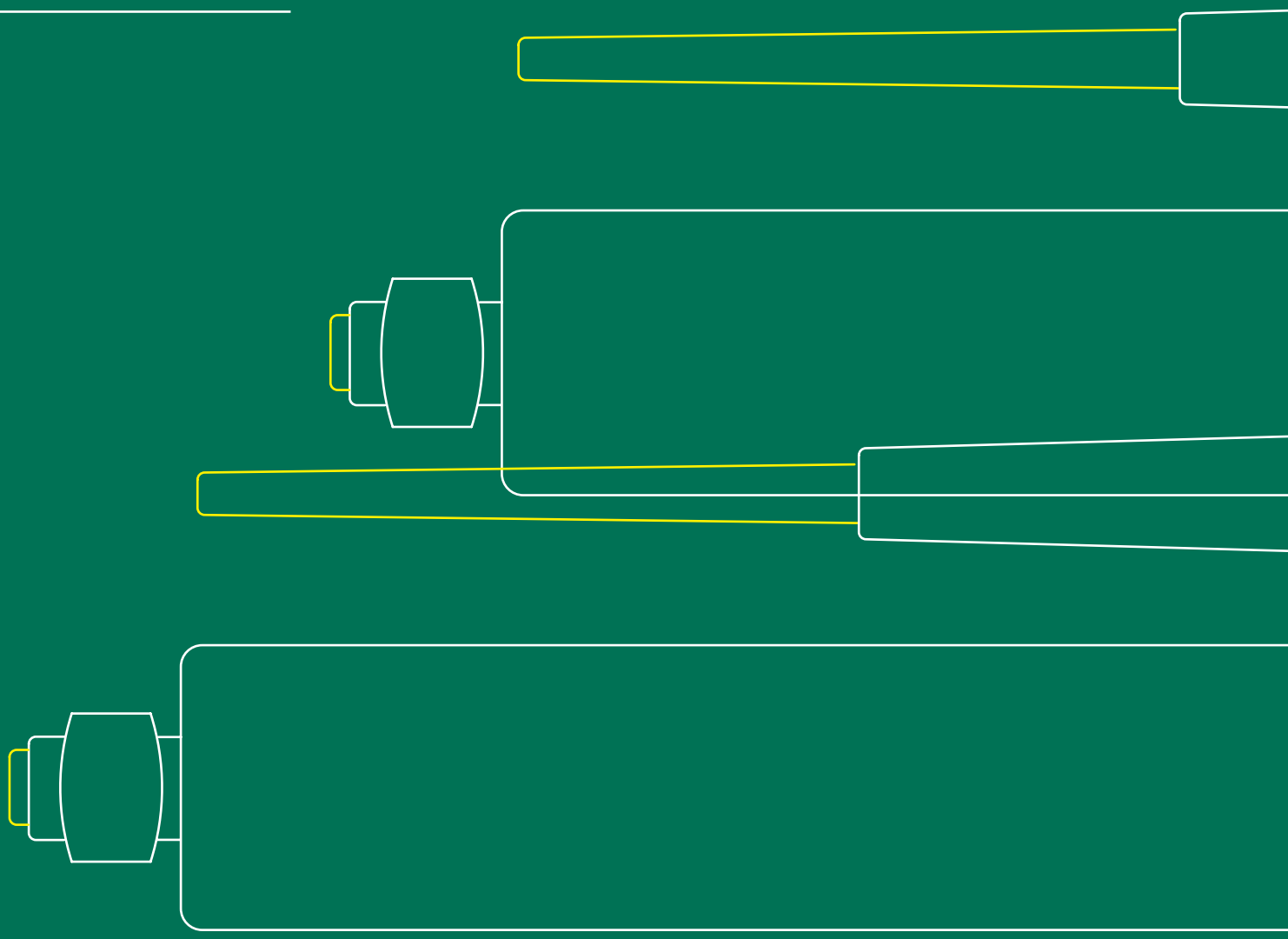
walraven

Approval



# WPSF100 Chemical Anchor

ETA-16/0542

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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
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# European Technical Assessment

