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Continued.......

ANCHORING SOLUTIONS FOR CONSTRUCTION AND INDUSTRY

UCAN Fastening Products is a wholly Canadian owned company specialized in concrete anchoring systems. UCAN was founded in 1964 by Harry Weitz who previously had an extensive construction background. UCAN has always emphasized the practicality and cost effectiveness of its products as well as on time delivery.

The UCAN line of anchors and fasteners is perhaps the most extensive available and ranges from light duty plastic anchors to heavy duty and adhesive anchors for dynamic loading. In addition, UCAN has developed custom made solutions for many special applications and invites your inquiries concerning specific problems. UCAN has established long term working partnerships with several of the world's leading fastener manufacturers and, with their help, carries on an active Research and Development program to improve both products and installation methods.
All fasteners are strictly quality controlled, both during production and prior to delivery, to assure adherence to performance specifications.

This Engineering Manual is designed to provide detailed technical information to allow engineers and specifiers to select the most appropriate anchor for their application. The data published in the Ucan Technical Manual are current and accurate as of the date of publication and based on independent laboratory and in-house testing using local materials and analytical calculations by qualified engineers. Variations in base materials and local site conditions may require on-site testing to verify anchor performance.

Ucan is committed to support you throughout the anchor selection, design and installation process. A highly experienced sales team is available to provide assistance and on-site load verification testing when required.

For information on updates, changes and technical assistance please contact us at:

416-631-9400
1-800-268-1248
416-631-9426 (24 hour fax)
e-mail: sales@ucanfast.com

Published by UCAN Fastening Products

1.2 SELECTING A FASTENER

About 70 years ago, two of the earliest concrete and masonry fasteners, the lead caulking anchor and the self drilling anchor, were introduced to the construction industry. Since that time, a host of diverse anchors, including adhesive anchors, have appeared on the market. This has made anchor selection, for a specific application, increasingly difficult.

There are a number of considerations which must be examined when an anchor is to be selected. This includes:

- Type of base material
- Strength and condition of the base material
- Thickness of the base material and the fixture
- Direction of the applied load
- Loading conditions
- Anchor embedment
- Spacing and edge distances
- Corrosiveness of the environment
- Acceptable load displacement
- Pre-tensioning requirements
- Safety factor
- Strength of the anchor material
- Mode of failure
- Installation cost

In this Technical Manual we will briefly examine these considerations so that the designer can make an informed anchor selection. If a particular application requires special attention, please contact us.

1.3 BASE MATERIAL

The most typical base materials for anchoring are:
- concrete (with or without reinforcement),
- masonry consisting of various masonry units (brick, concrete block, stone, clay tile blocks etc.) bonded together with a cement-sand mortar
- wall boards (drywall, etc.)

Here are a few base material considerations that must be examined before selecting an anchor:

.3.1 The Strength of the Base Material

For maximum anchor performance, the base material must be capable of supporting the same load as the anchor. The higher the compressive strength of the base material, the higher the load it is capable of supporting, depending on the anchor material strength. Generally, anchors which are required to carry medium to heavy loads should not be used in concrete with compressive strength less than 2000 psi (14 MPa) or uncured concrete (less than 7 days old). When fastening into low strength base material, a light duty anchor is recommended.

.3.2 Conditions of the Base Material

Most bricks and blocks are very brittle, thus anchors, which exert little or no expansion force on the base material (nylon; lead; zinc; etc.), are recommended for these applications.

Due to the inconsistency of mortar mixtures, critical applications should not be made in mortar joints. Light duty or temporary fastening can be made in horizontal mortar joints only, never in vertical joints.

When installing anchors in the cracked tensile zone, a follow-up expansion type anchor should be used. Other anchor types can be used as long as they are embedded past the neutral axis and into the compressive zone. The latest development in adhesive and mechanical anchoring technology has created anchoring systems suitable for tension zone fastening. Please call the UCAN for more information.

.3.3 Thickness of the Base Material

When concrete or masonry is drilled, with a hammer drill or rotary hammer, the force could cause spalling near the back of the base material. To ensure that the anchor performs to specification, the base material must be a minimum of 25% thicker than the

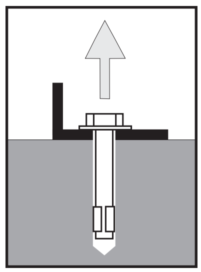
ANCHOR DESIGN

1.4 ANCHOR EMBEDMENT

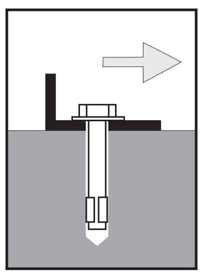
The depth of embedment affects the ultimate pull out capacity of an anchor. For example, anchors installed at less than the recommended embedment will exhibit reduced holding power. Deeper embedment will increase the anchor's holding power up to the point where the mode of failure changes to anchor breakage. Further increase of concrete strength or embedment depth will not increase the holding power.

1.5 DIRECTION OF THE APPLIED LOAD

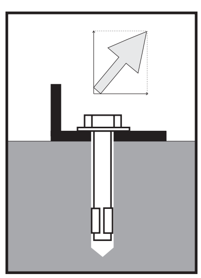
The applied load on an anchor can be separated into the following categories:



Tension load
The direction of the acting load is parallel with the longitudinal axis of the fastener



Shear load
The direction of the acting load is perpendicular to the longitudinal axis of the anchor



Combined loading
Anchors loaded in tension and shear simultaneously will have lower ultimate load capacities than an anchor loaded in pure shear or tension separately.

Anchors required to resist both tension and shear load shall be proportioned so that:

$$\left(\frac{N_{applied}}{N_{allowable}}\right)^{5/3} + \left(\frac{V_{applied}}{V_{allowable}}\right)^{5/3} \leq 1$$

N - Tension load
V - Shear load

1.6 BENDING MOMENT

When the acting force on the anchoring connection is at some distance from the surface of the load bearing base material, it is often the strength of the anchor material that determines the anchor's holding power. In that case the allowable bending load should be calculated using the anchor rod's material strength properties according to the current local and national design code.

1.7 LOADING CONDITIONS

The type of the load acting on the anchoring connection is an important factor when selecting an anchoring system. Anchors are designed to carry certain types of loads and should be matched to the expected load type. The following loads must be considered when selecting an anchor:

Live Loads
Loads due to the intended use and occupancy of the building, moving equipment, snow, rain soil or hydrostatic pressure and any other live loads stipulated by the applicable building code and by-law

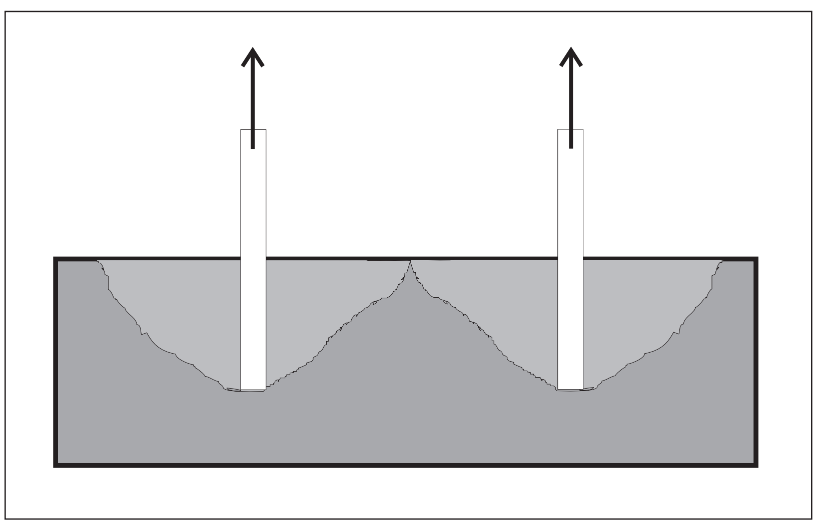
Dead Loads
Loads permanently in place during the life of the structure

Static Loads
Forces which are acting on the structure at a continuous and constant rate

Dynamic Loads
Forces applied at various rates which continue to change over time. Seismic, shock and vibratory loads are examples of dynamic loads.

1.8 ANCHOR SPACING AND EDGE DISTANCE

Most anchoring connections are designed for the mode of failure of concrete breakage under pure tensile (pull-out) loading, where a conical piece of concrete is pulled away from the concrete when the anchor fails. Although the shape and the taper angle of the surface of the cone are somewhat different for various anchor systems, in general for expansion anchors, the approximate diameter of the cone at the concrete surface is about 3 to 3.5 times the embedment.
The concrete cone for adhesive anchors is considerably smaller, due to their different load bearing behavior. The mean diameter of the cone is about 2 times the embedment.

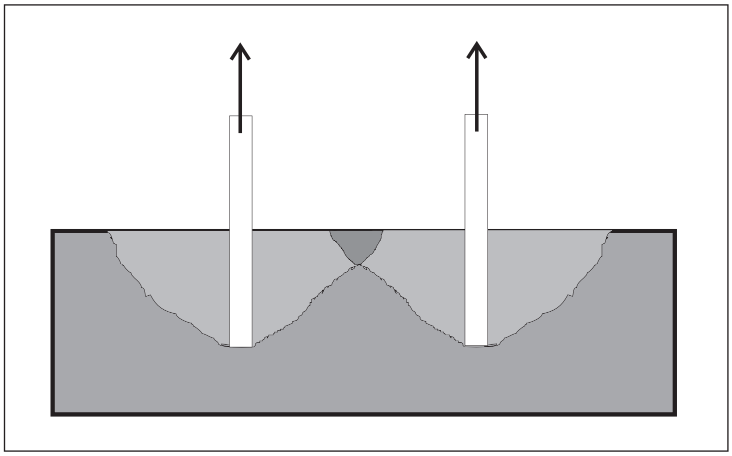


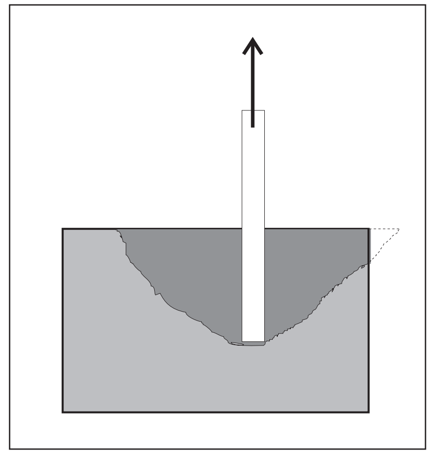
When anchors are close to one another, or to edges, the cone of the concrete cannot form fully. Therefore a reduction in the ultimate load bearing capacity of the anchor is anticipated.

ANCHOR DESIGN

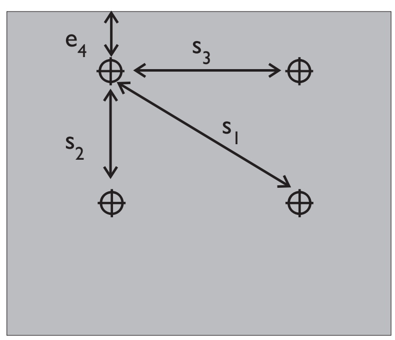
.8.1 Reduction factors

If the distance between anchors in a group is less than the standard spacing, or the anchor is closer to the edge than recommended, the ultimate load capacity in both tension and shear must be reduced by applying an appropriate reduction factor. The total reduction factor is obtained by multiplying all applicable factors. Between the limiting values, (standard and minimum), a linear relationship is established. The UCAN technical data sheets include tabulated reduction factors for most anchors.





Sample calculation:



Anchor #4 is the most effected by edge and spacing conditions in the anchor group.

The reduced ultimate load for anchor #4 is:

$F_r = f_{total} \times$ Ultimate Load where $f_{total} = f_{e4} \times f_{s1} \times f_{s2} \times f_{s3}$

1.9 ACCEPTABLE LOAD DISPLACEMENT / PRE -TENSIONING REQUIREMENTS

To limit anchor displacement, a correct initial pre-tensioning (torque) must be applied. As the anchor is torqued, the concrete is placed locally in compression, and the anchor has no displacement (movement) until the external load overcomes the internal pre-tensioning force. For most anchor systems the initial pre-tensioning (installation torque) guarantees minimal anchor movement at the safe working load level.

1.10 SAFETY FACTOR

All published loads in this Engineering Manual are average ultimate loads based on actual anchor testing. In fastening design, in addition to influencing factors (spacing, edge distance, embedment, concrete strength, etc.) a safety factor must be used to compensate for variations in loading, material strength and installation conditions and to ensure minimal load displacement.

The following safety factors are recommended for Ucan anchors in order to calculate safe working loads:

$$P_{allowable} = \frac{P_{ultimate}}{4}$$

where $P_{allowable}$ = Allowable working Load
$P_{ultimate}$ = Ultimate Tension or Shear Load

If the anchor is subjected to dynamic loading, further reduction of the allowable load is to be considered due to material fatigue. The allowable static load must be reduced by a factor ranging from 0.3 to 1.0 to keep the stress levels in the anchor system within the range of fatigue stress of the stressed parts.

If only the breakage of the steel anchor rod occurs (e.g. breakage due to deep embedment or a steel of lower strength) a smaller safety factor can be used with the minimum yield strength of the anchor steel. This factor must be in line with current design code requirements for steel breakage in tension.

A larger safety factor should be used in calculation if:

- the failure of the fastener would create a hazardous situation
- the code specifies a larger safety factor

It is the design engineer's responsibility to analyze all conditions and select the appropriate safety factor.

1.11 CORROSION

Corrosion is the destruction of material resulting from its environments. In the case of fasteners, this process is usually electrochemical. Rain, condensation, dew and water in different amounts provide the electrolyte for atmospheric corrosion. The rate of corrosion is influenced by

- the type of dissimilar metals coupled together
- the ratio of the area of the dissimilar metals
- concentration of the electrolyte

To fully protect against corrosion, in-depth knowledge of corrosion and the specific application must be known. However, the following basic steps can minimize corrosion problems with anchors:

- eliminate some of the causes of potential corrosion
- do not attach dissimilar metal parts together
- use protective coating or corrosion resistant fastener
- keep materials dry
- separate dissimilar metals with an inactive material

All anchor parts are protected against corrosion by zinc plating. This type of protection is sufficient for indoor applications with no particular influence of moisture or for applications where the anchors will be covered with concrete.

Hot dip galvanizing provides additional protection in damp indoor areas and slightly corrosive outdoor environments.

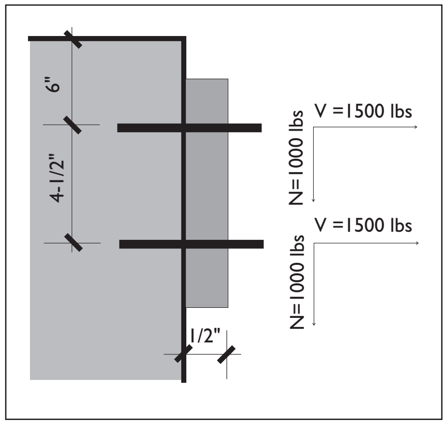
On small diameter self drilling screws (U-DRILLS) Ucan applies proprietary barrier coatings to provide protection against corrosion. For detailed information on the available coatings and their corrosion protection properties, see Section 7 in the Technical Manual.

Stainless steel anchors provide the most protection against corrosion in industrial, marine and city environments. The various types of stainless steel grades provide different degrees of protection. The best corrosion protection is provided by the UCAN Heavy Load stainless steel anchor in grade A4-70 alloyed with Titanium.

If you have a specific corrosion problem, please call UCAN Fastening Products.

ANCHOR DESIGN

1.12 SAMPLE ANCHOR DESIGN



Design data:

- Concrete strength = 4,000 psi (28MPa)
- Design loads (working, unfactored)
  Shear = 1,000 lbs
  Tension = 1,500 lbs
- No specific corrosion protection is required
- Embedment = 80mm (3-1/4")
- Fixture thickness = 25mm (1/2")

Design steps:
1. select anchor suitable for reduced edge and spacing conditions
2. select anchor with no, or minimal displacement feature

Based on the above criteria, the UCAN Heavy Load Anchor is selected.

Try UCAN Heavy Load Anchor SHL 1225

Product data as per UCAN data sheet:

		Ultimate	*Allowable*
Average ultimate loads:	Tension	= 11,463 lbs	3,275 lbs
	Shear	= 19,278 lbs	5,508 lbs

Check anchor spacing and edge distance:

Reduction factors:

For edge distance
fes = 0.47 x 152/80 - 0.17 = 0.72
fes = 0.20 x 152/80 + 0.50 = 0.88

For spacing
fs = 0.15 x 114/80 + 0.55 = 0.76

Calculate allowable working loads:

Modified ultimate loads :
Tension : 11,463 x 0.88 x 0.76 = 7,666.45 lbs
Shear: 19,278 x 0.72 x 0.76 = 10,548.92 lbs

Factored allowable working loads:

Tension: 3,275 x 0.88 x 0.76 = 2,190.32 lbs
Shear: 5,508 x 0.72 x 0.76 = 3,013.98 lbs

Check combined load condition:

$$\left(\frac{N_{design}}{N_{allowable}}\right)^{5/3} + \left(\frac{V_{design}}{V_{allowable}}\right)^{5/3} \leq 1$$

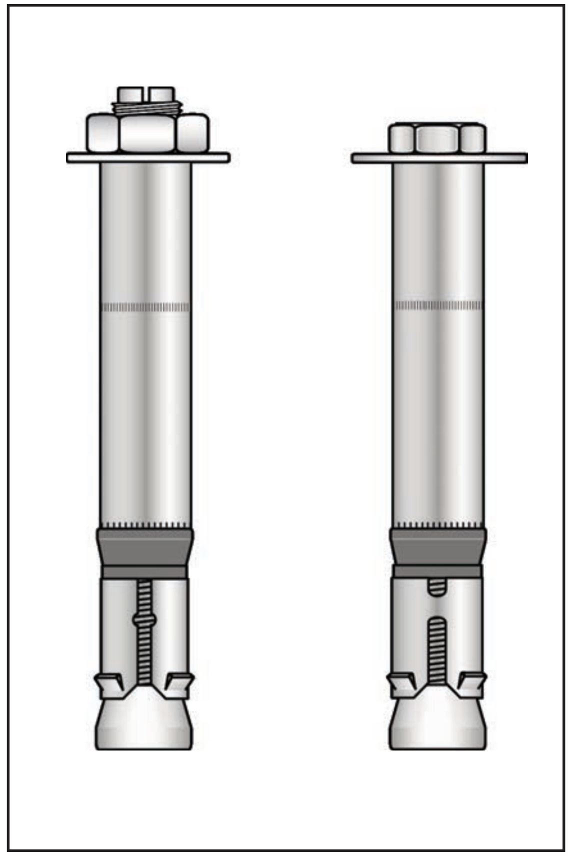
(1500 / 2190.32)5/3 + (1000 / 3013.98)5/3 = 0.53 + 0.16 = 0.69 < 1 ok!

Specification: 2 - UCAN SHL 1225 Heavy Load anchor installed into 18mm diameter hole (embedment = 80mm).

SZ HEAVY LOAD EXPANSION ANCHOR

DESCRIPTION

UCAN SZ Heavy Load Anchors are mechanical anchors with controlled expansion that deliver exceptionally high tension and shear loads. Available in both zinc plated Grade 8.8 carbon steel & Grade 316 stainless steel, heavy load anchors are ideal for applications requiring a high degree of security and reliability. UCAN SZ heavy load anchors are offered in a choice of 3 head styles, finished hex bolt, hex nut and countersunk. The size range is now expanded to include M24.



