edge failure														
Installation safety facto	r	γ2		1,0										

## Injection system Dana Lim Forankringsmasse 294 for concrete

Performances Characteristic values of resistance for rebar under shear loads in non-cracked concrete, (Design according to TR 029 or TR 045)



			M 8	M 10	M 12	M 16	M 20	M24	M 27	M 30
ice,	N <sub>Rk,s</sub>	[kN]	15	23	34	63	98	141	184	224
nce,	Neka	[kN]	18	29	42	78	122	176	230	280
ice,										
	N <sub>Rk,s</sub>	[KIN]	29	46	67	125	196	282	368	449
70 (≤ M24)	$N_{Rk,s}$	[kN]	26	41	59	110	171	247	230	281
crete failure										
in non-cracked concrete	e C20/25									
dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	11	10	9
flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5		not adr	nissible	
dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	8,5	7,5	6,5
flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5		not adr	nissible	
dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0
flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0		not adr	nissible	
	C30/37					1,	04			
perature range III: perature range III: dry and wet concrete	C40/50					1,	08			
	C50/60					1,	10			
.2.3	k <sub>8</sub>	[-]	[-] 10,1							
.3.1	$k_{ucr}$	[-]				10	0,1			
	C <sub>cr,N</sub>	[mm]				1,5	h <sub>ef</sub>			
	S <sub>cr,N</sub>	[mm]				3,0	h <sub>ef</sub>			
	C <sub>cr,sp</sub>	[mm]		1	,0 >h <sub>ef</sub> ≤	2 xh <sub>ef</sub> (2,	$5 - \frac{h}{h_{ef}}$	≤ 2,4 ×h <sub>e</sub>	əf	
	S <sub>cr,sp</sub>	[mm]				2 c	cr,sp			
nd wet concrete)	γinst		1,0				1,2			
ed bore hole)	$\gamma_{inst}$						not admissible			
	nce, nce, 70 (≤ M24) crete failure a in non-cracked concrete dry and wet concrete flooded bore hole dry and wet concrete flooded bore hole dry and wet concrete flooded bore hole 3.2.3 .3.1 	NRK,s         InCe,       NRK,s         InCe,       NRK,s         InCe,       NRK,s         InCe,       NRK,s         70 (≤ M24)       NRK,s         Strete failure       NRK,s         Ince,       TRK,ucr         Incoded bore hole       TRK,ucr         Ince,       TRK,ucr         Inced bore hole       TRK,ucr         Inced bore <td>NRk,s[KN]ICCP, Incc, 7.0 (<math>\leq</math> M24)NRk,s[kN]Prete failureNRk,s[kN]Prete failureIRK,uer[KN]Prete failureTRK,uer[N/mm2]Prete failureTRK,uer[-]Prete failureTRK,uer[-]Prete failureSer,N[mm]Prete failureSer,sp[mm]Ind wet concreteTrustTrust</td> <td><math display="block">\begin{array}{ c c c } &amp; N_{Rk,s} &amp; [KN] &amp; 18 \\ \hline N_{Rk,s} &amp; [KN] &amp; 29 \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; \\ \hline nce, &amp; \\ \hline nce, &amp; \\ \hline nce, &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline nce, &amp; &amp; &amp; &amp; &amp; \\ \hline nce,</math></td> <td><math display="block">\begin{array}{ c c c } N_{Rk,s} &amp; [KN] &amp; 18 &amp; 29 \\ \hline Rk,s &amp; [KN] &amp; 29 &amp; 46 \\ \hline Rk,s &amp; [KN] &amp; 26 &amp; 41 \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (q) (q) (q) (q) (q) (q) (q) (q) (q) (q)</math></td> <td><math display="block">\begin{array}{ c c c } N_{Rk,s} &amp; [KN] &amp; 16 &amp; 29 &amp; 42 \\ \hline cce, &amp; &amp;</math></td> <td><math display="block">\begin{array}{c c c c c c c c } &amp; N_{Rk,s} &amp; [KN] &amp; 18 &amp; 29 &amp; 42 &amp; 78 \\ \hline 100 &amp; N_{Rk,s} &amp; [KN] &amp; 29 &amp; 46 &amp; 67 &amp; 125 \\ \hline 100 &amp; N_{Rk,s} &amp; [KN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 \\ \hline 100 &amp; Strete failure \\ \hline 100 &amp; Strete failure \\ \hline 100 &amp; Strete failure \\ \hline 110 &amp; 12 &amp; 12 &amp; 12 &amp; 12 \\ \hline 100 &amp; Strete failure \\ \hline 110 &amp; Stre</math></td> <td><math display="block">\begin{array}{ c c c c } &amp;  N_{Rk,s} &amp; [kN] &amp; 16 &amp; 29 &amp; 42 &amp; 78 &amp; 122 \\ \hline 100 \\  C0,   &amp; N_{Rk,s} &amp; [kN] &amp; 29 &amp; 46 &amp; 67 &amp; 125 &amp; 196 \\ \hline 100 \\  C0,   &amp; N_{Rk,s} &amp; [kN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 &amp; 171 \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; &amp; &amp; \\ \hline 70 (\leq M24) &amp; &amp; \\ \hline 70 (\leq M24) &amp;</math></td> <td><math display="block">\begin{array}{ c c c }  N_{Rk,s} &amp; [kN] &amp; 16 &amp; 29 &amp; 42 &amp; 78 &amp; 122 &amp; 176 \\  C6 , &amp; N_{Rk,s} &amp; [kN] &amp; 29 &amp; 46 &amp; 67 &amp; 125 &amp; 196 &amp; 282 \\  cc , &amp; N_{Rk,s} &amp; [kN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 &amp; 171 &amp; 247 \\  70 (\leq M24) &amp; &amp; &amp; &amp; &amp; &amp; \\  KN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 &amp; 171 &amp; 247 \\  createfailure &amp; &amp; &amp; &amp; &amp; \\  createfailure &amp;</math></td> <td><math display="block">\begin{array}{ c c c c }  N_{Rk,s} &amp; [kN] &amp; 16 &amp; 29 &amp; 42 &amp; 78 &amp; 122 &amp; 176 &amp; 230 \\  C6 , &amp; N_{Rk,s} &amp; [kN] &amp; 29 &amp; 46 &amp; 67 &amp; 125 &amp; 196 &amp; 282 &amp; 368 \\  c6 , &amp; N_{Rk,s} &amp; [kN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 &amp; 171 &amp; 247 &amp; 230 \\ \hline 70 (\leq M24) &amp; N_{Rk,s} &amp; [kN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 &amp; 171 &amp; 247 &amp; 230 \\ \hline 70 (\leq M24) &amp; R_{Rk,s} &amp; [kN] &amp; 26 &amp; 41 &amp; 59 &amp; 110 &amp; 171 &amp; 247 &amp; 230 \\ \hline 70 (\leq M24) &amp; R_{Rk,s} &amp; [kN] &amp; 10 &amp; 12 &amp; 12 &amp; 12 &amp; 12 &amp; 11 &amp; 10 \\ \hline 10 (dodd bor hole &amp; \$restring restring restri</math></td>	NRk,s[KN]ICCP, Incc, 7.0 ( $\leq$ M24)NRk,s[kN]Prete failureNRk,s[kN]Prete failureIRK,uer[KN]Prete failureTRK,uer[N/mm2]Prete failureTRK,uer[-]Prete failureTRK,uer[-]Prete failureSer,N[mm]Prete failureSer,sp[mm]Ind wet concreteTrustTrust	$\begin{array}{ c c c } & N_{Rk,s} & [KN] & 18 \\ \hline N_{Rk,s} & [KN] & 29 \\ \hline nce, & & & & & & & & & \\ \hline nce, & & & & & & & & & \\ \hline nce, & & & & & & & & & & \\ \hline nce, & & & & & & & & & & \\ \hline nce, & & & & & & & & & & \\ \hline nce, & & & & & & & & & & \\ \hline nce, & & & & & & & & & \\ \hline nce, & & & & & & & & & \\ \hline nce, & & & & & & & & & \\ \hline nce, & & & & & & & & \\ \hline nce, & & & & & & \\ \hline nce, & & & & & \\ \hline nce,$	$\begin{array}{ c c c } N_{Rk,s} & [KN] & 18 & 29 \\ \hline Rk,s & [KN] & 29 & 46 \\ \hline Rk,s & [KN] & 26 & 41 \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & \\ \hline 70 (\leq M24) & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (q) (q) (q) (q) (q) (q) (q) (q) (q) (q)$	$\begin{array}{ c c c } N_{Rk,s} & [KN] & 16 & 29 & 42 \\ \hline cce, & & & & & & & & & & & & & & & & & & &$	$\begin{array}{c c c c c c c c } & N_{Rk,s} & [KN] & 18 & 29 & 42 & 78 \\ \hline 100 & N_{Rk,s} & [KN] & 29 & 46 & 67 & 125 \\ \hline 100 & N_{Rk,s} & [KN] & 26 & 41 & 59 & 110 \\ \hline 100 & Strete failure \\ \hline 100 & Strete failure \\ \hline 100 & Strete failure \\ \hline 110 & 12 & 12 & 12 & 12 \\ \hline 100 & Strete failure \\ \hline 110 & Stre$	$\begin{array}{ c c c c } &  N_{Rk,s} & [kN] & 16 & 29 & 42 & 78 & 122 \\ \hline 100 \\  C0,   & N_{Rk,s} & [kN] & 29 & 46 & 67 & 125 & 196 \\ \hline 100 \\  C0,   & N_{Rk,s} & [kN] & 26 & 41 & 59 & 110 & 171 \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & & \\ \hline 70 (\leq M24) & & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & & & \\ \hline 70 (\leq M24) & & \\ \hline 70 (\leq M24) &$	$\begin{array}{ c c c }  N_{Rk,s} & [kN] & 16 & 29 & 42 & 78 & 122 & 176 \\  C6 , & N_{Rk,s} & [kN] & 29 & 46 & 67 & 125 & 196 & 282 \\  cc , & N_{Rk,s} & [kN] & 26 & 41 & 59 & 110 & 171 & 247 \\  70 (\leq M24) & & & & & & \\  KN] & 26 & 41 & 59 & 110 & 171 & 247 \\  createfailure & & & & & \\  createfailure &$	$\begin{array}{ c c c c }  N_{Rk,s} & [kN] & 16 & 29 & 42 & 78 & 122 & 176 & 230 \\  C6 , & N_{Rk,s} & [kN] & 29 & 46 & 67 & 125 & 196 & 282 & 368 \\  c6 , & N_{Rk,s} & [kN] & 26 & 41 & 59 & 110 & 171 & 247 & 230 \\ \hline 70 (\leq M24) & N_{Rk,s} & [kN] & 26 & 41 & 59 & 110 & 171 & 247 & 230 \\ \hline 70 (\leq M24) & R_{Rk,s} & [kN] & 26 & 41 & 59 & 110 & 171 & 247 & 230 \\ \hline 70 (\leq M24) & R_{Rk,s} & [kN] & 10 & 12 & 12 & 12 & 12 & 11 & 10 \\ \hline 10 (dodd bor hole & $restring restring restri$

