ICC EVALUATION SERVICE®

ICC-ES Evaluation Report
ESR-3572

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DIVISION: 03 00 00–CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

fischerwerke GmbH & Co. KG

EVALUATION SUBJECT:

fischer SUPERBOND ADHESIVE ANCHORING SYSTEM FOR CRACKED AND UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

fischer Superbond Adhesive Anchor System consist of the cartridge system FIS SB or the capsule system RSB. The adhesive anchors using the cartridge system FIS SB are used to resist static, wind and earthquake (IBC Seismic Design Categories A through F) tension and shear loads in cracked and uncracked normal-weight concrete. The adhesive anchors using the capsule system RSB are used to resist static, wind and earthquake (IBC Seismic Design Categories A through F) tension and shear loads in cracked and uncracked normal-weight concrete with M10, M12, M16, M20, M24, M30 RG M metric diameter (0.39, 0.47, 0.63, 0.79, 0.94 and 1.18 inch) threaded steel rods and are used to resist static, wind and earthquake (IBC Seismic Design Categories A and B only) tension and shear loads in cracked and uncracked normal-weight concrete with M8 RG M metric diameter (0.31 inch) threaded steel rods.

Use is limited to normal-weight concrete with a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The anchor system complies with anchors as described in Section 1901.3 of the 2021, 2018 and 2015 IBC, Section 1909 of the 2012 IBC and is an alternative to cast-in-place and post-installed anchors described in Section 1908 of the 2012 IBC, and Sections 1911 and 1912 of the 2009 IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 General:

The fischer Superbond Adhesive Anchor System is comprised of the following components:

Cartridge

- fischer FIS SB 390 S, fischer FIS SB 585 S or fischer FIS SB 1500 S adhesive packaged in cartridges
- Adhesive mixing and dispensing equipment
- Equipment for hole cleaning and adhesive injection

Capsule:

- fischer RSB 8, fischer RSB 10mini, fischer RSB 10, fischer RSB 12mini, fischer RSB 12, fischer RSB 16mini, fischer RSB 16, fischer RSB 20, fischer RSB 20E/24, fischer RSB 30 packaged in capsules.
- setting tool and equipment for hole cleaning

fischer FIS SB adhesive may only be used with continuously threaded steel rods or deformed steel reinforcing bars described in Tables 2, 3, and 4 of this report. The primary components of the fischer adhesive anchor system, including the fischer FIS SB Adhesive and 3 anchoring elements are shown in Figure 4 of this report. fischer RSB adhesive may only be used with continuously threaded steel rods RG M described in Tables 2 and 3 of this report. The primary components of the fischer adhesive anchor system, including the fischer RSB Adhesive and the anchoring element RG M are shown in Figure 5 of this report.

Installation information and parameters are shown in Figure 3 of this report.

The manufacturer's printed installation instructions (MPII), as included with each adhesive unit package, are shown in Figure 7 and 8 of this report.

3.2 Materials:

3.2.1 fischer Superbond Adhesive: fischer Superbond Adhesive Anchoring system include the capsule system RSB and the cartridge system FIS SB.

3.2.1.1 fischer FIS SB: fischer FIS SB Adhesive is an injectable, vinylester adhesive. The two components are kept separate in a dual-chambered cartridge. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold. The system is labeled fischer FIS SB 390 S [13.2 oz (390 mL)], or fischer FIS SB 585 S [19.8 oz. (585 mL)], or fischer FIS SB 1500 S [50.7 oz (1500 mL)]. These three cartridge sizes are denoted as fischer FIS SB.

3.2.1.2 fischer RSB: fischer RSB Adhesive is a resin capsule. The two components are kept in a glass capsule. The two components combine and react when the anchor is driven in while using a hammer drill set on rotary hammer action. The capsules are labeled fischer RSB 8, RSB 10mini, RSB 10, RSB 12mini, RSB 12, RSB 16mini, RSB 16, RSB 20, RSB 20E/24, RSB 30.

The cartridge FIS SB and the RSB box are stamped with the adhesive expiration date. The shelf life, as indicated by the expiration date, corresponds to an unopened cartridge or RSB box stored in a dry, dark environment. Storage temperature of the adhesive is 41°F to 77°F (5°C to 25°C).

3.2.2 Hole cleaning equipment: Hole cleaning equipment comprised of steel wire brushes supplied by fischer and air nozzles must be used in accordance with Figure 7 and 8 of this report.

3.2.3 Dispensers: fischer FIS SB adhesive must be dispensed with manual dispensers, cordless electric dispensers or pneumatic dispensers supplied by fischer.

3.2.4 Setting tool: fischer RSB adhesive must be set with the setting tool and using a suitable adapter. The anchor element is driven into the capsule using a hammer drill set on rotary hammer action.

3.2.5 Steel anchor elements:

3.2.5.1 Standard threaded steel rods: Threaded steel rods must be clean, continuously threaded rods (all-thread) in diameters as described in Tables 5 and 13 of this report. Steel design information for common grades of threaded rod and associated nuts are provided in Tables 2, 3, 5 and 13 of this report. Carbon steel threaded rods are furnished with a 0.0002-inch-thick (0.005 mm) zinc electroplated coating in accordance with ASTM B633 SC 1, or must be hot-dipped galvanized in accordance with ASTM A153, Class C or D.

The stainless steel threaded rods must comply with Table 3 of this report. Steel grades and types of material (carbon, stainless) for the washers and nuts must match the threaded rods. Threaded steel rods must be straight and free of indentations or other defects along their length. The end may be stamped with identifying marks and the embedded end may be blunt cut or cut on the bias (chisel point).

3.2.5.2 fischer threaded steel rods FIS A and RG M: fischer FIS A and RG M anchor rods are threaded rods. The fischer FIS A is a threaded rod with flat shape on both end. The fischer RG M is a threaded rod with a chamfer shape on the embedded section and flat or hexagonal end on the concrete surface side, as shown in Tables 2, 3 and Figure 6. Mechanical properties for the fischer FIS A and RG M are provided in Tables 2, 3 and 5 of this report. The anchor rods are available in diameters as shown in Table 5. fischer FIS A and RG M anchor rods are produced from carbon steel and furnished with a 0.0002-inch-thick (0.005 mm) zinc electroplated coating or fabricated from stainless steel. Steel grades and types of material (carbon, stainless) for the washers and nuts must match the threaded rods. The threaded rods are marked on the head with an identifying mark (see Figure 6).

3.2.5.3 Steel Reinforcing bars: Steel reinforcing bars are deformed reinforcing bars as described in Table 4 of this report. Tables 10 and 16 summarize reinforcing bar size ranges. The embedded portions of reinforcing bars must be straight, and free of mill scale, rust, mud, oil and other coatings that impair the bond with the adhesive. Reinforcing bars must not be bent after installation, except as set forth in ACI 318-19 Section 26.6.3.2 (b), ACI 318-14 Section 26.6.3.1 (b) or ACI 318-11 Section 7.3.2, as applicable, with the additional condition that the bars must be bent cold, and heating of reinforcing bars to facilitate field bending is not permitted.

3.2.5.4 Ductility: In accordance with ACI 318-19 and ACI 318-14 Section 2.3 or ACI 318-11 D.1, as applicable, in order for a steel element to be considered ductile, the tested elongation must be at least 14 percent and reduction of area must be at least 30 percent. Steel elements with a tested elongation of less than 14 percent or a reduction of area of less than 30 percent, or both, are considered brittle. Values for various steel materials are provided in Tables 2 and 3 of this report. Where values are nonconforming or unstated, the steel must be considered brittle.

3.3 Concrete:

Normal-weight concrete must comply with Sections 1903 and 1905 of the IBC. The specified compressive strength of the concrete must be from 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

4.0 DESIGN AND INSTALLATION

4.1 Strength Design:

4.1.1 General: The design strength of anchors under the 2021 IBC, as well as the 2021 IRC must be determined in accordance with ACI 318-19 and this report. The design strength of anchors under the 2018 and 2015 IBC, as well as the 2018 and 2015 IRC must be determined in accordance with ACI 318-14 and this report. The design strength of anchors under the 2012 and 2009 IBC, as well as the 2012 and 2009 IRC, must be determined in accordance with ACI 318-11 and this report.

The strength design of anchors must comply with ACI 318-19 17.5.1.2, ACI 318-14 17.3.1 or 318-11 D.4.1, as applicable, except as required in ACI 318-19 17.10, ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable. An index for the different design strengths is provided in Table 1 of this report.

Design parameters are provided in Tables 5 through 18 of this report. Strength reduction factors, ϕ, as described in ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, must be used for load combinations calculated in accordance with Section 1605.1 of the 2021 IBC, or Section 1605.2 of the 2018, 2015, 2012 and 2009 IBC, ACI 318-19 and ACI 318-14 5.3 or ACI 318-11 9.2, as applicable. Strength reduction factors, ϕ, as described in ACI 318-11 D.4.4 must be used for load combinations calculated in accordance with ACI 318-11 Appendix C.

4.1.2 Static Steel Strength in Tension: The nominal steel strength of a single anchor in tension, N_{sa}, shall be calculated in accordance with ACI 318-19 17.6.1.2, ACI 318-14 17.4.1.2 or ACI 318-11 D.5.1.2, as applicable, and the associated strength reduction factors, ϕ, in accordance with ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are given in Tables 5, 10, 13, and 16 of this report for the anchor element types included in this report. See Table 1.

4.1.3 Static Concrete Breakout Strength in Tension: The nominal static concrete breakout strength in tension of a single anchor of group of anchors, N_{cb} or N_{cbg}, must be calculated in accordance with ACI 318-19 17.6.2, ACI 318-14 17.4.2 or ACI 318-11 D.5.2, as applicable, with the following addition:

The basic concrete breakout strength of a single anchor in tension, N_b, must be calculated in accordance with ACI 318-19 17.6.2.2, ACI 318-14 17.4.2.2 or ACI 318-11 D.5.2.2, as applicable, using the values of $k_{c,cr}$, and $k_{c,uncr}$ as described in the tables of this report. Where analysis indicates no cracking in accordance with ACI 318-19 17.6.2.5, ACI 318-14 17.4.2.6 or ACI 318-11 D.5.2.6, as applicable, N_b must be calculated using $k_{c,uncr}$ and $\Psi_{c,N}$ = 1.0, see Table 1 of this report. For anchors in lightweight concrete see ACI 318-19 17.2.4, ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable. The value of f'_c used for calculation must be limited to 8,000 psi (55 MPa) in accordance with ACI 318-19 17.3.1, ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable. Additional information for the determination of nominal bond strength in tension is given in Section 4.1.4 of this report.

4.1.4 Static Bond Strength in Tension: The nominal static bond strength of a single adhesive anchor or group of adhesive anchors in tension, N_a or N_{ag}, must be calculated in accordance with ACI 318-19 17.6.5, ACI 318-14 17.4.5 or ACI 318-11 D.5.5, as applicable. Bond strength values are a function of the adhesive system, concrete compressive strength, whether the concrete is cracked or uncracked, the concrete temperature range, and the installation conditions (dry, water-saturated concrete, and water-filled holes). The resulting characteristic bond strength shall be multiplied by the associated strength reduction factor ϕ_{nn} and must be modified with the factor κ_{nn} for cases where holes are drilled in dry concrete (κ_d), where the holes are drilled in water-satured concrete (κ_{ws}) or where the holes are water-filled at the time of anchor installation(κ_{wf}), as follows:

CONCRETE TYPE	PERMISSIBLE INSTALLATION CONDITIONS	BOND STRENGTH	ASSOCIATED STRENGTH REDUCTION FACTOR
Uncracked	Dry	$\tau_{uncr} \cdot \kappa_d$	ϕ_d
	Water-saturated	$\tau_{uncr} \cdot \kappa_{ws}$	ϕ_{ws}
	Standing water in hole	$\tau_{uncr} \cdot \kappa_{wf}$	ϕ_{wf}
Cracked	Dry	$\tau_{cr} \cdot \kappa_d$	ϕ_d
	Water-saturated	$\tau_{cr} \cdot \kappa_{ws}$	ϕ_{ws}
	Standing water in hole	$\tau_{cr}\ \kappa_{wf}$	ϕ_{wf}

Figure 1 and 2 of this report presents a bond strength design selection flowchart. Strength reduction factors for determination of the bond strength are given in Tables 8, 9, 12, 15 and 18 of this report. See Table 1. Adjustments to the bond strength may also be taken for increased concrete compressive strength as noted in the footnotes to the corresponding tables and above.