FEATURES

- ICC-ES® Listed ESR-3304
- ACI 318 category 1 anchor for cracked or uncracked concrete
- Superior fastening for dynamic and static loads
- Torque controlled expansion, High shear load, Through fastening
- Collapsible collar provides reliable pull-down force
- Expanded size range – now includes M24
- Available in Stainless Steel & Galvanized finish to order
- Offered in three different head styles - hex bolt, stud + hex nut & countersunk

TYPICAL APPLICATIONS

High load capacity, safety-relevant or dynamic applications including

- Road and bridge construction
- Medical equipment installation
- Heavy machinery and robotics installation
- Structural steel columns and frame
- Dynamic and seismic loading applications
- Parking structure rehabilitation
- Cantilevers, cranes, car hoists
- Heavy pipe supports, pumps

LIMITATIONS

- Not recommended for uncured concrete (less than 7 days old), lightweight concrete, masonry block or brick.
- Concrete compressive strength range:
  2,500 Psi (17.2 MPa) 8,500 Psi (58.6 MPa)

LISTING AND APPROVALS

ICC-ES® - ESR 3304

- ACI 318 category 1 anchor for cracked or uncracked concrete

COMPLIANCE WITH THE FOLLOWING CODES

- 2012, 2009, 2006 International Building Code® (IBC)
- 2012, 2009, 2006 International Residential Code® (IRC)

LEED® COMPLIANCE

MRc4 - 25% Recycled Materials

SZ HEAVY LOAD EXPANSION ANCHOR

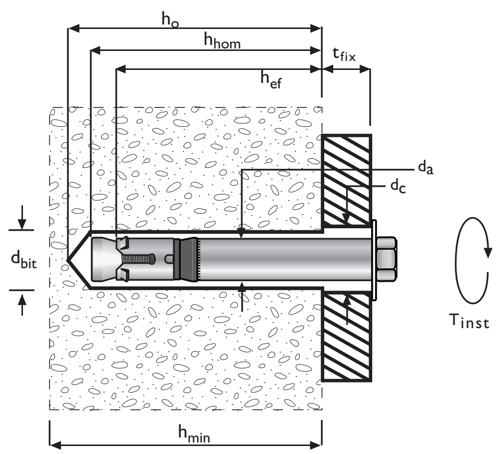
www.ucanfast.com

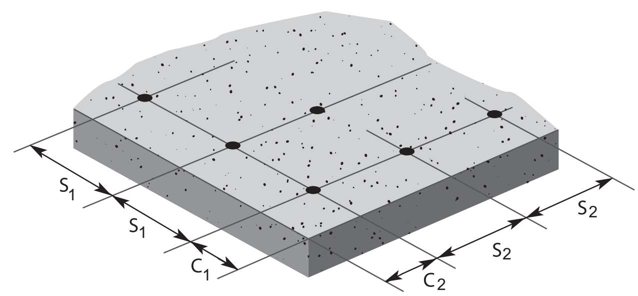
MATERIAL SPECIFICATIONS

Anchor Component	Material Standard	Mechanical Properties F_u	F_y
Carbon steel hex-head bolt	Class 8.8; EN ISO 891-1	800 MPa (116 ksi)	640 MPa (93 ksi)
Carbon steel threaded stud	Class 8.8; EN ISO 891-1	800 MPa (116 ksi)	640 MPa (93 ksi)
Collapsible collar	-	Polyethylene	
Corrosion protection	DIN ISO 4042	≤5μm, zinc plated	
Stainless steel (A4) hex bolt, distance and expansion sleeve cone, washer (EN 10088)	Class 70; EN10088 1.4401/ 1.4404 / 1.4571	700 MPa (101.5 ksi)	450 MPa (65.3 ksi)
Stainless steel hex nut (A4)	Class 70; ISO 3506		

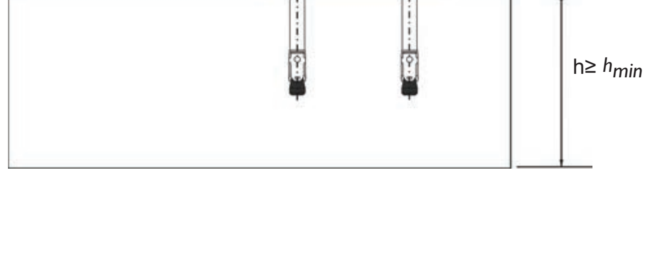
ANCHOR INSTALATION

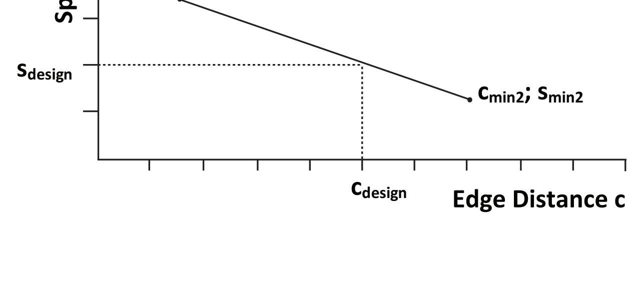
• INSTALLATION DETAILS



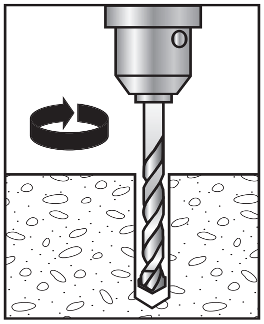


• EXAMPLE OF ALLOWABLE INTERPOLATION OF MINIMUM EDGE DISTANCE AND MINIMUM SPACING

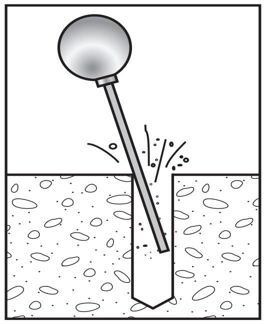




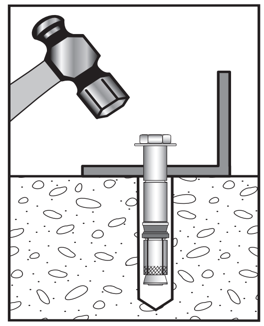
• INSTALLATION INSTRUCTION



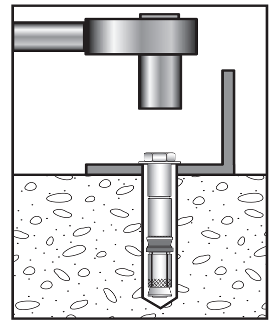
1) Select the correct diameter metric drill bit, drill hole to minimum required hole depth or deeper.



2) Remove drilling debris with a blowout bulb, compressed air or vacuum



3) Using a hammer, tap the anchor through the part being fastened into the drilled hole until the washer is in contact with the fastened part. Do not expand anchor by hand prior to installation.



4) Using a torque wrench, apply the specified installation to the anchor.

TABLE 1A - SZ CARBON STEEL INSTALLATION INFORMATION[1]

Setting Information	Symbol	Units	Nominal Anchor Diameter					
			M8	M10	M12	M16	M20	M24
Anchor Outside diameter	d_a (d_o)[5]	in. (mm)	0.45 (11.5)	0.57 (14.5)	0.69 (17.5)	0.93 (23.5)	1.08 (27.5)	1.26 (32)
Drill Bit Diameter	d_{bit}	mm	12	15	18	24	28	32
Minimum Hole Depth	h_0	in. (mm)	3.15 (80)	3.74 (95)	4.13 (105)	5.12 (130)	6.3 (160)	7.08 (180)
Minimum Base Plate Clearance Hole Dia.[2]	d_c	in. (mm)	0.55 (14)	0.67 (17)	0.79 (20)	1.20 (26)	1.22 (31)	1.38 (35)
Installation torque (Carbon Steel)	T_{inst}	ft-lbf (N-m)	22.1 (30)	36.8 (50)	59 (80)	118 (160)	207 (280)	207 (280)
Embedment Depth	h_{nom}	in. (mm)	2.72 (69)	3.25 (82.5)	3.72 (94.5)	4.65 (118)	5.83 (148)	6.65 (169)
Effective Embedment depth	h_{ef}	in. (mm)	2.4 (60)	2.8 (70)	3.1 (80)	3.94 (100)	4.92 (125)	5.92 (150)
Minimum Edge Distance	C_{min1}	in. (mm)	2.4 (60)	2.8 (70)	3.5 (90)	4.7 (120)	7.1 (180)	5.9 (150)
Minimum Spacing[3]	S_{min1}	in. (mm)	4.9 (125)	6.9 (175)	7.9 (200)	12.6 (320)	21.3 (540)	11.8 (300)
Minimum Edge Distance	C_{min2}	in. (mm)	3.9 (100)	5.1 (130)	6.3 (160)	7.1 (180)	11.8 (300)	11.8 (300)
Minimum Spacing[4]	S_{min2}	in. (mm)	2.4 (60)	2.8 (70)	3.1 (80)	3.9 (100)	4.9 (125)	5.9 (150)
Minimum Concrete Thickness	h_{min}	in. (mm)	4.7 (120)	5.5 (140)	6.3 (160)	7.9 (200)	9.8 (250)	11.8 (300)

For SI: 1 inch = 25.4 mm, 1ft-lbf = 1.356 N-m.
[1]The information presented in this table must be used in conjunction with the design requirements of ACI 318 Appendix D, or CSA A23.3-19 Annex D
[2]The clearance must comply with applicable code requirements for the connected element.
[3]S_{min1} applies when C_{min1} is provided.
[4]S_{min2} applies when C_{min2} is provided.
[5]The notation in parenthesis is for 2006 IBC

SZ HEAVY LOAD EXPANSION ANCHOR

CARBON STEEL SELECTION

Part Number		Bolt/Stud	Drill Bit/ Anchor	Anchor Length		Maximum Fixture Thickness	Box Quantity
SHL	BHL	diameter	diameter	SHL/SHS	BHL/BHS		
		mm	mm	mm	mm	mm	
SHL600	BHL600	6	10	65	67	0	100
SHL610	BHL610			75	77	10	50
SHL630	BHL630			95	97	30	50
SHL650	BHL650			115	117	50	25
_	BHL6100			_	167	100	25
SHL800	BHL800	8	12	77	80	0	50
SHL810	BHL810			87	90	10	50
SHL830	BHL830			107	110	30	50
SHL850	BHL850			127	130	50	25
_	BHL8100			_	180	100	25
SHL1000	BHL1000	10	15	93	96	0	25
SHL1015	BHL1015			108	111	15	25
SHL1025	BHL1025			118	121	25	25
SHL1045	BHL1045			138	141	45	25
SHL1095	BHL1095			188	191	95	25
SHL1200	BHL1200	12	18	107	112	0	20
SHL1210	BHL1210			117	122	10	20
SHL1220	BHL1220			127	132	20	20
SHL1240	BHL1240			147	152	40	20
SHL1270	BHL1270			177	182	70	20
_	BHL12100			_	212	100	10
SHL1600	BHL1600	16	24	132	137	0	10
SHL1620	BHL1620			152	157	20	10
SHL1650	BHL1650			182	187	50	10
_	BHL16100			_	237	100	5
SHL2010	BHL2010	20	28	152	161	0	10
SHL2030	BHL2030			192	201	30	10
SHL2060	BHL2060			222	231	60	5
SHL20100	BHL20100			262	271	100	5
SHL2410	BHL2410	24	32	212	217	10	5
SHL2430	BHL2430			232	237	10	5
SHL2460	BHL2460			262	267	10	5

TABLE 1B - SZ STAINLESS STEEL INSTALLATION INFORMATION[1]

Setting Information	Symbol		Units	Nominal Anchor Diameter			
				M8	M10	M12	M16
Anchor Outside diameter	da (d_o)		in. (mm)	0.45 (11.5)	0.57 (14.5)	0.69 (17.5)	0.93 (23.5)
Drill Bit Diameter	d_{bit}		(mm)	12	15	18	24
Minimum Hole Depth	h_0		in. (mm)	3.15 (80)	3.74 (95)	4.13 (105)	5.12 (130)
Minimum Base Plate Clearance Hole Diameter[2]	d_c		in. (mm)	0.55 (14)	0.67 (17)	0.79 (20)	1.20 (26)
Installation torque (Stainless Steel)	T_{inst}	SHS	ft-lbf (N-m)	22.1 (30)	36.8 (50)	59 (80)	125 (170)
		BHS		25.8 (35)	40.5 (55)	66.3 (90)	125 (170)
Embedment Depth	h_{nom}		in. (mm)	2.72 (69)	3.25 (82.5)	3.72 (94.5)	4.67 (118.5)
Effective Embedment depth	h_{ef}		in. (mm)	2.4 (60)	2.8 (70)	3.1 (80)	3.9 (100)
Minimum Edge Distance	C_{min1}		in. (mm)	2.9 (75)	3.3 (85)	3.9 (100)	7.1 (180)
Minimum Spacing[3]	S_{min1}		in. (mm)	5.3 (135)	7.2 (185)	8.3 (210)	7.1 (180)
Minimum Edge Distance	C_{min2}		in. (mm)	3.9 (100)	5.5 (140)	6.7 (170)	7.1 (180)
Minimum Spacing[4]	S_{min2}		in. (mm)	2.8 (70)	3.3 (85)	3.9 (100)	7.1 (180)
Minimum Concrete Thickness	h_{min}		in. (mm)	4.7 (120)	5.5 (140)	6.3 (160)	7.8 (200)

For SI: 1 inch = 25.4 mm, 1ft-lbf = 1.356 N-m.
[1]The information presented in this table must be used in conjunction with the design requirements of ACI 318 Appendix D, or CSA A23.3-19 Annex D
[2]The clearance must comply with applicable code requirements for the connected element.
[3]S_{min1} applies when C_{min1} is provided.
[4]S_{min2} applies when C_{min2} is provided.

STAINLESS STEEL SELECTION

Part Number		Bolt/Stud	Drill Bit/ Anchor	Anchor Length		Maximum Fixture	Box
SHS	BHS	diameter	diameter	SHL/SHS	BHL/BHS	Thickness	Quantity
		mm	mm	mm	mm	mm	
SHS830	BHS830	8	10	105	109	30	50
SHS850	BHS850			125	129	50	25
SHS1025	BHS1025	10	15	116	120	25	25
SHS1045	BHS1045			136	140	45	25
SHS1220	BHS1220	12	18	128	131	20	20
SHS1240	BHS1240			148	151	40	25
SHS1620	BHS1620	16	24	150	157	20	10
SHS1650	BHS1650			180	187	50	10

[1]Stainless steel sizes are in limited stock or special order
[2]Other lengths, sizes countersunk type anchors and custom assemblies are special order items.

SZ HEAVY LOAD EXPANSION ANCHOR

TECHNICAL DATA (LIMIT STATE DESIGN / STRENGTH DESIGN) IN CRACKED AND UNCRACKED CONCRETE

TABLE 2A - SZ CARBON STEEL CHARACTERISTIC TENSION STRENGTH DESIGN DATA[1]

Characteristic	Symbol	Units	Nominal anchor diameter					
			M8	M10	M12	M16	M20	M24
Anchor Category	1,2 or 3	-	3	1	1	1	1	1
Embedment Depth	h_{nom}	in. (mm)	2.76 (70)	3.31 (84)	3.74 (95)	4.65 (118)	5.83 (148)	6.65 (169)
Steel Strength in Tension								
Specified Yield Strength	f_{ya}	psi (N/mm^2)	92,888 640	92,888 640	92,888 640	92,888 640	92,888 640	92,888 640
Specified Tensile Strength	f_{uta}	psi (N/mm^2)	116,110 800	116,110 800	116,110 800	116,110 800	116,110 800	116,110 800
Effective Tensile Stress Area	A_{se}	in^2 (mm^2)	0.06 (36.6)	0.09 (58)	0.13 (84.3)	0.24 (156.7)	0.38 (244.8)	0.55 (352.8)
Tension Resistance of Steel	N_{sa}	lbf (kN)	6,580 29.3	10,427 46.4	15,155 67.4	28,171 125.4	44,009 195.8	63,486 282.4
Strength Reduction Factor-Steel Failure[2,9]	$\varnothing_{sa}$	-	0.65	0.65	0.65	0.65	0.65	0.65
Concrete Breakout Strength in Tension								
Effective Embedment Depth	h_{ef}	in. (mm)	2.4 (60)	2.8 (71)	3.1 (80)	3.94 (100)	4.92 (125)	5.92 (150)
Critical Edge Distance	C_{ac}	in. (mm)	5.2 (132)	7.0 (178)	6.3 (160)	9.1 (230)	11.3 (288)	12.2 (310)
Effectiveness Factor-Uncracked Concrete	k_{uncr}	-	24 (10)	24 (10)	24 (10)	27 (11.3)	27 (11.3)	27 (11.3)
Effectiveness Factor-Cracked Concrete	k_{cr}	-	17 (7.1)	17 (7.1)	21 (8.8)	21 (8.8)	21 (8.8)	24 (10)
Modification Factor[8,9]	$\Psi_{c,N}$	-	1.0	1.0	1.0	1.0	1.0	1.0
Strength Reduction Factor-Concrete Breakout Failure[3,9]	$\varnothing_{cb}$	-	0.65	0.65	0.65	0.65	0.65	0.65
Pull-Out Strength in Tension								
Pull-Out Resistance Cracked Concrete (f'_c=2,500 psi)[5]	$N_{pn,cr}$	lbf (kN)	2,911 (12.9)	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]
Pull-Out Resistance Uncracked Concrete (f'_c=2,500 psi)[5]	$N_{pn,uncr}$	lbf (kN)	3,887 (17.3)	4,734 (21.1)	6,149 (27.4)	N/A[4]	N/A[4]	N/A[4]
Strength Reduction Factor-Pullout Failure[6,9]	Φ_p	-	0.65	0.65	0.65	0.65	0.65	0.65
Tension Strength for Seismic Applications								
Tension Resistance of Single Anchor for Seismic Loads (f'_c=2,500 psi)[5]	$N_{np,eq}$	lbf (kN)	2,911 (12.9)	N/A[4]	N/A[4]	N/A[4]	N/A[4]	16,748 (74.5)
Strength Reduction Factor-Pullout Failure[6,8]	Φ_{eq}	-	0.65	0.65	0.65	0.65	0.65	0.65
Axial Stiffness in Service Load Range, Cracked Concrete[7]	β_{cr}	lb/in. (kN/mm)	145,923 25.6	229,946 40.3	143,155 25.1	57,102 10	142,754 25	217,714 (38.1)
Axial Stiffness in Service Load Range, Uncracked Concrete[7]	β_{uncr}	lb/in. (kN/mm)	386,670 67.7	455,987 80.0	483,412 84.7	114,203 20	485,364 85	1,056,000 184.8

For **SI:** 1 inch = 25.4mm, 1 lbf = 0.00445kN, 1 lb/in = 0.175 N/mm, 1 psi = 0.00689 N/mm^2, 1 in^2 = 645 mm^2

[1] The information presented in this table must be used in conjunction with the design requirements of ACI 318 Appendix D, or CSA A23.3 - 19 Annex D.

[2] The tabulated value of Φ_{sa} applies when the load combinations of Section 1605.2 of the IBC or ACI 318 9.2 are used. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ_{sa} must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 and -05 D.4.5). The M16 and M20 diameter anchors are brittle steel elements as defined in ACI 318 D.1.

[3] The tabulated value of Φ_{cb} applies when both the load combinations of Section 1605.2 of the IBC, or ACI 318 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c))for Condition B are satisfied. For installations where complying supplementary reinforcement can be verified, the Φ_{cb} factors described in ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ_{cb} must be determined in accordance with ACI 318 D.4.4.(ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.5

[4] As described in Section 4.1.3 of ESR-3304, N/A (Not Applicable) denotes that pullout resistance is not critical and does not need to be considered.

[5] For all design cases $\Psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (K_{cr}) or uncracked concrete (K_{uncr}) must be used.

[6] The tabulated value of Φ_p or Φ_{eq} applies when both the load combinations of Section 1605.2 of the IBC, or ACI 318 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. Condition B applies where supplementary reinforcement is not provided or where pullout strength governs. For installations where complying supplementary reinforcement can be verified, the Φ factors described in ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 D.4.4 and -05 D.4.5).

[7] Minimum axial stiffness value. Actual stiffness may vary depending on the concrete strength, loading and geometry of the application.

[8] For all design cases $\Psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (K_{cr}) or uncracked concrete (K_{uncr}) must be used.

[9] For limit State Design as per CSA A23.3-19 Annex D, material resistance factors (Φ) and resistance modification factor (R) listed in Table 4 shall be used.