Performances

Annex C 5

Characteristic values of resistance for threaded rods under tension loads in non-cracked concrete (Design according to CEN/TS 1992-4)



### Table C6: Characteristic values of resistance for threaded rods under shear loads in noncracked concrete (Design according to CEN/TS 1992-4)

Anchor size threaded rod			M 8	M 10	M 12	M 16	M 20	M24	M 27	M 30
Steel failure without lever arm		·								
Characteristic shear resistance, Steel, property class 4.6	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Characteristic shear resistance, Steel, property class 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Characteristic shear resistance, Steel, property class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Characteristic shear resistance, Stainless steel A4 and HCR, property class 50 (>M24) and 70 (≤ M24)	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	115	140
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1	k <sub>2</sub>					0,8				
Steel failure with lever arm										
Characteristic bending moment, Steel, property class 4.6	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	15	30	52	133	260	449	666	900
Characteristic bending moment, Steel, property class 5.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	19	37	65	166	324	560	833	1123
Characteristic bending moment, Steel, property class 8.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	30	60	105	266	519	896	1333	1797
Characteristic bending moment, Stainless steel A4 and HCR, property class 50 (>M24) and 70 ( $\leq$ M24)	${\sf M}^{\sf O}_{\sf Rk,s}$	[Nm]	26	52	92	232	454	784	832	1125
Concrete pry-out failure										
Factor in equation (27) of CEN/TS 1992-4-5 Section 6.3.3	k <sub>3</sub>					2,0				
Installation safety factor	γinst					1,0				
Concrete edge failure <sup>3)</sup>	·	·								
Effective length of anchor	l <sub>f</sub>	[mm]			$I_{f} =$	min(h <sub>ef</sub> ; \$	8 d <sub>nom</sub> )			
Outside diameter of anchor	d <sub>nom</sub>	[mm]	8	10	12	16	20	24	27	30
Installation safety factor	γinst					1,0				