4.1.5 Static Steel Strength in Shear: The nominal static strength of a single anchor in shear as governed by the steel, V_{sa}, in accordance with ACI 318-19 17.7.1.2, ACI 318-14 17.5.1.2 or ACI 318-11 D.6.1.2, as applicable, and the associated strength reduction factors, ϕ, in accordance with ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are given in Tables 5, 10, 13, and 16 for the anchor element types included in this report. See Table 1.

4.1.6 Static Concrete Breakout Strength in Shear: The nominal static concrete breakout strength of a single anchor or group of anchors in shear, V_{cb}, or V_{cbg}, must be calculated in accordance with ACI 318-19 17.7.2, ACI 318-14 17.5.2 or ACI 318-11 D.6.2, as applicable, based on information given in Tables 6, 7, 11, 14, and 17 of this report. See Table 1. The basic concrete breakout strength of a single anchor in shear, V_b, must be calculated in accordance with ACI 318-19 17.7.2.2, ACI 318-14 17.5.5.2 or ACI 318-11 D.6.2.2, as applicable, using the values of d given in Tables 6, 7, 11, 14, and 17 for the corresponding anchor steel in lieu of d_a. In addition, h_{ef} must be substituted for ℓ_e. In no case shall ℓ_e exceed 8d. The value of f'_c shall be limited to a maximum of 8,000 psi (55 MPa) in accordance with ACI 318-19 17.3.1, ACI 318-14 17.2.7 or ACI 318-11 D.3.7, as applicable.

4.1.7 Static Concrete Pryout Strength in Shear: The nominal static pryout strength of a single anchor or group of anchors in shear, V_{cp} or V_{cpg}, shall be calculated in accordance with ACI 318-19 17.7.3, ACI 318-14 17.5.3 or ACI 318-11 D.6.3, as applicable.

4.1.8 Interaction of Tensile and Shear Forces: For designs that include combined tension and shear, the interaction of tension and shear must be calculated in accordance with ACI 318-19 17.8, ACI 318-14 17.6 or ACI 318-11 D.7, as applicable.

4.1.9 Minimum Member Thickness, h_{min}, Anchor Spacing, s_{min}, and Edge Distance, c_{min}: In lieu of ACI 318-19 17.9.2, ACI 318-14 17.7.1 and 17.7.3 or ACI 318-11 D.8.1 and D.8.3, as applicable, values of s_{min} and c_{min} described in this report (Tables 6, 7, 11, 14, and 17) must be observed for anchor design and installation. The minimum member thickness, h_{min}, described in this report (Tables 6, 7, 11, 14, and 17) must be observed for anchor design and installation. For adhesive anchors that will remain untorqued, ACI 318-19 17.9.3, ACI 318-14 17.7.4 or ACI 318-11 D.8.4, as applicable, applies.

4.1.10 Critical Edge Distance c_{ac} and $\psi_{cp,Na}$: The modification factor $\psi_{cp,Na}$, must be determined in accordance with ACI 318-19 17.6.5.5, ACI 318-14 17.4.5.5 or ACI 318-11 D.5.5.5, as applicable, except as noted below:

For all cases where c_{Na}/c_{ac}<1.0, $\psi_{cp,Na}$ determined from ACI 318-19 17.6.5.5.1b, ACI 318-14 Eq. 17.4.5.5b or ACI 318-11 Eq. D-27, as applicable, need not be taken less than c_{Na}/c_{ac}. For all other cases, $\psi_{cp,Na}$ shall be taken as 1.0.

The critical edge distance, c_{ac} must be calculated according to Eq. 17.6.5.5.1c for ACI 318-19, Eq. 17.4.5.5c for ACI 318-14 or Eq. D-27a for ACI 318-11, in lieu of ACI 318-14 17.7.6 or ACI 318-11 D.8.6, as applicable.

$$c_{ac}=h_{ef}\cdot\left(\frac{\tau_{k,uncr}}{1160}\right)^{0.4}\cdot\left[3.1 - 0.7\frac{h}{h_{ef}}\right]$$

(Eq. 17.4.5.5.1c for ACI 318-19, Eq. 17.4.5.5c for ACI 318-14 or Eq. D-27a for ACI 318-11)

where

$\left[\frac{h}{h_{ef}}\right]$ need not be taken as larger than 2.4; and

$\tau_{k,uncr}$ = the characteristic bond strength stated in the tables of this report whereby $\tau_{k,uncr}$ need not be taken as larger than:

$$\tau_{k,uncr} = \frac{k_{uncr}\sqrt{h_{ef}f'_c}}{\pi \cdot d_a} \qquad \text{Eq. (4-1)}$$

4.1.11 Design Strength in Seismic Design Categories C, D, E and F: In structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, anchors must be designed in accordance with ACI 318-19 17.10, ACI 318-14 17.2.3 or ACI 318-11 D.3.3, as applicable. The nominal steel shear strength, V_{sa}, must be adjusted by $\alpha_{V,seis}$ as given in Tables 5, 10, 13, and 16 of this report for the anchor element types included in this report. The nominal bond strength $\tau_{k,cr}$ must be adjusted by $\alpha_{N,seis}$ as noted in Tables 8, 9, 12, 15, and 18 of this report.

As an exception to ACI 318-11 D.3.3.4.2: Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy ACI 318-11 D.3.3.4.3(d).

Under ACI 318-11 D.3.3.4.3(d), in lieu of requiring the anchor design tensile strength to satisfy the tensile strength requirements of ACI 318-11 D.4.1.1, the anchor design tensile strength shall be calculated from ACI 318-11 D.3.3.4.4.

The following exceptions apply to ACI 318-11 D.3.3.5.2:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or non-bearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with ACI 318-11 D.6.2 and D.6.3 need not be computed and ACI 318-11 D.3.3.5.3 need not apply provided all of the following are satisfied:

1.1. The allowable in-plane shear strength of the anchor is determined in accordance with AF&PA NDS Table 11E for lateral design values parallel to grain.

1.2. The maximum anchor nominal diameter is $^{5}/_{8}$ inch (16 mm).

1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

1.4. Anchor bolts are located a minimum of 1$^{3}/_{4}$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

1.6. The sill plate is 2-inch or 3-inch nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or non-bearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with ACI 318-11 D.6.2 and D.6.3 need not be computed and ACI 318-11 D.3.3.5.3 need not apply provided all of the following are satisfied:

2.1. The maximum anchor nominal diameter is $^{5}/_{8}$ inch (16 mm).

2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

2.3. Anchors are located a minimum of 1$^{3}/_{4}$ inches (45 mm) from the edge of the concrete parallel to the length of the track.

2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.

2.5. The track is 33 to 68 mil designation thickness. Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete shall be permitted to be determined in accordance with AISI S100 Section E3.3.1.

3. In light-frame construction, bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching a sill plate or track to foundation or foundation stem wall need not satisfy ACI 318-11 D.3.3.5.3(a) through (c) when the design strength of the anchors is determined in accordance with ACI 318-11 D.6.2.1(c).

4.2 Installation:

Installation parameters are illustrated in Figure 3 of this report. Installation must be in accordance with ACI 318-19 26.7.2, ACI 318-14 17.8.1 and 17.8.2 or ACI 318-11 D.9.1 and D.9.2, as applicable. Anchor locations must comply with this report and the plans and specifications approved by the code official. Installation of the fischer FIS SB and fischer RSB Adhesive Anchor System must conform to the manufacturer's printed installation instructions included in each unit package as described in Figure 7 (FIS SB) and Figure 8 (RSB) of this report.

The adhesive anchor system may be used for upwardly inclined orientation applications (e.g. overhead). Upwardly inclined and horizontal orientation applications are to be installed using the appropriate injection adapter and wedges to support the anchor during curing time as described in Figure 7.

Installation of anchors in horizontal or upwardly inclined orientations shall be fully restrained from movement throughout the specified curing period through the use of temporary wedges, external supports, or other methods. Where temporary restraint devices are used, their use shall not result in implairment of the anchor shear resistance.

4.3 Special Inspection:

Periodic special inspection must be performed where required in accordance with Sections 1705.1.1 and Table 1705.3 of the 2021, 2018, 2015 or 2012 IBC, Table 1704.4 and Section 1704.15 of the 2009 IBC and this report. The special inspector must be on the jobsite initially during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, adhesive identification and expiration date, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete thickness, anchor embedment, tightening torque and adherence to the manufacturer's published installation instructions.

The special inspector must verify the initial installations of each type and size of adhesive anchor by construction personnel on site. Subsequent installations of the same anchor type and size by the same construction personnel are permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or the personnel performing the installation requires an initial inspection. For ongoing installations over an extended period, the special inspector must make regular inspections to confirm correct handling and installation of the product.

Continuous special inspection of adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be performed in accordance with ACI 318-19 26.13.3.2(e), ACI 318-14 17.8.2.4, 26.7.1(h) and 26.13.3.2(c) or ACI 318-11 D.9.2.4, as applicable.

Under the IBC, additional requirements as set forth in Section 1705.1.1 and Table 1705.3 of the 2021, 2018, 2015 or 2012 IBC and Sections 1705, 1706, or 1707 of the 2009 IBC must be observed, where applicable.

5.0 CONDITIONS OF USE

The fischer Superbond Adhesive Anchor System described in this report is a suitable alternative to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 fischer Superbond adhesive anchors must be installed in accordance with this report and the manufacturer's printed installation instructions included in the adhesive packaging and described in Figure 7 (FIS SB) and Figure 8 (RSB) of this report.

5.2 The anchors must be installed in cracked or uncracked normal-weight concrete having a specified compressive strength f'_c = 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

5.3 The values of f'_c used for calculation purposes must not exceed 8,000 psi (55 MPa).

5.4 Anchors must be installed in concrete base materials in holes predrilled in accordance with the instructions provided in Figures 7 and 8 of this report.

5.5 Loads applied to the anchors must be adjusted in accordance with Section 1605.1 of the 2021 IBC or Section 1605.2 of the 2018, 2015, 2012 and 2009 IBC for strength design.

5.6 fischer Superbond adhesive anchors are recognized for use to resist short- and long-term loads, including wind and earthquake loads, subject to the conditions of this report.

5.7 In structures assigned to Seismic Design Category C, D, E or F under the IBC or IRC, anchor strength must be adjusted in accordance with Section 4.1.11 of this report.

5.8 fischer Superbond adhesive anchors are permitted to be installed in concrete that is cracked or that may be expected to crack during the service life of the anchor, subject to the conditions of this report.

5.9 Strength design values are established in accordance with Section 4.1 of this report.

5.10 Minimum anchor spacing and edge distance, as well as minimum member thickness, must comply with the values given in this report.

5.11 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code official. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.12 The fischer Superbond Adhesive Anchoring System is not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, the fischer Superbond Adhesive Anchoring System is permitted for installation in fire-resistive construction provided that at least one of the following conditions is fulfilled:

- Anchors are used to resist wind or seismic forces only.
- Anchors that support gravity load–bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.13 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of adhesive anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under such conditions is beyond the scope of this report.

5.14 Use of zinc-plated carbon steel threaded rods or steel reinforcing bars is limited to dry, interior locations.

5.15 Use of hot-dipped galvanized carbon steel and stainless steel rods is permitted for exterior exposure or damp environments.

5.16 Steel anchoring materials in contact with preservative-treated and fire-retardant-treated wood must be of zinc-coated carbon steel or stainless steel. The minimum coating weights for zinc-coated steel must comply with ASTM A153.

5.17 Periodic special inspection must be provided in accordance with Section 4.3 of this report. Continuous special inspection for anchors installed in horizontal or upwardly inclined orientations resist sustained tension loads must be provided in accordance with Section 4.3 of this report.

5.18 Installation of anchors in horizontal or upwardly inclined orientations to resist sustained tension loads shall be performed by personnel certified by an applicable certification program in accordance with ACI 318-19 26.7.2(e), ACI 318-14 17.8.2.2 or 17.8.2.3; or ACI 318-11 D.9.2.2 or D.9.2.3, as applicable.