# ETA 16/0542 of 27/06/2016

| | |
|---|---|
| **Technical Assessment Body issuing the ETA:** Technical and Test Institute for Construction Prague | |
| **Trade name of the construction product** | Walraven Injection System WPSF100, WPSF100W, WPSF100T galvanized or stainless steel bonded anchor |
| **Product family to which the construction product belongs** | Product area code: 33 Bonded injection type anchor for use in non-cracked concrete |
| **Manufacturer** | J. van Walraven Holding B.V. Industrieweg 5 3641 RK Mijdrecht The Netherlands |
| **Manufacturing plant** | Walraven Factory A1 |
| **This European Technical Assessment contains** | 14 pages including 10 Annexes which form an integral part of this assessment |
| **This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of** | ETAG 001-Part 1 and Part 5, edition 2013, used as European Assessment Document (EAD) |

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

## 1. Technical description of the product

The Walraven Injection System WPSF100, WPSF100W (faster curing time) and WPSF100T (extended curing time) with steel elements is bonded anchor (injection type).

Steel elements can be galvanized or stainless steel.

Steel element is placed into a drilled hole filled with injection mortar. The steel element is anchored via the bond between metal part, injection mortar and concrete. The anchor is intended to be used with embedment depth from 8 diameters to 12 diameters.

The illustration and the description of the product are given in Annex A.

## 2. Specification of the intended use in accordance with the applicable EAD

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 provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 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 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 |
| Characteristic resistance for shear loads | See Annex C 2 |
| Displacement | See Annex C 3 |

### 3.2 Safety in case of fire (BWR 2)

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

### 3.3 Hygiene, health and environment (BWR 3)

Regarding dangerous substances contained in this European Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the 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)

For basic requirement safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability.

### 3.5 Sustainable use of natural resources (BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

### 3.6 General aspects relating to fitness for use

Durability and serviceability are only ensured if the specifications of intended use according to Annex B 1 are kept.

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

According to the Decision 96/582/EC of the European Commission[1] the system of assessment verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

| Product | Intended use | Level or class | System |
|---|---|---|---|
| Metal anchors for use in concrete | For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units | - | 1 |

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

### 5.1 Tasks of the manufacturer

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this European Technical Assessment.

The manufacturer may only use raw materials stated in the technical documentation of this European Technical Assessment.

The factory production control shall be in accordance with the control plan which is a part of the technical documentation of this European Technical Assessment. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Technický a zkušební ústav stavební Praha, s.p.[2] The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

The manufacturer shall, on the basis of a contract, involve a body which is notified for the tasks referred to in section 4 in the field of anchors in order to undertake the actions laid down in section 5.2. For this purpose, the control plan referred to in this section and section 5.2 shall be handed over by the manufacturer to the notified body involved.

The manufacturer shall make a declaration of performance, stating that the construction product is in conformity with the provisions of this European Technical Assessment.

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1 Official Journal of the European Communities L 254 of 08.10.1996

2 The control plan is a confidential part of the documentation of the European Technical Assessment, but not published together with the ETA and only handed over to the approved body involved in the procedure of AVCP.

## 5.2 Tasks of the notified bodies

The notified body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The notified certification body involved by the manufacturer shall issue a certificate of constancy of performance of the product stating the conformity with the provisions of this European Technical Assessment.

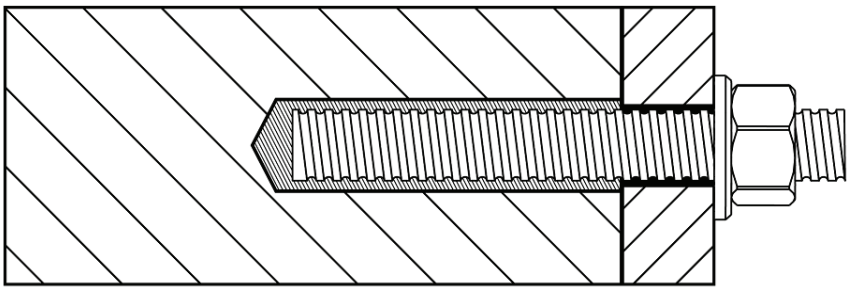
In cases where the provisions of the European Technical Assessment and its control plan are no longer fulfilled the notified body shall withdraw the certificate of constancy of performance and inform Technický a zkušební ústav stavební Praha, s.p without delay.

