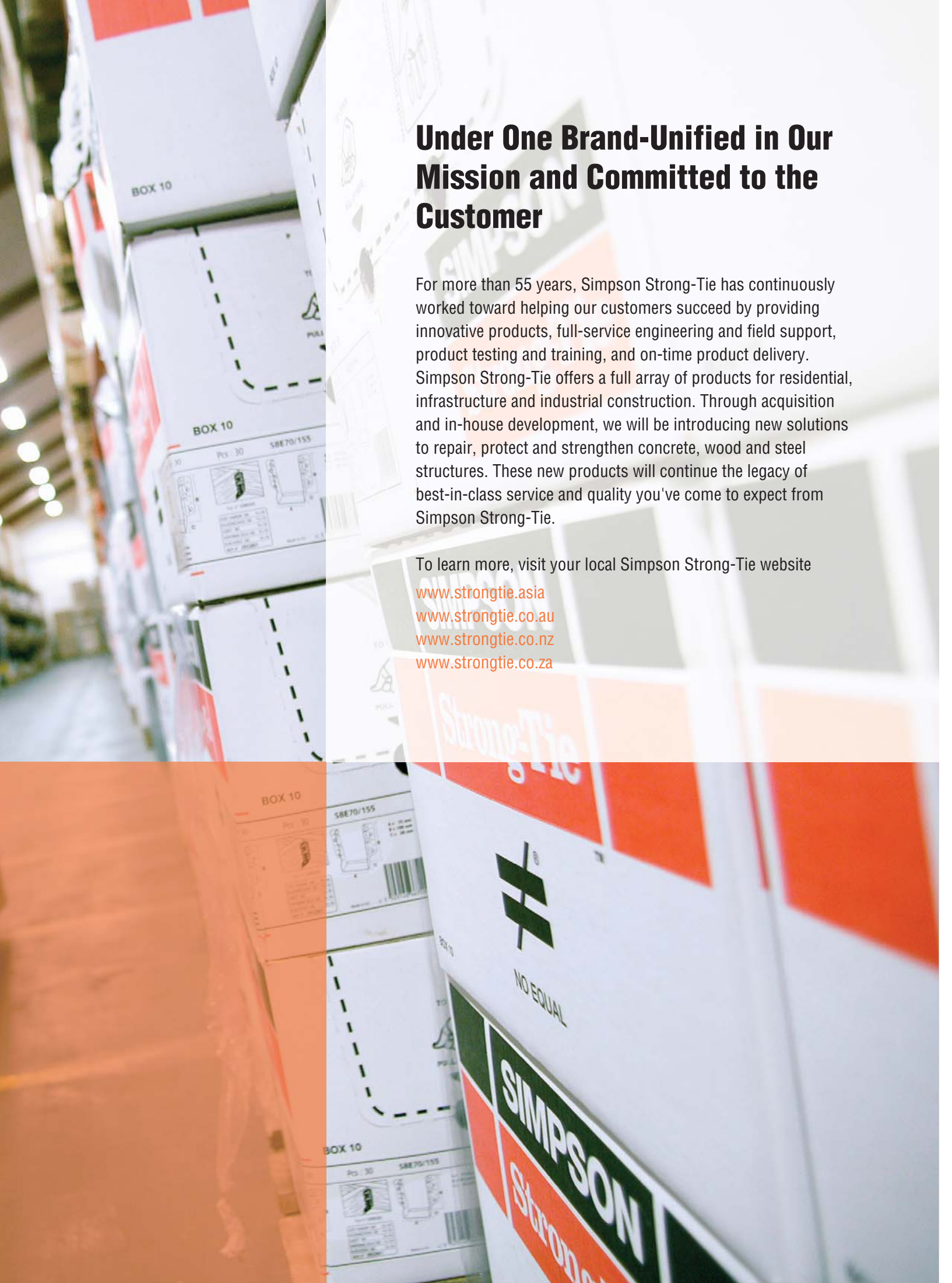
SIMPSON Strong-Tie®

In the Specs – On the Job – At Your Service™

METRIC ANCHORING SYSTEMS TECHNICAL DESIGN MANUAL

C-TECHMAN-2013



Under One Brand-Unified in Our Mission and Committed to the Customer

For more than 55 years, Simpson Strong-Tie has continuously worked toward helping our customers succeed by providing innovative products, full-service engineering and field support, product testing and training, and on-time product delivery. Simpson Strong-Tie offers a full array of products for residential, infrastructure and industrial construction. Through acquisition and in-house development, we will be introducing new solutions to repair, protect and strengthen concrete, wood and steel structures. These new products will continue the legacy of best-in-class service and quality you've come to expect from Simpson Strong-Tie.

To learn more, visit your local Simpson Strong-Tie website

www.strongtie.asia
www.strongtie.co.au
www.strongtie.co.nz
www.strongtie.co.za

QUICK FACTS ABOUT SIMPSON STRONG-TIE®

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Australia
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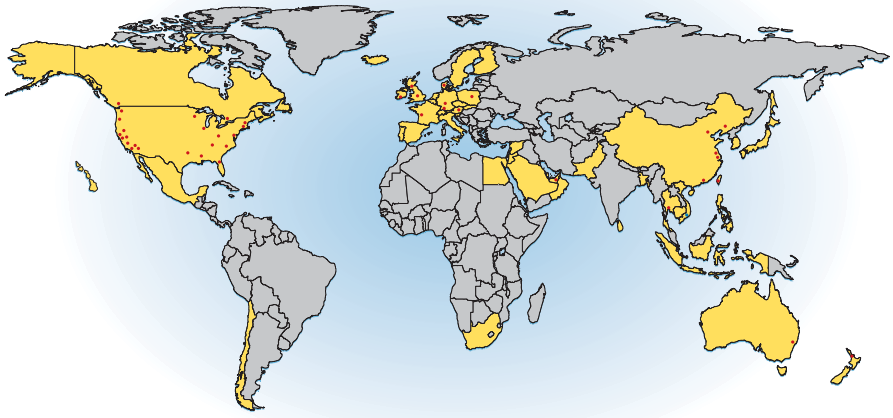
Company Overview For more than 50 years, Simpson Strong-Tie has been helping people build safer, stronger structures economically. The company is the leader in structural systems technology and has earned a reputation for providing customers with innovative, high-quality products, technical and field support, testing and training.
Simpson Strong-Tie designs, engineers and manufactures steel connectors, lateral systems, anchor and fastening systems. These products are used to secure the frame of structures and buildings. We have laboratory facilities that are dedicated to finding solutions to improve the way structures are designed and built. The company's research is being used to help advance the industry and develop products that help structures resist earthquakes, typhoons and high-wind storms.

Customers Simpson Strong-Tie serves the new construction, retrofitting and do-it-yourself (DIY) markets. Customers include builders, contractors, engineers, architects, building officials, dealers, distributors and owners.

Employees Approximately 2,500 employees world-wide

World-wide Locations



Factories, offices, and warehouses in Asia, Australia, Austria, Canada, Denmark, France, Germany, New Zealand, Poland, Scotland, South Africa, Switzerland, UK, UAE and U.S.A

Distribution in Australia, Canada, Chile, Western Europe and part of Eastern Europe, Middle East, Japan, Korea, Mexico, New Zealand, South Africa, UK, U.S.A and other Asian countries

Web sites www.strongtie.com; www.strongtie.asia; www.strongtie.co.au; www.strongtie.co.nz; www.strongtie.co.za

Stock Symbol SSD, New York Stock Exchange

NO-EQUAL pledge of performance

Every day we work hard to earn your business, blending the talents of our people with the quality of our products and services to exceed your expectations.

Karen Colonias
Chief Executive Officer

Terry Kingsfather
President

WE ARE ISO 9001-2000 REGISTERED

nqa. ISO 9001 Registered

SIMPSON STRONG-TIE QUALITY POLICY

We help people build safer structures economically. We do this by designing, engineering and manufacturing "No Equal" structural connectors and other related products that meet or exceed our customers' needs and expectations.

Everyone is responsible for product quality and is committed to ensuring the effectiveness of the Quality Management System.

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IMPORTANT INFORMATION AND GENERAL NOTES

INTENDED USE OF THE TECHNICAL DESIGN MANUAL

This Tech Manual is a supplemental design tool that provides Designers an efficient way to determine chemical and mechanical anchor design load resistances (design capacities) into normal weight concrete for common single-anchor and group-anchor configurations when using Simpson Strong-Tie® Anchoring Systems products for structural anchoring applications. It is important to reference all footnotes in the design tables, as critical design parameters and assumptions are provided in these notes.

Tension and shear design load resistances for the tables in this document are determined in accordance with EOTA ETAG 001 Annex C, Design Method A for mechanical anchors; and EOTA Technical Report TR 029 for bonded (chemical) anchors, where applicable*. Please refer to these latest Guidelines for more detailed information.

The partial safety factors used in the calculation of the design loads are taken from the product's European Technical Approval* (ETA), and consists of the combination of material and installation partial safety factors that may be used in the absence of local or national regulations.

The Tech Manual should be be used in conjunction with Simpson Strong-Tie main Anchoring and Fastening Systems catalog (C-APACME), as it contains additional detailed product information related to uses, features and benefits, installation instructions, etc .

Please contact your local Simpson Strong-Tie Representative to request the latest release of C-APACME, or visit your local Simpson Strong-Tie website to download the electronic version.

** ET-HP bond strengths and partial factors of safety are derived from testing in accordance with ICC AC308.*

WARNING

Simpson Strong-Tie Asia Ltd. anchor products are designed and tested to provide specified design loads. To obtain optimal performance from Simpson Strong-Tie Asia Ltd. products and achieve maximum allowable design load and design strength, the products must be properly installed and used in accordance with the installation instructions and design limits provided by Simpson Strong-Tie Asia Ltd. To ensure proper installation and use, designers and installers must carefully read the following General Notes, General Instructions for the Installer and General Instructions for the Designer as well as consult the applicable catalog pages for specific product installation instructions and notes. If you do not understand the catalog, or if you have any questions, contact Simpson Strong-Tie Asia Ltd. for further information.

In addition to following all notes, warnings and instructions provided in the catalog, installers, designers, engineers and consumers should consult the Simpson Strong-Tie Asia Ltd. web site to obtain additional design and installation information.

Failure to follow fully all of the notes and instructions provided by Simpson Strong-Tie Asia Ltd. may result in improper design or installation of products. Improperly designed or installed products may not perform to the specifications set forth in this catalog and may reduce a structure's ability to resist the movement, stress and loading that occurs from gravity loads as well as impact events such as earthquakes and high velocity winds.

Simpson Strong-Tie Asia Ltd. does not guarantee the performance or safety of products that are modified, improperly installed, or not used in accordance with the design and load limits set forth in this catalog.

GENERAL NOTES

These general notes are provided to ensure proper installation of Simpson Strong-Tie Company Asia Ltd. products and must be followed fully.

a) Simpson Strong-Tie Company Asia Ltd. reserves the right to change specifications, designs, and models without notice or liability for such changes.

b) Unless otherwise noted, dimensions are in millimeters (mm) and loads are in kilonewtons (kN).

c) Do not overload, which will jeopardize the anchorage. Factored loads shall not exceed design resistances calculated in accordance with published design data.

d) Some hardened fasteners may experience premature failure if exposed to moisture. These fasteners are recommended to be used in dry interior applications.

e) Do not weld products listed in this catalog. Some steel types have poor weldability and a tendency to crack when welded.

LIMITED WARRANTY

Simpson Strong-Tie Asia Ltd. warrants catalog products to be free from substantial defects in material or manufacturing. Simpson Strong-Tie Asia Ltd. products are further warranted for adequacy of design when used in accordance with design limits in this catalog and when properly specified, installed, and maintained. This warranty does not apply to uses not in compliance with specific applications and installation procedures set forth in this catalog, or to non-catalog or modified products, or to deterioration due to environmental conditions.

Simpson Strong-Tie® products are designed to enable structures to resist the movement, stress, and loading that results from impact events such as earthquakes and high velocity winds. Simpson Strong-Tie® products are designed to the load capacities and uses listed in this catalog. Properly-installed Simpson Strong-Tie products will perform substantially in accordance with the specifications set forth on the website or in the applicable Simpson catalog. Additional performance limitations for specific products may be listed on the applicable catalog pages.

Due to the particular characteristics of potential impact events, the specific design and location of the structure, the building materials used, the quality of construction, and the condition of the soils involved, damage may nonetheless result to a structure and its contents even if the loads resulting from the impact event do not exceed Simpson catalog specifications and Simpson Strong-Tie products are properly installed in accordance with applicable building codes.

All warranty obligations of Simpson Strong-Tie Asia Ltd. shall be limited, at the discretion of Simpson Strong-Tie Asia Ltd., to repair or replacement of the defective part. These remedies shall constitute Simpson Strong-Tie Asia Ltd.'s sole obligation and sole remedy of purchaser under this warranty. In no event will Simpson Strong-Tie Asia Ltd. be responsible for incidental, consequential, or special loss or damage, however caused.

This warranty is expressly in lieu of all other warranties, expressed or implied, including warranties of merchantability or fitness for a particular purpose, all such other warranties being hereby expressly excluded. This warranty may change periodically – consult Simpson Strong-Tie Asia Ltd. website for current information.

GENERAL INSTRUCTIONS FOR THE DESIGNER

These general instructions for the designer are provided to ensure the proper selection and installation of Simpson Strong-Tie products and must be followed carefully. These general instructions are in addition to the specific design and installation instructions and notes provided for each particular product, all of which should be consulted prior to and during the design process.

a) The term "Designer" used throughout this catalog is intended to mean a licensed/certified building design professional, a licensed professional engineer, or a licensed architect.

b) All connected members and related elements shall be designed by the Designer and must have sufficient strength (bending, shear, etc) to resist the loads imposed by the anchors.

c) When the ultimate limit state design method is used, the factored loads shall not exceed the design resistance calculated in accordance with the published design data.

d) Simpson Strong-Tie strongly recommends the following addition to construction drawings and specifications: "Simpson Strong-Tie products are specifically required to meet the structural calculations of plan. Before substituting another brand, confirm load capacity based on reliable published testing data or calculations. The Engineer/Designer of Record should evaluate and give written approval for substitution prior to installation."

e) Local and/or regional building codes may require meeting special conditions. Building codes often require special inspections of anchors installed in concrete or masonry. For compliance with these requirements, it is necessary to contact the local and/or regional building authority. Except where mandated by code, Simpson Strong-Tie® products do not require special inspection.

f) Design resistances are determined from test results, calculations, and experience. These are guide values for sound base materials with known properties. Due to variation in base materials and site conditions, site-specific testing should be conducted if exact performance in a specific base material at a specific site must be known.

g) Tests are conducted with anchors installed perpendicular (±6°) to the surface of the base material. Deviations can result in anchor bending stresses and reduce the load carrying capacity of the anchor.

h) Design resistances do not consider bending stresses due to shear loads applied with large eccentricities. Refer to EOTA ETAG 001, Annex C, Section 5.2.3.2b for bending analysis.

i) Metal anchors and fasteners will corrode and may lose load-carrying capacity when installed in corrosive environments or exposed to corrosive materials. See Supplemental Topic C1.

j) Mechanical anchors should not be installed into concrete that is less than 7 days old. The allowable loads and design strengths of mechanical anchors that are installed into concrete less than 28 days old should be based on the actual compressive strength of the concrete at the time of installation.

k) Nominal embedment depth (embedment depth) is the distance from the surface of the base material to the installed end of the anchor and is measured prior to application of an installation torgue (if applicable). Effective embedment depth is the distance from the surface of the base material to the deepest point at which the load is transferred to the base material.

l) Drill bits shall meet the diameter requirements of ANSI B212.15. For adhesive anchor installations in oversized holes, see Supplemental Topic A1. For adhesive anchor installations into core-drilled holes, see Supplemental Topic A2.

m) Threaded-rod inserts for adhesive anchors shall be UNC fully threaded steel.

n) Allowable loads and design strengths are generally based on testing of adhesive anchors installed into dry holes. For installations in damp, wet and submerged environments, see Supplemental Topic A3.

o) Adhesive anchors should not be installed into concrete that is less than 7 days old. The allowable loads and design strengths of adhesive anchors that are installed into concrete less than 28 days old should be based on the actual compressive strength of the concrete at the time load is applied.

p) Adhesive anchors can be affected by elevated base material temperature. See Supplemental Topic A4.

q) Anchors are permitted to support fire-resistive construction provided at least one of the following conditions is fulfilled: a) Anchors are used to resist wind or seismic forces only. b) Anchors that support gravity load-bearing structural elements are within a fire-resistance-rated envelope or a fire-resistance-rated membrane, are protected by approved fire-resistance rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards. c) Anchors are used to support nonstructural elements.

r) Some adhesives are not qualified for resisting long-term sustained loads. These adhesives are for resisting short-term loads such as wind or seismic loads only. See Supplemental Topic A5.

s) Exposure to some chemicals may degrade the bond strength of adhesive anchors. Refer to the product description for chemical resistance information. Information is also available through website, Technical Bulletin T-SAS-CHEMRES.

SUPPLEMENTAL TOPICS

GENERAL

G1. Base Materials

"Base material" is a generic industry term that refers to the element or substrate to be anchored to. Base materials include concrete, brick, concrete block (CMU) and structural tile, to name a few. The base material will determine the type of fastener for the application. The most common type of base material where adhesive and mechanical anchors are used is concrete.

Concrete – Concrete can be cast in place or precast concrete. Concrete has excellent compressive strength, but relatively low tensile strength. Cast-in-place (or sometimes called "poured in place") concrete is placed in forms erected on the building site. Cast-in-place concrete can be either normal-weight or lightweight concrete. Lightweight concrete is specified when it is desirable to reduce the weight of the building structure.

Lightweight concrete differs from normal-weight concrete by the weight of aggregate used in the mixture. Normal-weight concrete has a unit weight of approximately 2400kg per cubic meter compared to approximately 1837kg per cubic meter for lightweight concrete.

The type of aggregate used in concrete can affect the tension capacity of an adhesive anchor. Presently, the relationship between aggregate properties and anchor performance is not well understood. A recent study based on a limited test program has shown that in relative terms, concrete with harder and more dense aggregates tend to yield greater anchor tension capacities. Conversely, use of softer, less dense aggregates tends to result in lower anchor tension capacities. Research in this area is ongoing. Test results should not be assumed to be representative of expected performance in all types of concrete aggregate.

Prefabricated concrete is also referred to as "precast concrete". Precast concrete can be made at a prefabricating plant or site-cast in forms constructed on the job. Precast concrete members may be solid or may contain hollow cores. Many precast components have thinner cross sections than cast in place concrete. Precast concrete may be either normal or lightweight concrete. Reinforced concrete contains steel bars, cable, wire mesh or random glass fibers. The addition of reinforcing material enables concrete to resist tensile stresses which lead to cracking.

The compressive strength of concrete varies according to the proportions of the components in the mixture. The desired compressive strength of the concrete will be specified according to the application. Water and cement content of the mix is the main determinant of the compressive strength.

The compressive strength of concrete can range from 13.8 MPa to over 138 MPa, depending on the mixture and how it is cured. Most concrete mixes are designed to obtain the desired properties within 28 days after being cast.

Concrete Masonry Units (CMU) – Block is typically formed with large hollow cores. Block with a minimum 75% solid cross section is called solid block even though it contains hollow cores. In many parts of the world building codes require steel reinforcing bars to be placed in the hollow cores, and the cores to be filled solid with grout.

In some areas of the world, past practice was to mix concrete with coal cinders to make cinder blocks. Although cinder blocks are no longer made, there are many existing buildings where they can be found. Cinder blocks require special attention as they soften with age.

Brick – Clay brick is formed solid or with hollow cores. The use of either type will vary in different parts of the world. Brick can be difficult to drill and anchor into. Most brick is hard and brittle. Old, red clay brick is often very soft and is easily over-drilled. Either of these situations can cause problems in drilling and anchoring. The most common use of brick today is for building facades (curtain wall or brick veneer) and not for structural applications. Brick facade is attached to the structure by the use of brick ties spaced at intervals throughout the wall. In older buildings, multiple widths, or “wythes” of solid brick were used to form the structural walls. Three and four wythe walls were common wall thicknesses.

Clay Tile – Clay tile block is formed with hollow cores and narrow cavity wall cross sections. Clay tile is very brittle, making drilling difficult without breaking the block. Caution must be used in attempting to drill and fasten into clay tile.

G2. Anchor failure modes

Anchor Failure Modes

The failure modes for both mechanical and adhesive anchors depends on a number of factors including the anchor type and geometry, anchor material mechanical properties, base material mechanical properties, loading type and direction, edge distance, spacing and embedment depth.

Six different failure modes are generally observed for mechanical and adhesive anchors installed in concrete under tension loading: concrete cone breakout, concrete edge breakout, concrete splitting, anchor slip, adhesive bond, and steel fracture. Three failure modes are generally observed for mechanical and adhesive anchors installed in concrete under shear loading: concrete edge breakout, pryout and steel failure.

Concrete Cone Breakout Failure

This failure mode is observed for both mechanical and adhesive anchors installed at shallow embedment depths under tension loading. This failure mode is also observed for groups of mechanical and adhesive anchors installed at less than critical spacing.

Concrete Edge Breakout Failure

This failure mode is observed for both mechanical and adhesive anchors installed at less than critical edge distance under either tension or shear loading. For this failure mode neither the adhesive nor mechanical anchor fail, but rather the concrete fails. According to Simpson Strong-Tie testing, the tension load at which failure occurs is correlated to the concrete aggregate performance. Other factors may also influence tension load.

Concrete Splitting Failure

This failure mode is observed for both mechanical and adhesive anchors installed in a "thin" concrete member under tension loading.

Anchor Slipping Failure

This failure mode is observed for mechanical anchors under tension loading in which the anchor either pulls out of the member (e.g.- a Drop-In Anchor installed through metal deck and into a concrete fill) or the anchor body pulls through the expansion clip (e.g.- a Throughbolt WA expansion anchor installed at a deep embedment depth in concrete).

Adhesive Bond Failure

This failure mode is observed for adhesive anchors under tension loading in which a shallow concrete cone breakout is observed along with an adhesive bond failure at the adhesive/base material interface. The concrete-cone breakout is not the primary failure mechanism.

Steel Fracture

This failure mode is observed for both mechanical and adhesive anchors under tension or shear loading where the concrete member thickness and mechanical properties along with the anchor embedment depth, edge distance, spacing, and adhesive bond strength (as applicable), preclude base material failure.

Pryout Failure

This failure mode is observed for both mechanical and adhesive anchors installed at shallow embedment under shear loading.

MECHANICAL ANCHORS

M1. Pre-Load Relaxation

Expansion anchors that have been set to the required installation torque in concrete will experience a reduction in pre-tension (due to torque) within several hours. This is known as pre-load relaxation. The high compression stresses placed on the concrete cause it to deform which results in a relaxation of the pre-tension force in the anchor. Tension in this context refers to the internal stresses induced in the anchor as a result of applied torque and does not refer to anchor capacity. Historical data shows it is normal for the initial tension values to decrease by as much as 40–60% within the first few hours after installation. Retorquing the anchor to the initial installation torque is not recommended, or necessary.

ADHESIVE ANCHORS

A1. Oversized Holes

The design loads in this manual are based on anchor tests in which holes were drilled with carbide-tipped drill bits of the same diameter that are listed in the product installation data. Drilled holes outside the range shown are not recommended. In the case that a different drill bit diameter is used than what is published, it is recommended that on-site proof load testing of the adhesive anchor shall be performed to confirm that the load capacity is acceptable to the Designer.

A2. Core-Drilled Holes

The design loads in this manual are based upon anchor tests in which holes were drilled with carbide-tipped drill bits. Test have not yet been conducted to verify characteristic bond strengths of the adhesives when installed in a diamond-core bit. In the case that a diamond-core bit is used, it is recommended that on-site proof load testing of the adhesive anchor shall be performed to confirm that the load capacity is acceptable to the Designer.

A3. Installation in Damp, Wet or Flooded Holes

Adhesive anchors are permitted to be installed in damp or wet holes; however, they are not permitted to be installed in flooded holes. Standing water (flooded hole) must be completely removed, and the hole must be thoroughly cleaned of debris prior to the installation of the adhesive.

A4. Elevated In-Service Temperature

Base material temperature represents the average internal temperature of the concrete. This temperature is not always the same as ambient temperature; therefore the actual base material temperature should be checked to achieve accurate measurements. It is assumed that the measured base material temperature occurs over the entire bonded length of the anchor.

The performance of all adhesive anchors is affected by elevated base material temperature. The design tables provided in this manual consider adhesive performance at “Temperature Range 1” (24°C maximum long-term temperature, 43°C maximum short-term temperature). Maximum long-term temperature is the base material temperature that occurs over a long period of time at a fairly constant rate. Maximum short-term temperature is the base material temperature that occurs over short intervals, such as during a diurnal cycle. For performance in temperatures that are higher than “Temperature Range 1”, refer to the product’s specific code/technical approval, or use Simpson Strong-Tie® "Anchor Designer" software.

A5. Creep Under Long-Term Loads

Creep is the slow continuous deformation of a material under constant stress. Creep occurs in many construction materials, including concrete and steel when the stress is great enough. The creep characteristics of adhesives are product dependent. Adhesive anchors that are not creep resistant can pull out slowly over time when sustained tensile loads are applied.

Because of the creep phenomenon, it is important for Designers to consider the nature of the applied tension loads and to determine if the tension loads will be continuously applied to the anchor over the long-term. If this is the case, a product that is suitable for resisting sustained loads over the long-term must be selected.

All Simpson Strong-Tie anchoring adhesives (SET-XP®, ET-HP and AT-HP) have been qualified for resisting long-term loads through ETA or ICC-ES AC308 “creep tests” in which an anchor is loaded and monitored for movement over time. According to ETA and ICC, anchors that pass the creep test are determined to be suitable for resisting long-term tensile loads.

C1. Corrosion Resistance

Some products are available with additional coating options or in stainless steel to provide additional corrosion resistance. Refer to C-APACME for stainless steel options.

Highly-hardened fasteners can experience premature failure due to hydrogen-assisted stress corrosion cracking when loaded in environments producing hydrogen. Simpson Strong-Tie® recommends that such fasteners be used in dry, interior and non-corrosive environments only.

UNDERSTANDING THE ISSUES

Metal anchors and fasteners will corrode and may lose load-carrying capacity when installed in corrosive environments or exposed to corrosive materials. There are many environments and materials which may cause corrosion including ocean salt air, fire-retardants, fumes, fertilizers, preservative-treated wood, dissimilar metals, and other corrosive elements.

The many variables present in a single building environment make it impossible to accurately predict if, or when, significant corrosion will begin or reach a critical level. This relative uncertainty makes it crucial that specifiers and users be knowledgeable of the potential risks and select a product coating or metal suitable for the intended use. It is also important that regular maintenance and periodic inspections are performed, especially for outdoor applications.

It is common to see some corrosion on anchors and fasteners especially in outdoor applications. Even stainless steel can corrode. The presence of some corrosion does not mean that load capacity has necessarily been affected or that a failure will occur. If significant corrosion is apparent or suspected, then the anchors should be inspected by a professional engineer or general contractor and may need to be replaced.

Stainless steel is always the most effective solution to corrosion risk. However, it is also more expensive and sometimes more difficult to obtain. To best serve our customers, Simpson Strong-Tie is evaluating the options to identify the safest and most cost-effective solutions. Based on our testing and experience there are some specific applications that are appropriate for hot-dip galvanized (HDG), mechanically galvanized (MG) or electroplated anchors.

See local Simpson Strong-Tie® website for additional information related to corrosion

www.strongtie.asia

www.strongtie.co.au

www.strongtie.co.nz

www.strongtie.co.za

Simpson Strong-Tie® Anchor Designer™ Software

Simpson Strong-Tie® Anchor Designer™ software provides Designers the most efficient way to solve anchoring problems using Simpson Strong-Tie® mechanical and anchoring adhesives products. The software analyzes various conditions that may be encountered, including cracked-concrete conditions. With its easy-to-use graphical interface, Simpson Strong-Tie® Anchor Designer™ Software accelerates the design process by eliminating the need for tedious calculations by hand. The software will design in accordance with both ETAG and ICC methodologies, respective to each product's qualifications.

Download the software today from your local Simpson Strong-Tie® website.

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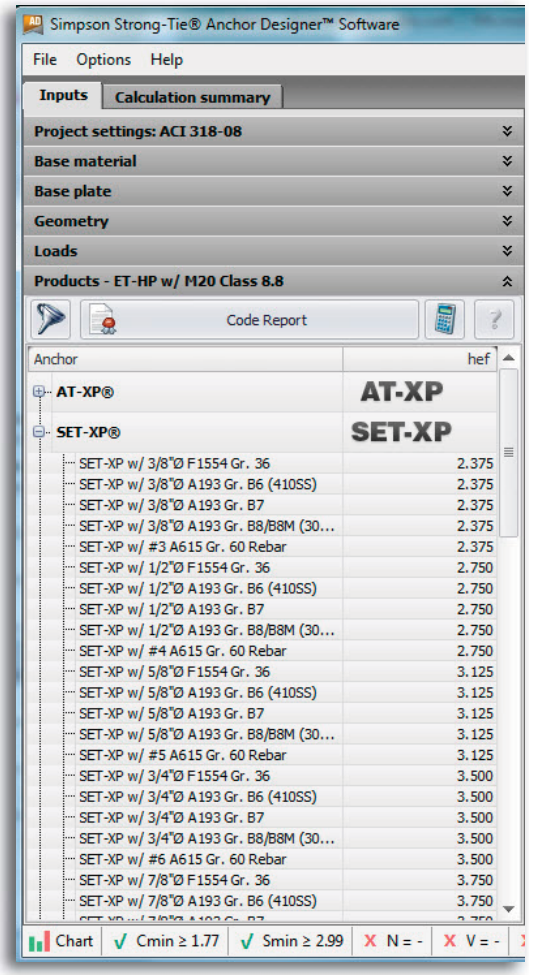
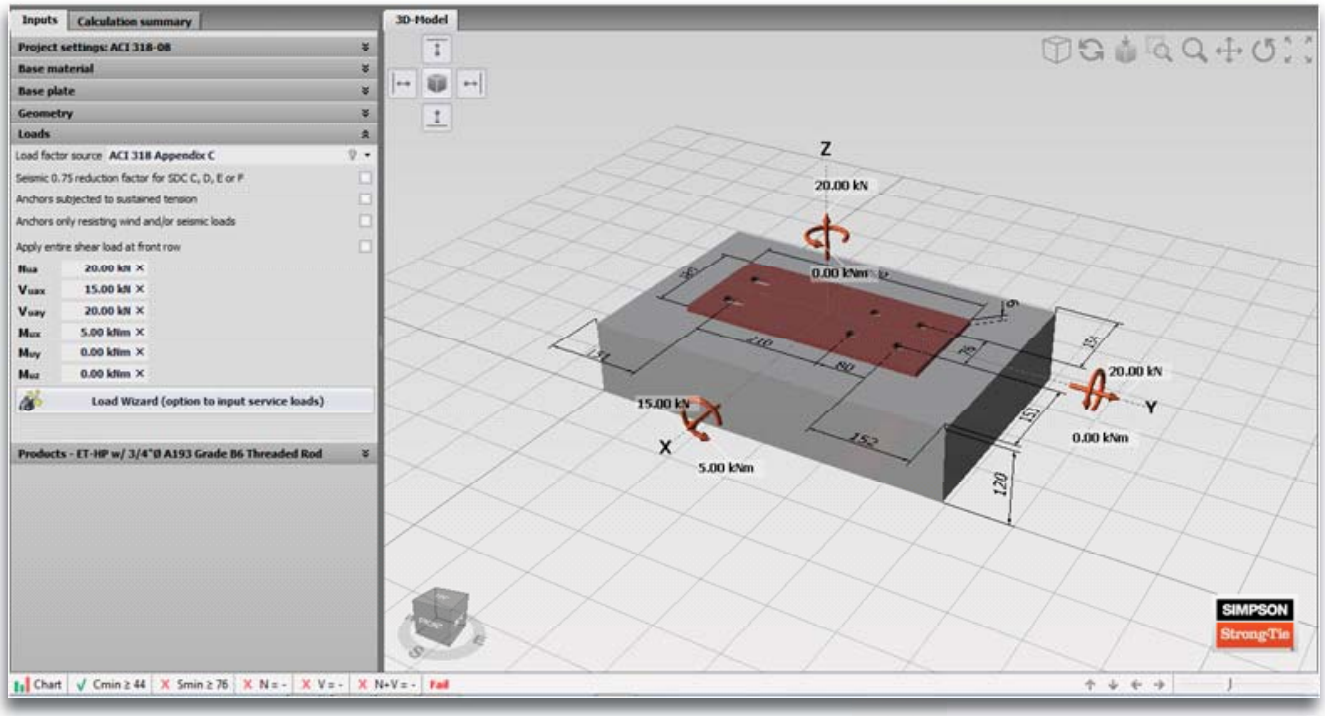




Adhesive (Bonded) Anchors in Accordance with EOTA Technical Report TR 029

Designer should reference the latest TR029 for a complete description of all variables and calculations

1. Tension Resistance

The Design Tension Load, (N_{Sd}), shall be less than the controlling (lowest) Design Resistance, $N_{Rd} = (N_{Rk}/\gamma_M)$, per the following table:

Failure Mode	Single Anchor	Anchor Group	
Steel	$N_{Sd} \le N_{Rk,s}/\gamma_{Ms}$	$N^h_{Sd} \le N_{Rk,s}/\gamma_{Ms}$	
Combined Pull-out and Concrete Cone	$N_{Sd} \le N_{Rk,p}/\gamma_{Mp}$	$N^h_{Sd} \le N_{Rk,p}/\gamma_{Mp}$	
Concrete Cone	$N_{Sd} \le N_{Rk,c}/\gamma_{Mc}$		$N^g_{Sd} \le N_{Rk,c}/\gamma_{Mc}$
Concrete Splitting	$N_{Sd} \le N_{Rk,sp}/\gamma_{Msp}$		$N^g_{Sd} \le N_{Rk,sp}/\gamma_{Msp}$

γ_M = the relevant material partial safety factor given in the product's ETA

A. Steel Resistance, $\mathbf{N_{Rk,s}}$ (given in the relevant ETA, or calculated based on the steel insert properties)

B. Combined Pull-out and Concrete Cone Resistance, $\mathbf{N_{Rk,p}}$,determined as follows:

$\mathbf{N_{Rk,p}} = N_{0Rk,p}\,(A_{p,N}/A^0_{p,N})\,\Psi_{s,Np}\,\Psi_{g,Np}\,\Psi_{ec,Np}\,\Psi_{re,Np}$

$N^0_{Rk,p} = \pi\, d\, h_{ef}\, \tau_{Rk}$

$A^0_{p,N}$ = influence area of an individual anchor with large spacing and edge distance at the concrete surface, idealizing the concrete cone as a pyramid with a base length equal to $s_{cr,Np}$

$A_{p,N}$ = actual area; it is limited by overlapping areas of adjoining anchors ($s \le s_{cr,Np}$) as well as by edges of the concrete member ($c \le c_{cr,Np}$)

$\Psi_{s,Np}$ - takes account of the disturbance of the distribution of stresses in the concrete due to edges of the concrete member

$\Psi_{g,Np}$ - takes account of the effect of the failure surface for anchor groups

$\Psi_{ec,Np}$ - takes account of a group effect when different tension loads are acting on the individual anchors of a group

$\Psi_{re,Np}$ - takes account of the effect of a reinforcement

C. Concrete Cone Resistance, $\mathbf{N_{Rk,c}}$, determined as follows:

$\mathbf{N_{Rk,c}} = N^0_{Rk,c}\,(A_{c,N}/A^0_{c,N})\,\Psi_{s,N}\,\Psi_{re,N}\,\Psi_{ec,N}$

$N^0_{RK,c} = k_1\,(f_{ck,cube})^{0.5}\,h_{ef}^{1.5}$

k1 = 7.2 for applications in cracked concrete

k1 = 10.1 for applications in non-cracked concrete

$A^0_{c,N}$ = influence area of an individual anchor with large spacing and edge distance at the concrete surface, idealizing the concrete cone as a pyramid with a base length equal to $s_{cr,N}$

$A_{c,N}$ = actual area; it is limited by overlapping areas of adjoining anchors ($s \le s_{cr,N}$) as well as by edges of the concrete member ($c \le c_{cr,N}$)

$\Psi_{s,N} = [0.7 + 0.3(c/c_{cr,N})] \le 1$; takes account of the disturbance of the distribution of stresses in the concrete due to edges of the concrete member

$\Psi_{re,N} = [0.5 + (h_{ef}/200)] \le 1$; shell spalling factor takes account of the effect of reinforcement

$\Psi_{ec,N} = [1/(1 + 2e_N/s_{cr,N})] \le 1$; takes account of a group effect when different tension loads are acting on the individual anchors of a group, where e_N = eccentricity of the resulting tensile load acting on the tensioned anchors

D. Splitting resistance due to load, $\mathbf{N_{Rk,sp}}$, determined as follows:

$\mathbf{N_{Rk,sp}} = N^0_{Rk,c}\,(A_{c,N}/A^0_{c,N})\,\Psi_{s,N}\,\Psi_{re,N}\,\Psi_{ec,N}\,\Psi_{h,sp}$

where $N^0_{Rk,c}$; $\Psi_{s,N}$; $\Psi_{re,N}$; $\Psi_{ec,N}$ are determined in part C. above

$A^0_{c,N}$ = influence area of an individual anchor with large spacing and edge distance at the concrete surface, idealizing the concrete cone as a pyramid with a base length equal to $s_{cr,sp}$

$A_{c,N}$ = actual area; it is limited by overlapping areas of adjoining anchors ($s \le s_{cr,sp}$) as well as by edges of the concrete member ($c \le c_{cr,sp}$)

$\Psi_{h,sp} = (h/h_{min})^{2/3}$; factor to account for the influence of the actual member depth, h, on the splitting resistance for anchors according to current experience

$\mathbf{N_{Rk}}$ is the lesser of: $N_{Rk,s}$; $N_{Rk,p}$; $N_{Rk,c}$; $N_{Rk,sp}$

$\mathbf{N_{Rd}} = N_{Rk}/\gamma_M$

2. Shear Resistance

The Design Shear Load, (V_{Sd}), shall be less than the controlling (lowest) Design Resistance, $V_{Rd} = (V_{Rk}/\gamma_M)$, per the following table:

Failure Mode	Single Anchor	Anchor Group	
Steel Resistance, shear load without lever arm	$V_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	$V^h_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	
Steel Resistance, shear load with lever arm	$V_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	$V^h_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	
Concrete Pry-out Resistance	$V_{Sd} \le V_{Rk,cp}/\gamma_{Mc}$		$V^g_{Sd} \le V_{Rk,cp}/\gamma_{Mc}$
Concrete Edge Resistance	$V_{Sd} \le V_{Rk,c}/\gamma_{Mc}$		$V^g_{Sd} \le V_{Rk,c}/\gamma_{Mc}$

γ_M = the relevant material partial safety factor given in the product's ETA

A. Steel Resistance, $\mathbf{V_{Rk,s}}$ (given in the relevant ETA, or calculated based on the steel insert properties)

B. Concrete Pry-out Resistance, $\mathbf{V_{Rk,cp}}$, determined as follows:

$\mathbf{V_{Rk,cp}}$ = k multiplied by the lower of $N_{Rk,c}$ and $N_{Rk,p}$
k is taken from the relevant ETA report

C. Characteristic Concrete Edge Resistance, $\mathbf{V_{Rk,c}}$, determined as follows:

$\mathbf{V_{Rk,c}} = V^0_{Rk,c}\,(A_{c,V}/A^0_{c,V})\,\Psi_{s,V}\,\Psi_{h,V}\,\Psi_{\alpha,V}\,\Psi_{ec,V}\,\Psi_{re,V}$

$V^0_{Rk,c} = k_1\, d_{nom}{}^{\alpha}\, h_{ef}{}^{ß}\, (f_{ck,cube})^{0.5} c_1{}^{1.5}$
k_1 = 1.7 for applications in cracked concrete
k_1 = 2.4 for applications in non-cracked concrete
$\alpha = 0.1\,(l_f / c_1)^{0.5}$
$ß = 0.1\,(d_{nom} / c_1)^{0.2}$

$A^0_{c,V}$ = area of concrete cone of an individual anchor at the lateral concrete surface not affected by edges parallel to the assumed loading direction, member thickness or adjacent anchors, assuming the shape of the fracture area as a half pyramid with a height equal to c_1 and a base-length of 1.5 c_1 and 3 c_1

$A_{c,V}$ = actual area of concrete cone of anchorage at the lateral concrete surface. It is limited by the overlapping concrete cones of adjoining anchors ($s \le 3\ c_1$) as well as by edges parallel to the assumed loading direction ($c_2 \le 1.5\ c_1$) and by member thickness ($h \le 1.5\ c_1$).

$\Psi_{s,V}$ = $[0.7 + (0.3\ c_2 / 1.5\ c_1)] \le 1.0$; takes account of the disturbance of the distribution of stresses in the concrete due to further edges of the concrete member on the shear resistance

$\Psi_{h,V}$ = $[1.5c_1/h]^{1/2} \le 1.0$; takes account of the fact that the shear resistance does not decrease proportionally to the member thickness as assumed by the ratio $A_{c,V}/A^0_{c,V}$

$\Psi_{\alpha,V}$ = $[1 / [(\cos_{\alpha,V})^2 + (\sin_{\alpha,V} / 2.5)^2]] \ge 1.0$; takes account of the angle $\alpha_{,V}$ between the load applied, V_{Sd}, and the direction perpendicular to the free edge of the concrete member

$\Psi_{ec,V}$ = $[1 / (1 + 2e_v / 3c_1)] \le 1.0$; takes account of a group effect when different shear loads are acting on the individual anchors of a group

$\Psi_{re,V}$ = 1.0 anchorage in non-cracked concrete and anchorage in cracked concrete without edge reinforcement or stirrups

$\Psi_{re,V}$ = 1.2 anchorage in cracked concrete with straight edge reinforcement (≥ Ø12 mm)

$\Psi_{re,V}$ = 1.4 anchorage in cracked concrete with edge reinforcement and closely spaced stirrups (a ≤ 100 mm)

$\mathbf{V_{Rk}}$ is the lesser of $V_{Rk,s}$; $V_{Rk,cp}$; $V_{Rk,c}$
$\mathbf{V_{Rd}} = V_{Rk}/\gamma_M$

3. Combined Tension & Shear

The following conditions must first be met:
ßN ≤ 1, where $ßN = N_{Sd}/N_{Rd}$
AND
ßV ≤ 1 where $ßV = V_{Sd}/V_{Rd}$

For Combined Tension and Shear Loading:
ßN + ßV ≤ 1.2 (more conservative results)
OR
$(ßN)^{\alpha} + (ßV)^{\alpha} \le 1$ (more accurate results)

α = 2.0 if N_{Rd} and V_{Rd} are governed by steel resistance
α = 1.5 for all other failure modes

Mechanical Anchors in Accordance with EOTA ETA 001, Annex C

Designer should reference the latest ETA 001 for a complete description of all variables and calculations

1. Tension Resistance

The Design Tension Load, (N_{Sd}), shall be less than the controlling (lowest) Design Resistance, $N_{Rd} = (N_{Rk}/\gamma_M)$, per the following table:

Failure Mode	Single Anchor	Anchor Group	
Steel	$N_{Sd} \le N_{Rk,s}/\gamma_{Ms}$	$N^h_{Sd} \le N_{Rk,s}/\gamma_{Ms}$	
Pull-out	$N_{Sd} \le N_{Rk,p}/\gamma_{Mp}$		$N^h_{Sd} \le N_{Rk,p}/\gamma_{Mp}$
Concrete Cone	$N_{Sd} \le N_{Rk,c}/\gamma_{Mc}$		$N^g_{Sd} \le N_{Rk,c}/\gamma_{Mc}$
Concrete Splitting	$N_{Sd} \le N_{Rk,sp}/\gamma_{Msp}$		$N^g_{Sd} \le N_{Rk,sp}/\gamma_{Msp}$

γ_M = the relevant material partial safety factor given in the product's ETA

A. Steel Resistance, $\mathbf{N_{Rk,s}}$ (given in the relevant ETA)

B. Characteristic Pull-out Resistance, $\mathbf{N_{Rk,p}}$ (given in the relevant ETA)

C. Concrete Cone Resistance, $\mathbf{N_{Rk,c}}$, determined as follows:

$\mathbf{N_{Rk,c}} = N^0_{Rk,c}\,(A_{c,N}/A^0_{c,N})\,\Psi_{s,N}\,\Psi_{re,N}\,\Psi_{ec,N}$

$N^0_{RK,c} = k_1\,(f_{ck,cube})^{0.5}\,h_{ef}^{1.5}$

k1 = 7.2 for applications in cracked concrete

k1 = 10.1 for applications in non-cracked concrete

$A^0_{c,N}$ = influence area of an individual anchor with large spacing and edge distance at the concrete surface, idealizing the concrete cone as a pyramid with a base length equal to $s_{cr,N}$

$A_{c,N}$ = actual area; it is limited by overlapping areas of adjoining anchors ($s \le s_{cr,N}$) as well as by edges of the concrete member ($c \le c_{cr,N}$)

$\Psi_{s,N}$ = $[0.7 + 0.3(c/c_{cr,N})] \le 1$; takes account of the disturbance of the distribution of stresses in the concrete due to edges of the concrete member

$\Psi_{re,N}$ = $[0.5 + (h_{ef}/200)] \le 1$; shell spalling factor takes account of the effect of reinforcement

$\Psi_{ec,N}$ = $[1/(1 + 2e_N/s_{cr,N})] \le 1$; takes account of a group effect when different tension loads are acting on the individual anchors of a group, where e_N = eccentricity of the resulting tensile load acting on the tensioned anchors

D. Splitting resistance due to load, $\mathbf{N_{Rk,sp}}$, determined as follows:

$\mathbf{N_{Rk,sp}} = N^0_{Rk,c}\,(A_{c,N}/A^0_{c,N})\,\Psi_{s,N}\,\Psi_{re,N}\,\Psi_{ec,N}\,\Psi_{h,sp}$

where $N^0_{Rk,c}$; $\Psi_{s,N}$; $\Psi_{re,N}$; $\Psi_{ec,N}$ are determined in part C. above

$A^0_{c,N}$ = influence area of an individual anchor with large spacing and edge distance at the concrete surface, idealizing the concrete cone as a pyramid with a base length equal to $s_{cr,sp}$

$A_{c,N}$ = actual area; it is limited by overlapping areas of adjoining anchors ($s \le s_{cr,sp}$) as well as by edges of the concrete member ($c \le c_{cr,sp}$)

$\Psi_{h,sp}$ = $(h/h_{min})^{2/3}$; factor to account for the influence of the actual member depth, h, on the splitting resistance for anchors according to current experience

$\mathbf{N_{Rk}}$ is the lesser of: $N_{Rk,s}$; $N_{Rk,p}$; $N_{Rk,c}$; $N_{Rk,sp}$

$\mathbf{N_{Rd}} = N_{Rk}/\gamma_M$

2. Shear Resistance

The Design Shear Load, (V_{Sd}), shall be less than the controlling (lowest) Design Resistance, $V_{Rd} = (V_{Rk}/\gamma_M)$, per the following table:

Failure Mode	Single Anchor	Anchor Group	
Steel Resistance, shear load without lever arm	$V_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	$V^h_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	
Steel Resistance, shear load with lever arm	$V_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	$V^h_{Sd} \le V_{Rk,s}/\gamma_{Ms}$	
Concrete Pry-out Resistance	$V_{Sd} \le V_{Rk,cp}/\gamma_{Mc}$		$V^g_{Sd} \le V_{Rk,cp}/\gamma_{Mc}$
Concrete Edge Resistance	$V_{Sd} \le V_{Rk,c}/\gamma_{Mc}$		$V^g_{Sd} \le V_{Rk,c}/\gamma_{Mc}$

γ_M = the relevant material partial safety factor given in the product's ETA

A. Steel Resistance, $\mathbf{V_{Rk,s}}$ (given in the relevant ETA, or calculated based on the steel insert properties)

B. Concrete Pry-out Resistance, $\mathbf{V_{Rk,cp}}$, determined as follows:

$\mathbf{V_{Rk,cp}} =$ $k\ N_{Rk,c}$
k is taken from the relevant ETA report

C. Characteristic Concrete Edge Resistance, $\mathbf{V_{Rk,c}}$, determined as follows:

$\mathbf{V_{Rk,c}} =$ $V^0_{Rk,c}\ (A_{c,V}/A^0_{c,V})\ \Psi_{s,V}\ \Psi_{h,V}\ \Psi_{\alpha,V}\ \Psi_{ec,V}\ \Psi_{re,V}$

$V^0_{Rk,c} =$ $k_1\ d_{nom}{}^{\alpha}\ h_{ef}{}^{ß}\ (f_{ck,cube})^{0.5} c_1{}^{1.5}$
k_1 = 1.7 for applications in cracked concrete
k_1 = 2.4 for applications in non-cracked concrete
$\alpha = 0.1\ (l_f / c_1)^{0.5}$
$ß = 0.1\ (d_{nom} / c_1)^{0.2}$

$A^0_{c,V} =$ area of concrete cone of an individual anchor at the lateral concrete surface not affected by edges parallel to the assumed loading direction, member thickness or adjacent anchors, assuming the shape of the fracture area as a half pyramid with a height equal to c_1 and a base-length of 1.5 c_1 and 3 c_1

$A_{c,V} =$ actual area of concrete cone of anchorage at the lateral concrete surface. It is limited by the overlapping concrete cones of adjoining anchors ($s \le 3\ c_1$) as well as by edges parallel to the assumed loading direction ($c_2 \le 1.5\ c_1$) and by member thickness ($h \le 1.5\ c_1$).

$\Psi_{s,V} =$ $[0.7 + (0.3\ c_2 / 1.5\ c_1)] \le 1.0$; takes account of the disturbance of the distribution of stresses in the concrete due to further edges of the concrete member on the shear resistance

$\Psi_{h,V} =$ $[1.5c_1/h]^{1/2} \le 1.0$; takes account of the fact that the shear resistance does not decrease proportionally to the member thickness as assumed by the ratio $A_{c,V}/A^0_{c,V}$

$\Psi_{\alpha,V} =$ $[1 / [(\cos_{\alpha,V})^2 + (\sin_{\alpha,V} / 2.5)^2]] \ge 1.0$; takes account of the angle αV between the load applied, V_{Sd}, and the direction perpendicular to the free edge of the concrete member

$\Psi_{ec,V} =$ $[1 / (1 + 2e_v / 3c_1)] \le 1.0$; takes account of a group effect when different shear loads are acting on the individual anchors of a group

$\Psi_{re,V} =$ 1.0 anchorage in non-cracked concrete and anchorage in cracked concrete without edge reinforcement or stirrups

$\Psi_{re,V} =$ 1.2 anchorage in cracked concrete with straight edge reinforcement (≥ Ø12 mm)

$\Psi_{re,V} =$ 1.4 anchorage in cracked concrete with edge reinforcement and closely spaced stirrups ($a \le 100$ mm)

$\mathbf{V_{Rk}}$ is the lesser of $V_{Rk,s}$; $V_{Rk,cp}$; $V_{Rk,c}$
$\mathbf{V_{Rd}} = V_{Rk}/\gamma_M$

3. Combined Tension & Shear

The following conditions must first be met:
$ßN \le 1$, where $ßN = N_{Sd}/N_{Rd}$
AND
$ßV \le 1$ where $ßV = V_{Sd}/V_{Rd}$

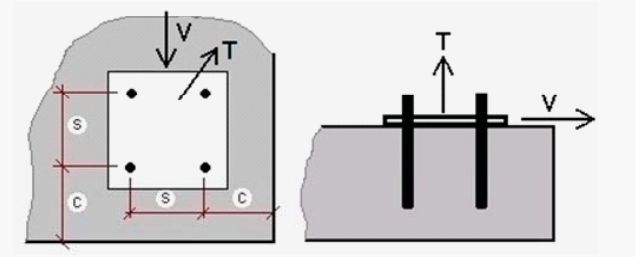
For Combined Tension and Shear Loading:
$ßN + ßV \le 1.2$ (more conservative results)
OR
$(ßN)^{\alpha} + (ßV)^{\alpha} \le 1$ (more accurate results)

$\alpha = 2.0$ if N_{Rd} and V_{Rd} are governed by steel resistance
$\alpha = 1.5$ for all other failure modes

DESIGN EXAMPLES

Adhesive Anchor Design Example

N_{Sd} = 25.0 kN (Normal to the anchor group)
V_{Sd} = 20.0 kN (Perpendicular towards one free edge)



Problem:

Design the connection as shown above which is comprised of (4) 24mm diameter all-threaded rod anchors installed into a 300mm thick concrete member. The anchor group is subject to a factored tension force, N_{Sd}, of 25.0 kN and a factored shear force, V_{Sd}, of 20.0 kN.