5.19 Anchors may be used for applications where the concrete temperature can vary from 40°F (5°C) to 80°F (27°C) within a 12-hour period. Such applications may include but are not limited to anchorage of building facade systems and other applications subject to direct sun exposure.

5.20 fischer Superbond adhesive is manufactured by fischerwerke GmbH & Co. KG, Denzlingen, Germany, under a quality-control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements (AC308), dated June 2019 (editorially revised February 2021).

7.0 IDENTIFICATION

7.1 fischer Superbond adhesive is identified by packaging labeled with the manufacturer's name (fischerwerke) and address, product name, lot number, expiration date, and the evaluation report number (ESR-3572).

7.2 Threaded rods, nuts, washers and deformed reinforcing bars are standard elements and must conform to applicable national or international specifications as set forth in Tables 2, 3, and 5 of this report.

7.3 The report holder's contact information is the following:

fischerwerke GmbH & Co. KG
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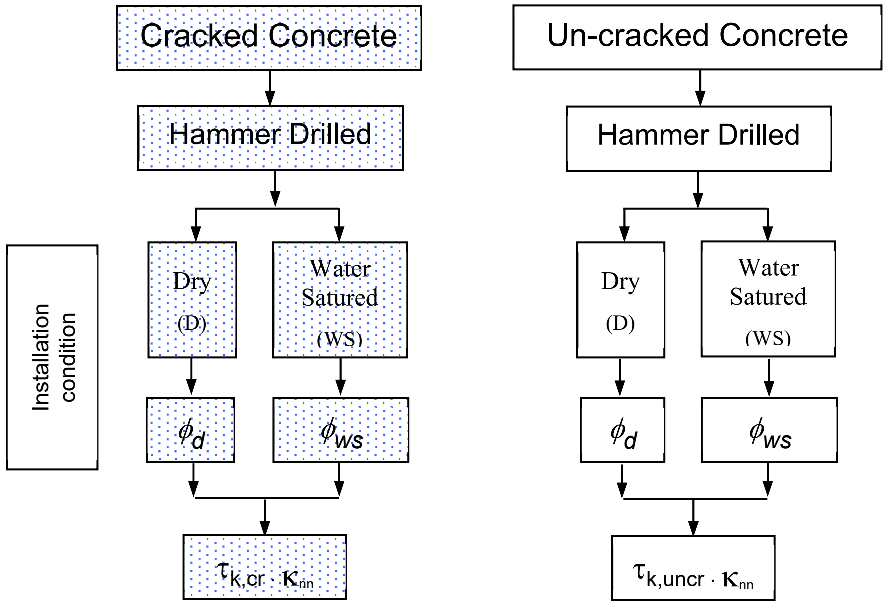


FIGURE 1—FLOWCHART: STRENGTH REDUCTION FACTORS FOR DETERMINATION OF THE DESIGN BOND STRENGTH WITH FIS SB

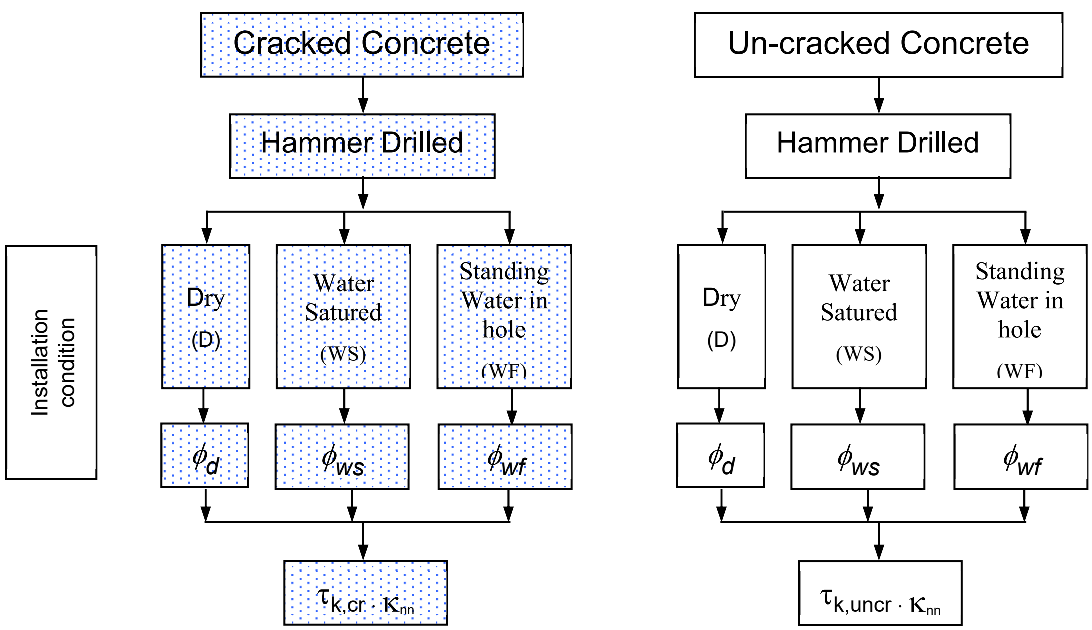


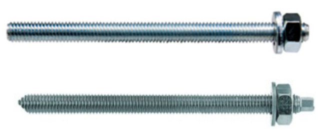
FIGURE 2—FLOWCHART: STRENGTH REDUCTION FACTORS FOR DETERMINATION OF THE DESIGN BOND STRENGTH WITH RSB

TABLE 1—DESIGN TABLE INDEX

Design strength[1]		Threaded rod		Deformed reinforcement	
		Metric	Fractional	Metric	Fractional
Steel	N_{sa}, V_{sa}	Table 5	Table 13	Table 10	Table 16
Concrete	N_{cb}, N_{cbg}, V_{cb}, V_{cbg}, V_{cp}, V_{cpg}	Table 6, 7	Table 14	Table 11	Table 17
Bond[2]	N_a, N_{ag}	Table 8, 9	Table 15	Table 12	Table 18
Bond reduction factors	ϕ_d, ϕ_{ws}, ϕ_{wf}, κ_d, κ_{ws}, κ_{wf}	Table 8, 9	Table 15	Table 12	Table 18

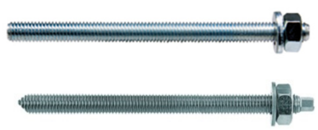
[1]Design strengths are as set forth in ACI 318.19 17.5.1.2, ACI 318-14 17.3.1.1 or ACI 318-11 D.4.1.1, as applicable.
[2]See Section 4.1 of this report for bond strength information.

TABLE 2—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON CARBON STEEL THREADED ROD MATERIALS[1] AND fischer THREADED RODS FIS A AND RG M

THREADED ROD SPECIFICATION 		**Minimum specified ultimate strength (f_{uta})**	**Minimum specified yield strength 0.2% offset (f_{ya})**	**f_{uta}/f_{ya}**	**Elongation, min. (percent)[7]**	**Reduction of Area, min. (percent)**	**Specification for nuts[8]**
ISO 898-1[2] Class 5.8	MPa (psi)	500 (72,519)	400 (58,015)	1.25	-	-	DIN 934 Grade 6
ISO 898-1[2] Class 8.8	MPa (psi)	800 (116,030)	640 (92,824)	1.25	12	52	DIN 934 Grade8
ASTM F568M[3] Class 5.8 (equivalent to ISO 898-1[2] Class 5.8)	MPa (psi)	500 (72,519)	400 (58,015)	1.25	10	35	ASTM A563 Grade DH DIN 934 Grade 6 (8-A2K)
ASTM A36[4] and F1554[5] Grade 36	MPa (psi)	400 (58,000)	248 (36,000)	1.61	23	40	ASTM A194 / A563 Grade A
ASTM F1554[5] Grade 55	MPa (psi)	517 (75,000)	380 (55,000)	1.36	23	40	
ASTM A193[6] Grade B7 ≤ 2 1/2 in. (≤64mm)	MPa (psi)	862 (125,000)	724 (105,000)	1.19	16	50	ASTM A194 / A563 Grade DH
ASTM F1554[5] Grade 105	MPa (psi)	862 (125,000)	724 (105,000)	1.19	15	45	

[1]fischer Superbond must be used with continuously threaded carbon steel rod (all-thread) with thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Thread Series.
[2]Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs.
[3]Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.
[4]Standard Specification for Carbon Structural Steel.
[5]Standard Specification for Anchor Bolts, Steel, 36, 55 and 105ksi Yield Strength.
[6]Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.
[7]Based on 2-in. (50 mm) gauge length except ISO 898, which is based on 5d.
[8]Nuts of other grades and styles having specified proof load stresses greater than the specified grade and style are also suitable. Nuts must have specified proof load stresses equal or greater than the minimum tensile strength of the specific threaded rods. Material types of the nuts and washers must be matched to the threaded rods.

TABLE 3—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON STAINLESS STEEL THREADED ROD MATERIALS[1] AND fischer THREADED RODS FIS A AND RG M

THREADED ROD SPECIFICATION 		Minimum specified ultimate strength (f_{uta})	Minimum specified yield strength 0.2% offset (f_{ya})	f_{uta}/f_{ya}	Elongation, min. (percent)[4]	Reduction of Area, min. (percent)	Specification for nuts[6]
ISO 3506-1[2] A4-80 M8-M30	MPa (psi)	800 (116,000)	600 (87,000)	1.34	12	-	ISO 4032
ISO 3056-1[2] A4-70 M8-M30	MPa (psi)	700 (101,500)	450 (65,250)	1.56	16	-	
ISO 3506-1[2] stainless C-80 M8-M30	MPa (psi)	800 (116,000)	600 (87,000)	1.34	12	-	ISO 4032
ISO 3506-1[2] stainless C-70 M8-M30	MPa (psi)	700 (101,500)	450 (65,250)	1.56	16	-	
ASTM F593[3] CW1 (316) 1/4 to 5/8 in.	MPa (psi)	689 (100,000)	448 (65,000)	1.54	20		ASTM F594 Alloy group 1, 2, 3
ASTM F593[3] CW2 (316) 3/4 to 1 1/2 in.	MPa (psi)	586 (85,000)	310 (45,000)	1.89	25		
ASTM A193[4] Grad B8/B8M, Class 1	MPa (psi)	517 (75,000)	207 (30,000)	2.50	30	50	ASTM F594 Alloy Group 1, 2 or 3
ASTM A193[4] Grad B8/B8M, Class 2B	MPa (psi)	655 (95,000)	517 (75,000)	1.27	25	40	

[1]fischer Superbond may be used with continuously threaded stainless steel rod (all-thread) with thread characteristics comparable with ANSI B1.1 UNC Coarse Thread Series or ANSI B1.13M M Profile Metric Thread Series.
[2]Mechanical properties of corrosion resistant stainless steel fasteners – Part 1: Bolts, screws and studs
[3]Standard Steel Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
[4]Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.
[5]Based on 2-in. (50 mm) gauge length except ISO 898, which is based on 5d.
[6]Nuts of other grades and styles having specified proof load stresses greater than the specified grade and style are also suitable. Nuts must have specified proof load stresses equal or greater than the minimum tensile strength of the specific threaded rods. Material types of the nuts and washers must be matched to the threaded rods.

TABLE 4—SPECIFICATIONS AND PHYSICAL PROPERTIES OF COMMON STEEL REINFORCING BARS[1]

REINFORCING BAR SPECIFICATION 		Minimum specified ultimate strength (f_{uta})	Minimum specified yield strength (f_{ya})
DIN 488 BSt 500[1]	MPa (psi)	550 (79,750)	500 (72,500)
ASTM A615[2], ASTM A767[3] Gr. 40	MPa (psi)	414 (60,000)	276 (40,000)
ASTM A615[2], ASTM A767[3] Gr. 60	MPa (psi)	620 (90,000)	420 (60,000)
ASTM A706[4], ASTM A767[3] Gr. 60	MPa (psi)	550 (80,000)	414 (60,000)

[1]Reinforcing steel; reinforcing steel bars; dimensions and masses.
[2]Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
[3]Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
[4]Billet Steel Bars for Concrete Reinforcement.