TABLE 2B - SZ STAINLESS STEEL CHARACTERISTIC TENSION STRENGTH DESIGN DATA[1]

Characteristic	Symbol		Units	Nominal anchor diameter			
				M8	M10	M12	M16
Anchor Category	1,2 or 3		-	1	1	1	1
Embedment Depth	h_{nom}		in. (mm)	2.72 (69)	3.25 (82.5)	3.72 (94.5)	4.67 (118.5)
Steel Strength in Tension							
Specified Yield Strength	f_{ya}	SHS	psi (N/mm²)	65,312 (450)	65,312 (450)	65,312 (450)	65,312 (450)
		BHS		81,277 (560)	81,277 (560)	81,277 (560)	81,277 (560)
Specified Tensile Strength	f_{uta}		psi (N/mm²)	101,600 (700)	101,600 (700)	101,600 (700)	101,600 (700)
Effective Tensile Stress Area	A_{se}		in² (mm²)	0.06 (36.6)	0.09 (58)	0.13 (84.3)	0.24 (157)
Tension Resistance of Steel	N_{sa}		lbf (kN)	5,845 (26)	9,217 (41)	13,263 (59)	24,429 (110)
Strength Reduction Factor-Steel Failure[2,9]	$\emptyset_{sa}$		-	0.65	0.65	0.65	0.65
Concrete Breakout Strength in Tension							
Effective Embedment Depth	h_{ef}		in. (mm)	2.4 (60)	2.8 (71)	3.1 (80)	3.94 (100)
Critical Edge Distance	C_{ac}		in. (mm)	7.1 (180)	9.3 (235)	10.4 (265)	13.0 (330)
Effectiveness Factor-Uncracked Concrete	k_{uncr}		-	24 (10)	24 (10)	24 (10)	27 (11.3)
Effectiveness Factor-Cracked Concrete	k_{cr}		-	17 (7.1)	17 (7.1)	17 (7.1)	24 (10)
Modification Factor for uncracked Concrete[8,9]	$\Psi_{c,N}$		-	1.0	1.0	1.0	1.0
Strength Reduction Factor-Concrete Breakout Failure[3,9]	$\emptyset_{cb}$		-	0.65	0.65	0.65	0.65
Pull-Out Strength in Tension							
Pull-Out Resistance Cracked Concrete (f'_c=2,500 psi)[5]	$N_{pn,cr}$		lbf (kN)	2,700 (12)	3,600 (16)	N/A[4]	N/A[4]
Pull-Out Resistance Uncracked Concrete (f'_c=2,500 psi)[5]	$N_{pn,uncr}$		lbf (kN)	3,600 (16)	5,600 (25)	N/A[4]	N/A[4]
Strength Reduction Factor-Pullout Failure[6,9]	Φ_p		-	0.65	0.65	0.65	0.65
Tension Strength for Seismic Applications							
Tension Resistance of Single Anchor for Seismic Loads (f'_c=2,500 psi)[5]	$N_{np,eq}$		lbf (kN)	2,700 (12)	3,600 (16)	5,685 (25.3)	N/A[4]
Strength Reduction Factor-Pullout Failure[6,9]	Φ_{eq}		-	0.65	0.65	0.65	0.65
Axial Stiffness in Service Load Range, Cracked Concrete[7]	β_{cr}		lb/in. (kN/mm)	74,200 (13)	62,800 (11)	85,600 (15)	103,000 (18)
Axial Stiffness in Service Load Range, Uncracked Concrete[7]	β_{uncr}		lb/in. (kN/mm)	285,000 (50)	211,00 (37)	114,000 (20)	365,000 (64)

For **SI:** 1 inch = 25.4mm, 1 lbf = 4.45N, 1 lb/in = 0.175 N/mm, 1 psi = 6.89 Pa, 1 in² = 645 mm², 1 lb/in = 0.175 Nmm

[1] The information presented in this table must be used in conjunction with the design requirements of ACI 318 Appendix D, or CSA A23.3 -19 Annex D.

[2] The tabulated value of Φ_{sa} applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used. If the load combination of ACI 318 Appendix C are used, the appropriate value of Φ_{sa} must be determined in accordance with ACI 318-11 D.4.3. (ACI 318-08 and -05 D.4.4). The M16 and M20 diameter anchors are brittle steel elements as defined in ACI 318 D.1.

[3] The tabulated value of Φ_{cb} applies when both the load combinations of Section 1605.2 of the IBC, or ACI 318 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c))for Condition B are satisfied. For installations where complying supplementary reinforcement can be verified, the Φ_{cb} factors described in ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ_{cb} must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 and -05 D.4.5).

[4] As described in Section 4.1.3 of ESR-3304, N/A (Not Applicable) denotes that pullout resistance is not critical and does not need to be considered.

[5] The characteristic pull-out resistance for greater concrete compressive strengths may be increased by multiplying the tabular value by $(f'_c / 2{,}500)^{0.5}$ in accordance with Section 4.1.3 of this report.

[6] The tabulated value of Φ_p or Φ_{eq} applies when both the load combinations of Section 1605.2 of the IBC, or ACI 318 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. Condition B applies where supplementary reinforcement is not provided or where pullout strength governs. For installations where complying supplementary reinforcement can be verified, the Φ factors described in ACI 318-11 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 D.4.4 and -05 D.4.5).

[7] Minimum axial stiffness value. Actual stiffness may vary depending on the concrete strength, loading and geometry of the application.

[8] For all design cases $\psi_{c,N}$ = 1.0. The appropriate effectiveness factor for cracked concrete (K_{cr}) or uncracked concrete (K_{uncr}) must be used.

[9] For limit State Design as per CSA A23.3-19Annex D, material resistance factors (Φ) and resistance modification factor (R) listed in Table 4 shall be used.

SZ HEAVY LOAD EXPANSION ANCHOR

TABLE 3A - SZ CARBON STEEL CHARACTERISTIC SHEAR DESIGN DATA

Characteristic	Symbol	Units	Nominal anchor diameter											
			M8		M10		M12		M16		M20		M24	
Anchor type			BHL	SHL	BHL	SHL	BHL	SHL	BHL	SHL	BHL	SHL	BHL	SHL
Anchor Category	1,2 or 3	-	3		1		1		1		1		1	
Embedment Depth	h_{nom}	in. (mm)	2.76 (70)		3.31 (84)		3.74 (95)		4.65 (118)		5.83 (148)		6.65 (169)	
Steel Strength in Shear														
Shear Resistance of Steel	V_{sa}	lb (kN)	5,475 (24.3)		8,793 (39.1)		13,037 (58.0)		19,100 (85)	21,600 (96)	22,400 (100)	27,600 (123)	44,984(200.1)	
Strength Reduction Factor-Steel Failure[2,5]	Φ_{sa}	-	0.6		0.6		0.6		0.6		0.6		06	
Concrete Breakout Strength is Shear														
Anchor Outside Diameter	d_a (d_{nom})	in. (mm)	0.45 (11,5)		0.57 (14.5)		0.69 (17.5)		0.93 (23.5)		1.08 (27.5)		1.26 (32)	
Load Bearing Length of Anchor in Shear	l_e	in. (mm)	0.91 (23)		1.14 (29)		1.38 (35)		1.85 (47)		2.17 (55)		2.52 (64)	
Strength Reduction Factor-Concrete Breakout Failure[3,5]	Φ_{cb}	-	0.7		0.7		0.7		0.7		0.7		0.7	
Concrete Pryout Strength in Shear														
Coefficient for Pryout Strength	k_{cp}	-	1		2		2		2		2		2	
Strength Reduction Factor-Concrete Pryout Failure[4,5]	Φ_{cp}	-	0.7		0.7		0.7		0.7		0.7		0.7	
Shear Strength for Seismic Applications														
Shear Resistance of Single Anchor for Seismic loads (f'_c=2,500 psi)	$V_{sa,eq}$	lb (kN)	3,934 (17.5)		6,627 (29.5)		8,977 (39.9)		9,217 (41)		22,256 (99)		35,992 (160.1)	
Strength Reduction Factor-Steel Failure[5]	Φ_{cq}	-	0.6		0.6		0.6		0.6		0.6		0.6	

For **SI:** 1inch = 25.4mm, 1lbf = 4.45N, 1 psi = 6.89 Pa, 1 in^2 = 645 mm^2.

[1]The information presented in Table 3A must be used in conjunction with the design criteria of ACI 318 Appendix D.

[2]The tabulated value of Φ_{sa} applies when the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ_{sa} must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 and -05D.4.5(c)) The M16 and M20 diameter anchors are brittle steel elements as defined in ACI 318 D.1.1

[3]The tabulated value of Φ_{cb} applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. Condition B applies where supplementary reinforcement is not provided or where pryout strength governs. For installations where complying supplementary reinforcement can be verified, the Φ factors described in ACI 318-11 D.4.3 (ACI3(ACI18-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 and -05 D.4.5).

[4]The tabulated value of Φ_{cp} applies when both the load combinations of Section 1605.2.1 of the IBC or ACI 318 9.2 are used and the requirements of ACI 318 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. Condition B applies where supplementary reinforcement is not provided or where Pryout governs. For installations where complying supplementary reinforcement can be verified, the Φ factors described in ACI 318 D.4.3 (ACI 318-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318 D.4.4 (ACI 318-08 and -05 D.4.5).

[5]For limit State Design as per CSA A23.3-19Annex D, material resistance factors (*Φ)* and resistance modification factor (R) listed in Table 4 shall be used.

TABLE 3B - SZ STAINLESS STEEL CHARACTERISTIC SHEAR DESIGN DATA

Characteristic	Symbol	Units	Nominal anchor diameter			
			M8	M10	M12	M16
Anchor Category	1,2 or 3	-	1	1	1	1
Embedment Depth	h_{nom}	in. (mm)	2.72 (69)	3.25 (82.5)	3.72 (94.5)	4.67 (118.5)
Steel Strength in Shear						
Shear Resistance of Steel	V_{sa}	lb (kN)	5,463 (24.3)	8,273 (36.8)	13,668 (60.8)	19,963 (88.8)
Strength Reduction Factor-Steel Failure[2,5]	Φ_{sa}	-	0.60	0.60	0.60	0.60
Concrete Breakout Strength is Shear						
Anchor Outside Diameter	d_a (d_{nom})	in. (mm)	0.45 (11,5)	0.57 (14.5)	0.69 (17.5)	0.93 (23.5)
Load Bearing Length of Anchor in Shear	l_e	in. (mm)	0.91 (23)	1.14 (29)	1.38 (35)	1.85 (47)
Strength Reduction Factor-Concrete Breakout Failure[3,5]	Φ_{cb}	-	0.7	0.7	0.7	0.7
Concrete Pryout Strength in Shear						
Coefficient for Pryout Strength	k_{cp}	-	2	2	2	2
Strength Reduction Factor-Concrete Pryout Failure[4,5]	Φ_{cp}	-	0.7	0.7	0.7	0.7
Shear Strength for Seismic Applications						
Shear Resistance of Single Anchor for Seismic loads(f'_c=2,500 psi)	$V_{sa,eq}$	lb (kN)	2,158 (9.6)	3,012 (13.4)	5,485 (24.4)	15,983 (71.1)
Strength Reduction Factor-Steel Failure[5]	Φ_{cq}	-	0.60	0.60	0.60	0.60

For **SI:** 1inch = 25.4mm, 1lbf = 4.45N, 1 psi = 6.89 Pa, 1 in^2 = 645 mm^2.

[1]The information presented in Table 3A and 3B must be used in conjunction with the design criteria of ACI 318 Appendix D.
[2]The tabulated value of Φ_{sa} applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ_{sa} must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 and -05 D.4.5) The M16 and M20 diameter anchors are brittle steel elements as defined in ACI 318 D.1.1
[3]The tabulated value of Φ_{cb} applies when both the load combinations of Section 1605.2 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. Condition B applies where supplementary reinforcement is not provided or where pryout strength governs. For installations where complying supplementary reinforcement can be verified, the Φ factors described in ACI 318-11 D.4.3 (ACI3(ACI18-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318-11 D.4.4. (ACI 318-08 and -05 D.4.5).
[4]The tabulated value of Φ_{cp} applies when both the load combinations of Section 1605.2.1 of the IBC or ACI 318 Section 9.2 are used and the requirements of ACI 318 D.4.3(c) (ACI 318-08 and -05 D.4.4(c)) for Condition B are satisfied. Condition B applies where supplementary reinforcement is not provided or where Pryout governs. For installations where complying supplementary reinforcement can be verified, the Φ factors described in ACI 318-11 D.4.3 (ACI18-08 and -05 D.4.4) for Condition A are allowed. If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ must be determined in accordance with ACI 318-11 D.4.4 (ACI 318-08 and -05 D.4.5).
[5]For limit State Design as per CSA A23.3-19Annex D, material resistance factors (Φ) and resistance modification factor (R) listed in Table 4 shall be used.

SZ HEAVY LOAD EXPANSION ANCHOR

TABLE 4 - RESISTANCE FACTORS FOR LIMIT STATE DESIGN IN ACCORDANCE WITH CSA A23.3-14, ANNEX D[1]

Setting Information	Symbol	Units	Nominal Anchor Diameter				
			M8	M10	M12	M16	M20
Concrete material resistance factor	Φ_c	-	0.65				
Steel material resistance factor	Φ_s	-	0.85				
Strength reduction factor for tension, steel failure modes	R		0.80			0.70	
Strength reduction factor for shear, steel failure modes	R		0.75			0.65	
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15				
		Cond. B	1.00				
Strength reduction factor for Shear, concrete failure modes	R	Cond. A	1.15				
		Cond. B	1.00				
Coefficient for factored concrete breakout in tension, cracked concrete	*k*	-	7				
Modification factor concrete resistance to account uncracked concrete	$\Psi_{c,N}$	-	1.4				

[1]The M16 and M20 diameter anchors are brittle steel elements as difined in ACI 318 D.1.1

ALLOWABLE STRESS DESIGN

TABLE 5A - SZ CARBON STEEL SAMPLE ALLOWABLE DESIGN VALUES FOR ILLUSTRATIVE PURPOSES[1,2,3,4,5,6,7]

Nominal Anchor Diameter	Embedment Depth, h_{nom} (in.)	Effective Embedment Depth, h_{ef} (in.)	Allowable Tension Load, ΦN_n / a (lbf)
M8	2.76	2.4	1,707
M10	3.31	2.8	2,079
M12	3.74	3.1	2,802
M16	4.65	3.94	4,117
M20	5.83	4.94	4,634
M24	6.65	5.92	8,540

For **SI:** 1 inch = 25.4 mm, 1ft-lbf = 1.356 N-m, 1 ibf = 4.45 N.

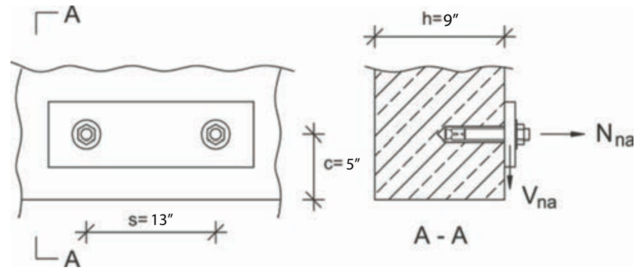
TABLE 5B - SZ STAINLESS STEEL SAMPLE ALLOWABLE DESIGN VALUES FOR ILLUSTRATIVE PURPOSES[1,2,3,4,5,6,7]

Nominal Anchor Diameter	Embedment Depth, h_{nom} (in.)	Effective Embedment Depth, h_{ef} (in.)	Allowable Tension Load, ΦN_n / a (lbf)
M8	2.72	2.4	1,581
M10	3.25	2.8	2,459
M12	3.72	3.1	2,877
M16	4.67	3.94	4,637

For **SI:** 1 inch = 25.4 mm, 1ft-lbf = 1.356 N-m, 1 ibf = 4.45 N.
[1]Single anchor with static tension load only
[2]Concrete determined to remain uncracked for the life of the anchorage.
[3]load combination from ACI 318 Section 9.2 (no seismic loading) with Φ_{sa} = 0.65, Φ_{cb} = 0.65, and Φ_p = 0.65
[4]30%dead load and 70% live load. Controlling load combination is 1.2D + 1.6L. calculation of a = 0.3*1.2 + 0.7*1.6 = 1.48
[5]f'_c = 2,500 psi (normal weight concrete)
[6]$C_{a1} = C_{a2} \geq C_{ac}$
[7]$h \geq h_{min}$

EXAMPLE CALCULATION - STRENGTH DESIGN

Determine if two M16 diameter SZ-B (Stud) carbon steel High Load anchors with an effective embedment depth h_{ef} = 3.94 inches installed 13 inches from center to center and 5 inches from the edge of a 9 inch deep slab is adequate for a service tension load of 4,000 lb. (live load) and a reversible service shear load of 2,000 lb. (live load) The anchor group will be in the tension zone, away from other anchors in f'_c = 3,000 psi normal – weight concrete.



ACI318-08 (ACI 318-19) Code Ref. | Report Ref.

1. Verify minimum Member Thickness, Spacing and Edge Distance:

$h = 9$ in. $\geq h_{min} = 7.9$ in.	o.k.	Table 1A
$s = 13$ in. $\geq S_{min} = 12.6$ in.	o.k.	Table 1A
$c_{a,min} = 5$ in. $\geq c_{min} = 4.7$ in.	o.k.	Table 1A

2. Determine the Factored Tension and Shear Design Loads: 9.2.1

$N_{ua} = 1.6\,L = 1.6 \times 4{,}000 = 6{,}400$ lb.
$V_{ua} = 1.6\,L = 1.6 \times 2{,}000 = 3{,}200$ lb.

3. Steel Capacity under Tension Loading: D.5.1

$N_{sa} = 28{,}171$ — Table 2A
$\Phi = 0.65$ — Table 2A
n = 2 (double anchor group)
Calculating for $\Phi\,N_{sa}$:
$\Phi\,N_{sa} = 0.65 \times 2 \times 28{,}171 = 36{,}622$ lb.

4. Concrete Breakout Capacity under Tension Loading D.5.2

$$N_{cbg} = \frac{A_{Nc}}{A_{Nco}}\ \Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N}N_b$$ Eq.(D-6)

where:

$N_b = K_c\lambda\sqrt{f'_c}\,h_{ef}^{1.5}$ — Table 2A

with $K_c = K_{cr} = 21$

$\lambda = 1.0$ for normal-weight concrete

$\Psi_{ec,N} = 1.0$ since eccentrically $e_N = 0$ — Eq.(D-8)

$\Psi_{ed,N} = 0.7 + 0.3\,\frac{C_{a,min}}{1.5h_{ef}}$ when $C_{a,min} \leq 1.5h_{ef}$ — Eq.(D-10)

by observation $C_{a,min} = 3 < 1.5h_{ef} = 5.91$in.

$$\Psi_{ed,N} = 0.7 + 0.3\,\frac{(5)}{1.5(3.94)} = 0.95$$

$\Psi_{c,N} = 1.0$ assuming cracking at service loads ($f_t > f_r$) — D.5.2.6

$\Psi_{cp,N} = 1.0$ designed for cracked concrete — D.5.2.7

ACI318-08 (ACI 318-19) Code Ref. | Report Ref

calculation for $\frac{A_{Nc}}{A_{Nco}}$

$A_{Nco} = 9h_{ef}^2 = 9(3.94)^2 = 139.71\ \text{In}^2$ — Eq. (D-5)

$A_{Nc} = (c_{a1}+1.5h_{ef})\,(2 \times 1.5h_{er} + s_1)$
$= (5 + 1.5 \times 3.94)\,(2 \times 1.5 \times 3.94 + 13)$ — Fig. RD.5.2.1 b
$= 270.8$ in.^{2}

$$\frac{A_{Nc}}{A_{Nco}} = \frac{270.8}{139.71} = 1.94$$

Calculation for N_b and N_{cbg}:

$N_b = 21 \times 1.0 \times \sqrt{3{,}000} \times (3.94)^{1.5} = 8{,}995$ lb.
$N_{cbg} = 1.94 \times 1.0 \times 0.95 \times 1.0 \times 1.0 \times 8{,}995 = 16{,}576$ lb.
$\Phi = 0.65$ for Condition B
(no supplementary reinforcement provided) — Table 2A

$\Phi\,N_{cb} = 0.65 \times 16{,}576 = 10{,}776$ lb.