All forces are applied concentrically on the steel plate, and the plate is assumed to be rigid enough to transfer forces equally to all four anchors. There is no lever arm for the applied shear force.

SET-XP adhesive is to be considered for use.

Additional Data:

- All-threaded rod anchor material is Grade 5.8 (carbon steel)
- Concrete strength is C20/25, and is considered "Non-Cracked"
- Anchors are spaced equally in both direction at 150mm apart
- Concrete edge distance to center of closest row of bolts is 200mm, for both edges
- No supplemental reinforcement has been verified to prevent concrete spalling/splitting

Solution:

Based on the anchor configuration and data given, refer to **Table 4A** :
"SET-XP with Four Anchors, Corner, Non-Cracked Concrete (T, V⊢)"

For anchor diameter "**d**" = 24mm, concrete edge distances "**c**" = 200mm, and spacings "**s**" = 150mm:

Effective Embedment "$\mathbf{h_{ef}}$" = 220mm

Minimum Concrete Thickness "$\mathbf{h_{min}}$" = 276mm < 300mm (OK)

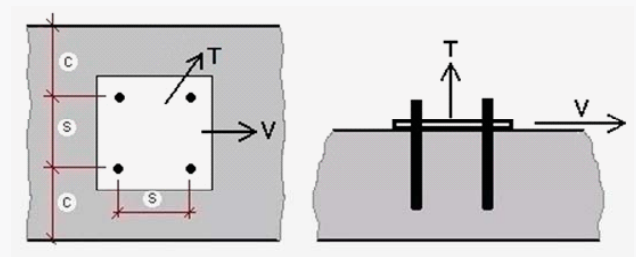
Design Resistances from table:

N_{Rd} = 36.3 kN
V_{Rd} = 42.0 kN
Check Steel Tension: $N_{Rd,s}$ = 4 anchors x 118.0 kN = 472.0 kN
Check Steel Shear: $V_{Rd,s}$ = 4 anchors x 70.4 kN = 281.6 kN
$N_{Rd,x}$ = min {N_{Rd} ; $N_{Rd,s}$} = min {36.3 kN ; 472.0 kN} = 36.3 kN
$V_{Rd,x}$ = min {V_{Rd} ; $V_{Rd,s}$} = min {42.0 kN ; 281.6 kN} = 42.0 kN
$N_{Rd,x}$ = 36.3kN > 25.0 kN (OK)
$V_{Rd,x}$ = 42.0kN > 20.0 kN (OK)

Check Interaction of combined loads per ETAG TR029 Equation 5.10:
$(25.0\text{ kN}/36.3\text{ kN})^{1.5} + (20.0\text{ kN}/42.0\text{ kN})^{1.5}$ = **0.90 < 1.0 (OK)** →
Use SET-XP adhesive for the problem shown

Mechanical Anchor Design Example

N_{Sd} = 25.0 kN (Normal to the anchor group)
V_{Sd} = 20.0 kN (Parallel to concrete edges)



Problem:

Design the connection as shown above which is comprised of (4) 12mm diameter mechanical anchors installed into a 300mm thick concrete member. The anchor group is subject to a factored tension force, N_{Sd}, of 25.0 kN and a factored shear force, V_{Sd}, of 20.0 kN.

All forces are applied concentrically on the steel plate, and the plate is assumed to be rigid enough to transfer forces equally to all four anchors. There is no lever arm for the applied shear force.

SUPERPLUS self-undercut anchor is to be considered for use.

Additional Data:

- SUPERPLUS anchor insert material is Grade 8.8 (carbon steel)
- Concrete quality is C20/25, and is considered "Cracked"
- Anchors are spaced equally in both direction at 250mm apart (s)
- Concrete edge distance to center of closest row of bolts is 150mm, for both edges (c)
- No supplemental reinforcement has been verified to prevent concrete spalling/splitting

Solution:

Based on the anchor configuration and data given, refer to **Table 6B** :
"SUPERPLUS with Four Anchors, 2-Edges, Cracked Concrete (T, V⫽)"

For anchor size **M12**, concrete edge distances "**c**" = 150mm, and spacings "**s**" = 250mm:

Effective Embedment "$\mathbf{h_{ef}}$" = 150mm

Minimum Concrete Thickness "$\mathbf{h_{min}}$" = 300mm (OK)

Design Resistances from table:

N_{Rd} = 56.9 kN > 25.0 kN (OK)
V_{Rd} = 76.4 kN > 20.0 kN (OK)

Check Interaction of combined loads per ETAG 001 Equation 5.9:
$(25.0\text{ kN}/56.9\text{ kN})^{1.5} + (20.0\text{ kN}/76.4\text{ kN})^{1.5}$ = **0.43 < 1.0 (OK)** →
Use SUPERPLUS self-undercutting anchor for the problem shown

ANCHOR SELECTION GUIDE

SIMPSON Strong-Tie®

PRODUCT NAME			Page	Cracked Concrete	Non-Cracked Concrete	Code Listing	Fire Rating
				↓	↕	ETA CE ES	R 120
SET-XP®			19	●	●	ETA CE ES	
ET-HP			34		●	ES PENDING	
AT-HP			43		●	ETA CE	
TITEN HD®			52	●	●	ETA CE ES	●
BOAX-II THROUGHBOLT			67	●	●	ETA CE	●
WA THROUGHBOLT			82		●	ETA CE	
SUPERPLUS			91	●	●	ETA CE	●
SAFETY BOLT			106	●	●	ETA CE	●
LIEBIG ANCHOR			123	●	●	ETA CE	●

Undercut Anchor

This type of anchor transfers load into the base material through mechanical interlock with an undercut that is formed in the base material. The undercut can be formed before or during setting of the anchor. These systems have very high reliability and performance.

Expansion Anchor

This type of anchor transfers load into the base material through friction grip that is established between the anchor's expansion sleeve and the sidewalls of the drilled hole.
This occurs when the anchor is set and the cone is drawn into the expansion sleeve. Expansion anchors provide a reliable and economical fixing system.

Adhesive Anchor

This type of anchor consists of a chemical adhesive and a steel insert. After installation a chemical reaction takes place that secures the insert in place and the chemical bonds to the sidewalls of the drilled hole. This system does not produce expansion forces, and therefore allows for smaller edge distances and spacings.

↓

Tension Zone Anchor

This anchor is suitable for use in cracked (tension zone) and non-cracked (compression zone) concrete.

↕

Compression Zone Anchor

This anchor is suitable for use in non-cracked (compression zone) concrete.

ETA CE

European Technical Approval

This anchor has been approved for construction applications in accordance with European Technical Approval Guidelines (ETAG).

ES

ICC-ES Listing

This anchor has been listed for construction applications in accordance with ICC-ES and ACI 355.2 guidelines.

Anchoring

Adhesives

SET-XP®

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ET-HP™

Page: 34

AT-HP™

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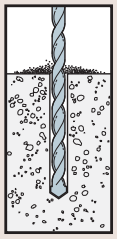
ANCHORING ADHESIVE INSTALLATION INSTRUCTIONS*

NOTE: Always check expiration date on product label. Do not use expired product.

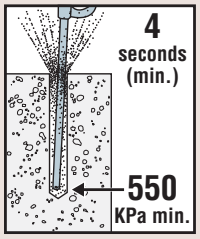
WARNING: When drilling and cleaning hole use eye and lung protection. When installing adhesive use eye and skin protection.

INSTALLATION FOR SET-XP® AND ET-HP™

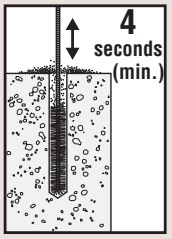
1 HOLE PREPARATION:



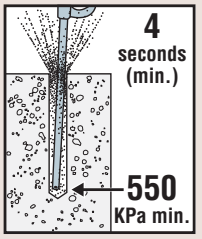
1. **Drill**–Drill hole to specified diameter and depth.



2. **Blow**–Remove dust from hole with oil-free compressed air for a minimum of 4 seconds.



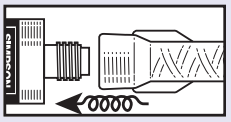
3. **Brush**–Clean with a nylon brush for a minimum of 4 cycles.



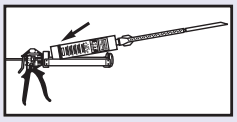
4. **Blow**–Remove dust from hole with oil-free compressed air for a minimum of 4 seconds.

2 CARTRIDGE PREPARATION:

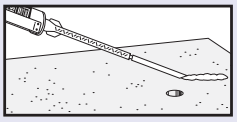
1. **Check**–Check expiration date on product label. **Do not use expired product.** Product is usable until end of printed expiration month.
2. **Open**–Open cartridge per package instructions.



3. **Attach**–Attach proper Simpson Strong-Tie® nozzle to cartridge. Do not modify nozzle.



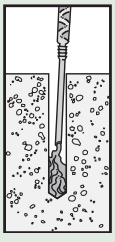
4. **Insert**–Insert cartridge into dispensing tool.



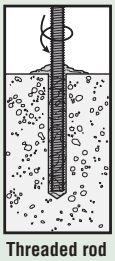
5. **Dispense**–Dispense adhesive to the side until properly mixed (uniform color).

3 FILLING THE HOLE: Vertical Anchorage

Dry and Damp Holes:

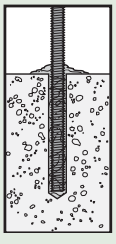


1. **Fill**–Fill hole ½ - ⅔ full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



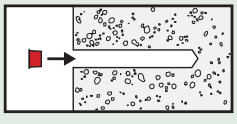
Threaded rod or rebar

2. **Insert**–Insert clean, oil free anchor, turning slowly until the anchor contacts the bottom of the hole.

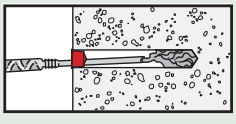


3. **Do not disturb**–Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

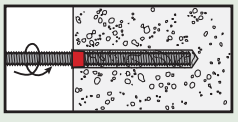
FILLING THE HOLE: Horizontal and Overhead Anchorage



1. **Install**–Install Simpson Strong-Tie ARC adhesive retaining cap.

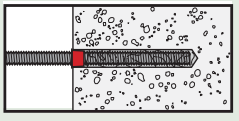


2. **Fill**–Fill hole ½ - ⅔ full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



Threaded rod or rebar

3. **Insert**–Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.



Threaded rod or rebar

4. **Do not disturb**–Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

***For AT-HP™ installation instructions, refer to ETA report.**

RFB Threaded Stud with Hex Head Nut, and Washer

RFB Carbon Steel

Finish: Zinc-plated (≥ 5microns)[1]

Model No.	Diameter	Length	Box[3] Quantity	Nominal Tensile Strength (f_{uk})	Nominal Yield Strength (f_{yk})
	[mm]	[mm]	[pcs]	MPa	MPa
RFB8 x 110-HS	8	110	50	520	420
RFB10 x 130-HS	10	130	40		
RFB12 x 160-HS	12	160	40		
RFB12 x 185-HS	12	185	25		
RFB12 x 215-HS	12	215	25		
RFB16 x 190-HS	16	190	10		
RFB16 x 230-HS	16	230	10		
RFB16 x 260-HS	16	260	10		
RFB16 x 300-HS	16	300	10		
RFB20 x 200-HS	20	200	10		
RFB20 x 260-HS	20	260	10		
RFB20 x 300-HS	20	300	8		
RFB24 x 300-HS	24	300	5		
RFB27 x 340-HS	27	340	20	-	-

RFB Stainless Steel, A4-70[2]

Model No.	Diameter	Length	Box[3] Quantity	Nominal Tensile Strength (f_{uk})	Nominal Yield Strength (f_{yk})
	[mm]	[mm]	[pcs]	MPa	MPa
RFB10 x 130-SS316	10	130	40	520	300
RFB12 x 160-SS316	12	160	40		
RFB16 x 190-SS316	16	100	10		
RFB20 x 200-SS316	20	200	10		

1. Hot-dip galvanized finish available upon request.
2. Custom sizes available. Contact Simpson Strong-Tie for special orders.
3. Each box contains one setting tool.

SET-XP® *High-Strength Anchoring Adhesive for Cracked and Uncracked Concrete*

SIMPSON Strong-Tie®

SET-XP® is a 1:1 two component, high solids epoxy-based anchoring adhesive formulated for optimum performance in both cracked and uncracked concrete. SET-XP exceeds ASTM C881 specification for Type I & IV, Grade 3, Class C epoxy

APPLICATIONS:

- Rebar Doweling
- Tension Zones
- Dry And Wet Concrete
- Threaded Rod Anchoring
- General Purpose Anchoring
- Overhead Anchoring (Tension Zones)
- Structural Steel
- Seismic Loading

APPROVALS: **ETA-11/0360 (OPTION 1) ; ICC-ES ESR-2508**
NSF/ANSI Standard 61 (313 cm²/1000 L)

BASE MATERIAL:
- Normal and Lightweight Concrete
- Hollow Concrete Block
- Grout-filled Concrete Block
- Solid Brick and Hollow Bricks

FEATURES
- Economical and safe
- Non-shrink
- High strength
- Versatile: for use in concrete, brick and concrete block
- Non-sag formulation: ideal for vertical and most overhead applications

INSTALLATION: Refer to page 17 for installation procedures

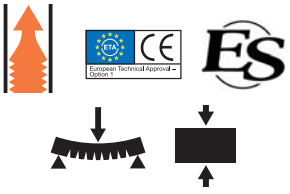
SHELF LIFE: 24 months from date of manufacture in unopened cartridge

STORAGE CONDITIONS: For best results, store between 7–32° C. To store partially used cartridges, leave hardened nozzle in place. To re-use, attach new nozzle

COLOR: Resin – white, hardener – black-green. When properly mixed, SET-XP adhesive will be a uniform teal color

CHEMICAL RESISTANCE: Very good to excellent against distilled water, in-organic acids and alkalis. Fair to good against organic acids and alkalis, and many organic solvents. Poor against ketones. For more detailed information, contact Simpson Strong-Tie®

SET-XP® Adhesive (label differs per region) **EMN22i**



EDT22S

Material Properties

PROPERTY	TEST METHOD	RESULTS
Consistency	ASTM C881	Passed, non-sag
Glass Transition Temperature	ASTM E1356	68°C
Bond Strength (moist cure)	ASTM C882	26MPa (2 days)
Water Absorption	ASTM D570	0.10%
Compressive Yield Strength	ASTM D695	102.3MPa
Compressive Modulus	ASTM D695	4442MPa
Gel Time	ASTM C881	49 minutes

Cartridge System

Model #	Contents ml (ounces)	Cartridge Type	Carton Qty	Disp. Tool(s)	Mixing Nozzle
SET-XP22	650 (22)	side-by-side 1:1 Ratio	10	EDT22S, EDT22AP	EMN22i

Refer to website for cartridge usage estimation guide.

Working and Curing Time Schedule

Internal Concrete Temperature	Working Time	Curing Time (Dry Concrete)	Curing Time (Wet Concrete)
$T_{anchorage\ base}$	t_{gel}	$t_{cure,dry}$	$t_{cure,wet}$
$T_{anchorage\ base} \geq +10°C$	60 min	72 h	144 h
$T_{anchorage\ base} \geq +21°C$	45 min	24 h	48 h
$T_{anchorage\ base} \geq +32°C$	25 min	24 h	48 h
$T_{anchorage\ base} \geq +43°C$	12 min	24 h	48 h

* Let anchor fully cure without disturbing.

In-Service Temperature*

Temperature Range I	Maximum Long Term Temperature	+24°C
	Maximum Short Term Temperature	+43°C
Temperature Range II	Maximum Long Term Temperature	+43°C
	Maximum Short Term Temperature	+65°C

* See "Supplemental Topics", section A.4 for more information

Rebar Installation Data

Description	Symbol	Units	Rebar Size (mm)				
			12	14	16	20	25
Drill Hole Diameter	d_o	mm	16	20	20	25	30
Minimum Embedment Depth	$h_{ef,min}$	mm	48	64	64	80	100
Standard Embedment Depth	h_{ef}	mm	120	160	160	200	250
Maximum Embedment Depth	$h_{ef,max}$	mm	240	280	320	400	500

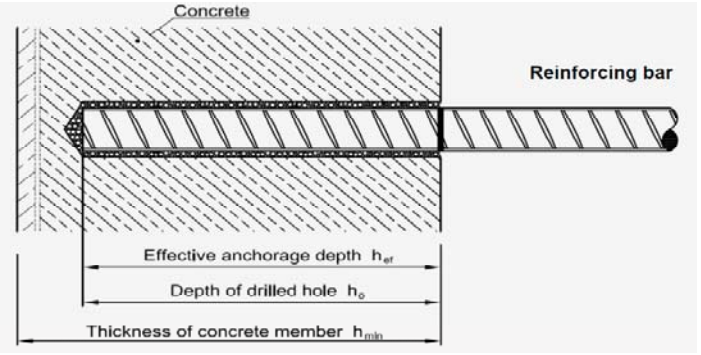
Rebar Strength [5,6]

Description	Symbol	Units	12	14	16	20	25
Nominal Yield Strength	f_{yk}	kN	56.5	77.0	101	157	245
Nominal Tensile Strength	f_{uk}	kN	62.2	84.7	111	173	270

Required Embedment Depth (Characteristic) [1, 2, 3, 4, 7]

Description	Symbol	Units	12	14	16	20	25
Embedment Depth to Exceed f_{yk}	$h_{,fyk}$	mm	200	220	260	360	580
Embedment Depth to Exceed f_{uk}	$h_{,fuk}$	mm	220	250	280	400	640
Minimum Concrete Thickness	h_{min}	mm	$h_{ef} + 2d_o$				

1. Characterisitc bond strengths are used to determine required embedment depth for yield and strength; Designer may apply safety factor to embedment depth at own discretion.
2. Minimum concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", non-cracked concrete, and exposure is temperature range 1.
3. Tabulated loads are valid at critical spacing and critical edge distance only. Designer should use Simpson Strong-Tie® Anchor Designer™ Software for spacing and edges less than critical.
4. Embedment depths are conservative for any rebar grade with less strength than B500.
5. Nominal yield strength (f_{yk}) for Gr 500B Rebar is determined by the equation: f_{yk} = 500 MPa x A_{nom}
6. Nominal tensile strength (f_{uk}) for Gr 500B Rebar is determined by the equation: f_{uk} = 550 MPa x A_{nom}
7. SET-XP characteristic bond strengths taken from relevant ETA. For sizes of rebar not shown, contact Simpson for additional data.



Characteristic Values of Resistance to Shear Loads [5] (Design Method TR 029)

Description	Symbol	Units	Rebar Size (mm)				
			12	14	16	20	25
Steel Failure Without Lever Arm							
Characteristic Resistance [3]	$V_{Rk,s}$	kN	31	42	55	86	135
Partial Safety Factor	γ_{Ms} [1]	-	1.5				
Steel Failure With Lever Arm							
Characteristic Resistance [4]	$V_{Rk,s}$	Nm	112	178	265	518	1012
Partial Safety Factor	γ_{Ms} [1]	-	1.5				
Concrete pry-out failure							
Characteristic Value	k	-	2				
Partial Safety Factor	γ_{Mcp} [1]	-	1.5				
Concrete edge failure							
See section 5.2.3.4 of The Technical Report TR 029 for the Design of Bonded Anchors							
Partial Safety Factor	γ_{Mc} [1]	-	1.5 [2]				

1. In absence of other national regulations.
2. The partial safety factor γ_2 = 1.0 is included.
3. For reinforcing bars that do not comply with DIN 488: The characteristic resistance $V_{Rk,s}$ shall be determined in accordance with TR 029, equation (5.5).
4. For reinforcing bars that do not comply with DIN 488: The characteristic resistance $M^0_{Rk,s}$ shall be determined in accordance with TR 029, equation (5.6b).
5. Rebar shear values based on Great B500 (DIN 488-2)

All-Threaded Rod Installation Data

Description	Symbol	Units	Threaded Rod Size (mm)				
			M12	M16	M20	M24	M27
Nominal Insert Diameter	d	mm	12	16	20	24	27
Drill Hole Diameter	d_o	mm	14	18	24	28	30
Minimum Embedment Depth	$h_{ef,min}$	mm	70	80	90	100	110
Maximum Embedment Depth	$h_{ef,max}$	mm	240	320	400	480	540
Clearance Hole Diameter in Fixture	d_f	mm	14	18	22	26	30
Installation Torque	$T_{inst, max}$	Nm	40	60	80	100	120

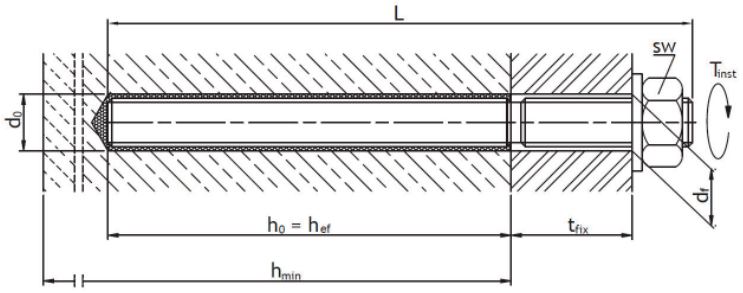
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M12	M16	M20	M24	M27
Minimum Concrete Thickness	h_{min}	mm	h_{ef} + 30mm	$h_{ef} + 2d_o$			
Minimum Edge Distance	c_{min}	mm	80	100	115	135	155
Minimum Spacing	s_{min}	mm	45	60	70	80	90
Critical Edge Distance	$c_{cr,N}$	mm	$3 \times h_{ef}$				
Critical Spacing	$s_{cr,N}$	mm	$2 \times c_{cr,N}$				

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8]

Description	Symbol	Units	M12	M16	M20	M24	M27
Embedment Depth	h_{ef}	mm	110	140	180	220	240
Minimum Concrete Thickness			140	176	228	276	300
			Non-Cracked Concrete				
TENSION	N_{Rd}	kN	27.7	33.5	53.9	71.1	67.9
SHEAR	V_{Rd}	kN	16.8	31.2	48.8	70.4	92.0
			Cracked Concrete				
TENSION	N_{Rd}	kN	11.9	15.1	16.2	23.7	29.1
SHEAR	V_{Rd}	kN	16.8	31.2	45.2	66.4	81.4

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck, cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used.
4. V_{Rd} is based on Grade 5.8 steel insert. If a different grade of steel is used, then the resistance should be re-evaluated using Simpson Strong-Tie® Anchor Designer™ Software.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing ($s_{cr,N}$) and Critical Edge Distance ($c_{cr,N}$) is taken from the relevant ETA for splitting and is conservative. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}.



Steel Design Resistance (Tension) [1,2]

Description	Symbol	Units	Threaded Rod Size (mm)				
			M12	M16	M20	M24	M27
Steel Grade 5.8	$N_{Rd,s}$	kN	28.0	52.7	82.0	118.0	153.3
Steel Grade 8.8	$N_{Rd,s}$	kN	44.7	84.0	130.7	188.0	244.7
Stainless Steel A4	$N_{Rd,s}$	kN	39.3	73.3	114.7	164.7	153.3

Steel Design Resistance (Shear) [1,2]

Description	Symbol	Units	M12	M16	M20	M24	M27
Steel Grade 5.8	$V_{Rd,s}$	kN	16.8	31.2	48.8	70.4	92.0
Steel Grade 8.8	$V_{Rd,s}$	kN	27.2	50.4	78.4	112.8	147.2
Stainless Steel A4	$V_{Rd,s}$	kN	24.0	44.0	68.8	99.2	92.0

1. $N_{Rd,s}$ and $V_{Rd,s}$ values are are derived from characteristic values and safety factors published in the ETA.
2. Refer to page 18 for Simpson Strong-Tie threaded-rod anchor products (Grade 5.8 Carbon Steel, and A4 Stainless Steel).

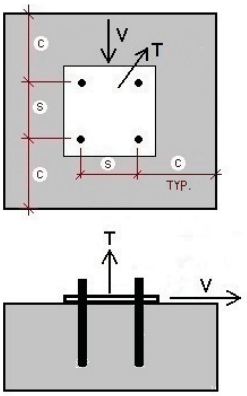


Table 1A: SET-XP with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	5.4	8.1	7.1	9.3	8.7	10.3	10.5	11.3	12.4	12.3	14.1	14.3
	100	6.9	10.3	8.8	11.6	10.4	12.6	12.2	13.7	14.2	14.8	18.5	16.9
	150	11.2	15.7	13.3	17.1	15.1	18.2	17.1	19.3	19.1	20.5	23.6	22.7
	200	16.2	19.2	18.5	20.5	20.5	21.6	22.6	22.7	24.8	23.7	29.5	25.9
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	7.8	12.2	8.8	12.9	10.4	14.1	12.2	15.3	14.2	16.4	18.5	18.8
	125	9.9	15.4	10.9	16.2	12.7	17.4	14.6	18.7	16.6	19.9	21.0	22.4
	150	12.2	18.8	13.3	19.5	15.1	20.8	17.1	22.1	19.1	23.4	23.6	26.0
	200	17.3	24.4	18.5	25.2	20.5	26.5	22.6	27.8	24.8	29.2	29.5	31.8
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	9.7	16.2	11.8	17.8	13.6	19.2	15.6	20.5	20.0	23.2	23.3	25.9
	150	12.9	21.4	15.1	23.1	17.1	24.5	19.1	26.0	23.6	28.9	28.6	31.8
	200	18.1	29.2	20.5	31.0	22.6	32.6	24.8	34.1	29.5	37.2	34.6	40.3
	250	23.8	35.9	26.3	37.8	28.6	39.4	30.9	41.0	35.9	44.1	41.2	47.3
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	12.2	21.5	13.6	22.7	15.5	24.2	17.6	25.7	22.0	28.8	26.9	31.9
	150	13.6	23.9	15.1	25.1	17.1	26.7	19.1	28.3	23.6	31.4	28.6	34.5
	200	18.9	32.4	20.5	33.6	22.6	35.3	24.8	37.0	29.5	40.4	34.6	43.7
	300	30.9	48.9	32.7	50.3	35.1	52.1	37.6	53.9	42.8	57.5	48.3	61.1
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	14.9	26.5	17.6	28.8	19.7	30.5	24.2	33.8	29.1	37.1	34.6	40.4
	200	19.6	34.5	22.6	36.9	24.8	38.7	29.5	42.2	34.6	45.7	40.1	49.2
	250	25.5	43.8	28.6	46.4	30.9	48.2	35.9	52.0	41.2	55.7	46.8	59.4
	300	31.8	53.9	35.1	56.4	37.6	58.6	42.8	62.5	48.3	66.4	54.1	70.3

1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

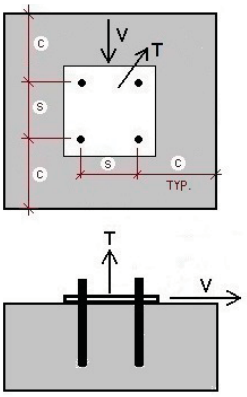


Table 1B: SET-XP with Four Anchors, Four Edge Distances, Cracked Concrete (T, V) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

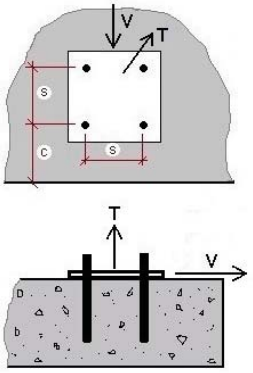
Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	3.9	5.8	5.1	6.6	6.2	7.3	7.5	8.0	8.9	8.7	10.1	10.1
	100	5.0	7.3	6.2	8.2	7.4	9.0	8.7	9.7	10.1	10.5	13.2	11.9
	150	8.0	11.1	9.5	12.1	10.8	12.9	12.2	13.7	13.6	14.5	16.8	16.1
	200	11.6	13.6	13.2	14.5	14.6	15.3	16.1	16.1	17.6	16.8	21.0	18.3
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	5.6	8.6	6.2	9.1	7.4	10.0	8.7	10.8	10.1	11.6	13.2	13.3
	125	7.1	10.9	7.8	11.5	9.0	12.3	10.4	13.2	11.8	14.1	14.9	15.9
	150	8.7	13.3	9.5	13.8	10.8	14.8	12.2	15.7	13.6	16.6	16.8	18.4
	200	12.3	17.3	13.2	17.8	14.6	18.8	16.1	19.7	17.6	20.7	21.0	22.5
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	6.9	11.5	8.4	12.6	9.7	13.6	11.1	14.5	14.2	16.4	16.6	18.4
	150	9.2	15.1	10.8	16.4	12.2	17.4	13.6	18.4	16.8	20.5	20.4	22.5
	200	12.9	20.7	14.6	22.0	16.1	23.1	17.6	24.2	21.0	26.4	24.6	28.6
	250	17.0	25.5	18.8	26.8	20.4	27.9	22.0	29.0	25.6	31.3	29.3	33.5
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	8.7	15.2	9.7	16.1	11.1	17.2	12.5	18.2	15.7	20.4	19.2	22.6
	150	9.7	16.9	10.8	17.8	12.2	18.9	13.6	20.0	16.8	22.2	20.4	24.5
	200	13.4	22.9	14.6	23.8	16.1	25.0	17.6	26.2	21.0	28.6	24.6	31.0
	300	22.0	34.6	23.3	35.6	25.0	36.9	26.8	38.2	30.5	40.7	34.4	43.3
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	10.6	18.8	12.5	20.4	14.0	21.6	17.2	23.9	20.8	26.3	24.7	28.6
	200	14.0	24.4	16.1	26.2	17.6	27.4	21.0	29.9	24.6	32.4	28.6	34.9
	250	18.2	31.0	20.4	32.9	22.0	34.2	25.6	36.8	29.3	39.4	33.4	42.1
	300	22.7	38.2	25.0	40.1	26.8	41.5	30.5	44.3	34.4	47.0	38.6	49.8

1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 2A: SET-XP with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	15.8	12.6	17.5	13.9	19.1	15.0	20.7	16.1	22.3	17.2	25.8	19.4
	100	16.9	15.7	18.7	17.1	20.3	18.2	22.0	19.3	23.7	20.5	27.3	22.7
	150	19.7	21.0	21.7	22.2	23.5	23.3	25.3	24.3	27.2	25.4	31.2	27.5
	200	22.8	26.1	25.0	27.3	26.9	28.3	28.9	29.4	30.9	30.4	35.3	32.4
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	22.7	18.8	23.7	19.6	25.4	20.9	27.1	22.2	28.9	23.5	32.6	26.1
	125	24.3	23.4	25.3	24.2	27.0	25.5	28.8	26.9	30.7	28.2	34.5	30.9
	150	25.8	26.4	26.9	27.2	28.7	28.5	30.6	29.8	32.5	31.1	36.5	33.7
	200	29.1	32.4	30.3	33.1	32.2	34.4	34.2	35.6	36.3	36.8	40.6	39.3
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	31.7	24.9	33.9	26.7	35.8	28.2	37.7	29.7	41.6	32.7	45.8	35.7
	150	34.1	33.4	36.4	35.3	38.3	36.9	40.3	38.5	44.4	41.7	48.8	44.9
	200	37.6	40.6	40.0	42.4	42.1	44.0	44.2	45.5	48.6	48.5	53.3	51.5
	250	41.3	47.6	43.9	49.3	46.1	50.7	48.3	52.2	52.9	55.1	57.8	58.0
Insert Diameter	**(d) = 24 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	42.0	33.0	43.6	34.4	45.6	36.1	47.6	37.8	51.9	41.2	56.3	44.6
	150	43.1	37.0	44.7	38.4	46.7	40.1	48.8	41.9	53.1	45.3	57.6	48.8
	200	46.9	48.9	48.6	50.3	50.7	52.1	52.9	53.9	57.4	57.5	62.1	61.1
	300	54.8	64.4	56.7	65.8	59.1	67.4	61.5	69.0	66.4	72.3	71.6	75.6
Insert Diameter	**(d) = 27 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	48.7	40.9	51.6	43.4	53.7	45.3	58.1	49.0	62.7	52.7	67.4	56.3
	200	52.2	53.9	55.2	56.6	57.5	58.6	62.0	62.5	66.8	66.4	71.7	70.3
	250	56.2	62.2	59.4	64.8	61.8	66.6	66.5	70.3	71.5	74.0	76.6	77.7
	300	60.4	70.3	63.7	72.8	66.2	74.6	71.2	78.2	76.4	81.7	81.7	85.3

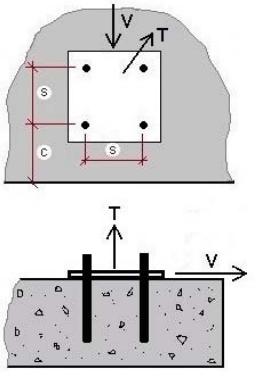


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 2B: SET-XP with Four Anchors, One Edge Distance, Cracked Concrete (T, V ⊢) [8]

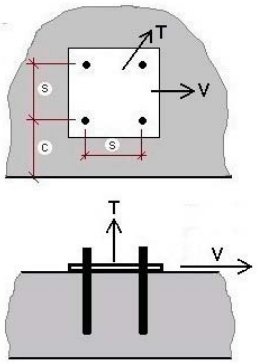
Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	11.3	8.9	12.5	9.8	13.6	10.6	14.7	11.4	15.9	12.2	18.4	13.7
	100	12.0	11.1	13.3	12.1	14.5	12.9	15.6	13.7	16.9	14.5	19.5	16.1
	150	14.1	14.8	15.5	15.7	16.7	16.5	18.0	17.2	19.4	18.0	22.2	19.5
	200	16.2	18.5	17.8	19.4	19.2	20.1	20.6	20.8	22.1	21.5	25.1	22.9
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	16.2	13.3	16.9	13.9	18.1	14.8	19.3	15.7	20.6	16.6	23.3	18.5
	125	17.3	16.6	18.0	17.1	19.3	18.1	20.5	19.0	21.9	20.0	24.6	21.9
	150	18.4	18.7	19.2	19.3	20.5	20.2	21.8	21.1	23.2	22.0	26.0	23.8
	200	20.8	23.0	21.6	23.5	23.0	24.3	24.4	25.2	25.9	26.1	28.9	27.8
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	20.8	17.6	22.7	18.9	24.2	20.0	25.9	21.0	29.3	23.2	32.6	25.3
	150	23.8	23.6	25.7	25.0	27.3	26.1	28.7	27.3	31.7	29.5	34.8	31.8
	200	26.8	28.8	28.5	30.1	30.0	31.1	31.5	32.2	34.6	34.4	37.9	36.5
	250	29.5	33.7	31.3	34.9	32.8	35.9	34.4	37.0	37.7	39.0	41.2	41.1
Insert Diameter	**(d) = 24 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	29.9	23.4	31.1	24.4	32.5	25.6	34.0	26.8	37.0	29.2	40.1	31.6
	150	30.7	26.2	31.9	27.2	33.3	28.4	34.8	29.6	37.9	32.1	41.0	34.6
	200	33.4	34.6	34.6	35.6	36.1	36.9	37.7	38.2	40.9	40.7	44.3	43.3
	300	39.1	45.6	40.4	46.6	42.1	47.7	43.8	48.9	47.3	51.2	51.0	53.6
Insert Diameter	**(d) = 27 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	34.7	29.0	36.8	30.8	38.3	32.1	41.4	34.7	44.7	37.3	48.1	39.9
	200	37.2	38.2	39.4	40.1	41.0	41.5	44.2	44.3	47.6	47.0	51.1	49.8
	250	40.1	44.0	42.4	45.9	44.0	47.2	47.4	49.8	51.0	52.4	54.6	55.0
	300	43.1	49.8	45.4	51.6	47.2	52.8	50.7	55.4	54.4	57.9	58.2	60.4



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3A: SET-XP with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//) [8]													
Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]													
Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	15.8	31.4	17.5	34.7	19.1	37.4	20.7	40.2	22.3	42.9	25.8	48.4
	100	16.9	39.2	18.7	42.6	20.3	45.5	22.0	48.3	23.7	51.2	27.3	56.8
	150	19.7	52.4	21.7	55.6	23.5	58.2	25.3	60.8	27.2	63.5	31.2	68.8
	200	22.8	65.3	25.0	68.3	26.9	70.9	28.9	73.4	30.9	75.9	35.3	81.0
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	22.7	46.9	23.7	48.9	25.4	52.1	27.1	55.4	28.9	58.7	32.6	65.2
	125	24.3	58.5	25.3	60.5	27.0	63.8	28.8	67.2	30.7	70.6	34.5	77.3
	150	25.8	66.0	26.9	68.0	28.7	71.2	30.6	74.4	32.5	77.7	36.5	84.2
	200	29.1	81.0	30.3	82.8	32.2	85.9	34.2	89.0	36.3	92.0	40.6	98.2
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	31.7	62.2	33.9	66.7	35.8	70.5	37.7	74.2	41.6	81.7	45.8	89.2
	150	34.1	83.4	36.4	88.2	38.3	92.2	40.3	96.2	44.4	104.3	48.8	112.3
	200	37.6	101.5	40.0	106.1	42.1	109.9	44.2	113.7	48.6	121.2	53.2	128.8
	250	41.3	118.9	43.9	123.2	46.1	126.9	48.3	130.5	52.9	137.7	57.8	145.0
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	42.0	82.6	43.6	86.0	45.6	90.2	47.6	94.5	51.9	103.0	56.3	111.5
	150	43.1	92.4	44.7	95.9	46.7	100.3	48.8	104.6	53.1	113.3	57.6	122.1
	200	46.9	122.1	48.6	125.7	50.7	130.2	52.9	134.7	57.4	143.7	62.1	152.7
	300	54.8	161.1	56.7	164.4	59.1	168.5	61.5	172.6	66.4	180.8	71.6	189.0
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	48.7	102.2	51.6	108.6	53.7	113.2	58.1	122.4	62.7	131.6	67.4	140.8
	200	52.2	134.8	55.2	141.6	57.5	146.7	62.0	156.2	66.8	166.0	71.0	175.8
	250	56.2	155.4	59.4	161.9	61.8	166.5	66.5	175.8	71.5	185.0	76.6	194.3
	300	60.4	175.9	63.7	182.1	66.2	186.5	71.2	195.4	76.4	204.3	81.7	213.5

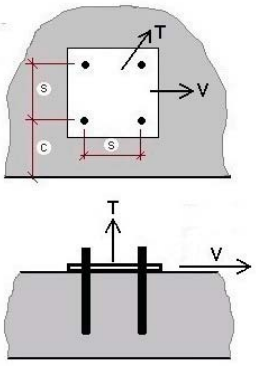


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3B: SET-XP with Four Anchors, One Edge Distance, Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	11.3	22.2	12.5	24.6	13.6	26.5	14.7	28.5	15.9	30.4	18.4	34.3
	100	12.0	27.8	13.3	30.2	14.5	32.2	15.6	34.2	16.9	36.2	19.5	40.3
	150	14.1	37.1	15.5	39.4	16.7	41.2	18.0	43.1	19.4	45.0	22.2	48.7
	200	16.2	46.2	17.8	48.4	19.2	50.2	20.6	52.0	22.1	53.8	25.1	57.4
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	16.2	33.2	16.9	34.6	18.1	36.9	19.3	39.2	20.6	41.6	23.3	46.2
	125	17.3	41.4	18.0	42.8	19.3	45.2	20.5	47.6	21.9	50.0	24.6	54.7
	150	18.4	46.8	19.2	48.1	20.5	50.4	21.8	52.7	23.2	55.0	26.0	59.6
	200	20.8	57.4	21.6	58.7	23.0	60.8	24.4	63.0	25.9	65.2	28.9	69.5
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	20.8	44.1	22.7	47.3	24.2	49.9	25.9	52.6	29.3	57.9	32.6	63.2
	150	23.8	59.1	25.7	62.5	27.3	65.3	28.7	68.2	31.7	73.9	34.8	79.5
	200	26.8	71.9	28.5	75.1	30.0	77.8	31.5	80.5	34.6	85.9	37.9	91.3
	250	29.5	84.2	31.3	87.3	32.8	89.9	34.4	92.4	37.7	97.6	41.2	102.7
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	29.9	58.5	31.1	60.9	32.5	63.9	34.0	66.9	37.0	73.0	40.1	79.0
	150	30.7	65.5	31.9	67.9	33.3	71.0	34.8	74.1	37.9	80.3	41.0	86.5
	200	33.4	86.5	34.6	89.1	36.1	92.2	37.7	95.4	40.9	101.8	44.3	108.2
	300	39.1	114.1	40.4	116.4	42.1	119.4	43.8	122.3	47.3	128.1	51.0	133.9
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	34.7	72.4	36.8	76.8	38.3	80.2	41.4	86.7	44.7	93.2	48.1	99.8
	200	37.2	95.5	39.4	100.3	41.0	103.8	44.2	110.7	47.6	117.6	51.1	124.5
	250	40.1	110.1	42.4	114.7	44.0	117.9	47.4	124.5	51.0	131.0	54.6	137.6
	300	43.1	124.6	45.4	129.0	47.2	132.1	50.7	138.4	54.4	144.7	58.2	151.0



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

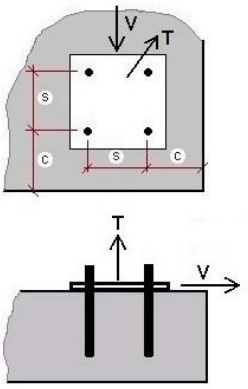


Table 4A: SET-XP with Four Anchors, Corner, Non-Cracked Concrete (T, V H) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

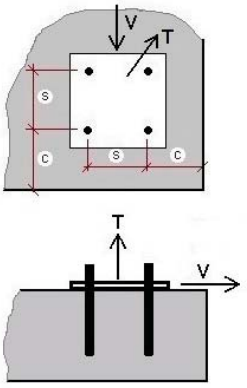
Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	10.2	9.7	11.6	10.9	12.8	11.9	14.1	12.9	15.4	13.9	18.3	15.9
	100	11.4	12.1	12.9	13.3	14.2	14.3	15.5	15.4	17.0	16.4	20.0	18.4
	150	14.7	16.0	16.4	17.1	17.9	18.1	19.5	19.1	21.1	20.0	24.6	21.9
	200	18.6	19.9	20.6	21.0	22.3	21.9	24.1	22.8	26.0	23.7	29.9	25.5
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	14.7	14.6	15.4	15.3	16.7	16.4	18.1	17.6	19.6	18.8	22.6	21.1
	125	16.3	18.0	17.1	18.8	18.5	20.0	20.0	21.2	21.5	22.4	24.8	24.8
	150	18.1	20.3	19.0	21.0	20.5	22.1	22.0	23.3	23.6	24.5	27.0	26.8
	200	22.0	24.7	23.0	25.4	24.7	26.5	26.4	27.6	28.2	28.7	32.0	30.9
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	20.0	19.3	21.7	20.9	23.1	22.3	24.7	23.6	27.8	26.3	31.2	29.0
	150	22.5	25.7	24.3	27.4	25.9	28.9	27.5	30.3	30.9	33.2	34.5	36.1
	200	26.5	31.1	28.5	32.7	30.2	34.1	32.0	35.5	35.7	38.2	39.6	40.9
	250	30.9	36.3	33.1	37.8	35.0	39.2	36.9	40.5	40.9	43.1	45.2	45.7
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	26.3	25.6	27.5	26.8	29.0	28.4	30.6	29.9	34.0	32.9	37.4	36.0
	150	27.2	28.6	28.7	29.8	30.2	31.4	31.9	33.0	35.3	36.1	38.9	39.2
	200	31.5	37.5	32.8	38.8	34.6	40.4	36.3	42.0	40.0	45.3	43.9	48.5
	300	40.7	49.1	42.3	50.3	44.3	51.8	46.4	53.3	50.7	56.2	55.2	59.2
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	30.7	31.6	33.0	34.0	34.6	35.6	38.1	38.9	41.7	42.3	45.5	45.6
	200	34.5	41.5	36.9	43.9	38.7	45.7	42.4	49.2	46.2	52.7	50.3	56.3
	250	39.0	47.6	41.6	50.0	43.5	51.6	47.5	55.0	51.6	58.3	55.9	61.6
	300	43.8	53.7	46.6	56.0	48.7	57.6	53.0	60.8	57.4	63.9	62.0	67.1

1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 4B: SET-XP with Four Anchors, Corner, Cracked Concrete (T, V⊢) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	7.3	6.9	8.3	7.7	9.1	8.4	10.0	9.1	11.0	9.8	13.1	11.2
	100	8.1	8.6	9.2	9.4	10.1	10.2	11.1	10.9	12.1	11.6	14.3	13.1
	150	10.5	11.3	11.7	12.1	12.8	12.8	13.9	13.5	15.1	14.2	17.6	15.5
	200	13.2	14.1	14.7	14.8	15.9	15.5	17.2	16.1	18.5	16.8	21.3	18.1
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	10.4	10.3	11.0	10.8	11.9	11.6	12.9	12.5	13.9	13.3	16.1	15.0
	125	11.6	12.8	12.2	13.3	13.2	14.1	14.3	15.0	15.3	15.9	17.6	17.6
	150	12.9	14.4	13.5	14.9	14.6	15.7	15.7	16.5	16.8	17.3	19.3	19.0
	200	15.7	17.5	16.4	18.0	17.6	18.8	18.8	19.6	20.1	20.3	22.8	21.9
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	14.3	13.7	15.5	14.8	16.5	15.8	17.6	16.7	19.8	18.6	22.2	20.6
	150	16.1	18.2	17.4	19.4	18.5	20.5	19.6	21.5	22.0	23.5	24.6	25.6
	200	18.9	22.0	20.3	23.2	21.5	24.2	22.8	25.1	25.4	27.1	28.2	29.0
	250	22.0	25.7	23.6	26.8	24.9	27.7	26.3	28.7	29.2	30.5	32.2	32.4
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	18.7	18.1	19.6	19.0	20.7	20.1	21.8	21.2	24.2	23.3	26.7	25.5
	150	19.5	20.2	20.4	21.1	21.6	22.2	22.7	23.3	25.2	25.6	27.7	27.8
	200	22.4	26.6	23.4	27.5	24.6	28.6	25.9	29.8	28.5	32.1	31.3	34.4
	300	29.0	34.8	30.2	35.6	31.6	36.7	33.1	37.7	36.1	39.8	39.3	41.9
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	21.9	22.4	23.5	24.1	24.7	25.2	27.2	27.6	29.7	29.9	32.5	32.3
	200	24.6	29.4	26.3	31.1	27.6	32.4	30.2	34.9	33.0	37.4	35.8	39.8
	250	27.8	33.7	29.6	35.4	31.0	36.6	33.8	38.9	36.8	41.3	39.9	43.6
	300	31.2	38.1	33.3	39.6	34.7	40.8	37.7	43.0	40.9	45.3	44.2	47.6

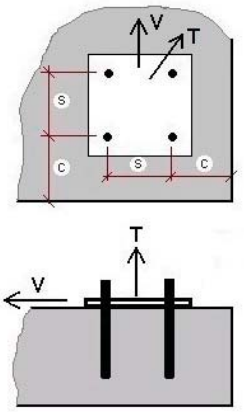


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5A: SET-XP with Four Anchors, Corner, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	10.2	24.3	11.6	27.2	12.8	29.7	14.1	32.2	15.4	34.7	18.3	39.6
	100	11.4	30.2	12.9	33.3	14.2	35.8	15.5	38.4	17.0	40.9	20.0	46.0
	150	14.7	40.0	16.4	42.9	17.9	45.2	19.5	47.6	21.1	50.0	24.6	54.8
	200	18.6	49.7	20.6	52.4	22.3	54.7	24.1	56.9	26.0	59.2	29.9	63.8
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	14.7	36.4	15.4	38.1	16.7	41.1	18.1	44.0	19.6	46.9	22.6	52.8
	125	16.3	45.1	17.1	46.9	18.5	49.9	20.0	52.9	21.5	55.9	24.7	62.0
	150	18.1	50.7	19.0	52.4	20.5	55.3	22.0	58.3	23.6	61.2	27.0	67.0
	200	22.0	61.8	23.0	63.5	24.7	66.3	26.4	69.0	28.2	71.8	32.0	77.3
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	20.0	48.3	21.7	52.3	23.1	55.7	24.7	59.1	27.8	65.8	31.2	72.5
	150	22.5	64.2	24.3	68.6	25.9	72.2	27.5	75.8	30.9	83.0	34.5	90.2
	200	26.5	77.8	28.5	81.8	30.2	85.3	32.0	88.7	35.7	95.5	39.6	102.3
	250	30.9	90.7	33.1	94.6	35.0	97.9	36.9	101.1	40.9	107.7	45.2	114.2
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	26.3	64.0	27.5	67.0	29.0	70.9	30.6	74.7	34.0	82.4	37.4	90.0
	150	27.4	71.4	28.7	75.5	30.2	78.5	31.9	82.4	35.3	90.2	38.9	98.1
	200	31.5	93.8	32.8	97.0	34.6	101.0	36.3	105.1	40.0	113.2	43.9	121.3
	300	40.7	122.8	42.3	125.8	44.3	129.5	46.4	133.2	50.7	140.6	55.2	148.0
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	30.7	79.1	33.0	84.9	34.6	89.1	38.1	97.3	41.7	105.6	45.5	113.9
	200	34.5	103.7	36.9	109.9	38.1	114.3	42.4	123.0	46.2	131.8	50.3	140.6
	250	39.0	119.1	41.6	124.9	43.5	129.0	47.5	137.4	51.6	145.7	55.9	154.0
	300	43.8	134.3	46.6	139.9	48.7	143.8	53.0	151.9	57.4	159.9	62.0	167.9

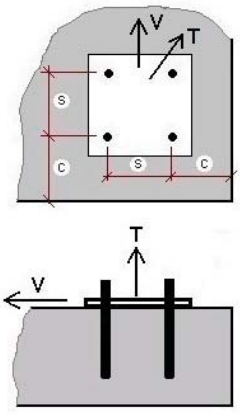


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5B: SET-XP with Four Anchors, Corner, Cracked Concrete (T, V//) [8]