FIS SB + RSB

TABLE 5—STEEL DESIGN INFORMATION FOR METRIC THREADED ROD[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm)						
				M8	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
ROD OUTSIDE DIAMETER		d	mm	8	10	12	16	20	24	30
			(in.)	(0.31)	(0.39)	(0.47)	(0.63)	(0.79)	(0.94)	(1.18)
ROD effective cross-sectional area		A_{se}	mm²	36.6	58.0	84.3	156.7	244.8	352.5	560.7
			(in².)	(0.057)	(0.090)	(0.131)	(0.243)	(0.379)	(0.546)	(0.869)
ISO 898-1 Class 5.8	Nominal strength as governed by steel strength	N_{sa}	kN	18.3	29.0	42.2	78.4	122.4	176.3	280.4
			(lb)	(4,114)	(6,520)	(9,476)	(17,615)	(27,518)	(39,625)	(63,028)
		V_{sa}	kN	11.0	17.4	25.3	47.0	73.4	105.8	168.2
			(lb)	(2,469)	(3,912)	(5,686)	(10,569)	(16,511)	(23,775)	(37,817)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	not applicable	1.0				0.87	
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65						
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60						
ISO 898-1 Class 8.8	Nominal strength as governed by steel strength	N_{sa}	kN	29.3	46.4	67.4	125.4	195.8	282.0	448.6
			(lb)	(6,583)	(10,432)	(15,162)	(28,183)	(44,029)	(63,399)	(100,845)
		V_{sa}	kN	17.6	27.8	40.5	75.2	117.5	169.2	269.1
			(lb)	(3,950)	(6,259)	(9,097)	(16,910)	(26,417)	(38,040)	(60,507)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	not applicable	0.90					
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65						
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60						
ISO 3506-1 Class A4-70 and stainless C-70	Nominal strength as governed by steel strength	N_{sa}	kN	25.6	40.6	59.0	109.7	171.4	246.8	392.5
			(lb)	(5,760)	(9,128)	(13,267)	(24,661)	(38,525)	(55,474)	(88,240)
		V_{sa}	kN	15.4	24.4	35.4	65.8	102.8	148.1	235.5
			(lb)	(3,456)	(5,477)	(7,960)	(14,796)	(23,115)	(33,285)	(52,944)
	Reduction for seismic shear	$\alpha_{V,seis}$		not applicable	0.90					
	Strength reduction factor ϕ for tension[2]	ϕ		0.65						
	Strength reduction factor ϕ for shear[2]	ϕ		0.60						
ISO 3506-1 Class A4-80 and stainless C-80	Nominal strength as governed by steel strength	N_{sa}	kN	29.3	46.4	67.4	125.4	195.8	282.0	448.6
			(lb)	(6,583)	(10,432)	(15,162)	(28,183)	(44,029)	(63,399)	(100,845)
		V_{sa}	kN	17.6	27.8	40.5	75.2	117.5	169.2	269.1
			(lb)	(3,950)	(6,259)	(9,097)	(16,910)	(26,417)	(38,040)	(60,507)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	not applicable	0.90					
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65						
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60						

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-19 Eq. 17.6.1.2 and Eq 17.7.1.2b, ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. D-2 and Eq. D-29, as applicable. Nuts and washers must be appropriate for the rod strength and type.

[2]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a brittle steel element.

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TABLE 6—CONCRETE BREAKOUT DESIGN INFORMATION FOR METRIC THREADED ROD

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (mm)						
			8	**10**	**12**	**16**	**20**	**24**	**30**
Min. embedment depth	$h_{ef,min}$	mm	60	60	70	80	90	96	120
		(in.)	(2.36)	(2.36)	(2.76)	(3.15)	(3.54)	(3.78)	(4.72)
Max. embedment depth	$h_{ef,max}$	mm	160	200	240	320	400	480	600
		(in.)	(6.299)	(7.87)	(9.45)	(12.60)	(15.75)	(18.90)	(23.62)
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI	7.1						
		(in.lb)	(17)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI	10						
		(in.lb)	(24)						
Min. anchor spacing	s_{min}	mm / (in.)	$s_{min} = c_{min}$						
Min. edge distance	c_{min}	mm	40	45	55	65	85	105	140
		(in.)	(1.575)	(1.77)	(2.17)	(2.56)	(3.35)	(4.13)	(5.51)
Minimum member thinckness	h_{min}	mm	h_{ef} + 30 (≥ 100)			$h_{ef} + 2d_0$[2)]			
		(in.)	h_{ef} + 1.25 (≥ 3.937)						
Critical edge distance for splitting failure	c_{ac}	mm	See Section 4.1.10 of this report.						
Strength reduction factor for tension, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.65						
Strength reduction factor for shear, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.70						

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4.

[2]d_0 = drill hole diameter.

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TABLE 7—CONCRETE BREAKOUT DESIGN INFORMATION FOR METRIC THREADED ROD RG M

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (mm)						
			8	**10**	**12**	**16**	**20**	**24**	**30**
Minimum embedment depth	$h_{ef,1}$	mm	-	75	75	90	-	-	-
		(in.)	-	(2.95)	(2.95)	(3.54)	-	-	-
Medium embedment depth	$h_{ef,2}$	mm	80	90	110	125	170	210	280
		(in.)	(3.15)	(3.54)	(4.33)	(4.92)	(6.69)	(8.27)	(11.02)
Maximum. embedment depth	$h_{ef,3}$	mm	-	150	150	190	210	-	-
		(in.)	-	(5.91)	(5.91)	(7.48)	(8.27)	-	-
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI	7.1						
		(in.lb)	(17)						
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI	10						
		(in.lb)	(24)						
Min. anchor spacing	s_{min}	mm / (in.)	$s_{min} = c_{min}$						
Min. edge distance	c_{min}	mm	40	45	55	65	85	105	140
		(in.)	(1.57)	(1.77)	(2.17)	(2.56)	(3.35)	(4.13)	(5.51)
Minimum member thickness	h_{min}	mm	h_{ef} + 30		$h_{ef} + 2d_0$[2)]				
		(in.)	h_{ef} + 1.25						
Critical edge distance for splitting failure	c_{ac}	(mm)	See Section 4.1.10 of this report.						
Strength reduction factor for tension, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.65						
Strength reduction factor for shear, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.70						

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4.

[2]d_0 = drill hole diameter.

FIS SB

TABLE 8—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED ROD[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm)						
				8	**10**	**12**	**16**	**20**	**24**	**30**
Min. embedment depth		$h_{ef,min}$	mm	60	60	70	80	90	96	120
			(in.)	(2.36)	(2.36)	(2.76)	(3.15)	(3.54)	(3.78)	(4.72)
Max. embedment depth		$h_{ef,max}$	mm	160	200	240	320	400	480	600
			(in.)	(6.299)	(7.87)	(9.45)	(12.60)	(15.75)	(18.90)	(23.62)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.8	4.3	4.3	4.3	4.6	4.6	4.8
			(psi)	(406)	(624)	(624)	(624)	(667)	(667)	(696)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	8.2	10.4	10.0	9.5	9.2	8.9	8.5
			(psi)	(1,189)	(1,508)	(1,450)	(1,378)	(1,334)	(1,291)	(1,233)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.5	3.9	3.9	3.9	4.2	4.2	4.4
			(psi)	(363)	(566)	(566)	(566)	(609)	(609)	(638)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	7.5	9.5	9.2	8.7	8.4	8.1	7.8
			(psi)	(1,088)	(1,378)	(1,334)	(1,262)	(1,218)	(1,175)	(1,131)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.2	3.5	3.5	3.5	3.7	3.7	3.9
			(psi)	(319)	(508)	(508)	(508)	(537)	(537)	(566)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	6.6	8.4	8.1	7.7	7.4	7.2	6.9
			(psi)	(957)	(1,218)	(1,175)	(1,117)	(1,073)	(1,044)	(1,001)
	Reduction for seismic tension	$\alpha_{N,seis}$	-	not applicable	1.0					
Strength reduction factor for permissible installation conditions	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water saturated concrete	ϕ_{ws}	-	0.65	0.65	0.55	0.55	0.55	0.45	0.45

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Characteristic bond strength values correspond to concrete compressive strength f'_c=2,500 psi (17.2 MPA). For concrete compressive strength f'_c between 2,500 psi (17.2 MPA) and 8,000 psi (55.2 MPA), the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2,500)^{0,1}$ (for SI: $(f'_c/17.2)^{0,1}$). See Section 4.1.4 of this report for bond strength determination.
[2]Temperature range A: Maximum short term temperature = 176°F (80°C), Maximum long term Temperature = 122°F (50°C).
Temperature range B: Maximum short term temperature = 248°F (120°C), Maximum long term Temperature = 162°F (72°C).
Temperature range C: Maximum short term temperature = 302°F (150°C), Maximum long term Temperature = 194°F (90°C).
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a results of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.

RSB

TABLE 9—BOND STRENGTH DESIGN INFORMATION FOR METRIC THREADED RODS - RG M[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (mm)						
				8	10	12	16	20	24	30
Minimum embedment depth		$h_{ef,1}$	mm	-	75	75	90	-	-	-
			(in.)	-	(2.95)	(2.95)	(3.54)	-	-	-
Medium embedment depth		$h_{ef,2}$	mm	80	90	110	125	170	210	280
			(in.)	(3.15)	(3.54)	(4.33)	(4.92)	(6.69)	(8.27)	(11.02)
Maximum. embedment depth		$h_{ef,3}$	mm	-	150	150	190	210	-	-
			(in.)	-	(5.91)	(5.91)	(7.48)	(8.27)	-	-
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.8	4.3	4.3	4.3	4.6	4.6	4.8
			(psi)	(406)	(624)	(624)	(624)	(667)	(667)	(696)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	8.2	10.4	10	9.5	9.2	8.9	8.5
			(psi)	(1,189)	(1,508)	(1,450)	(1,378)	(1,334)	(1,291)	(1,233)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.5	3.9	3.9	3.9	4.2	4.2	4.4
			(psi)	(363)	(566)	(566)	(566)	(609)	(609)	(638)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	7.5	9.5	9.2	8.7	8.4	8.1	7.8
			(psi)	(1,088)	(1,378)	(1,334)	(1,262)	(1,218)	(1,175)	(1,131)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.2	3.5	3.5	3.5	3.7	3.7	3.9
			(psi)	(319)	(508)	(508)	(508)	(537)	(537)	(566)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	6.6	8.4	8.1	7.7	7.4	7.2	6.9
			(psi)	(957)	(1,218)	(1,175)	(1,117)	(1,073)	(1,044)	(1,001)
	Reduction for seismic tension	$\alpha_{N,seis}$	-	not applicable	1.0					
Strength reduction factor for permissible installation conditions	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
		κ_d	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Water saturated concrete	ϕ_{ws}	-	0.55	0.55	0.55	0.65	0.65	0.65	0.65
		κ_{ws}		1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Standing water in hole	ϕ_{wf}		0.45	0.45	0.55	0.55	0.55	0.55	0.55
		κ_{wf}		0.97	0.97	1.0	1.0	1.0	1.0	1.0

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Characteristic bond strength values correspond to concrete compressive strength f'_c =2,500 psi (17.2 MPA). For concrete compressive strength f'_c between 2,500 psi (17.2 MPA) and 8,000 psi (55.2 MPA), the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2{,}500)^{0.1}$ (for SI: $(f'_c/17.2)^{0.1}$). See Section 4.1.4 of this report for bond strength determination.
[2]Temperature range A: Maximum short term temperature = 176°F (80°C), Maximum long term Temperature = 122°F (50°C).
Temperature range B: Maximum short term temperature = 248°F (120°C), Maximum long term Temperature = 162°F (72°C).
Temperature range C: Maximum short term temperature = 302°F (150°C), Maximum long term Temperature = 194°F (90°C).
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a results of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.