5. Pullout Capacity D.5.3

not decisive — Table 2A

6. Check all Failure Modes under Tension Loading: D.4.1.2

Summary:

Steel Capacity	= 36,622 lb.
Concrete Breakout Capacity	= 10,776 lb. ← **Controls**
Pullout Capacity	= not decisive

$\Phi\,N_n = 10{,}776$ lb. as Concrete Breakout Capacity Controls $> N_{ua} = 6{,}400$ lb. - OK

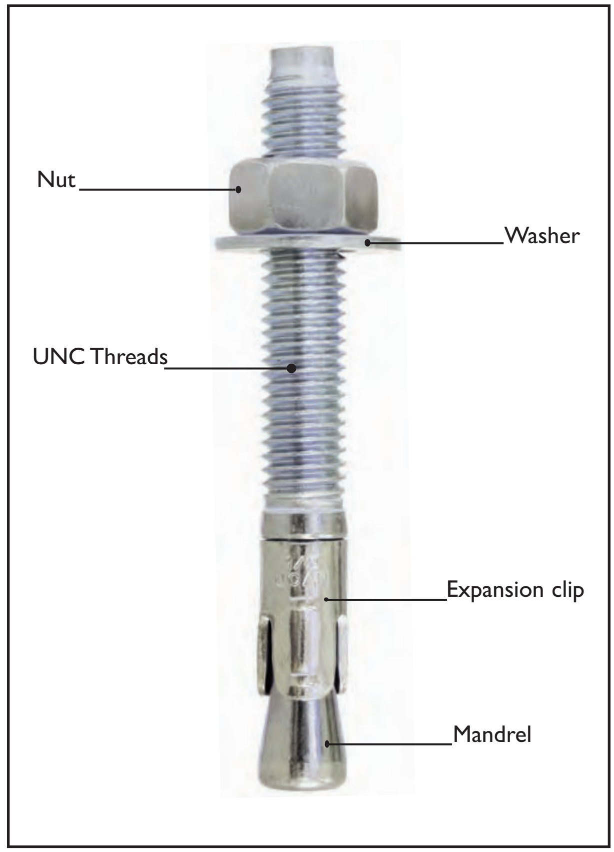
7. Steel Capacity under Shear Loading: D.6.1

Calculating for ΦV_{sa}:

$V_{sa} = 2 \times 19{,}100 = 38{,}200$ lb. — Table 3A
$\Phi = 0.65$ — Table 3A
$\Phi\,V_{sa} = 0.65 \times 38{,}200 = 24{,}830$ lb.

DESCRIPTION

UCAN TZ torque controlled mechanical expansion wedge anchors have a Category 1 classification. They are used to resist static, wind and seismic tension and shear loads in cracked and uncracked normal weight concrete that has a specified compressive strength of between 2,500 psi (17.2 MPa) and 8,500 psi (58.6 MPa). UCAN TZ wedge anchors are fully threaded, zinc plated carbon steel anchors assembled with a unique 3 segment clip. They include a nut and washer and are available in diameters ranging from 3/8" to 3/4".



FEATURES

- Fast torque up
- Anchor size = hole size
- Non bottom bearing
- Through fastening type
- Fully threaded

APPROVALS AND LISTINGS

- IAPMO ER-373
- Code compliant with the 2012, 2009, 2006 IBC
- Code compliant with the 2012, 2009, 2006 IRC
- Tested in accordance with ACI 355.2 and ICC-ES AC193 for use in cracked or uncracked structural concrete using the design provisions of ACI 318 Appendix D
- Meets CSA A23.3-14, Annex D requirements
- UL Listed File # EX. 4936

Head Marking

Legend
Letter Code = Length Identification Mark
'+' Symbol = Strength Design Complaint Anchor (see ordering information)

LIMITATIONS

Not recommended for use in concrete less than 21 days old.

TYPICAL APPLICATIONS

- Steel base plates
- Storage racking
- Seating
- Curtain wall
- Tilt-up braces
- Mechanical equipment
- Cable trays
- Pipe support
- Brick shelf angles

MATERIAL SPECIFICATIONS

Anchor Body:	Carbon steel with 5 µm zinc plating conforming to ASTM B 633
Expansion Clips:	Carbon steel with 5 µm zinc plating conforming to ASTM B 633
Plain Steel Hex Nuts:	ASTM A 563, Grade A
Plain Steel Washers:	ASTM F 844

TZ WEDGE ANCHOR FOR CRACKED AND UNCRACKED CONCRETE

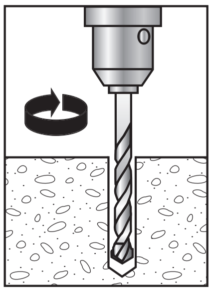
www.ucanfast.com

UCAN

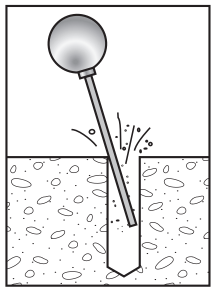
CARBON STEEL WEDGE ANCHOR SIZES

	Item Number	Nominal Anchor Dia. and Drill Bit Dia. (in.)	Anchor Length (in.)	Installation Torque (ft. lb)	Head (Length) Mark
Standard	WED14134	1/4	1 ¾	8	A
	WED14214	1/4	2 ¼	8	B
	WED14314	1/4	3	8	D
	WED38214	3/8	2 ¼	20	B
	WED38234	3/8	2 ¾	20	C
TZ for cracked / uncracked concrete	WED383	3/8	3	20	D +
	WED38334	3/8	3 ¾	20	E +
	WED385	3/8	5	20	H +
	WED12234	1/2	2 ¾	40	E +
	WED12334	1/2	3 ¾	40	E +
	WED12412	1/2	4 ½	40	F +
	WED12512	1/2	5 ½	40	I +
	WED127	1/2	7	40	L +
	WED12812	1/2	8 ½	40	O +
	WED1210	1/2	10	40	R +
	WED58412	5/8	4 ½	80	G +
	WED585	5/8	5	80	H +
	WED586	5/8	6	80	J +
	WED587	5/8	7	80	L +
	WED58812	5/8	8 ½	80	O +
	WED5810	5/8	10	80	R +
	WED34512	3/4	5 ½	110	I +
	WED34614	3/4	6 ¼	110	J +
	WED347	3/4	7	110	L +
	WED34812	3/4	8 ½	110	O +
	WED3410	3/4	10	110	R +
	WED3412	3/4	12	110	T +
Standard	WED786	7/8	6	160	J
	WED788	7/8	8	160	N
	WED7810	7/8	10	160	R
	WED16	1	6	250	J
	WED19	1	9	250	P
	WED112	1	12	250	T
	WED1149	1 ¼	9	320	P
	WED11412	1 ¼	12	320	T

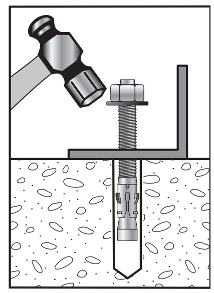
INSTALLATION



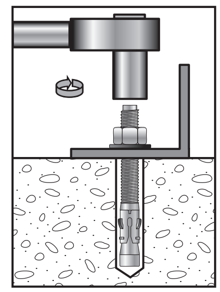
1) Select the correct diameter drill hole to minimum required hole depth or deeper. Drill bit must conform to ANSI Standard B212.15



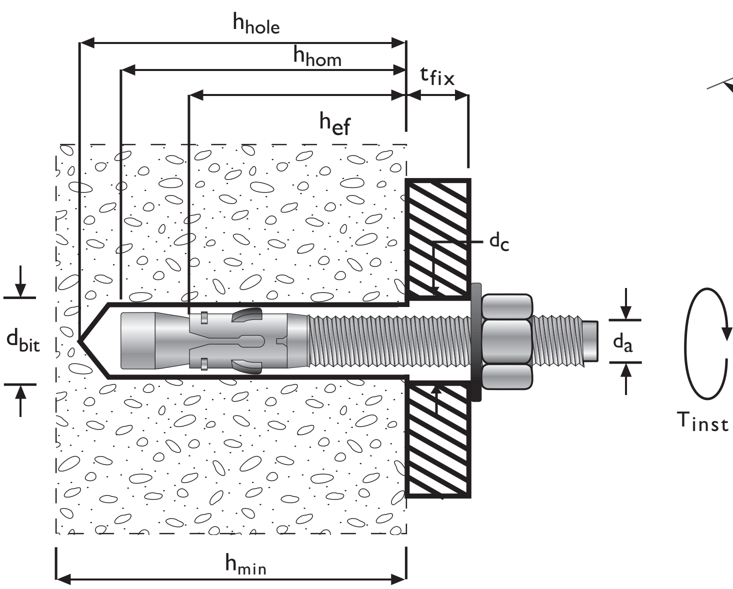
2) Remove drilling debris with a hand pump or with compressed air.

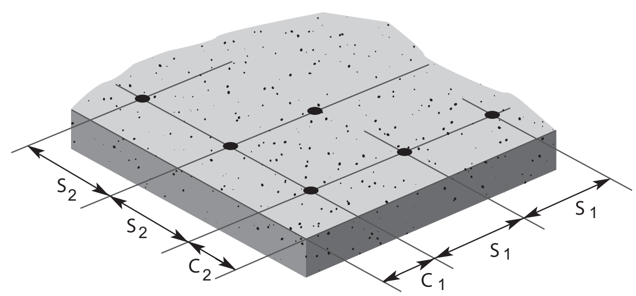


3) Locate the washer on the anchor and thread the nut in place. Using a hammer tap the anchor through the fixture into the drill hole until the washer is in contact with the fixture.
Ensure anchor is inserted to minimun required embedment depth h_{nom}



4) Using a torque wrench, apply the specified installation torque.





DESIGN DATA IN CRACKED AND UNCRACKED NORMAL WEIGHT CONCRETE (CARBON STEEL ANCHOR)

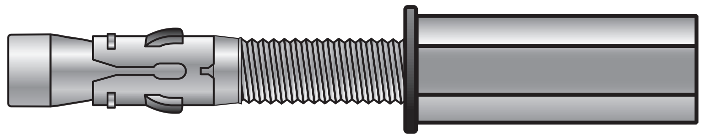
Table 1 - Installation Parameters in Concrete[1,2]

Property	Notation	Unit	Nominal Anchor Diameter (in.)						
			3/8	1/2		5/8		3/4	
Anchor Diameter	d_a[2]	inch	3/8	1/2		5/8		3/4	
		mm	9.5	12.7		15.9		19.1	
Drill Bit Diameter	d_{bit}	inch	3/8 ANSI	1/2 ANSI		5/8 ANSI		3/4 ANSI	
Minimum Clearance Hole Diameter (through drilling)	d_c	inch	1/2	5/8		3/4		7/8	
		mm	12	16		18		22	
Nominal Embedment Depth	h_{nom}	inch	2-3/8	2-3/4	3-3/4	3-3/8	4-5/8	4	5-5/8
		mm	60	70	95	85	117	102	143
Effective Embedment Depth	h_{ef}	inch	2	2	3-1/2	2-3/4	4	3-1/4	4-3/4
		mm	51	51	89	70	102	83	121
Minimum Hole Depth	h_{hole}	inch	2-1/2	2-3/4	3-3/4	3-3/8	4-5/8	4	5-5/8
		mm	64	70	95	86	117	102	143
Installation Torque	T_{inst}	ft.lb	20	40	40	80	80	110	110
		Nm	27	54	54	108	108	149	149
Minimum Concrete Member Thickness	h_{min}	inch	3-1/2	4	7	6	7	7	10
		mm	89	102	178	152	178	178	254
Minimun Edge Distance	c_{min}	inch	3	3	2-1/2	6	3	7	6
		mm	76	76	64	152	76	178	152
Minimum Spacing Distance	s_{min}	inch	4-1/2	5	3	4	5	4-1/2	3-1/2
		mm	114	127	76	102	127	114	89
Critical Edge Distance (Uncracked Concrete)	c_{ac}	inch	7	5	7	5-1/2	8	8	8-1/2
		mm	178	127	178	140	203	203	216

[1]Information in this table is for use in conjunction with the design criteria of ACI 318 Appendix D or CSA A23.3-14, Annex D (Canada)

[2]For the 2006 IBC, d_o becomes d_a

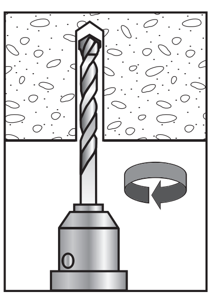
OVERHEAD PIPE- SUPPORT INSTALLATION



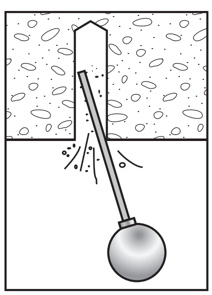
Anchor Selection

Part Number		Anchor Size (in.)	Drill bit diameter (in.)	Minimum hole depth (in.)	Nominal embedment (in.)	Installation torque (ft-lbs)
Anchor	Anchor and Coupling Nut					
WED 383	WED 383C	3/8 x 3	3/8	2 - 1/2	2 - 3/8	20
WED 12234	WED 12234C	1/2 x 2-3/4	1/2	2 - 3/4	2 - 3/4	40
WED 58312	WED 58312C	5/8 x 3-1/2	5/8	3 - 3/8	3 - 3/8	80
WED 34414	WED 34314C	3/4 x 4-1/4	3/4	4	4	110

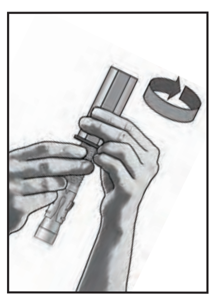
INSTALLATION



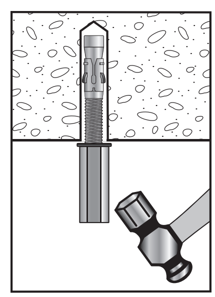
Drill the specified hole diameter and minimum hole depth using ANSI compliant drill bit



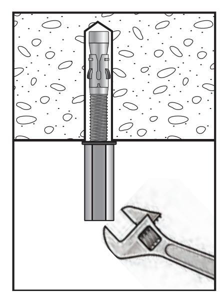
Clean hole free of dust and debris



Thread on the rod coupler and washer until the distance between the bottom of the anchor and the underside of the nut is equal to the nominal embedment



Tap the anchor, rod couple and washer assembly into the drilled hole until the washer is flush with the underside of the concrete structure



Set the anchor by applying the specified installation torque using a torque wrench

TZ WEDGE ANCHOR FOR CRACKED AND UNCRACKED CONCRETE

DESIGN DATA IN CRACKED AND UNCRACKED NORMAL WEIGHT CONCRETE (CARBON STEEL ANCHOR)

Table 2 - Tension Design Parameters[1,2]

Property	Notation	Unit	Nominal Anchor Size (in.) 3/8	1/2		5/8		3/4	
Anchor Category	1,2 or 3	-	1	1	1	1	1	1	1
Steel Strength in Tension									
Minimum Specified Yield Strength	f_{ya}	ksi	60	60	60	60	60	60	60
		Mpa	414	414	414	414	414	414	414
Minimum Specified Tensile Strength	f_{uta}	ksi	75	75	75	75	75	75	75
		Mpa	517	517	517	517	517	517	517
Effective Tensile Stress Area	$A_{se,N}$	in.^{2}	0.0775	01419	0.1419	0.2260	0.2260	0.3345	0.3345
		mm^2	49.2	90.1	90.1	144.0	144.0	212.0	212.0
Axial Tension Strength[4,5]	N_{sa}	lbf	5,813	10,643	10,643	16,950	16,950	25,088	25,088
		kN	25.86	47.34	47.34	75.40	75.40	111.59	111.59
Reduction Factor for Steel Strength[2,4]	ϕ	-	0.65	0.75	0.75	0.75	0.75	0.75	0.75
Concrete Breakout Strength in Tension									
Effective Embedment Depth	h_{ef}	inch	2	2	3-1/2	2-3/4	4	3-1/4	4-3/4
		mm	51	51	89	70	102	83	121
Effectiveness Factor for Uncracked Concrete	k_{uncr}	-	24	24	24	24	24	27	24
Effectiveness Factor for Cracked Concrete	k_{cr}	-	17	17	17	21	17	21	21
Modification for Cracked & Uncracked Concrete	$\psi_{c,N}$	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Reduction Factor for Concrete Breakout Strength[2,3]	ϕ	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Pullout Strength in Tension (Non-Seismic Applications)									
Characteristic Pullout Strength for Uncracked Concrete[6,8]	$N_{p,uncr}$	lbf	Note 7	Note 7	6,520	Note 7	9,379	Note 7	Note 7
		kN			29		41.72		
Characteristic Pullout Strength for Cracked Concrete[6,8]	$N_{p,cr}$	lbf	2,035	Note 7	4,808	Note 7	Note 7	Note 7	Note 7
		kN	9.05		21.39				
Reduction Factor for Pullout Strength[2,3]	ϕ	-	0.65	Note 7	0.65	Note 7	0.65	Note 7	Note 7
Pullout Strength in Tension for Seismic Applications									
Characteristic Pullout Strength for Seismic[8]	$N_{p,eq}$	lbf	2,035	Note 7	4,808	Note 7	Note 7	Note 7	Note 7
		kN	9.05		21.39				
Reduction Factor for Pullout Strength[2,3]	ϕ	-	0.65	Note 7	0.65	Note 7	Note 7	Note 7	Note 7

[1]The data in this table shall be used with the design provisions of ACI 318 Appendix D, or CSA A23.3-14, Appendix D (Canada). Tabulated parameters apply to normal weight concrete. For installation in sand-lightweight concrete, additional provisions apply.

[2]All ϕ factors apply to the load combinations of IBC Section 1605.2.1 or ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, then the value of ϕ shall be determined in accordance with ACI 318-11 D.4.4 (D.4.5 of ACI 318-08 or ACI 318-05). For reinforcement that satisfies ACI 318. Appendix D requirements for Condition A, refer to ACI 318-11, D.4.3 (ACI 318-08 and ACI 318-05, D.4.4) for the appropriate ϕ factor when the load combination of IBC Section 1605.2 or ACI 318 Section 9.2 are used. For limit state design (Canada), all ϕ factors as per CSA A23.3-14 and R factors as per CSA A23.3-14, Annex D shall be used.

[3]For ϕ factors, Condition B as defined in ACI 318-11 D.4.3 and D.4.4 or ACI 318-08 and -05 D.4.4 and D.4.5 applies.

[4]The 3/8 inch TZ Wedge Anchor is considered a brittle steel element. The other sizes are considered ductile steel elements as defined be ACI 318 D.1.

[5]The tabulated values for steel strength in tension are based on tests and analysis in accordance with ACI 355.2 and shall be used for design.

[6]Pullout strength value, where tabulated is for installation in normal weight concrete with a compressive strength, f'c, of 2,500 psi (17.2 MPa), and may be adjusted for higher concrete compressive strength in accordance with Section 4.1.4 of the IAPMO ER 373 report.

[7]Pullout strength does not control design of these anchors; pullout strength need not be calculated for the indicated anchors.

[8]For all design cases $\psi c,P = 1.0$.