Issued in Prague on 27.06.2016

By

**Ing. Mária Schaan**
Head of the Technical Assessment Body

**Threaded rod**



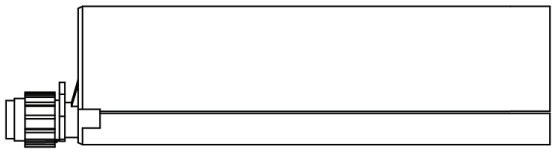
| | |
|---|---|
| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex A 1** |
| **Product description**<br>Installed conditions | |

**Coaxial cartridge**

WPSF100, WPSF100W, WPSF100T 150 ml
380 ml
400 ml
410 ml

**Side by side cartridge**

WPSF100, WPSF100W, WPSF100T 345 ml
825 ml



**Two part foil in a single piston component cartridge**

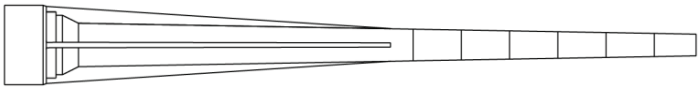
WPSF100, WPSF100W, WPSF100T 170 ml
300 ml
550 ml
850 ml

**Marking of the mortar cartridges**

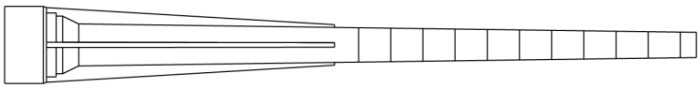
Identifying mark of the producer, Trade name, Charge code number, Storage life, Curing and processing time

**Mixing nozzle**

WIS Standard Nozzle

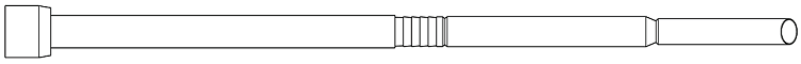


WIS Wide-outlet Nozzle

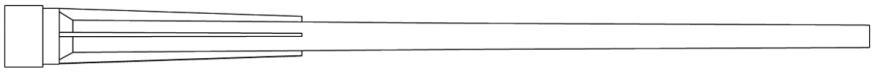


WIS Short Nozzle

WIS Long Nozzle

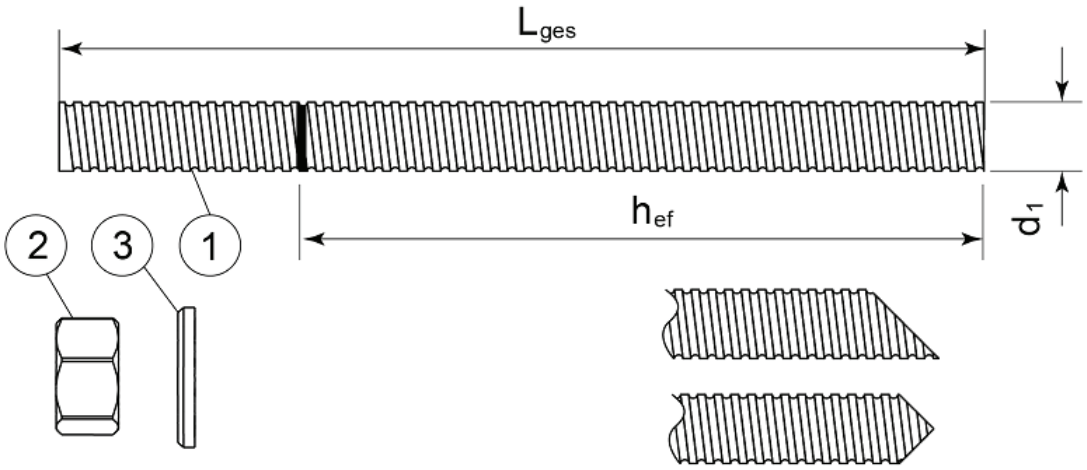


WIS Nozzle 850



| | |
|---|---|
| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex A 2** |
| **Product description**<br>Injection system | |