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TABLE 10—STEEL DESIGN INFORMATION FOR COMMON STEEL REINFORCING BARS[1]

	DESIGN INFORMATION	Symbol	Units	Bar size							
				8	10	12	16	20	25	28	32
	Nominal bar diameter	d	mm	8	10	12	16	20	25	28	32
			(in.)	0.31	0.39	0.47	0.63	0.79	0.98	1.1	1.26
	Bar effective cross-sectional area	A_{se}	mm²	50.2	78.5	113.1	201.1	314.2	490.9	615.8	804.2
			(in².)	0.078	0.112	0.175	0.312	0.487	0.761	0.954	1.247
DIN 488 BSt 550/500	Nominal strength as governed by steel strength	N_{sa}	kN	28.0	43.2	62.2	110.6	172.8	270.0	338.7	442.3
			(lb)	6294	9711	13983	24863	38845	60696	76140	99429
		V_{sa}	kN	13.8	25.9	37.3	66.4	103.7	162.0	203.2	265.4
			(lb)	3102	5822	8385	14927	23312	36418	45679	59662
	Reduction for seismic shear	$\alpha_{V,seis}$	-	not applicable	1.00						
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60							

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 150.0 psi.
[1]Values provided for common reinforcing bar based on specified strength and calculated in accordance with ACI 318-19 Eq. 17.6.1.2 and Eq. 17.7.1.2(b), ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. (D-2) and Eq. (D-29), as applicable.
[2]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a brittle steel element.

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TABLE 11—CONCRETE BREAKOUT DESIGN INFORMATION FOR COMMON STEEL REINFORCING BARS[1]

DESIGN INFORMATION	Symbol	Units	Bar size							
			8	10	12	16	20	25	28	32
Min. embedment depth	$h_{ef,min}$	mm	60	60	70	80	90	100	112	128
		(in.)	2.36	2.36	2.76	3.15	3.54	3.94	4.41	5.04
Max. embedment depth	$h_{ef,max}$	mm	160	200	240	320	400	500	560	640
		(in.)	6.30	7.87	9.45	12.60	15.75	19.69	22.05	25.20
Effectiveness factor for cracked concrete	$k_{c,cr}$	SI	7.1							
		(in.lb)	17							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	SI	10							
		(in.lb)	24							
Min. anchor spacing	s_{min}	mm / (in.)	$s_{min} = c_{min}$							
Min. edge distance	c_{min}	mm	40	45	55	65	85	110	130	160
		(in.)	(1.57)	(1.77)	(2.17)	(2.56)	(3.35)	(4.33)	(5.12)	(6.30)
Minimum member thinckness	h_{min}	mm	h_{ef} + 30 (≥ 100)			h_{ef} + 2d_0[2)]				
		(in.)	h_{ef} + 1.25 (≥ 3.937)							
Critical edge distance for splitting failure	c_{ac}	mm	See Section 4.1.10 of this report.							
Strength reduction factor for tension, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.7							

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.
[1]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4.
[2]d_0 = drill hole diameter.

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TABLE 12—BOND STRENGTH DESIGN INFORMATION FOR COMMON STEEL REINFORCING BARS[1]

DESIGN INFORMATION		Symbol	Units	Bar size							
				8	**10**	**12**	**16**	**20**	**25**	**28**	**32**
Min. embedment depth		$h_{ef,min}$	mm	60	60	70	80	90	100	112	128
			(in.)	(2.36)	(2.36)	(2.76)	(3.15)	(3.54)	(3.94)	(4.41)	(5.04)
Max. embedment depth		$h_{ef,max}$	mm	160	200	240	320	400	500	560	640
			(in.)	(6.30)	(7.87)	(9.45)	(12.60)	(15.75)	(19.69)	(22.05)	(25.20)
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	2.1	3.2	3.2	3.2	3.4	3.4	3.4	3.6
			(psi)	(305)	(464)	(464)	(464)	(493)	(493)	(493)	(522)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	-	7.8	7.5	7.1	6.9	6.6	6.5	6.3
			(psi)	(-)	(1131)	(1088)	(1030)	(1001)	(957)	(943)	(914)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	1.9	3	3	3	3.1	3.1	3.1	3.3
			(psi)	(276)	(435)	(435)	(435)	(450)	(450)	(450)	(479)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	-	7.1	6.9	6.6	6.3	6.1	5.9	5.8
			(psi)	(-)	(1030)	(1001)	(957)	(914)	(885)	(856)	(841)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	N/mm²	1.7	2.6	2.6	2.6	2.8	2.8	2.8	2.9
			(psi)	(247)	(377)	(377)	(377)	(406)	(406)	(406)	(421)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	N/mm²	-	6.3	6.1	5.8	5.6	5.4	5.2	5.1
			(psi)	(-)	(914)	(885)	(841)	(812)	(783)	(754)	(740)
	Reduction for seismic tension	$\alpha_{N,seis}$	-	not applicable	0.98	1.0					
Strength reduction factor for permissible installation conditions	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water saturated concrete	ϕ_{ws}	-	0.65	0.65	0.55	0.55	0.55	0.45	0.45	0.45

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Characteristic bond strength values correspond to concrete compressive strength f'_c=2,500 psi (17.2 MPA). For concrete compressive strength f'_c between 2,500 psi (17.2 MPA) and 8,000 psi (55.2 MPA), the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2{,}500)^{0,1}$ (for SI: $(f'_c/17.2)^{0,1}$). See Section 4.1.4 of this report for bond strength determination.
[2]Temperature range A: Maximum short term temperature = 176°F (80°C), Maximum long term Temperature = 122°F (50°C)
Temperature range B: Maximum short term temperature = 248°F (120°C), Maximum long term Temperature = 162°F (72°C)
Temperature range B: Maximum short term temperature = 302°F (150°C), Maximum long term Temperature = 194°F (90°C)
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.

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TABLE 13—STEEL DESIGN INFORMATION FOR FRACTIONAL THREADED ROD[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)							
				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"
ROD OUTSIDE DIAMETER		d	in.	0.375	0.5	0.625	0.75	0.875	1	1,125	1.25
			(mm)	(9.5)	(12.7)	(15.9)	(19.1)	(22.2)	(25.4)	(28.6)	(31.8)
ROD effective cross-sectional area		A_{se}	in².	0.0775	0.1419	0.2260	0.3345	0.4617	0.6057	0.7626	0.9691
			(mm²)	(50)	(92)	(146)	(216)	(298)	(391)	(492)	(625)
ASTM F568M Class 5.8 / ISO 898-1 Class 5.8	Nominal strength as governed by steel strength	N_{sa}	lb	5,620	10,290	16,385	24,250	33,475	43,915	55,301	70,260
			(kN)	(25.0)	(45.8)	(72.9)	(107.9)	(148.9)	(195.3)	2(46)	(312.5)
		V_{sa}	lb	3,370	6,170	9,830	14,550	20,085	26,350	33,180	42,160
			(kN)	(15.0)	(27.5)	(43.7)	(64.7)	(89.3)	(117.2)	(147.6)	(187.5)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.8				0.6			
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.6							
ASTM A36 Grade 36 / F1554 Grade 36	Nominal strength as governed by steel strength	N_{sa}	lb	4,496	8,273	13,128	19,423	26,796	35,159	44,241	56,200
			(kN)	(20.0)	(36.8)	(58.4)	(86.4)	(119.2)	(156.4)	(196.8)	(250.0)
		V_{sa}	lb	2,698	4,964	7,877	11,654	16,078	21,095	26,544	33,720
			(kN)	(12.0)	(22.1)	(35.0)	(51.8)	(71.5)	(93.8)	(118.1)	(150.0)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.8				0.6			
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.6							
F1554 Grade 55	Nominal strength as governed by steel strength	N_{sa}	lb	5,811	10,692	16,968	25,104	34,634	45,443	57,181	72,639
			(kN)	(25.9)	(47.6)	(75.5)	(111.7)	(154.1)	(202.1)	(254.4)	(323.1)
		V_{sa}	lb	3,487	6,415	10,181	15,062	20,780	27,266	34,309	43,583
			(kN)	(15.5)	(28.5)	(45.3)	(67.0)	(92.4)	(121.3)	(152.6)	(193.9)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.8				0.6			
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.6							
ASTM A193 B7 ASTM F1554 Grade105	Nominal strength as governed by steel strength	N_{sa}	lb	9,690	17,740	28,250	41,810	57,710	75,710	95,117	121,135
			(kN)	(43.1)	(78.9)	(125.7)	(186.0)	(256.7)	(336.8)	(423.1)	(538.8)
		V_{sa}	lb	5,810	10,640	16,950	25,085	34,625	45,425	57,070	72,680
			(kN)	(25.9)	(47.3)	(75.4)	(111.6)	(154.0)	(202.1)	(253.8)	(323.3)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.8				0.6			
	Strength reduction factor ϕ for tension[3]	ϕ	-	0.75							
	Strength reduction factor ϕ for shear[3]	ϕ	-	0.65							

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TABLE 13—STEEL DESIGN INFORMATION FOR FRACTIONAL THREADED ROD[1] (Continued)

ASTM A193 Grade B8/B8M Class 1 Stainless	Nominal strength as governed by steel strength	N_{sa}	lb	4,420	8,090	12,880	19,065	26,315	34,525	43,470	55,240
			(kN)	(19.7)	(36.0)	(57.3)	(84.8)	(117.1)	(153.6)	(193.4)	(245.7)
		V_{sa}	lb	2,650	4,855	7,730	11,440	15,790	20,715	26080	33,145
			(kN)	(11.8)	(21.6)	(34.4)	(50.9)	(70.2)	(92.1)	(116.0)	(147.4)
	Reduction for seismic shear	$\alpha_{V,seis}$		0.8				0.6			
	Strength reduction factor ϕ for tension[2]	ϕ		0.65							
	Strength reduction factor ϕ for shear[2]	ϕ		0.6							
ASTM A193 Grade B8/B8M Class 2B Stainless	Nominal strength as governed by steel strength	N_{sa}	lb	7,362	13,546	21,498	31,805	43,879	57,572	72,444	92,028
			(kN)	32.8	60.3	95.6	141.5	195.2	256.1	322.3	409.4
		V_{sa}	lb	4,417	8,128	12,899	19,083	26,327	34,543	43,466	55,217
			(kN)	19.7	36.2	57.4	84.9	117.1	153.7	193.4	245.6
	Reduction for seismic shear	$\alpha_{V,seis}$		0.8				0.6			
	Strength reduction factor ϕ for tension[2]	ϕ		0.65							
	Strength reduction factor ϕ for shear[2]	ϕ		0.6							
ASTM F593, CW Stainless	Nominal strength as governed by steel strength	N_{sa}	lb	7,740	14,175	22,580	28,420	39,230	51,470	65,255	82,350
			(kN)	(34.4)	(63.1)	(100.4)	(126.4)	(174.5)	(228.9)	(290.3)	(366.3)
		V_{sa}	lb	4,645	8,505	13,550	17,055	23,540	30,880	39,153	49,410
			(kN)	(20.7)	(37.8)	(60.3)	(75.9)	(104.7)	(137.4)	(174.2	(219.8)
	Reduction for seismic shear	$\alpha_{V,seis}$		0.8				0.6			
	Strength reduction factor ϕ for tension[2]	ϕ		0.65							
	Strength reduction factor ϕ for shear[2]	ϕ		0.6							

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-19 Eq.17.6.1.2 and Eq. 17.7.1.2(b), ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. D-2 and Eq. D-29, as applicable. Nuts and washers must be appropriate for the rod strength and type.

[2] The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a brittle steel element.

[3] The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a ductile steel element.

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TABLE 14—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL THREADED ROD[1]

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (in.)							
			$^3/_8$"	$^1/_2$"	$^5/_8$"	$^3/_4$"	$^7/_8$"	1"	$1^1/_8$"	$1^1/_4$"
Min. embedment depth	$h_{ef,min}$	in.	2.36	2.76	3.11	3.50	3.50	4.02	4.49	5.00
		(mm)	60	70	79	89	89	102	114	127
Max. embedment depth	$h_{ef,max}$	in.	7.52	10.00	12.52	15.00	17.52	20.00	22.52	25.00
		(mm)	191	254	318	381	445	508	572	635
Effectiveness factor for cracked concrete	$k_{c,cr}$	in.lb	17							
		(SI)	7.1							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in.lb	24							
		(SI)	10							
Min. anchor spacing	s_{min}	in. / (mm)	$s_{min} = c_{min}$							
Min. edge distance	c_{min}	in.	1.69	2.28	2.56	3.15	3.74	4.33	5.12	6.30
		(mm)	(43)	(58)	(65)	(80)	(95)	(110)	(130)	(160)
Minimum member thinckness	h_{min}	in.	h_{ef} + 30 (≥ 100)	$h_{ef} + 2d_0$[2)]						
		(mm)	h_{ef} + 1.25 (≥ 3.937)							
Critical edge distance for splitting failure	c_{ac}	in. / (mm)	See Section 4.1.10 of this report.							
Strength reduction factor for tension, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.7							

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4.