Table 3 - Shear Design Parameters[1,2]

Property	Notation	Unit	Nominal Anchor Size (in.)						
			3/8	1/2		5/8		3/4	
Anchor Category	1,2 or 3	-	1	1	1	1	1	1	1
Steel Strength in Shear									
Minimum Specified Yield Strength	f_{ya}	ksi	60	60	60	60	60	60	60
		Mpa	414	414	414	414	414	414	414
Minimum Specified Tensile Strength	f_{uta}	ksi	75	75	75	75	75	75	75
		Mpa	517	517	517	517	517	517	517
Effective Tensile Stress Area (Threads)	$A_{se,N}$	$in.^2$	0.0775	01419	0.1419	0.2260	0.2260	0.3345	0.3345
		mm^2	49.2	90.1	90.1	144.0	144.0	212.0	212.0
Steel Strength in Shear[4,5]	N_{sa}	lbf	1,678	4,199	4,199	5,151	5,151	9,801	9,801
		kN	7.46	18.68	18.68	22.91	22.91	43.60	43.60
Reduction for Steel Strength[2,4]	ϕ	-	0.6	0.65	0.65	0.65	0.65	0.65	0.65
Concrete Breakout Strength in Shear									
Load Bearing Length of Anchor[6]	$N_{p,uncr}$	inch	2	2	3-1/3	2-3/4	4	3-1/4	4-3/4
		mm	51	51	89	70	102	83	121
Nominal Anchor Diameter	$N_{p,cr}$	inch	0.375	0.500	0.500	0.625	0.625	0.750	0.750
		mm	9.5	12.7	12.7	15.9	15.9	19.1	19.1
Reduction for Concrete Breakout Strength[2,3]	ϕ	-	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Pullout Strength in Shear									
Coefficient for Pryout Strength[7]	k_{cp}	-	1	1	2	2	2	2	2
Effective Embedment Depth	h_{ef}	inch	2	2	3-1/2	2-3/4	4	3-1/4	4-3/4
		mm	51	51	89	70	102	83	121
Reduction Factor for Pryout Strength[2,3]	ϕ	-	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Steel Strength in Shear for Seismic Applications									
Characteristic Pullout Strength for Seismic[8]	$v_{sa,eq}$	lbf	1,678	3,564	3,564	4,904	4,904	6,861	6,861
		kN	7.46	15.85	15.85	21.81	21.81	30.52	30.52
Reduction Factor for Pullout Strength[2,3]	ϕ	-	0.60	0.65	0.65	0.65	0.65	0.65	0.65

[1]The data in this table shall be used with the design provisions of ACI 318 Appendix D. or CSA A23.3-14, Annex D (Canada). Tabulated parameters apply to normal weight concrete. For installation in sand-lightweight concrete, additional provisions apply.
[2]All ϕ factors apply to the load combinations of IBC Section 1605.2.1 or ACI 318 Section 9.2. If the load combinations of ACI 318 Appendix C are used, then the value of ϕ shall be determined in accordance with ACI 318-11 D.4.4 (D.4.5 of ACI 318-08 or ACI 318-05). For reinforcement that satisfies ACI 318. Appendix D requirements for Condition A, refer to ACI 318-11, D.4.3 (ACI 318-08 and ACI 318-05, D.4.4) for the appropriate ϕ factor when the load combination of IBC Section 1605.2 or ACI 318 Section 9.2 are used. For limit state design (Canada), all ϕ factors as per CSA A23.3-14 and R factors as per CSA A23.3-14, Annex D shall be used.
[3]For ϕ factors, Condition B as defined in ACI 318-11 D.4.3 and D.4.4 or ACI 318-08 and -05 D.4.4 and D.4.5 applies.
[4]The 3/8 inch TZ Wedge Anchor is considered a brittle steel element. The other sizes are considered ductile steel elements as defined be ACI 318 D.1.
[5]The tabulated values for steel strength in tension are based on tests and analysis in accordance with ACI 355.2 and shall be used for design.
[6]Load bearing length is the lesser of h_{ef} or $8d_o$.
[7]The coefficient for pryout strength, kcp, shall comply with ACI 318 D.6.3.1.
[8]For the 2006 IBC, d_o becomes d_a.

Table 4 - Design Tension and Shear Capacities in Cracked Concrete[1,2,3,4,5] at effective embedment

Nominal Anchor Size (inch)	Effective Embedment Depth (inch)	Minimum Concrete Compressive Strength									
		f'_c = 2,500 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi		f'_c = 8,000 psi	
		ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)
3/8	2	1,323 (5.82)	1,007 (4.43)	1,449 (6.38)	1,007 (4.43)	1,673 (7.36)	1,007 (4.43)	2,049 (9.02)	1,007 (4.43)	2,366 (10.41)	1,007 (4.43)
1/2	2	1,563 (6.88)	1,683 (7.41)	1,712 (7.53)	1,844 (8.11)	1,977 (8,70)	2,129 (9,37)	2,421 (10.65)	2,607 (11.47)	2,795 (12.30)	2,729 (12.01)
1/2	3-1/2	3,125 (13.75)	2,729 (12.01)	3,423 (15,06)	2,729 (12.01)	3,953 (17.39)	2,729 (12.01)	4,842 (21.30)	2,729 (12.01)	5,591 (24.60)	2,729 (12.01)
5/8	2-3/4	3,112 (13.69)	3,348 (14.73)	3,410 (15.00)	3,348 (14.73)	3,937 (17.32)	3,348 (14.73)	4,822 (21.22)	3,348 (14.73)	5,568 (24.50)	3,348 (14.73)
5/8	4	4,420 (19.45)	3,348 (14.73)	4,842 (21.30)	3,348 (14.73)	5,591 (24.60)	3,348 (14.73)	6,847 (30.13)	3,348 (14.73)	7,907 (34.79)	3,348 (14.73)
3/4	3-1/4	3,999 (17,60)	6,371 (28.03)	4,380 (19,27)	6,371 (28.03)	5,058 (22.26)	6,371 (28.03)	6,195 (27.26)	6,371 (28.03)	7,153 (31.47)	6,317 (28.03)
3/4	4-3/4	7,066 (31.09)	6,371 (28.03)	7,740 (34,06)	6,371 (28.03)	8,937 (39.32)	6,371 (28.03)	10,946 (48.16)	6,371 (28.03)	12,639 (55.61)	6,371 (28.03)

Key:

- Steel Strength Controls
- Concrete Breakout Strength Controls
- Anchor Pullout / Pryout Strength Controls

[1]Tabulated values are for single anchors installed in normal weight concrete with minimum slab thickness, $h_a = h_{min}$ and:

- $c_{a1} \ge c_{ac}$
- $c_{a2} \ge 1.5c_{a1}$

[2]Calculations were performed according to ACI 318-11 Appendix D. The load level corresponding to the controlling failure mode is listed.

[3]Strength reduction factors are based on ACI 318 section 9.2 for load combinations assuming Condition B.

[4]For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318 Appendix D.

[5]Interpolation of tabulated values is not allowed. For intermediate concrete compressive strengths or other design criteria including seismic loading please see ACI 318 Appendix D.

Table 5 - Mean Axial Stiffness, β, in Normal Weight Concrete[1,2]

Concrete type	Unit	Nominal Anchor Size 3/8	1/2		5/8		3/4	
Effective Embedment	inch	2	2	3-1/2	3-1/2	4	3-1/4	4-3/4
	mm	51	51	89	70	102	83	121
Uncracked Concrete	10^3 lb/inch	580	476	246	1,334	2,296	1,023	412
	kN/mm	102	83	43	234	402	179	72
Cracked Concrete	10^3 lb/inch	63	66	35	267	59	171	76
	kN/mm	11	12	6	47	10	30	13

[1]The data in this table is based on test results in accordance with ACI 355.2.
[2]Actual stiffness can vary substantially based on a variety of parameters including concrete strength, geometry of installation and use, and loading

Table 6 - Design Tension and Shear Capacities in Uncracked Concrete[1,2,3,4,5,6] at effective embedment

Nominal Anchor Size (inch)	Effective Embedment Depth (inch)	Minimum Concrete Compressive Strength f'_c = 2,500 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi		f'_c = 8,000 psi	
		ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)	ϕN_n Tension lbf (kN)	ϕV_n Shear lbf (kN)
3/8	2	2,206 (9.71)	1,007 (4.43)	2,417 (10.63)	1,007 (4.43)	2,791 (12.28)	1,007 (4.43)	3,418 (15.04)	1,007 (4.43)	3,778 (16.62)	1,007 (4.43)
1/2	2	2,206 (9.71)	2,376 (10.45)	2,417 (10.63)	2,603 (11.45)	2,791 (12,28)	2,729 (12.01)	3,418 (15.04)	2,729 (12.01)	3,947 (17.37)	2,729 (12.01)
1/2	3-1/2	4,238 (18.65)	2,729 (12.01)	4,642 (20.42)	2,729 (12.01)	5,361 (23.59)	2,729 (12.01)	6,565 (28.89)	2,729 (12.01)	7,581 (33.36)	2,729 (12.01)
5/8	2-3/4	3,557 (15.65)	3,348 (14.73)	3,897 (17.15)	3,348 (14.73)	4,499 (19.80)	3,348 (14.73)	5,511 (24.25)	3,348 (14.73)	6,363 (28.00)	3,348 (14.73)
5/8	4	6,069 (26.70)	3,348 (14.73)	6,678 (29.38)	3,348 (14.73)	7,711 (33.93)	3,348 (14.73)	9,444 (41.55)	3,348 (14.73)	10,905 (47.98)	3,348 (14.73)
3/4	3-1/4	5,141 (22.66)	6,371 (28.03)	5,632 (24.78)	6,371 (28.03)	6,503 (28.61)	6,371 (28.03)	7,965 (35.05)	6,371 (28.03)	9,197 (40.47)	6,317 (28.03)
3/4	4-3/4	8,075 (35.53)	6,371 (28.03)	8,846 (38.92)	6,371 (28.03)	10,103 (44.94)	6,371 (28.03)	12,510 (55.04)	6,371 (28.03)	14,445 (63.56)	6,371 (28.03)

Key:
- Steel Strength Controls
- Concrete Breakout Strength Controls
- Anchor Pullout / Pryout Strength Controls

[1]Tabulated values are for single anchors installed in normal weight concrete with minimum slab thickness, $h_a = h_{min}$ and:
- $c_{a1} \geq c_{ac}$
- $c_{a2} \geq 1.5c_{a1}$

[2]Calculations were performed according to ACI 318-11 Appendix D. The load level corresponding to the controlling failure mode is listed.
[3]Strength reduction factors are based on ACI 318 section 9.2 for load combinations assuming Condition B.
[4]Tabular values are permitted for static loading only. Seismic loading is not considered.
[5]For designs that include combined tension and shear, the interaction of tension and shear loads must be calculated in accordance with ACI 318 Appendix D.
[6]Interpolation of tabulated values is not allowed. For intermediate concrete compressive strengths or other design criteria including seismic loading please see ACI 318 Appendix D.

ALLOWABLE STRESS DESIGN

Table 7 - Allowable Load Capacities In Tension Shear[1,2,3,4,5,6]

Anchor Diameter (in.)	Min Embed Depth in. (mm)	Minimum Concrete Compressive Strength					
		f'_c = 2,500 psi (17.2 MPa)		f'_c = 4,000 psi (27.6 MPa)		f'_c = 6,000 psi (41.4 MPa)	
		Tension lbf (kN)	Shear lbf (kN)	Tension lbf (kN)	Shear lbf (kN)	Tension lbf (kN)	Shear lbf (kN)
1/4	1-1/2 (38)	318 (1.42)	382 (1.70)	411 (1.83)	382 (1.70)	474 (2.11)	382 (1.70
	2-1/4 (57)	500 (2.22)	480 (2.13)	553 (2.38)	480 (2.13)	534 (2.38)	480 (2.13)
3/8	2 (51)	1491 (6.56)	680 (2.99)	1,886 (8.30)	680 (2.99)	2,309 (10.16)	680 (2.99)
1/2	2 (51)	1,491 (6.56)	1,605 (7.06)	1,886 (8.30)	1,844 (8.11)	2,309 (10.16)	1,844 (8.11)
	3-1/2 (89)	2,864 (12.60)	1,844 (8.11)	3,622 (15.94)	1,844 (8.11)	4,436 (19.52)	1,844 (8.11)
5/8	2-3/4 (70)	2,403 (10.57)	2,262 (9.95)	3,040 (13.38)	2,262 (9.95)	3,724 (16.38)	2,262 (9.95)
	4 (102)	4,101 (18.04)	2,262 (9.95)	5,210 (22,92)	2,262 (9.95)	6,381 (28.08)	2,262 (9.95)
3/4	3-3/4 (95)	3,474 (15.28)	4,305 (18.94)	4,394 (19.33)	4,305 (18.94)	5,382 (23.68)	4,305 (18.94)
	4-3/4 (121)	5,456 (24.01)	4,305 (18.84)	6,901 (30.37)	4,305 (18.94)	8,453 (37.19)	4,305 (18.94)
1	4-1/2 (114)	2,691 (11.97)	7,104 (31.60)	4,124 (18.34)	7,104 (31.60)	4,947 (22.01)	7,104 (31.60)
	6 (152)	4,395 (19.55)	8,276 (36.81)	5,658 (25.17)	8,276 (36.81)	7,316 (23.54)	8,276 (6.81)

[1]Tabulated values are for anchors installed in uncracked concrete without edge and spacing considerations. Concrete compressive strength must be minimum at the time of installation.

[2]For the 1/4 inch and 1 inch diameter anchors, the allowable load capacities are calculated using an applied safety factor of 4.0 over the ultimate load values.

[3]For 3/8 inch -3/4 inch diameter anchors, the design values for use in allowable stress design load combinations were calculated in accordance with Section 1605.3 of the IBC using the following relationships:

$$T_{allowable,ASD} = \frac{\phi N_n}{\alpha} \quad \text{and} \quad V_{allowable,ASD} = \frac{\phi V_n}{\alpha}$$

where α = a conversion factor calculated as a weighted average of the load factors for the controlling load combination, load combination is 1.2D + 1.6L. Calculation of α based on weighted average: $\alpha = 0.3*1.2 + 0.7*1.6 = 1.48$

[4]Allowable load capacities must be multiplied by reduction factors when the edge or spacing distances are less than the critical distances.

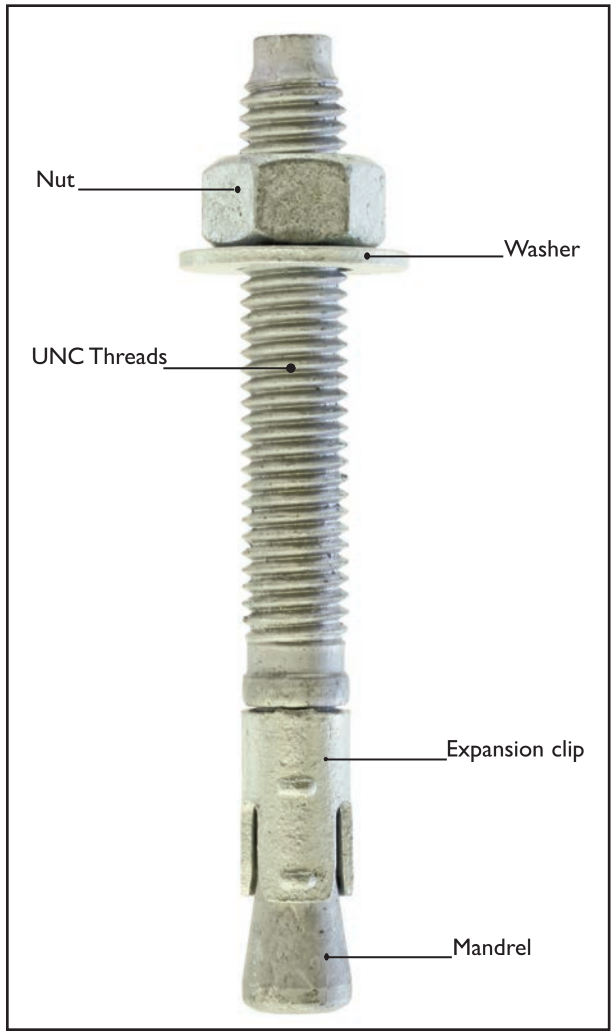
[5]Greater safety factors may be required depending on the application.

[6]Linear interpolation to determine allowable loads for intermediate depths and compressive strengths is not allowed

WEDGE ANCHOR GALVANIZED AND STAINLESS STEEL

DESCRIPTION

The UCAN WAG anchor is a fully threaded torque controlled expansion anchor assembled with a three segment expansion clip. All parts are galvanized for extended corrosion protection and include nut and washer.
The UCAN ISS and IST stainless steel anchors are fully threaded torque controlled expansion anchor assembled with a three segment expansion clip. The anchors are manufactured from stainless steel including the expansion clip, nut and washer.
Both anchor type are most suitable for corrosion resistive anchoring applications for static loading, and can be loaded immediately.



FEATURES

- Fast torque up
- Anchor size = hole size
- Non bottom bearing
- Through fastening type +1/8" clearance hole diameter required
- Fully threaded

LIMITATIONS

Not recommended for uncured concrete (less than 21 days old), lightweight concrete, masonry block or brick.

TYPICAL APPLICATIONS

- Exterior anchoring
- Safety equipment
- Fence installation
- Curtain wall
- Balcony railings
- Mechanical equipment
- Pipe support in corrosive environment
- Brick shelf angles

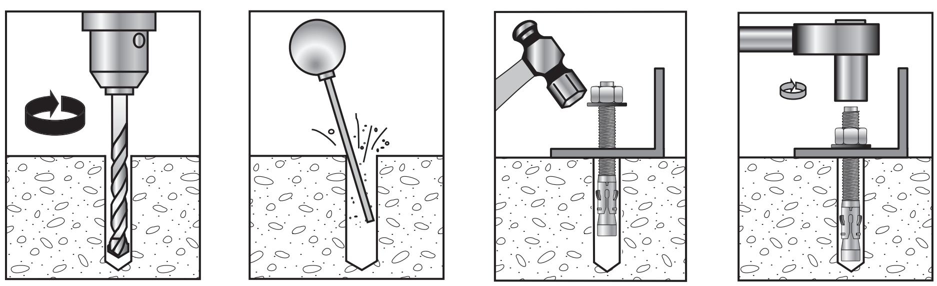
MATERIAL SPECIFICATIONS

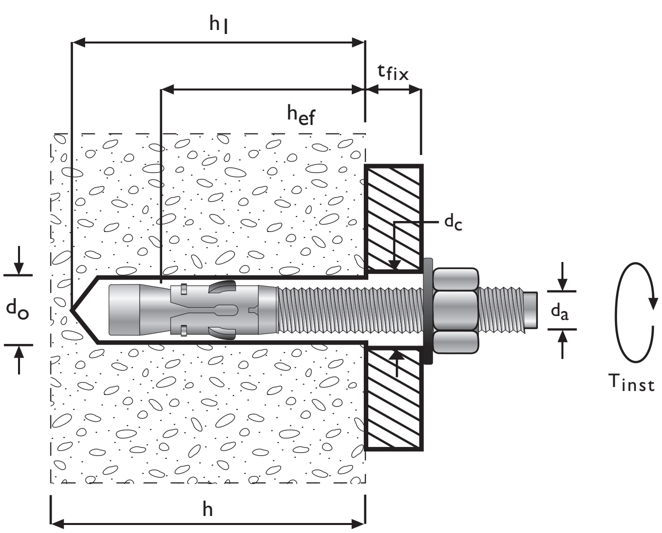
Anchor Component	Material / Standard	
Carbon steel anchor body (galvanized anchor)	1/4" – 3/4" (AISI 1022 - AISI 1035) 7/8" - 1-1/4" (AISI 1008)	
Clip (galvanized anchor)	AISI 1018 - 1010	
Stainless steel, 304 Anchor body and clip	ASTM F593 (AISI 304)	
Stainless steel, 316 Anchor body and clip	ASTM F593 (AISI 316)	
Corrosion protection (galvanized anchor)	ASTM B695 - 04	Class 65, Type 1 mechanically galvanized