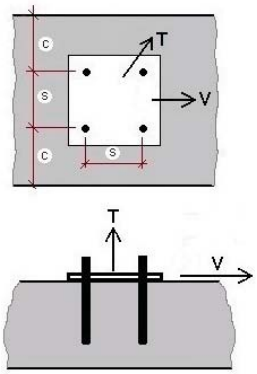
Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	7.3	17.2	8.3	19.3	9.1	21.1	10.0	22.8	11.0	24.6	13.1	28.1
	100	8.1	21.4	9.2	23.6	10.1	25.4	11.1	27.2	12.1	29.0	14.3	32.6
	150	10.5	28.3	11.7	30.4	12.8	32.0	13.9	33.7	15.1	35.4	17.6	38.8
	200	13.2	35.2	14.7	37.1	15.9	38.7	17.2	40.3	18.5	41.9	21.3	45.2
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	10.4	25.8	11.0	27.0	11.9	29.1	12.9	31.2	13.9	33.2	16.1	37.4
	125	11.6	31.9	12.2	33.2	13.2	35.3	14.3	37.5	15.3	39.6	17.6	43.9
	150	12.9	35.9	13.5	37.1	14.6	39.2	15.7	41.3	16.8	43.3	19.3	47.5
	200	15.7	43.8	16.4	45.0	17.6	46.9	18.8	48.9	20.1	50.9	22.8	54.8
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	14.3	34.2	15.5	37.1	16.5	39.4	17.6	41.8	19.8	46.6	22.2	51.4
	150	16.1	45.5	17.4	48.6	18.5	51.1	19.6	53.7	22.0	58.8	24.6	63.9
	200	18.9	55.1	20.3	58.0	21.5	60.4	22.8	62.8	25.4	67.6	28.2	72.5
	250	22.0	64.2	23.6	67.0	24.9	69.3	26.3	71.6	29.2	76.3	32.2	80.9
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	18.7	45.3	19.6	47.5	20.7	50.2	21.8	52.9	24.2	58.3	26.7	63.8
	150	19.5	50.6	20.4	52.8	21.6	55.6	22.7	58.4	25.2	63.9	27.7	69.5
	200	22.4	66.4	23.4	68.7	24.6	71.6	25.9	74.4	28.5	80.2	31.3	85.9
	300	29.0	87.0	30.2	89.1	31.6	91.7	33.1	94.3	36.1	99.6	39.3	104.8
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	21.9	56.0	23.5	60.1	24.7	63.1	27.2	68.9	29.7	74.8	32.5	80.7
	200	24.6	73.5	26.3	77.8	27.6	80.9	30.2	87.2	33.0	93.4	35.8	99.6
	250	27.8	84.3	29.6	88.5	31.0	91.4	33.8	97.3	36.8	103.2	39.9	109.1
	300	31.2	95.1	33.3	99.1	34.7	101.9	37.7	107.6	40.9	113.2	44.2	118.9



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6A: SET-XP with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//) [8]													
Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]													
Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	7.1	31.4	8.5	34.7	9.7	37.4	11.0	40.2	12.4	42.9	15.2	48.4
	100	8.7	39.2	10.2	42.6	11.5	45.5	12.9	48.3	14.3	51.2	17.3	56.8
	150	13.0	52.4	14.7	55.6	16.2	58.2	17.8	60.8	19.4	63.5	22.9	68.8
	200	17.6	65.3	19.6	68.3	21.3	70.9	23.2	73.4	25.0	75.9	29.0	81.0
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	10.2	46.9	11.0	48.9	12.3	52.1	13.7	55.4	15.1	58.7	18.1	65.2
	125	12.4	58.5	13.3	60.5	14.7	63.8	16.1	67.2	17.7	70.6	20.9	77.3
	150	14.8	66.0	15.6	68.0	17.1	71.2	18.7	74.4	20.3	77.7	23.7	84.2
	200	19.7	81.0	20.7	82.8	22.4	85.9	24.1	89.0	25.9	92.0	29.7	98.2
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	13.1	62.2	14.8	66.7	16.3	70.5	17.8	74.2	20.9	81.7	24.3	89.2
	150	16.6	83.4	18.4	88.2	20.0	92.2	21.6	96.2	25.0	104.3	28.5	112.3
	200	21.8	101.5	23.8	106.1	25.6	109.9	27.3	113.7	31.0	121.2	34.9	128.8
	250	27.4	118.9	29.6	123.2	31.5	126.9	33.4	130.5	37.4	137.7	41.7	145.0
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	16.8	82.6	18.0	86.0	19.6	90.2	21.2	94.5	24.5	103.0	28.0	111.5
	150	18.4	92.4	19.7	95.9	21.3	100.3	22.9	104.6	26.3	113.3	29.9	122.1
	200	23.9	122.1	25.3	125.7	27.0	130.2	28.8	134.7	32.5	143.7	36.4	152.7
	300	35.9	161.1	37.4	164.4	39.5	168.5	41.5	172.6	45.8	180.8	50.3	189.0
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	20.2	102.2	22.4	108.6	24.1	113.2	27.6	122.4	31.2	131.6	35.0	140.8
	200	25.3	134.8	27.8	141.6	29.5	146.5	33.2	156.2	37.1	166.0	41.1	175.8
	250	31.3	155.4	33.9	161.9	35.8	166.5	39.8	175.8	44.0	185.0	48.3	194.3
	300	37.6	175.9	40.4	182.1	42.4	186.5	46.7	195.4	51.1	204.3	55.7	213.2

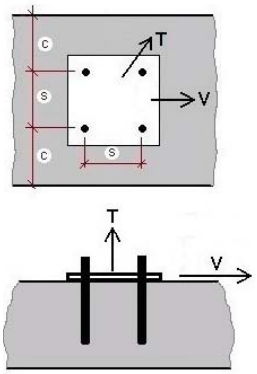


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6B: SET-XP with Four Anchors, 2-Edges, Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	5.1	22.2	6.1	24.6	6.9	26.5	7.9	28.5	8.8	30.4	10.9	34.3
	100	6.2	27.8	7.3	30.2	8.2	32.2	9.2	34.2	10.2	36.2	12.4	40.3
	150	9.2	37.1	10.5	39.4	11.5	41.2	12.7	43.1	13.8	45.0	16.3	48.7
	200	12.6	46.2	14.0	48.4	15.2	50.2	16.5	52.0	17.8	53.8	20.7	57.4
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	7.3	33.2	7.8	34.6	8.8	36.9	9.7	39.2	10.8	41.6	12.9	46.2
	125	8.9	41.4	9.5	42.8	10.5	45.2	11.5	47.6	12.6	50.0	14.9	54.7
	150	10.5	46.8	11.2	48.1	12.2	50.4	13.3	52.7	14.5	55.0	16.9	59.6
	200	14.0	57.4	14.7	58.7	15.9	60.8	17.2	63.0	18.5	65.2	21.2	69.5
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	9.4	44.1	10.6	47.3	11.6	49.9	12.7	52.6	14.9	57.9	17.3	63.2
	150	11.8	59.1	13.1	62.5	14.2	65.3	15.4	68.2	17.8	73.9	20.3	79.5
	200	15.6	71.9	17.0	75.1	18.2	77.8	19.5	80.5	22.1	85.9	24.9	91.3
	250	19.5	84.2	21.1	87.3	22.4	89.9	23.8	92.4	26.7	97.6	29.7	102.7
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	12.0	58.5	12.8	60.9	14.0	63.9	15.1	66.9	17.5	73.0	20.0	79.0
	150	13.1	65.5	14.0	67.9	15.2	71.0	16.3	74.1	18.7	80.3	21.3	86.5
	200	17.1	86.5	18.0	89.1	19.3	92.2	20.5	95.4	23.2	101.8	25.9	108.2
	300	25.6	114.1	26.7	116.4	28.1	119.4	29.6	123.0	32.7	128.1	35.8	133.9
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	14.4	72.4	16.0	76.9	17.2	80.2	19.7	86.7	22.2	93.2	24.9	99.8
	200	18.1	95.5	19.8	100.3	21.1	103.8	23.7	110.7	26.5	117.6	29.3	124.5
	250	22.3	110.1	24.2	114.7	25.6	117.9	28.4	124.5	31.3	131.0	34.4	137.6
	300	26.8	124.6	28.8	129.0	30.2	132.1	33.3	138.4	36.4	144.7	39.7	151.0



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

ET-HP *(formerly "ET") Anchoring Adhesive*

ET-HP is a two-component, 100% solids epoxy-based anchoring adhesives for use as a high strength, non-shrink anchor grouting material. ET-HP exceeds ASTM C881 specification for Type I, II , IV & V, Grade 3, Classes B & C epoxy.

APPLICATIONS:

- Rebar Doweling
- Threaded Rod Anchoring
- General Purpose Anchoring
- Dry And Wet Concrete
- Structural Steel

APPROVAL: **ICC-ESR Pending**

BASE MATERIAL:

- Normal and Lightweight Concrete
- Grout-filled Concrete Block
- Hollow Concrete Block
- Solid Brick and Hollow Bricks

FEATURES

- Economical and Safe
- Non-shrink
- High Strength
- Versatile: for use in concrete and masonry
- Non-sag Formulation

INSTALLATION: Refer to page 17 for installation procedures.

SHELF LIFE: 24 months from date of manufacture in unopened cartridge.

STORAGE CONDITIONS: For best results, store between 7–32° C. To store partially used cartridges, leave hardened nozzle in place. To re-use, attach new nozzle.

COLOR: Resin – white, hardener – black. When properly mixed, ET-HP adhesive will be a uniform medium gray color.

CHEMICAL RESISTANCE: Very good to excellent against distilled water, in-organic acids and alkalis. Fair to good against organic acids and alkalis, and many organic solvents. Poor against ketones. For more detailed information visit website for T-CHEMRES.

ET-HP
(label differs per region)

EMN22i

pending

EDT22S

Material Properties

PROPERTY	TEST METHOD	RESULTS
Bond Strength Moist Cure	ASTM C 882	14 MPa (2 days) 29 MPa (14 days)
Compressive Yield Strength	ASTM D 695	63 MPa (24 hours) 92 MPa (7 days)
Consistency (25 ˚C)	ASTM C 881	Non-Sag Thixotropic Paste
Water Absorption	ASTM D 570	0.19% (24 hours)
Compressive Modulus	ASTM D 695	4535 MPa (7days)
Heat Deflection	ASTM D 648	76 ˚C
Gel Time (25 ˚C)	ASTM C 881	30 Minutes (thin film)

Cartridge System

Model #	Contents ml (ounces)	Cartridge Type	Carton Qty	Disp. tool(s)	Mixing Nozzle
ET-HP	650 (22)	side-by-side 1:1 Ratio	10	EDT22S/ EDT22AP	EMN22i

Refer to website for cartridge usage estimation guide

Working and Curing Time Schedule

Internal Concrete Temperature	Working Time	Curing Time (Dry Concrete)	Curing Time (Wet Concrete)
$T_{anchorage\ base}$	t_{gel}	$t_{cure,dry}$	$t_{cure,wet}$
$T_{anchorage\ base} \geq +10°C$	45 min	72 h	144 h
$T_{anchorage\ base} \geq +16°C$	30 min	24 h	48 h
$T_{anchorage\ base} \geq +27°C$	20 min	24 h	48 h
$T_{anchorage\ base} \geq +38°C$	15 min	12 h	24 h

* Let anchor fully cure without disturbing.

In-Service Temperature*

Temperature Range I	Maximum Long Term Temperature	+24°C
	Maximum Short Term Temperature	+43°C
Temperature Range II	Maximum Long Term Temperature	+43°C
	Maximum Short Term Temperature	+65°C

* See "Supplemental Topics", section A.4 for more information

Rebar Installation Data

Description	Symbol	Units	Rebar Size (mm)									
			8	10	12	16	20	25	28	32	36	40
Drill Hole Diameter	d_o	mm	12	14	16	20	25	30	35	40	45	55
Minimum Embedment Depth	$h_{ef,min}$	mm	32	40	48	64	80	100	112	128	144	160
Standard Embedment Depth	h_{ef}	mm	80	100	120	160	200	250	280	320	360	400
Maximum Embedment Depth	$h_{ef,max}$	mm	160	200	240	320	400	500	560	640	720	800

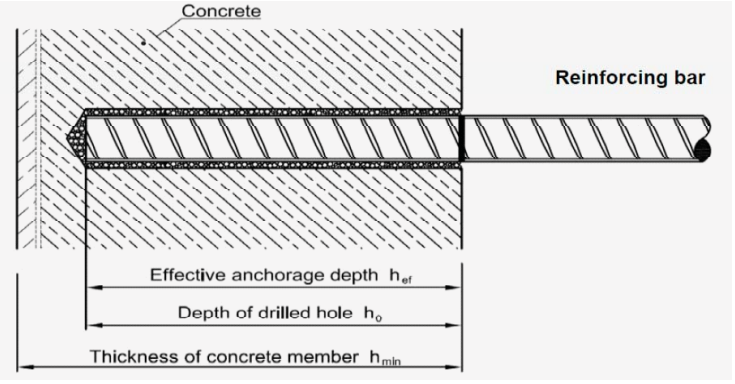
Rebar Strength [5,6]

Description	Symbol	Units	8	10	12	16	20	25	28	32	36	40
Nominal Yield Strength	f_{yk}	kN	25.1	39.3	56.5	101	157	245	308	402	509	628
Nominal Tensile Strength	f_{uk}	kN	27.6	43.2	62.2	111	173	270	339	442	560	691

Required Embedment Depth (Characteristic) [1,2,3,4,7,8]

Description	Symbol	Units	8	10	12	16	20	25	28	32	36	40
Embedment Depth to Exceed f_{yk}	$h_{,fyk}$	mm	120	140	160	200	240	300	340	440	500	540
Embedment Depth to Exceed f_{uk}	$h_{,fuk}$	mm	130	160	180	220	260	320	380	480	540	600
Minimum Concrete Thickness	h_{min}	mm	$h_{ef} + 2d_o$									

1. Characterisitc bond strengths are used to determine required embedment depth for yield and strength; Designer may apply safety factor to embedment depth at own discretion.
2. Minimum concrete strength is C14/16 ($f_{ck,\ cube}$ = 16 MPa),hole condition is "dry", non-cracked concrete, and exposure is temperature range 1.
3. Tabulated loads are valid at critical spacing and critical edge distance only.
4. Embedment depths are conservative for any rebar grade with less strength than B500.
5. Nominal yield strength (f_{yk}) for Gr 500B Rebar is determined by the equation: f_{yk} = 500 MPa x A_{nom}
6. Nominal tensile strength (f_{uk}) for Gr 500B Rebar is determined by the equation: f_{uk} = 550 MPa x A_{nom}
7. ET-HP characteristic bond strengths derived from testing in accordance with ICC AC308 and ACI 355.2.
8. Gray-shaded cells indicate embedment depths not based on ICC AC308 testing; depths are determined by additional technical data.



Installation Data

Description	Symbol	Units	Threaded Rod Size (mm)				
			M12	M16	M20	M24	M27
Nominal Insert Diameter	d	mm	12	16	20	24	27
Drill Hole Diameter	d_o	mm	14	18	24	28	30
Minimum Embedment Depth	$h_{ef,min}$	mm	70	80	90	100	110
Maximum Embedment Depth	$h_{ef,max}$	mm	240	320	400	480	540
Clearance Hole Diameter in Fixture	d_f	mm	14	18	22	26	30
Installation Torque	$T_{inst, max}$	Nm	40	60	80	100	120

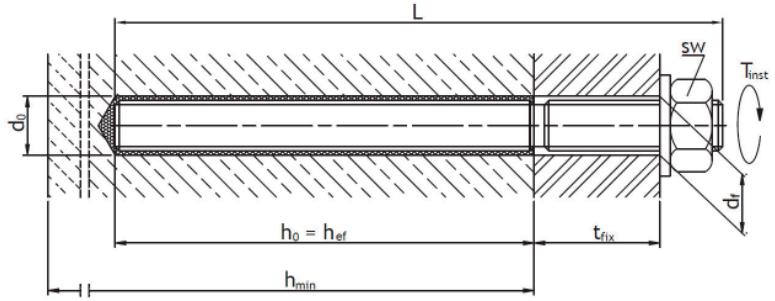
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M12	M16	M20	M24	M27
Minimum Concrete Thickness	h_{min}	mm	h_{ef} + 30mm	$h_{ef} + 2d_o$			
Minimum Edge Distance	c_{min}	mm	45	45	45	45	45
Minimum Spacing	s_{min}	mm	75	75	75	75	75
Critical Edge Distance	$c_{cr,N}$	mm	$3 \times h_{ef}$				
Critical Spacing	$s_{cr,N}$	mm	$2 \times c_{cr,N}$				

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8]

Description	Symbol	Units	M12	M16	M20	M24	M27
Embedment Depth	h_{ef}	mm	110	140	180	220	240
Minimum Concrete Thickness			140	175	220	270	300
			Non-Cracked Concrete				
TENSION	N_{Rd}	kN	20.3	36.1	63.7	91.8	104.6
SHEAR	V_{Rd}	kN	16.8	31.2	48.8	70.4	92.0

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck, cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used.
4. V_{Rd} is based on Grade 5.8 steel insert. If a different grade of steel is used, then the resistance should be re-evaluated using Simpson Strong-Tie® Anchor Designer™ Software.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Critical Spacing ($s_{cr,N}$) and Critical Edge Distance ($c_{cr,N}$) is taken from ICC AC308 testing. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}



Steel Design Resistance (Tension) [1,2]

Description	Symbol	Units	Threaded Rod Size (mm)				
			M12	M16	M20	M24	M27
Steel Grade 5.8	$N_{Rd,s}$	kN	28.0	52.7	82.0	118.0	153.3
Steel Grade 8.8	$N_{Rd,s}$	kN	44.7	84.0	130.7	188.0	244.7
Stainless Steel A4	$N_{Rd,s}$	kN	39.3	73.3	114.7	164.7	153.3

Steel Design Resistance (Shear) [1,2]

Description	Symbol	Units	M12	M16	M20	M24	M27
Steel Grade 5.8	$V_{Rd,s}$	kN	16.8	31.2	48.8	70.4	92.0
Steel Grade 8.8	$V_{Rd,s}$	kN	27.2	50.4	78.4	112.8	147.2
Stainless Steel A4	$V_{Rd,s}$	kN	24.0	44.0	68.8	99.2	92.0

1. $N_{Rd,s}$ and $V_{Rd,s}$ values are are derived from characteristic values and safety factors published in the ETA.
2. Refer to page 18 for Simpson threaded-rod anchor products (Grade 5.8 Carbon Steel, and A4 Stainless Steel).

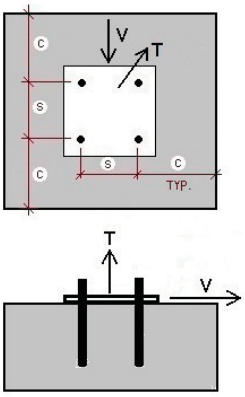


Table 1: ET-HP with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V)[8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

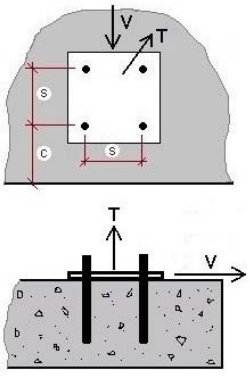
Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	6.4	8.1	8.4	9.3	10.2	10.3	12.3	11.3	14.5	12.3	16.5	14.3
	100	8.1	10.3	10.2	11.6	12.2	12.6	14.3	13.7	16.6	14.8	21.7	16.9
	150	13.2	15.7	15.5	17.1	17.7	18.2	20.0	19.3	22.4	20.5	27.6	22.7
	200	19.0	19.2	21.6	20.5	23.9	21.6	26.4	22.7	29.0	23.7	34.5	25.9
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	9.1	12.2	10.2	12.9	12.2	14.1	14.3	15.3	16.6	16.4	21.7	18.8
	125	11.6	15.4	12.8	16.2	14.8	17.4	17.0	18.7	19.4	19.9	24.5	22.4
	150	14.3	18.8	15.5	19.5	17.7	20.8	20.0	22.1	22.4	23.4	27.6	26.0
	200	20.3	24.4	21.6	25.2	23.9	26.5	26.4	27.8	29.0	29.2	34.5	31.8
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	11.4	16.2	13.7	17.8	15.9	19.2	18.2	20.5	23.3	23.2	27.2	25.9
	150	15.1	21.4	17.7	23.1	20.0	24.5	22.4	26.0	27.6	28.9	33.4	31.8
	200	21.1	29.2	23.9	31.0	26.4	32.6	29.0	34.1	34.5	37.2	40.4	40.3
	250	27.8	35.9	30.8	37.8	33.4	39.4	36.2	41.0	42.0	44.1	48.2	47.3
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	14.3	21.5	15.9	22.7	18.2	24.2	20.6	25.7	25.7	28.8	31.5	31.9
	150	16.0	23.9	17.7	25.1	20.0	26.7	22.4	28.3	27.6	31.4	33.4	34.5
	200	22.1	32.3	23.9	33.6	26.4	35.3	29.0	37.0	34.5	40.4	40.4	43.7
	300	36.1	48.9	38.3	50.3	41.1	52.1	44.0	53.9	50.0	57.5	56.5	61.1
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	17.4	26.5	20.6	28.8	23.0	30.5	28.3	33.8	34.1	37.1	40.5	40.4
	200	23.0	34.5	26.4	36.9	29.0	38.7	34.5	42.2	40.4	45.7	46.9	49.2
	250	29.8	43.8	33.4	46.4	36.2	48.2	42.0	52.0	48.2	55.7	54.8	59.4
	300	37.2	53.9	41.1	56.6	44.0	58.6	50.0	62.5	56.5	66.4	63.3	70.3

1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ICC AC308 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances for ET-HP in these tables are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 2: ET-HP with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.2	12.6	20.5	13.9	22.3	15.0	24.2	16.1	26.1	17.2	30.2	19.4
	100	19.1	15.7	21.9	17.1	23.7	18.2	25.7	19.3	27.7	20.5	31.9	22.7
	150	23.1	21.0	25.4	22.2	27.5	23.3	29.6	24.3	31.8	25.4	36.4	27.5
	200	26.6	26.1	29.2	27.3	31.5	28.3	33.8	29.4	36.2	30.4	41.3	32.4
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	26.6	18.8	27.7	19.6	29.7	20.9	31.7	22.2	33.8	23.5	38.2	26.1
	125	28.4	23.4	29.6	24.2	31.6	25.5	33.7	26.9	35.9	28.2	40.4	30.9
	150	30.2	26.4	31.5	27.2	33.6	28.5	35.8	29.8	38.0	31.1	42.7	33.7
	200	34.1	32.4	35.4	33.1	37.7	34.4	40.0	35.6	42.4	36.8	47.5	39.3
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	37.1	24.9	39.6	26.7	41.8	28.2	44.1	29.7	48.7	32.7	53.6	35.7
	150	39.9	33.4	42.5	35.3	44.8	36.9	47.2	38.5	52.0	41.7	57.0	44.9
	200	44.0	40.6	46.8	42.4	49.2	44.0	51.7	45.5	56.9	48.5	62.3	51.5
	250	48.3	47.6	51.3	49.3	53.9	50.7	56.5	52.2	61.9	55.1	67.6	58.0
Insert Diameter	**(d) = 24 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	49.1	33.0	51.0	34.4	53.3	36.1	55.7	37.8	60.7	41.2	65.8	44.6
	150	50.4	37.0	52.3	38.4	54.7	40.1	57.1	41.9	62.1	45.3	67.4	48.8
	200	54.8	48.9	56.8	50.3	59.3	52.1	61.9	53.9	67.1	57.5	72.6	61.1
	300	64.2	64.4	66.3	65.8	69.1	67.4	71.9	69.0	77.7	72.3	83.7	75.6
Insert Diameter	**(d) = 27 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	57.0	40.9	60.4	43.4	62.9	45.3	68.0	49.0	73.3	52.7	78.9	56.3
	200	61.1	53.9	64.6	56.6	67.2	58.6	72.6	62.5	78.1	66.4	83.9	70.3
	250	65.8	62.2	69.5	64.8	72.2	66.6	77.8	70.3	83.6	74.0	89.6	77.7
	300	70.7	70.3	74.6	72.8	77.4	74.6	83.3	78.2	89.3	81.7	95.6	85.3

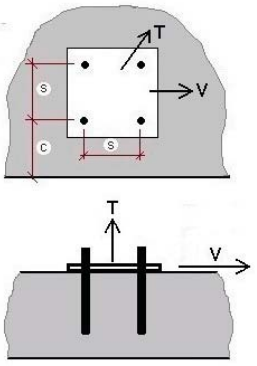


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ICC AC308 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances for ET-HP in these tables are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3: ET-HP with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.2	31.4	20.5	34.7	22.3	37.4	24.2	40.2	26.1	42.9	30.2	48.4
	100	19.1	39.2	21.9	42.6	23.7	45.5	25.7	48.3	27.7	51.2	31.9	56.8
	150	23.1	52.4	25.4	55.6	27.5	58.2	29.6	60.8	31.8	63.5	36.4	68.8
	200	26.6	65.3	29.2	68.3	31.5	70.9	33.8	73.4	36.2	75.9	41.3	81.0
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	26.6	46.9	27.7	48.9	29.7	52.1	31.7	55.4	33.8	58.7	38.2	65.2
	125	28.4	58.5	29.6	60.5	31.6	63.8	33.7	67.2	35.9	70.6	40.4	77.3
	150	30.2	66.0	31.5	68.0	33.6	71.2	35.8	74.4	38.0	77.7	42.7	84.2
	200	34.1	81.0	35.4	82.8	37.7	85.9	40.0	89.0	42.4	92.0	47.5	98.2
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	37.1	62.3	39.6	66.7	41.8	70.5	44.1	74.2	48.7	81.7	53.6	89.2
	150	39.9	83.4	42.5	88.2	44.8	92.2	47.2	96.2	52.0	104.3	57.0	112.3
	200	44.0	101.5	46.8	106.1	49.2	109.9	51.7	113.7	56.9	121.2	62.2	128.8
	250	48.3	118.9	51.3	123.2	53.9	126.9	56.5	130.5	61.9	137.7	67.6	145.0
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	49.1	82.6	51.0	86.0	53.3	90.2	55.7	94.5	60.7	103.0	65.8	111.5
	150	50.4	99.4	52.3	95.9	54.7	100.3	57.1	104.6	62.1	113.3	67.4	122.1
	200	54.8	122.1	56.8	125.7	59.3	130.2	61.9	134.7	67.1	143.7	72.6	152.7
	300	64.2	161.1	66.3	164.4	69.1	168.5	71.9	172.6	77.7	180.8	83.7	189.0
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	57.0	102.2	60.4	108.6	62.9	113.2	68.0	122.4	73.3	131.6	78.9	140.8
	200	61.1	134.8	64.6	141.6	67.2	146.7	72.6	156.2	78.1	166.0	83.1	175.8
	250	65.8	155.4	69.5	161.9	72.2	166.5	77.8	175.8	83.6	185.0	89.6	194.3
	300	70.7	175.9	74.6	182.1	77.4	186.5	83.3	195.4	89.3	204.3	95.6	213.5



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ICC AC308 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances for ET-HP in these tables are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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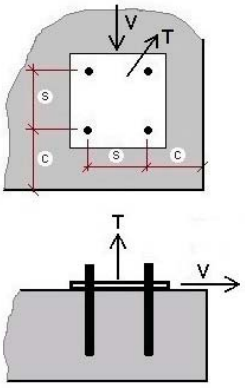
Table 4: ET-HP with Four Anchors, Corner, Non-Cracked Concrete (T, V ⊢) [8]													
Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]													
Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	11.9	9.7	13.5	10.9	15.0	11.9	16.5	12.9	18.1	13.9	21.4	15.9
	100	13.3	12.1	15.0	13.3	16.6	14.3	18.2	15.4	19.8	16.4	23.4	18.4
	150	17.2	16.0	19.2	17.1	21.0	18.1	22.8	19.1	24.7	20.0	28.8	21.9
	200	21.7	19.9	24.1	21.0	26.1	21.9	28.2	22.8	30.4	23.7	35.0	25.5
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	17.1	14.6	18.0	15.3	19.6	16.4	21.2	17.6	22.9	18.8	26.4	21.1
	125	19.1	18.0	20.0	18.8	21.7	20.0	23.4	21.2	25.2	22.4	28.5	24.8
	150	21.2	20.3	22.2	21.0	23.9	22.1	25.8	23.3	27.6	24.5	31.6	26.8
	200	25.7	24.7	26.9	25.4	28.9	26.5	30.9	27.6	33.0	28.7	37.4	30.9
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	23.4	19.3	25.4	20.9	27.1	22.3	28.8	23.6	32.5	26.3	36.4	29.0
	150	26.4	25.7	28.5	27.4	30.3	28.9	32.2	30.3	36.1	33.2	40.3	36.1
	200	31.0	31.1	33.3	32.7	35.4	34.1	37.4	35.5	41.7	38.2	46.3	40.9
	250	36.1	36.3	38.7	37.8	40.9	39.2	43.2	40.5	47.9	43.1	52.9	45.7
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	30.7	25.6	32.1	26.8	34.0	28.4	35.8	29.9	39.7	32.9	43.8	36.0
	150	32.1	28.6	33.5	29.8	35.4	31.4	37.3	33.0	41.3	36.1	45.5	39.2
	200	36.8	37.5	38.4	38.8	40.4	40.4	42.5	42.0	46.8	45.3	51.4	48.5
	300	47.7	49.1	49.5	50.3	51.9	51.8	54.3	53.3	59.3	56.2	64.5	59.2
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	35.9	31.6	38.6	34.0	40.5	35.6	44.6	38.9	48.8	42.3	53.3	45.6
	200	40.3	41.5	43.2	43.9	45.2	45.7	49.6	49.2	54.1	52.7	58.8	56.3
	250	45.6	47.6	48.7	50.0	50.9	51.6	55.5	55.0	60.4	58.3	65.4	61.6
	300	51.3	53.7	54.6	56.0	57.0	57.6	62.0	60.8	67.1	63.9	72.5	67.1

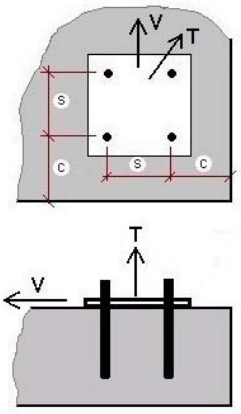


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ICC AC308 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances for ET-HP in these tables are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5: ET-HP with Four Anchors, Corner, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	11.9	24.3	13.5	27.2	15.0	29.7	16.5	32.2	18.1	34.7	21.4	39.6
	100	13.3	30.2	15.0	33.3	16.6	35.8	18.2	38.4	19.8	40.9	23.4	46.0
	150	17.2	40.0	19.2	42.9	21.0	45.2	22.8	47.6	24.7	50.0	28.8	54.8
	200	21.7	49.7	24.1	52.4	26.1	54.7	28.2	56.9	30.4	59.2	35.0	63.8
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	17.1	36.4	18.0	38.1	19.6	41.1	21.2	44.0	22.9	46.9	26.4	52.8
	125	19.1	45.1	20.0	46.9	21.7	49.9	23.4	52.9	25.2	55.9	28.9	62.0
	150	21.2	50.7	22.2	52.4	23.9	55.3	25.8	58.3	27.6	61.2	31.6	67.0
	200	25.7	61.8	26.9	63.5	28.9	66.3	30.9	69.0	33.0	71.8	37.4	77.3
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	23.4	48.3	25.4	52.3	27.1	55.7	28.8	59.1	32.5	65.8	36.4	72.5
	150	26.4	64.2	28.5	68.6	30.3	72.2	32.2	75.8	36.1	83.0	40.3	90.2
	200	31.0	77.8	33.3	81.8	35.4	85.3	37.4	88.7	41.7	95.5	46.3	102.3
	250	36.1	90.7	38.7	94.6	40.9	97.9	43.2	101.1	47.9	107.7	52.9	114.2
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	30.7	64.0	32.1	67.0	34.0	70.9	35.8	74.7	39.7	82.4	43.8	90.0
	150	32.1	71.4	33.5	74.5	35.4	78.5	37.3	82.4	41.3	90.2	45.5	98.1
	200	36.8	93.8	38.4	97.0	40.4	101.0	42.5	105.1	46.8	113.2	51.4	121.3
	300	47.7	122.8	49.5	125.8	51.9	129.5	54.3	133.2	59.3	140.6	64.5	148.0
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	35.9	79.1	38.6	84.9	40.5	89.1	44.6	97.3	48.8	105.6	53.3	113.9
	200	40.3	103.7	43.2	109.9	45.2	114.3	49.6	123.0	54.1	131.8	58.8	140.6
	250	45.6	119.1	48.6	124.9	50.9	129.0	55.5	137.4	60.4	145.7	65.4	154.0
	300	51.3	134.3	54.6	139.9	57.0	143.9	62.0	151.9	67.1	159.9	72.5	167.9

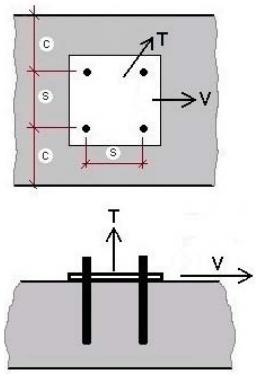


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ICC AC308 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances for ET-HP in these tables are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6: ET-HP with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 12 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	8.3	31.4	9.9	34.7	11.4	37.4	12.9	40.2	14.5	42.9	17.8	48.4
	100	10.2	39.2	11.9	42.6	13.4	45.5	15.0	48.3	16.7	51.2	20.3	56.8
	150	15.2	52.4	17.2	55.6	18.9	58.2	20.8	60.8	22.7	63.5	26.8	68.8
	200	20.6	65.3	22.9	68.3	25.0	70.9	27.1	73.4	29.3	75.9	33.9	81.0
Insert Diameter	**(d) = 16 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 176 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	11.9	46.9	12.8	48.9	14.4	52.1	16.0	55.4	17.7	58.7	21.2	65.2
	125	14.5	58.5	15.5	60.5	17.2	63.8	18.9	67.2	20.7	70.6	24.4	77.3
	150	17.3	66.0	18.3	68.0	20.0	71.2	21.9	74.4	23.8	77.7	27.7	84.2
	200	23.0	81.0	24.2	82.8	26.2	85.9	28.2	89.0	30.3	92.0	34.7	98.2
Insert Diameter	**(d) = 20 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 228 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	115	15.4	62.2	17.3	66.7	19.0	70.5	20.8	74.2	24.5	81.7	28.4	89.2
	150	19.4	83.4	21.5	88.2	23.4	92.2	25.3	96.2	29.2	104.3	33.4	112.3
	200	25.5	101.5	27.9	106.1	29.9	109.9	32.0	113.7	36.3	121.2	40.8	128.8
	250	32.0	118.9	34.6	123.2	36.8	126.9	39.1	130.5	43.8	137.7	48.7	145.0
Insert Diameter	**(d) = 24 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 220 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 276 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	135	19.7	82.6	21.1	86.0	22.9	90.2	24.8	94.5	28.7	103.0	32.7	111.5
	150	21.5	92.4	23.0	95.9	24.9	100.3	26.8	104.6	30.8	113.3	34.9	122.1
	200	28.0	122.1	29.6	125.7	31.6	130.2	33.7	134.7	38.0	143.7	42.5	152.7
	300	42.0	161.1	43.8	164.4	46.2	168.5	48.6	172.6	53.6	180.8	58.8	189.0
Insert Diameter	**(d) = 27 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 240 mm**	90		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	155	23.6	102.2	26.3	108.6	28.2	113.2	32.3	122.4	36.5	131.6	40.9	140.8
	200	29.6	134.8	32.5	141.6	34.6	146.5	38.9	156.2	43.4	166.0	48.1	175.8
	250	36.6	155.4	39.7	161.9	41.9	166.5	46.6	175.8	51.4	185.0	56.5	194.3
	300	43.9	175.9	47.2	182.1	49.6	186.5	54.6	195.4	59.8	204.3	65.2	213.2



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and exposure is temperature range 1.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ICC AC308 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances for ET-HP in these tables are derived from the product's characteristic values and safety factors derived from testing in accordance with ICC AC308 and ACI 355.2, and have been converted to meet ETA design methodology.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

AT-HP™ *High Strength Anchoring Adhesive*

AT-HP is two component, styrene free methacrylate resin suitable for high performance fixing applications of threaded rod and rebar into concrete. Easy to dispense and fast curing. Specially designed for structural fixings.

APPLICATIONS:

- Rebar Doweling
- Threaded Rod Anchoring
- Structural Steel
- Balconies
- Facade

APPROVAL:

- **ETA 11/0150 for Stainless Steel Treaded Rod**
- **ETA 11/0151 for Galvanized Threaded Rod**
- **ETA 11/0139 for Rebar**

BASE MATERIAL:

- Normal and Lightweight Concrete
- Grout-filled Concrete Block
- Hollow Concrete Block
- Solid Brick and Hollow Bricks

FEATURES:

- Fast Curing
- Low Odor
- Non-Flammable

INSTALLATION: Refer to page 17 for installation procedures

SHELF LIFE: 24 months from date of manufacture in unopened cartridge

STORAGE CONDITIONS: For best results store between 7°C - 32°C. To store partially used cartridges, leave hardened nozzle in place. To re-use, attach new nozzle.

COLOR: Resin – white, hardener – black
When properly mixed, AT-HP adhesive will be a uniform medium gray color.

AT-HP™

MN1 (2 included with each cartridge)

Cartridge Systems

Model #	Contents	Cartridge Type	Carton Qty	Disp. Tools	Mixing Nozzle
AT-HP™ 380	380 ml	Side-by-side 10:1 Ratio	12	DT380	MN-1 (2 Incl.)
AT-HP™ 825	825 ml		8	DT825	MN-1 (2 Incl.)

DT380

Working and Curing Time Schedule

Internal Concrete Temperature	Working time	Curing time (dry concrete)	Curing time (wet concrete)
$T_{anchorage\ base}$	t_{gel}	$t_{cure,dry}$	$t_{cure,wet}$
$T_{anchorage\ base} \leq 0°C$	25 min	5 h	7 h 30 min
$T_{anchorage\ base} \leq +5°C$	25 min	150 min	225 min
$T_{anchorage\ base} \leq +10°C$	10 min	105 min	160 min
$T_{anchorage\ base} \leq +20°C$	4 min	75 min	110 min
$T_{anchorage\ base} \leq +35°C$	1 min 30 sec	45 min	70 min

* Let anchor fully cure without disturbing.

DT825

Installation Data

Description	Symbol	Units	Threaded Rod Size (mm)				
			M8	M10	M12	M16	M20
Nominal Insert Diameter	d	mm	8	10	12	16	20
Drill Hole Diameter	d_o	mm	10	12	14	18	22
Minimum Embedment Depth	$h_{ef,min}$	mm	64	80	96	128	160
Maximum Embedment Depth	$h_{ef,max}$	mm	96	120	144	192	240
Clearance Hole Diameter in Fixture	d_f	mm	9	12	14	18	22
Installation Torque	$T_{inst, max}$	Nm	10	20	40	80	150

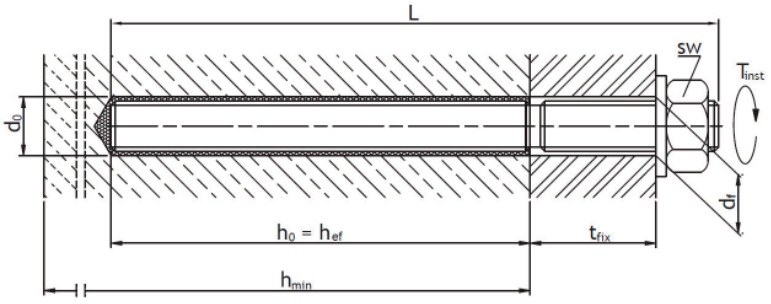
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M8	M10	M12	M16	M20
Minimum Concrete Thickness	h_{min}	mm	h_{ef} + 40mm				
Minimum Edge Distance	c_{min}	mm	0.5 x h_{ef}				
Minimum Spacing	s_{min}	mm	0.5 x h_{ef}				
Critical Edge Distance	$c_{cr,N}$	mm	2 x h_{ef}				
Critical Spacing	$s_{cr,N}$	mm	2 x $c_{cr,N}$				

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8]

Description	Symbol	Units	M8	M10	M12	M16	M20
Embedment Depth	h_{ef}	mm	70	90	110	140	180
Minimum Concrete Thickness			110	130	150	180	220
			Non-Cracked Concrete				
TENSION	N_{Rd}	kN	15.2	20.6	30.6	44.4	56.7
SHEAR	V_{Rd}	kN	6.3	10.1	14.6	27.2	41.3

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck, cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used.
4. V_{Rd} is based on Grade 5.8 steel insert. If a different grade of steel is used, then the resistance should be re-evaluated using Simpson Strong-Tie® Anchor Designer™ Software.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing ($s_{cr,N}$) and Critical Edge Distance ($c_{cr,N}$) is taken from the relevant ETA for splitting and is conservative. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}



Steel Design Resistance (Tension) [1,2]

Description	Symbol	Units	Threaded Rod Size (mm)				
			M8	M10	M12	M16	M20
Steel Grade 5.8	$N_{Rd,s}$	kN	12.8	20.1	28.0	52.7	82.0
Steel Grade 8.8	$N_{Rd,s}$	kN	19.3	30.7	44.7	84.0	130.7
Stainless Steel A4	$N_{Rd,s}$	kN	13.7	21.6	39.3	73.3	114.7

Steel Design Resistance (Shear) [1,2]

Description	Symbol	Units	M8	M10	M12	M16	M20
Steel Grade 5.8	$V_{Rd,s}$	kN	6.3	10.1	16.8	31.2	48.8
Steel Grade 8.8	$V_{Rd,s}$	kN	11.7	18.6	27.2	50.4	78.4
Stainless Steel A4	$V_{Rd,s}$	kN	8.2	13.0	24.0	44.0	68.8

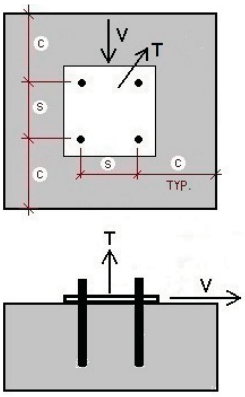
1. $N_{Rd,s}$ and $V_{Rd,s}$ values are are derived from characteristic values and safety factors published in the ETA.
2. Refer to page 18 for Simpson Strong-Tie threaded-rod anchor products (Grade 5.8 Carbon Steel, and A4 Stainless Steel).

SIMPSON Strong-Tie®

Table 1: AT-HP with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 8 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	37.5		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	37.5	9.2	3.0	11.3	3.3	16.3	4.0	15.3	4.7	15.3	5.0	15.6	5.0
	50	10.3	4.0	12.2	4.4	16.7	5.1	21.8	5.8	20.7	6.6	20.4	7.3
	75	12.8	6.2	14.5	6.7	18.4	7.5	22.7	8.3	27.4	9.1	32.6	10.0
	125	18.0	10.4	19.6	10.8	23.0	11.7	26.7	12.6	30.6	13.5	34.8	14.4
Insert Diameter	**(d) = 10 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 90 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	45	11.6	4.2	17.3	5.1	20.0	5.9	19.4	6.7	19.3	7.0	20.1	7.0
	75	14.5	7.1	19.3	8.1	23.8	9.0	28.8	9.9	34.3	10.8	32.4	12.7
	100	17.2	9.6	21.6	10.8	25.7	11.7	30.2	12.7	35.0	13.7	45.7	15.7
	150	22.7	14.2	26.8	15.4	30.5	16.4	34.4	17.4	38.6	18.5	47.7	20.5
Insert Diameter	**(d) = 12 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	18.8	6.6	22.0	7.1	28.0	8.1	33.0	9.0	31.7	9.9	31.3	11.0
	75	20.4	8.2	23.4	8.8	28.9	9.7	35.0	10.7	41.7	11.7	39.3	13.6
	100	23.5	11.0	26.3	11.7	31.3	12.7	36.7	13.8	42.5	14.8	55.6	17.0
	150	30.0	17.0	32.6	17.7	37.0	18.8	41.8	20.0	46.9	21.2	57.9	23.5
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	25.0	9.02	32.6	10.3	39.8	11.4	43.5	12.5	41.7	14.6	41.9	15.03
	100	28.9	12.7	35.7	14.1	41.9	15.3	48.5	16.4	63.4	18.8	60.3	21.1
	125	32.5	15.9	38.8	17.4	44.6	18.7	50.7	19.9	64.2	22.4	79.2	24.9
	250	51.5	29.3	57.1	30.8	61.9	32.1	67.0	33.4	77.7	35.9	89.2	38.5
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	31.9	13.8	40.7	15.6	47.6	16.9	55.1	18.1	55.1	19.4	53.3	22.0
	125	36.4	18.7	44.3	20.7	50.4	22.0	56.9	23.4	63.8	24.8	78.7	27.6
	150	39.9	22.5	47.4	24.5	53.1	26.0	59.2	27.4	65.6	28.8	79.4	31.7
	200	47.2	30.4	54.2	32.6	59.5	34.1	65.1	35.7	70.8	37.2	83.1	40.3

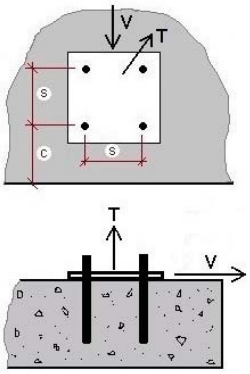


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 2: AT-HP with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 8 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	37.5		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	37.5	10.4	4.5	11.4	4.8	13.6	5.6	16.0	6.3	18.6	6.7	21.4	6.7
	50	11.3	6.1	12.4	6.5	14.8	7.3	17.3	8.1	20.0	8.9	22.9	9.7
	75	13.4	9.6	14.6	10.1	17.2	11.0	20.0	11.9	23.0	12.8	26.2	13.7
	125	18.1	14.1	19.5	14.5	22.7	15.3	26.1	16.2	29.7	17.1	33.6	17.9
Insert Diameter	**(d) = 10 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 90 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	45	13.5	6.2	16.1	7.3	18.4	8.1	20.9	9.0	23.5	9.3	29.3	9.3
	75	15.9	10.8	18.8	12.0	21.4	13.1	24.2	14.1	27.1	15.1	33.4	17.1
	100	18.1	14.2	21.3	15.4	24.1	16.4	27.0	17.4	30.2	18.5	37.0	20.5
	150	22.9	19.1	26.6	20.2	29.8	21.2	33.3	22.2	36.9	23.1	44.8	25.1
Insert Diameter	**(d) = 12 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	21.0	9.8	22.6	10.4	25.3	11.4	28.3	12.4	31.3	13.4	37.9	14.6
	75	22.5	12.3	24.1	13.0	27.0	14.1	30.1	15.1	33.2	16.2	40.1	18.4
	100	25.1	17.0	26.9	17.7	29.9	18.8	33.2	20.0	36.6	21.2	43.9	23.5
	150	30.7	22.3	32.7	23.0	36.2	24.1	39.9	25.2	43.8	26.3	52.1	28.5
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	29.0	13.4	32.6	14.8	35.7	16.0	38.9	17.2	45.8	19.6	53.3	20.0
	100	32.4	19.3	36.2	20.9	39.5	22.2	43.0	23.5	50.3	26.1	58.3	28.7
	125	35.3	24.2	39.3	25.8	42.8	27.2	46.5	28.5	54.3	31.3	62.6	34.0
	250	51.8	39.2	57.0	40.6	36.2	41.8	66.1	43.0	76.0	45.4	86.5	47.8
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	37.1	20.4	41.2	22.4	44.2	23.8	47.4	25.3	50.7	26.7	57.5	29.5
	125	40.9	28.5	45.3	30.6	48.6	32.1	51.9	33.7	55.4	35.2	62.7	38.3
	150	43.8	34.3	48.4	36.5	51.8	38.1	55.3	39.7	58.9	41.2	66.5	44.4
	200	49.9	41.1	54.8	43.2	58.5	44.7	62.3	46.2	66.2	47.6	74.4	50.6

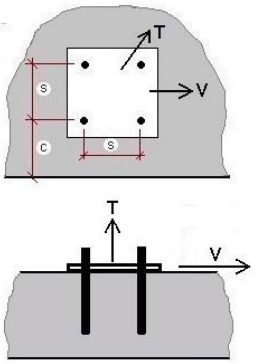


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3: AT-HP with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 8 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	37.5		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	37.5	10.4	11.1	11.4	12.0	13.6	13.9	16.0	15.7	18.6	16.7	21.4	16.7
	50	11.3	15.2	12.4	16.2	14.8	18.2	17.3	20.2	20.0	22.3	22.9	24.3
	75	13.4	24.0	14.6	25.2	17.2	27.5	20.0	29.8	23.0	32.1	26.2	34.3
	125	18.1	35.2	19.5	30.7	22.7	38.4	26.1	40.5	29.7	42.6	33.6	44.8
Insert Diameter	**(d) = 10 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 90 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	45	13.5	15.6	16.1	18.2	18.4	20.3	20.9	22.5	23.5	23.3	29.3	23.3
	75	15.9	27.1	18.8	30.1	21.4	32.6	24.2	35.1	27.1	37.6	33.4	42.7
	100	18.1	35.4	21.3	38.5	24.1	41.0	27.0	43.6	30.2	46.2	37.0	51.3
	150	22.9	47.7	26.6	50.6	29.8	53.0	33.3	55.4	36.9	57.8	44.8	62.7
Insert Diameter	**(d) = 12 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	21.0	24.4	22.6	25.9	25.3	28.5	28.2	31.0	31.3	33.5	37.9	36.6
	75	22.5	30.8	24.1	32.4	27.0	35.1	30.1	37.8	33.2	40.5	40.1	45.9
	100	25.1	42.4	26.9	44.1	29.9	47.1	33.2	50.0	36.6	53.0	43.9	58.8
	150	30.7	55.9	32.7	57.5	36.2	60.2	39.9	63.0	43.8	65.7	52.1	71.2
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	29.0	33.4	32.6	37.0	35.7	40.0	38.9	42.9	45.8	48.9	53.3	50.1
	100	32.4	48.2	36.2	52.1	39.5	55.4	43.0	58.7	50.3	65.2	58.3	71.7
	125	35.3	60.5	39.3	64.6	42.8	68.0	46.5	71.3	54.3	78.1	62.6	84.9
	250	51.8	98.0	57.0	101.6	61.5	104.6	66.1	107.6	76.0	113.6	86.5	119.5
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	37.1	51.1	41.2	56.1	44.2	59.6	47.4	63.1	50.7	66.7	57.5	73.8
	125	40.9	71.2	45.3	76.5	48.6	80.4	51.9	84.2	55.4	88.0	62.7	95.7
	150	43.8	85.7	48.4	91.2	51.8	95.2	55.3	99.1	58.9	103.1	66.5	111.0
	200	49.9	102.7	54.8	107.9	58.5	111.7	62.3	115.4	66.2	119.1	74.4	126.5



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

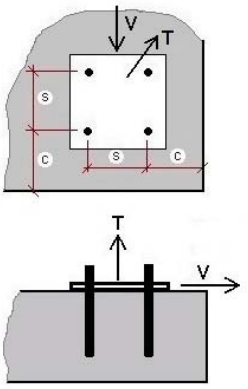


Table 4: AT-HP with Four Anchors, Corner, Non-Cracked Concrete (T, V ⊢) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