[2]d_0 = drill hole diameter.

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TABLE 15—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL THREADED ROD[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)							
				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"
Min. embedment depth		$h_{ef,min}$	in.	2.36	2.76	3.11	3.50	3.50	4.02	4.49	5.00
			(mm)	60	70	79	89	89	102	114	127
Max. embedment depth		$h_{ef,max}$	in.	7.52	10.00	12.52	15.00	17.52	20.00	22.52	25.00
			(mm)	191	254	318	381	445	508	572	635
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi	624	624	624	667	667	667	667	754
			(N/mm²)	(4.3)	(4.3)	(4.3)	(4.6)	(4.6)	(4.6)	(4.6)	(5.2)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi	1,523	1,436	1,378	1,334	1,305	1,276	1,247	1,218
			(N/mm²)	(10.5)	(9.9)	(9.5)	(9.2)	(9.0)	(8.8)	(8.6)	(8.4)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi	566	566	566	609	609	609	609	696
			(N/mm²)	(3.9)	(3.9)	(3.9)	(4.2)	(4.2)	(4.2)	(4.2)	(4.8)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi	1,392	1,320	1,276	1,233	1,189	1,160	1,146	1,117
			(N/mm²)	(9.6)	(9.1)	(8.8)	(8.5)	(8.2)	(8.0)	(7.9)	(7.7)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi	508	508	508	537	537	537	537	609
			(N/mm²)	(3.5)	(3.5)	(3.5)	(3.7)	(3.7)	(3.7)	(3.7)	(4.2)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi	1,233	1,175	1,117	1,088	1,059	1,030	1,015	986
			(N/mm²)	(8.5)	(8.1)	(7.7)	(7.5)	(7.3)	(7.1)	(7.0)	(6.8)
	Reduction for seismic tension	$\alpha_{N,seis}$	-	1.0							
Strength reduction factor for permissible installation conditions	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water saturated concrete	ϕ_{ws}	-	0.65	0.55	0.55	0.55	0.45	0.45	0.45	0.45

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Characteristic bond strength values correspond to concrete compressive strength f'_c=2,500 psi (17.2 MPA). For concrete compressive strength f'_c between 2,500 psi (17.2 MPA) and 8,000 psi (55.2 MPA), the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2{,}500)^{0,1}$ (for SI: $(f'_c/17.2)^{0,1}$). See Section 4.1.4 of this report for bond strength determination.
[2]Temperature range A: Maximum short term temperature = 176°F (80°C), Maximum long term Temperature = 122°F (50°C)
Temperature range B: Maximum short term temperature = 248°F (120°C), Maximum long term Temperature = 162°F (72°C)
Temperature range B: Maximum short term temperature = 302°F (150°C), Maximum long term Temperature = 194°F (90°C)
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.

FIS SB

TABLE 16—STEEL DESIGN INFORMATION FOR FRACTIONAL REINFORCING BARS[1]

DESIGN INFORMATION		Symbol	Units	BAR SIZE							
				#3	#4	#5	#6	#7	#8	#9	#10
ROD OUTSIDE DIAMETER		d	in.	$^{3}/_{8}$	$^{1}/_{2}$	$^{5}/_{8}$	$^{3}/_{4}$	$^{7}/_{8}$	1	$1^{1}/_{8}$	$1^{1}/_{4}$
			(mm)	(9.5)	(12.7)	(15.9)	(19.1)	(22.2)	(25.4)	(28.6)	(31.8)
ROD effective cross-sectional area		A_{se}	in².	0.11	0.2	0.31	0.44	0.6	0.79	1	1.27
			(mm²)	(71)	(129)	(200)	(284)	(387)	(510)	(645	(819)
ASTM A615 Grade 40	Nominal strength as governed by steel strength	N_{sa}	lb	6,609	12,004	18,591	26,392	35,990	47,410	59,999	76,207
			(kN)	(29.4)	(53.4)	(82.7)	(117.4)	(160.1)	(210.9)	(266.9)	(339)
		V_{sa}	lb	3,956	7,194	11,150	15,848	21,603	28,437	35,990	45,724
			(kN)	(17.6)	(32)	(49.6)	(70.5)	(96.1)	(126.5)	(160.1)	(203.4)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.74							0.93
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60							
ASTM A615 Grade 60	Nominal strength as governed by steel strength	N_{sa}	lb	9,891	18,006	27,898	39,610	53,997	71,104	90,010	114,311
			(kN)	(44)	(80.1)	(124.1)	(176.2)	(240.2)	(316.3)	(400.4)	(508.5)
		V_{sa}	lb	5,935	10,790	16,748	23,761	32,394	42,667	53,997	68,586
			(kN)	(26.4)	(48)	(74.5)	(105.7)	(144.1)	(189.8)	(240.2)	(305.1)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.74							0.93
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60							
ASTM A706 Grade 60	Nominal strength as governed by steel strength	N_{sa}	lb	8,790	16,006	24,795	35,204	47,995	63,191	80,006	101,610
			(kN)	(39.1)	(71.2)	(110.3)	(156.6)	(213.5)	(281.1)	(355.9)	(452)
		V_{sa}	lb	5,283	9,599	14,882	21,131	28,797	37,924	47,995	60,966
			(kN)	(23.5)	(42.7)	(66.2)	(94)	(128.1)	(168.7)	(213.5)	(271.2)
	Reduction for seismic shear	$\alpha_{V,seis}$	-	0.74							0.93
	Strength reduction factor ϕ for tension[2]	ϕ	-	0.65							
	Strength reduction factor ϕ for shear[2]	ϕ	-	0.60							

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-19 Eq.17.6.1.2 and Eq 17.7.1.2b, ACI 318-14 Eq. 17.4.1.2 and Eq. 17.5.1.2b or ACI 318-11 Eq. D-2 and Eq. D-29, as applicable. Nuts and washers must be appropriate for the rod strength and type.

[2]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4. Values correspond to a brittle steel element.

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TABLE 17—CONCRETE BREAKOUT DESIGN INFORMATION FOR FRACTIONAL REINFORCING BAR[1]

DESIGN INFORMATION	Symbol	Units	Nominal rod diameter (in.)							
			#3	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**#10**
Min. embedment depth	$h_{ef,min}$	in.	2,36	2,76	3,11	3,50	3,50	4,02	4,49	5,00
		(mm)	60	70	79	89	89	102	114	127
Max. embedment depth	$h_{ef,max}$	in.	7,52	10,00	12,52	15,00	17,52	20,00	22,52	25,00
		(mm)	191	254	318	381	445	508	572	635
Effectiveness factor for cracked concrete	$k_{c,cr}$	in.lb	17							
		(SI)	7.1							
Effectiveness factor for uncracked concrete	$k_{c,uncr}$	in.lb	24							
		(SI)	10							
Min. anchor spacing	s_{min}	in. / (mm)	$s_{min} = c_{min}$							
Min. edge distance	c_{min}	in.	1.67	2.26	2.56	3.15	3.74	4.33	5.12	6.30
		(mm)	43	58	65	80	95	110	130	160
Minimum member thinckness	h_{min}	in.	h_{ef} + 30 (≥ 100)		$h_{ef} + 2d_0$[2)]					
		(mm)	h_{ef} + 1.25 (≥ 3.937)							
Critical edge distance for splitting failure	c_{ac}	in. / (mm)	See Section 4.1.10 of this report.							
Strength reduction factor for tension, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.65							
Strength reduction factor for shear, concrete failure modes, (Condition B, supplementary reinforcement not present)[1]	ϕ	-	0.7							

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4.

[2]d_0 = drill hole diameter.

FIS SB

TABLE 18—BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL REINFORCING BAR[1]

DESIGN INFORMATION		Symbol	Units	Nominal rod diameter (in.)							
				#3	#4	#5	#6	#7	#8	#9	#10
Min. embedment depth		$h_{ef,min}$	in.	2,36	2,76	3,11	3,50	3,50	4,02	4,49	5,00
			(mm)	60	70	79	89	89	102	114	127
Max. embedment depth		$h_{ef,max}$	in.	7,52	10,00	12,52	15,00	17,52	20,00	22,52	25,00
			(mm)	191	254	318	381	445	508	572	635
Temperature range A[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi	464	464	464	493	493	493	493	566
			(N/mm²)	(3.2)	(3.2)	(3.2)	(3.4)	(3.4)	(3.4)	(3.4)	(3.9)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi	1,131	1,073	1,044	1,001	972	957	928	914
			(N/mm²)	(7.8)	(7.4)	(7.2)	(6.9)	(6.7)	(6.6)	(6.4)	(6.3)
Temperature range B[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi	435	435	435	450	450	450	450	522
			(N/mm²)	(3.0)	(3.0)	(3.0)	(3.1)	(3.1)	(3.1)	(3.1)	(3.6)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi	1044	986	957	928	899	870	856	841
			(N/mm²)	(7.2)	(6.8)	(6.6)	(6.4)	(6.2)	(6.0)	(5.9)	(5.8)
Temperature range C[2]	Characteristic bond strength in cracked concrete	$\tau_{k,cr}$	psi	377	377	377	406	406	406	406	464
			(N/mm²)	(2.6)	(2.6)	(2.6)	(2.8)	(2.8)	(2.8)	(2.8)	(3.2)
	Characteristic bond strength in uncracked concrete	$\tau_{k,uncr}$	psi	928	870	841	812	798	769	754	740
			(N/mm²)	(6.4)	(6.0)	(5.8)	(5.6)	(5.5)	(5.3)	(5.2)	(5.1)
	Reduction for seismic tension	$\alpha_{N,seis}$	-	1.0							
Strength reduction factor for permissible installation conditions	Dry concrete	ϕ_d	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
	Water saturated concrete	ϕ_{ws}	-	0.65	0.55	0.55	0.55	0.45	0.45	0.45	0.45

For **SI:** 1 inch = 25.4 mm, 1lbf = 4.448 N, 1 psi = 0.006897 MPa.
For pound-inch units: 1 mm = 0.03937 inch, 1 N = 0.2248 lbf, 1MPa = 145.0 psi.

[1]Characteristic bond strength values correspond to concrete compressive strength f'_c=2,500 psi (17.2 MPA). For concrete compressive strength f'_c between 2,500 psi (17.2 MPA) and 8,000 psi (55.2 MPA), the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2{,}500)^{0,1}$ (for SI: $(f'_c/17.2)^{0,1}$). See Section 4.1.4 of this report for bond strength determination.
[2]Temperature range A: Maximum short term temperature = 176°F (80°C), Maximum long term Temperature = 122°F (50°C)
Temperature range B: Maximum short term temperature = 248°F (120°C), Maximum long term Temperature = 162°F (72°C)
Temperature range B: Maximum short term temperature = 302°F (150°C), Maximum long term Temperature = 194°F (90°C)
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.

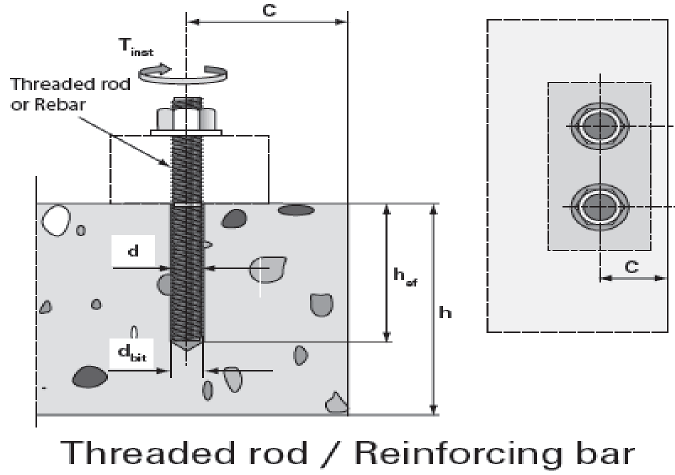
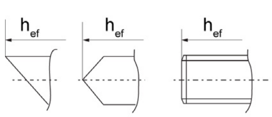


FIGURE 3—INSTALLATION PARAMETERS FOR THREADED ROADS AND REINFORCING BARS

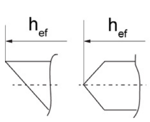
FIGURE 4—FIS SB ANCHORING SYSTEM & STEEL ELEMENTS

FIGURE 5—RSB ANCHORING SYSTEM & RGM

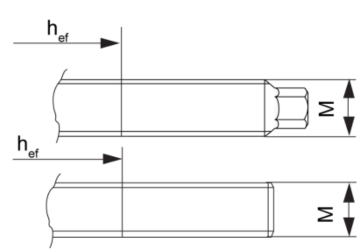
Alternative point geometry threaded rod FIS A



Alternative point geometry threaded rod RGM



Alternative head geometry threaded rod FIS A and RGM



Marking (on the head):
Property class 8.8 or high corrosion-resistant steel, property class 80: •
Stainless steel A4, property class 70; high corrosion-resistant steel, property class 70 and property class 5.8: no marking

FIGURE 6—FISCHER THREADED RODS FIS A AND RGM

Installation instruction

see ICC-ES Evaluation Report No. 3572 at www.icc-es.org

fischer adhesive anchoring system FIS SB

fischer FIS SB is an adhesive anchoring system for fastenings in normal weight concrete.
Important: Before use, read and review the installation instructions and the SDS (safety data sheet). Do not use expired adhesive.