**Threaded rod M8, M10, M12, M16, M20, M24**




Standard commercial threaded rod with marked embedment depth

| Part | Designation | Material |
|---|---|---|
| **Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042 or Steel, Hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461 and EN ISO 10684 or Steel, zinc diffusion coating ≥ 15 µm acc. to EN 13811** | | |
| 1 | Threaded rod | Steel, EN 10087 or EN 10263<br>Property class 5.8, 8.8, 10.9* EN ISO 898-1 |
| 2 | Hexagon nut<br>EN ISO 4032 | According to threaded rod, EN 20898-2 |
| 3 | Washer<br>EN ISO 887, EN ISO 7089,<br>EN ISO 7093 or EN ISO 7094 | According to threaded rod |
| **Stainless steel** | | |
| 1 | Threaded rod | Material: A2-70, A4-70, A4-80, EN ISO 3506 |
| 2 | Hexagon nut<br>EN ISO 4032 | According to threaded rod |
| 3 | Washer<br>EN ISO 887, EN ISO 7089,<br>EN ISO 7093 or EN ISO 7094 | According to threaded rod |
| **High corrosion resistant steel** | | |
| 1 | Threaded rod | Material: 1.4529, 1.4565, EN 10088-1 |
| 2 | Hexagon nut<br>EN ISO 4032 | According to threaded rod |
| 3 | Washer<br>EN ISO 887, EN ISO 7089,<br>EN ISO 7093 or EN ISO 7094 | According to threaded rod |

*Galvanized rod of high strength are sensitive to hydrogen induced brittle failure

| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex A 3** |
|---|---|
| **Product description**<br>Threaded rod and materials | |

**Specifications of intended use**

**Anchorages subject to:**
- Static and quasi-static load.

**Base materials**
- Non-cracked concrete.
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206-1:2000-12.

**Temperature range:**
- -40°C to +80°C (max. short. term temperature +80°C and max. long term temperature +50°C)

**Use conditions (Environmental conditions)**
- Structures subject to dry internal conditions (zinc coated steel, stainless steel, high corrosion resistance steel).
- Structures subject to external atmospheric exposure including industrial and marine environment, if no particular aggressive conditions exist (stainless steel A4, high corrosion resistance steel).
- Structures subject to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel A4, high corrosion resistance steel).
- Structures subject to permanently damp internal condition, with particular aggressive conditions exist (high corrosion resistance 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).

**Use categories:**
- Category 2 – installation in dry, wet concrete or flooded hole.

**Design:**
- The anchorages are designed in accordance with the EOTA Technical Report TR 029 “Design of bonded anchors” under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings.

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

| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex B 1** |
|---|---|
| **Intended use**<br>Specifications | |

**Applicator gun**

A

B

C

D

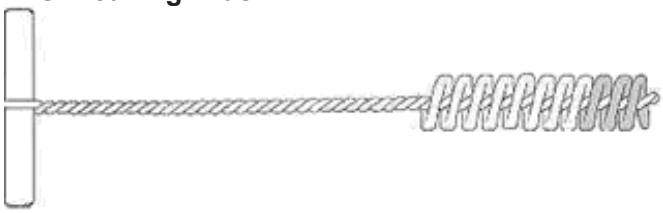
E

F

G

| Applicator gun | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Cartridge | Coaxial<br>380ml<br>400ml<br>410ml | Side by side<br>345ml | Foil capsule<br>170ml<br>300ml<br>550ml | Foil capsule<br>170ml<br>300ml | Coaxial<br>150ml | Side by side<br>825ml | Foil capsule<br>850ml |

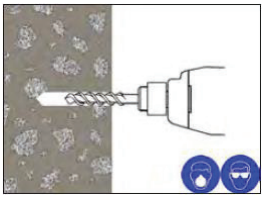
**WIS Cleaning Brush**



| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex B 2** |
|---|---|
| **Intended use**<br>Applicator guns<br>Cleaning brush | |