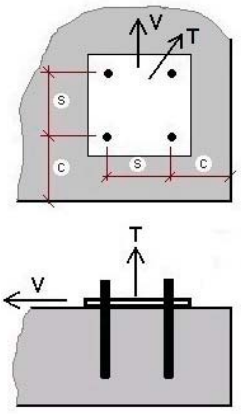
Insert Diameter	**(d) = 8 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	37.5		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	37.5	7.0	3.5	7.9	3.8	9.7	4.5	11.7	5.2	13.9	5.5	16.3	5.5
	50	8.1	4.7	9.0	5.1	11.0	5.8	13.2	6.6	15.6	7.3	18.1	8.0
	75	10.7	7.4	11.7	7.8	14.1	8.7	16.6	9.5	19.3	10.3	22.3	11.1
	125	17.2	10.7	18.7	11.1	21.7	11.9	25.1	12.7	28.6	13.4	32.4	14.2
Insert Diameter	**(d) = 10 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 90 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	45	9.0	4.9	11.1	5.8	13.0	6.6	15.1	7.4	17.3	7.7	22.2	7.7
	75	11.8	8.4	14.3	9.5	16.5	10.4	18.9	11.3	21.5	12.2	27.1	14.0
	100	14.5	10.9	17.4	12.0	19.9	12.9	22.6	13.9	25.5	14.8	31.7	16.6
	150	21.2	14.6	24.8	15.6	27.9	16.5	31.2	17.4	34.8	18.2	44.4	20.0
Insert Diameter	**(d) = 12 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	14.3	7.7	15.6	8.2	17.8	9.2	20.2	10.1	22.8	11.0	28.4	12.1
	75	16.0	9.6	17.3	10.2	19.8	11.2	22.3	12.2	25.1	13.1	31.0	15.1
	100	19.1	13.1	20.6	13.8	23.3	14.8	26.1	15.9	29.2	17.0	35.7	19.1
	150	26.4	17.2	28.3	17.7	31.5	18.7	35.0	19.7	38.6	20.7	46.4	22.7
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	19.3	10.5	22.2	11.8	24.7	12.9	27.4	14.0	33.2	16.1	39.5	16.5
	100	23.1	15.0	26.3	16.4	29.1	17.6	32.1	18.8	38.4	21.1	45.3	23.5
	125	26.6	18.7	30.1	20.2	33.2	21.4	36.4	22.6	43.2	25.1	50.6	27.5
	250	49.3	29.9	54.4	31.2	58.8	32.3	63.3	33.4	73.0	35.5	83.3	37.7
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	24.7	16.1	28.0	17.9	30.5	19.2	33.1	20.4	35.8	21.7	41.5	24.3
	125	29.1	22.2	32.7	24.1	35.5	25.5	38.3	26.9	41.3	28.2	47.5	31.0
	150	32.5	26.6	36.4	28.6	39.3	30.0	42.3	31.4	45.5	32.8	52.1	35.7
	200	40.0	31.6	44.5	33.5	47.8	34.8	51.2	36.2	54.7	37.5	62.2	40.2

1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5: AT-HP with Four Anchors, Corner, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 8 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	37.5		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	37.5	7.0	8.8	7.9	9.6	9.7	11.3	11.7	12.9	13.9	13.8	16.3	13.8
	50	8.1	11.8	9.0	12.8	11.0	14.6	13.2	16.4	15.6	18.2	18.1	20.0
	75	10.7	18.5	11.7	19.6	14.1	21.6	16.6	23.7	19.3	25.8	22.3	27.8
	125	17.2	26.9	18.7	27.8	21.7	29.7	25.1	31.6	28.6	33.6	32.4	35.5
Insert Diameter	**(d) = 10 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 90 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	45	9.0	12.3	11.1	14.6	13.0	16.5	15.1	18.5	17.3	19.3	22.2	19.3
	75	11.8	21.0	14.3	23.7	16.5	26.0	18.9	28.2	21.5	30.5	27.1	35.0
	100	14.5	27.2	17.4	30.0	19.9	32.3	22.6	34.6	25.5	36.9	31.7	41.5
	150	21.2	36.4	24.8	39.0	27.9	41.2	31.2	43.6	34.8	45.5	42.4	49.9
Insert Diameter	**(d) = 12 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	14.3	19.2	15.6	20.6	17.8	22.9	20.2	25.2	22.8	27.4	28.4	30.2
	75	16.0	24.1	17.3	25.5	19.8	28.0	22.3	30.4	25.1	32.8	31.0	37.7
	100	19.1	32.8	20.6	34.4	23.3	37.1	26.1	39.7	29.2	42.4	35.7	47.7
	150	26.4	42.9	28.3	44.4	31.5	46.8	35.0	49.3	38.6	51.8	46.4	56.7
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	19.3	26.3	22.2	29.5	24.7	32.2	27.4	34.9	33.2	40.3	39.5	41.3
	100	23.1	37.5	26.3	41.1	29.1	44.0	32.1	46.9	38.4	52.8	45.3	58.7
	125	26.6	46.8	30.1	50.5	33.2	53.5	36.4	56.6	43.2	62.7	50.6	68.8
	250	49.3	74.8	54.4	78.0	58.8	80.7	63.3	83.4	73.0	88.8	83.3	94.1
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	24.7	40.2	28.0	44.7	30.5	47.9	33.1	51.1	35.8	54.3	41.5	60.7
	125	29.1	55.4	32.7	60.3	35.5	63.7	38.3	67.2	41.3	70.6	47.3	77.5
	150	32.5	66.4	36.4	71.4	39.3	74.9	42.3	78.5	45.5	82.1	52.1	89.2
	200	40.0	79.1	44.5	83.7	47.8	87.1	51.2	90.4	54.7	93.8	62.2	100.5

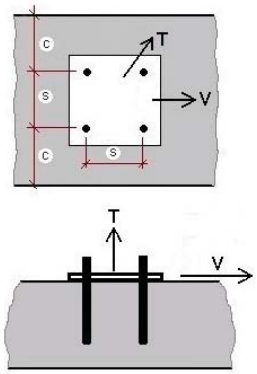


1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6: AT-HP with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//) [8]

Design Resistance Values for TENSION and SHEAR [1, 2, 3, 4, 5, 6, 7]

Insert Diameter	**(d) = 8 mm**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	37.5		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	37.5	5.4	11.1	6.3	12.0	8.1	13.9	10.1	15.7	12.3	16.7	14.7	16.7
	50	6.8	15.2	7.8	16.2	9.7	18.2	11.9	20.2	14.3	22.3	16.9	24.3
	75	10.0	24.0	11.0	25.2	13.4	27.5	15.9	29.8	18.6	32.1	21.6	34.3
	125	17.2	35.2	18.6	36.2	21.7	38.4	25.0	40.5	28.6	42.6	32.3	44.8
Insert Diameter	**(d) = 10 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 90 mm**	45		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	45	6.7	15.6	8.8	18.2	10.8	20.3	12.8	22.5	15.1	23.3	20.0	23.3
	75	10.4	27.1	12.8	30.1	15.1	32.6	17.5	35.1	20.1	37.6	25.7	42.7
	100	13.7	35.4	16.5	38.5	19.0	41.0	21.7	43.6	24.6	46.2	30.8	51.3
	150	21.1	47.7	24.6	50.6	27.8	53.0	31.1	55.4	34.6	57.8	42.3	62.7
Insert Diameter	**(d) = 12 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 110 mm**	60		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	11.1	24.4	12.4	25.9	14.7	28.5	17.1	31.0	19.7	33.5	25.3	36.6
	75	13.3	30.8	14.7	32.4	17.1	35.1	19.7	37.8	22.4	40.5	28.4	45.9
	100	17.2	42.4	18.7	44.1	21.4	47.1	24.2	50.0	27.3	53.0	33.8	58.9
	150	25.7	55.9	27.6	57.5	30.8	60.2	34.3	63.0	37.9	65.7	45.7	71.2
Insert Diameter	**(d) = 16 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 140 mm**	70		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	14.5	33.4	17.4	37.0	19.9	40.0	22.6	42.9	28.3	48.9	34.6	50.1
	100	19.4	48.2	22.6	52.1	25.4	55.4	28.4	58.7	34.7	65.2	41.6	71.7
	125	23.8	60.5	27.3	64.6	30.3	68.0	33.5	71.3	40.4	78.1	47.8	84.9
	250	49.2	98.0	54.2	101.6	58.6	104.6	63.2	107.6	72.9	113.6	83.2	119.5
Insert Diameter	**(d) = 20 mm**	Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 180 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	18.5	51.1	21.8	56.1	24.3	59.6	26.9	63.1	29.6	66.7	35.3	73.8
	125	24.2	71.2	27.9	76.5	30.6	80.4	33.4	84.2	36.4	88.0	42.6	95.7
	150	28.5	85.7	32.4	91.2	35.3	95.2	38.3	99.1	41.5	103.1	48.1	111.0
	200	37.6	102.7	42.0	107.9	45.3	111.7	48.8	115.4	52.3	119.1	59.7	126.5



1. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa), hole condition is "dry", and installed between 5C and 35C.
2. N_{Rd} value shown is based on the lesser of $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$. These values are good for any grade of steel used and Designer needs to check steel tension design resistance seperately.
3. V_{Rd} value shown is based on the lesser of $V_{Rd,c}$ and $V_{Rd,cp}$. These values are good for any grade of steel used and Designer needs to check steel shear design resistance seperately.
4. Reference "Anchor Design Methodology" on page 10 for the descriptions of N_{Rd} and V_{Rd}
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG TR 029 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
8. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Mechanical

Anchors

TITEN HD® *Heavy Duty Screw Anchor for Concrete and Masonry*

The proprietary design of the threads on the Titen HD® anchor hold the key to its performance. During installation, hardened cutting teeth at the tip of the anchor undercut the concrete allowing the rest of the threads to follow with very little friction. The result is a continuous mechanical interlock between the anchor and base material that requires little installation torque. The Titen HD® works in cracked and non-cracked concrete, in addition to seismic applications.

Titen HD® screw anchor

APPLICATIONS:

- Structural Steel
- Subway/Railway Fixings
- Machinery and Equipment
- Concrete Formwork and Bracing
- Access Equipment: Ladders, Staircases
- Sill Plates and Ledgers
- Overhead Anchoring (Tension Zones)
- Strut and Pipe Hangers
- Junction Boxes and Control Panels
- Tilt-up Panel Braces
- Racking, Mezzanines, Conveyors
- Furniture and Storage
- Guardrails, Railings, Fencing
- Seismic Bracing/Anchoring

APPROVALS:

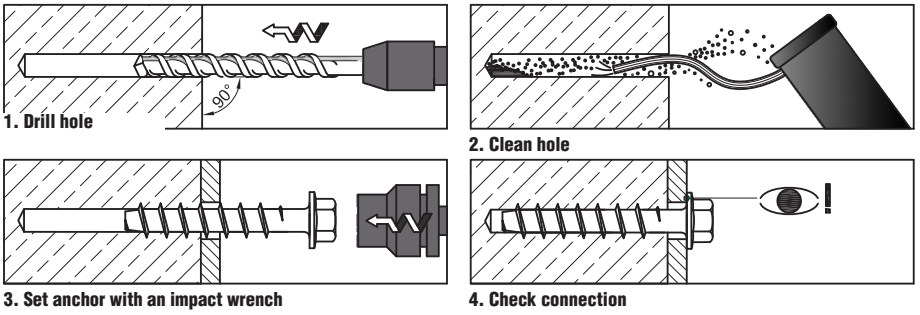
- **ETA-12/0060 (Option 1); ICC ESR 2713**

FEATURES:

- Reduced Installation Time
- Low Installation Torque
- No Special Drill Bits
- Removable
- Built in Hex Head
- Easy Post-Installation Inspection
- Vibration and Shock Resistance
- Excellent Minimum Edge Distance Performance
- Ductile Anchor Through Proprietary Heat-Treatment Process

R 120

INSTALLATION:



1. Drill hole

2. Clean hole

3. Set anchor with an impact wrench

4. Check connection

Product Availability: Carbon Steel, Zinc Plated[1]

Model Size	Order Code	Anchor Size	Max. Fixture Thickness	Wrench Size	Total [3] Length	Weight	Quantity	
			$t_{fix,max}$		L		Box	Carton
		[mm]	[mm]	[mm]	[mm]	[kg/100 pcs.]	[pcs]	
THD8 x 70/5	THD08070	8	5	13	70	3.73	50	200
THD8 x 80/15	THD08080		15		80	4.14	50	200
THD8 x 100/35	THD08100		35		100	4.94	50	200
THD8 x 120/55	THD08120		55		120	5.68	50	100
THD8 x 140/75	THD08140		75		140	6.47	50	100
THD10 x 80/5	THD10080	10	5	15	80	6.67	50	200
THD10 x 90/15	THD10090		15		90	7.28	50	200
THD10 x 100/25	THD10100		25		100	7.87	50	200
THD10 x 120/45	THD10120		45		120	9.04	50	200
THD10 x 140/65	THD10140		65		140	10.32	50	100
THD10 x 160/85	THD10160		85		160	11.59	50	100
THD12 x 110/15	THD12110	12	15	18	110	12.70	20	80
THD12 x 130/35	THD12130		35		130	14.47	20	80
THD12 x 150/55	THD12150		55		150	16.24	20	80
THD16 x 130/15	THD16130	16	15	24	130	28.15	10	40
THD16 x 150/35	THD16150		35		150	31.77	10	40
THD20 x 150/15	THD20150	20	15	30	150	44.39	5	20
THD20 x 170/35	THD20170		35		170	50.31	5	10

Product Availability: Carbon Steel, Mechanically Galvanized[2, 4, 5]

Model Size	Order Code	Anchor Size	Max. Fixture Thickness	Wrench Size	Total [3] Length	Weight	Quantity	
			$t_{fix,max}$		L		Box	Carton
		[mm]	[mm]	[mm]	[mm]	[kg/100 pcs.]	[pcs]	
THD8 x 70/5 MG	THD08070MG	8	5	13	70	3.73	50	200
THD8 x 80/15 MG	THD08080MG		15		80	4.14	50	200
THD8 x 100/35 MG	THD08100MG		35		100	4.94	50	200
THD8 x 120/55 MG	THD08120MG		55		120	5.68	50	100
THD8 x 140/75 MG	THD08140MG		75		140	6.47	50	100
THD10 x 80/5 MG	THD10080MG	10	5	15	80	6.67	50	200
THD10 x 90/15 MG	THD10090MG		15		90	7.28	50	200
THD10 x 100/25 MG	THD10100MG		25		100	7.87	50	200
THD10 x 120/45 MG	THD10120MG		45		120	9.04	50	200
THD12 x 110/15 MG	THD12110MG	12	15	18	110	12.70	20	80
THD16 x 130/15 MG	THD16130MG	16	15	24	130	28.15	10	40
THD20 x 150/15 MG	THD20150MG	20	15	30	150	44.39	5	20
THD20 x 170/35 MG	THD20170MG		35		170	50.31	5	10

1) Zinc plating meets ASTM B633, SC1.
2) Mechanical galvanizing meets ASTM B695, Class 65, Type 1 (Minimum thickness of 65 microns zinc coating). Not for use in highly corrosive or outdoor environments.
3) Length is measured from the underside of the head to the tip of the anchor.
4) Other sizes available in MG finish by special order, contact Simpson Strong-Tie for details.
5) MG finish ETA approval pending.

Installation Data

Description	Symbol	Units	Anchor Size				
			M8	M10	M12	M16	M20
Drill Hole Diameter	d_o	mm	8	10	12	16	20
Maximum Diameter of Drill Bit	$d_{cut,\ max} \leq$	mm	8.45	10.45	12.50	16.50	20.55
Drill Depth	$h_1 \geq$	mm	75	85	105	130	150
Effective Anchorage Depth	h_{ef}	mm	65	75	95	115	135
Anchor Length Range	L	mm	70-140	60-160	75-150	130-150	150-170
Clearance Hole Diameter in Fixture	$d_f \leq$	mm	12	14	16	22	26
Maximum Thickness of Fixture [9]	$t_{fix,max}$	mm	85	85	85	85	85
Width Across Flats	SW	mm	13	15	18	24	30
Installation Torque	T_{inst}	Nm	Recommended impact screw driver with max. power output specified according to manufacturer's instructions.				
			200		515		

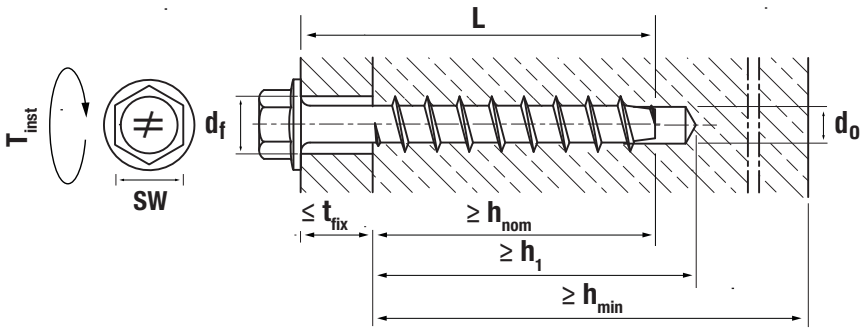
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M8	M10	M12	M16	M20
Minimum Concrete Thickness	h_{min}	mm	105	125	150	180	220
Minimum Spacing	s_{min}	mm	50	60	80	100	120
Minimum Edge Distance	c_{min}	mm	50	60	80	100	120
Critical Spacing (cone)	$s_{cr,N}$	mm	$3 \times h_{ef}$				
Critical Edge Distance (cone)	$c_{cr,N}$	mm	$1.5 \times h_{ef}$				
Critical Spacing (splitting)	$s_{cr,sp}$	mm	$3 \times h_{ef}$				
Critical Edge Distance (splitting)	$c_{cr,sp}$	mm	$1.5 \times h_{ef}$				

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8, 9]

Description	Symbol	Units	M8	M10	M12	M16	M20
Effective Embedment Depth	h_{ef}	mm	47	55	70	86	102
Minimum Concrete Thickness	h_{min}	mm	105	125	150	180	220
			Non-Cracked Concrete				
TENSION	N_{Rd}	kN	4.2	5.8	13.9	16.7	27.8
SHEAR	V_{Rd}	kN	8.0	10.6	**25.2**	**46.7**	69.4
			Cracked Concrete				
TENSION	N_{Rd}	kN	3.3	4.2	6.7	13.9	19.4
SHEAR	V_{Rd}	kN	5.7	7.6	23.9	35.6	49.5

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$
4. V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing and Critical Edge Distance is taken from the relevant ETA. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Bold values indicate that steel controls design resistance.
9. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}



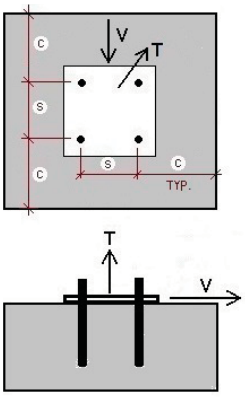


Table 1A: TITEN HD with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	8.9	4.0	12.2	4.7	15.9	5.4	16.7	6.7	16.7	6.7	16.7	6.7
	75	12.2	6.2	15.6	7.0	16.7	7.7	16.7	9.3	16.7	10.8	16.7	11.3
	100	12.2	8.3	15.6	9.2	16.7	10.0	16.7	11.7	16.7	13.3	16.7	14.0
	150	12.2	11.3	15.6	12.1	16.7	12.9	16.7	14.5	16.7	16.2	16.7	17.8
Anchor Size	= M10	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	12.4	5.5	14.5	5.9	18.5	6.7	23.3	8.2	23.3	9.1	23.3	9.1
	75	15.1	6.9	17.3	7.4	21.4	8.2	23.3	9.9	23.3	11.5	23.3	12.3
	100	16.5	9.3	18.8	9.8	22.9	10.7	23.3	12.5	23.3	14.3	23.3	16.1
	150	16.5	13.3	18.8	13.9	22.9	14.8	23.3	16.7	23.3	18.5	23.3	20.4
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	20.9	8.6	24.5	9.3	29.5	10.2	34.9	11.1	39.5	12.9	40.3	14.4
	100	25.4	10.8	29.2	11.6	34.3	12.6	39.8	13.5	51.9	15.5	52.5	17.4
	150	26.6	16.3	30.4	17.2	35.5	18.3	41.0	19.4	53.2	21.5	55.6	23.6
	200	26.6	19.8	30.4	20.6	35.5	21.6	41.0	22.7	53.2	24.7	55.6	26.8
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	32.0	12.6	37.5	13.6	43.5	14.7	56.8	16.8	60.5	18.9	61.2	21.0
	150	40.1	18.8	45.9	20.0	52.0	21.1	65.7	23.5	66.7	25.8	66.7	28.2
	200	40.1	24.3	45.9	25.5	52.0	26.7	65.7	29.1	66.7	31.6	66.7	34.0
	250	40.1	28.1	45.9	29.3	52.0	30.5	65.7	32.8	66.7	35.1	66.7	37.5
Anchor Size	= M20	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	45.2	17.1	53.0	18.6	67.5	21.0	81.0	23.3	85.5	25.7	86.1	28.1
	150	55.0	21.4	63.1	22.9	77.9	25.5	94.3	28.0	111.1	30.5	111.1	33.1
	200	56.0	28.5	64.2	30.1	79.0	32.8	95.4	35.6	111.1	38.3	111.1	41.1
	250	56.0	34.1	64.2	35.7	79.0	38.5	95.4	41.2	111.1	44.0	111.1	46.7

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

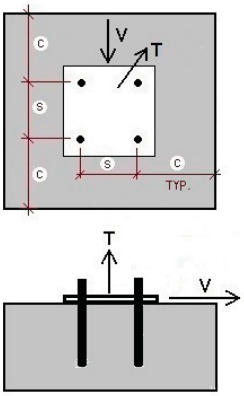


Table 1B: TITEN HD with Four Anchors, Four Edge Distances, Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	6.4	2.9	8.7	3.3	11.3	3.8	12.6	4.8	12.6	4.8	12.6	4.8
	75	8.7	4.4	11.1	4.9	13.3	5.5	13.3	6.6	13.3	7.7	13.3	8.0
	100	8.7	5.9	11.1	6.5	13.3	7.1	13.3	8.3	13.3	9.4	13.3	9.9
	150	8.7	8.0	11.1	8.6	13.3	9.2	13.3	10.3	13.3	11.5	13.3	12.6
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	60	8.8	3.9	10.4	4.2	13.2	4.8	16.7	5.8	16.7	6.5	16.7	6.5
	75	10.7	4.9	12.3	5.2	15.2	5.8	16.7	7.0	16.7	8.2	16.7	8.7
	100	11.8	6.6	13.4	7.0	16.3	7.6	16.7	8.8	16.7	10.1	16.7	11.4
	150	11.8	9.4	13.4	9.8	16.3	10.5	16.7	11.8	16.7	13.1	16.7	14.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	14.9	6.1	17.5	6.6	21.0	7.3	24.9	7.9	26.7	9.2	26.7	10.2
	100	18.1	7.7	20.8	8.2	24.4	8.9	26.7	9.6	26.7	11.0	26.7	12.3
	150	19.0	11.6	21.7	12.2	25.3	12.9	26.7	13.7	26.7	15.2	26.7	16.8
	200	19.0	14.0	21.7	14.6	25.3	15.3	26.7	16.1	26.7	17.5	26.7	19.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	22.8	8.9	26.7	9.7	31.0	10.4	40.5	11.9	43.1	13.4	43.6	14.9
	150	28.6	13.3	32.7	14.1	37.1	15.0	46.8	16.6	55.6	18.3	55.6	20.0
	200	28.6	17.2	32.7	18.1	37.1	18.9	46.8	20.6	55.6	22.4	55.6	24.1
	250	28.6	19.9	32.7	20.7	37.1	21.6	46.8	23.2	55.6	24.9	55.6	26.5
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	120	32.2	12.1	37.8	13.2	48.1	14.8	57.8	16.5	60.9	18.2	61.4	19.9
	150	39.2	15.1	45.0	16.2	55.6	18.0	67.2	19.8	77.8	21.6	77.8	23.4
	200	39.9	20.2	45.8	21.3	56.3	23.3	68.0	25.2	77.8	27.1	77.8	29.1
	250	39.9	24.2	45.8	25.3	56.3	27.3	68.0	29.2	77.8	31.2	77.8	33.1

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

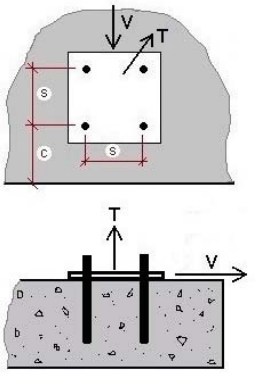


Table 2A: TITEN HD with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 47 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 105 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	9.9	6.0	12.9	6.7	16.2	7.5	16.7	9.0	16.7	9.0	16.7	9.0
	75	12.2	9.2	15.6	10.0	16.7	10.9	16.7	12.6	16.7	14.2	16.7	15.1
	100	12.2	11.3	15.6	12.1	16.7	12.9	16.7	14.5	16.7	16.2	16.7	17.8
	150	12.2	14.6	15.6	16.2	16.7	17.0	16.7	18.6	16.7	20.1	16.7	21.7
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 125 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	13.6	8.1	15.6	8.6	19.2	9.5	23.3	11.2	23.3	12.2	23.3	12.2
	75	15.5	10.4	17.7	11.0	21.6	11.9	23.3	13.7	23.3	15.5	23.3	16.5
	100	16.5	13.3	18.8	13.9	22.9	14.8	23.3	16.7	23.3	18.5	23.3	20.4
	150	16.5	17.9	18.8	18.5	22.9	19.4	23.3	21.1	23.3	22.9	23.3	24.6
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	22.6	12.8	26.0	13.6	30.5	14.6	35.5	15.6	46.4	17.6	48.8	19.1
	100	25.8	16.3	29.5	17.2	34.5	18.3	39.9	19.4	51.8	21.5	54.4	23.6
	150	26.6	21.5	30.4	22.3	35.5	23.3	41.0	24.3	53.2	26.4	55.6	28.4
	200	26.6	26.6	30.4	27.4	35.5	28.3	41.0	29.3	53.2	31.3	55.6	33.2
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 86 mm**	100		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	34.3	18.7	39.5	19.8	45.1	21.0	57.3	23.3	66.7	25.7	66.7	28.0
	150	40.1	26.2	45.9	27.4	52.0	28.6	65.6	31.0	66.7	33.3	66.7	35.7
	200	40.1	31.9	45.9	33.1	52.0	34.2	65.6	36.5	66.7	38.8	66.7	41.0
	250	40.1	37.6	45.9	38.7	52.0	39.8	65.6	42.0	66.7	44.2	66.7	46.4
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 102 mm**	120		150		200		250		300		350	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	48.3	25.4	55.7	27.0	69.1	29.6	84.0	32.3	100.2	34.9	102.3	37.6
	150	55.3	31.9	63.4	33.6	78.1	36.4	94.3	39.2	111.1	42.0	111.1	44.8
	200	56.0	38.4	64.2	40.0	79.0	42.6	95.4	45.3	111.1	48.0	111.1	50.6
	250	56.0	44.8	64.2	46.3	79.0	48.9	95.4	51.5	111.1	54.1	111.1	56.6

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

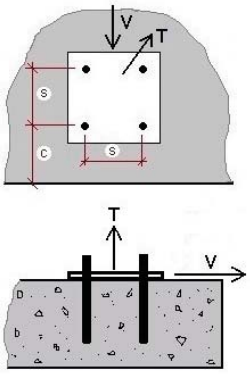


Table 2B: TITEN HD with Four Anchors, One Edge Distance, Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	7.1	4.2	9.2	4.8	11.6	5.3	13.3	6.4	13.3	6.4	13.3	6.4
	75	8.7	6.5	11.1	7.1	13.3	7.7	13.3	8.9	13.3	10.1	13.3	10.7
	100	8.7	8.0	11.1	8.6	13.3	9.2	13.3	10.3	13.3	11.5	13.3	12.6
	150	8.7	11.0	11.1	11.5	13.3	12.1	13.3	13.2	13.3	14.2	13.3	15.3
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	60	9.7	5.8	11.1	6.1	13.7	6.7	16.7	7.9	16.7	8.6	16.7	8.6
	75	11.1	7.4	12.6	7.8	15.4	8.4	16.7	9.7	16.7	11.0	16.7	11.7
	100	11.8	9.4	13.4	9.8	16.3	10.5	16.7	11.8	16.7	13.1	16.7	14.4
	150	11.8	12.7	13.4	13.1	16.3	13.7	16.7	15.0	16.7	16.2	16.7	17.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	16.1	9.0	18.5	9.6	21.8	10.3	25.3	11.0	26.7	12.4	26.7	13.6
	100	18.4	11.6	21.0	12.2	24.6	12.9	26.7	13.7	26.7	15.2	26.7	16.8
	150	19.0	15.2	21.7	15.8	25.3	16.5	26.7	17.2	26.7	18.7	26.7	20.1
	200	19.0	18.8	21.7	19.4	25.3	20.1	26.7	20.8	26.7	22.2	26.7	23.5
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	24.5	13.2	28.2	14.0	32.1	14.9	40.8	16.5	50.6	18.2	52.2	19.8
	150	28.6	18.6	32.7	19.4	37.1	20.2	46.8	21.9	55.6	23.6	55.6	25.3
	200	28.6	22.6	32.7	23.4	37.1	24.2	46.8	25.8	55.6	27.5	55.6	29.1
	250	28.6	26.6	32.7	27.4	37.1	28.2	46.8	29.8	55.6	31.3	55.6	32.9
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	120	34.5	18.0	39.7	19.1	49.3	21.0	59.8	22.9	71.5	24.7	72.9	26.6
	150	39.4	22.6	45.2	23.8	55.7	25.8	67.3	27.8	77.8	29.8	77.8	31.8
	200	39.9	27.2	45.8	28.3	56.3	30.2	68.0	32.1	77.8	34.0	77.8	35.9
	250	40.0	31.7	45.8	32.8	56.3	34.6	68.0	36.5	77.8	38.3	77.8	40.1

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

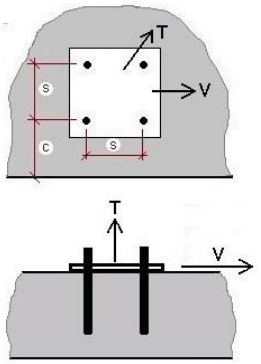


Table 3A: TITEN HD with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	9.9	11.9	12.9	15.4	16.2	18.7	16.7	22.5	16.7	22.5	16.7	22.5
	75	12.2	14.6	15.6	18.7	16.7	18.7	16.7	31.4	16.7	31.9	16.7	31.9
	100	12.2	14.6	15.6	18.7	16.7	18.7	16.7	31.9	16.7	31.9	16.7	31.9
	150	12.2	14.6	15.6	18.7	16.7	18.7	16.7	31.9	16.7	31.9	16.7	31.9
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	60	13.6	16.4	15.6	18.7	19.2	23.1	23.3	27.9	23.3	30.5	23.3	30.5
	75	15.5	18.6	17.7	21.2	21.6	26.0	23.3	34.3	23.3	38.8	23.3	40.5
	100	16.5	19.8	18.8	22.5	22.9	27.4	23.3	38.8	23.3	42.6	23.3	42.6
	150	16.5	19.8	18.8	22.5	22.9	27.4	23.3	38.8	23.3	42.6	23.3	42.6
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	22.6	31.9	26.0	33.9	30.5	36.4	35.5	38.9	46.4	43.9	48.8	47.9
	100	25.8	40.8	29.5	43.0	34.5	45.7	39.9	48.4	51.8	53.7	54.4	59.1
	150	26.6	53.7	30.4	55.8	35.5	58.3	41.0	60.8	53.2	65.9	55.6	71.0
	200	26.6	63.9	30.4	68.4	35.5	70.9	41.0	73.3	53.2	78.2	55.6	83.1
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	34.3	46.6	39.5	49.6	45.1	52.5	57.3	58.3	66.7	64.1	66.7	70.0
	150	40.1	65.5	45.9	68.5	52.0	71.4	65.6	77.4	66.7	83.3	66.7	89.3
	200	40.1	79.8	45.9	82.6	52.0	85.5	65.6	91.2	66.7	96.9	66.7	102.6
	250	40.1	54.0	45.9	96.8	52.0	99.5	65.6	105.0	66.7	110.6	66.7	116.1
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	120	48.3	63.5	55.7	67.5	69.1	74.1	84.0	80.7	100.2	87.3	102.3	93.9
	150	55.3	79.8	63.4	84.1	78.1	91.1	94.3	98.1	111.1	105.1	111.1	112.1
	200	56.0	96.0	64.2	100.0	79.0	106.6	95.4	113.3	111.1	119.9	111.1	126.6
	250	56.0	112.0	64.2	115.8	79.0	122.3	95.4	128.7	111.1	135.1	111.1	141.6

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

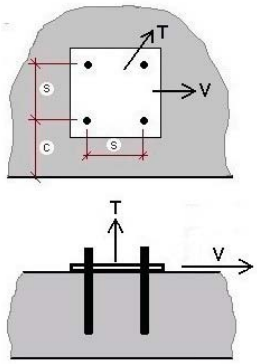


Table 3B: TITEN HD with Four Anchors, One Edge Distance, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	7.1	8.5	9.2	11.0	11.1	13.3	13.3	15.9	13.3	15.9	13.3	15.9
	75	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.2	13.3	22.7	13.3	22.7
	100	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.7	13.3	22.7	13.3	22.7
	150	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.7	13.3	22.7	13.3	22.7
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	60	9.7	11.6	11.1	13.4	13.7	16.4	16.7	19.8	16.7	21.6	16.7	21.6
	75	11.1	13.3	12.6	15.1	15.4	18.5	16.7	24.3	16.7	27.5	16.7	28.8
	100	11.8	14.1	13.4	16.0	16.3	19.6	16.7	27.6	16.7	30.4	16.7	30.4
	150	11.8	14.1	13.4	16.0	16.3	19.6	16.7	27.6	16.7	30.4	16.7	30.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	16.1	22.6	18.5	24.0	21.8	25.8	25.3	27.5	26.7	31.1	26.7	33.9
	100	18.4	28.9	21.0	30.5	24.6	32.4	26.7	34.3	26.7	38.1	26.7	41.9
	150	19.0	38.1	21.7	39.5	25.3	41.3	26.7	43.1	26.7	46.7	26.7	50.3
	200	19.0	45.6	21.7	48.5	25.3	50.2	26.7	51.9	26.7	55.4	26.7	58.9
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	24.5	33.0	28.2	35.1	32.1	37.2	40.8	41.3	50.6	45.4	52.2	49.6
	150	28.6	46.4	32.7	48.5	37.1	50.6	46.8	54.8	55.6	59.0	55.6	63.3
	200	28.6	56.5	32.7	58.5	37.1	60.6	46.8	64.6	55.6	68.6	55.6	72.7
	250	28.6	66.6	32.7	68.5	37.1	70.5	46.8	74.4	55.6	78.3	55.6	82.2
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	120	34.5	45.0	39.7	47.8	49.3	52.5	59.8	57.1	71.5	61.8	72.9	66.5
	150	39.4	56.6	45.2	59.5	55.7	64.5	67.3	69.5	77.8	74.4	77.8	79.4
	200	39.9	68.0	45.8	70.8	56.3	75.5	68.0	80.2	77.8	85.0	77.8	89.7
	250	39.9	79.3	45.8	82.0	56.3	86.6	68.0	91.2	77.8	95.7	77.8	100.3

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

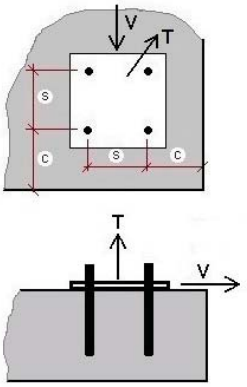


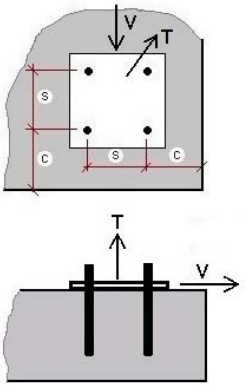
Table 4A: TITEN HD with Four Anchors, Corner, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	8.9	4.7	11.7	5.4	14.8	6.1	16.7	7.4	16.7	7.4	16.7	7.4
	75	12.2	7.2	15.6	7.9	16.7	8.7	16.7	10.2	16.7	11.7	16.7	12.4
	100	12.2	8.7	15.6	9.5	16.7	10.2	16.7	11.6	16.7	13.1	16.7	14.5
	150	12.2	11.8	15.6	12.5	16.7	13.2	16.7	14.6	16.7	16.0	16.7	17.4
Anchor Size	= M10	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	12.3	6.4	14.2	6.9	17.6	7.6	23.3	9.1	23.3	10.1	23.3	10.1
	75	15.0	8.1	17.1	8.6	21.0	9.5	23.3	11.1	23.3	12.8	23.3	13.6
	100	16.5	10.3	18.8	10.8	22.9	11.7	23.3	13.3	23.3	15.0	23.3	16.7
	150	16.5	13.8	18.8	14.3	22.9	15.0	23.3	16.6	23.3	18.2	23.3	19.8
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	20.7	10.1	23.9	10.8	28.3	11.7	33.0	12.6	43.6	14.4	45.9	15.8
	100	25.4	12.8	29.0	13.5	34.0	14.5	39.3	15.5	51.2	17.4	53.8	19.4
	150	26.6	16.6	30.4	17.3	35.5	18.2	41.0	19.2	53.2	21.0	55.6	22.8
	200	26.6	20.4	30.4	21.1	35.5	22.0	41.0	22.9	53.2	24.6	55.6	26.4
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	31.6	14.7	36.5	15.7	41.9	16.8	53.7	18.9	66.7	21.0	66.7	23.1
	150	40.1	20.4	45.9	21.4	52.0	22.5	65.6	24.6	66.7	26.8	66.7	28.9
	200	40.1	24.6	45.9	25.7	52.0	26.7	65.6	28.7	66.7	30.8	66.7	32.8
	250	40.1	28.9	45.9	29.9	52.0	30.9	65.6	32.8	66.7	34.8	66.7	36.8
Anchor Size	= M20	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	44.6	20.0	51.7	21.4	64.6	23.8	79.0	26.2	94.8	28.6	96.8	31.0
	150	54.9	25.0	63.0	26.5	77.6	29.0	93.8	31.5	111.1	34.0	111.1	36.6
	200	56.0	29.7	64.2	31.2	79.0	33.6	95.4	36.0	111.1	38.4	111.1	40.8
	250	56.0	34.5	64.2	35.9	79.0	38.2	95.4	40.5	111.1	42.9	111.1	45.2

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 4B: TITEN HD with Four Anchors, Corner, Cracked Concrete (T, V⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 47 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 105 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	6.3	3.3	8.3	3.8	10.6	4.3	13.3	5.3	13.3	5.3	13.3	5.3
	75	8.7	5.1	11.1	5.6	13.3	6.1	13.3	7.2	13.3	8.3	13.3	8.8
	100	8.7	6.2	11.1	6.7	13.3	7.2	13.3	8.2	13.3	9.3	13.3	10.3
	150	8.7	8.4	11.1	8.9	13.3	9.4	13.3	10.4	13.3	11.3	13.3	12.3
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 125 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	8.7	4.5	10.1	4.9	12.5	5.4	16.7	6.5	16.7	7.1	16.7	7.1
	75	10.7	5.8	12.2	6.1	15.0	6.7	16.7	7.9	16.7	9.0	16.7	9.6
	100	11.8	7.3	13.4	7.7	16.3	8.3	16.7	9.4	16.7	10.6	16.7	11.8
	150	11.8	9.8	13.4	10.1	16.3	10.7	16.7	11.8	16.7	12.9	16.7	14.0
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	14.7	7.1	17.0	7.6	20.2	8.3	23.5	8.9	26.7	10.2	26.7	11.2
	100	18.1	9.0	20.7	9.6	24.2	10.3	26.7	11.0	26.7	12.3	26.7	13.7
	150	19.0	11.8	21.7	12.3	25.3	12.9	26.7	13.6	26.7	14.9	26.7	16.2
	200	19.0	14.5	21.7	15.0	25.3	15.6	26.7	16.2	26.7	17.5	26.7	18.7
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 86 mm**	100		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	22.5	10.4	26.0	11.2	29.9	11.9	38.3	13.4	47.7	14.9	49.3	16.4
	150	28.6	14.4	32.7	15.2	37.1	15.9	46.8	17.5	55.6	19.0	55.6	20.5
	200	28.6	17.4	32.7	18.2	37.1	18.9	46.8	20.4	55.6	21.8	55.6	23.3
	250	28.6	20.4	32.7	21.2	37.1	21.9	46.8	23.3	55.6	24.7	55.6	26.1
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 102 mm**	120		150		200		250		300		350	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	31.8	14.2	36.8	15.2	46.0	16.9	56.3	18.6	67.6	20.2	69.0	21.9
	150	39.1	17.7	44.9	18.8	55.3	20.5	66.9	22.3	77.8	24.1	77.8	25.9
	200	39.9	21.1	45.8	22.1	56.3	23.8	68.0	25.5	77.8	27.2	77.8	28.9
	250	39.9	24.5	45.8	25.4	56.3	27.1	68.0	28.7	77.8	30.4	77.8	32.0



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

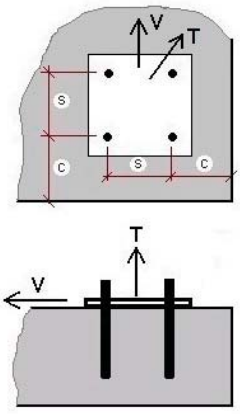


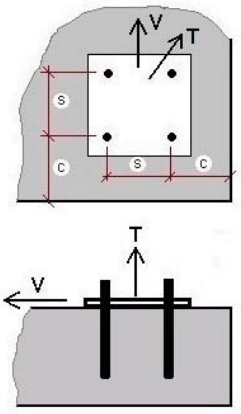
Table 5A: TITEN HD with Four Anchors, Corner, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	8.9	10.6	11.7	13.5	14.8	15.2	16.7	18.5	16.7	18.5	16.7	18.5
	75	12.2	14.6	15.6	18.7	16.7	21.7	16.7	25.4	16.7	29.2	16.7	31.1
	100	12.2	14.6	15.6	18.7	16.7	23.3	16.7	29.1	16.7	31.9	16.7	31.9
	150	12.2	14.6	15.6	18.7	16.7	23.3	16.7	31.9	16.7	31.9	16.7	31.9
Anchor Size	= M10	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	12.3	14.7	14.2	17.0	17.6	19.1	23.3	22.9	23.3	25.1	23.3	25.1
	75	15.0	18.0	17.1	20.6	21.0	23.7	23.3	27.8	23.3	31.9	23.3	33.9
	100	16.5	19.8	18.8	22.5	22.9	27.4	23.3	33.3	23.3	37.5	23.3	42.6
	150	16.5	19.8	18.8	22.5	22.9	27.4	23.3	38.8	23.3	42.6	23.3	42.6
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	20.7	25.1	23.9	26.9	28.3	29.2	33.0	31.4	43.9	35.9	45.9	39.5
	100	25.4	31.9	29.0	33.9	34.0	36.3	39.3	38.7	51.2	43.5	53.8	48.4
	150	26.6	41.5	30.4	43.3	35.5	45.6	41.0	47.9	53.2	52.5	55.6	57.0
	200	26.6	51.0	30.4	52.8	35.5	55.0	41.0	57.2	53.2	61.6	55.6	66.0
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	31.6	36.7	36.5	39.4	41.9	42.0	53.7	47.2	66.7	52.5	66.7	57.7
	150	40.1	50.9	45.9	53.6	52.0	56.3	65.6	61.6	66.7	67.0	66.7	72.3
	200	40.1	61.6	45.9	64.1	52.0	66.7	65.6	71.8	66.7	76.9	66.7	82.1
	250	40.1	72.1	45.9	74.6	52.0	77.1	65.6	82.1	66.7	87.1	66.7	92.1
Anchor Size	= M20	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	44.6	50.0	51.7	53.6	64.6	59.5	79.0	65.5	94.8	71.4	96.8	77.4
	150	54.9	62.4	63.0	66.2	77.6	72.5	93.8	78.8	111.1	85.1	111.1	91.4
	200	56.0	74.4	64.2	78.0	79.0	84.0	95.4	90.0	111.1	96.0	111.1	102.0
	250	56.0	86.3	64.2	89.8	79.0	95.6	95.4	101.3	111.1	107.1	111.1	112.9

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5B: TITEN HD with Four Anchors, Corner, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 47 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 105 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	6.3	7.6	8.3	9.6	10.6	10.7	13.3	13.1	13.3	13.1	13.3	13.1
	75	8.7	10.4	11.1	13.3	13.3	15.3	13.3	18.0	13.3	20.7	13.3	22.0
	100	8.7	10.4	11.1	13.3	13.3	16.6	13.3	20.6	13.3	22.7	13.3	22.7
	150	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.7	13.3	22.7	13.3	22.7
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 125 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	8.7	10.5	10.1	12.1	12.5	13.5	16.7	16.2	16.7	17.8	16.7	17.8
	75	10.7	12.8	12.2	14.6	15.0	16.8	16.7	19.7	16.7	22.6	16.7	24.0
	100	11.8	14.1	13.4	16.0	16.3	19.6	16.7	23.6	16.7	26.5	16.7	29.5
	150	11.8	14.1	13.4	16.0	16.3	19.6	16.7	27.6	16.7	30.4	16.7	30.4
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	14.7	17.8	17.0	19.1	20.2	20.7	23.5	22.3	26.7	25.4	26.7	28.0
	100	18.1	22.6	20.7	24.0	24.2	25.7	26.7	27.4	26.7	30.8	26.7	34.3
	150	19.0	29.4	21.7	30.7	25.3	32.3	26.7	33.9	26.7	37.2	26.7	40.4
	200	19.0	36.1	21.7	37.4	25.3	38.9	26.7	40.5	26.7	43.6	26.7	46.7
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 86 mm**	100		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	22.5	26.0	26.0	27.9	29.9	29.7	38.3	33.5	47.7	37.2	49.3	40.9
	150	28.6	36.1	32.7	38.0	37.1	39.9	46.8	43.6	55.6	47.4	55.6	51.2
	200	28.6	43.6	32.7	45.4	37.1	47.2	46.8	50.9	55.6	54.5	55.6	58.1
	250	28.6	51.1	32.7	52.9	37.1	54.6	46.8	58.2	55.6	61.7	55.6	65.2
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 102 mm**	120		150		200		250		300		350	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	31.8	35.4	36.8	37.9	46.0	42.2	56.3	46.4	67.6	50.6	69.0	54.8
	150	39.1	44.2	44.9	46.9	55.3	51.4	66.4	55.8	77.8	60.3	77.8	64.7
	200	39.9	52.7	45.8	55.2	56.3	59.5	68.0	63.7	77.8	68.0	77.8	72.2
	250	39.9	61.1	45.8	63.6	56.3	67.7	68.0	71.8	77.8	75.9	77.8	80.0

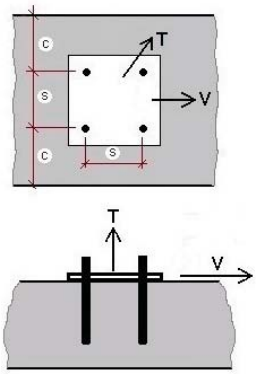


1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6A: TITEN HD with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 47 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 105 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	8.7	10.5	11.5	13.8	14.7	17.6	16.7	22.5	16.7	22.5	16.7	22.5
	75	12.2	14.6	15.6	18.7	16.7	23.3	16.7	31.4	16.7	31.9	16.7	31.9
	100	12.2	14.6	15.6	18.7	16.7	23.3	16.7	31.9	16.7	31.9	16.7	31.9
	150	12.2	14.6	15.6	18.7	16.7	23.3	16.7	31.9	16.7	31.9	16.7	31.9
Anchor Size	= M10	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 125 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	60	12.1	14.5	14.0	16.8	17.4	20.9	23.3	27.9	23.3	30.5	23.3	30.5
	75	15.0	18.0	17.1	20.5	21.0	25.2	23.3	34.3	23.3	38.8	23.3	39.5
	100	16.5	19.8	18.8	22.5	22.9	27.4	23.3	38.8	23.3	42.6	23.3	42.6
	150	16.5	19.8	18.8	22.5	22.9	27.4	23.3	38.8	23.3	42.6	23.3	42.6
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 150 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	20.5	31.9	23.7	33.9	28.1	36.4	32.8	38.9	43.4	43.9	45.7	47.9
	100	25.4	40.8	29.0	43.0	34.0	45.7	39.3	48.4	51.2	53.7	53.8	59.1
	150	26.6	53.7	30.4	55.8	35.5	58.3	41.0	60.8	53.2	65.9	55.6	71.0
	200	26.6	63.9	30.4	68.4	35.5	70.9	41.0	73.3	53.2	78.2	55.6	83.1
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 86 mm**	100		125		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 180 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	31.3	46.6	36.3	49.6	41.6	52.5	53.4	58.3	66.6	64.1	66.7	70.0
	150	40.1	65.5	45.9	68.5	52.0	71.4	65.6	77.4	66.7	83.3	66.7	89.3
	200	40.1	79.8	45.9	82.6	52.0	85.5	65.6	91.2	66.7	96.9	66.7	102.6
	250	40.1	94.0	45.9	96.8	52.0	99.5	65.6	105.0	66.7	110.6	66.7	116.1
Anchor Size	= M20	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 102 mm**	120		150		200		250		300		350	
Min. Concrete Thickness	**(h_{min}) = 220 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	120	44.3	63.5	51.3	67.5	64.3	74.1	78.7	80.7	94.5	87.3	96.5	93.9
	150	54.9	79.8	63.0	84.1	77.6	91.1	93.8	98.1	111.1	105.1	111.1	112.1
	200	56.0	96.0	64.2	100.0	79.0	106.6	95.4	113.3	111.1	119.9	111.1	126.6
	250	56.0	112.0	64.2	115.8	79.0	122.3	95.4	128.7	111.1	135.1	111.1	141.6



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

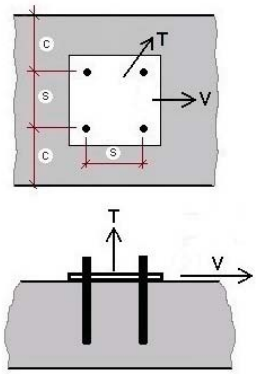


Table 6B: TITEN HD with Four Anchors, 2-Edges, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 47 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 105 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	6.2	7.5	8.2	9.9	10.5	12.6	13.3	15.9	13.3	15.9	13.3	15.9
	75	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.2	13.3	22.7	13.3	22.7
	100	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.2	13.3	22.7	13.3	22.7
	150	8.7	10.4	11.1	13.3	13.3	16.6	13.3	22.2	13.3	22.7	13.3	22.7
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 125 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	60	8.6	10.4	10.0	12.0	12.4	14.9	16.7	19.8	16.7	21.6	16.7	21.6
	75	10.7	12.8	12.2	14.6	15.0	18.0	16.7	24.3	16.7	27.5	16.7	28.2
	100	11.8	14.1	13.4	16.0	16.3	19.6	16.7	27.6	16.7	30.4	16.7	30.4
	150	11.8	14.1	13.4	16.0	16.3	19.6	16.7	27.6	16.7	30.4	16.7	30.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 150 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	14.6	22.6	16.9	24.0	20.0	25.8	23.4	27.5	26.7	31.1	26.7	33.9
	100	18.1	28.9	20.7	30.5	24.2	32.4	26.7	34.3	26.7	38.1	26.7	41.9
	150	19.0	38.1	21.7	39.5	25.3	41.3	26.7	43.1	26.7	46.7	26.7	50.3
	200	19.0	45.6	21.7	48.5	25.3	50.2	26.7	51.9	26.7	55.4	26.7	58.9
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 86 mm	100		125		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 180 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	22.3	33.0	25.9	35.1	29.7	37.2	38.1	41.3	47.5	45.4	49.1	49.6
	150	28.6	46.4	32.7	48.5	37.1	50.6	46.8	54.8	55.6	59.0	55.6	63.3
	200	28.6	56.5	32.7	58.5	37.1	60.6	46.8	64.6	55.6	68.6	55.6	72.7
	250	28.6	66.6	32.7	68.5	37.1	70.5	46.8	74.4	55.6	78.3	55.6	82.2
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 102 mm	120		150		200		250		300		350	
Min. Concrete Thickness	(h_{min}) = 220 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	120	31.6	45.0	36.6	47.8	45.8	52.5	56.1	57.1	67.3	61.8	68.8	66.5
	150	39.1	56.6	44.9	59.5	55.3	64.5	66.9	69.5	77.8	74.4	77.8	79.4
	200	39.9	68.0	45.8	70.8	56.3	75.5	68.0	80.2	77.8	85.0	77.8	89.7
	250	39.9	79.3	45.8	82.0	56.3	86.6	68.0	91.2	77.8	95.7	77.8	100.3

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

BOAX-II THROUGHBOLT *Expansion Anchor*

SIMPSON Strong-Tie®

Economical wedge-type anchor for medium-duty loads, into cracked and non-cracked concrete.