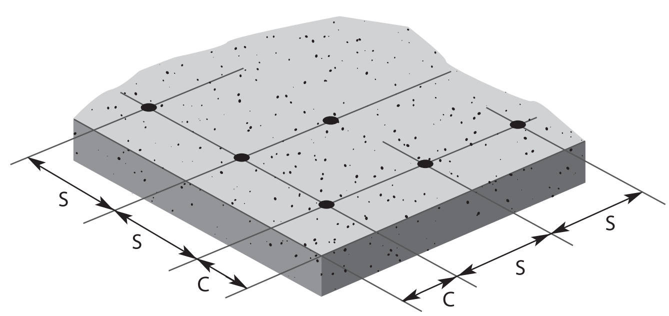
INSTALLATION

Setting Details	Anchor Diameter (in)					
	1/4	3/8	1/2	5/8	3/4	1
Nominal drill bit dia. d_o (in.)	1/4	3/8	1/2	5/8	3/4	1
Minimum embedment (test) h_{ef} (in.)	1-1/2	2	2-1/2	3	3-1/2	4-1/2
Clearance hole dia. d_c (in.)	3/8	1/2	5/8	3/4	7/8	1-1/8
Required anchor spacing for 100% performance s (in.)	3-1/2	4	5-1/2	6-1/2	8	9
Minimum anchor spacing in tension s_{min} (in.)	1-1/2	2	2-1/2	3	3-1/2	4-1/2
Required edge distance for 100% performance c (in.)	3	4	4	4-1/2	5-1/2	6-1/2
Minimum edge distance (tension; shear) c_{min} (in.)	1-1/2	2	2-1/2	3	4-1/2	5-1/2
Installation torque T_{inst} (ft. lbs.)	8	20	40	60	110	N/A
Minimum base material thickness h (in.)	3" or 1.5 x h_{ef} - whichever is greater					

Note: Carbide tipped drill bit shall conform to ANSI B 212.15







ANCHOR SELECTION

Size	Carbon Steel Galvanized	Stainless Steel (304)	Stainless Steel (316)	Hole Diameter inch	Minimum Embedment inch	Overall Anchor Length inch	Fixture Thickness inch
1/4 x 1-3/4		ISS14134	IST 14134	1/4	1-1/8	1-3/4	1/4
1/4 x 2-1/4		ISS14214	IST14214	1/4	1-1/8	2-1/4	7/8
1/4 x 3-1/4		ISS14314	IST14314	1/4	1-1/8	3	1-5/8
		ISS38214		3/8	1-5/8	2-1/4	1/4
3/8 x 2-3/4	WAG38234	ISS38234	IST38234	3/8	1-5/8	2-3/4	3/4
3/8 x 3		ISS383		3/8	1-5/8	3	1
3/8 x 3-3/4	WAG38334	ISS38334	IST38334	3/8	1-5/8	3-3/4	1-3/4
3/8 x 5		ISS385	IST385	3/8	1-5/8	5	3
1/2 x 2-3/4		ISS12234	IST12234	1/2	2-1/4	2-3/4	1/8
1/2 x 3-3/4		ISS12334	IST12334	1/2	2-1/4	3-3/4	1
1/2 x 4-1/2	WAG12412	ISS12412		1/2	2-1/4	4-1/2	1-1/2
1/2 x 5-1/2	WAG12512	ISS12512		1/2	2-1/4	5-1/2	2-3/4
1/2 x 7		ISS127		1/2	2-1/4	7	4-1/4
5/8 x 3-1/2		ISS58312		5/8	2-3/4	3-1/2	1/8
5/8 x 4-1/2	WAG58412	ISS58412	IST58412	5/8	2-3/4	4-1/2	1-1/8
5/8 x 6	WAG586	ISS586	IST586	5/8	2-3/4	6	2-5/8
5/8 x 7			IST587	5/8	2-3/4	7	3-5/8
3/4 x 4-1/4	WAG34414	ISS34414	IST34414	3/4	3-1/4	4-1/4	1/4
3/4 x 5-1/2	WAG34512	ISS34512		3/4	3-1/4	5-1/2	1-1/2
3/4 x 7	WAG347	ISS347	IST347	3/4	3-1/4	7	3
3/4 x 10		ISS3410		3/4	3-1/4	10	6
1 x 6		ISS16		1	4-1/2	6	1/2
1 x 9		ISS19		1	4-1/2	9	3-1/2

WEDGE ANCHOR GALVANIZED AND STAINLESS STEEL

DESIGN DATA

Average Ultimate Tension and Shear Loads
Normal weight stone aggregate concrete

Anchor Diameter	Minimum Embedment	Tension						Shear	
		2,000 psi Concrete		4,000 psi Concrete		6,000 psi Concrete		4,000 psi Concrete	
(in)	(in)	lbf	kN	lbf	kN	lbf	kN	lbf	kN
1/4	1-1/2	1,210	5.38	1,560	6.94	1,800	8.01	1,450	6.45
	2-1/4	1,900	8.45	2,100	9.34	2,030	9.03	1,823	8.11
3/8	2	2,875	12.79	4,550	20.24	5,776	25.69	4,860	21.62
	4-1/2	3,600	16.01	6,024	26.80	7,250	32.25	5,150	22.91
1/2	2-1/2	4,428	19.70	5,940	26.42	7,411	32.97	8,990	39.99
	4-3/4	7,150	31.80	9,284	41.30	12,100	53.82	9,870	43.90
5/8	3	6,187	27.52	8,050	35.81	10,589	47.10	12,083	53.75
	5-1/2	11,500	51.15	14,180	63.08	14,950	66.50	17,800	79.18
3/4	3-1/2	8,133	36.18	10,020	44.57	12,094	53.80	15,489	68.90
	5	12,010	53.42	15,600	69.39	23,450	104.31	21,200	94.30
1	4-1/2	10,226	45.49	15,670	69.70	18,800	83.63	26,997	120.09
	6	16,700	74.29	21,500	95.64	27,800	123.66	31,540	139.90

Note: Tabulated values are developed using independent laboratory and in-house testing data.

Allowable Tension and Shear Loads
Normal weight stone aggregate concrete

Anchor Diameter	Minimum Embedment	Tension						Shear	
		2,000 psi Concrete		4,000 psi Concrete		6,000 psi Concrete		4,000 psi Concrete	
(in)	(in)	lbf	kN	lbf	kN	lbf	kN	lbf	kN
1/4	1-1/2	318	1.42	411	1.83	474	2.11	382	1.70
	2-1/4	500	2.22	553	2.46	534	2.38	480	2.13
3/8	2	757	3.37	1,197	5.33	1,520	6.76	1,279	5.69
	4-1/2	947	4.21	1,585	7.05	1,908	8.49	1,355	6.03
1/2	2-1/2	1,165	5.18	1,563	6.95	1,950	8.68	2,366	10.52
	4-3/4	1,882	8.37	2,443	10.87	3,184	14.16	2,597	11.55
5/8	3	1,628	7.24	2,118	9.42	2,787	12.40	3,180	14.14
	5-1/2	3,026	13.46	3,732	16.60	3,934	17.50	4,684	20.84
3/4	3-1/2	2,140	9.52	2,637	11.73	3,183	14.16	5,276	23.47
	5	3,161	14.06	4,105	18.26	6,171	27.45	5,579	24.82
1	4-1/2	2,691	11.97	4,124	18.34	4,947	22.01	7,104	31.60
	6	4,395	19.55	5,658	25.17	7,316	23.54	8,276	36.81

DESIGN DATA

Load Adjustment Factors - Spacing

Anchor in Tension												
Anchor Dia. (in)	**1/4**		**3/8**		**1/2**		**5/8**		**3/4**		**1**	
Embedment (in)	1.5	2.25	2	4.5	2.5	4.75	3	5.5	3.5	5	4.5	6
Spacing (in)												
1.5	0.65											
2	0.74		0.65									
2.5	0.83	0.65	0.74		0.65							
3	0.91	0.72	0.83		0.71		0.65					
3.5	1.00	0.79	0.91		0.77		0.70		0.65			
3.75		0.83	0.96		0.80		0.73		0.67			
4		0.86	1.00		0.83	0.65	0.75		0.69			
4.5		0.93		0.65	0.88	0.69	0.80		0.73		0.65	
5		1.00		0.68	0.94	0.72	0.85		0.77	0.65	0.69	
5.5				0.71	1.00	0.76	0.90	0.65	0.81	0.69	0.73	
6				0.75		0.79	0.95	0.69	0.84	0.72	0.77	0.65
6.5				0.78		0.83	1.00	0.72	0.88	0.76	0.81	0.67
7.5				0.84		0.90		0.79	0.96	0.83	0.88	0.72
8				0.87		0.93		0.83	1.00	0.86	0.92	0.74
9				0.94		1.00		0.90		0.93	1.00	0.79
10				1.00				0.97		1.00		0.84
10.5								1.00				0.86
12												0.93
13.5												1.00

Load Adjustment Factors - Edge Distance

Anchor in Tension												
Anchor Dia. (in)	**1/4**		**3/8**		**1/2**		**5/8**		**3/4**		**1**	
Embedment (in)	1.5	2.25	2	4.5	2.5	4.75	3	5.5	3.5	5	4.5	6
Spacing (in)												
1.5	0.70											
2	0.80	0.70	0.70									
2.5	0.90	0.78	0.78		0.70							
3	1.00	0.85	0.85		0.80		0.70					
3.5		0.93	0.93		0.90		0.80		0.70			
3.75		0.96	0.96		0.95		0.85		0.74			
4		1.00	1.00		1.00		0.90		0.78			
4.5				0.70		0.70	1.00		0.85		0.70	
5				0.76		0.76			0.93	0.70	0.76	
5.5				0.82		0.82		0.70	1.00	0.75	0.82	
6				0.88		0.88		0.76		0.80	0.88	0.70
6.5				0.94		0.94		0.82		0.85	0.94	0.75
7				1.00		1.00		0.88		0.90	1.00	0.80
8								1.00		1.00		0.90
9												1.00

WEDGE ANCHOR GALVANIZED AND STAINLESS STEEL

DESIGN DATA

Load Adjustment Factors - Edge Distance

Anchor in Shear						
Anchor Dia. (in)	**1/4**	**3/8**	**1/2**	**5/8**	**3/4**	**1**
Embedment (in)	**1.5**	**2**	**2.5**	**3**	**3.5**	**4.5**
Edge (in)						
1.5	0.50					
2	0.67	0.50				
2.5	0.83	0.63	0.50			
3	1.00	0.75	0.63	0.50		
3.5		0.88	0.75	0.57		
3.75		0.94	0.88	0.61		
4		1.00	0.94	0.64		
4.5			1.00	0.71	0.50	
5				0.79	0.56	
5.5				0.86	0.61	
6				0.93	0.67	0.50
6.5				1.00	0.72	0.54
7					0.78	0.57
8					0.89	0.64
9					1.00	0.71
13						1.00

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Square brackets [ ] indicate alternatives, data required, or need for the specifier to fill in information.

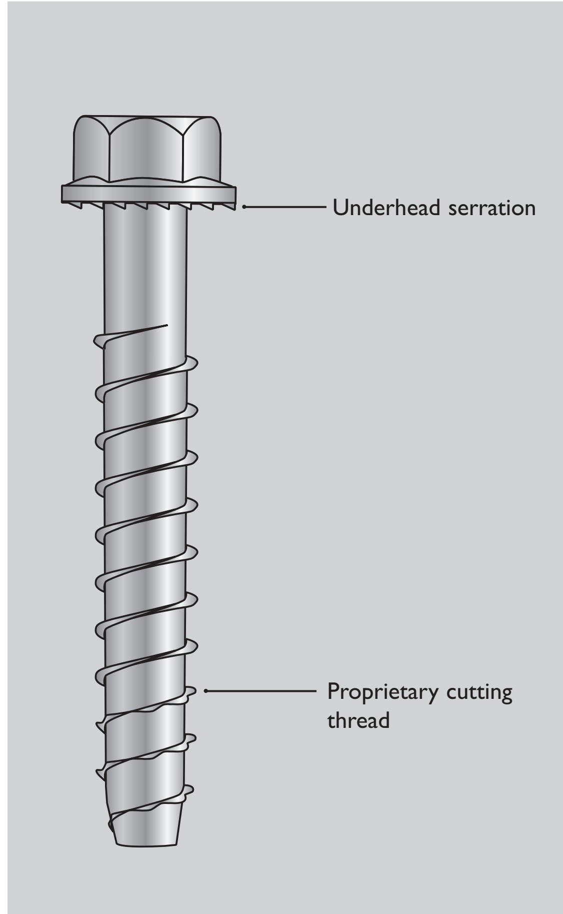
ANCHORS (FASTENERS)

Expansion anchors shall be UCAN Wedge Anchors [diameter and length to suit load and fixture requirements], supplied by UCAN Fastening Products. Anchors to be zinc plated (stainless steel, AISI grade 304 or 316) and installed according to UCAN's published instructions.

UCAN TORPEDO® BOLT

DESCRIPTION

UCAN TORPEDO® BOLT is an excellent anchoring solution for medium duty applications. TORPEDO® is available in both mechanically galvanized carbon steel as well as 316 Stainless Steel. For this reason, TORPEDO® is suitable for a wide variety of applications. Matched with a standard UCAN ANSI tolerance drill bit, this fastener exhibits consistently high load values. UCAN TORPEDO® BOLT installs quickly leaving the clean appearance of a finished hex washer head on the working surface.



FEATURES

- Available in both mechanically galvanized carbon steel and 316 Stainless steel
- Grade 316 stainless UTB for high corrosion resistance applications. Also for exterior anchoring in normal environmental condition
- Use with UCAN standard ANSI compliant drill
- Fast installation and reduced edge distance requirements, compared to mechanical expansion anchors.
- One piece fastener with finished hex washer head.
- Unique thread pattern facilitates ease of installation
- Anchor can be set with an impact or manual socket wrench.
- Underhead serrations.
- Removable–Ideal for temporary anchoring applications.
- Reusable– Reusing the anchor reduces the holding power; the number of reuses depends on the anchor diameter and concrete compressive strength.
- Anchor size is stamped on head for easy identification and enhanced quality control after anchor Installation.
- ICC-ES® Listing is pending

TYPICAL APPLICATIONS

- Racking, Railing, Sill plates, Stadium seating.
- Tilt-up braces, Formwork, Anchoring equipment

LIMITATIONS

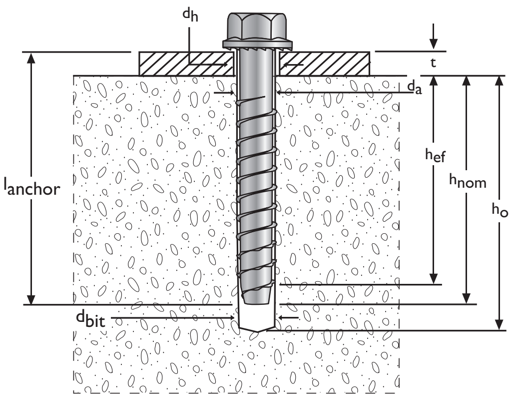
Not recommended for installation into uncured concrete(less than 7 days old).

MATERIAL SPECIFICATIONS

Properties	Carbon Steel	Stainless Steel - bimetal
Anchor body	Heat treated carbon steel	316 Stainless steel body with carbon steel cutting tip
Head style	Hex flange head with locking serrations	
Corrosion protection	Mechanically galvanized as per ASTM B-695, Class 65, Type 1	316 Stainless steel, passivated, with yellow zinc plating on cutting tip

UCAN TORPEDO® BOLT

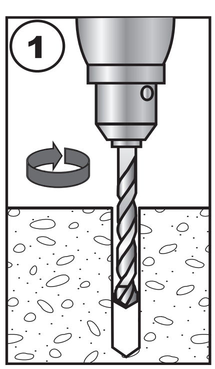
INSTALLATION DATA



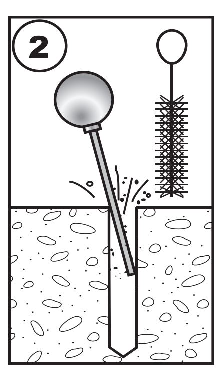
Installation Details

Characteristic	Symbol	Unit	Nominal Anchor diameter				
Anchor diameter	d_a	in.	1/4	3/8	1/2	5/8	3/4
Drill bit diameter	d_{bit}	in.	1/4	3/8	1/2	5/8	3/4
Clearance hole diameter	d_h	in.	3/8	1/2	5/8	3/4	7/8
Installation Torque	T_{inst}	ft-lbs	8	25	55	85	150
Nominal embedment	h_{nom}	in.	1-3/4	2 3-3/4	2 3-3/4	2 3-3/4	3-3/4 4-1/2
Effective embedment	h_{ef}	in.	1-1/2	1-3/4 3-1/2	1-3/4 3-1/2	1-3/4 3-1/2	3-1/2 4-1/4
Minimum hole depth	h_o	in.	2	2-1/2 4-1/4	2-1/2 4-1/4	2-1/2 4-1/4	4-1/4 5
Critical edge distance	-	in.	2	3-1/2 5-1/2	3-1/2 5-1/2	3-1/2 5-1/2	5-1/2 6-3/4
Minimum edge distance	-	in.	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4
Critical anchor spacing	-	in.	3	4-1/2	6	7-1/2	9
Minimum anchor spacing	-	in.	1	1-1/2	2	2-1/2	3
Head height	-	in.	1/4	3/8	31/64	19/32	45/64
Washer OD	-	in.	1/2	3/4	1	1-5/32	1-3/8
Wrench socket size	-	in.	7/16	9/16	3/4	15/16	1-1/8

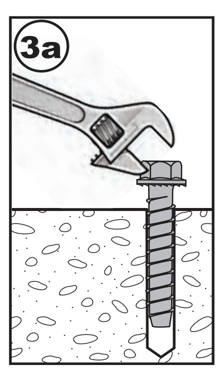
INSTALLATION INSTRUCTIONS



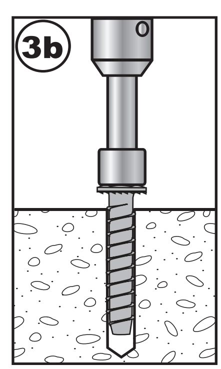
Drill hole to the specified diameter and depth



Blow out dust from the hole



Place anchor in drilled hole



Apply installation torque to set anchor

DESIGN DATA

Ultimate and Allowable Load Data

Anchor diameter	Drill bit diameter	Nominal embedment		Allowable Load Data				Ultimate Load Data			
				3000 psi concrete		6000 psi concrete		3000 psi concrete		6000 psi concrete	
in.	in.	in.	Units	Tension	Shear	Tension	Shear	Tension	Shear	Tension	Shear
1/4	1/4	1-1/2	lbs	181	430	256	670	725	1719	1025	2680
			kN	0.81	1.91	1.14	2.98	3.22	7.65	4.56	11.92
1/4	1/4	2-1/2	lbs	610	430	863	670	2440	1719	3450	2680
			kN	2.71	1.91	3.84	2.98	10.85	7.65	15.35	11.92
3/8	3/8	2	lbs	916	892	1295	1742	3664	3567	5182	6967
			kN	4.07	3.97	5.76	7.75	16.30	15.87	23.05	30.99
3/8	3/8	3-1/2	lbs	2080	2050	2941	3007	8319	8199	11764	12030
			kN	9.25	9.12	13.08	13.38	37.00	36.47	52.33	53.51
1/2	1/2	2	lbs	853	1088	1206	1686	3411	4350	4824	6744
			kN	3.79	4.84	5.37	7.50	15.17	19.35	21.46	30
1/2	1/2	3-1/2	lbs	2190	2235	3097	3068	8759	8938	12387	12272
			kN	9.74	9.94	13.78	13.65	38.96	39.76	55.1	54.59
5/8	5/8	2	lbs	864	1164	1221	1643	3454	4657	4885	6573
			kN	3.84	5.18	5.43	7.31	15.37	20.72	21.73	29.24
5/8	5/8	3-1/2	lbs	2324	2389	3287	3168	9296	9557	13147	12670
			kN	10.34	10.63	14.62	14.09	41.35	42.51	58.48	56.36
3/4	3/4	2-1/2	lbs	1078	1569	1525	2254	4313	6276	6099	9015
			kN	4.80	6.98	6.78	10.03	19.18	27.92	27.13	40.1
3/4	3/4	4	lbs	2632	3167	3723	4729	10530	12667	14891	18918
			kN	11.71	14.09	16.56	21.04	46.84	56.35	66.24	84.15

Note: The data presented in this table is based on independent laboratory testing at critical anchor spacing and edge distance.