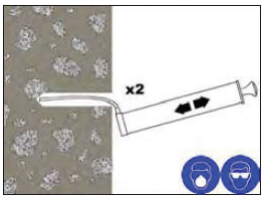
## Installation procedure

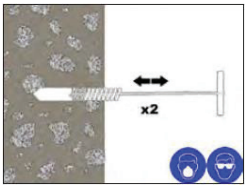
1. Drill the hole to the correct diameter and depth. This can be done with either a rotary percussion or rotary hammer drilling machine depending upon the substrate.

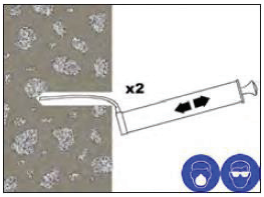


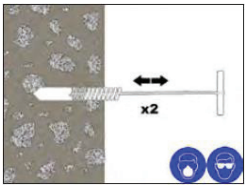
2. Thoroughly clean the hole in the following sequence using the brush with the required extensions and a blow pump.

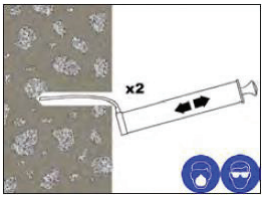
**Blow Clean x2.**
**Brush Clean x2.**
**Blow Clean x2.**
**Brush Clean x2.**
**Blow Clean x2.**



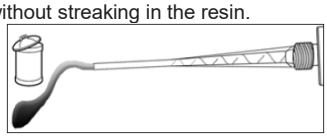



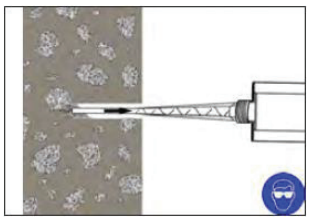

**If the hole collects water after the initial cleaning this water must be removed before injecting the resin.**

3. Select the appropriate static mixer nozzle for the installation, open the cartridge/foil and screw onto the mouth of the cartridge. Insert the cartridge into the correct applicator gun.
4. Extrude the first part of the cartridge to waste until an even colour has been achieved without streaking in the resin.

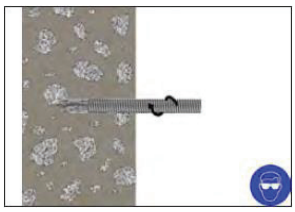


5. If necessary, cut the extension tube to the depth of the hole and push onto the end of the mixer nozzle, and (for threaded bar 16mm dia. or more) fit the correct resin stopper to the other end. Attach extension tubing and resin stopper.

6. Insert the mixer nozzle (resin stopper / extension tube if applicable) to the bottom of the hole. Begin to extrude the resin and slowly withdraw the mixer nozzle from the hole ensuring that there are no air voids as the mixer nozzle is withdrawn. Fill the hole to approximately ½ to ¾ full and remove the mixer nozzle completely.



7. Insert the clean threaded bar, free from oil or other release agents, to the bottom of the hole using a back and forth twisting motion ensuring all the threads are thoroughly coated. Adjust to the correct position within the stated working time.

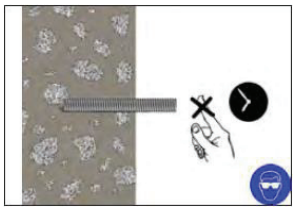


8. Any excess resin should be expelled from the hole evenly around the steel element showing that the hole is full.

   This excess resin should be removed from around the mouth of the hole before it sets.

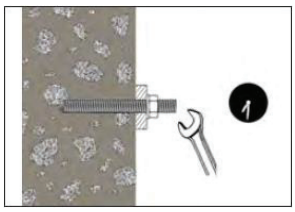
9. Leave the anchor to cure.

   Do not disturb the anchor until the appropriate loading/curing time has elapsed depending on the substrate conditions and ambient temperature.