### Injection system Dana Lim Forankringsmasse 294 for concrete

Performances

Characteristic values of resistance for threaded rods under shear loads in non-cracked concrete, (Design according to CEN/TS 1992-4 or TR 045)



	racteristic value cracked concre									ls in		
Anchor size reinforcing ba	ır			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure												
Characteristic tension resista	ance	N <sub>Rk,s</sub>	[kN]					A₅ ∙ f <sub>uk</sub>				
Combined pull-out and co	ncrete failure											
Characteristic bond resistan	ce in non-cracked concre	ete C20/2	5									
Temperature range I:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	12	11	10	8,5
40°C/24°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	8,5		not adr	nissible	
Temperature range II:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5 9 9 9 9 9 8,0		7,0	6,0					
80°C/50°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5		not adr	nissible	
Temperature range III:	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5
120°C/72°C	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	5,0		not adr	nissible	
		C30/37						1,04				
Increasing factors for concre $\Psi_c$	ete	C40/50						1,08				
		C50/60						1,10				
Factor according to CEN/TS 1992-4-5 Section 6	.2.2.3	k <sub>8</sub>	[-]					10,1				
Concrete cone failure												
Factor according to CEN/TS 1992-4-5 Section 6	.2.3.1	k <sub>ucr</sub>	[-]					10,1				
Edge distance		C <sub>cr,N</sub>	[mm]					1,5 h <sub>ef</sub>				
Axial distance		S <sub>cr,N</sub>	[mm]					3,0 h <sub>ef</sub>				
Splitting failure												
Edge distance		C <sub>cr,sp</sub>	[mm]			1,0 ×h <sub>e</sub>	<sub>ef</sub> ≤2×h,	<sub>ef</sub> (2,5	$\left(\frac{h}{h_{ef}}\right) \le 2$	,4 ×h <sub>ef</sub>		
Axial distance		S <sub>cr,sp</sub>	[mm]					2 c <sub>cr,sp</sub>				
Installation safety factor (dry	and wet concrete)	γinst		1.0				1	,2			
Installation safety factor (floo	oded bore hole)	γinst				1,4				not adr	nissible	
Injection system D Performances Characteristic values of		-					te		-	Anne	ex C 7	,

(Design according to CEN/TS 1992-4)

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Table C8: Characteristic value cracked concrete (D								ads ir	n non	-	
Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure without lever arm											
Characteristic shear resistance	$V_{Rk,s}$	[kN]				0,5	50 • A <sub>s</sub> •	f <sub>uk</sub>			
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1	k <sub>2</sub>						0,8				
Steel failure with lever arm											
Characteristic bending moment	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]				1.:	2 • W <sub>el</sub> •	f <sub>uk</sub>			
Concrete pry-out failure											
Factor in equation (27) of CEN/TS 1992-4-5 Section 6.3.3	k <sub>3</sub>						2,0				
Installation safety factor	γinst						1,0				
Concrete edge failure											
Effective length of anchor	l <sub>f</sub>	[mm]				l <sub>f</sub> = m	nin(h <sub>ef</sub> ; 8	d <sub>nom</sub> )			
Outside diameter of anchor	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	25	28	32
Installation safety factor	γinst						1,0				

Performances

Characteristic values of resistance for rebar under shear loads in non-cracked concrete, (Design according to CEN/TS 1992-4 or TR 045)