A Preparing the cartridge

1. Remove the cap by turning and pulling it off.
2. Insert the static mixer (FIS MR/FIS UMR) and lock it in place (turn to the right). **The spiral element mixer in the static mixer must be clearly visible**. Never use without the static mixer!
3. Place the cartridge in the dispenser. Press approx. 10 cm of material out **until the resin mortar comes out evenly grey in colour.** Mortar which is not grey colour will not cure and must be disposed off. - The temperature of the concrete must be at least 5 °F (-15 °C) and at most 104 °F (40 °C) (see **Table VII).** The temperature of the cartridge and anchor must be at least ϑ = 41 °F (5 °C) and at most 95 °F (35 °C). After finishing work, leave the static mixer attached to the cartridge.

Important: If the processing time is exceeded, use a new static mixer and if necessary remove encrusted material in the cartridge mouth.

B Installation

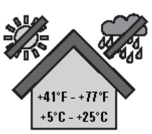
Important: Installation instructions - follow the pictograms 1-7 for the sequence of operating and refer to **Tables I-VI** for setting details. The construction drawings must be adhered.
For any applications not covered by this document, or by any problems with installation contact **fischer**.

1. Drill hole with a hammer drill set. Observe the correct hole diameter and depth according to **Tables I-VI.**

2.1/2.2/2.3. Standing water in bore holes must be completely removed by blowing out before cleaning the bore hole. The drill hole must blown out twice with compressed air (oil-free ≥ 87 psi (6 bar)), brushed two times (minimal by hand) starting from the bottom of the hole and then again blown out twice with compressed air (oil-free ≥ 87psi (6bar)). For drill holes d_0<18 mm it is allowed to use hand pump. The diameters of the brushes are given in **Table I and Table IV.** Clean dirty brushes. Check brushes for wear with brush gauge (brush Ø ≥ drill hole Ø). If required use brush extension.

3. Fill approx. ⅔ of the hole with mortar starting from the bottom of the hole. For drill hole depth > 150 mm use an extention tube. Observe processing time.
4. Anchoring element must be straight and free of oil and other contaminants. Mark the anchor with correct embedment depth. Press the anchoring element down to the bottom of the hole, turning it slightly while so doing. After insert the anchoring element, excess mortar must emerge from the mouth of the hole.
5. For overhead installations and applications between horizontal and overhead use the appropriate injection adapter and wedges to support the anchor during curing time. Also use an injection adapter for all applications with a drill hole depth > 250 mm or a drill hole diameter do ≥ 30 mm. Use appropriate accessories to capture excess adhesive during installation of the anchor element in order to protect the unbonded portion of the anchor element from adhesive. Overhead and horizontal installtion are only covered for the sizes M8 to M30, rebar 8 to 28, 3/8" to 1 1/8" and #3 to #9.
6. Do not disturb the anchoring element until cure time has elapsed. Do not apply load or installation torque moment to the anchor until the prescribed curing times are elapsed. The allowable working time and the minimum curing time are given in **Table VII.**
7. The installation torque moments are given in **Table II and Table V**.

Table VII Processing and curing times



Store mortar in a cool dry place.

Temperature range °C	Temperature range °F	Adhesive Temperature °C	Adhesive Temperature °F	Working time/ processing time	Curing time
> -15 to -10	> +5 to +14	≥ +5	≥ +41	60 min	36 h
> -10 to -5	> +14 to +23	≥ +5	≥ +41	30 min	24 h
> -5 to ±0	> +23 to +32	≥ +5	≥ +41	20 min	8 h
> ±0 to +5	> +32 to +41	≥ +5	≥ +41	13 min	4 h
> +5 to +10	> +41 to +50	≥ +5	≥ +41	9 min	120 min
> +10 to +20	> +50 to +68	≥ +10	≥ +50	5 min	60 min
> +20 to +30	> +68 to +86	≥ +20	≥ +68	4 min	45 min
> +30 to +40	> +86 to +104	≥ +25	≥ +77	2 min	30 min

Table I Drill hole diameter / Accessories for metric sizes

Drill bit Ø [inch]	Drill bit Ø [mm]	Rods Ø [mm]	Rebar Ø [mm]	Brush Type	Brush Item No.	Injection adapter Size	Injection adapter Color
3/8	10	M8	-	BS 10	78178	-	-
7/16	12	M10	8	BS12	78179	12	beige
9/16	14	M12	10	BS14	78180	14	blue
5/8	16	-	12	BS16/18	78181	16	red
3/4	18	M16	-	BS16/18	78181	18	yellow
13/16	20	-	16	BS20	52277	20	green
1	24	M20	-	BS24	78182	24	brown
1	25	-	20	BS25	97806	25	black
1 1/8	28	M24	-	BS28	78183	28	blue
1 1/4	30	-	25	BS35	78184	30	grey
1 3/8	35	M30	28	BS35	78184	35	brown
1 1/2	40	-	32	BS40	505061	40	red

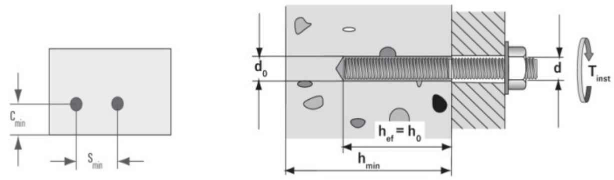


Table II Metric threaded rods

d	d_0 [mm]	d_0 [inch]	$h_{ef,min}$ [mm]	$h_{ef,min}$ [inch]	$h_{ef,max}$ [mm]	$h_{ef,max}$ [inch]	h_{min} [mm]	h_{min} [inch]	$s_{min} = c_{min}$ [mm]	$s_{min} = c_{min}$ [inch]	T_{inst} [Nm]	T_{inst} [ft-lb]
M8	3/8	10	60	2,36	160	6,30	h_{ef} + 30	h_{ef} + 1,25	40	1,57	10	7
M10	7/16	12	60	2,36	200	7,87			45	1,77	20	15
M12	9/16	14	70	2,76	240	9,45			55	2,17	40	30
M16	3/4	18	80	3,15	320	12,60	h_{ef} + $2d_0$	h_{ef} + $2d_0$	65	2,56	60	44
M20	1	24	90	3,54	400	15,75			85	3,35	120	89
M24	1 1/8	28	96	3,78	480	18,90			105	4,13	150	111
M30	1 3/8	35	120	4,72	600	23,62			140	5,51	300	221

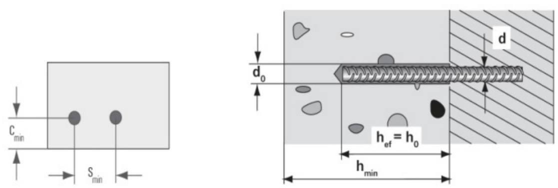


Table III Metric rebar

d	d_0 [mm]	d_0 [inch]	$h_{ef,min}$ [mm]	$h_{ef,min}$ [inch]	$h_{ef,max}$ [mm]	$h_{ef,max}$ [inch]	h_{min} [mm]	h_{min} [inch]	$s_{min} = c_{min}$ [mm]	$s_{min} = c_{min}$ [inch]
8	7/16	12	60	2,36	160	6,30	h_{ef} + 30	h_{ef} + 1,25	45	1,77
10	9/16	14	60	2,36	200	7,87			45	1,77
12	5/8	16	70	2,76	240	9,45	h_{ef} + $2d_0$	h_{ef} + $2d_0$	55	2,17
16	13/16	20	80	3,15	320	12,60			65	2,56
20	1	25	90	3,54	400	15,75			85	3,35
25	1 1/4	30	100	3,94	500	19,69			110	4,33
28	1 3/8	35	112	4,41	560	22,05			130	5,12
32	1 1/2	40	128	5,04	640	25,20			160	6,30

FIGURE 7—FIS SB INSTALLATION INFORMATION

Table IV Drill hole diameter / Accessories for fractional sizes

Drill bit		Rods	Rebar	Brush		Injection adapter	
Ø [inch]	Ø [mm]	Ø [mm]	Ø [mm]	Type	Item No.	Size	Color
7/16	12	3/8	-	BS12	78179	-	-
1/2	14	-	#3	BS14	78180	12	
9/16	15	1/2	-	BS14	78180	14	
5/8	16	-	#4	BS16/18	78181	16	
3/4	18	5/8	-	BS20	52277	18	
3/4	20	-	#5	BS20	52277	18	
7/8	22	3/4	#6	BS20	52277	20	
1	25	7/8	-	BS25	97806	25	
1 1/8	28	1	#7	BS28	78183	28	
1 1/4	32	1 1/8	#8	BS35	78184	30	
1 3/8	35	1 1/4	#9	BS35	78184	35	
1 1/2	40	-	#10	BS40	505061	35	

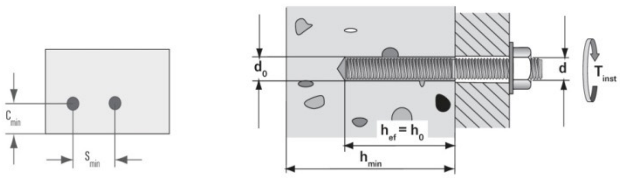


Table V Fractional threaded rods

d	d_0		$h_{ef,min}$		$h_{ef,max}$		h_{min}		$s_{min} = c_{min}$		T_{inst}	
	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[Nm]	[ft-lb]
3/8	7/16	12	60	2,38	191	7,50	h_{ef} + 30	h_{ef} + 1,25	42,5	1,67	20	15
1/2	9/16	15	70	2,75	254	10,00			57,5	2,26	41	30
5/8	3/4	18	79	3,13	318	12,50	h_{ef} + $2d_0$	h_{ef} + $2d_0$	65	2,56	68	50
3/4	7/8	22	89	3,50	381	15,00			80	3,15	122	90
7/8	1	25	89	3,50	445	17,50			95	3,74	136	100
1	1 1/8	28	102	4,00	508	20,00			110	4,33	183	135
1 1/8	1 1/4	32	114	4,50	572	22,50			135	5,31	244	180
1 1/4	1 3/8	35	127	5,00	635	25,00			160	6,30	325	240

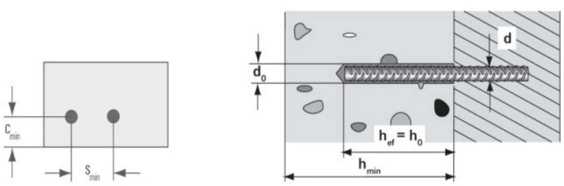
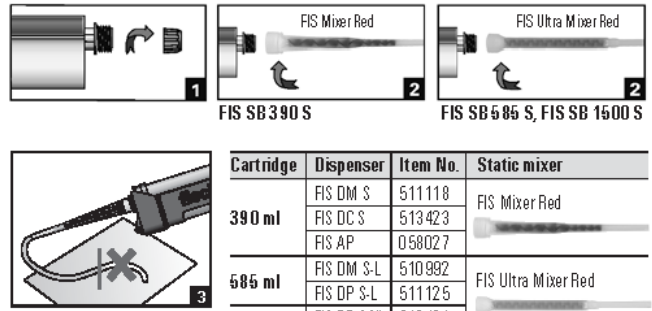