10 Attach the fixture and tighten the nut to the recommended torque.

   **Do not overtighten.**



| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex B 3** |
|---|---|
| **Intended use**<br>Installation procedure | |

**Table B1**: Installation parameter

| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $Ød_0$ | [mm] | 10 | 12 | 14 | 18 | 22 | 26 |
| Diameter of cleaning brush | $d_b$ | [mm] | 14 | 14 | 20 | 20 | 29 | 29 |
| Torque moment | $T_{inst}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 |
| $h_{ef,min}$ = 8d | | | | | | | | |
| Depth of drill hole | $h_0$ | [mm] | 64 | 80 | 96 | 128 | 160 | 192 |
| Minimum edge distance | $c_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 |
| Minimum spacing | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 |
| Minimum thickness of member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | | $h_{ef}$ + $2d_0$ | |
| $h_{ef,max}$ = 12d | | | | | | | | |
| Depth of drill hole | $h_0$ | [mm] | 96 | 120 | 144 | 192 | 240 | 288 |
| Minimum edge distance | $c_{min}$ | [mm] | 50 | 60 | 70 | 95 | 120 | 145 |
| Minimum spacing | $s_{min}$ | [mm] | 50 | 60 | 70 | 95 | 120 | 145 |
| Minimum thickness of member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | | $h_{ef}$ + $2d_0$ | |

**Table B2**: Cleaning

| All diameters |
|---|
| - 2 x blowing |
| - 2 x brushing |
| - 2 x blowing |
| - 2 x brushing |
| - 2 x blowing |

**Table B3.1**: Minimum curing time WPSF100

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|---|---|---|---|
| min +5 | 18 | min +5 | 145 |
| +5 to +10 | 10 | +5 to +10 | |
| +10 to +20 | 6 | +10 to +20 | 85 |
| +20 to +25 | 5 | +20 to +25 | 50 |
| +25 to +30 | 4 | +25 to +30 | 40 |
| +30 | | +30 | 35 |

**Table B3.2**: Minimum curing time WPSF100W

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|---|---|---|---|
| min +5 | 5 | -10 to -5 | 4 hours |
| | | -5 to +5 | 125 |
| +5 to +10 | 3,5 | +5 to +10 | 60 |
| +10 to +20 | 2 | +10 to +20 | 40 |
| +20 to +25 | 1,5 | +20 to +25 | 20 |
| +25 to +30 | 1 | +25 to +30 | 15 |
| +30 | | +30 | 10 |

**Table B3.3**: Minimum curing time WPSF100T

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|---|---|---|---|
| min +10 | 30 | min +10 | 5 hours |
| +10 to +20 | 15 | +10 to +20 | |
| +20 to +25 | 10 | +20 to +25 | 145 |
| +25 to +30 | 7,5 | +25 to +30 | 85 |
| +30 to +35 | 5 | +30 to +35 | 50 |
| +35 to +40 | 3,5 | +35 to +40 | 40 |
| +40 to +45 | 2,5 | +40 to +45 | 35 |
| +45 | | +45 | 12 |

T work is typical gel time at highest temperature  T load is set at the lowest temperature

**Walraven Injection System WPSF100, WPSF100W, WPSF100T**

**Intended use**
Installation parameters
Curing time

**Annex B 4**

**Table C1:** Design method TR 029
Characteristic values of resistance to tension load

| **Steel failure – Characteristic resistance** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,5 | | | | | |
| Steel grade **8.8** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,5 | | | | | |
| Steel grade **10.9** | $N_{Rk,s}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,4 | | | | | |
| Stainless steel grade **A2-70**, **A4-70** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,9 | | | | | |
| Stainless steel grade **A4-80** | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,6 | | | | | |
| Stainless steel grade **1.4529** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,5 | | | | | |
| Stainless steel grade **1.4565** | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,9 | | | | | |