APPLICATIONS:
- Steel Fixtures
- Cable trays
- Overhead Anchoring (Tension Zones)
- Facades
- Brackets
- Railing
- Ladders

APPROVALS: **ETA-08/0276 (Option 1)**

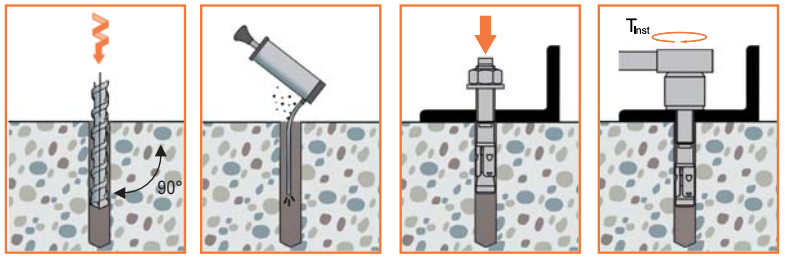
FEATURES:
- Approved for use in cracked and non-cracked concrete
- No Special Drill Bits
- Made in Europe

MATERIAL: Carbon Steel, and A4 Stainless Steel

FINISH: Zinc Plated Carbon Steel and A4 Stainless Steel

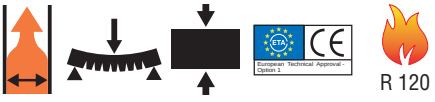
BASE MATERIAL: Cracked and non-cracked concrete.
Also suitable for high density natural stone ($\sigma_D \geq 25$ N/mm^2)

INSTALLATION:



1. Drill hole
2. Clean hole (blowing)
3. Insert anchor through fixture
4. Apply recommended fastening torque with a calibrated torque-wrench

BoAX-II Throughbolt with Hex Nut, Washer



Product Availability: Carbon Steel, Zinc Plated

Model Size.	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embed-ment Depth	Total Length	Thread Length	Weight	Box Quantity
			$d_0 \times h_1$	$t_{fix,max}$	d_f	h_{ef}	L	f		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
BoA-X 6/15*	BOAX0606035015	M6	6 x 50	15	7	35	65	28	1.54	100
BoA-X 6/50*	BOAX0606035050	M6	6 x 50	50	7	35	100	28	2.27	100
BoAX-II 8/10	BOAXII08045010	M8	8 x 60	10	9	45	72	32	2.91	50
BoAX-II 8/30	BOAXII08045030	M8	8 x 60	30	9	45	92	52	3.53	50
BoAX-II 8/50	BOAXII08045050	M8	8 x 60	50	9	45	112	72	4.14	40
BoAX-II 8/85	BOAXII08045085	M8	8 x 60	85	9	45	147	107	5.21	40
BoAX-II 10/10	BOAXII10060010	M10	10 x 75	10	12	60	92	47	5.92	40
BoAX-II 10/20	BOAXII10060020	M10	10 x 75	20	12	60	102	57	6.41	25
BoAX-II 10/30	BOAXII10060030	M10	10 x 75	30	12	60	112	67	6.91	25
BoAX-II 10/50	BOAXII10060050	M10	10 x 75	50	12	60	132	87	7.89	25
BoAX-II 10/80	BOAXII10060080	M10	10 x 75	80	12	60	162	115	9.37	25
BoAX-II 12/5	BOAXII12070005	M12	12 x 90	5	14	70	103	53	9.53	20
BoAX-II 12/20	BOAXII12070020	M12	12 x 90	20	14	70	118	68	10.60	20
BoAX-II 12/30	BOAXII12070030	M12	12 x 90	30	14	70	128	78	11.31	20
BoAX-II 12/50	BOAXII12070050	M12	12 x 90	50	14	70	148	98	12.73	20
BoAX-II 12/65	BOAXII12070065	M12	12 x 90	65	14	70	163	113	13.80	20
BoAX-II 12/80	BOAXII12070080	M12	12 x 90	80	14	70	178	115	14.87	20
BoAX-II 16/5	BOAXII16085005	M16	16 x 110	5	18	85	123	65	20.16	10
BoAX-II 16/20	BOAXII16085020	M16	16 x 110	20	18	85	138	80	22.17	10
BoAX-II 16/50	BOAXII16085050	M16	16 x 110	50	18	85	168	110	26.19	10
BoAX-II 16/60	BOAXII16085060	M16	16 x 110	60	18	85	178	115	27.53	10
BoA-X 16/95*	BOAX1616085095	M16	16 x 110	95	18	80	213	55	35.01	10
BoA-X 20/20*	BOAX2020110020	M20	20 x 130	20	22	110	170	55	44.83	5
BoA-X 20/70*	BOAX2020110070	M20	20 x 130	70	22	110	220	55	57.02	5
BoA-X 20/130*	BOAX2020110130	M20	20 x 130	130	22	110	280	55	71.78	5

*Not included in approval.

Product Availability: A4 stainless steel

Model Size.	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Thread Length	Weight	Box Quantity
			$d_0 \times h_1$	$t_{fix,max}$	d_f	h_{ef}	L	f		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
BoA-X 6/15 A4*	BOAX0606035015A4	M6	6 x 50	15	7	35	65	28	1.5	100
BoAX-II 8/10 A4	BOAXII08045010A4	M8	8 x 60	10	9	45	72	32	2.9	50
BoAX-II 8/30 A4	BOAXII08045030A4	M8	8 x 60	30	9	45	92	52	3.5	50
BoAX-II 8/50 A4	BOAXII08045050A4	M8	8 x 60	50	9	45	112	72	4.1	40
BoAX-II 10/10 A4	BOAXII10060010A4	M10	10 x 75	10	12	60	92	47	5.9	40
BoAX-II 10/20 A4	BOAXII10060020A4	M10	10 x 75	20	12	60	102	57	6.4	25
BoAX-II 10/30 A4	BOAXII10060030A4	M10	10 x 75	30	12	60	112	67	6.9	25
BoAX-II10/50 A4	BOAXII10060050A4	M10	10 x 75	50	12	60	132	87	7.9	25
BoAX-II 12/5 A4	BOAXII12070005A4	M12	12 x 90	5	14	70	103	53	9.5	20
BoAX-II 12/20 A4	BOAXII12070020A4	M12	12 x 90	20	14	70	118	68	10.6	20
BoAX-II 12/30 A4	BOAXII12070030A4	M12	12 x 90	30	14	70	128	78	11.3	20
BoAX-II 12/50 A4	BOAXII12070050A4	M12	12 x 90	50	14	70	148	98	12.7	20
BoAX-II 12/65 A4	BOAXII12070065A4	M12	12 x 90	65	14	70	163	113	13.8	20
BoAX-II 16/5 A4	BOAXII16085005A4	M16	16 x 110	5	18	85	123	65	20.2	10
BoAX-II 16/20 A4	BOAXII16085020A4	M16	16 x 110	20	18	85	138	80	22.2	10
BoAX-II 16/50 A4	BOAXII16085050A4	M16	16 x 110	50	18	85	168	110	26.2	10
BoA-X 20/20 A4*	BOAX2020110020A4	M20	20 x 130	20	22	110	170	55	44.8	5
BoA-X 20/70 A4*	BOAX2020110070A4	M20	20 x 130	70	22	110	220	55	57.0	5

*Not included in approval.

Installation Data

Description	Symbol	Units	Anchor Size			
			M8	M10	M12	M16
Drill Hole Diameter	d_o	mm	8	10	12	16
Maximum Diameter of Drill Bit	$d_{cut,\ max} \leq$	mm	8.45	10.45	12.50	16.50
Drill Depth	$h_1 \geq$	mm	60	75	90	110
Effective Anchorage Depth	h_{ef}	mm	45	60	70	85
Anchor Length Range	L	mm	72-147	92-162	103-178	123-213
Clearance Hole Diameter in Fixture	$d_f \leq$	mm	9	12	14	18
Maximum Thickness of Fixture	$t_{fix,max}$	mm	85	80	80	95
Width Across Flats	SW	mm	13	17	19	24
Installation Torque	T_{inst}	Nm	20	35	50	120

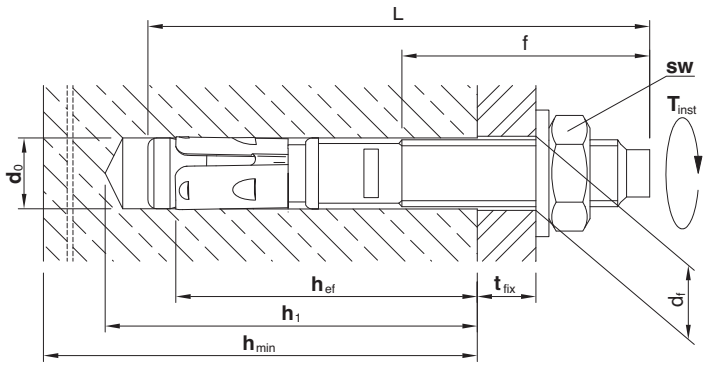
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M8	M10	M12	M16
Minimum Concrete Thickness	h_{min}	mm	100	120	140	170
Minimum Spacing	s_{min}	mm	50	55	60	70
	when c ≥	mm	50	80	90	120
Minimum Edge Distance	c_{min}	mm	50	50	55	85
	when s ≥	mm	50	100	145	150
Critical Spacing (cone)	$s_{cr,N}$	mm	135	180	210	255
Critical Edge Distance (cone)	$c_{cr,N}$	mm	68	90	105	128
Critical Spacing (splitting)	$s_{cr,sp}$	mm	180	240	280	340
Critical Edge Distance (splitting)	$c_{cr,sp}$	mm	90	120	140	170

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8, 9]

Description	Symbol	Units	M8	M10	M12	M16
Effective Embedment Depth	h_{ef}	mm	45	60	70	85
Minimum Concrete Thickness	h_{min}	mm	100	120	140	170
			Non-Cracked Concrete			
TENSION	N_{Rd}	kN	5.0	8.9	11.1	23.3
SHEAR	V_{Rd}	kN	**6.7**	**12.0**	**15.3**	**29.3**
			Cracked Concrete			
TENSION	N_{Rd}	kN	2.8	5.0	6.7	13.3
SHEAR	V_{Rd}	kN	5.3	**12.0**	**15.3**	**29.3**

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$
4. V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing and Critical Edge Distance is taken from the relevant ETA. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Bold values indicate that steel controls design resistance.
9. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}

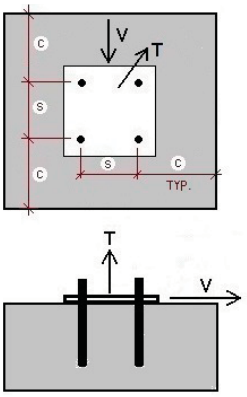


SIMPSON Strong-Tie®

Table 1A: BOAX-II with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	5.7	4.0	7.8	4.7	10.2	5.4	11.7	6.7	12.9	6.7	12.9	6.7
	75	8.3	6.1	10.5	6.9	13.0	7.7	18.7	9.2	19.6	10.7	19.6	11.0
	100	10.0	8.3	12.3	9.1	14.9	9.9	20.0	11.6	20.0	13.3	20.0	13.6
	150	11.5	11.0	14.9	11.8	18.6	12.6	20.0	14.2	20.0	15.8	20.0	17.3
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 60 mm	55		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 120 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	-	-	-	-	11.2	5.9	12.9	7.4	15.2	7.4	17.3	7.4
	80	10.3	7.4	12.3	8.1	15.0	8.9	21.3	10.6	24.2	12.4	26.1	13.7
	100	12.9	9.2	15.0	10.0	17.9	10.9	24.3	12.7	31.7	14.5	33.3	16.0
	150	17.8	13.1	20.9	13.8	25.2	14.8	35.1	16.6	35.6	18.5	35.6	20.3
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	55	-	-	-	-	-	-	15.1	8.4	17.3	8.9	20.3	8.9
	90	12.8	9.0	14.5	9.6	17.4	10.5	24.2	12.4	29.5	14.3	31.9	16.2
	120	17.3	12.2	19.1	12.8	22.2	13.8	29.3	15.8	37.3	17.8	44.4	19.9
	150	20.6	15.1	22.5	15.7	25.7	16.8	32.9	18.9	41.0	20.9	44.4	23.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 85 mm	70		100		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 170 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	85	-	-	-	-	30.6	12.8	36.0	14.9	39.3	16.9	43.2	17.1
	100	-	-	-	-	33.7	14.8	44.0	16.9	46.9	19.0	50.6	21.1
	120	24.2	13.8	29.1	15.1	38.2	17.3	48.7	19.6	58.4	21.8	61.6	24.0
	150	30.8	17.4	36.0	18.8	45.5	21.2	56.2	23.5	68.0	25.9	80.9	28.2

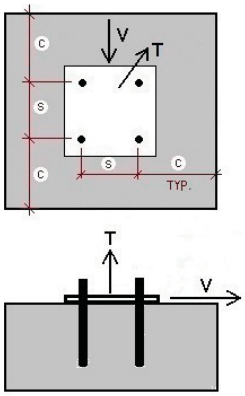


1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 1B: BOAX-II with Four Anchors, Four Edge Distances, Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	4.1	2.9	5.6	3.3	7.3	3.8	8.3	4.8	9.2	4.8	9.2	4.8
	75	5.9	4.3	7.5	4.9	9.2	5.4	11.1	6.5	11.1	7.6	11.1	7.8
	100	7.2	5.9	8.8	6.5	11.1	7.0	11.1	8.2	11.1	9.4	11.1	9.7
	150	8.2	7.8	10.6	8.4	11.1	8.9	11.1	10.0	11.1	11.2	11.1	12.3
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 60 mm	55		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 120 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	-	-	-	-	8.0	4.2	9.2	5.2	10.8	5.2	12.3	5.2
	80	7.3	5.2	8.7	5.7	10.7	6.3	15.2	7.5	17.2	8.8	18.6	9.7
	100	9.2	6.6	10.7	7.1	12.7	7.7	17.3	9.0	20.0	10.3	20.0	11.4
	150	12.7	9.3	14.9	9.8	18.0	10.5	20.0	11.8	20.0	13.1	20.0	14.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	55	-	-	-	-	-	-	10.8	5.9	12.5	6.3	14.5	6.3
	90	9.1	6.4	10.3	6.8	12.4	7.5	17.3	8.8	21.1	10.1	22.8	11.5
	120	12.4	8.6	13.6	9.0	15.9	9.8	20.9	11.2	26.6	12.6	26.7	14.1
	150	14.7	10.7	16.0	11.1	18.3	11.9	23.5	13.4	26.7	14.8	26.7	16.3
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 85 mm	70		100		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 170 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	85	-	-	-	-	21.8	9.1	25.7	10.5	28.0	11.9	30.8	12.1
	100	-	-	-	-	24.0	10.5	31.4	12.0	33.4	13.4	36.1	14.9
	120	17.2	9.8	20.7	10.7	27.2	12.3	34.7	13.9	41.6	15.4	43.9	17.0
	150	21.9	12.3	25.6	13.3	32.4	15.0	40.1	16.7	48.5	18.3	53.3	20.0



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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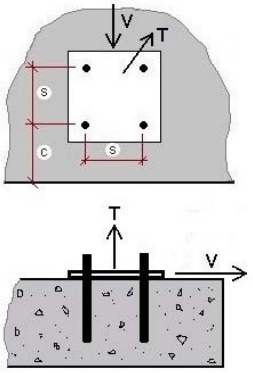
Table 2A: BOAX-II with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	7.2	6.0	9.0	6.7	11.0	7.5	15.7	9.0	18.9	9.0	18.9	9.0
	75	8.9	9.0	11.0	9.8	13.4	10.6	18.7	12.2	20.0	13.9	20.0	14.7
	100	10.0	11.0	12.3	11.8	14.9	12.6	20.0	14.2	20.0	15.8	20.0	17.3
	150	11.5	13.8	14.9	15.8	18.6	16.6	20.0	18.1	20.0	19.6	20.0	21.1
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	13.7	8.2	18.7	9.8	24.3	9.8	29.4	9.8
	80	12.3	11.3	14.1	12.0	16.6	13.0	22.3	14.9	27.9	15.9	34.4	18.3
	100	14.0	13.1	16.0	13.8	18.7	14.8	24.8	16.6	31.8	18.5	35.6	20.3
	150	17.8	17.7	20.9	18.4	25.2	19.3	35.1	21.0	35.6	22.8	35.6	24.5
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	21.6	11.3	27.6	11.8	34.4	11.8
	90	15.7	13.8	17.2	14.4	20.0	15.5	26.0	17.6	32.8	19.7	40.5	21.8
	120	18.6	17.1	20.3	17.7	23.3	18.7	30.1	20.8	37.7	22.8	44.4	24.8
	150	20.6	20.1	22.5	20.7	25.7	21.7	32.9	23.7	41.0	25.6	44.4	27.6
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	35.6	18.1	44.1	20.3	53.5	22.5	63.7	22.7
	100	-	-	-	-	38.1	21.1	47.0	23.4	56.8	25.8	67.5	28.1
	120	28.4	20.7	33.0	22.2	41.5	24.6	50.9	27.0	61.3	29.4	72.7	31.8
	150	32.6	24.2	37.6	25.6	46.9	27.9	57.2	30.2	68.5	32.5	80.8	34.9



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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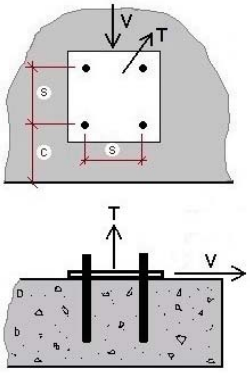


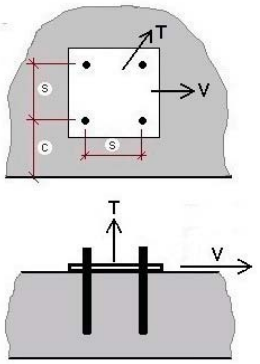
Table 2B: BOAX-II with Four Anchors, One Edge Distance, Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	5.1	4.2	6.4	4.8	7.9	5.3	11.1	6.4	11.1	6.4	11.1	6.4
	75	6.4	6.4	7.9	6.9	9.5	7.5	11.1	8.7	11.1	9.8	11.1	10.4
	100	7.2	7.8	8.8	8.4	10.6	8.9	11.1	10.0	11.1	11.2	11.1	12.3
	150	8.2	9.9	10.6	11.2	11.1	11.8	11.1	12.8	11.1	13.9	11.1	15.0
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	9.8	5.8	13.3	6.9	17.3	6.9	20.0	6.9
	80	8.7	8.0	10.1	8.5	11.9	9.2	15.9	10.5	20.0	11.9	20.0	13.0
	100	10.0	9.3	11.4	9.8	13.3	10.5	17.7	11.8	20.0	13.1	20.0	14.4
	150	12.7	12.5	14.9	13.0	18.0	13.6	20.0	14.9	20.0	16.1	20.0	17.4
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	15.4	8.0	19.7	8.4	24.5	8.4
	90	11.2	9.8	12.3	10.2	14.2	11.0	18.5	12.5	23.4	13.9	26.7	15.4
	120	13.2	12.1	14.5	12.6	16.6	13.3	21.4	14.7	26.7	16.2	26.7	17.6
	150	14.7	14.3	16.0	14.7	18.3	15.4	23.5	16.8	26.7	18.2	26.7	19.6
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	25.4	12.8	31.4	14.4	38.1	16.0	45.4	16.1
	100	-	-	-	-	27.2	14.9	33.5	16.6	40.5	18.3	48.1	19.9
	120	20.3	14.7	23.6	15.7	29.6	17.4	36.3	19.1	43.7	20.9	51.8	22.6
	150	23.2	17.1	26.8	18.1	33.4	19.8	40.8	21.4	48.8	23.0	53.3	24.7

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3A: BOAX-II with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	7.2	11.5	9.0	15.0	11.0	19.0	15.7	22.4	18.9	22.4	18.9	22.4
	75	8.9	13.8	11.0	17.8	13.4	22.3	18.7	29.5	20.0	29.5	20.0	29.5
	100	10.0	13.8	12.3	17.8	14.9	22.3	20.0	29.5	20.0	29.5	20.0	29.5
	150	11.5	13.8	14.9	17.8	18.6	22.3	20.0	29.5	20.0	29.5	20.0	29.5
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 60 mm	55		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 120 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	-	-	-	-	13.7	20.4	18.7	24.5	24.3	24.5	29.4	24.5
	80	8.9	28.1	14.1	30.0	16.6	32.4	22.3	37.2	28.7	42.0	34.4	45.8
	100	14.0	32.8	16.0	34.6	18.7	36.9	24.8	41.5	31.8	46.1	35.6	50.8
	150	17.8	42.7	20.9	46.0	25.2	48.1	35.1	52.5	35.6	56.9	35.6	61.3
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	55	-	-	-	-	-	-	21.6	28.2	27.6	29.5	34.4	29.5
	90	15.7	34.5	17.2	36.1	20.0	38.7	26.0	43.9	32.8	49.2	40.5	54.4
	120	18.6	42.8	20.3	44.3	23.3	46.8	30.1	51.9	37.7	57.0	44.4	62.1
	150	20.6	50.3	22.5	51.8	25.7	54.2	32.9	59.2	41.0	64.1	44.4	69.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 85 mm	70		100		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 170 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	85	-	-	-	-	35.6	45.2	44.1	50.7	53.5	56.3	63.7	56.9
	100	-	-	-	-	38.1	52.7	47.0	58.6	56.8	64.4	67.5	70.3
	120	28.4	51.9	33.0	55.5	41.5	61.5	50.9	67.5	61.3	73.6	72.7	79.6
	150	32.6	60.4	37.6	63.9	46.9	69.7	57.2	75.5	68.5	81.3	80.8	87.1



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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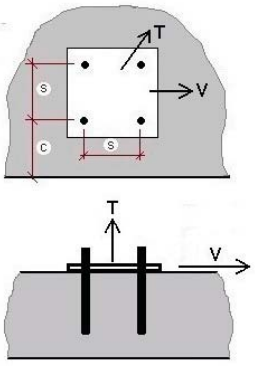
Table 3B: BOAX-II with Four Anchors, One Edge Distance, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size		= M8	Anchor Spacing (**s**)											
Effective Embedment		(h_{ef}) = 45 mm	50		75		100		150		200		250	
Min. Concrete Thickness		(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50		5.1	8.2	6.4	10.7	7.9	13.2	11.1	15.9	11.1	15.9	11.1	15.9
	75		6.4	9.9	7.9	12.7	9.5	15.9	11.1	21.0	11.1	21.0	11.1	21.0
	100		7.2	9.9	8.8	12.7	10.6	15.9	11.1	21.0	11.1	21.0	11.1	21.0
	150		8.2	9.9	10.6	12.7	11.1	16.0	11.1	21.0	11.1	21.0	11.1	21.0
Anchor Size		= M10	Anchor Spacing (**s**)											
Effective Embedment		(h_{ef}) = 60 mm	55		75		100		150		200		250	
Min. Concrete Thickness		(h_{min}) = 120 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50		-	-	-	-	9.8	14.5	13.3	17.3	17.3	17.3	20.0	17.3
	80		8.7	19.9	10.1	21.3	11.9	23.0	15.9	26.3	20.0	29.7	20.0	32.4
	100		10.0	23.2	11.4	24.5	13.3	26.2	17.7	29.4	20.0	32.7	20.0	36.0
	150		12.7	30.4	14.9	32.6	18.0	34.1	20.0	37.2	20.0	40.3	20.0	43.3
Anchor Size		= M12	Anchor Spacing (**s**)											
Effective Embedment		(h_{ef}) = 70 mm	60		75		100		150		200		250	
Min. Concrete Thickness		(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55		-	-	-	-	-	-	15.4	20.0	19.7	20.9	24.5	20.9
	90		11.2	24.5	12.3	25.6	14.2	27.4	18.5	31.1	23.4	34.8	26.7	38.5
	120		13.2	30.3	14.5	31.4	16.6	33.2	21.4	36.8	26.7	40.4	26.7	44.0
	150		14.7	35.6	16.0	36.7	18.3	38.4	23.5	41.9	26.7	45.4	26.7	48.9
Anchor Size		= M16	Anchor Spacing (**s**)											
Effective Embedment		(h_{ef}) = 85 mm	70		100		150		200		250		300	
Min. Concrete Thickness		(h_{min}) = 170 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85		-	-	-	-	25.4	32.0	31.4	35.9	38.1	39.9	45.4	40.3
	100		-	-	-	-	27.2	37.3	33.5	41.5	40.5	45.6	48.1	49.8
	120		20.3	36.7	23.6	39.3	29.6	43.6	36.3	47.8	43.7	52.1	51.8	56.4
	150		23.2	42.8	26.8	45.3	33.4	49.4	40.8	53.5	48.8	57.6	53.3	61.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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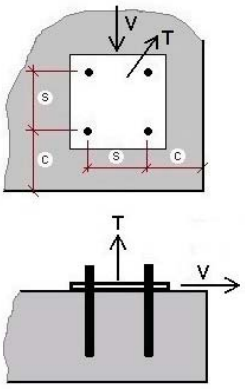
Table 4A: BOAX-II with Four Anchors, Corner, Non-Cracked Concrete (T, V⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	5.9	4.7	7.6	5.4	9.5	6.1	13.8	7.4	16.8	7.4	16.8	7.4
	75	8.3	7.0	10.4	7.7	12.6	8.4	17.9	9.9	20.0	11.4	20.0	12.1
	100	10.0	8.5	12.3	9.2	14.9	9.9	20.0	11.3	20.0	12.8	20.0	14.2
	150	11.5	11.5	14.9	12.2	18.6	12.9	20.0	14.3	20.0	15.6	20.0	17.0
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	10.9	6.6	15.3	8.1	20.5	8.1	25.1	8.1
	80	10.0	8.8	12.3	9.4	14.7	10.3	20.0	12.0	26.1	13.7	31.6	15.1
	100	13.0	10.1	15.0	10.8	17.6	11.6	23.6	13.3	30.4	15.0	35.6	16.6
	150	17.8	13.6	20.9	14.2	25.2	15.0	35.1	16.5	35.6	18.1	35.6	19.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	17.3	9.3	22.7	9.8	28.9	9.8
	90	13.4	10.7	14.8	11.3	17.3	12.2	23.0	14.1	29.4	16.0	36.7	17.9
	120	17.5	13.2	19.1	13.7	22.1	14.7	28.7	16.5	36.1	18.3	44.4	20.2
	150	20.6	15.4	22.5	16.0	25.7	16.9	32.9	18.6	41.0	20.4	44.4	22.2
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	29.4	14.6	37.2	16.6	45.8	18.6	55.3	18.8
	100	-	-	-	-	32.6	16.9	40.9	19.0	50.0	21.1	60.1	23.2
	120	25.0	16.1	29.3	17.4	37.3	19.5	46.2	21.7	56.1	23.9	67.0	26.1
	150	31.0	18.6	35.9	19.9	45.0	22.0	55.1	24.0	66.2	26.1	78.3	28.2



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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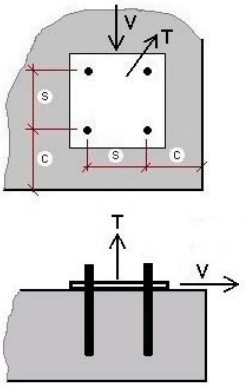
Table 4B: BOAX-II with Four Anchors, Corner, Cracked Concrete (T, V⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	4.2	3.3	5.4	3.8	6.7	4.3	9.9	5.2	11.1	5.2	11.1	5.2
	75	5.9	4.9	7.4	5.5	9.0	6.0	11.1	7.0	11.1	8.1	11.1	8.6
	100	7.2	6.0	8.8	6.5	10.6	7.0	11.1	8.0	11.1	9.0	11.1	10.0
	150	8.2	8.2	10.6	8.7	11.1	9.1	11.1	10.1	11.1	11.1	11.1	12.0
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	7.8	4.7	10.9	5.7	14.6	5.7	17.9	5.7
	80	7.6	6.2	8.8	6.7	10.5	7.3	14.2	8.5	18.6	9.7	20.0	10.7
	100	9.3	7.2	10.7	7.7	12.6	8.2	16.8	9.4	20.0	10.6	20.0	11.8
	150	12.7	9.6	14.9	10.0	18.0	10.6	20.0	11.7	20.0	12.8	20.0	14.0
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	12.4	6.6	16.2	6.9	20.6	6.9
	90	9.5	7.6	10.6	8.0	12.4	8.7	16.4	10.0	21.0	11.3	26.1	12.7
	120	12.5	9.4	13.6	9.7	15.8	10.4	20.4	11.7	25.7	13.0	26.7	14.3
	150	14.7	10.9	16.0	11.3	18.3	12.0	23.5	13.2	26.7	14.5	26.7	15.7
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	21.0	10.3	26.5	11.7	32.6	13.2	39.4	13.3
	100	-	-	-	-	23.3	12.0	29.1	13.4	35.7	14.9	42.9	16.4
	120	17.8	11.4	20.9	12.3	26.6	13.8	33.0	15.4	40.0	16.9	47.8	18.5
	150	22.1	13.2	25.6	14.1	32.1	15.6	39.3	17.0	47.2	18.5	53.3	20.0



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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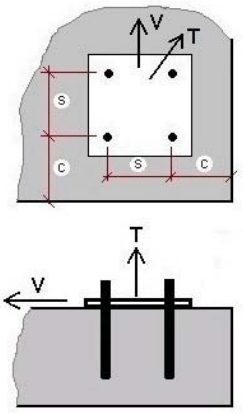
Table 5A: BOAX-II with Four Anchors, Corner, Non-Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	5.9	10.4	7.6	13.5	9.5	15.1	13.8	18.5	16.8	18.5	16.8	18.5
	75	8.3	13.8	10.4	17.8	12.6	21.1	17.9	24.8	20.0	28.4	20.0	29.5
	100	10.0	13.8	12.3	17.8	14.9	22.3	20.0	28.4	20.0	29.5	20.0	29.5
	150	11.5	13.8	14.9	17.8	18.6	22.3	20.0	29.5	20.0	29.5	20.0	29.5
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	10.9	16.5	15.3	20.2	20.5	20.2	25.1	20.2
	80	10.6	21.9	12.3	23.6	14.7	25.8	20.0	30.0	26.1	34.3	31.6	37.8
	100	13.0	25.3	15.0	27.0	17.6	29.1	23.6	33.2	30.4	37.4	35.6	41.5
	150	17.8	33.9	20.9	35.5	25.2	37.4	35.1	41.4	35.6	45.3	35.6	49.2
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	17.3	23.2	22.7	24.4	28.9	24.4
	90	13.4	26.8	14.8	28.2	17.3	30.6	23.0	35.3	29.4	40.0	36.7	44.7
	120	17.5	33.0	19.1	34.4	22.1	36.7	28.7	41.2	36.1	45.8	44.4	50.4
	150	20.6	38.6	22.5	39.9	25.7	42.2	32.9	46.6	41.0	51.0	44.4	55.5
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	29.4	36.4	37.2	41.4	45.8	46.4	55.3	46.9
	100	-	-	-	-	32.6	42.2	40.9	47.4	50.0	52.7	60.1	58.0
	120	25.0	40.2	29.3	43.4	37.3	48.9	46.2	54.3	56.1	59.7	67.0	65.1
	150	31.0	46.5	35.9	49.7	45.0	54.9	55.1	60.1	66.2	65.3	78.3	70.6

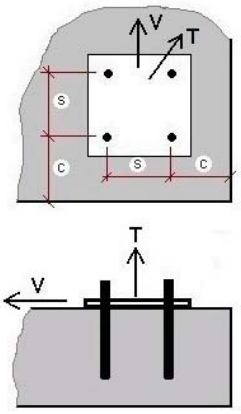


1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5B: BOAX II with Four Anchors, Corner, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

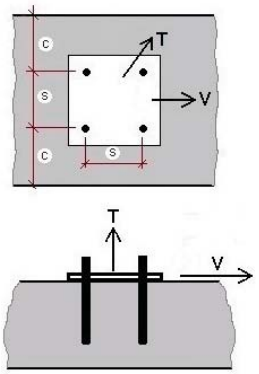
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	50		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	4.2	7.4	5.4	9.5	6.7	10.7	9.9	13.1	11.1	13.1	11.1	13.1
	75	5.9	9.9	7.4	12.7	9.0	15.0	11.1	17.6	11.1	20.2	11.1	21.0
	100	7.2	9.9	8.8	12.7	10.6	15.9	11.1	20.1	11.1	21.0	11.1	21.0
	150	8.2	9.9	10.6	12.7	11.1	15.9	11.1	21.0	11.1	21.0	11.1	21.0
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 60 mm	55		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 120 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	-	-	-	-	7.8	11.7	10.9	14.3	14.6	14.3	17.9	14.3
	80	7.6	15.5	8.8	16.7	10.5	18.2	14.2	21.3	18.6	24.3	20.0	26.8
	100	9.3	17.9	10.7	19.1	12.6	20.6	16.8	23.5	20.0	26.5	20.0	29.4
	150	12.7	24.0	14.9	25.1	18.0	26.5	20.0	29.3	20.0	32.1	20.0	34.9
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	60		75		100		150		200		250	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	55	-	-	-	-	-	-	12.4	16.4	16.2	17.3	20.6	17.3
	90	9.5	19.0	10.6	20.0	12.4	21.7	16.4	25.0	21.0	28.3	26.1	31.7
	120	12.5	23.4	13.6	24.3	15.8	26.0	20.4	29.2	25.7	32.5	26.7	35.7
	150	14.7	27.4	16.0	28.3	18.3	29.9	23.5	33.0	26.7	36.2	26.7	39.3
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 85 mm	70		100		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 170 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	85	-	-	-	-	21.0	25.8	26.5	29.3	32.6	32.9	39.4	33.2
	100	-	-	-	-	23.3	29.9	29.1	33.6	35.7	37.3	42.9	41.1
	120	17.8	28.5	20.9	30.8	26.6	34.6	33.0	38.4	40.0	42.3	47.8	46.1
	150	22.1	33.0	25.6	35.2	32.1	38.9	39.3	42.6	47.2	46.3	53.3	50.0



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SIMPSON Strong-Tie®

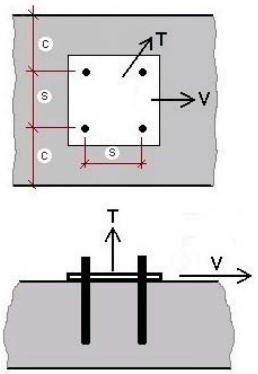
Table 6A: BOAX-II with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	5.7	10.3	7.3	13.7	9.2	17.5	13.6	22.4	16.6	22.4	16.6	22.4
	75	8.3	13.8	10.3	17.8	12.6	22.3	17.8	29.5	20.0	29.5	20.0	29.5
	100	10.0	13.8	12.3	17.8	14.9	22.3	20.0	29.5	20.0	29.5	20.0	29.5
	150	11.5	13.8	14.9	17.8	18.6	22.3	20.0	29.5	20.0	29.5	20.0	29.5
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	10.2	20.4	14.6	24.5	19.7	24.4	24.4	24.5
	80	10.3	28.1	12.1	30.0	14.4	32.4	19.7	37.2	25.8	42.0	31.3	45.8
	100	12.9	32.8	14.9	34.6	17.6	36.9	23.5	41.5	30.3	46.1	35.6	50.8
	150	17.8	42.7	20.9	46.0	25.2	48.1	35.1	52.5	35.6	56.9	35.6	61.3
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	16.3	28.2	21.7	29.5	27.8	29.5
	90	13.0	34.5	14.4	36.1	16.9	38.7	22.6	43.9	29.0	49.2	36.3	54.4
	120	17.4	42.8	19.1	44.3	22.0	46.8	28.6	51.9	36.0	57.0	44.3	62.1
	150	20.6	50.3	22.5	51.8	25.7	54.2	32.9	59.2	41.0	64.1	44.4	69.0
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	28.1	45.2	35.9	50.7	44.5	56.3	54.0	56.9
	100	-	-	-	-	31.7	52.7	40.0	58.6	49.1	64.4	59.2	70.3
	120	24.5	51.9	28.8	55.5	36.8	61.5	45.7	67.5	55.7	73.6	66.5	79.6
	150	30.9	60.4	35.8	63.9	44.9	69.7	55.0	75.5	66.1	81.3	78.2	87.1



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SIMPSON Strong-Tie®

Table 6B: BOAX-II with Four Anchors, 2-Edges, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	50		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	4.0	7.4	5.2	9.8	6.6	12.5	9.7	15.9	11.1	15.9	11.1	15.9
	75	5.9	9.9	7.4	12.7	9.0	15.9	11.1	21.0	11.1	21.0	11.1	21.0
	100	7.2	9.9	8.8	12.7	10.6	15.9	11.1	21.0	11.1	21.0	11.1	21.0
	150	8.2	9.9	10.6	12.7	11.1	15.9	11.1	21.0	11.1	21.0	11.1	21.0
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 60 mm**	55		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 120 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	-	-	-	-	7.2	14.5	10.4	17.3	14.1	17.3	17.4	17.3
	80	7.4	19.9	8.6	21.3	10.3	23.0	14.1	26.3	18.4	29.7	20.0	32.4
	100	9.2	23.2	10.6	24.5	12.5	26.2	16.7	29.4	20.0	32.7	20.0	36.0
	150	12.7	30.4	14.9	32.6	18.0	34.1	20.0	37.2	20.0	40.3	20.0	43.4
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	60		75		100		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	55	-	-	-	-	-	-	11.6	20.0	15.5	20.9	19.8	20.9
	90	9.3	24.5	10.3	25.6	12.1	27.4	16.1	31.1	20.7	34.8	25.8	38.5
	120	12.4	30.3	13.6	31.4	15.7	33.2	20.4	36.8	25.7	40.4	26.7	44.0
	150	14.7	35.6	16.0	36.7	18.3	38.4	23.5	41.9	26.7	45.4	26.7	48.9
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 85 mm**	70		100		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 170 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	85	-	-	-	-	20.1	32.0	25.6	35.9	31.7	39.9	38.5	40.3
	100	-	-	-	-	22.6	37.3	28.5	41.5	35.0	45.6	42.2	49.8
	120	17.4	36.7	20.5	39.3	26.2	43.6	32.6	47.8	39.7	52.1	47.4	56.4
	150	22.0	42.8	25.6	45.3	32.0	49.4	39.2	53.5	47.1	57.6	53.3	61.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

THROUGHBOLT WA *Expansion Anchor*

SIMPSON Strong-Tie®

Simple and economical wedge-type expansion anchor for medium-duty loads into non-cracked concrete.

Throughbolt WA with Hex Nut, Sleeve and Washer

APPLICATIONS:

- Steel Fixtures
- Brackets
- Facades
- Ladders
- Railing
- Ladders
- Cable trays

APPROVALS: **ETA-11/0080 (Option 7)**

FEATURES:

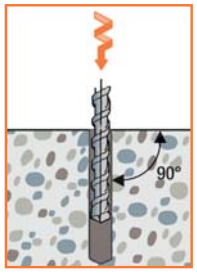
Application of the installation torque draws the cone end of the stud into the expansion clip. The expansion clip expands and develops a frictional grip with the sidewalls of the hole. This gives the anchor its resistance to tension loads.

- Economical anchor for medium-duty loads
- Approved for use in non-cracked concrete

MATERIAL: Carbon Steel, Zinc Plated and Blue Passivated

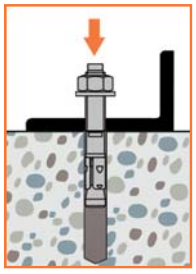
BASE MATERIAL: Non-cracked concrete.

INSTALLATION:

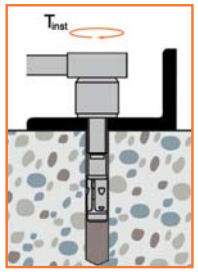


1. Drill hole

2. Clean hole (blowing)



3. Insert anchor through fixture



4. Apply recommended fastening torque with a calibrated torque-wrench

Product Availability: Carbon steel, Zinc Plated

Model Size.	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Thread Length	Weight	Box Quantity
			$d_0 \times h_1$	$t_{fix,max}$	d_f	h_{ef}	L	f		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
WA 6/5	WA06060	M6	6 x 55	5	7	40	60	14	500	100
WA 6/20	WA06075	M6		20			75	16.4	500	100
WA 6/30	WA06085	M6		30			85	18.1	500	100
WA 8/5	WA08068	M8	8 x 65	5	9	45	68	28.4	250	50
WA 8/20	WA08083	M8		20			83	33.0	250	50
WA 8/30	WA08093	M8		30			93	36.1	200	50
WA 8/50	WA08113	M8		50			113	42.2	200	50
WA 8/100	WA08163	M8		100			163	57.5	200	50
WA 10/10	WA10083	M10	10 x 70	10	12	50	83	56.1	200	50
WA 10/20	WA10093	M10		20			93	61	200	50
WA 10/30	WA10103	M10		30			103	65.8	200	50
WA 10/50	WA10123	M10		50			123	75.5	200	50
WA 10/70	WA10143	M10		70			143	85.2	100	50
WA 10/100	WA10173	M10		100			173	99.6	100	50
WA 10/140	WA10213	M10		140			213	120.6	100	50
WA 12/05	WA12085	M12	12 x 90	5	14	65	85	84.4	125	25
WA 12/10	WA12109	M12		10			109	101.4	100	25
WA 12/30	WA12129	M12		30			129	115.4	100	25
WA 12/50	WA12149	M12		50			149	129.6	100	25
WA 12/100	WA12199	M12		100			199	164.7	50	25
WA 12/120	WA12219	M12		120			219	178.8	50	25
WA 12/140	WA12239	M12		140			239	202.0	50	25
WA 12/160	WA12259	M12		160			259	225.6	40	20
WA 16/05	WA16110	M16	16 x 110	10	18	80	110	190	80	20
WA 16/30	WA16151	M16		30			151	243.4	40	20
WA 16/50	WA16171	M16		50			171	269.6	40	20
WA 16/80	WA16201	M16		80			201	308.9	20	10
WA 16/100	WA16221	M16		100			221	362.2	20	10
WA 16/140	WA16261	M16		140			261	420.2	20	10
WA 20/05 [1]	WA20120	M20	20 x 130	5	22	100	120	332.8	40	10
WA 20/30 [1]	WA20173	M20		30			173	441.1	40	10
WA 20/50 [1]	WA20193	M20		50			193	490.0	40	10
WA 20/120 [1]	WA20263	M20		120			263	652.3	20	10

1. This size is not listed in the ETA.

Installation Data

Description	Symbol	Units	Anchor Size				
			M6	M8	M10	M12	M16
Drill Hole Diameter	d_o	mm	6	8	10	12	16
Maximum Diameter of Drill Bit	$d_{cut,\ max} \leq$	mm	6.45	8.45	10.45	12.50	16.50
Drill Depth	$h_1 \geq$	mm	55	65	70	90	110
Effective Anchorage Depth	h_{ef}	mm	40	45	50	65	80
Anchor Length Range	L	mm	60-85	68-163	78-233	104-259	151-261
Clearance Hole Diameter in Fixture	$d_f \leq$	mm	7	9	12	14	18
Maximum Thickness of Fixture	$t_{fix,max}$	mm	45	100	160	160	160
Width Across Flats	SW	mm	10	13	17	19	24
Installation Torque	T_{inst}	Nm	8	15	30	50	100

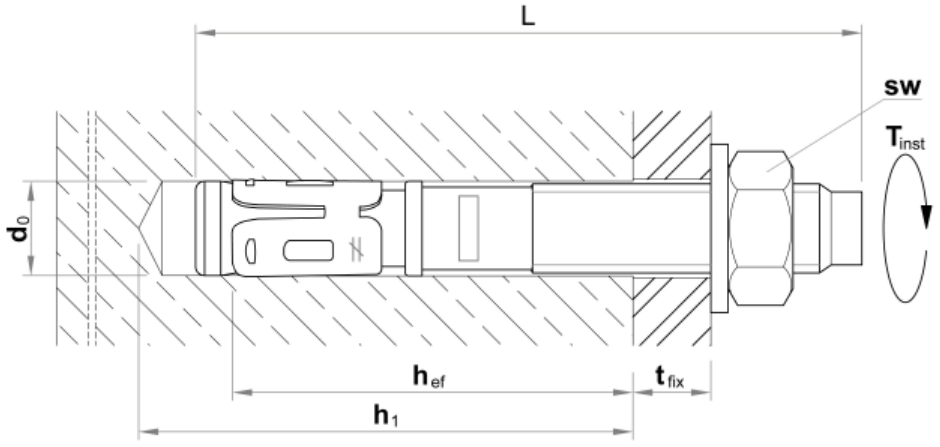
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M6	M8	M10	M12	M16
Minimum Concrete Thickness	h_{min}	mm	100	100	100	130	160
Minimum Spacing	s_{min}	mm	30	40	50	70	90
Minimum Edge Distance	c_{min}	mm	40	40	50	70	90
Critical Spacing (cone)	$s_{cr,N}$	mm	$3 \times h_{ef}$				
Critical Edge Distance (cone)	$c_{cr,N}$	mm	$1.5 \times h_{ef}$				
Critical Spacing (splitting)	$s_{cr,sp}$	mm	$2 \times C_{cr,sp}$				
Critical Edge Distance (splitting)	$c_{cr,sp}$	mm	80	115	125	180	200

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8, 9]

Description	Symbol	Units	M6	M8	M10	M12	M16
Effective Embedment Depth	h_{ef}	mm	40	45	50	65	80
Minimum Concrete Thickness	h_{min}	mm	100	100	100	130	160
			Non-Cracked Concrete				
TENSION	N_{Rd}	kN	6.0	7.4	8.9	14.6	21.7
SHEAR	V_{Rd}	kN	**4.8**	7.4	8.9	**20.0**	**37.6**

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$
4. V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing and Critical Edge Distance is taken from the relevant ETA. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Bold values indicate that steel controls design resistance.
9. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}



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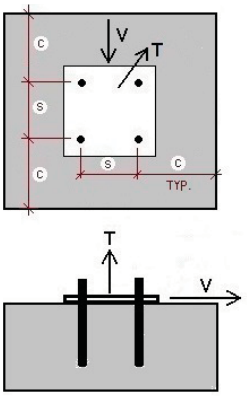

Table 1: WA with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	30		50		75		100		125		150	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	4.0	2.6	5.6	3.0	7.9	3.6	9.0	4.2	9.9	4.7	10.9	4.7
	100	9.3	7.2	12.0	7.9	15.7	8.6	20.0	9.4	23.9	10.2	23.9	11.0
	150	9.3	9.3	12.0	10.5	15.7	11.3	20.0	12.0	23.9	12.8	23.9	13.5
	200	9.3	9.3	12.0	12.0	15.7	13.9	20.0	14.6	23.9	15.4	23.9	16.1
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	40		75		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	3.4	3.0	5.7	3.9	6.4	4.5	7.1	5.0	7.9	5.0	9.6	5.0
	100	8.6	8.0	11.3	9.1	13.4	9.9	15.8	10.8	18.3	11.6	23.9	13.3
	150	12.4	10.7	17.8	11.8	22.3	12.6	27.3	13.4	29.5	14.2	29.5	15.8
	200	12.4	12.4	17.8	14.5	22.3	15.3	27.3	16.0	29.5	16.8	29.5	18.3
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 50 mm	50		75		100		125		150		175	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	5.1	4.3	6.9	5.0	9.0	5.7	9.6	6.4	10.4	7.1	11.3	7.1
	100	10.0	8.7	12.1	9.6	14.4	10.4	16.9	11.3	19.6	12.2	22.5	13.0
	150	15.9	11.5	20.1	12.3	24.8	13.1	30.0	13.9	35.7	14.8	35.7	15.6
	200	15.9	14.2	20.1	15.0	24.8	15.8	30.0	16.6	35.7	17.4	35.7	18.2
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	70		100		125		150		175		200	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	70	7.9	7.2	10.4	8.2	12.7	9.1	14.3	9.9	15.0	10.8	15.9	11.6
	100	11.0	10.3	13.6	11.4	15.9	12.3	18.5	13.3	21.2	14.2	24.1	15.2
	150	16.9	14.8	19.7	15.9	22.2	16.9	24.9	17.9	27.8	18.9	30.8	19.9
	200	20.8	18.0	23.8	19.1	26.4	20.1	29.2	21.0	32.2	22.0	35.2	22.9
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	90		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	90	14.7	10.9	18.8	12.3	22.0	13.3	25.5	14.3	26.8	15.3	29.0	17.3
	150	23.8	18.1	28.3	19.7	31.7	20.9	35.3	22.0	39.1	23.2	47.3	25.5
	200	32.5	22.3	37.4	23.9	41.0	25.0	44.8	26.2	48.8	27.3	57.3	29.6
	250	41.0	25.9	50.2	27.4	57.3	28.5	64.8	29.6	72.9	30.7	86.7	32.9

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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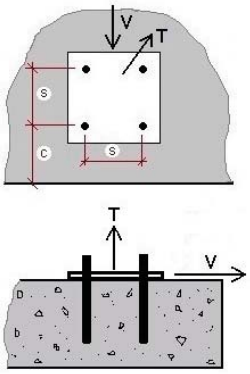
Table 2: WA with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	30		50		75		100		125		150	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	5.6	3.9	7.1	4.4	9.1	5.1	11.3	5.7	13.8	6.2	16.6	6.2
	100	9.3	9.3	12.0	10.5	15.7	11.3	20.0	12.0	23.9	12.8	23.9	13.5
	150	9.3	9.3	12.0	12.0	15.7	15.2	20.0	16.0	23.9	16.7	23.9	17.4
	200	9.3	9.3	12.0	12.0	15.7	15.8	20.0	19.8	23.9	20.5	23.9	21.2
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	40		75		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	5.9	4.4	7.9	5.4	9.4	6.1	11.1	6.7	13.0	6.7	17.1	6.7
	100	9.2	10.7	11.8	11.8	13.9	12.6	16.2	13.4	18.6	14.2	23.9	15.8
	150	12.4	12.4	17.8	15.8	22.3	16.6	27.3	17.3	29.5	18.1	29.5	19.6
	200	12.4	12.4	17.8	17.8	22.3	20.5	27.3	21.3	29.5	22.0	29.5	23.5
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 50 mm	50		75		100		125		150		175	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	7.9	6.3	9.5	7.1	11.3	7.9	13.2	8.7	15.2	9.5	17.4	9.5
	100	11.1	11.5	13.1	12.3	15.3	13.1	17.6	13.9	20.1	14.8	22.8	15.6
	150	10.7	15.6	20.1	16.4	24.8	17.2	30.0	18.0	35.7	18.7	35.7	19.5
	200	15.9	15.9	20.1	20.1	24.8	21.2	30.0	22.0	35.7	22.7	35.7	23.5
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	70		100		125		150		175		200	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	70	12.6	10.6	14.8	11.8	16.7	12.7	18.7	13.7	20.9	14.6	23.1	15.6
	100	14.7	14.8	17.0	15.9	19.1	16.9	21.4	17.9	23.7	18.9	26.2	19.9
	150	18.4	19.6	21.1	20.7	23.5	21.6	26.1	22.6	28.8	23.5	31.7	24.5
	200	20.8	24.3	23.8	25.4	26.4	26.3	29.2	27.2	32.2	28.1	35.2	29.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	90		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	90	21.1	16.1	24.7	17.7	27.4	18.8	30.3	19.9	33.3	21.1	39.7	23.3
	150	27.0	24.1	31.3	25.7	34.5	26.8	37.8	27.9	41.4	29.0	48.9	31.2
	200	32.5	29.5	37.4	31.0	41.0	32.1	44.8	33.1	48.8	34.2	57.3	36.3
	250	41.0	34.9	50.2	36.3	57.3	37.3	64.8	38.4	72.9	39.4	86.7	41.5