Table VI Fractional reinforcing bars

d	d_0		$h_{ef,min}$		$h_{ef,max}$		h_{min}		$s_{min} = c_{min}$	
	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
#3	14	1/2	60	2,38	191	7,50	h_{ef} + 30	h_{ef} + 1,25	43	1,69
#4	16	5/8	70	2,75	254	10,00			58	2,28
#5	20	3/4	79	3,13	318	12,50	h_{ef} + $2d_0$	h_{ef} + $2d_0$	65	2,56
#6	22	7/8	89	3,50	381	15,00			80	3,15
#7	28	1 1/8	89	3,50	445	17,50			95	3,74
#8	32	1 1/4	102	4,00	508	20,00			110	4,33
#9	35	1 3/8	114	4,50	572	22,50			130	5,12
#10	40	1 1/2	127	5,00	635	25,00			160	6,30

A **FIS SB 390 S / FIS SB 585 S / FIS SB 1500 S**



Cartridge	Dispenser	Item No.	Static mixer
390 ml	FIS DM S	511118	FIS Mixer Red
	FIS DC S	513423	
	FIS AP	058027	
585 ml	FIS DM S-L	510992	FIS Ultra Mixer Red
	FIS DP S-L	511125	
1500 ml	FIS DP S-XL	512401	

B

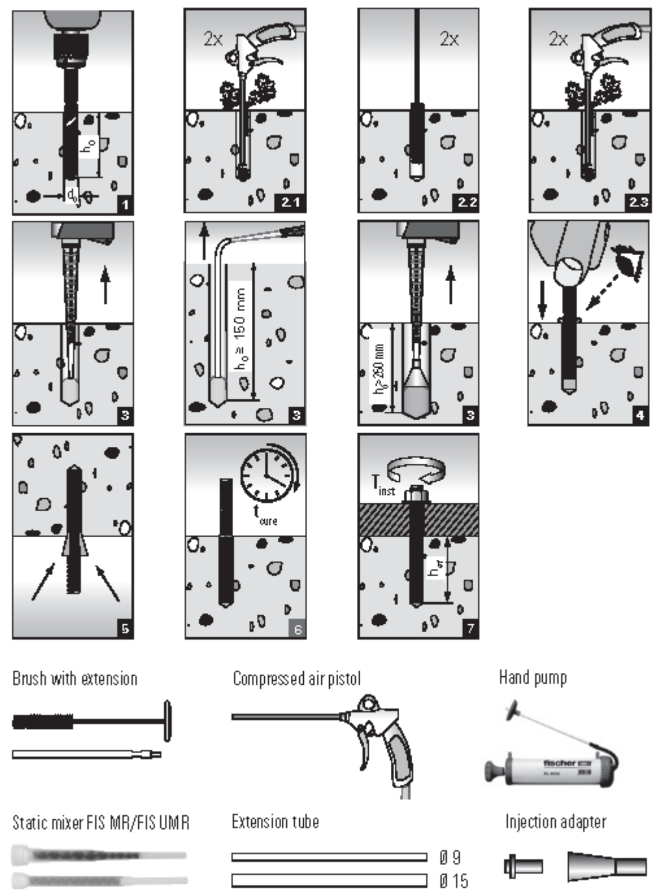


FIGURE 7—FIS SB INSTALLATION INFORMATION (Continued)

Installation instruction

see ICC-ES Evaluation Report
No. 3572 at www.icc-es.org

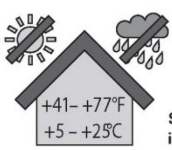
fischer adhesive anchoring system RSB

fischer RSB is an adhesive anchoring system for anchorage in normal weight concrete.

Important:
Before use, read and review the installation instructions and the SDS (safety data sheet). Do not use expired adhesive.

A Installation in hammer-drilled hole

1. Drill the hole. Drill hole diameter d_0 and drill hole depth h_0, see **Table II** or **III.**
2. Drill hole cleaning: Blow out the drill hole four times with oil-free compressed air (p ≥ 6 bar). The use of a manual blow-out pump is possible, if at the same time the drill hole diameter is less than 18 mm and the embedment depth h_{ef} is less than 10d.
3. Resin capsule RSB or two RSB mini, must be pushed into the drill hole by hand. Depending on the fischer RG M anchor element being installed, a suitable setting tool should be used.
4. Only use clean and grease-free anchors.
Using a suitable adapter, drive the fischer RG M anchor element into the capsule using a hammer drill set on rotary hammer action. Stop when the anchor element reaches the bottom of the hole and is set to the correct embedment depth.
5. When fully embedded, excess adhesive must emerge from the mouth of the drill hole. If not, the anchor must be pulled out immediately and a second resin capsule must be pushed into the drill hole. Setting process must be repeated, step (4).
6. Wait for the specified curing time. T_{cure} see **Table I.**
Admissible concrete and adhesive temperature see **Table I.**
Mounting the fixture $T_{inst,max}$ see **Table III.**

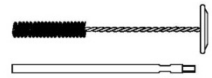


Store adhesive in a cool dry place.

Table I Curing times

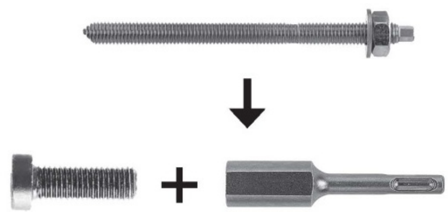
Concrete Temperature range		Adhesive Temperature		Curing time
°C	°F	°C	°F	t_{cure}
> −20 to −15	> −4 to +5	≥ −15	≥ +5	48 h
> −15 to −10	> +5 to +14	≥ −15	≥ +5	30 h
> −10 to −5	> +14 to +23	≥ −10	≥ +14	16 h
> −5 to ±0	> +23 to +32	≥ −5	≥ +23	10 h
> ±0 to +5	> +32 to +41	≥ ±0	≥ +32	45 min
> +5 to +10	> +41 to +50	≥ +5	≥ +41	30 min
> +10 to +20	> +50 to +68	≥ +10	≥ +50	20 min
> +20 to +30	> +68 to +86	≥ +20	≥ +68	5 min
> +30 to +40	> +86 to +104	≥ +25	≥ +77	5 min

Brush with extension

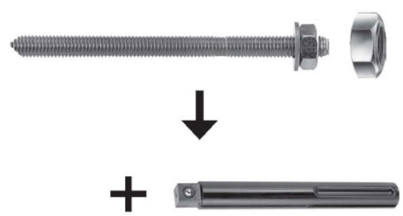


Hand pump

Compressed air pistol



RA-SDS
Art. No. 062420



SDS max 1/2" VK (M16 - M20)
Art. No. 001538

SDS max 3/4" VK (M20 - M30)
Art. No. 001539

SDS plus 1/2" VK (M8 - M16)
Art. No. 001537

SK SW 8 1/2" VK (M8 - M22)
Art. No. 001536

fischer *innovative solutions*

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FIGURE 8—RSB INSTALLATION INFORMATION

Table II

	Rods	Ø	Drill bit	Anchoring depth	Brush	Capsule	RSB	
	mm	inch	d_0	h_{ef}	Ø d_b	1 x / 2 x	RSB	Item No.
RG M 	M8	3/8	Ø 10 mm	80 mm	11	1 x	RSB 8	518807
	M10	15/32	Ø 12 mm	75 mm	14	1 x	RSB 10 mini	518820
				90 mm	14	1 x	RSB 10	518821
				150 mm	14	2 x	RSB 10 mini	518820
	M12	9/16	Ø 14 mm	75 mm	16	1 x	RSB 12 mini	518822
				110 mm	16	1 x	RSB 12	518823
				150 mm	16	2 x	RSB 12 mini	518822
	M16	1 1/16	Ø 18 mm	95 mm	20	1 x	RSB 16 mini	518824
				125 mm	20	1 x	RSB 16	518825
				190 mm	20	2 x	RSB 16 mini	518824
	M20	1	Ø 25 mm	170 mm	27	1 x	RSB 20	518827
				210 mm	27	1 x	RSB 20 E / 24	518828
	M24	1 1/8	Ø 28 mm	210 mm	30	1 x	RSB 20 E / 24	518828
	M30	1 3/8	Ø 35 mm	280 mm	40	1 x	RSB 30	518829

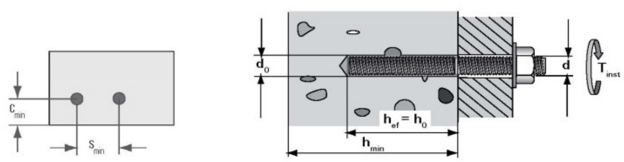

Table III Threaded rod

d	Drill bit d_0		Anchoring depth h_{ef}		Minimum member thickness h_{min}		Minimum spacing, edge distance $s_{min} = c_{min}$		Maximum torque $T_{inst, max}$	
mm	mm	inch	mm	inch	mm	inch	mm	inch	Nm	$f_t - l_b$
M8	10	3/8	80	3.15	h_{ef} + 30	h_{ef} + 1.25	40	1.57	10	7.35
M10	12	15/32	75	2.95			45	1.77	20	14.75
			90	3.54			45	1.77	20	14.75
			150	5.91			45	1.77	20	14.75
M12	14	9/16	75	2.95			55	2.17	40	29.50
			110	4.33			55	2.17	40	29.50
			150	5.91			55	2.17	40	29.50
M16	18	11/16	95	3.74	h_{ef} + 2d_0	h_{ef} + 2d_0	65	2.56	60	44.25
			125	4.92			65	2.56	60	44.25
			190	7.48			65	2.56	60	44.25
M20	25	1	170	6.69			85	3.35	120	88.50
			210	8.27			85	3.35	120	88.50
M24	28	1 1/8	210	8.27			105	4.13	150	110.60
M30	35	1 3/8	280	11.02			140	5.51	300	221.25

A Installation in hammer-drilled hole

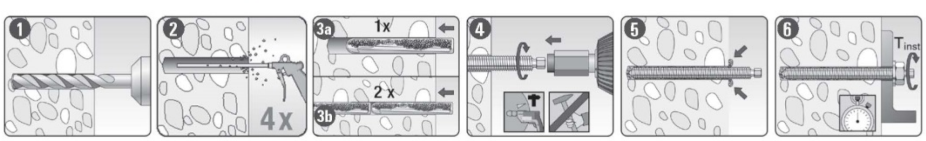

FIGURE 8—RSB INSTALLATION INFORMATION (Continued)

ICC-ES Evaluation Report

ESR-3572 CBC and CRC Supplement

Issued April 2023

This report is subject to renewal April 2024.

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DIVISION: 03 00 00–CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

fischerwerke GmbH & Co. KG

EVALUATION SUBJECT:

fischer SUPERBOND ADHESIVE ANCHORING SYSTEM FOR CRACKED AND UNCRACKED CONCRETE

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the fischer Superbond Adhesive Anchor System, described in ICC-ES evaluation report ESR-3572, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2022 and 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2022 and 2019 *California Residential Code* (CRC).

2.0 CONCLUSIONS

2.1 CBC:

The fischer Superbond Adhesive Anchor System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3572, complies with CBC Chapter 19, provided the design and installation are in accordance with the 2021 and 2018 *International Building Code®* (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapter 16, 17 and 19, as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The fischer Superbond Adhesive Anchor System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3572, complies with CRC Section R301.1.3, provided the design and installation are in accordance with the 2021 and 2018 *International Building Code®* (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 16, 17 and 19, as applicable.

This supplement expires concurrently with the evaluation report, reissued April 2023.

ICC-ES Evaluation Report

ESR-3572 FBC Supplement

Reissued April 2023

This report is subject to renewal April 2024.

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1.0 REPORT PURPOSE AND SCOPE

Purpose:

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Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The fischer Superbond Adhesive Anchoring System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3572, complies with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design requirements are determined in accordance with the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable. The installation requirements noted in the ICC-ES evaluation report ESR-3572 for the 2018 *Internation Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential*, as applicable.

Use of the fischer Superbond Adhesive Anchoring System has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* with the following condition:

a) For connections subject to uplift, the connection must be designed for no less than 700 pounds (3114 N).

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued April 2023.