| **Combined pullout and concrete cone failure in non-cracked concrete C20/25** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| **Characteristic bond resistance in non-cracked concrete** | | | | | | | | |
| **Characteristic bond resistance Dry/wet concrete and flooded hole** | $\tau_{Rk}$ | [N/mm²] | 8,5 | 8 | 9 | 9 | 8 | 7,5 |
| Partial safety factor | $\gamma_{Mc}$ [1)] | [-] | 1,8 [2)] | | | | | |
| Factor for concrete C30/37 | $\psi_c$ | [-] | 1,12 | | | | | |
| Factor for concrete C40/45 | $\psi_c$ | [-] | 1,19 | | | | | |
| Factor for concrete C50/60 | $\psi_c$ | [-] | 1,30 | | | | | |

| **Splitting failure** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Size | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Edge distance | $c_{cr,sp}$ | [mm] | $2,0h_{ef}$ | | | $1,5h_{ef}$ | | |
| Spacing | $s_{cr,sp}$ | [mm] | $4,0h_{ef}$ | | | $3,0h_{ef}$ | | |
| Partial safety factor | $\gamma_{Msp}$ [1)] | [-] | 1,8 | | | | | |

[1)] In absence of national regulations
[2)] The partial safety factor $\gamma_2$=1,2 is included

**Walraven Injection System WPSF100, WPSF100W, WPSF100T**

**Performances**
Characteristic resistance for tension loads

**Annex C 1**

**Table C2:** Design method TR 029
Characteristic values of resistance to shear load

| **Steel failure without lever arm** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $V_{Rk,s}$ | [kN] | 9 | 15 | 21 | 39 | 61 | 88 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | | | |
| Steel grade **8.8** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | | | |
| Steel grade **10.9** | $V_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,5 | | | | | |
| Stainless steel grade **A2-70**, **A4-70** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,56 | | | | | |
| Stainless steel grade **A4-80** | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,33 | | | | | |
| Stainless steel grade **1.4529** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | | | |
| Stainless steel grade **1.4565** | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,56 | | | | | |

| **Steel failure with lever arm** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Steel grade **5.8** | $M^0_{Rk,s}$ | [N.m] | 19 | 37 | 66 | 166 | 325 | 561 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | | | |
| Steel grade **8.8** | $M^0_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | | | |
| Steel grade **10.9** | $M^0_{Rk,s}$ | [N.m] | 37 | 75 | 131 | 333 | 649 | 1123 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,50 | | | | | |
| Stainless steel grade **A2-70**, **A4-70** | $M^0_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,56 | | | | | |
| Stainless steel grade **A4-80** | $M^0_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,33 | | | | | |
| Stainless steel grade **1.4529** | $M^0_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | | | |
| Stainless steel grade **1.4565** | $M^0_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | [-] | 1,56 | | | | | |
| **Concrete pryout failure** | | | | | | | | |
| Factor *k* from TR 029<br>Design of bonded anchors, Part 5.2.3.3 | | | 2 | | | | | |
| Partial safety factor | $\gamma_{Mp}$ [1)] | [-] | 1,5 | | | | | |

| **Concrete edge failure** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Size** | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors | | | | | | | |
| Partial safety factor | $\gamma_{Mc}$ [1)] [-] | 1,5 | | | | | |

[1)] In absence of national regulations

| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex C 2** |
|---|---|
| **Performances**<br>Characteristic resistance for shear loads | |

**Table C3:** Displacement under tension and shear load

| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|---|
| Tension load | F | [kN] | 6,3 | 7,9 | 11,9 | 23,8 | 29,8 | 45,6 |
| Displacement | $\delta_{N0}$ | [mm] | 0,2 | 0,2 | 0,3 | 0,5 | 0,7 | 0,9 |
| | $\delta_{N\infty}$ | [mm] | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Shear load | F | [kN] | 5,2 | 8,3 | 12,0 | 22,4 | 35,0 | 50,4 |
| Displacement | $\delta_{V0}$ | [mm] | 0,1 | 0,1 | 0,2 | 0,4 | 0,8 | 1,5 |
| | $\delta_{V\infty}$ | [mm] | 0,2 | 0,2 | 0,3 | 0,6 | 1,2 | 2,3 |

| | |
|---|---|
| **Walraven Injection System WPSF100, WPSF100W, WPSF100T** | **Annex C 3** |
| **Performances**<br>Displacement | |

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