UCAN TORPEDO® BOLT

PRODUCT ORDERING INFORMATION

Part number	Head style	Anchor size	Drill bit diameter	Wrench socket size	Minimum embedment	Box qty	Casse qty
UTB 14214	hex	1/4 x 2-1/4	1/4	7/16	1-1/4	100	800
UTB 143	hex	1/4 x 3	1/4	7/16	2-1/4	100	800
UTB 38134	hex	3/8 x 1-3/4	3/8	9/16	3/4	50	400
UTB 38212	hex	3/8 x 2-1/2	3/8	9/16	1-1/2	50	400
UTB 383	hex	3/8 x 3	3/8	9/16	2	50	400
UTB 384	hex	3/8 x 4	3/8	9/16	3-1/2	50	400
UTB 385	hex	3/8 x 5	3/8	9/16	3-1/2	25	75
UTB 123	hex	1/2 x 3	1/2	3/4	2	50	150
UTB 12212	hex	1/2 x 2-1/2	1/2	3/4	2	50	400
UTB 124	hex	1/2 x 4	1/2	3/4	3-1/2	40	120
UTB 125	hex	1/2 x 5	1/2	3/4	3-1/2	30	90
UTB 583	hex	5/8 x 3	5/8	15/16	2	25	75
UTB 584	hex	5/8 x 4	5/8	15/16	3-1/2	25	75
UTB 585	hex	5/8 x 5	5/8	15/16	3-1/2	20	60
UTB 586	hex	5/8 x 6	5/8	15/16	3-1/2	20	60
UTB 344	hex	3/4 x 4	3/4	1-1/8	2	15	45
UTB 345	hex	3/4 x 5	3/4	1-1/8	3-1/2	15	45
UTB 346	hex	3/4 x 6	3/4	1-1/8	3-1/2	15	45
UTB 347	hex	3/4 x 7	3/4	1-1/8	3-1/2	15	45

LOAD ADJUSTMENT FACTORS (ALLOWABLE STRESS DESIGN)

Anchor Spacing

Diameter	Critical spacing		Minimum Spacing		Reduction Factor	
	Tension	Shear	Tension	Shear	Tension	Shear
1/4	3"	3"	1"	1"	0.5	0.7
3/8	4-1/2"	4-1/2"	1-1/2"	1-1/2"		
1/2	6"	6"	2"	2"		
5/8	7-1/2"	7-1/2"	2-1/2"	2-1/2"		
3/4	9"	9"	3"	3"		

Edge Distance

Diameter	Critical Edge Distance		Minimum Edge Distance		Reduction Factor	
	Tension	Shear	Tension	Shear	Tension	Shear
1/4	$1.5 \times h_{ef}$		$0.8 \times h_{ef}$	1-3/4"	0.75	0.25
3/8						
1/2						
5/8						
3/4						

Note: Reduction factor at critical distances equals 1.0 for edge and spacing distances between critical and minimum distances, use linear interpolation. Reduction factors are cumulative.

DESCRIPTION

UCAN FLO-ROK® FR5 MAX is a styrene free epoxy acrylate adhesive suitable for year-round use without preconditioning in temperature ranging from -20°C to over 30°C. This versatile two component, high strength anchoring adhesive, provides stress free fastening and is an excellent choice for anchoring & dowelling. A matching static mixing nozzle, as well as FLO-ROK's low mix ratio sensitivity, ensures thorough, 10:1 mixing of the resin and the hardener. FR5-MAX is available in 2 sizes 10 oz. for small jobs, and 28 oz. that is perfect for high volume applications such as rebar dowelling.

UCAN FLO-ROK® FR5 MAX anchoring adhesive is specifically formulated for continuously threaded steel rod and deformed steel reinforcing bar anchoring to resist static, wind or earthquake (Seismic Design Categories A through F) tension and shear loads in cracked and un-cracked, normal-weight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The FLO-ROK® FR5 MAX adhesive anchors are designed to be used for floor (vertically down), wall (horizontal) anchoring applications.

FEATURES

- IAPMO ER0490
- ACI 318 Category 1 anchor (continous spec. inspection) for cracked & uncracked concrete
- Tested in accordance to AC 308 for long term sustained load at standard and elevated temperature.
- Seismic resistance
- Use friendly, low odour, styrene free & MMA free
- Meets LEED guidelines; low VOC
- Moisture insensitive, non sag formula
- Suitable for damp and water filled holes
- Shelf life 1 year, store cartridge at +5°C to +25°C before use
- Meets CSA A23.3-14, Annex D requirements

TYPICAL APPLICATIONS

- Rebar dowelling
- Highway and bridge construction
- Machine, crane and hoist installation
- Hollow wall anchoring applications
- Renovations

LISTING AND APPROVALS

IAPMO UNIFORM ES®

- IAPMO ER0490

- MTO MI 120
- MTQ Approved

COMPLIANCE WITH THE FOLLOWING CODES

- 2015, 2012, 2009, 2003 International Building Code® (IBC)
- 2015, 2012, 2009, 2003 International Residential Code® (IRC)

LEED® COMPLIANCE

U.S. GREEN BUILDING COUNCIL®

- Credit 4.1 - Low Emitting Materials

FLO-ROK® FR5MAX INJECTION ADHESIVE ANCHOR

MATERIAL SPECIFICATIONS

TABLE 1. ANCHOR RODS

Properties	Symbol	Unit	Value	Test Standard
Standard Threaded Rod / Carbon Steel	f_u	psi	72,500	ISO 898 Grade 5.8
		MPa	500	
	f_y	psi	58,000	
		MPa	400	
High Strength Threaded Rod / Carbon Steel	f_u	psi	125,000	ASTM A 193, Grade B7
		MPa	862	
	f_y	psi	105,000	
		MPa	724	
Stainless Steel Threaded Rod	f_u	psi	100,000	ASTM F 593 (AISI 304/316)
		MPa	689	
	f_y	psi	65,000	
		MPa	448	
Carbon Steel Nuts	-	-	-	ASTM A 563
Stainless Steel Nuts	-	-	-	ASTM F 594
Carbon and Stainless Steel Washers	-	-	-	ASTM B18.22.1 Type A Plain

TABLE 2 - CURED EPOXY

Properties		Unit	Value	Test Standard
Compressive Strength	24 hrs.	psi	10,400	ASTM D 695 @ 20°C/72°
		MPa	72	
	7 days	psi	11,100	
		MPa	77	
Tensile Strength	24 hrs	psi	1,885	ASTM D 638 @ 20°C/72°
		MPa	13	
	7 days	psi	2,175	
		MPa	15	
Elongation at Break	24 hrs.	%	6.0	ASTM D 638 @ 20°C/72°
	7 days		7.0	
Tensile Modulus	24 hrs.	psi	536,000	ASTM D 638 @ 20°C/72°
		GNm^{-2}	3.7	
	7 days	psi	551,000	
		GNm^{-2}	3.7	
Flexural Strength	24 hrs	psi	4,200	ASTM D 790 @ 20°C/72°
		MPa	29	
HDT (Heat Deflection Temp.)	7 days	°F	169	ASTM D 648 @ 20°C/72°
		°C	76	

IN SERVICE TEMPERATURE RANGE

Short Term : -40°C (-40°F) to +80°C (+176° F)
Long Term : -40°C (-40°F) to +50° (+122° F

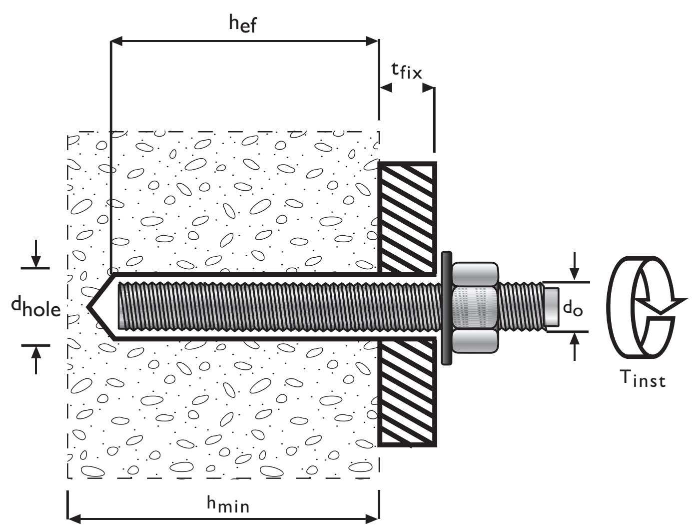
TABLE 3. CURING TIMES

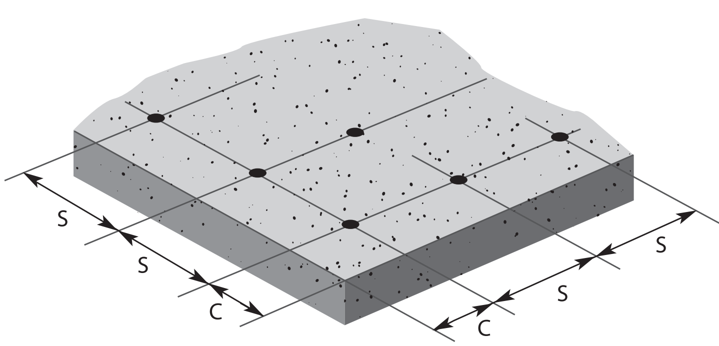
IMPORTANT!

- Install stud immediately after injecting adhesive. Do not disturb stud during curing time.

APPLICATION TEMPERATURE TEMPÉRATURE D'APPLICATION	GEL TIME TEMPS DE GEL	CURE TIME TEMPS DE DUR.
-10°C to +5°C (14°F to 41°F)	15 mins	12 hours
+5°C to +10°C (41°F to 50°)	10 mins	145 mins
+10°C to +15°C (50°F to 59°)	8 mins	85 mins
+15°C to +20°C (59°F to 68°)	6 mins	75 mins
+20°C to +25°C (68°F to 77°)	5 mins	50 mins
+25°C to +30°C (77°F to 86°)	4 mins	40 mins
+30°C to +35°C (86°F to 95°)	2 mins	30 mins

Cartridge shall be conditioned to a minimum 41°F (+5°C) prior to use





FLO-ROK® FR5MAX INJECTION ADHESIVE ANCHOR

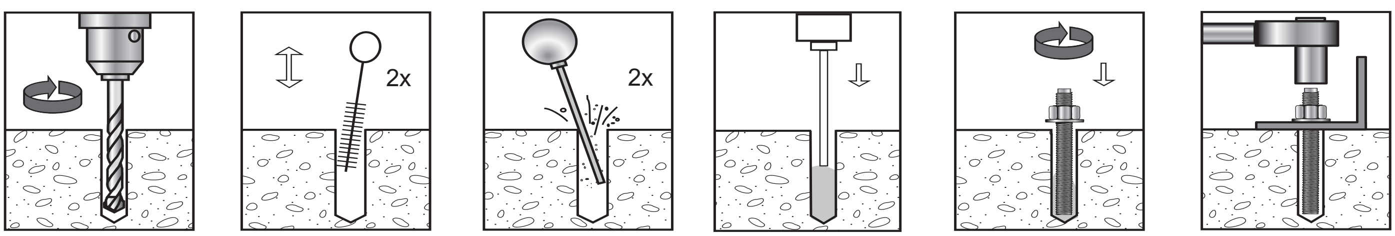
INSTALLATION

TABLE 4 - ANCHOR SYSTEM INSTALLATION INFORMATION

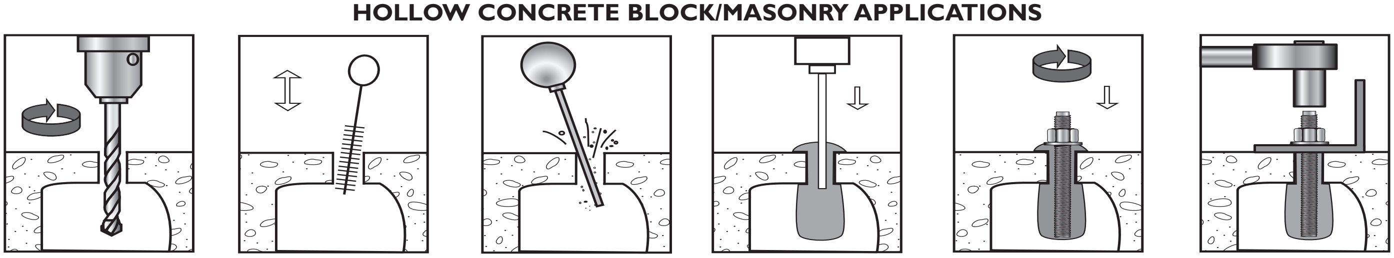
Characteristics		Symbol	Unit	Nominal Anchor Element Diameter						
UNC Threaded Bar	Size	d_o	inch	3/8	1/2	5/8	3/4	7/8	1	1-1/4
	Drill Size	d_{hole}	inch	1/2	9/16	3/4	7/8	1	1-1/8	1-3/8
US Re-bar	Size	d_o	inch	#3	#4	#5	#6	#7	#8	#10
	Drill Size	d_{hole}	inch	9/16	5/8	3/4	7/8	1	1-1/8	1-3/8
Metric Threaded Rod	Size	d_o	mm	M10	M12	M16	M20	-	M24	M30
	Drill Size	d_{hole}	mm	1	14	18	22	-	26	35
Metric Re-bar (CAN)	Size	M	-	10M	-	15M	20M	-	25M	30M
	Drill Size	d_{hole}	inch	9/16	-	3/4	7/8	-	1-1/4	1-1/2
Maximum Tightening Torque		T_{inst}	ft·lb	15	30	60	100	125	150	200
Embedment Depth Range		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/8	3-3/4	4	4	5
		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15	17-1/2	20	25
Minimum Concrete Thickness		h_{min}	inch	$2.0 \cdot h_{ef}$						
Critical Edge Distance		C_{ac}	inch	See Section 3.1.10. (IAPMO ER0490)						
Minimum Edge Distance		C_{min}	inch	$0.5 \cdot h_{ef}$						
Minimum Anchor Spacing		S_{min}	inch	$0.5 \cdot h_{ef}$						

For **SI:** 1 inch = 25.4 mm, 1ft·lb = 1.356 N·m

SOLID CONCRETE/MASONRY APPLICATIONS



HOLLOW CONCRETE BLOCK/MASONRY APPLICATIONS



NOTE:

- Clean hole thoroughly by using nylon brush and blow-out bulb or compressed air (65 - 80 psi)
- Always dispense about 1 oz. FLO - ROK to the side, prior to injecting it into the clean hole, to assure uniform mixing indicated by a consistent dark grey colour.
- At a minimum, half fill the hole starting from the bottom up by slowly withdrawing the nozzle. (solid installation)
  Fill the screen fully starting from the bottom by slowly withdrawing the nozzle. (hollow installation)
- Mark embedment depth on the threaded rod (rebar) prior to installation, and insert the rod (rebar) turning it slowly until it reaches the bottom of the hole (depth mark is flush with the surface).
- Observe curing time. The installed anchor must not be disturbed or loaded before the specified curing time has elapsed.

STRENGTH DESIGN

General: The design strength of anchors shall be determined in accordance with ACI 318-14 chapter 17 or ACI 318-11 Appendix D and the IAPMO ER0490.

The strength design of anchors must comply with ACI 318-14 and Section 3.2.2 of IAPMO ER0490.

Design parameters, including strength reduction factors, φ, corresponding to each limit state, are provided in Tables 6 through 12. Strength reduction factors, Φ Applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318 Appendix C are used, the appropriate value of Φ shall be determined in accordance with ACI 318 D.4.4.

Interaction of Tensile and Shear Forces: For designs that include combined tension and shear forces, the interaction of the tension and shear loads must be calculated in accordance with ACI 318-14 Section 17.5.3.1 (ACI 318-11 Section D.4.3)

LIMIT STATE DESIGN (CSA A23.3-14, ANNEX D)

The design strength of anchors in Limit State Design (Canada) shall comply with CSA A23.3-14, Annex D.
Design parameters are provided in Tables 6 through 12. Strength Reduction Factors (R) and Material Resistance Factors (Φ) are provided in Table 5. The requirements for member thickness edge distance and spacing shown in Table must apply. For designs that include tension and shear forces, the interaction of the loads must be calculated in accordance with CSA A23.3-14, Annex D.8

TABLE 5 - RESISTANCE FACTORS FOR LIMIT STATE DESIGN IN ACCORDANCE WITH CSA A23.3-14, ANNEX D

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)						
			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
			10M	15M	20M	25M	30M		
Concrete material resistance factor (dry concrete)	Φ_c	-	0.65						
Steel material resistance factor	Φ_s	-	0.85						
Strength reduction factor for tension, steel failure modes (carbon and stainless steel threaded rod)	R		0.80						
Strength reduction factor for tension, steel failure modes (reinforcing bar)	R		0.70						
Strength reduction factor for shear, steel failure modes (carbon and stainless steel threaded rod)	R		0.75						
Strength reduction factor for shear, steel failure modes (reinforcing bar)	R		0.65						
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15						
		Cond. B	1.00						
Strength reduction factor for Shear, concrete failure modes	R	Cond. A	1.15						
		Cond. B	1.00						
Coefficient for factored concrete breakout in tension, cracked concrete	k	-	7						
Modification factor concrete resistance to account uncracked concrete	$\psi_{c,N}$	-	1.4						

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TABLE 6—STEEL DESIGN INFORMATION FOR FRACTIONAL CARBON STEEL AND STAINLESS STEEL THREADED ROD[1,2,3,4]

	Characteristic	Symbol	Units	Nominal Rod Diameter, d_o						
	Nominal Size	do	inch	3/8	1/2	5/8	3/4	7/8	1	1-1/4
	Stress Area[1]	Ase	in.^{2}	0.0775	0.1419	0.226	0.334	0.462	0.606	0.969
Carbon Steel Threaded Rod	**Reduction Factor for Tension Steel Failure**[3,4]	Ø	-	0.75						
Carbon Steel Threaded Rod	**Strength Reduction Factor for Shear Steel Failure**[3,4]	Ø	-	0.65						
Carbon Steel Threaded Rod	**Tension Resistance of Carbon Steel ISO 898-1 Class 5.8**	Nsa	lb (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33.475 (148.9)	43,910 (195.3)	70,260 (312.5)
Carbon Steel Threaded Rod	**Tension Resistance of Carbon Steel ASTM A193 B7**	Nsa	lb (kN)	9,690 (43.1)	17,740 (78.9)	28,250 (125.7)	41,750 (185.7)	57,750 (256.9)	75,750 (337.0)	121,125 (538.8)
Carbon Steel Threaded Rod	**Shear Resistance of Carbon Steel ISO 898-1 Class 5.8**	Vsa	lb (kN)	2,810 (12.5)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,345 (117.2)	42,155 (187.5)
Carbon Steel Threaded Rod	**Shear Resistance of Carbon Steel ASTM A193 B7**	Vsa	lb (kN)	4,845 (21.6)	10,645 (47.4)	16,950 (75.4)	25,050 (111.4)	34,650 (154.1)	45,450 (202.2)	72,675 (323.3)
Stainless Steel Threaded Rod	**Strength Reduction Factor for Tension Steel Failure**[3,4]	Ø	-	0.75						
Stainless Steel Threaded Rod	**Strength Reduction Factor for Shear Steel Failure**[3,4]	Ø	-	0.65						
Stainless Steel Threaded Rod	**Tension Resistance of Stainless Steel ASTM F593 CW1**	Nsa	lb (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	--	--	--	--
Stainless Steel Threaded Rod	**Tension Resistance of Stainless Steel ASTM F593 CW2**	Nsa	lb (kN)	--	--	--	28,390 (126.3)	39,270 (174.7)	51,510 (229.1)	82,365 (366.4)
Stainless Steel Threaded Rod	**Tension Resistance of Stainless Steel ASTM F593 SH1**	Nsa	lb (kN)	8,915 (39.7)	16,320 (72.6)	25,990 (115.6)	--	--	--	--
Stainless Steel Threaded Rod	**Tension Resistance of Stainless Steel ASTM F593 SH2**	Nsa	lb (kN)	--	--	--	35,070 (156.0)	48,510 (215.8)	63,630 (283.0	--
Stainless Steel Threaded Rod	**Tension Resistance of Stainless Steel ASTM F593 SH3**	Nsa	lb (kN)	--	--	--	--	--	--	92,055 (409.5)
Stainless Steel Threaded Rod	**Shear Resistance of Stainless Steel ASTM F593 CW1**	Vsa	lb (kN)	3,875 (17.2)	7,095 (31.6)	11,300 (50.3)	--	--	--	--
Stainless Steel Threaded Rod	**Shear Resistance of Stainless Steel ASTM F593 CW2**	Vsa	lb (kN)	--	--	--	14,195 (63.1)	19,635 (87.3)	25,755 (114.6)	41,185 (183.2)
Stainless Steel Threaded Rod	**Shear Resistance of Stainless Steel ASTM F593 SH1**	Vsa	lb (kN)	4,455 (19.8)	9,790 (43.5)	15,595 (69.4)	--	--	--	--
Stainless Steel Threaded Rod	**Shear Resistance of Stainless Steel ASTM F593 SH2**	Vsa	lb (kN)	--	--	--	17,535 (78.0)	24,255 (107.9)	31,815 (141.5)	--
Stainless Steel Threaded Rod	**Shear Resistance of Stainless Steel ASTM F593 SH3**	Vsa	lb (kN)	--	--	--	--	--	--	46,030 (204.8)

For **SI**: 1 inch = 25.4 mm, 1 in.2 = 645.16 mm2, 1 lb = 0.004448 kN

[1]Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-14 Eq. (17.4.1.2) and Eq. (17.5.1.2b) or ACI 318-11 Eq. (D-2) and Eq. (D-29). Nuts and washers shall be appropriate for the rod as set forth in Table 1 of this report.