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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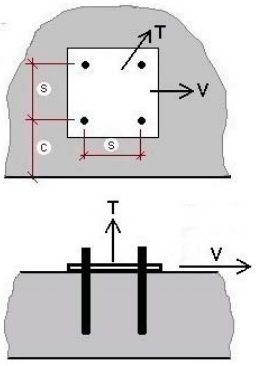
Table 3: WA with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	30		50		75		100		125		150	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	5.6	7.3	7.1	9.5	9.1	12.7	11.3	14.3	13.8	15.6	16.6	15.6
	100	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
	150	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
	200	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	40		75		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	5.9	9.2	7.9	13.5	9.4	15.2	11.1	16.6	13.0	16.6	17.1	16.6
	100	9.2	12.4	11.8	17.8	13.9	22.3	16.2	27.3	18.6	29.5	23.9	29.5
	150	12.4	12.4	17.8	17.8	22.3	22.3	27.3	27.3	29.5	29.5	29.5	29.5
	200	12.4	12.4	17.8	17.8	22.3	22.3	27.3	27.3	29.5	29.5	29.5	29.5
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 50 mm	50		75		100		125		150		175	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	7.9	12.5	9.5	16.1	11.3	19.7	13.2	21.7	15.2	23.6	17.4	23.6
	100	11.1	15.9	13.1	20.1	15.3	24.8	17.1	30.0	20.1	35.7	22.8	35.7
	150	15.9	15.9	20.1	20.1	24.8	24.8	30.0	30.0	35.7	35.7	35.7	35.7
	200	15.9	15.9	20.1	20.1	24.8	24.8	30.0	30.0	35.7	35.7	35.7	35.7
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	70		100		125		150		175		200	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	70	12.6	26.6	14.8	29.5	16.7	31.8	18.7	34.2	20.9	36.6	23.1	37.0
	100	14.7	36.9	17.0	39.5	19.1	42.4	21.4	44.8	23.7	47.3	26.2	49.8
	150	18.4	48.9	21.1	51.7	23.5	54.1	26.1	56.4	28.8	58.8	31.7	61.1
	200	20.8	53.8	23.8	63.3	26.4	65.8	29.2	68.0	32.2	70.3	35.2	72.6
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	90		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	90	21.1	40.3	24.7	44.3	27.4	47.1	30.3	49.9	33.3	52.7	39.7	58.3
	150	27.0	60.2	31.3	64.2	34.5	66.9	37.8	69.7	41.4	72.5	48.9	78.1
	200	32.5	73.8	37.4	77.5	41.0	80.2	44.8	82.8	48.8	85.5	57.3	90.9
	250	41.0	82.0	50.2	90.8	57.3	93.4	64.8	95.9	72.9	98.5	86.7	103.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SIMPSON Strong-Tie®

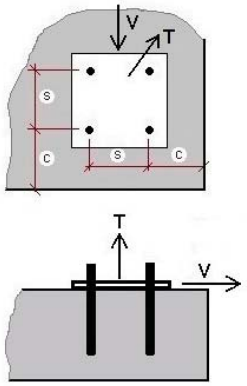


Table 4: WA with Four Anchors, Corner, Non-Cracked Concrete (T, V⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	30		50		75		100		125		150	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	4.5	3.0	5.7	3.5	7.5	4.1	9.6	4.7	11.9	5.1	14.4	5.1
	100	9.3	7.6	12.0	8.1	15.7	8.8	20.0	9.5	23.9	10.2	23.9	10.8
	150	9.3	9.3	12.0	11.1	15.7	11.7	20.0	12.4	23.9	13.1	23.9	13.7
	200	9.3	9.3	12.0	12.0	15.7	14.7	20.0	15.3	23.9	15.9	23.9	16.6
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	40		75		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	4.3	3.5	5.9	4.4	7.3	5.0	8.8	5.5	10.4	5.5	14.1	5.5
	100	8.7	8.2	11.3	9.2	13.3	9.9	15.5	10.6	17.8	11.3	23.1	12.8
	150	12.4	11.3	17.8	12.2	22.3	12.9	27.3	13.6	29.5	14.3	29.5	15.6
	200	12.4	12.4	17.8	15.2	22.3	15.9	27.3	16.5	29.5	17.2	29.5	18.5
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 50 mm	50		75		100		125		150		175	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	5.9	5.0	7.3	5.7	8.9	6.4	10.5	7.1	12.4	7.8	14.4	7.8
	100	10.2	8.9	10.7	9.6	14.2	10.3	16.5	11.1	18.9	11.8	21.5	12.5
	150	15.9	11.9	20.1	12.7	24.8	13.4	30.0	14.1	35.7	14.8	35.7	15.5
	200	15.9	15.0	20.1	15.7	24.8	16.4	30.0	17.0	35.7	17.7	35.7	18.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	70		100		125		150		175		200	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	70	9.4	8.4	11.2	9.4	12.9	10.3	14.7	11.1	16.6	12.0	18.6	12.8
	100	11.9	11.5	14.1	12.6	16.0	13.5	18.0	14.4	20.2	15.3	22.4	16.1
	150	17.1	15.1	19.7	16.1	22.1	16.9	24.6	17.8	27.2	18.6	30.0	19.5
	200	20.8	18.6	23.8	19.6	26.4	20.4	29.2	21.2	32.2	22.0	35.2	22.9
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	90		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	90	16.3	12.7	19.5	14.1	21.9	15.1	24.5	16.1	27.2	17.1	33.0	19.2
	150	24.3	18.7	28.3	20.1	31.3	21.1	34.6	22.1	37.9	23.1	45.1	25.1
	200	32.5	22.7	37.4	24.1	41.0	25.0	44.8	26.0	48.8	26.9	57.3	28.9
	250	41.0	26.7	50.2	28.0	57.3	28.9	64.8	29.9	72.9	30.8	86.7	32.7

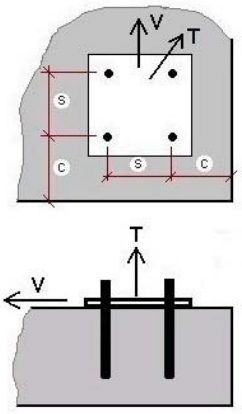
1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SIMPSON Strong-Tie®

Table 5: WA with Four Anchors, Corner, Non-Cracked Concrete (T, V//)

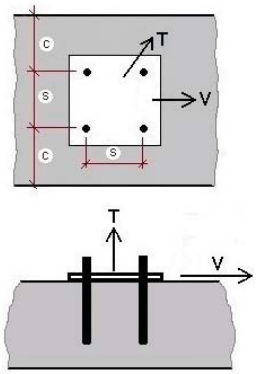
Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	30		50		75		100		125		150	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	4.5	6.3	5.7	8.4	7.5	10.2	9.6	11.7	11.9	12.9	14.4	12.9
	100	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
	150	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
	200	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	40		75		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	40	4.3	7.9	5.9	10.9	7.3	15.3	8.8	13.7	10.4	13.7	14.1	13.7
	100	8.7	12.4	11.3	17.8	13.3	22.3	15.5	26.6	17.8	28.4	23.1	29.5
	150	12.4	12.4	17.8	17.8	22.3	22.3	27.3	27.3	29.5	29.5	29.5	29.5
	200	12.4	12.4	17.8	17.8	22.3	22.3	27.3	27.3	29.5	29.5	29.5	29.5
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 50 mm	50		75		100		125		150		175	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	5.9	10.9	7.3	14.2	8.9	16.0	10.5	17.7	12.4	19.5	14.4	19.5
	100	10.2	15.9	12.1	20.1	14.2	24.8	16.5	27.7	18.9	29.5	21.5	31.4
	150	15.9	15.9	20.1	20.1	24.8	24.8	30.0	30.0	35.7	35.7	35.7	35.7
	200	15.9	15.9	20.1	20.1	24.8	24.8	30.0	30.0	35.7	35.7	35.7	35.7
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	70		100		125		150		175		200	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	70	9.4	21.0	11.2	23.5	12.9	25.7	14.7	27.8	16.6	29.9	18.6	32.1
	100	11.9	28.7	14.1	31.4	16.0	33.6	18.0	35.9	20.2	38.1	22.4	40.4
	150	17.1	37.7	19.7	40.2	22.1	42.3	24.6	44.4	27.2	46.6	30.0	48.7
	200	20.8	46.5	23.8	49.0	26.4	51.0	29.2	53.1	32.2	55.1	35.2	57.1
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	90		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	90	16.3	31.8	19.5	35.3	21.9	37.8	24.5	40.3	27.2	42.9	33.0	47.9
	150	24.3	46.7	28.3	50.2	31.3	52.7	34.6	55.2	37.9	57.7	45.1	62.8
	200	32.5	56.8	37.4	60.1	41.0	62.5	44.8	64.9	48.8	67.3	57.3	72.2
	250	41.0	66.7	50.2	70.0	57.3	72.3	64.8	74.7	72.9	77.0	86.7	81.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6: WA with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	30		50		75		100		125		150	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	40	4.1	6.2	5.4	8.2	7.2	11.3	9.2	14.3	11.6	15.6	14.1	15.6
	100	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
	150	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
	200	9.3	9.3	12.0	12.0	15.7	15.8	20.0	20.0	23.9	23.8	23.9	23.8
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	40		75		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	40	3.6	7.4	5.3	11.6	6.7	15.0	8.2	16.6	9.8	16.6	13.5	16.6
	100	8.7	12.4	11.2	17.8	13.3	22.3	15.4	27.3	17.8	29.5	23.0	29.5
	150	12.4	12.4	17.8	17.8	22.3	22.3	27.3	27.3	29.5	29.5	29.5	29.5
	200	12.4	12.4	17.8	17.8	22.3	22.3	27.3	27.3	29.5	29.5	29.5	29.5
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 50 mm**	50		75		100		125		150		175	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	5.3	10.7	6.7	14.1	8.2	17.8	9.9	21.7	11.7	23.6	13.7	23.6
	100	10.1	15.9	12.0	20.1	14.1	24.8	16.4	30.0	18.8	35.7	21.4	35.7
	150	15.9	15.9	20.1	20.1	24.8	24.8	30.0	30.0	35.7	35.7	35.7	35.7
	200	15.9	15.9	20.1	20.1	24.8	24.8	30.0	30.0	35.7	35.7	35.7	35.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 65 mm**	70		100		125		150		175		200	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	70	8.3	26.6	10.1	29.5	11.8	31.8	13.6	34.2	15.5	36.6	17.5	39.0
	100	11.3	36.9	13.4	39.9	15.3	42.4	17.4	44.8	19.5	47.3	21.8	49.8
	150	17.0	48.9	19.6	51.7	22.0	54.1	24.5	56.4	27.1	58.8	29.9	61.1
	200	20.8	53.8	23.8	63.5	26.4	65.8	29.2	68.0	32.2	70.3	35.2	72.6
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	90		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	90	15.0	40.3	18.1	44.3	20.5	47.1	23.1	49.9	25.8	52.7	31.6	58.3
	150	24.0	60.2	28.0	64.2	31.0	66.9	34.2	69.7	37.6	72.5	44.8	78.1
	200	32.5	73.8	37.4	77.5	41.0	80.2	44.8	82.8	48.8	85.5	57.3	90.9
	250	41.0	82.0	50.2	90.8	57.3	93.4	64.8	95.9	72.9	98.5	86.7	103.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SUPERPLUS *Self-Undercutting Anchor*

The SUPERPLUS offers the high load capacity and reliability of an undercut anchor, but with the ease of installation of an expansion anchor. In contrast to competing undercut anchor systems, the SUPERPLUS does not require special drill bits or setting tools. You need only apply the torque to create the self-undercut. Good for cracked and non-cracked concrete.

SUPERPLUS

APPLICATIONS:

- Power Plants
- Industrial Plants
- Base plates
- Machines
- Facades
- Heavy Duty Steel Fixings
- Subway/Railway Fixings
- Overhead Anchoring (Tension Zones)

APPROVAL:

ETA-01/0011 (Option 1) – Carbon Steel, Zinc Plated
ETA-05/0013 (Option 1) – A4 Stainless Steel

FEATURES:

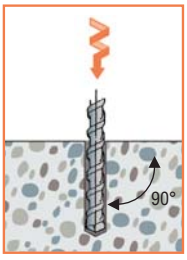
- High capacity in cracked and non-cracked concrete
- High reliability due to undercut technology
- Simple installation, no special drill bit or setting tool required
- Applying torque creates undercut
- Two approved embedment depths per diameter
- Lower installed cost than traditional undercut anchors
- Reduced edge distances and spacings
- Shallow embedment depths
- High tension and shear capacity

MATERIAL:

- Grade 8.8 Carbon Steel, Zinc Plated and Blue Passivated
- A4-80 Stainless Steel

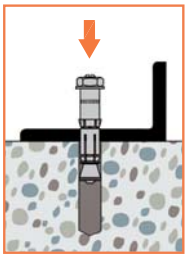
BASE MATERIAL: Cracked and Non-cracked Concrete

INSTALLATION: Through-fix installation shown

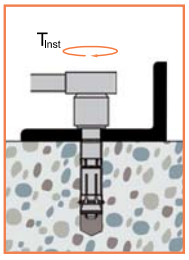


1. Drill hole

2. Clean hole (blowing)



3. Insert anchor through fixture



4. Apply recommended fastening torque with a calibrated torque-wrench

Product Availability: Carbon Steel, Zinc Plated

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max.Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_0 x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
BLS M8-14/40/15	BLS0814040015	M8	14 x 60	15	16	40	80	8.0	25
BLS M8-14/80/25	BLS0814080025	M8	14 x 100	25	16	80	130	13.4	25
BLS M12-20/80/15	BLS1220080015	M12	20 x 105	15	21	80	130	26.5	10
BLS M12-20/80/30	BLS1220080030	M12	20 x 105	30	21	80	145	29.5	10
BLS M12-20/150/30	BLS1220150030	M12	20 x 175	30	21	150	215	43.5	10
BLS M12-20/150/50	BLS1220150050	M12	20 x 175	50	21	150	235	46.0	10
BLS M16-25/150/30	BLS1625150030	M16	25 x 185	30	26	150	220	70.0	10
BLS M16-25/150/40	BLS1625150040	M16	25 x 185	40	26	150	230	72.0	10
BLS M16-25/150/60	BLS1625150060	M16	25 x 185	60	26	150	250	76.0	10
BLS M16-25/200/40	BLS1625200040	M16	25 x 235	40	26	200	280	89.0	10
BLS M16-25/200/60	BLS1625200060	M16	25 x 235	60	26	200	300	95.0	10

Custom lengths available on request.

Product Availability: A4 Stainless Steel

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max.Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_0 x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
BLS M8-14/80/25A4	BLS0814080025A4	M8	14 x 100	25	16	80	130	13.4	25
BLS M12-20/80/15A4	BLS1220080015A4	M12	20 x 105	15	21	80	130	26.5	10
BLS M12-20/80/30A4	BLS1220080030A4	M12	20 x 105	30	21	80	145	29.5	10
BLS M16-25/150/30A4	BLS1625150030A4	M16	25 x 185	30	26	150	220	70.0	10
BLS M16-25/150/40A4	BLS1625150040A4	M16	25 x 185	40	26	150	230	72.0	10

Custom lengths available on request.

Product Availability: Internally Threaded, Carbon Steel, Zinc Plated

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max.Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_0 x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
ILS M8-14/80	ILS0814080	M8	14 x 100	-	10	80	93	8.7	25

Custom lengths available on request.

Installation Data

Description		Symbol	Units	Anchor Size					
				M8		M12		M16	
Drill Hole Diameter		d_o	mm	14		20		25	
Maximum Diameter of Drill Bit		$d_{cut,\ max} \leq$	mm	14.5		20.55		25.55	
Drill Depth		$h_1 \geq$	mm	60	100	105	175	185	235
Effective Anchorage Depth		h_{ef}	mm	40	80	80	150	150	200
Anchor Length Range		L	mm	80-130		130-235		220-300	
Clearance Hole Diameter in Fixture	Through-Fix	$d_f \leq$	mm	16		21		26	
	Installed on Threaded Stud	$d_f \leq$	mm	10		14		18	
Maximum Thickness of Fixture		$t_{fix,max}$	mm	50		80		120	
Width Across Flats		SW	mm	17		22		27	
Installation Torque		T_{inst}	Nm	25		80		180	

Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M8		M12		M16	
Minimum Concrete Thickness	h_{min}	mm	100	160	160	300	300	400
Minimum Spacing	s_{min}	mm	100	80	120	150	200	150
Minimum Edge Distance	c_{min}	mm	80	50	100	80	150	100
Critical Spacing	$s_{cr,N}$	mm	120	240	240	450	450	600
Critical Edge Distance	$c_{cr,N}$	mm	60	120	120	225	225	300

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8, 9]

Description	Symbol	Units	M8		M12		M16	
Effective Embedment Depth	h_{ef}	mm	40	80	80	150	150	200
Minimum Concrete Thickness	h_{min}	mm	100	160	160	300	300	400
			Non-Cracked Concrete					
TENSION	N_{Rd}	kN	6.0	**15.1**	21.7	39.7	61.8	74.1
SHEAR	V_{Rd}	kN	6.0	**33.1**	43.4	**56.0**	**94.4**	**94.4**
			Cracked Concrete					
TENSION	N_{Rd}	kN	4.3	10.7	15.5	26.7	33.3	50.0
SHEAR	V_{Rd}	kN	4.3	30.9	30.9	**56.0**	88.2	94.0

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$
4. V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing and Critical Edge Distance is taken from the relevant ETA. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Bold values indicate that steel controls design resistance.
9. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}

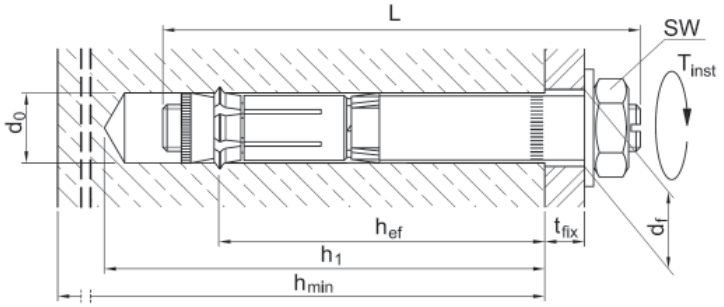
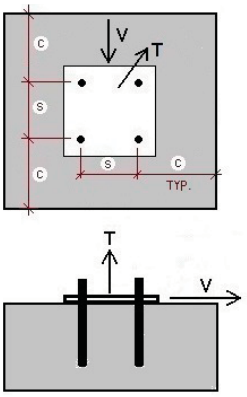


Table 1A: SUPERPLUS with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.5	8.6	20.6	9.2	23.9	10.2	23.9	11.8	23.9	12.3	23.9	12.3
	100	20.0	10.5	23.9	11.2	23.9	12.3	23.9	14.0	23.9	14.3	23.9	14.9
	150	20.0	13.2	23.9	13.9	23.9	14.9	23.9	16.5	23.9	18.2	23.9	19.8
	200	20.0	15.9	23.9	16.6	23.9	17.5	23.9	19.1	23.9	20.7	23.9	22.3
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	10.3	6.0	12.7	6.7	13.5	7.5	14.6	8.3	17.2	8.3	19.5	8.3
	75	13.7	8.6	16.2	9.3	19.6	10.3	23.3	11.2	25.4	13.1	27.7	14.0
	100	17.6	11.4	20.2	12.3	23.7	13.3	27.5	14.3	35.9	16.3	37.7	18.0
	150	26.5	17.3	29.3	18.2	33.1	19.3	37.1	20.5	45.8	22.7	53.4	24.6
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	23.0	13.8	27.5	15.1	31.6	16.2	35.9	17.2	37.0	18.3	37.7	19.0
	120	26.6	16.3	31.2	17.6	35.3	18.8	39.7	19.9	44.3	21.0	47.2	21.7
	150	32.3	20.1	37.1	21.6	41.4	22.8	45.8	24.0	50.5	25.2	53.4	25.9
	200	38.5	24.4	43.5	25.8	47.9	27.0	52.5	28.1	57.3	29.3	60.2	30.0
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	37.5	14.7	42.5	17.0	46.7	18.9	51.8	18.9	57.4	18.9	69.7	18.9
	100	42.7	17.4	55.8	19.9	59.3	22.4	64.0	24.9	69.5	24.9	81.8	24.9
	150	57.6	25.0	71.1	27.7	86.1	30.5	102.4	33.3	106.5	36.0	154.6	41.6
	225	83.7	37.2	98.2	40.3	113.9	43.4	130.7	46.5	148.7	49.6	188.2	55.8
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	67.4	28.8	81.5	31.7	97.0	34.5	100.9	34.5	105.8	40.3	111.4	43.2
	175	75.5	33.0	89.8	36.0	105.4	39.0	122.2	42.0	126.3	45.1	131.4	48.1
	200	84.0	37.5	98.6	40.6	114.4	43.7	131.3	46.8	149.4	49.9	153.7	53.1
	225	93.0	41.7	107.8	44.9	123.8	48.1	140.8	51.3	159.0	54.5	178.2	57.7
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	62.2	19.8	81.3	22.6	93.3	28.3	109.9	28.3	129.1	28.3	141.6	28.3
	150	75.8	27.8	93.5	30.9	134.7	37.0	146.8	43.2	163.2	46.3	182.1	46.3
	200	98.0	36.5	116.6	39.9	158.7	46.5	207.3	53.1	220.6	59.8	238.1	66.4
	400	148.8	76.0	169.3	80.1	214.3	88.1	264.5	96.1	320.1	104.1	380.9	112.1



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

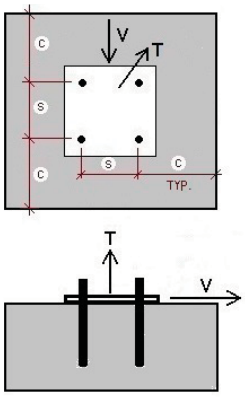
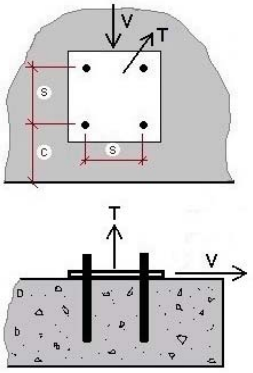


Table 1B: SUPERPLUS with Four Anchors, Four Edge Distances, Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	12.5	6.1	14.7	6.5	17.0	7.2	17.0	8.4	17.0	8.7	17.0	8.7
	100	14.3	7.4	17.0	7.9	17.0	8.7	17.0	9.9	17.0	10.1	17.0	10.5
	150	14.3	9.4	17.0	9.8	17.0	10.5	17.0	11.7	17.0	12.9	17.0	14.0
	200	14.3	11.3	17.0	11.7	17.0	12.4	17.0	13.5	17.0	14.7	17.0	15.8
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	7.3	4.2	9.1	4.7	9.6	5.3	10.4	5.9	12.2	5.9	13.9	5.9
	75	9.8	6.1	11.6	6.6	14.0	7.3	16.6	7.9	18.1	9.3	19.7	9.9
	100	12.5	8.1	14.4	8.7	16.9	9.4	19.6	10.1	25.6	11.6	26.9	12.7
	150	18.9	12.2	20.9	12.9	23.6	13.7	26.5	14.5	32.7	16.1	38.1	17.4
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	16.4	9.8	19.6	10.7	22.5	11.5	25.6	12.2	26.3	13.0	26.9	13.4
	120	18.9	11.5	22.2	12.5	25.2	13.3	28.3	14.1	31.6	14.9	33.7	15.4
	150	23.0	14.3	26.5	15.3	29.5	16.1	32.7	17.0	36.0	17.8	38.1	18.3
	200	27.5	17.3	31.0	18.3	34.1	19.1	37.4	19.9	40.8	20.8	42.9	21.3
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	26.7	10.4	30.3	12.1	33.3	13.4	36.9	13.4	40.9	13.4	49.7	13.4
	100	30.4	12.4	39.8	14.1	42.3	15.9	45.6	17.6	49.5	17.6	58.3	17.6
	150	41.1	17.7	50.7	19.6	61.4	21.6	73.0	23.6	76.0	25.5	83.9	29.5
	225	59.6	26.4	70.0	28.6	81.2	30.8	93.2	33.0	106.0	35.2	134.2	39.5
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	48.0	20.4	58.1	22.4	69.2	24.5	71.9	26.5	75.4	28.5	79.4	30.6
	175	53.8	23.4	64.0	25.5	75.1	27.7	87.1	29.8	90.1	31.9	93.7	34.0
	200	59.9	26.5	70.3	28.7	81.5	31.0	93.6	33.2	106.5	35.4	109.5	37.6
	225	66.3	29.5	76.9	31.8	88.2	34.1	100.4	36.4	113.3	38.6	127.0	40.9
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	40.0	14.0	52.3	16.0	60.0	20.0	70.7	20.0	83.0	20.0	96.5	20.0
	150	54.0	19.7	66.7	21.9	96.0	26.2	104.7	30.6	116.3	32.8	129.8	32.8
	200	69.9	25.9	83.1	28.2	113.2	32.9	147.8	37.6	157.3	42.4	169.7	47.1
	400	106.1	53.9	120.7	56.7	152.7	62.4	188.6	68.0	228.2	73.7	271.5	79.4

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 2A: SUPERPLUS with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.5	11.6	20.6	12.3	23.9	13.3	23.9	15.0	23.9	16.3	23.9	16.3
	100	20.0	13.2	23.9	13.9	23.9	14.9	23.9	16.5	23.9	18.2	23.9	19.8
	150	20.0	17.3	23.9	17.9	23.9	18.8	23.9	20.4	23.9	22.0	23.9	23.5
	200	20.0	21.3	23.9	21.9	23.9	22.8	23.9	23.8	23.9	23.8	23.9	23.8
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	17.9	8.5	19.9	9.2	22.6	10.2	25.4	11.1	31.6	11.1	37.0	11.1
	75	20.3	12.7	22.5	13.5	25.4	14.5	28.5	15.6	35.2	17.6	41.0	18.7
	100	23.0	17.3	25.3	18.2	28.5	19.3	31.8	20.4	39.0	22.7	45.2	24.5
	150	28.7	23.3	31.4	24.1	35.1	25.2	38.9	26.3	47.2	28.5	54.4	30.3
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	27.8	20.1	31.8	21.6	35.3	22.8	39.0	24.0	42.8	25.1	45.2	25.9
	120	30.4	22.9	34.6	24.4	38.3	25.6	42.2	26.8	46.2	28.0	48.8	28.7
	150	34.3	26.2	38.9	27.6	42.9	28.7	47.2	29.9	51.6	31.0	54.4	31.7
	200	38.5	31.6	43.5	32.9	47.9	34.0	52.5	35.1	57.3	36.2	60.2	36.9
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	57.7	20.5	68.1	23.1	79.3	25.2	91.4	25.2	104.2	25.2	132.5	25.2
	100	61.7	24.9	72.6	27.7	84.3	30.4	96.8	33.2	110.2	33.2	139.7	33.2
	150	72.3	37.0	84.3	40.0	97.3	43.1	111.2	46.2	126.0	49.3	158.3	55.4
	225	89.7	54.1	103.6	57.4	118.6	60.7	134.6	64.0	151.5	67.2	188.5	73.8
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	81.3	41.6	93.5	44.8	106.6	48.0	120.5	51.2	135.3	54.4	150.9	57.6
	175	87.1	48.4	100.0	51.7	113.7	55.1	128.2	58.4	143.7	61.7	160.0	65.1
	200	93.2	55.5	106.6	59.0	121.0	62.4	136.2	65.9	152.3	69.4	169.4	72.8
	225	99.5	59.3	113.5	62.7	128.5	66.1	144.4	69.4	161.3	72.8	179.0	76.2
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	87.3	28.3	101.6	31.4	133.3	37.7	169.3	37.7	209.5	37.7	258.0	37.7
	150	101.2	41.2	116.9	44.6	151.8	51.4	191.1	58.3	235.0	61.7	283.3	61.7
	200	116.1	55.4	133.3	59.0	171.4	66.4	214.4	73.8	261.9	81.2	314.2	88.6
	400	148.8	100.1	169.3	103.8	214.3	111.2	264.5	118.6	320.1	126.0	380.9	133.4

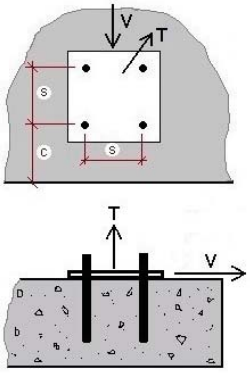


1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 2B: SUPERPLUS with Four Anchors, One Edge Distance, Cracked Concrete (T, V ⊢)

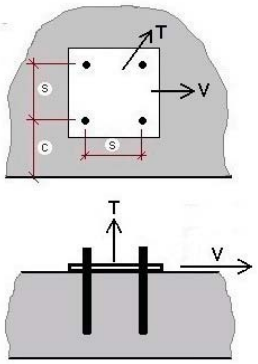
Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	100		120		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	12.5	8.2	14.7	8.7	17.0	9.4	17.0	10.6	17.0	11.6	17.0	11.6
	100	14.3	9.4	17.0	9.8	17.0	10.5	17.0	11.7	17.0	12.9	17.0	14.0
	150	14.3	12.2	17.0	12.7	17.0	13.3	17.0	14.5	17.0	15.6	17.0	16.7
	200	14.3	15.1	17.0	15.5	17.0	16.2	17.0	17.0	17.0	17.0	17.0	17.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	80		100		125		150		200		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	12.7	6.0	14.2	6.6	16.1	7.2	18.1	7.9	22.5	7.9	26.3	7.9
	75	14.5	9.0	16.1	9.6	18.1	10.3	20.3	11.0	25.1	12.5	29.2	13.2
	100	16.4	12.2	18.1	12.9	20.3	13.7	22.7	14.5	27.8	16.1	32.3	17.4
	150	20.4	16.5	22.4	17.1	25.0	17.9	27.7	18.6	33.6	20.2	38.8	21.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	120		150		175		200		225		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	19.8	14.3	22.7	15.3	25.2	16.1	27.8	17.0	30.5	17.8	32.3	18.3
	120	21.6	16.2	24.6	17.3	27.3	18.1	30.1	19.0	33.0	19.8	34.8	20.3
	150	24.5	18.6	27.7	19.5	30.6	20.3	33.6	21.2	36.8	22.0	38.8	22.5
	200	27.5	22.4	31.0	23.3	34.1	24.1	37.4	24.9	40.8	25.7	42.9	26.1
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 150 mm	150		200		250		300		350		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	41.2	14.5	48.6	16.4	56.5	17.9	65.1	17.9	74.3	17.9	94.5	17.9
	100	44.0	17.6	51.7	19.6	60.1	21.6	69.0	23.5	78.6	23.5	99.6	23.5
	150	51.5	26.2	60.1	28.4	69.4	30.5	79.3	32.7	89.8	34.9	112.9	39.3
	225	63.9	38.3	73.9	40.7	84.5	43.0	95.9	45.3	108.0	47.6	134.4	52.3
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 150 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	57.9	29.5	66.7	31.7	76.0	34.0	85.9	36.2	96.4	38.5	107.6	40.8
	175	62.1	34.3	71.3	36.6	81.0	39.0	91.4	41.4	102.4	43.7	114.1	46.1
	200	66.4	39.3	76.0	41.8	86.2	44.2	97.1	46.7	108.6	49.1	120.7	51.6
	225	70.9	42.0	80.9	44.4	91.6	46.8	102.9	49.2	115.0	51.6	127.6	54.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 200 mm	150		200		300		400		500		600	
Min. Concrete Thickness	(h_{min}) = 400 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	62.2	20.0	72.4	22.3	95.0	26.7	120.7	26.7	163.0	26.7	181.0	26.7
	150	72.1	29.2	83.3	31.6	108.2	36.4	136.2	41.3	167.5	43.7	200.0	43.7
	200	82.7	39.2	95.0	41.8	122.2	47.1	152.7	52.3	186.7	57.5	200.0	62.7
	400	106.1	70.9	120.7	73.5	152.7	78.8	188.6	84.0	200.0	89.3	200.0	94.5



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

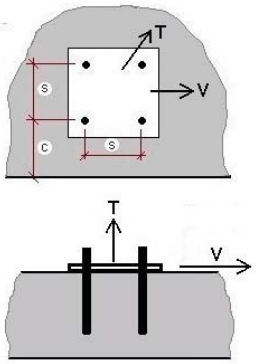
Table 3A: SUPERPLUS with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.5	20.0	20.6	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	100	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	150	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	200	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	17.9	21.3	19.9	23.1	22.6	25.4	25.4	27.7	31.6	27.7	37.0	27.7
	75	20.3	31.6	22.5	33.7	25.4	36.3	28.5	38.9	35.2	44.1	41.0	46.7
	100	23.0	43.1	25.3	45.4	28.5	48.2	31.8	51.1	39.0	56.7	45.2	61.3
	150	28.7	58.1	31.4	60.3	35.1	63.1	38.9	65.8	47.2	71.3	54.4	75.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	27.8	50.3	31.8	53.9	35.3	56.9	39.0	59.9	42.8	62.9	45.2	64.7
	120	30.4	57.3	34.6	60.9	38.3	63.9	42.2	66.9	46.2	69.9	48.8	71.7
	150	34.3	65.5	38.9	68.9	42.9	71.8	47.2	74.7	51.6	77.5	54.4	79.3
	200	38.5	79.0	43.5	82.3	47.9	85.0	52.5	87.8	57.3	90.5	60.2	92.2
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	57.7	51.2	68.1	57.8	79.3	63.1	91.4	63.1	104.2	63.1	132.5	63.1
	100	61.7	62.3	72.6	69.2	84.3	76.1	96.8	83.0	110.2	83.0	139.7	83.0
	150	72.3	92.4	84.3	100.1	97.3	107.8	111.2	115.5	126.0	123.2	158.3	138.6
	225	89.7	135.3	103.6	143.5	118.6	151.7	134.6	159.9	151.5	168.1	188.5	184.5
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	81.3	103.9	93.5	111.9	106.6	119.9	120.5	127.9	135.3	135.9	150.9	143.9
	175	87.1	121.0	99.5	129.3	113.7	137.6	128.2	146.0	143.7	154.3	160.0	162.7
	200	93.2	138.7	106.6	147.4	121.0	156.1	136.2	164.7	152.3	173.4	169.4	182.1
	225	99.5	148.2	113.5	156.7	128.5	165.1	144.4	173.6	161.3	183.0	179.0	190.5
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	87.3	70.7	101.6	78.5	133.3	94.2	169.3	94.2	209.5	94.2	253.9	94.2
	150	101.2	102.9	116.9	111.5	151.8	128.6	191.1	145.8	235.0	154.3	283.3	154.3
	200	116.1	138.4	133.3	147.6	171.4	166.1	214.3	184.2	261.9	203.0	314.2	221.4
	400	148.8	250.2	169.3	259.4	214.3	278.0	264.5	296.5	320.1	315.0	380.9	333.6



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3B: SUPERPLUS with Four Anchors, One Edge Distance, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR



Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	100		120		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	12.5	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	100	14.3	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	150	14.3	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	200	14.3	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	80		100		125		150		200		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	12.7	15.1	14.2	16.4	16.1	18.0	18.1	19.7	22.5	19.7	26.3	19.7
	75	14.5	22.4	16.1	23.9	18.1	25.7	20.3	27.6	25.1	31.2	29.2	33.1
	100	16.4	30.5	18.1	32.2	20.3	34.2	22.7	36.2	27.8	40.2	32.3	43.4
	150	20.4	41.2	22.4	42.7	25.0	44.7	27.7	46.6	33.6	50.5	38.8	53.6
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	120		150		175		200		225		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	19.8	35.6	22.7	38.2	25.2	40.3	27.8	42.4	30.5	44.5	32.3	45.8
	120	21.6	40.6	24.6	43.2	27.3	45.3	30.1	47.4	33.0	49.5	34.8	50.8
	150	24.5	46.4	27.7	48.8	30.6	50.8	33.6	52.9	36.8	54.9	38.8	56.1
	200	27.5	56.0	31.0	58.3	34.1	60.2	37.4	62.2	40.8	64.1	42.9	65.3
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 150 mm	150		200		250		300		350		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	41.2	36.3	48.6	41.0	56.5	44.7	65.1	44.7	74.3	44.7	94.5	44.7
	100	44.0	44.1	51.7	49.0	60.1	53.9	69.0	58.8	78.6	58.8	99.6	58.8
	150	51.5	65.5	60.1	70.9	69.4	76.4	79.3	81.8	89.8	87.3	112.9	98.2
	225	63.9	95.8	73.9	101.6	84.5	107.4	95.9	113.2	108.0	119.1	134.4	130.7
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 150 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	57.9	73.6	66.7	79.3	76.0	84.9	85.9	90.6	96.4	96.3	107.6	101.9
	175	62.1	85.7	71.3	91.6	81.0	97.5	91.4	103.4	102.4	109.3	114.1	115.2
	200	66.4	98.3	76.0	104.4	86.2	110.5	97.1	116.7	108.6	122.8	120.7	129.0
	225	70.9	104.3	80.9	111.0	91.6	117.0	102.9	123.0	115.0	129.0	127.6	135.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 200 mm	150		200		300		400		500		600	
Min. Concrete Thickness	(h_{min}) = 400 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	62.2	50.1	72.4	55.6	95.0	66.7	120.7	66.7	149.3	66.7	181.0	66.7
	150	72.1	72.9	83.3	79.0	108.2	91.1	136.2	103.2	167.5	109.3	202.0	109.3
	200	82.7	98.0	95.0	104.6	122.2	117.6	152.7	130.7	186.7	143.8	244.0	156.8
	400	106.1	177.2	120.7	183.8	152.7	196.9	188.6	210.0	228.2	233.2	271.5	236.3

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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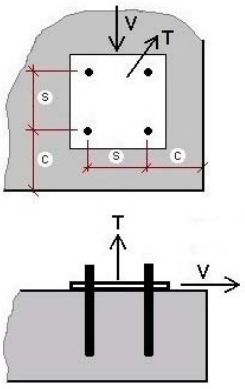
Table 4A: SUPERPLUS with Four Anchors, Corner, Non-Cracked Concrete (T, V⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.5	9.2	20.6	9.8	23.9	10.7	23.9	12.3	23.9	13.5	23.9	13.5
	100	20.0	10.4	23.9	11.0	23.9	11.9	23.9	13.4	23.9	14.9	23.9	16.3
	150	20.0	13.4	23.9	14.0	23.9	14.8	23.9	16.2	23.9	17.7	23.9	19.1
	200	20.0	16.4	23.9	17.0	23.9	17.8	23.9	19.2	23.9	20.5	23.9	21.9
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	12.6	6.8	14.3	7.5	16.5	8.3	18.9	9.2	24.3	9.2	29.0	9.2
	75	15.5	10.0	17.4	10.7	19.9	11.7	22.6	12.6	27.6	14.5	33.8	15.4
	100	18.8	13.5	20.9	14.3	23.8	15.3	26.8	16.3	33.4	18.4	39.2	20.0
	150	26.7	18.0	29.4	19.0	32.9	19.7	36.6	20.7	44.5	22.7	51.6	24.3
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	23.2	16.0	26.8	17.2	30.0	18.3	33.4	19.4	37.0	20.5	39.2	21.1
	120	26.6	18.1	30.5	19.4	34.0	20.4	37.6	21.5	41.5	22.6	43.9	23.2
	150	32.2	20.5	36.6	21.7	40.5	22.7	44.6	23.8	49.0	24.8	51.6	25.4
	200	38.5	24.5	43.5	25.7	47.9	26.7	52.5	27.7	57.3	28.3	60.2	29.2
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	41.8	16.6	50.6	18.9	60.2	20.8	70.7	20.8	82.0	20.8	107.1	20.8
	100	46.5	19.9	55.9	22.4	66.1	24.9	77.2	27.4	89.2	27.4	115.7	27.4
	150	59.7	29.1	70.7	31.9	82.5	34.7	95.3	37.4	109.0	40.2	139.1	45.7
	225	83.8	42.1	97.3	45.0	111.8	48.0	127.4	50.9	143.9	53.9	179.9	59.8
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	67.4	33.1	78.5	36.0	90.5	38.9	103.3	41.7	116.9	44.6	131.5	47.5
	175	75.1	38.3	87.0	41.3	99.8	44.3	113.4	47.3	128.0	50.3	143.4	53.3
	200	83.4	43.7	96.1	46.8	109.7	49.9	124.2	53.1	139.6	56.2	156.0	59.3
	225	92.3	46.5	105.8	49.5	120.3	52.6	135.7	55.4	152.0	58.7	169.3	61.7
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	64.0	22.6	76.2	25.4	103.7	31.1	135.4	31.1	171.4	31.1	211.6	31.1
	150	80.9	32.4	95.0	35.5	126.5	41.7	162.4	47.8	202.9	50.9	247.9	50.9
	200	100.6	43.2	116.7	46.5	152.4	53.1	192.8	59.8	238.1	66.4	288.1	73.1
	400	148.8	76.7	169.3	80.1	214.3	86.7	264.5	93.4	320.1	100.1	380.9	106.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

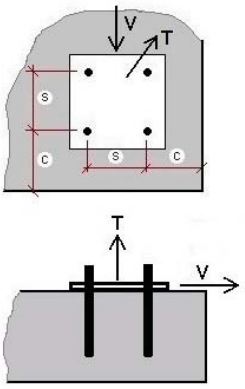


Table 4B: SUPERPLUS with Four Anchors, Corner, Cracked Concrete (T, V⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 40 mm	100		120		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	12.5	6.5	14.7	6.9	17.0	7.6	17.0	8.7	17.0	9.6	17.0	9.6
	100	14.3	7.4	17.0	7.8	17.0	8.4	17.0	9.5	17.0	10.5	17.0	11.6
	150	14.3	9.5	17.0	9.9	17.0	10.5	17.0	11.5	17.0	12.5	17.0	13.5
	200	14.3	11.6	17.0	12.0	17.0	12.6	17.0	13.6	17.0	14.6	17.0	15.5
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	80		100		125		150		200		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	50	9.0	4.8	10.2	5.3	11.8	5.9	13.5	6.5	17.3	6.5	20.6	6.5
	75	11.0	7.1	12.4	7.6	14.2	8.3	16.1	8.9	20.4	10.3	24.1	10.9
	100	13.4	9.6	14.9	10.1	17.0	10.9	19.1	11.6	23.8	13.0	28.0	14.2
	150	19.0	12.7	21.0	13.3	23.5	14.0	26.1	14.7	31.8	16.1	36.8	17.2
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	120		150		175		200		225		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	16.5	11.3	19.1	12.2	21.4	13.0	23.8	13.7	26.4	14.5	28.0	15.0
	120	18.9	12.8	21.7	13.7	24.2	14.5	26.8	15.2	29.6	16.0	31.3	16.5
	150	22.9	14.5	26.1	15.4	28.9	16.1	31.8	16.8	34.9	17.6	36.8	18.0
	200	27.5	17.4	31.0	18.2	34.1	18.9	37.4	19.6	40.8	20.3	42.9	20.7
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 150 mm	150		200		250		300		350		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	29.8	11.7	36.1	13.4	42.9	14.7	50.4	14.7	58.5	14.7	76.3	14.7
	100	33.2	14.1	39.9	15.9	47.1	17.6	55.1	19.4	63.6	19.4	82.5	19.4
	150	42.6	20.6	50.4	22.6	58.8	24.5	67.9	26.5	77.7	28.5	99.2	32.4
	225	59.8	29.8	69.4	31.9	79.7	34.0	90.8	36.1	102.6	38.2	128.3	42.3
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 150 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	48.0	23.4	56.0	25.5	64.5	27.5	76.3	29.6	83.4	31.6	93.7	33.6
	175	53.5	27.1	62.0	29.3	71.1	31.4	80.9	33.5	91.2	35.6	102.2	37.8
	200	59.4	31.0	68.5	33.2	78.2	35.4	88.6	37.6	99.6	39.8	111.2	42.0
	225	65.8	32.9	75.4	35.1	85.7	37.3	96.7	39.1	108.4	41.6	120.7	43.7
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 200 mm	150		200		300		400		500		600	
Min. Concrete Thickness	(h_{min}) = 400 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	45.6	16.0	54.3	18.0	73.9	22.0	96.5	22.0	122.2	22.0	150.9	22.0
	150	57.7	23.0	67.7	25.1	90.2	29.5	115.8	33.9	144.7	36.1	176.7	36.1
	200	71.7	30.6	83.2	32.9	108.6	37.6	137.5	42.4	169.7	47.1	205.3	51.8
	400	106.1	54.3	120.7	56.7	152.7	61.4	188.6	66.2	228.2	70.9	271.5	75.6

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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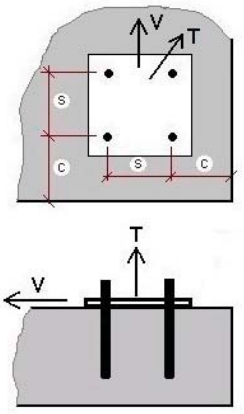
Table 5A: SUPERPLUS with Four Anchors, Corner, Non-Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.5	20.0	20.6	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	100	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	150	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	200	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	12.6	17.1	14.3	18.7	16.5	20.8	18.9	22.9	24.2	22.9	29.0	22.9
	75	15.5	25.0	17.4	26.8	19.9	29.2	22.6	31.5	28.6	36.2	33.8	38.5
	100	18.8	33.7	20.9	35.7	23.8	38.3	26.8	40.9	33.4	46.0	39.2	50.0
	150	26.7	44.9	29.4	46.9	32.9	49.4	36.6	51.8	44.6	56.8	51.6	60.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	23.2	39.9	26.8	43.1	30.0	45.8	33.4	48.5	37.0	51.2	39.2	52.8
	120	26.6	45.2	30.5	48.4	34.0	51.1	37.6	53.8	41.5	56.4	43.9	58.1
	150	32.2	51.2	36.6	54.3	40.5	56.9	44.6	59.4	49.0	62.0	51.6	63.6
	200	38.5	61.2	43.5	64.2	47.9	66.7	52.5	69.1	57.3	71.6	60.2	73.1
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	41.8	41.4	50.6	47.3	60.2	52.0	70.7	52.0	82.0	52.0	107.1	52.0
	100	46.5	49.8	55.9	56.0	66.1	62.3	77.2	68.5	89.2	68.5	115.7	68.5
	150	59.7	72.8	70.7	79.7	82.5	86.6	95.3	93.6	109.0	100.5	139.1	114.3
	225	83.8	105.1	97.3	112.5	111.8	119.9	127.4	127.3	143.9	134.7	179.9	149.4
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	67.4	82.7	78.5	89.9	90.5	97.1	103.3	104.3	116.9	111.5	131.5	118.7
	175	75.1	95.7	87.0	103.2	99.8	110.7	113.4	118.3	128.0	125.8	143.4	133.3
	200	83.4	109.2	96.1	117.1	109.7	124.9	124.2	132.7	139.6	140.5	156.0	148.3
	225	92.3	116.2	105.8	123.8	120.3	131.5	135.7	139.1	152.0	146.7	169.3	154.3
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	64.0	56.5	76.2	63.6	103.7	77.7	135.4	77.7	171.4	77.7	211.6	77.7
	150	80.9	81.0	95.0	88.7	126.5	104.2	162.4	119.6	202.9	127.3	247.9	127.3
	200	100.6	107.9	116.7	116.2	152.4	132.9	192.8	149.5	238.1	166.1	288.1	182.7
	400	148.8	191.8	169.3	200.1	214.3	216.8	264.5	233.5	320.1	250.2	380.9	266.9

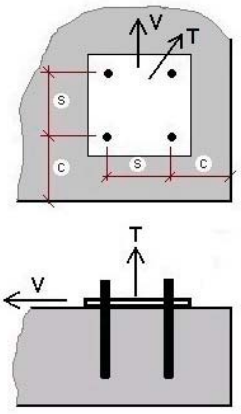


1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 5B: SUPERPLUS with Four Anchors, Corner, Cracked Concrete (T, V//)

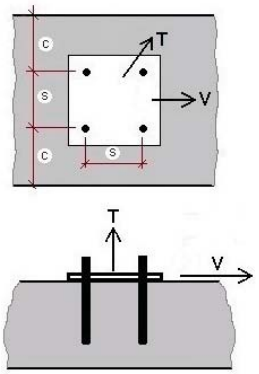
Design Resistance Values for TENSION and SHEAR

Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 40 mm	100		120		150		200		250		300	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	12.5	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	100	14.3	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	150	14.3	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	200	14.3	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 80 mm	80		100		125		150		200		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	9.0	12.1	10.2	13.3	11.8	14.7	13.5	16.2	17.3	16.2	20.6	16.2
	75	11.0	17.7	12.4	19.0	14.2	20.7	16.1	22.3	20.4	25.6	24.1	27.3
	100	13.4	23.9	14.9	25.3	17.0	27.1	19.1	28.9	23.8	32.6	28.0	35.4
	150	19.0	31.8	21.0	33.2	23.5	35.0	26.1	36.7	31.8	40.2	36.8	43.0
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 80 mm	120		150		175		200		225		240	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	16.5	28.2	19.1	30.5	21.4	32.4	23.8	34.4	26.4	36.3	28.0	37.4
	120	18.9	32.0	21.7	34.3	24.2	36.2	26.8	38.1	29.6	40.0	31.3	41.1
	150	22.9	36.2	26.1	38.4	28.9	40.3	31.8	42.1	34.9	43.9	36.8	45.0
	200	27.5	43.4	31.0	45.5	34.1	47.2	37.4	49.0	40.8	50.7	42.9	51.8
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 150 mm	150		200		250		300		350		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	29.8	29.3	36.1	33.5	42.9	36.9	50.4	36.9	58.5	36.9	76.3	36.9
	100	33.2	35.3	39.9	39.7	47.1	44.1	55.1	48.5	63.8	48.5	82.5	48.5
	150	42.6	51.5	50.4	56.5	58.8	61.4	67.9	66.3	77.7	71.2	99.2	81.0
	225	59.8	74.5	69.4	79.7	79.7	84.9	90.8	90.2	102.6	95.4	128.3	105.8
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 150 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 300 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	48.0	58.6	56.0	63.7	64.5	68.8	73.6	73.9	83.4	79.0	93.7	84.1
	175	53.5	67.8	62.0	73.1	71.1	78.4	80.9	83.8	91.2	89.1	102.2	94.4
	200	59.4	77.4	68.5	82.9	78.2	88.4	88.6	94.0	99.6	99.5	111.2	105.0
	225	65.8	82.3	75.4	87.7	85.7	93.1	96.7	98.5	108.4	103.9	120.7	109.3
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 200 mm	150		200		300		400		500		600	
Min. Concrete Thickness	(h_{min}) = 400 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	45.6	40.0	54.3	45.1	73.9	55.1	96.5	55.1	122.2	55.1	150.9	55.1
	150	57.7	57.4	67.7	62.9	90.2	73.8	115.8	84.7	144.7	90.2	176.7	90.2
	200	71.7	76.5	83.2	82.3	108.6	94.1	137.5	105.9	169.7	117.6	205.3	129.4
	400	106.1	135.9	120.7	141.8	152.7	153.6	188.6	165.4	228.2	177.2	271.5	189.0



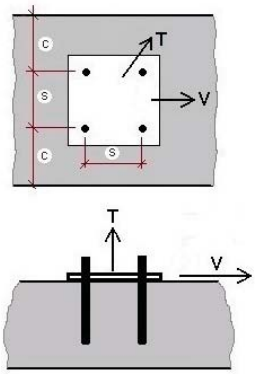
1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6A: SUPERPLUS with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	17.5	20.0	20.6	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	100	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	150	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
	200	20.0	20.0	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8	23.9	23.8
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	10.4	21.3	12.1	23.1	14.3	25.4	16.7	27.7	22.0	27.7	26.7	27.7
	75	14.0	31.6	15.9	33.7	18.4	36.3	21.1	38.9	27.1	44.1	32.3	46.7
	100	17.9	43.1	20.0	45.4	22.9	48.2	25.9	51.1	32.5	56.7	38.3	61.3
	150	26.6	58.1	29.2	60.3	32.8	63.1	36.5	65.8	44.5	71.3	51.5	75.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	22.3	50.3	25.9	53.9	29.1	56.9	32.5	59.9	36.1	62.9	38.3	64.7
	120	26.0	57.3	30.0	60.9	33.4	63.9	37.1	66.9	41.0	69.9	43.4	71.7
	150	32.0	65.5	36.5	68.9	40.4	71.8	44.5	74.7	48.8	77.5	51.5	79.3
	200	38.5	79.0	43.5	82.3	47.9	85.0	52.5	87.8	57.3	90.5	60.2	92.2
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	35.8	51.2	44.6	57.8	54.2	63.1	64.7	63.1	76.0	63.1	101.1	63.1
	100	41.6	62.3	50.9	69.2	61.2	76.1	72.3	83.0	84.2	83.0	110.7	83.0
	150	57.1	92.4	68.0	100.1	79.9	107.8	92.7	115.5	106.2	123.2	136.5	138.6
	225	83.4	135.3	96.9	143.5	111.4	151.6	126.9	159.9	143.5	168.1	179.5	184.5
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	64.5	103.9	75.6	111.9	87.6	119.9	100.4	127.9	114.1	135.9	128.6	143.9
	175	73.2	121.0	85.1	129.3	97.9	137.6	111.5	146.0	126.0	154.3	141.4	162.7
	200	82.2	138.7	94.9	147.4	108.6	156.1	123.1	164.7	138.5	173.4	154.8	182.1
	225	91.7	148.2	105.2	156.7	119.7	165.1	135.1	173.6	151.5	182.1	168.7	190.5
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	55.6	70.7	67.7	78.5	95.2	94.2	127.0	94.2	162.9	94.2	203.1	94.2
	150	75.9	102.9	99.3	111.5	121.4	128.6	157.4	145.8	197.9	154.3	242.8	154.3
	200	98.2	138.4	114.3	147.6	150.0	166.1	190.5	184.5	235.7	203.0	285.7	221.4
	400	148.8	250.2	169.3	259.4	214.3	278.0	264.5	296.5	320.1	315.0	380.9	333.6



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6B: SUPERPLUS with Four Anchors, 2-Edges, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 40 mm**	100		120		150		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	12.5	14.3	14.7	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	100	14.3	14.3	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	150	14.3	14.3	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
	200	14.3	14.3	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	80		100		125		150		200		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	50	7.4	15.6	8.6	16.4	10.2	18.0	11.9	19.7	15.7	19.7	19.1	19.7
	75	10.0	22.4	11.3	23.9	13.1	25.7	15.1	27.6	19.3	31.2	23.0	33.1
	100	12.7	30.5	14.3	32.2	16.3	34.2	18.5	36.2	23.2	40.2	27.3	43.4
	150	18.9	41.2	20.9	42.7	23.4	44.7	26.0	46.6	31.7	50.5	36.7	53.6
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	120		150		175		200		225		240	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	15.9	35.6	18.5	38.2	20.7	40.3	23.2	42.4	25.7	44.5	27.3	45.8
	120	18.6	40.6	21.4	43.2	23.8	45.3	26.5	47.4	29.2	49.5	30.9	50.8
	150	22.8	46.4	26.0	48.8	28.8	50.8	31.7	52.9	34.8	54.9	36.7	56.1
	200	27.5	56.0	31.0	58.3	34.1	60.2	37.4	62.2	40.8	64.1	42.9	65.3
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	150		200		250		300		350		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	25.5	36.3	31.8	41.0	38.6	44.7	46.1	44.7	54.1	44.7	72.0	44.7
	100	29.6	44.1	36.3	49.0	43.6	53.9	51.5	58.8	60.0	58.8	78.9	58.8
	150	40.7	65.5	48.5	70.9	56.9	76.4	66.1	81.8	75.8	87.3	97.3	98.2
	225	59.5	95.8	69.1	101.6	79.4	107.4	90.5	113.2	102.3	119.1	128.0	130.7
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 150 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 300 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	46.0	73.6	53.9	79.3	62.4	84.9	71.3	90.6	81.3	96.3	91.7	101.9
	175	52.2	85.7	60.6	91.6	69.8	97.5	79.5	103.4	89.8	109.3	100.8	115.2
	200	58.6	98.3	67.8	104.4	77.4	110.5	87.7	116.7	98.7	122.8	110.4	129.0
	225	65.0	105.0	75.0	111.0	85.3	117.0	96.3	123.0	108.0	129.0	120.3	135.0
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 200 mm**	150		200		300		400		500		600	
Min. Concrete Thickness	**(h_{min}) = 400 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	39.6	50.1	48.3	55.6	67.9	66.7	90.5	66.7	116.2	66.7	144.8	66.7
	150	54.0	72.9	64.1	79.0	86.6	91.1	112.2	103.2	141.0	109.3	173.1	109.3
	200	70.0	98.0	81.5	104.6	106.9	117.6	135.8	130.7	168.0	143.8	203.7	156.8
	400	106.1	177.2	120.7	183.8	152.7	196.9	188.6	210.0	228.2	223.2	271.5	236.3



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SAFETY BOLT *Expansion Anchor*

SIMPSON Strong-Tie®

Twin-cone heavy duty sleeve-type expansion anchor with cylindrical expansion for increased anchoring security. Good for cracked and non-cracked concrete.