splaceme	nts under tensic	on load'	(threa	ided ro	od)				
ed rod		M 8	M 10	M 12	M 16	M 20	M24	M 27	M 30
ete C20/25									
$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,021	0,023	0,026	0,031	0,036	0,041	0,045	0,049
$\delta_{N_\infty}$ -factor	[mm/(N/mm²)]	0,030	0,033	0,037	0,045	0,052	0,060	0,065	0,071
$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
$\delta_{N_\infty}$ -factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
	ed rod ete C20/25 $\delta_{N0}$ -factor $\delta_{N\infty}$ -factor $\delta_{N0}$ -factor $\delta_{N\infty}$ -factor $\delta_{N0}$ -factor	ed rod ete C20/25 $\delta_{N0}$ -factor [mm/(N/mm <sup>2</sup> )] $\delta_{No}$ -factor [mm/(N/mm <sup>2</sup> )] $\delta_{N0}$ -factor [mm/(N/mm <sup>2</sup> )] $\delta_{No}$ -factor [mm/(N/mm <sup>2</sup> )] $\delta_{N0}$ -factor [mm/(N/mm <sup>2</sup> )]	ed rod         M 8           ete C20/25 $\delta_{N0}$ -factor         [mm/(N/mm^2)]         0,021 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,030 $\delta_{N0}$ -factor         [mm/(N/mm^2)]         0,050 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,072 $\delta_{N0}$ -factor         [mm/(N/mm^2)]         0,050	ed rod         M 8         M 10           ete C20/25 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,021         0,023 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,030         0,033 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,072         0,081 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056	ed rod         M 8         M 10         M 12           ete C20/25 $\delta_{N0}$ -factor         [mm/(N/mm^2)]         0,021         0,023         0,026 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,030         0,033         0,037 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,050         0,056         0,063 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,072         0,081         0,090 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,050         0,056         0,063	ete C20/25 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,021         0,023         0,026         0,031 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,030         0,033         0,037         0,045 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056         0,063         0,075 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,072         0,081         0,090         0,108 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056         0,063         0,075	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ed rod         M 8         M 10         M 12         M 16         M 20         M24           ete C20/25 $\delta_{N0}$ -factor         [mm/(N/mm^2)]         0,021         0,023         0,026         0,031         0,036         0,041 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,030         0,033         0,037         0,045         0,052         0,060 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,050         0,056         0,063         0,075         0,088         0,100 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,050         0,056         0,063         0,075         0,088         0,100 $\delta_{No}$ -factor         [mm/(N/mm^2)]         0,050         0,056         0,063         0,075         0,088         0,100	ed rod         M 8         M 10         M 12         M 16         M 20         M24         M 27           ete C20/25 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,021         0,023         0,026         0,031         0,036         0,041         0,045 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,030         0,033         0,037         0,045         0,052         0,060         0,065 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056         0,063         0,075         0,088         0,100         0,110 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056         0,063         0,075         0,088         0,100         0,110 $\delta_{No}$ -factor         [mm/(N/mm <sup>2</sup> )]         0,050         0,056         0,063         0,075         0,088         0,100         0,110

<sup>1)</sup> Calculation of the displacement

 $\delta_{N0} = \delta_{N0}$ -factor  $\times \tau$ ;

 $\delta_{N_{\infty}} = \delta_{N_{\infty}}$ -factor  $\times \tau$ ;

## Table C10: Displacements under shear load<sup>1)</sup> (threaded rod)

(t: action bond strength)

Anchor size thre	aded rod		M 8	<b>M</b> 10	M 12	M 16	M 20	M24	M 27	M 30
For non-cracked	concrete C2	0/25		-						
All temperature	$\delta_{V0}$ -factor	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
ranges	$\delta_{V_\infty}$ -factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
<sup>1)</sup> Calculation of			-,	5,55	-,	-,	-,	-,	-,	-,

alculation of the displacement

 $\delta_{V0} = \delta_{V0}$ -factor ×V;  $\delta_{V_{\infty}} = \delta_{V_{\infty}}$ -factor  $\times V$ ;

(V: action shear load)

Injection system Dana Lim Forankringsmasse 294 for concrete

Performances Displacements (threaded rods)



Anchor size reinfo	orcing bar	,	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Non-cracked con	crete C20/	25									
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,021	0,023	0,026	0,028	0,031	0,036	0,043	0,047	0,05
40°C/24°C	$\delta_{N_{\infty}}$ -factor	[mm/(N/mm²)]	0,030	0,033	0,037	0,041	0,045	0,052	0,061	0,071	0,07
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,12
80°C/50°C	$\delta_{N\infty}\text{-factor}$	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,18
Temperature range III:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,12
120°C/72°C	$\delta_{\text{N}\infty}\text{-factor}$	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,18
$\delta_{N0} = \delta_{N0}$ -factor $\delta_{N\infty} = \delta_{N\infty}$ -factor Table C12: D	×τ;	(τ: action nent under s			ebar)						
Anchor size reinfo	orcing bar		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 3
Non-cracked cond	rete C20/3	25									
ton-cracked cont											
	$\delta_{V0}$ -factor	[mm/(kN)]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,0
All temperature ranges <sup>1)</sup> Calculation of th $\delta_{V0} = \delta_{V0}$ -factor $\delta_{V\infty} = \delta_{V\infty}$ -factor	$\delta_{V0}$ -factor $\delta_{V\infty}$ -factor ne displacem $\times V;$	[mm/(kN)] [mm/(kN)]	0,09	0,08	0,05	0,04	0,04 0,06	0,04	0,03	0,03	
All temperature anges <sup>1)</sup> Calculation of th $\delta_{V0} = \delta_{V0}$ -factor	$\delta_{V0}$ -factor $\delta_{V\infty}$ -factor ne displacem $\times V;$	[mm/(kN)] [mm/(kN)] nent	0,09	0,08	,		,	-	,	-	0,03