APPLICATIONS:

- Steel Construction
- Machines
- Lifting Systems
- Cable Trays
- Gates
- Base Plates
- Railing
- Facades
- Overhead Anchoring (Tension Zones)

APPROVAL: **ETA-06/0108 (Option 1)**

FEATURES:

- High capacity in cracked and non-cracked concrete
- Cylindrical expansion of sleeve over entire length
- Solid all-steel construction
- Torque indication from domed washer
- Twin-cone sleeve anchor for high loads
- Torque-controlled mechanical anchor

MATERIAL:

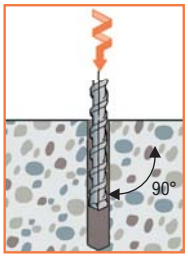
- Grade 8.8 Carbon Steel, Zinc Plated and Blue Passivated
- A4-80 Stainless Steel (Type B), A4-70 Stainless Steel (Type S, SK)

BASE MATERIAL: Cracked and Non-cracked Concrete: C20/25 to C50/60

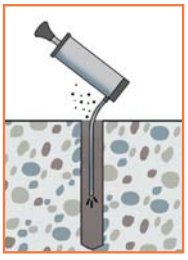
INSTALLATION: Through-fix installation

Type B "Hex Nut" | **Type S "Hex Screw"** | **Type SK "Countersunk Screw"**

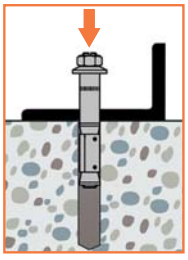
SAFETY BOLT



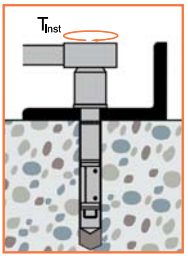
1. Drill hole



2. Clean hole (blowing)



3. Insert anchor through fixture



4. Apply recommended fastening torque with a calibrated torque-wrench

R 120

Product Availability: Carbon steel, Zinc Plated

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_0 x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
B M6-10/45/5	LB0610045005	M6	10 x 60	5	12	45	70	2.7	50
B M6-10/45/15	LB0610045015	M6	10 x 60	15	12	45	80	3.4	50
B M6-10/45/40	LB0610045040	M6	10 x 60	40	12	45	105	4.6	50
B M8-12/55/5	LB0812055005	M8	12 x 70	5	14	55	85	5.8	25
B M8-12/55/15	LB0812055015	M8	12 x 70	15	14	55	95	7.0	25
B M8-12/55/40	LB0812055040	M8	12 x 70	40	14	55	120	9.0	25
B M8-12/55/65	LB0812055065	M8	12 x 70	65	14	55	145	10.6	25
B M8-12/55/100	LB0812055100	M8	12 x 70	100	14	55	180	12.7	25
B M10-15/70/5	LB1015070005	M10	15 x 85	5	17	70	100	11.0	25
B M10-15/70/15	LB1015070015	M10	15 x 85	15	17	70	110	12.8	25
B M10-15/70/40	LB1015070040	M10	15 x 85	40	17	70	135	16.0	10
B M10-15/70/65	LB1015070065	M10	15 x 85	65	17	70	160	18.5	10
B M10-15/70/100	LB1015070100	M10	15 x 85	100	17	70	195	22.0	10
B M12-20/80/5	LB1220080005	M12	20 x 100	5	21	80	120	20.8	10
B M12-20/80/15	LB1220080015	M12	20 x 100	15	21	80	130	24.8	10
B M12-20/80/40	LB1220080040	M12	20 x 100	40	21	80	155	29.0	10
B M12-20/80/65	LB1220080065	M12	20 x 100	65	21	80	180	33.5	10
B M12-20/80/100	LB1220080100	M12	20 x 100	100	21	80	215	39.8	20
B M16-25/100/5	LB1625100005	M16	25 x 125	5	26	100	150	43.4	5
B M16-25/100/15	LB1625100015	M16	25 x 125	15	26	100	160	48.4	5
B M16-25/100/40	LB1625100040	M16	25 x 125	40	26	100	185	56.7	5
B M16-25/100/65	LB1625100065	M16	25 x 125	65	26	100	210	63.6	10
B M16-25/100/100	LB1625100100	M16	25 x 125	100	26	100	245	75.0	10
B M20-30/125/15*	B2030125015	M20	30 x 150	15	32	125	180	85.9	5
B M20-30/125/40*	B2030125040	M20	30 x 150	40	32	125	205	96.7	5
B M20-30/125/65*	B2030125065	M20	30 x 150	65	32	125	230	107.6	5
B M20-30/125/100*	B2030125100	M20	30 x 150	100	32	125	265	122.0	5

Custom lengths available on request.

*Not included in approval.

Product Availability: Carbon steel, Zinc Plated

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
S M6-10/45/5	LS0610045005	M6	10 x 60	5	12	45	70	2.7	50
S M6-10/45/15	LS0610045015	M6	10 x 60	15	12	45	80	3.4	50
S M6-10/45/40	LS0610045040	M6	10 x 60	40	12	45	105	4.6	50
S M8-12/55/5	LS0812055005	M8	12 x 70	5	14	55	80	5.8	25
S M8-12/55/15	LS0812055015	M8	12 x 70	15	14	55	90	7.0	25
S M8-12/55/40	LS0812055040	M8	12 x 70	40	14	55	115	9.0	25
S M10-15/70/5	LS1015070005	M10	15 x 85	5	17	70	95	11.0	25
S M10-15/70/15	LS1015070015	M10	15 x 85	15	17	70	105	12.8	25
S M10-15/70/40	LS1015070040	M10	15 x 85	40	17	70	130	16.0	10
S M12-20/80/5	LS1220080005	M12	20 x 100	5	21	80	113	20.8	10
S M12-20/80/15	LS1220080015	M12	20 x 100	15	21	80	123	24.8	10
S M12-20/80/40	LS1220080040	M12	20 x 100	40	21	80	148	29.0	10
S M16-25/100/5	LS1625100005	M16	25 x 125	5	26	100	145	43.4	5
S M16-25/100/15	LS1625100015	M16	25 x 125	15	26	100	155	48.4	5
S M16-25/100/40	LS1625100040	M16	25 x 125	40	26	100	180	56.7	5
S M20-30/125/15*	S2030125015	M20	30 x 150	15	32	125	180	85.9	5
S M20-30/125/40*	S2030125040	M20	30 x 150	40	32	125	205	96.7	5

Custom lengths available on request.

*Not included in approval.

Product Availability: Carbon Steel, Zinc-Plated, Type SK

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
SK M6-10/45/6	LSK0610045006	M6	10 x 60	6	12	45	60	2.7	50
SK M6-10/45/15	LSK0610045015	M6	10 x 60	15	12	45	70	3.4	50
SK M6-10/45/40	LSK0610045040	M6	10 x 60	40	12	45	95	4.6	50
SK M8-12/55/10	LSK0812055010	M8	12 x 70	10	14	55	75	5.8	25
SK M8-12/55/15	LSK0812055015	M8	12 x 70	15	14	55	85	7.0	25
SK M8-12/55/40	LSK0812055040	M8	12 x 70	40	14	55	110	9.0	25
SK M10-15/70/10	LSK1015070010	M10	15 x 85	10	17	70	90	11.0	25
SK M10-15/70/15	LSK1015070015	M10	15 x 85	15	17	70	100	12.8	25
SK M10-15/70/40	LSK1015070040	M10	15 x 85	40	17	70	120	16.0	25
SK M12-20/80/15	LSK1220080015	M12	20 x 100	15	21	80	110	24.8	10
SK M12-20/80/40	LSK1220080040	M12	20 x 100	40	21	80	135	29.0	10
SK M16-25/100/15	LSK1625100015	M16	25 x 125	15	26	100	135	48.4	5
SK M16-25/100/40	LSK1625100040	M16	25 x 125	40	26	100	160	56.7	5

Custom lengths available on request.

Product Availability: A4 Stainless Steel Type B

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
B M6-10/45/5 A4	B0610045005A4	M6	10 x 60	5	12	45	70	2.7	50
B M6-10/45/15 A4	B0610045015A4	M6	10 x 60	15	12	45	80	3.4	50
B M6-10/45/40 A4	B0610045040A4	M6	10 x 60	40	12	45	105	4.6	50
B M8-12/55/5 A4	B0812055005A4	M8	12 x 70	5	14	55	85	5.8	25
B M8-12/55/15 A4	B0812055015A4	M8	12 x 70	15	14	55	95	7.0	25
B M8-12/55/40 A4	B0812055040A4	M8	12 x 70	40	14	55	120	9.0	25
B M10-15/70/5 A4	B1015070005A4	M10	15 x 85	5	17	70	100	11.0	25
B M10-15/70/15 A4	B1015070015A4	M10	15 x 85	15	17	70	110	12.8	25
B M10-15/70/40 A4	B1015070040A4	M10	15 x 85	40	17	70	135	16.0	10
B M12-20/80/5 A4	B1220080005A4	M12	20 x 95	5	21	80	120	20.8	10
B M12-20/80/15 A4	B1220080015A4	M12	20 x 95	15	21	80	130	24.8	10
B M12-20/80/40 A4	B1220080040A4	M12	20 x 95	40	21	80	155	29.0	10
B M16-25/100/15 A4	B1625100015A4	M16	25 x 125	15	26	100	160	48.4	5
B M16-25/100/40 A4	B1625100040A4	M16	25 x 125	40	26	100	185	56.7	5
B M20-30/125/40 A4	B2030125040A4	M20	30 x 150	40	32	125	205	96.7	5

Custom lengths available on request.

Product Availability: A4 Stainless Steel Type S

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
S M6-10/45/15 A4	S0610045015A4	M6	10 x 60	15	12	45	80	3.4	50
S M6-10/45/40 A4	S0610045040A4	M6	10 x 60	40	12	45	105	4.6	50
S M8-12/55/15 A4	S0812055015A4	M8	12 x 70	15	14	55	90	7.0	25
S M8-12/55/40 A4	S0812055040A4	M8	12 x 70	40	14	55	115	9.0	25
S M10-15/70/15 A4	S1015070015A4	M10	15 x 85	15	17	70	105	12.8	25
S M10-15/70/40 A4	S1015070040A4	M10	15 x 85	40	17	70	130	16.0	10
S M12-20/80/15 A4	S1220080015A4	M12	20 x 95	15	21	80	123	24.8	10
S M12-20/80/40 A4	S1220080040A4	M12	20 x 95	40	21	80	148	29.0	10

Custom lengths available on request.

Product Availability: A4 Stainless Steel Type SK

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
SK M6-10/45/15 A4	SK0610045015A4	M6	10 x 60	15	12	45	70	3.4	50
SK M6-10/45/40 A4	SK0610045040A4	M6	10 x 60	40	12	45	95	4.6	50
SK M8-12/55/15 A4	SK0812055015A4	M8	12 x 70	15	14	55	85	7.0	25
SK M8-12/55/40 A4	SK0812055040A4	M8	12 x 70	40	14	55	110	9.0	25
SK M10-15/70/15 A4	SK1015070015A4	M10	15 x 85	15	17	70	100	12.8	25
SK M10-15/70/40 A4	SK1015070040A4	M10	15 x 85	40	17	70	125	16.0	25
SK M12-20/80/15 A4	SK1220080015A4	M12	20 x 95	15	21	80	110	24.8	10
SK M12-20/80/40 A4	SK1220080040A4	M12	20 x 95	40	21	80	135	29.0	10

Custom lengths available on request.

Installation Data

Description	Symbol	Units	Anchor Size					
			M6	M8	M10	M12	M16	M20 [6]
Drill Hole Diameter	d_o	mm	10	12	15	20	25	30
Maximum Diameter of Drill Bit	$d_{cut,\ max} \leq$	mm	10.45	12.50	15.50	20.55	25.55	30.55
Drill Depth	$h_1 \geq$	mm	60	70	85	100	125	150
Effective Anchorage Depth	h_{ef}	mm	45	55	70	80	100	125
Anchor Length Range (type B)	L_B	mm	70-105	85-180	100-195	120-215	150-245	180-265
Anchor Length Range (type S)	L_S	mm	70-105	80-115	95-130	113-148	145-180	180-205
Anchor Length Range (type SK)	L_{SK}	mm	60-95	75-110	90-120	110-135	135-160	-
Clearance Hole Diameter in Fixture (type B & S - through set)	$d_f \leq$	mm	12	14	17	21	26	32
Clearance Hole Diameter in Fixture (type B - mount on top of threads)	$d_f \leq$	mm	7	9	12	14	18	22
Maximum Thickness of Fixture	$t_{fix,max}$	mm	200					
Width Across Flats (type B & S)	SW	mm	10	13	17	19	24	32
Width Across Flats (type SK)	S	mm	4	5	6	8	10	-
Installation Torque (type B)	T_{inst}	Nm	8	15	40	70	115	300
Installation Torque (type S)			8	20	60	90	170	300
Installation Torque (type SK)			12	20	60	90	190	-

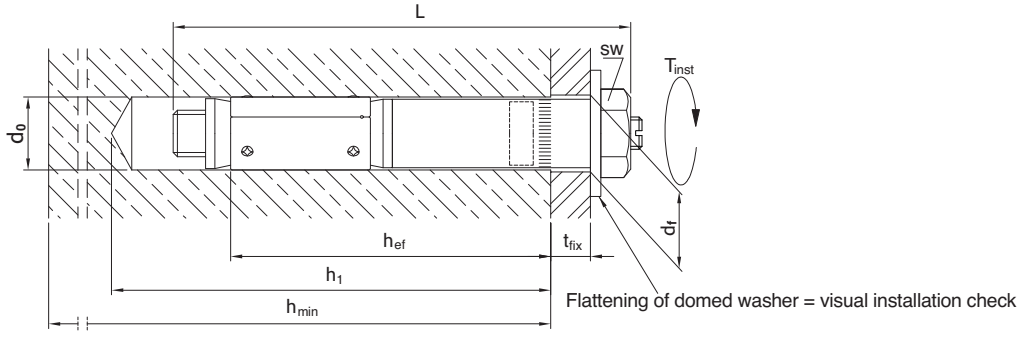
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M6	M8	M10	M12	M16	M20 [6]
Minimum Concrete Thickness	h_{min}	mm	100	110	140	160	200	250
Minimum Spacing	s_{min}	mm	60	100	150	200	250	195
	when c ≥	mm	130	200	300	500	600	-
Minimum Edge Distance	c_{min}	mm	80	100	150	200	250	350
	when s ≥	mm	140	200	250	380	440	-
Critical Spacing	$s_{cr,N}$	mm	$3 \times h_{ef}$					
Critical Edge Distance	$c_{cr,N}$	mm	$1.5 \times h_{ef}$					

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8, 9]

Description	Symbol	Units	M6	M8	M10	M12	M16	M20 [6]
Effective Embedment Depth	h_{ef}	mm	45	55	70	80	100	125
Minimum Concrete Thickness	h_{min}	mm	100	110	140	160	200	250
			Non-Cracked Concrete					
TENSION	N_{Rd}	kN	4.2	6.7	13.3	21.7	33.7	44.2
SHEAR	V_{Rd}	kN	7.4	10.6	**31.2**	43.4	67.3	94.1
			Cracked Concrete					
TENSION	N_{Rd}	kN	3.3	5.0	10.7	15.5	24.0	26.0
SHEAR	V_{Rd}	kN	5.3	7.6	23.9	30.9	48.0	67.1

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$
4. V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
7. Critical Spacing and Critical Edge Distance is taken from the relevant ETA. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Bold values indicate that steel controls design resistance.
9. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}



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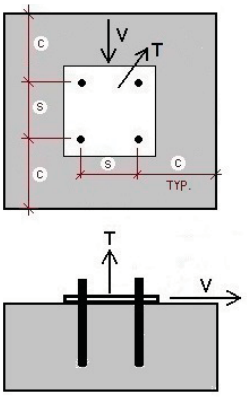

Table 1A: SAFETY BOLT with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	13.8	10.0	15.7	11.6
	100	-	-	-	-	-	-	13.6	11.1	15.8	12.0	16.7	13.7
	125	-	-	11.3	10.9	12.8	11.6	12.8	11.6	16.7	13.2	16.7	14.9
	150	12.8	11.6	15.6	12.3	16.7	12.9	16.7	13.7	16.7	14.5	16.7	16.2
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	22.0	14.6	23.4	15.5
	150	-	-	-	-	21.2	16.1	23.8	17.0	26.5	17.8	26.7	19.6
	200	22.9	17.2	27.4	18.0	26.7	18.9	26.7	19.7	26.7	20.6	26.7	22.3
	250	22.9	20.0	26.7	20.9	26.7	21.7	26.7	22.5	26.7	23.4	26.7	25.0
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	-	-	-	-	-	-	-	-	44.7	23.8	53.2	25.9
	200	-	-	-	-	-	-	45.2	25.8	49.3	26.8	53.3	28.9
	250	-	-	-	-	53.3	27.9	53.3	28.9	53.3	29.9	53.3	31.9
	300	49.3	29.2	53.3	30.2	53.3	31.2	53.3	32.1	53.3	33.1	53.3	35.1
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	-	-	-	-	86.7	37.5	86.7	37.8
	300	-	-	-	-	-	-	86.7	41.7	86.7	43.9	86.7	46.1
	400	-	-	-	-	86.7	46.3	86.7	48.5	86.7	50.6	86.7	52.7
	500	72.9	49.1	86.7	51.2	86.7	53.2	86.7	55.3	86.7	57.3	86.7	59.4
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	250	-	-	-	-	-	-	-	-	121.5	51.4	134.7	54.2
	400	-	-	-	-	-	-	134.7	60.0	134.7	62.5	134.7	65.0
	500	-	-	-	-	134.7	65.2	134.7	67.7	134.7	70.1	134.7	72.5
	600	113.2	68.3	134.7	70.7	134.7	73.0	134.7	75.4	134.7	77.8	134.7	80.1
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	350	82.0	54.5	92.2	57.7	103.1	60.6	114.5	63.6	126.6	66.6	152.4	72.7
	400	110.6	59.1	130.7	62.1	152.4	65.0	175.9	68.0	176.8	70.9	176.8	76.8
	500	110.6	68.3	130.7	71.1	152.4	74.0	175.9	76.8	176.8	79.7	176.8	85.4
	600	110.6	77.4	130.7	80.2	152.4	83.0	175.9	85.7	176.8	88.5	176.8	94.0

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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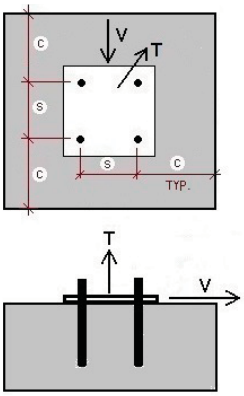

Table 1B: SAFETY BOLT with Four Anchors, Four Edge Distances, Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	9.9	7.1	11.2	8.2
	100	-	-	-	-	-	-	9.7	7.9	11.2	8.5	13.3	9.7
	125	-	-	8.0	7.7	9.1	8.2	10.6	8.8	12.2	9.4	13.3	10.5
	150	9.1	8.2	11.1	8.7	13.3	9.2	13.3	9.7	13.3	10.3	13.3	11.4
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	15.7	10.3	16.7	11.0
	150	-	-	-	-	15.1	11.4	16.9	12.0	18.9	12.6	20.0	13.9
	200	16.3	12.2	19.5	12.8	20.0	13.4	20.0	14.0	20.0	14.6	20.0	15.8
	250	16.3	14.2	19.5	14.8	20.0	15.4	20.0	16.0	20.0	16.6	20.0	17.7
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	-	-	-	-	-	-	-	-	31.9	16.8	37.9	18.4
	200	-	-	-	-	-	-	32.3	18.3	35.1	19.0	41.2	20.5
	250	-	-	-	-	42.7	19.8	42.7	20.5	42.7	21.2	42.7	22.6
	300	35.1	20.7	40.2	21.4	42.7	22.1	42.7	22.8	42.7	23.5	42.7	24.8
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	-	-	-	-	61.8	26.6	61.8	26.7
	300	-	-	-	-	-	-	61.8	29.5	61.8	31.1	61.8	32.6
	400	-	-	-	-	61.8	32.8	61.8	34.3	61.8	35.8	61.8	37.3
	500	52.0	34.8	61.8	36.3	61.8	37.7	61.8	39.2	61.8	40.6	61.8	42.1
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	250	-	-	-	-	-	-	-	-	88.6	36.4	96.0	38.4
	400	-	-	-	-	-	-	96.0	42.5	96.0	44.2	96.0	46.0
	500	-	-	-	-	96.0	46.2	96.0	47.9	96.0	49.6	96.0	51.3
	600	80.7	48.4	96.0	50.1	96.0	51.7	96.0	53.4	96.0	55.1	96.0	56.7
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	350	58.4	38.6	65.7	40.8	73.5	42.9	81.6	45.0	90.2	47.2	104.0	51.5
	400	78.9	41.9	93.2	44.0	104.0	46.1	104.0	48.1	104.0	50.2	104.0	54.4
	500	78.9	48.4	93.2	50.4	104.0	52.4	104.0	54.4	104.0	56.4	104.0	60.5
	600	78.9	54.8	93.2	56.8	104.0	58.8	104.0	60.7	104.0	62.7	104.0	66.6

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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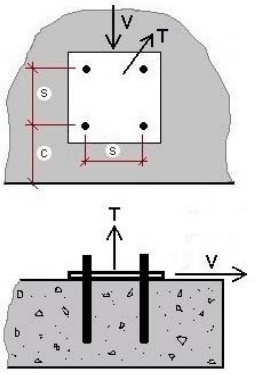

Table 2A: SAFETY BOLT with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	14.2	13.0	16.7	14.6
	100	-	-	-	-	-	-	13.9	13.7	15.9	14.5	16.7	16.2
	125	-	-	11.3	14.3	12.8	14.9	14.9	15.7	16.7	16.5	16.7	18.1
	150	12.8	15.4	15.6	16.3	16.7	17.0	16.7	17.7	16.7	18.5	16.7	20.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	22.4	17.8	26.7	19.6
	150	-	-	-	-	21.2	20.3	23.8	21.1	26.5	22.0	26.7	23.7
	200	22.9	22.9	26.7	23.7	26.7	24.5	26.7	25.3	26.7	26.2	26.7	27.8
	250	22.6	27.1	26.7	27.9	26.7	28.7	26.7	29.5	26.7	30.3	26.7	31.9
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	-	-	-	-	-	-	-	-	45.2	28.4	53.2	30.4
	200	-	-	-	-	-	-	45.2	32.1	49.3	33.1	53.3	35.1
	250	-	-	-	-	53.3	36.0	53.3	36.9	53.3	37.9	53.3	39.8
	300	49.3	38.9	53.3	39.9	53.3	40.8	53.3	41.7	53.3	42.6	53.3	44.5
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	-	-	-	-	86.7	43.9	86.7	46.1
	300	-	-	-	-	-	-	86.7	51.9	86.7	53.9	86.7	56.0
	400	-	-	-	-	86.7	60.1	86.7	62.1	86.7	64.1	86.7	66.1
	500	72.9	66.4	86.7	68.4	86.7	70.4	86.7	72.3	86.7	74.3	86.7	76.2
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	250	-	-	-	-	-	-	-	-	121.5	60.6	134.7	63.1
	400	-	-	-	-	-	-	134.7	75.4	134.7	77.6	134.7	80.1
	500	-	-	-	-	134.7	84.7	134.7	87.0	134.7	89.3	134.7	91.6
	600	113.2	91.9	134.7	94.1	134.7	96.4	134.7	98.6	134.7	100.8	134.7	103.1
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	350	82.0	70.6	92.2	73.4	103.1	76.2	114.5	79.0	126.6	81.9	152.4	87.5
	400	110.6	77.4	130.7	80.2	152.5	83.0	175.9	85.7	176.8	88.5	176.8	94.0
	500	110.6	91.0	130.7	93.7	152.5	96.4	175.9	99.1	176.8	101.7	176.8	107.1
	600	110.6	104.5	130.7	107.1	152.5	109.7	175.9	112.3	176.8	114.9	176.8	120.2

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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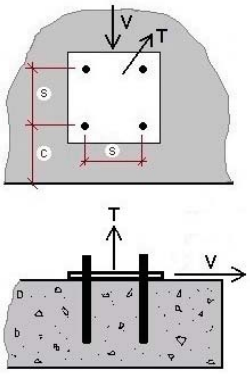
Table 2B: SAFETY BOLT with Four Anchors, One Edge Distance, Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	10.1	9.2	13.2	10.4
	100	-	-	-	-	-	-	9.9	9.7	11.4	10.3	13.3	11.4
	125	-	-	8.0	10.1	9.1	10.6	10.6	11.1	12.2	11.7	13.3	12.8
	150	9.1	11.0	11.1	11.6	13.3	12.0	13.3	12.6	13.3	13.1	13.3	14.2
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	100		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	16.0	12.6	19.7	13.9
	150	-	-	-	-	15.1	14.4	16.9	15.0	18.9	15.6	20.0	16.8
	200	16.3	16.2	19.5	16.8	20.0	17.4	20.0	17.9	20.0	18.5	20.0	19.7
	250	16.3	19.2	19.5	19.8	20.0	20.4	20.0	20.9	20.0	21.5	20.0	22.6
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	150		175		200		225		250		300	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	-	-	-	-	-	-	-	-	32.2	20.1	37.9	21.5
	200	-	-	-	-	-	-	32.3	22.8	35.1	23.5	41.2	24.8
	250	-	-	-	-	42.7	25.5	42.7	26.2	42.7	26.8	42.7	28.2
	300	35.1	27.6	40.2	28.2	42.7	28.9	42.7	29.6	42.7	30.2	42.7	31.5
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	-	-	-	-	61.8	31.1	61.8	32.6
	300	-	-	-	-	-	-	61.8	36.7	61.8	38.2	61.8	39.7
	400	-	-	-	-	61.8	42.6	61.8	44.0	61.8	45.4	61.8	46.8
	500	52.0	47.1	61.8	48.5	61.8	49.8	61.8	51.2	61.8	52.6	61.8	54.0
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	250		300		350		400		450		500	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	250	-	-	-	-	-	-	-	-	86.6	42.9	96.0	44.7
	400	-	-	-	-	-	-	96.0	53.4	96.0	55.1	96.0	56.7
	500	-	-	-	-	96.0	60.0	96.0	61.6	96.0	63.3	96.0	64.9
	600	80.7	65.1	96.0	66.7	96.0	68.3	96.0	69.8	96.0	71.4	96.0	73.0
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 125 mm**	200		250		300		350		400		500	
Min. Concrete Thickness	**(h_{min}) = 250 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	350	58.4	50.0	65.7	52.0	73.5	54.0	81.6	56.0	90.2	58.0	104.0	62.0
	400	78.9	54.8	93.2	56.8	104.0	58.8	104.0	60.7	104.0	62.7	104.0	66.6
	500	78.9	64.5	93.2	66.4	104.0	68.3	104.0	70.2	104.0	72.1	104.0	75.9
	600	78.9	74.0	93.2	75.9	104.0	77.7	104.0	79.6	104.0	81.4	104.0	85.1



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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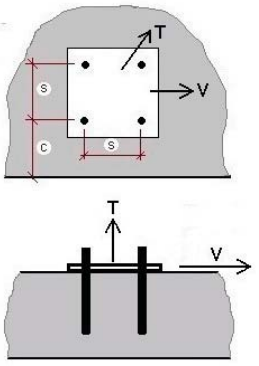
Table 3A: SAFETY BOLT with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	14.2	29.5	16.7	29.5
	100	-	-	-	-	-	-	13.9	27.3	15.9	29.5	16.7	29.5
	125	-	-	11.3	18.5	12.8	22.3	14.9	27.3	16.7	29.5	16.7	29.5
	150	12.8	15.4	15.6	18.7	16.7	22.3	16.7	27.3	16.7	29.5	16.7	29.5
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	22.4	42.6	26.7	42.6
	150	-	-	-	-	21.2	38.8	23.8	42.6	26.5	42.6	26.7	42.6
	200	22.9	27.4	26.7	32.9	26.9	38.8	26.9	42.6	26.7	42.6	26.7	42.6
	250	22.9	27.4	26.7	32.9	26.9	38.8	26.9	42.6	26.7	42.6	26.7	42.6
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	-	-	-	-	-	-	-	-	45.2	70.9	53.2	76.0
	200	-	-	-	-	-	-	45.2	80.2	49.3	82.8	53.3	87.6
	250	-	-	-	-	53.3	90.0	53.3	92.3	53.3	94.7	53.3	99.4
	300	49.3	97.3	53.3	99.7	53.3	102.0	53.3	104.3	53.3	106.6	53.3	111.2
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	-	-	-	-	86.7	109.7	86.7	115.2
	300	-	-	-	-	-	-	86.7	129.6	86.7	134.8	86.7	140.0
	400	-	-	-	-	86.7	150.2	86.7	155.2	86.7	160.2	86.7	165.2
	500	72.9	145.8	86.7	171.0	86.7	173.4	86.7	173.4	86.7	173.4	86.7	173.4
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	250	-	-	-	-	-	-	-	-	121.5	151.4	134.7	157.7
	400	-	-	-	-	-	-	134.4	188.5	134.7	194.4	134.7	200.3
	500	-	-	-	-	134.7	211.8	134.7	217.5	134.7	223.3	134.7	229.0
	600	113.2	226.3	134.7	235.3	134.7	240.9	134.7	246.5	134.7	252.1	134.7	257.7
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	350	82.0	176.4	92.2	183.5	103.1	190.5	114.5	197.6	126.6	204.7	152.4	218.8
	400	110.6	193.5	130.7	200.5	152.5	207.4	175.9	214.3	176.8	221.2	176.8	235.0
	500	110.6	221.2	130.7	234.2	152.5	240.9	175.9	247.6	176.8	254.3	176.8	267.7
	600	110.6	221.2	130.7	267.8	152.5	274.3	175.9	280.8	176.8	287.4	176.8	300.4



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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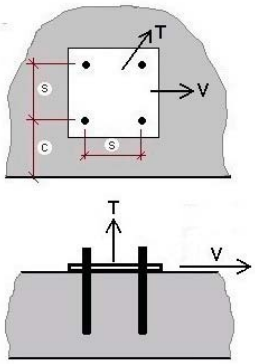
Table 3B: SAFETY BOLT with Four Anchors, One Edge Distance, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	10.1	21.0	13.2	21.0
	100	-	-	-	-	-	-	9.9	19.5	11.4	21.0	13.3	21.0
	125	-	-	8.0	13.3	9.1	15.9	10.6	19.5	12.2	21.0	13.3	21.0
	150	9.1	11.0	11.1	13.3	13.3	15.9	13.3	19.5	13.3	21.0	13.3	21.0
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	100		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	16.0	30.4	19.7	30.4
	150	-	-	-	-	15.1	27.6	16.9	30.4	18.9	30.4	20.0	30.4
	200	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4	20.0	30.4
	250	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4	20.0	30.4
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	150		175		200		225		250		300	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	-	-	-	-	-	-	-	-	32.2	50.2	37.9	53.3
	200	-	-	-	-	-	-	32.3	56.9	35.1	58.6	41.2	62.1
	250	-	-	-	-	42.7	63.7	42.7	66.0	42.7	67.1	42.7	70.4
	300	35.1	69.0	40.2	70.6	42.7	72.2	42.7	73.9	42.7	75.5	42.7	78.8
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	-	-	-	-	61.8	77.7	61.8	81.6
	300	-	-	-	-	-	-	61.8	91.8	61.8	95.5	61.8	99.2
	400	-	-	-	-	61.8	106.4	61.8	110.0	61.8	113.5	61.8	117.1
	500	52.0	103.9	61.8	121.6	61.8	123.6	61.8	123.6	61.8	123.6	61.8	123.9
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	250		300		350		400		450		500	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	250	-	-	-	-	-	-	-	-	86.6	107.3	96.0	111.7
	400	-	-	-	-	-	-	96.0	133.5	96.0	137.7	96.0	141.9
	500	-	-	-	-	96.0	150.0	96.0	154.1	96.0	158.1	96.0	162.2
	600	80.7	161.3	96.0	166.7	96.0	170.6	96.0	174.6	96.0	178.6	96.0	182.5
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 125 mm**	200		250		300		350		400		500	
Min. Concrete Thickness	**(h_{min}) = 250 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	350	58.4	125.0	65.7	130.0	73.5	134.7	81.6	140.0	90.2	145.0	104.0	155.0
	400	78.9	137.1	93.2	142.0	104.0	146.9	104.0	151.8	104.0	156.7	104.0	166.5
	500	78.9	157.7	93.2	165.9	104.0	170.7	104.0	175.4	104.0	180.1	104.0	189.6
	600	78.9	157.7	93.2	186.3	104.0	194.3	104.0	198.9	104.0	203.5	104.0	212.8



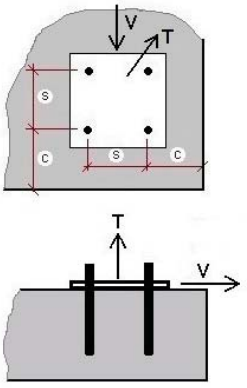
1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

SIMPSON Strong-Tie®

Table 4A: SAFETY BOLT with Four Anchors, Corner, Non-Cracked Concrete (T, V⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	13.0	10.5	16.7	12.0
	100	-	-	-	-	-	-	13.4	10.9	15.4	11.6	16.7	13.1
	125	-	-	11.3	11.1	12.8	11.7	14.9	12.4	16.7	13.1	16.7	14.5
	150	12.8	12.1	15.6	12.6	16.7	13.2	16.7	13.9	16.7	14.6	16.7	16.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	20.6	14.5	25.6	16.1
	150	-	-	-	-	21.2	16.0	23.8	16.7	26.5	17.5	26.7	19.0
	200	22.9	17.7	26.7	18.4	26.7	19.1	26.7	19.9	26.7	20.6	26.7	22.1
	250	22.9	20.8	26.7	21.6	26.7	22.3	26.7	23.0	26.7	23.7	26.7	25.1
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	-	-	-	-	-	-	-	-	43.3	22.8	51.2	24.6
	200	-	-	-	-	-	-	45.2	25.4	49.3	26.3	53.3	28.0
	250	-	-	-	-	53.3	28.1	53.3	29.0	53.3	29.8	53.3	31.5
	300	49.3	30.0	53.3	30.9	53.3	31.7	53.3	32.5	53.3	33.4	53.3	35.0
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	-	-	-	-	86.7	35.6	86.7	37.5
	300	-	-	-	-	-	-	86.7	41.1	86.7	42.9	86.7	44.8
	400	-	-	-	-	86.7	46.9	86.7	48.7	86.7	50.5	86.7	52.3
	500	72.9	51.0	86.7	52.8	86.7	54.5	86.7	56.3	86.7	58.0	86.7	59.8
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	250	-	-	-	-	-	-	-	-	121.5	48.8	134.7	51.1
	400	-	-	-	-	-	-	134.7	59.4	134.7	61.5	134.7	63.6
	500	-	-	-	-	134.7	65.9	134.7	68.0	134.7	70.1	134.7	72.1
	600	113.2	70.6	134.7	72.6	134.7	74.6	134.7	76.6	134.7	78.7	134.7	80.7
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	350	82.0	54.6	92.2	57.2	103.1	59.7	114.5	62.2	126.6	64.8	152.4	69.9
	400	110.6	59.7	130.7	62.2	152.4	64.7	175.9	67.2	176.8	69.7	176.8	74.7
	500	110.6	69.9	130.7	72.3	152.4	74.7	175.9	77.1	176.8	79.5	176.8	84.3
	600	110.6	79.9	130.7	82.3	152.4	84.6	175.9	87.0	176.8	89.3	176.8	94.0



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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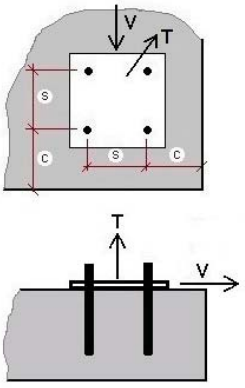
Table 4B: SAFETY BOLT with Four Anchors, Corner, Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	9.3	7.4	12.2	8.5
	100	-	-	-	-	-	-	9.5	7.7	11.0	8.2	13.3	9.3
	125	-	-	8.0	7.9	9.1	8.3	10.6	8.8	12.2	9.3	13.3	10.3
	150	9.1	8.6	11.1	8.9	13.3	9.3	13.3	9.8	13.3	10.3	13.3	11.3
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	100		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	14.7	10.2	18.2	11.4
	150	-	-	-	-	15.1	11.3	16.9	11.9	18.9	12.4	20.0	13.5
	200	16.3	12.5	19.5	13.0	20.0	13.5	20.0	14.1	20.0	14.6	20.0	15.6
	250	16.3	14.8	19.5	15.3	20.0	15.8	20.0	16.3	20.0	16.8	20.0	17.8
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	150		175		200		225		250		300	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	-	-	-	-	-	-	-	-	30.9	16.2	36.5	17.4
	200	-	-	-	-	-	-	35.1	18.0	35.1	18.6	41.2	19.9
	250	-	-	-	-	42.7	19.9	42.7	20.5	42.7	21.1	42.7	22.3
	300	35.1	21.3	40.2	21.9	42.7	22.5	42.7	23.1	42.7	23.6	42.7	24.8
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	-	-	-	-	61.8	25.2	61.8	26.6
	300	-	-	-	-	-	-	61.8	29.1	61.8	30.4	61.8	31.7
	400	-	-	-	-	61.8	33.2	61.8	34.5	61.8	35.8	61.8	37.0
	500	52.0	36.1	61.8	37.4	61.8	38.6	61.8	39.9	61.8	41.1	61.8	42.4
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	250		300		350		400		450		500	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	250	-	-	-	-	-	-	-	-	86.6	34.6	96.0	36.2
	400	-	-	-	-	-	-	96.0	42.1	96.0	43.6	96.0	45.1
	500	-	-	-	-	96.0	46.7	96.0	48.2	96.0	49.6	96.0	51.1
	600	80.7	50.0	96.0	51.4	96.0	52.9	96.0	54.3	96.0	55.7	96.0	57.1
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 125 mm**	200		250		300		350		400		500	
Min. Concrete Thickness	**(h_{min}) = 250 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	350	58.4	38.7	65.7	40.5	73.5	42.3	81.6	44.1	90.2	45.9	108.7	49.5
	400	78.9	42.3	93.2	44.1	104.0	45.8	104.0	47.6	104.0	49.4	104.0	52.9
	500	78.9	49.5	93.2	51.2	104.0	52.9	104.0	54.6	104.0	56.3	104.0	59.6
	600	78.9	56.6	93.2	58.3	104.0	60.0	104.0	61.6	104.0	63.3	104.0	66.6



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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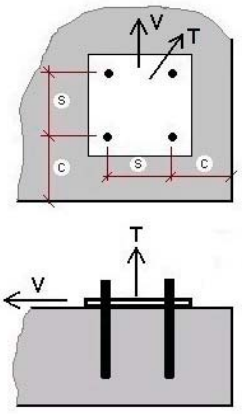
Table 5A: SAFETY BOLT with Four Anchors, Corner, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	13.0	26.2	16.7	27.5
	100	-	-	-	-	-	-	13.4	27.3	15.4	27.5	16.7	27.5
	125	-	-	11.3	18.7	12.8	22.3	14.9	27.3	16.7	27.5	16.7	27.5
	150	12.8	15.4	15.6	18.7	16.7	22.3	16.7	27.3	16.7	27.5	16.7	27.5
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	20.6	36.1	25.6	40.2
	150	-	-	-	-	21.2	38.8	23.8	41.8	26.5	42.6	26.7	42.6
	200	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6	26.7	42.6
	250	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6	26.7	42.6
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	150	-	-	-	-	-	-	-	-	43.3	56.9	51.2	61.6
	200	-	-	-	-	-	-	45.2	63.5	49.3	65.7	53.3	70.1
	250	-	-	-	-	53.3	70.3	53.3	72.4	53.3	74.6	53.3	78.8
	300	49.3	75.1	53.3	77.2	53.3	79.3	53.3	81.4	53.3	83.4	53.3	87.6
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	-	-	-	-	86.7	88.9	86.7	93.8
	300	-	-	-	-	-	-	86.7	102.7	86.7	107.3	86.7	112.0
	400	-	-	-	-	86.7	117.2	86.7	121.7	86.7	126.2	86.7	130.7
	500	72.7	127.5	86.7	131.9	86.7	136.3	86.7	140.7	86.7	145.1	86.7	149.0
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	250	-	-	-	-	-	-	-	-	121.5	122.1	134.7	127.8
	400	-	-	-	-	-	-	134.7	148.4	134.7	153.7	134.7	159.0
	500	-	-	-	-	134.7	164.9	134.7	170.0	134.7	175.2	134.7	180.3
	600	113.2	176.5	134.7	181.5	134.7	186.6	134.7	191.6	134.7	196.6	134.7	201.7
Anchor Size	= M20	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	350	82.0	136.6	92.2	142.9	103.1	149.3	114.5	155.6	126.6	162.0	152.4	174.7
	400	110.6	149.3	130.7	155.5	152.4	161.8	175.9	168.0	176.8	174.2	176.8	186.6
	500	110.6	174.7	130.7	180.7	152.4	186.7	175.9	192.7	176.8	198.8	176.8	210.8
	600	110.6	199.8	130.7	205.7	152.4	211.6	175.9	217.5	176.8	223.4	176.8	235.1



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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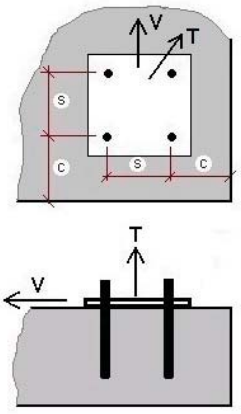
Table 5B: SAFETY BOLT with Four Anchors, Corner, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	9.3	18.6	12.2	21.0
	100	-	-	-	-	-	-	9.5	19.3	11.0	20.6	13.3	21.0
	125	-	-	8.0	13.3	9.1	15.9	10.6	19.5	13.3	21.0	13.3	21.0
	150	9.1	11.0	11.1	13.3	13.3	15.9	13.3	19.5	13.3	21.0	13.3	21.0
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	100		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	14.7	25.6	18.2	28.4
	150	-	-	-	-	15.1	27.6	16.9	29.6	18.9	30.4	20.0	30.4
	200	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4	20.0	30.4
	250	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4	20.0	30.4
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	150		175		200		225		250		300	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	-	-	-	-	-	-	-	-	30.9	40.4	36.5	43.6
	200	-	-	-	-	-	-	32.3	45.0	35.1	46.6	41.2	49.7
	250	-	-	-	-	42.7	49.8	42.7	51.3	42.7	52.8	42.7	55.8
	300	35.1	53.2	40.2	54.7	42.7	56.1	42.7	57.6	42.7	59.1	42.7	62.1
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	-	-	-	-	61.8	63.0	61.8	66.5
	300	-	-	-	-	-	-	61.8	72.7	61.8	76.0	61.8	79.3
	400	-	-	-	-	61.8	83.0	61.8	86.2	61.8	89.4	61.8	92.6
	500	51.5	90.3	61.8	93.4	61.8	96.6	61.8	99.7	61.8	102.8	61.8	105.9
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	250		300		350		400		450		500	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	250	-	-	-	-	-	-	-	-	86.6	86.5	96.0	90.5
	400	-	-	-	-	-	-	96.0	105.1	96.0	108.9	96.0	112.7
	500	-	-	-	-	96.0	116.8	96.0	120.4	96.0	124.1	96.0	127.7
	600	80.7	125.0	96.0	128.6	96.0	132.1	96.0	135.7	96.0	139.3	96.0	142.9
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 125 mm**	200		250		300		350		400		500	
Min. Concrete Thickness	**(h_{min}) = 250 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	350	58.4	96.7	65.7	101.3	73.5	105.7	81.6	110.2	90.2	114.7	104.0	123.7
	400	78.9	105.8	93.2	110.2	104.0	114.4	104.0	119.0	104.0	123.4	104.0	132.2
	500	78.9	123.7	93.2	128.0	104.0	132.3	104.0	136.5	104.0	140.8	104.0	149.3
	600	78.9	141.6	93.2	145.7	104.0	149.9	104.0	154.0	104.0	158.2	104.0	166.5



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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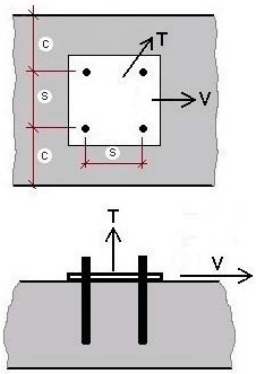


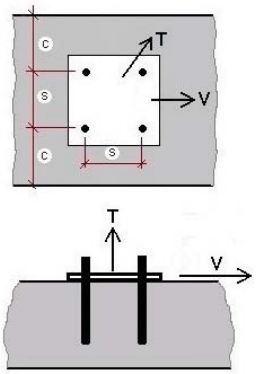
Table 6A: SAFETY BOLT with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	16.7	29.5	16.7	29.5
	100	-	-	-	-	-	-	13.3	27.3	16.7	29.5	16.7	29.5
	125	-	-	11.3	18.7	12.8	22.3	14.9	27.3	16.7	29.5	16.7	29.5
	150	12.8	15.4	15.6	18.7	16.7	22.3	16.7	27.3	16.7	29.5	16.7	29.5
Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 55 mm	100		125		150		175		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	20.5	42.6	25.4	42.6
	150	-	-	-	-	21.2	38.8	23.8	42.6	26.5	42.6	26.7	42.6
	200	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6	26.7	42.6
	250	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6	26.7	42.6
Anchor Size	= M10	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 70 mm	150		175		200		225		250		300	
Min. Concrete Thickness	(h_{min}) = 140 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	-	-	-	-	-	-	-	-	43.2	70.9	51.1	76.0
	200	-	-	-	-	-	-	45.2	80.3	49.3	82.8	53.3	87.6
	250	-	-	-	-	53.3	90.0	53.3	92.3	53.3	94.7	53.3	99.4
	300	49.3	97.3	53.3	99.7	53.3	102.0	53.3	104.3	53.3	106.6	53.3	111.2
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	-	-	-	-	86.7	109.7	86.7	115.2
	300	-	-	-	-	-	-	86.7	129.6	86.7	134.8	86.7	140.0
	400	-	-	-	-	86.7	150.2	86.7	155.2	86.7	160.2	86.7	165.2
	500	72.9	145.8	86.7	171.0	86.7	173.4	86.7	173.4	86.7	173.4	86.7	173.4
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 100 mm	250		300		350		400		450		500	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	250	-	-	-	-	-	-	-	-	121.5	151.4	134.7	157.7
	400	-	-	-	-	-	-	134.7	188.5	134.7	194.4	134.7	200.3
	500	-	-	-	-	134.7	211.8	134.7	217.5	134.7	223.3	134.7	229.0
	600	113.2	229.7	134.7	235.3	134.7	240.9	134.7	246.5	134.7	252.1	134.7	257.7
Anchor Size	= M20	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 125 mm	200		250		300		350		400		500	
Min. Concrete Thickness	(h_{min}) = 250 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	350	82.0	176.4	99.2	183.5	103.1	190.5	114.5	197.6	126.6	204.7	152.4	218.8
	400	110.6	193.5	130.7	200.5	152.4	207.4	175.9	214.3	176.8	221.2	176.8	235.0
	500	110.6	221.2	130.7	234.2	152.4	240.9	175.9	247.6	176.8	254.3	176.8	267.7
	600	110.6	221.2	130.7	261.4	152.4	274.3	175.9	280.8	176.8	287.4	176.8	300.4

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 6B: SAFETY BOLT with Four Anchors, 2-Edges, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	9.2	21.0	12.1	21.0
	100	-	-	-	-	-	-	9.5	19.5	11.0	21.0	13.3	21.0
	125	-	-	8.0	13.3	9.1	15.9	10.6	19.5	12.2	21.0	13.3	21.0
	150	9.1	11.0	11.1	13.3	13.3	15.9	13.3	19.5	13.3	21.0	13.3	21.0
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	100		125		150		175		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	14.6	30.4	18.1	30.4
	150	-	-	-	-	15.1	27.6	16.9	30.4	18.9	30.4	20.0	30.4
	200	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4	20.0	30.4
	250	16.3	20.0	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4	20.0	30.4
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 70 mm**	150		175		200		225		250		300	
Min. Concrete Thickness	**(h_{min}) = 140 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	150	-	-	-	-	-	-	-	-	30.8	50.2	36.4	53.8
	200	-	-	-	-	-	-	32.3	56.9	35.1	58.6	41.2	62.1
	250	-	-	-	-	42.7	63.7	42.7	65.4	42.7	67.1	42.7	70.4
	300	35.1	69.0	40.2	70.6	42.7	72.2	42.7	73.9	42.7	75.5	42.7	78.8
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	-	-	-	-	61.8	77.7	61.8	81.6
	300	-	-	-	-	-	-	61.8	91.5	61.8	95.5	61.8	99.2
	400	-	-	-	-	61.8	106.4	61.8	110.0	61.8	113.5	61.8	117.1
	500	52.0	103.9	61.8	121.1	61.8	123.6	61.8	123.6	61.8	123.6	61.8	123.6
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	250		300		350		400		450		500	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	250	-	-	-	-	-	-	-	-	86.6	107.3	96.0	111.7
	400	-	-	-	-	-	-	96.0	133.5	96.0	137.7	96.0	141.9
	500	-	-	-	-	96.0	150.0	96.0	154.1	96.0	158.1	96.0	162.2
	600	80.7	161.3	96.0	166.7	96.0	170.6	96.0	174.6	96.0	178.6	96.0	182.5
Anchor Size	**= M20**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 125 mm**	200		250		300		350		400		500	
Min. Concrete Thickness	**(h_{min}) = 250 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	350	58.4	125.0	65.7	130.0	73.5	135.0	81.6	140.0	90.2	145.0	104.0	155.0
	400	78.9	137.1	93.2	142.0	104.0	146.9	104.0	151.8	104.0	156.7	104.0	166.5
	500	78.9	157.7	93.2	165.9	104.0	170.7	104.0	175.4	104.0	180.1	104.0	189.6
	600	78.9	157.7	93.2	186.3	104.0	194.3	104.0	198.9	104.0	203.5	104.0	212.8



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA except for M20 bolt which is based on in-house testing.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

LIEBIG ANCHOR *Expansion Anchor*

SIMPSON Strong-Tie®

General purpose heavy duty sleeve-type expansion anchor. Good for cracked and non-cracked concrete.

APPLICATIONS:

- Steel Construction
- Machines
- Lifting Systems
- Cable Trays
- Gates
- Base Plates
- Railing
- Facades
- Overhead Anchoring (Tension Zones)

APPROVAL: **ETA-06/0123 (Option 1)**

FEATURES:

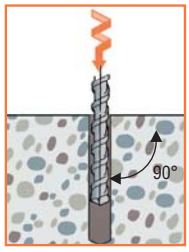
- Economical high capacity anchor
- Approved for use in cracked and non-cracked concrete
- Torque indication from domed washer
- Heavy duty anchor for high loads

MATERIAL:

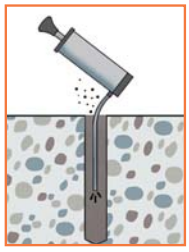
- Grade 8.8 Carbon Steel, Zinc Plated and Blue Passivated
- A4-80 Stainless Steel (Type AB), A4-70 Stainless Steel (Type AS)

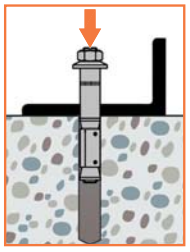
BASE MATERIAL: Cracked and Non-cracked Concrete: C20/25 to C50/60

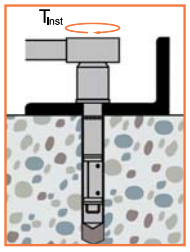
INSTALLATION: Through-fix installation shown



1. Drill hole


2. Clean hole (blowing)


3. Insert anchor through fixture



4. Apply recommended fastening torque with a calibrated torque-wrench


Typ AB "Hex Nut"


Typ AS "Hex Screw"


LIEBIG ANCHOR

Product Availability: Carbon steel, Zinc Plated, Type AB

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
AB M6-10/45/5	LAB0610045005	M6	10 x 60	5	12	45	70	2.7	50
AB M6-10/45/15	LAB0610045015	M6	10 x 60	15	12	45	80	3.4	50
AB M6-10/45/40	LAB0610045040	M6	10 x 60	40	12	45	105	4.6	50
AB M8-12/55/5	LAB0812055005	M8	12 x 70	5	14	55	85	5.8	25
AB M8-12/55/15	LAB0812055015	M8	12 x 70	15	14	55	95	7.0	25
AB M8-12/55/40	LAB0812055040	M8	12 x 70	40	14	55	120	9.0	25
AB M8-12/55/65	LAB0812055065	M8	12 x 70	65	14	55	145	10.6	25
AB M8-12/55/100	LAB0812055100	M8	12 x 70	100	14	55	180	12.8	25
AB M10-15/65/5	LAB1015065005	M10	15 x 85	5	17	65	100	11.0	25
AB M10-15/65/15	LAB1015065015	M10	15 x 85	15	17	65	110	12.8	25
AB M10-15/65/40	LAB1015065040	M10	15 x 85	40	17	65	135	16.0	10
AB M10-15/65/65	LAB1015065065	M10	15 x 85	65	17	65	160	18.5	10
AB M10-15/65/100	LAB1015065100	M10	15 x 85	100	17	65	195	22.0	10
AB M12-20/80/5	LAB1220080005	M12	20 x 100	5	21	80	120	20.8	10
AB M12-20/80/15	LAB1220080015	M12	20 x 100	15	21	80	130	24.8	10
AB M12-20/80/40	LAB1220080040	M12	20 x 100	40	21	80	155	29.0	10
AB M12-20/80/65	LAB1220080065	M12	20 x 100	65	21	80	180	33.5	10
AB M12-20/80/100	LAB1220080100	M12	20 x 100	100	21	80	215	39.8	20
AB M16-25/100/5	LAB1625100005	M16	25 x 125	5	26	100	150	43.4	5
AB M16-25/100/15	LAB1625100015	M16	25 x 125	15	26	100	160	48.4	5
AB M16-25/100/40	LAB1625100040	M16	25 x 125	40	26	100	185	56.7	5
AB M16-25/100/65	LAB1625100065	M16	25 x 125	65	26	100	210	63.6	10
AB M16-25/100/100	LAB1625100100	M16	25 x 125	100	26	100	245	73.3	10

Custom lengths available on request.

Product Availability: Carbon steel, Zinc Plated, Type AS

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_o x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
AS M6-10/45/5	LAS0610045005	M6	10 x 60	5	12	45	70	2.7	50
AS M6-10/45/15	LAS0610045015	M6	10 x 60	15	12	45	80	3.4	50
AS M6-10/45/40	LAS0610045040	M6	10 x 60	40	12	45	105	4.6	50
AS M8-12/55/5	LAS0812055005	M8	12 x 70	5	14	55	80	5.8	25
AS M8-12/55/15	LAS0812055015	M8	12 x 70	15	14	55	90	7.0	25
AS M8-12/55/40	LAS0812055040	M8	12 x 70	40	14	55	115	9.0	25
AS M10-15/65/5	LAS1015065005	M10	15 x 85	5	17	65	95	11.0	25
AS M10-15/65/15	LAS1015065015	M10	15 x 85	15	17	65	105	12.8	25
AS M10-15/65/40	LAS1015065040	M10	15 x 85	40	17	65	130	16.0	10
AS M12-20/80/5	LAS1220080005	M12	20 x 100	5	21	80	113	20.8	10
AS M12-20/80/15	LAS1220080015	M12	20 x 100	15	21	80	123	24.8	10
AS M12-20/80/40	LAS1220080040	M12	20 x 100	40	21	80	148	29.0	10
AS M16-25/100/15	LAS1625100015	M16	25 x 125	15	26	100	155	48.4	5
AS M16-25/100/40	LAS1625100040	M16	25 x 125	40	26	100	180	56.7	5

Custom lengths available on request.

Product Availability: A4 Stainless Steel, Type AB

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_0 x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
AB M6-10/45/5 A4	AB0610045005A4	M6	10 x 60	5	12	45	70	2.9	50
AB M6-10/45/15 A4	AB0610045015A4	M6	10 x 60	15	12	45	80	3.4	50
AB M6-10/45/40 A4	AB0610045040A4	M6	10 x 60	40	12	45	105	4.6	50
AB M8-12/55/5 A4	AB0812055005A4	M8	12 x 70	5	14	55	85	6.2	25
AB M8-12/55/15 A4	AB0812055015A4	M8	12 x 70	15	14	55	95	7.0	25
AB M8-12/55/40 A4	AB0812055040A4	M8	12 x 70	40	14	55	120	9.0	25
AB M10-15/65/5 A4	AB1015065005A4	M10	15 x 85	5	17	65	100	11.5	25
AB M10-15/65/15 A4	AB1015065015A4	M10	15 x 85	15	17	65	110	12.8	25
AB M10-15/65/40 A4	AB1015065040A4	M10	15 x 85	40	17	65	135	16.0	10
AB M12-20/80/5 A4	AB1220080005A4	M12	20 x 95	5	21	80	120	25.1	10
AB M12-20/80/15 A4	AB1220080015A4	M12	20 x 95	15	21	80	130	24.8	10
AB M12-20/80/40 A4	AB1220080040A4	M12	20 x 95	40	21	80	155	29.0	10
AB M16-25/100/15 A4	AB1625100015A4	M16	25 x 125	15	26	100	160	48.4	5
AB M16-25/100/40 A4	AB1625100040A4	M16	25 x 125	40	26	100	185	56.7	5

Custom lengths available on request.

Product Availability: A4 Stainless Steel, Type AS

Model Size	Order Code	Anchor Size	Ø x Depth of Drilled Hole	Max. Fixture Thickness	Ø Fixture Hole	Eff. Embedment Depth	Total Length	Weight	Box Quantity
			d_0 x h_1	$t_{fix,\ max}$	d_f	h_{ef}	L		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/100 pcs]	[pcs]
AS M6-10/45/5 A4	AS0610045005A4	M6	10 x 60	5	12	45	70	2.9	50
AS M6-10/45/15 A4	AS0610045015A4	M6	10 x 60	15	12	45	80	3.4	50
AS M8-12/55/15 A4	AS0812055015A4	M8	12 x 70	15	14	55	90	7.0	25
AS M8-12/55/40 A4	AS0812055040A4	M8	12 x 70	40	14	55	115	9.0	25
AS M10-15/65/15 A4	AS1015065015A4	M10	15 x 85	15	17	65	105	12.8	25
AS M10-15/65/40 A4	AS1015065040A4	M10	15 x 85	40	17	65	130	16.0	10
AS M12-20/80/15 A4	AS1220080015A4	M12	20 x 95	15	21	80	123	24.8	10
AS M12-20/80/40 A4	AS1220080040A4	M12	20 x 95	40	21	80	148	29.0	10

Custom lengths available on request.

Installation Data

Description	Symbol	Units	Anchor Size				
			M6	M8	M10	M12	M16
Drill Hole Diameter	d_o	mm	10	12	15	20	25
Maximum Diameter of Drill Bit	$d_{cut,\ max} \leq$	mm	10.45	12.50	15.50	20.55	25.55
Drill Depth	$h_1 \geq$	mm	60	70	85	100	125
Effective Anchorage Depth	h_{ef}	mm	45	55	65	80	100
Anchor Length Range (type AB)	L_B	mm	70-105	85-180	100-195	120-215	150-245
Anchor Length Range (type AS)	L_S	mm	70-105	80-115	95-130	113-148	155-180
Anchor Length Range (type SK)	L_{SK}	mm	60-95	75-110	90-120	110-135	135-160
Clearance Hole Diameter in Fixture (type AS & SK)	$d_f \leq$	mm	12	14	17	21	26
Clearance Hole Diameter in Fixture (type AB - mount on top of threads)	$d_f \leq$	mm	7	9	12	14	18
Maximum Thickness of Fixture	$t_{fix,max}$	mm	200				
Width Across Flats (type AB & AS)	SW	mm	10	13	17	19	24
Width Across Flats (type SK)	S	mm	4	5	6	8	10
Installation Torque (type AB)	T_{inst}	Nm	7	15	30	50	115
Installation Torque (type AS)			8	20	50	75	170
Installation Torque (type SK)			12	20	50	90	190

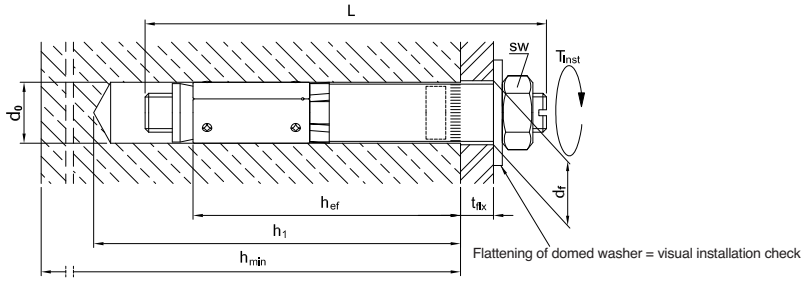
Concrete Thickness, Edge Distance and Spacing [7]

Description	Symbol	Units	M6	M8	M10	M12	M16
Minimum Concrete Thickness	h_{min}	mm	100	110	130	160	200
Minimum Spacing	s_{min}	mm	60	80	130	200	300
	when c ≥	mm	130	180	230	300	400
Minimum Edge Distance	c_{min}	mm	80	100	130	200	300
	when s ≥	mm	140	200	230	300	350
Critical Spacing	$s_{cr,N}$	mm	$3 \times h_{ef}$				
Critical Edge Distance	$c_{cr,N}$	mm	$1.5 \times h_{ef}$				

Design Resistance - Single Anchor, No Concrete Edge or Spacing Influence [1, 2, 3, 4, 5, 6, 8, 9]

Description	Symbol	Units	M6	M8	M10	M12	M16
Effective Embedment Depth	h_{ef}	mm	47	55	70	86	102
Minimum Concrete Thickness	h_{min}	mm	105	125	150	180	220
			Non-Cracked Concrete				
TENSION	N_{Rd}	kN	4.2	5.8	13.9	16.7	27.8
SHEAR	V_{Rd}	kN	8.0	10.6	25.2	46.7	69.4
			Cracked Concrete				
TENSION	N_{Rd}	kN	3.3	4.2	6.7	13.9	19.4
SHEAR	V_{Rd}	kN	5.7	7.6	23.9	35.6	49.5

1. N_{Rd} and V_{Rd} values are based on no edge distance, no anchor spacing, and installed in the minimum allowable concrete thickness for the embedment depth (h_{ef}) shown.
2. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
3. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$
4. V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
5. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
6. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
7. Critical Spacing and Critical Edge Distance is taken from the relevant ETA. For spacing and edge distance less than critical, use Simpson Strong-Tie® Anchor Designer™ Software for analysis.
8. Bold values indicate that steel controls design resistance.
9. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}



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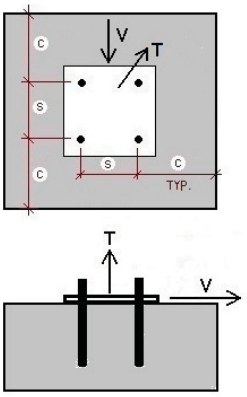

Table 1A: LIEBIG ANCHOR with Four Anchors, Four Edge Distances, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	13.8	10.0	15.7	11.6
	100	-	-	-	-	-	-	13.6	11.1	15.8	12.0	16.7	13.7
	125	-	-	11.3	10.9	12.8	11.6	14.9	12.4	16.7	13.2	16.7	14.9
	150	12.8	11.6	15.6	12.3	16.7	12.9	16.7	13.7	16.7	14.5	16.7	16.2
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	22.0	14.6	23.4	15.5
	150	-	-	-	-	18.8	15.2	21.2	16.1	26.5	17.8	26.7	19.6
	200	19.6	16.5	22.9	17.2	26.7	18.0	26.7	18.9	26.7	20.6	26.7	22.3
	250	19.6	19.4	22.9	20.0	26.7	20.9	26.7	21.7	26.7	23.4	26.7	25.0
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	40.1	21.5	43.2	22.1
	200	-	-	-	-	52.4	22.6	53.3	23.6	53.3	25.5	53.3	27.5
	250	40.4	24.0	45.6	24.7	52.4	25.7	53.3	26.6	53.3	28.5	53.3	30.4
	300	40.4	27.1	45.6	27.9	52.4	28.8	53.3	29.7	53.3	31.6	53.3	33.4
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	66.4	32.8	76.2	35.2	86.7	37.5	86.7	37.8
	300	72.9	35.1	86.7	37.3	86.7	39.5	86.7	41.7	86.7	43.9	86.7	46.1
	400	72.9	42.1	86.7	44.2	86.7	46.3	86.7	48.5	86.7	50.6	86.7	52.7
	500	72.9	49.1	86.7	51.2	86.7	53.2	86.7	55.3	86.7	57.3	86.7	59.4
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	134.7	49.8	134.7	52.4	134.7	55.0	134.7	57.6	134.7	60.3
	400	134.7	55.0	134.7	57.5	134.7	60.0	134.7	62.5	134.7	65.0	134.7	67.5
	500	134.7	62.8	134.7	65.2	134.7	67.7	134.7	70.1	134.7	72.5	134.7	74.9
	600	134.7	70.7	134.7	73.0	134.7	75.4	134.7	77.8	134.7	80.1	134.7	82.5

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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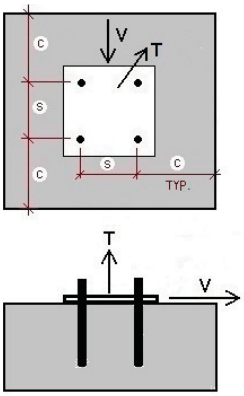

Table 1B: LIEBIG ANCHOR with Four Anchors, Four Edge Distances, Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	9.9	7.1	11.2	8.2
	100	-	-	-	-	-	-	9.7	7.9	11.2	8.5	13.3	9.7
	125	-	-	8.0	7.7	9.1	8.2	10.6	8.8	12.2	9.4	13.3	10.6
	150	9.1	8.2	11.1	8.7	13.3	9.2	13.3	9.7	13.3	10.3	13.3	10.6
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	15.7	10.3	16.7	11.0
	150	-	-	-	-	13.4	10.7	15.1	11.4	18.9	12.6	20.0	13.9
	200	13.9	11.7	16.3	12.2	19.5	12.8	20.0	13.4	20.0	14.6	20.0	15.8
	250	13.9	13.7	16.3	14.2	19.5	14.8	20.0	15.4	20.0	16.6	20.0	17.7
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 65 mm**	130		150		175		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	130	-	-	-	-	-	-	-	-	28.6	15.2	30.8	15.7
	200	-	-	-	-	37.4	16.0	41.5	16.7	41.5	18.1	41.5	19.5
	250	28.8	17.0	32.5	17.5	37.4	18.2	41.5	18.9	41.5	20.2	41.5	21.6
	300	28.8	19.2	32.5	19.4	37.4	20.4	41.5	21.1	41.5	22.4	41.5	23.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	47.3	23.2	54.3	24.9	61.8	26.6	61.8	26.7
	300	52.0	24.9	61.8	26.4	61.8	28.0	61.8	29.5	61.8	31.1	61.8	32.6
	400	52.0	29.8	61.8	31.3	61.8	32.8	61.8	34.3	61.8	35.8	61.8	37.3
	500	52.0	34.8	61.8	36.3	61.8	37.7	61.8	39.2	61.8	40.6	61.8	42.1
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	300		350		400		450		500		550	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	300	-	-	96.0	35.3	96.0	37.1	96.0	39.0	96.0	40.8	96.0	42.7
	400	96.0	38.9	96.0	40.7	96.0	42.5	96.0	44.2	96.0	46.0	96.0	47.8
	500	96.0	44.5	96.0	46.2	96.0	47.9	96.0	49.6	96.0	51.3	96.0	53.1
	600	96.0	50.1	96.0	51.7	96.0	53.4	96.0	55.1	96.0	56.7	96.0	58.4

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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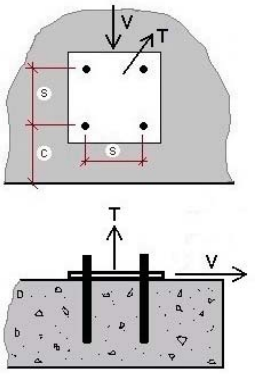
Table 2A: LIEBIG ANCHOR with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V ⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	14.2	13.0	16.7	14.6
	100	-	-	-	-	-	-	13.9	13.7	15.9	14.5	16.7	16.2
	125	-	-	11.3	14.3	12.8	14.9	14.9	15.7	16.7	16.5	16.7	18.1
	150	12.8	15.4	15.6	16.3	16.7	17.0	16.7	17.7	16.7	18.5	16.7	20.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	22.4	17.8	26.7	19.6
	150	-	-	-	-	18.8	19.4	21.2	20.3	26.5	22.0	26.7	23.7
	200	19.6	22.2	22.9	22.9	26.7	23.7	26.7	24.5	26.7	26.2	26.7	27.8
	250	19.6	23.5	22.9	27.1	26.7	27.9	26.7	28.7	26.7	30.3	26.7	31.9
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	40.4	25.2	48.0	27.2
	200	-	-	-	-	52.4	28.8	53.3	29.7	53.3	31.6	53.3	33.4
	250	40.4	31.8	45.6	32.5	52.4	33.4	53.3	33.4	53.3	36.2	53.3	38.0
	300	40.4	36.5	45.6	37.2	52.4	38.1	53.3	39.0	53.3	40.7	53.3	42.5
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	66.4	39.5	86.7	41.7	86.7	43.9	86.7	46.1
	300	72.9	45.6	86.7	47.7	86.7	49.8	86.7	51.9	86.7	53.9	86.7	56.0
	400	72.9	56.1	86.7	58.1	86.7	60.1	86.7	62.1	86.7	64.1	86.7	66.1
	500	72.9	66.4	86.7	68.4	86.7	70.4	86.7	72.3	86.7	74.3	86.7	76.2
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	134.7	61.3	134.7	63.8	134.7	66.3	134.7	68.7	134.7	71.2
	400	134.7	70.7	134.7	73.0	134.7	75.4	134.7	77.8	134.7	80.1	134.7	82.5
	500	134.7	82.4	134.7	84.7	134.7	87.0	134.7	89.3	134.7	91.6	134.7	93.9
	600	134.7	94.1	134.7	96.4	134.7	98.6	134.7	100.8	134.7	103.1	134.7	105.3



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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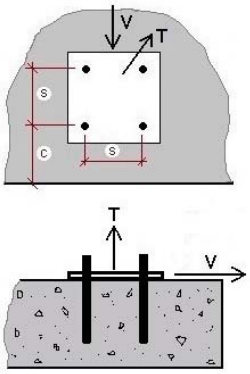
Table 2B: LIEBIG ANCHOR with Four Anchors, One Edge Distance, Cracked Concrete (T, V ⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	10.1	9.2	13.2	10.4
	100	-	-	-	-	-	-	9.9	9.7	11.4	10.3	13.3	11.4
	125	-	-	8.0	10.1	9.1	10.6	10.6	11.1	12.2	11.7	13.3	12.8
	150	9.1	11.0	11.1	11.6	13.3	12.0	13.3	12.6	13.3	13.1	13.3	14.2
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	16.0	12.6	19.7	13.9
	150	-	-	-	-	13.4	13.8	15.1	14.4	18.9	15.6	20.0	16.8
	200	13.9	15.7	16.3	16.2	19.5	16.8	20.0	17.4	20.0	18.5	20.0	19.7
	250	13.9	16.7	16.3	19.2	19.5	19.8	20.0	20.4	20.0	21.5	20.0	22.6
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 65 mm**	130		150		175		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	130	-	-	-	-	-	-	-	-	28.8	17.9	34.2	19.3
	200	-	-	-	-	37.4	20.4	41.5	21.1	41.5	22.4	41.5	23.7
	250	28.8	22.5	32.5	23.1	37.4	23.7	41.5	24.3	41.5	25.6	41.5	26.9
	300	28.8	25.8	32.5	26.3	37.4	27.0	41.5	27.6	41.5	28.9	41.5	30.1
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	47.3	28.0	54.3	29.5	61.8	31.1	61.8	32.6
	300	52.0	32.3	61.8	33.8	61.8	35.3	61.8	36.7	61.8	38.2	61.8	39.7
	400	52.0	39.7	61.8	41.1	61.8	42.6	61.8	44.0	61.8	45.4	61.8	46.8
	500	52.0	47.1	61.8	48.5	61.8	49.8	61.8	51.2	61.8	52.6	61.8	54.0
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	300		350		400		450		500		550	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	300	-	-	96.0	43.5	96.0	45.2	96.0	46.9	96.0	48.7	96.0	50.4
	400	96.0	50.1	96.0	51.7	96.0	53.4	96.0	55.1	96.0	56.7	96.0	58.4
	500	96.0	58.4	96.0	60.0	96.0	61.6	96.0	63.3	96.0	64.9	96.0	66.5
	600	96.0	66.7	96.0	68.3	96.0	69.8	96.0	71.4	96.0	73.0	96.0	74.6

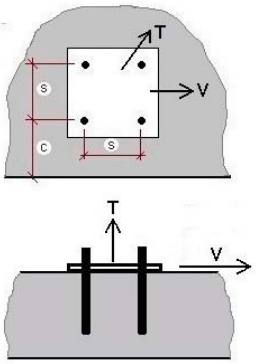


1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

Table 3A: LIEBIG ANCHOR with Four Anchors, One Edge Distance, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	14.2	29.5	16.7	29.5
	100	-	-	-	-	-	-	13.9	27.3	15.9	29.5	16.7	29.5
	125	-	-	11.3	18.7	12.8	22.3	14.9	27.3	16.7	29.5	16.7	29.5
	150	12.8	15.4	15.6	18.7	16.7	22.3	16.7	27.3	16.7	29.5	16.7	29.5
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	22.4	42.6	26.7	42.6
	150	-	-	-	-	18.8	32.9	21.2	38.8	26.5	42.6	26.7	42.6
	200	19.6	23.5	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6
	250	19.6	23.5	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	40.4	63.1	48.0	68.0
	200	-	-	-	-	52.4	72.0	53.3	74.3	53.3	78.9	53.3	83.6
	250	40.4	79.5	45.6	81.3	52.4	83.6	53.3	85.9	53.3	90.4	53.3	94.9
	300	40.4	80.9	45.6	91.1	52.4	95.2	53.3	97.4	53.3	101.8	53.3	106.3
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	66.4	98.8	76.2	104.2	86.7	109.7	86.7	115.2
	300	72.9	114.1	86.7	119.3	86.7	124.5	86.7	129.6	86.7	134.8	86.7	140.0
	400	72.9	140.2	86.7	145.2	86.7	150.2	86.7	155.2	86.7	160.2	86.7	165.2
	500	72.9	145.8	86.7	171.0	86.7	173.4	86.7	173.4	86.7	173.4	86.7	173.4
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	134.7	153.4	134.7	159.5	134.7	165.6	134.7	171.8	134.7	177.9
	400	134.7	176.7	134.7	182.6	134.7	188.5	134.7	194.4	134.7	200.3	134.7	206.2
	500	134.7	206.1	134.7	211.8	134.7	217.5	134.7	223.3	134.7	229.0	134.7	234.7
	600	134.7	235.3	134.7	240.9	134.7	246.5	134.7	252.1	134.7	257.7	134.7	263.3



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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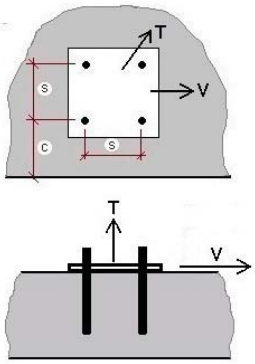

Table 3B: LIEBIG ANCHOR with Four Anchors, One Edge Distance, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	10.1	21.0	13.2	21.0
	100	-	-	-	-	-	-	9.9	19.5	11.4	21.0	13.3	21.0
	125	-	-	8.0	13.3	9.1	15.9	10.6	19.5	12.2	21.0	13.3	21.0
	150	9.1	11.0	11.1	13.3	13.3	15.9	13.3	19.5	13.3	21.0	13.3	21.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	16.0	30.4	19.7	30.4
	150	-	-	-	-	13.4	23.4	15.1	27.6	18.9	30.4	20.0	30.4
	200	13.9	16.7	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4
	250	13.9	16.7	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	28.8	44.7	34.2	48.2
	200	-	-	-	-	37.4	51.0	41.5	52.6	41.5	55.9	41.5	59.2
	250	28.8	56.3	32.5	57.6	37.4	59.2	41.5	60.8	41.5	64.0	41.5	67.2
	300	28.8	57.6	32.5	65.0	37.4	67.4	41.5	69.0	41.5	72.1	41.5	75.3
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	47.3	70.0	61.8	73.8	61.8	77.7	61.8	81.6
	300	52.0	80.8	61.8	84.5	61.8	88.2	61.8	91.8	61.8	95.5	61.8	99.2
	400	52.0	99.3	61.8	102.9	61.8	106.4	61.8	110.0	61.8	113.5	61.8	117.1
	500	52.0	103.9	61.8	121.1	61.8	123.6	61.8	128.0	61.8	123.6	61.8	123.6
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	96.0	108.6	96.0	113.0	96.0	117.3	96.0	121.7	96.0	126.0
	400	96.0	125.2	96.0	129.3	96.0	133.5	96.0	137.7	96.0	141.9	96.0	146.0
	500	96.0	146.0	96.0	150.0	96.0	154.1	96.0	158.1	96.0	162.2	96.0	166.2
	600	96.0	166.7	96.0	170.6	96.0	174.6	96.0	178.6	96.0	182.5	96.0	186.5

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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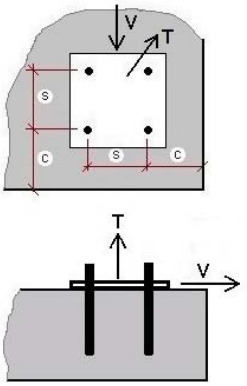

Table 4A: LIEBIG ANCHOR with Four Anchors, Corner, Non-Cracked Concrete (T, V⊢)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	13.0	10.5	16.7	12.0
	100	-	-	-	-	-	-	13.4	10.9	15.4	11.6	16.7	13.1
	125	-	-	11.3	11.1	12.8	11.7	14.9	12.4	16.7	13.1	16.7	14.5
	150	12.8	12.1	15.6	12.6	16.7	13.2	16.7	13.9	16.7	14.6	16.7	16.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	20.6	14.5	25.6	16.1
	150	-	-	-	-	18.8	15.2	21.2	16.0	26.5	17.5	26.7	19.0
	200	19.6	17.1	22.9	17.7	26.7	18.4	26.7	19.1	26.7	20.6	26.7	22.1
	250	19.6	20.3	22.9	20.8	26.7	21.6	26.7	22.3	26.7	23.7	26.7	25.1
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	38.1	20.4	45.5	22.2
	200	-	-	-	-	52.4	22.6	53.3	23.4	53.3	25.1	53.3	26.8
	250	40.4	24.6	45.6	25.2	52.4	26.0	53.3	26.8	53.3	28.5	53.3	30.1
	300	40.4	28.1	45.6	28.7	52.4	29.5	53.3	30.3	53.3	31.9	53.3	33.5
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	66.4	31.6	76.2	33.6	86.7	35.6	86.7	37.5
	300	72.9	35.5	86.7	37.3	86.7	39.2	86.7	41.1	86.7	42.9	86.7	44.8
	400	72.9	43.3	86.7	45.1	86.7	46.9	86.7	48.7	86.7	50.5	86.7	52.3
	500	72.9	51.0	86.7	52.8	86.7	54.5	86.7	56.3	86.7	58.0	86.7	59.8
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	134.7	48.6	134.7	50.8	134.7	53.0	134.7	55.2	134.7	57.4
	400	134.7	55.1	134.7	57.3	134.7	59.4	134.7	61.5	134.7	63.6	134.7	65.7
	500	134.7	63.9	134.7	65.9	134.7	68.0	134.7	70.1	134.7	72.1	134.7	74.2
	600	134.7	72.6	134.7	74.6	134.7	76.6	134.7	78.7	134.7	80.7	134.7	82.7

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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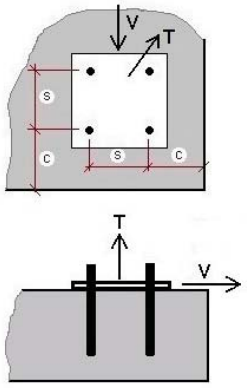

Table 4B: LIEBIG ANCHOR with Four Anchors, Corner, Cracked Concrete (T, V⊢)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	9.3	7.4	12.2	8.5
	100	-	-	-	-	-	-	9.5	7.7	11.0	8.2	13.3	9.3
	125	-	-	8.0	7.9	9.1	8.3	10.6	8.8	12.2	9.2	13.3	10.3
	150	9.1	8.6	11.1	8.9	13.3	9.3	13.3	9.8	13.3	10.3	13.3	11.3
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	14.7	10.2	18.2	11.4
	150	-	-	-	-	13.4	10.8	15.1	11.3	18.9	12.4	20.0	13.5
	200	13.9	12.1	16.3	12.5	19.5	13.0	20.0	13.5	20.0	14.6	20.0	15.6
	250	13.9	14.3	16.3	14.8	19.5	15.3	20.0	15.8	20.0	16.8	20.0	17.8
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 65 mm**	130		150		175		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	130	-	-	-	-	-	-	-	-	27.2	14.5	32.4	15.7
	200	-	-	-	-	37.4	16.0	41.5	16.6	41.5	17.8	41.5	19.0
	250	28.8	17.4	32.5	17.9	37.4	18.4	41.5	19.0	41.5	20.2	41.5	21.3
	300	28.8	19.9	32.5	20.3	37.4	20.9	41.5	21.5	41.5	22.6	41.5	23.7
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	47.3	22.4	54.3	23.8	61.8	25.2	61.8	26.6
	300	52.0	25.1	61.8	26.5	61.8	27.8	61.8	29.1	61.8	30.4	61.8	31.7
	400	52.0	30.7	61.8	31.9	61.8	33.2	61.8	34.5	61.8	35.8	61.8	37.0
	500	52.0	36.1	61.8	37.4	61.8	38.6	61.8	39.9	61.8	41.1	61.8	42.4
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	300		350		400		450		500		550	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	300	-	-	96.0	34.4	96.0	36.0	96.0	37.5	96.0	39.1	96.0	40.7
	400	96.0	39.1	96.0	40.6	96.0	42.1	96.0	43.6	96.0	45.1	96.0	46.6
	500	96.0	45.3	96.0	46.7	96.0	48.2	96.0	49.6	96.0	51.1	96.0	52.6
	600	96.0	51.4	96.0	52.9	96.0	54.3	96.0	55.7	96.0	57.1	96.0	58.6

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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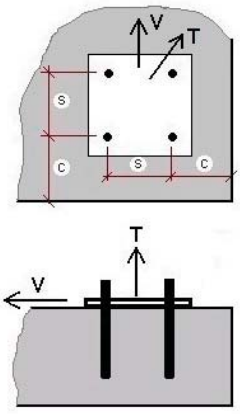
Table 5A: LIEBIG ANCHOR with Four Anchors, Corner, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	13.0	26.2	16.7	29.5
	100	-	-	-	-	-	-	13.4	27.3	15.4	29.1	16.7	29.5
	125	-	-	11.3	18.7	12.8	22.3	14.9	27.3	16.7	29.1	16.7	29.5
	150	12.8	15.4	15.6	18.7	16.7	22.3	16.7	27.3	16.7	29.1	16.7	29.5
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	20.6	36.1	25.6	40.2
	150	-	-	-	-	18.8	32.9	21.2	38.8	26.5	42.6	26.7	42.6
	200	19.6	23.5	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6
	250	19.6	23.5	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	38.1	51.0	45.5	55.4
	200	-	-	-	-	52.4	56.4	53.3	58.5	53.3	62.7	53.3	66.9
	250	40.4	61.4	45.6	63.0	52.4	65.1	53.3	67.1	53.3	71.2	53.3	75.2
	300	40.4	70.1	45.6	71.7	52.4	73.7	53.3	75.7	53.3	79.7	53.3	83.7
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	66.4	79.0	76.2	83.9	86.7	88.9	86.7	93.8
	300	72.9	88.7	86.7	93.3	86.7	98.0	86.7	102.7	86.7	107.3	86.7	112.0
	400	72.9	108.2	86.7	112.7	86.7	117.2	86.7	121.7	86.7	126.2	86.7	130.7
	500	72.9	127.5	86.7	131.9	86.7	136.3	86.7	140.7	86.7	145.1	86.7	149.5
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	134.7	121.5	134.7	127.0	134.7	132.5	134.7	138.0	134.7	143.5
	400	134.7	137.8	134.7	143.1	134.7	148.4	134.7	153.7	134.7	159.0	134.7	164.3
	500	134.7	159.7	134.7	164.9	134.7	170.0	134.7	175.2	134.7	180.3	134.7	185.5
	600	134.7	181.5	134.7	186.6	134.7	191.6	134.7	196.6	134.7	201.7	134.7	206.7



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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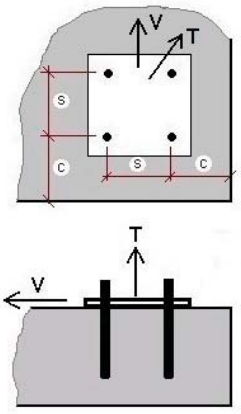
Table 5B: LIEBIG ANCHOR with Four Anchors, Corner, Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	80	-	-	-	-	-	-	-	-	9.3	18.6	12.2	21.0
	100	-	-	-	-	-	-	9.5	19.3	11.0	20.6	13.3	21.0
	125	-	-	8.0	13.3	9.1	15.9	10.6	19.5	12.2	21.0	13.3	21.0
	150	9.1	11.0	11.1	13.3	13.3	15.9	13.3	19.5	13.3	21.0	13.3	21.0
Anchor Size	= M8	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	100	-	-	-	-	-	-	-	-	14.7	25.6	18.2	28.4
	150	-	-	-	-	13.4	23.4	15.1	27.6	18.9	30.4	20.0	30.4
	200	13.9	16.7	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4
	250	13.9	16.7	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4
Anchor Size	= M10	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	130	-	-	-	-	-	-	-	-	27.2	36.1	32.4	39.3
	200	-	-	-	-	37.4	40.0	41.5	41.4	41.5	44.4	41.5	47.4
	250	28.8	43.5	32.5	44.7	37.4	46.1	41.5	47.5	41.5	50.4	41.5	53.3
	300	28.8	49.7	32.5	50.8	37.4	52.2	41.5	53.6	41.5	56.5	41.5	59.3
Anchor Size	= M12	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	200	-	-	-	-	47.3	56.0	54.3	59.5	61.8	63.0	61.8	66.5
	300	52.0	62.8	61.8	66.1	61.8	69.4	61.8	72.7	61.8	76.0	61.8	79.3
	400	52.0	76.6	61.8	79.8	61.8	83.0	61.8	86.2	61.8	89.4	61.8	92.6
	500	52.0	90.3	61.8	93.4	61.8	96.6	61.8	99.7	61.8	102.8	61.8	105.9
Anchor Size	= M16	Anchor Spacing (s)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (c)	300	-	-	96.0	86.0	96.0	89.9	96.0	93.9	96.0	97.8	96.0	101.7
	400	96.0	97.6	96.0	101.4	96.0	105.1	96.0	108.9	96.0	112.7	96.0	116.4
	500	96.0	113.1	96.0	116.8	96.0	120.4	96.0	124.1	96.0	127.7	96.0	131.4
	600	96.0	128.6	96.0	132.1	96.0	135.7	96.0	139.3	96.0	142.9	96.0	146.4



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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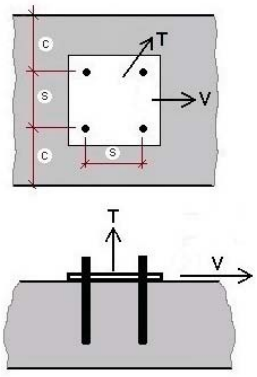
Table 6A: LIEBIG ANCHOR with Four Anchors, 2-Edges, Non-Cracked Concrete (T, V//)

Design Resistance Values for TENSION and SHEAR

Anchor Size	= M6	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 45 mm	60		80		100		125		150		200	
Min. Concrete Thickness	(h_{min}) = 100 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	12.9	29.5	16.7	29.5
	100	-	-	-	-	-	-	13.3	27.3	15.4	29.5	16.7	29.5
	125	-	-	11.3	18.7	12.8	22.3	14.9	27.3	16.7	29.5	16.7	29.5
	150	12.8	15.4	15.6	18.7	16.7	22.3	16.7	27.3	16.7	29.5	16.7	29.5
Anchor Size	= M8	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 55 mm	80		100		125		150		200		250	
Min. Concrete Thickness	(h_{min}) = 110 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	20.5	42.6	25.4	42.6
	150	-	-	-	-	18.8	32.9	21.2	38.8	26.5	42.6	26.7	42.6
	200	19.6	23.5	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6
	250	19.6	23.5	22.9	27.4	26.7	32.9	26.7	38.8	26.7	42.6	26.7	42.6
Anchor Size	= M10	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 65 mm	130		150		175		200		250		300	
Min. Concrete Thickness	(h_{min}) = 130 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	130	-	-	-	-	-	-	-	-	38.0	63.1	45.3	68.0
	200	-	-	-	-	52.4	72.0	53.3	74.3	53.3	78.9	53.3	83.6
	250	40.4	79.5	45.6	81.3	52.4	83.6	53.3	85.9	53.3	90.4	53.3	94.9
	300	40.4	80.9	45.6	91.1	52.4	95.2	53.3	97.4	53.3	101.8	53.3	106.3
Anchor Size	= M12	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 80 mm	200		250		300		350		400		450	
Min. Concrete Thickness	(h_{min}) = 160 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	86.7	98.8	86.7	104.2	86.7	109.7	86.7	115.2
	300	72.9	114.1	86.7	119.3	86.7	124.5	86.7	129.6	86.7	134.8	86.7	140.0
	400	72.9	140.2	86.7	145.2	86.7	150.2	86.7	155.2	86.7	160.2	86.7	165.2
	500	72.9	145.8	86.7	171.0	86.7	173.4	86.7	173.4	86.7	173.4	86.7	173.4
Anchor Size	= M16	Anchor Spacing (**s**)											
Effective Embedment	(h_{ef}) = 100 mm	300		350		400		450		500		550	
Min. Concrete Thickness	(h_{min}) = 200 mm	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	300	-	-	134.7	153.4	134.7	159.5	134.7	165.6	134.7	171.8	134.7	177.9
	400	134.7	176.7	134.7	185.6	134.7	188.5	134.7	194.4	134.7	200.3	134.7	206.2
	500	134.7	206.1	134.7	211.8	134.7	217.5	134.7	223.3	134.7	229.0	134.7	234.7
	600	134.7	235.3	134.7	240.9	134.7	246.5	134.7	252.1	134.7	257.7	134.7	263.3



1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

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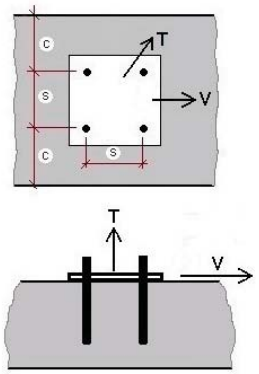

Table 6B: LIEBIG ANCHOR with Four Anchors, 2-Edges, Cracked Concrete (T, V//)													
Design Resistance Values for TENSION and SHEAR													
Anchor Size	**= M6**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 45 mm**	60		80		100		125		150		200	
Min. Concrete Thickness	**(h_{min}) = 100 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	80	-	-	-	-	-	-	-	-	9.2	17.0	12.1	21.0
	100	-	-	-	-	-	-	9.5	19.5	11.0	21.0	13.3	21.0
	125	-	-	8.0	13.3	9.1	15.9	10.6	19.5	12.2	21.0	13.3	21.0
	150	9.1	11.0	11.1	13.3	13.3	15.9	13.3	19.5	13.3	21.0	13.3	21.0
Anchor Size	**= M8**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 55 mm**	80		100		125		150		200		250	
Min. Concrete Thickness	**(h_{min}) = 110 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	100	-	-	-	-	-	-	-	-	14.6	30.4	18.1	30.4
	150	-	-	-	-	13.4	23.4	15.1	27.6	18.9	30.4	20.0	30.4
	200	13.9	16.7	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4
	250	13.9	16.7	16.3	19.6	19.5	23.4	20.0	27.6	20.0	30.4	20.0	30.4
Anchor Size	**= M10**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 65 mm**	130		150		175		200		250		300	
Min. Concrete Thickness	**(h_{min}) = 130 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	130	-	-	-	-	-	-	-	-	27.1	20.8	32.3	48.2
	200	-	-	-	-	37.4	51.0	41.5	52.6	41.5	55.9	41.5	59.2
	250	28.8	56.3	32.5	57.6	37.4	59.2	41.5	60.8	41.5	64.0	41.5	67.2
	300	28.8	57.6	32.5	66.2	37.4	67.4	41.5	69.0	41.5	72.1	41.5	75.3
Anchor Size	**= M12**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 80 mm**	200		250		300		350		400		450	
Min. Concrete Thickness	**(h_{min}) = 160 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	200	-	-	-	-	47.3	70.0	54.3	73.8	61.8	77.7	61.8	81.6
	300	52.0	80.8	61.8	84.5	61.8	88.2	61.8	91.8	61.8	95.5	61.8	99.2
	400	52.0	99.3	61.8	102.9	61.8	106.4	61.8	110.0	61.8	113.5	61.8	117.1
	500	52.0	103.9	61.8	121.1	61.8	123.6	61.8	123.6	61.8	123.6	61.8	123.6
Anchor Size	**= M16**	Anchor Spacing (**s**)											
Effective Embedment	**(h_{ef}) = 100 mm**	300		350		400		450		500		550	
Min. Concrete Thickness	**(h_{min}) = 200 mm**	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}	N_{Rd}	V_{Rd}
Edge Distance (**c**)	300	-	-	96.0	108.6	96.0	113.0	96.0	117.3	96.0	121.7	96.0	126.0
	400	96.0	125.2	96.0	129.3	96.0	133.5	96.0	137.7	96.0	141.9	96.0	146.0
	500	96.0	146.0	96.0	150.0	96.0	154.1	96.0	158.1	96.0	162.2	96.0	166.2
	600	96.0	166.7	96.0	170.6	96.0	174.6	96.0	178.6	96.0	182.5	96.0	186.5

1. N_{Rd} value shown is based on the lesser of $N_{Rd,s}$ $N_{Rd,p}$ $N_{Rd,c}$ and $N_{Rd,sp}$; V_{Rd} is based on value shown is based on the lesser of $V_{Rd,s}$ $V_{Rd,c}$ and $V_{Rd,cp}$ and with no lever arm.
2. Reference "Anchor Design Methodology" on page 12 for the descriptions of N_{Rd} and V_{Rd}
3. Concrete strength is C20/25 ($f_{ck,\ cube}$ = 25 MPa). Bolt material is Carbon Steel, Zinc Plated. For other concrete strengths and bolt material finishes, use Simpson Strong-Tie® Anchor Designer™ Software.
4. Concrete is considered un-reinforced, and therefore concrete splitting and spalling is not controlled. If reinforcement is present and can be verified per ETAG 001 requirements, then Designer should re-evaluate the design resistances using Simpson Strong-Tie® Anchor Designer™ Software as the design values may increase significantly.
5. All design resistances are derived from the product's characteristic values and safety factors published in the ETA.
6. Concrete edge Distance "c" is measured from edge of concrete to centerline of the bolt(s). Anchor Spacing "s" is measured from centerline of bolt(s) to centerline of bolt(s).
7. Concrete is considered non-cracked when the tensile stress within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification σ_R = 3 N/mm² can be assumed (σ_L equals the tensile stress within the concrete induced by external loads, anchors loads included).

TESTING REPORTS

Test report	Certification Authority	Logo
ETA	European Technical Approvals	
GB50367-2006	Design Code for Strengthening Concrete Structure	
JGJ145-2004	Technical Specification for Post-Installed Fastenings in Concrete Structures	
IBC	International Building Code	
ICC-ES	International Code Council Evaluation Service	
ACI	American Concrete Institute	
AISC	American Institute of Steel Construction	
ANSI	American National Standards Institute	
ASTM	American Society for Testing and Materials	
CAMA	Concrete Anchor Manufacturers' Association	
NSF/ANSI	The Public Health and Safety Company	
LEED	Leadership in Energy and Environmental Design	
H&B	Singapore Housing & Development Board	

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