[2]Stress area is minimum stress area applicable for either tension or shear.

[3]Tabulate value of φ complies with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3) and applies when the load combinations of Section 1605.1 of the IBC or ACI318-14 Section 5.3 (ACI 318-11 Section 9.2) are used. When the load combinations in ACI 318 Appendix C are used, the appropriate value of φ shall be determined in accordance with ACI 318-11 D.4.4.

[4]For limit state design as per CSA A23.3-14, Annex D, Material resistance factors (ϕ) and resistance modification factors (R) in table shall be used.

TABLE 7a—STEEL DESIGN INFORMATION FOR FRACTIONAL STEEL US REINFORCING BAR[1,2,3]

	Characteristic	Symbol	Units	Nominal Reinforcing Bar size, d_o						
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
Reinforcing bar	Nominal bar diameter	d_o	inch	0.375	0.500	0.625	0.750	0.875	1.000	1.250
	Stress Area	A_{se}	in.^{2}	0.11	0.20	0.31	0.44	0.60	0.79	1.27
	Strength Reduction Factor for Tension Steel Failure	Ø		0.75						
	Strength Reduction Shear for Tension Steel Failure	Ø		0.65						
	Tension Resistance of Carbon Steel ASTM A615 Grade 40	N_{sa}	lb (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	76,200 (339.0)
	Tension Resistance of Carbon Steel ASTM A615 Grade 60	N_{sa}	lb (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	114,300 (508.4)
	Tension Resistance of Carbon Steel ASTM A615 Grade 40	V_{sa}	lb (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)	21,600 (96.1)	28,440 (126.5)	45,720 (203.4)
	Tension Resistance of Carbon Steel ASTM A615 Grade 60	V_{sa}	lb (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	68,580 (305.1)

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Values provided for common rod material types are based on specified strength and calculated in accordance with ACI 318-14 Eq. (17.4.1.2) and Eq. (17.5.1.2b) or ACI 318-11 Eq. (D-2) and Eq. (D-29). Nuts and washers shall be appropriate for the rod as set forth in Table 3 of this report.
[2]Stress area is minimum stress area applicable for either tension or shear.
[3]Tabulate value of φ complies with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3) and applies when the load combinations of Section 1605.1 of the IBC or ACI318-14 Section 5.3 (ACI 318-11 Section 9.2) are used. When the load combinations in ACI 318 Appendix C are used, the appropriate value of φ shall be determined in accordance with ACI 318-11 D.4.4.

TABLE 7b—STEEL DESIGN STRENGTH FOR CAN GRADE 400 REINFORCING BAR[1,2]

Rebar size	Area(mm²)	f_{uta}(MPa)	f_{ya}(MPa)	Tension N_{sar}	Shear V_{sar}	Seismic Shear V_{sar}
10M	100	540	400	36.72 kN 8,255 lb	17.44 kN 3,921 lb	12.73 kN 2,863 lb
15M	200	540	400	73.44 kN 16,511 lb	34.88 kN 7,843 lb	23.37 kN 5,255 lb
20M	300	540	400	110.16 kN 24,766 lb	52.33 kN 11,764 lb	35.06 kN 7,882 lb
25M	500	540	400	183.60 kN 41,277 lb	87.21 kN 19,607 lb	53.20 kN 11,960 lb
30M	700	540	400	257.04 kN 57,788 lb	122.09 kN 27,449 lb	56.16 kN 12,627 lb

[1]Tabulated value are calculated in accordance with CSA A23.3-14 Annex D (Factored Resistance Loads)
[2]CSA G30.18 Grade 400 reinforcing bar are considered ductile steel elements.

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TABLE 8 - FRACTIONAL THREADED ROD AND REINFORCING BAR CONCRETE BREAKOUT STRENGTH DESIGN INFORMATION[1,2]

Characteristic		Symbol	Units	Nominal Anchor Element Diameter						
US Threaded Rod	Size	d_o	inch	3/8	1/2	5/8	3/4	7/8	1	1-1/4
	Drill Size	d_{hole}	inch	1/2	9/16	3/4	7/8	1	1-1/8	1-3/8
US Re-bar	Size	d_o	inch	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
	Drill Size	d_{hole}	inch	9/16	5/8	3/4	1	1	1-1/4	1-5/8
Embedment Depth Range		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/8	3-1/2	4	4	5
		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15	17-1/2	20	25
Minimum Anchor Spacing		s_{min}	inch	$0.5 \cdot h_{ef}$						
Minimum Edge Distance		c_{min}	inch	$0.5 \cdot h_{ef}$						
Minimum Concrete Thickness		h_{min}	inch	$2.0 \cdot h_{ef}$						
Critical Edge Distance		c_{ac}	-	See ACI 318 D.8.6						
Effectiveness Factor for Uncracked Concrete, Breakout		$k_{c,uncr}$	--	24						
			(SI)	(10)						
Effectiveness Factor for Cracked Concrete, Breakout		$k_{c,cr}$	--	17						
			(SI)	(7.1)						
$k_{c,uncr} / k_{c,cr}$		–	--	1.41						
Strength Reduction Factor for Tension, Concrete Failure Modes, Condition B[2]		Ø	--	0.65						
Strength Reduction Factor for Shear, Concrete Failure Modes, Condition B[2]		Ø	--	0.70						

TABLE 9—CANADIAN METRIC REINFORCING BAR CONCRETE BREAKOUT STRENGTH DESIGN INFORMATION[1,2,3]

Characteristic	Symbol	Units	Bar size				
			10M	15 M	20M	25M	30M
Embedment Depth Range	$h_{ef,min}$	inch	2-3/8	3-1/8	3-1/2	4	5
	$h_{ef,max}$	inch	7-1/2	12-1/2	15	20	25
Minimum Anchor Spacing	s_{min}	inch	$0.5 \cdot h_{ef}$				
Minimum Edge Distance	c_{min}	inch	$0.5 \cdot h_{ef}$				
Minimum Concrete Thickness	h_{min}	inch	$2.0 \cdot h_{ef}$				
Critical Edge Distance	c_{ac}-		See Section 3.1.10 (IAPMO ER0490)				
Effectiveness Factor for Uncracked Concrete, Breakout	$k_{c,uncr}$	--	24				
		(SI)	(10)				
Effectiveness Factor for Cracked Concrete, Breakout	$k_{c,cr}$	--	17				
		(SI)	(7.1)				
$k_{c,uncr} / k_{c,cr}$	–	--	1.41				
Strength Reduction Factor for Tension, Concrete Failure Modes, Condition B[3]	Ø	--	0.65				
Strength Reduction Factor for Shear, Concrete Failure Modes, Condition B[3]	Ø	--	0.70				

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]The tabulated value of ϕ applies when the load combinations of Section 1605.2 of the IBC, or ACI 318-14 Section 5.3(ACI 318 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318 D.4.4.
[2]The values of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installation anchors designed using the load combination of IBC Section 1605.2. If the load combinations of ACI 318-11 Appendix C are used, the corresponding value of ϕ shall be determined.
[3]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (ϕ) and resistance modification factors (R) in table shall be used. Condition B applies where supplemental reinforcement is not provided as per CAS A23.3-14, Clause D.5.3

TABLE 10 - BOND STRENGTH DESIGN INFORMATION FOR FRACTIONAL STEEL THREADED RODS IN HAMMER DRILLED HOLES[1,2,3,4,5,6]

Design Information		Symbol	Units	Nominal Anchor Element Diameter					
				3/8"	1/2"	5/8"	3/4"	1"	1-1/4"
Minimun Embedment Depth		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/4	3-1/2	4	5
Maximun Embedment Depth		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15	20	25
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension loading[2,3]		$t_{k,sust,uncr}$	psi (N/mm^2)	1,320 (9.10)	1,237 (8.53)	1,154 (7.95)	1,070 (7.38)	-	-
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads[2,3]		$t_{k,uncr}$	psi (N/mm^2)	1,230 (9.10)	1,237 (8.53)	1,154 (7.95)	1,070 (7.38)	-	-
Characteristic Bond Strength in Cracked Concrete for Sustained Tension Loading[2,3]		$t_{k,sust,cr}$	psi (N/mm^2)	598 (4.13)	817 (5.63)	769 (5.30)	720 (4.96)	623 (4.29)	518 (3.57)
Characteristic Bond Strength in Cracked Concrete for Short Term Loads[2,3]		tk,cr	psi (N/mm^2)	598 (4.13)	817 (5.63)	769 (5.30)	720 (4.96)	623 (4.29)	518 (3.57)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	*Anchor Category*	-	2	2	2	2	2	3
		$Ø_d$	-	0.55	0.55	0.55	0.55	0.55	0.45
	Water-saturated Concrete	*Anchor Catergory*	-	1	2	2	2	2	3
		$Ø_{ws}$	-	0.65	0.55	0.55	0.55	0.55	0.55
	Water-filled Holes	*Anchor Category*	-	3	3	3	3	3	3
		$Ø_{wf}$	-	0.45	0.45	0.45	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	*Anchor Category*	-	1	1	1	1	1	1
		$Ø_d$	-	0.65	0.65	0.65	0.65	0.65	0.65
	Water-saturated Concrete	*Anchor Catergory*	-	1	1	1	1	1	3
		$Ø_{ws}$	-	0.65	0.65	0.65	0.65	0.65	0.65
	Water-filled Holes	*Anchor Category*	-	1	1	1	1	1	1
		$Ø_{wf}$	-	0.65	0.65	0.65	0.65	0.65	0.65
Reduction for Seismic Tension		$\alpha_{N,seis}$	-	1.00	0.41	0.54	1.00	0.50	0.96

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Bond strength values correspond to concrete compressive strength, f'_c = 2,500 psi

[2]Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C)

[3]Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.

[4]The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318 D.4.4.

[5]The value of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value ϕ shall be determined.

[6]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (ϕ) and resistance modification factors (R) in table shall be used. Condition B applies where supplemental reinforcement is not provided as per CAS A23.3-14, Clause D.5.3

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TABLE 11 - BOND STRENGTH DESIGN INFORMATION FOR US REINFORCING BARS IN HAMMER DRILLED HOLES USED AS ANCHOR ELEMENTS[1,2,3,4,5]

Design Information		Symbol	Units	Nominal Anchor Element Diameter			
				#3	#4	#5	#6
Minimum Embedment Depth		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/4	3-1/2
Maximun Embedment Depth		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension loading[2,3]		$t_{k,sust,uncr}$	psi (N/mm²)	1,262 (8.70)	1,174 (8.10)	1,087 (7.49)	1,000 (6.89)
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads[2,3]		$t_{k,uncr}$	psi (N/mm²)	1,262 (8.70)	1,174 (8.10)	1,087 (7.49)	1,000 (6.89)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	Anchor Category	-	2	2	2	2
		$Ø_d$	-	0.55	0.55	0.55	0.55
	Water-saturated Concrete	Anchor Catergory	-	1	2	2	2
		$Ø_{ws}$	-	0.65	0.55	0.55	0.55
	Water-filled Holes	Anchor Category	-	3	3	3	3
		$Ø_{wf}$	-	0.45	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	Anchor Category	-	1	1	1	1
		$Ø_d$	-	0.65	0.65	0.65	0.65
	Water-saturated Concrete	Anchor Category	-	1	1	1	1
		$Ø_{ws}$	-	0.65	0.65	0.65	0.65
	Water-filled Holes	Anchor Category	-	1	1	1	1
		$Ø_{wf}$	-	0.65	0.65	0.65	0.65

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Bond strength values correspond to concrete compressive strengths ranging from 2,500 psi to 8,000 psi.

[2]Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C)

[3]Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.

[4]The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318 D.4.4.

[5]The value of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value ϕ shall be determined.

TABLE 12 - BOND STRENGTH DESIGN INFORMATION FOR METRIC REINFORCING BARS IN HAMMER DRILLED HOLES USED AS ANCHOR ELEMENTS[1,2,3,4,5,6]

Design Information		Symbol	Units	Nominal Anchor Element Diameter			
				M10	M12	M16	M20
Minimun Embedment Depth		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/4	3-1/2
Maximun Embedment Depth		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15
Characteristic Bond Strength in Uncracked Concrete for Sustained Tension loading[2,3]		$t_{k,sust,uncr}$	psi (N/mm^2)	1,262 (8.70)	1,174 (8.10)	1,087 (7.49)	1,000 (6.89)
Characteristic Bond Strength in Uncracked Concrete for Short Term Loads[2,3]		$t_{k,uncr}$	psi (N/mm^2)	1,262 (8.70)	1,174 (8.10)	1,087 (7.49)	1,000 (6.89)
Permissible Installation Conditions, Periodic Special Inspection	Dry Concrete	*Anchor Category*	-	2	2	2	2
		Ød	-	0.55	0.55	0.55	0.55
	Water-saturated Concrete	*Anchor Catergory*	-	1	2	2	2
		Øws	-	0.65	0.55	0.55	0.55
	Water-filled Holes	*Anchor Category*	-	3	3	3	3
		Øwf	-	0.45	0.45	0.45	0.45
Permissible Installation Conditions, Continuous Special Inspection	Dry Concrete	*Anchor Category*	-	1	1	1	1
		Ød	-	0.65	0.65	0.65	0.65
	Water-saturated Concrete	*Anchor Catergory*	-	1	1	1	1
		Øws	-	0.65	0.65	0.65	0.65
	Water-filled Holes	*Anchor Category*	-	1	1	1	1
		Øwf	-	0.65	0.65	0.65	0.65

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Bond strength values correspond to concrete compressive strengths ranging from 2,500 psi to 8,000 psi.

[2]Maximum long term temperature: 122°F (+50°C); maximum short term temperature: 176°F (+80°C)

[3]Short term elevated concrete temperatures are those that occur over brief intervals, e.g. transient or part of a regular cycle of heating and cooling, such as day-night temperature rise and fall. Long term elevated concrete temperatures are roughly constant over significant periods of time.

[4]The tabulated value of ϕ applies when load combinations of Section 1605.2 of the IBC or ACI 318-14 Section 5.3 (ACI 318-11 Section 9.2), are used in accordance with ACI 318-14 Section 17.3.3 (ACI 318-11 Section D.4.3). If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ shall be determined in accordance with ACI 318 D.4.4.

[5]The value of ϕ correspond to Condition B as described in Section 17.3.3 of ACI 318-14 (Section D.4.3 of ACI 318-11) for post-installed anchors designed using the load combinations of IBC Section 1605.2. If the load combinations in ACI 318-11 Appendix C are used, the corresponding value ϕ shall be determined.

[6]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (ϕ) and resistance modification factors (R) in table shall be used. Condition B applies where supplemental reinforcement is not provided as per CAS A23.3-14, Clause D.5.3

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STRENGTH DESIGN DATA TABLES AT SELECTED EMBEDMENT AND CONCRETE STRENGTH

TABLE 13 - DESIGN STRENGTH FOR FRACTIONAL THREADED RODS IN UNCRACKED CONCRETE[1,2,3,4,5,6,7,8,9,10]

Anchor Size	Embedment Depth	Sustained Tension Design Strength - ϕN_n			Shear Design Strength - ϕV_n		
		3,000 psi (20.7 MPa)	4,000 psi (27.8 MPa)	6,000 psi (41.4 MPa)	3,000 psi (20.7 MPa)	4,000 psi (27.8 MPa)	6,000 psi (41.4 MPa)
3/8"	60 mm 2-3/8 inch	10.62 kN 2,388 lb	10.62 kN 2,388 lb	10.62 kN 2,388 lb	17.49 kN 3,932 lb	20.27 kN 4,557 lb	24.73 kN 5,561 lb
	86 mm 3-3/8 inch	15.22 kN 3,422 lb	15.22 kN 3,422 lb	15.22 kN 3,422 lb	32.25 kN 7,251 lb	37.78 kN 8,403 lb	45.61 kN 10,255 lb
	191 mm 7-1/2 inch	33.81 kN 7,600 lb	33.81 kN 7,600 lb	33.81 kN 7,600 lb	125.22 kN 28,153 lb	145.12 kN 32,626 lb	177.09 kN 39,814 lb
1/2"	114 mm 4-1/2 inch	25.22 kN 5,670 lb	25.22 kN 5,670 lb	25.22 kN 5,670 lb	56.77 kN 12,764 lb	65.78 kN 14,792 lb	80.29 kN 18,051 lb
	152 mm 6 inch	33.62 kN 7,650 lb	33.62 kN 7,560 lb	33.62 kN 7,560 lb	92.59 kN 20,815 lb	107.30 kN 24,122 lb	130.94 kN 29,437 lb
	254 mm 10 inch	56.19 kN 12,632 lb	56.19 kN 12,632 lb	56.19 kN 12,632 lb	221.63 kN 49,827 lb	256.84 kN 57,744 lb	313.43 kN 70,466 lb
5/8"	143 mm 5-5/8 inch	36.85 kN 8,285 lb	36.85 kN 8,285 lb	36.85 kN 8,285 lb	89.24 kN 20,063 lb	103.42 kN 23,250 lb	126.20 kN 28,373 lb
	191 mm 7-1/2 inch	49.10 kN 11,038 lb	49.10 kN 11,038 lb	49.10 kN 11,038 lb	145.31 kN 32,670 lb	168.40 kN 37,860 lb	205.51 kN 46,202 lb
	318 mm 12-1/2 inch	81.83 kN 18,396 lb	81.83 kN 18,396 lb	81.83 kN 18,396 lb	346.30 kN 77,670 lb	401.32 kN 90,224 lb	489.74 kN 110,104 lb
3/4"	171 mm 6-3/4 inch	49.09 kN 11,137 lb	49.09 kN 11,137 lb	49.09 kN 11,137 lb	127.74 kN 28,719 lb	148.04 kN 33,282 lb	180.66 kN 40,615 lb
	229 mm 9 inch	65.63 kN 14,755 lb	65.63 kN 14,755 lb	65.63 kN 14,755 lb	209.25 kN 47,044 lb	242.50 kN 54,518 lb	295.93 kN 66,531 lb
	381 mm 15 inch	109.38 kN 24,591 lb	109.38 kN 24,591 lb	109.38 kN 24,591 lb	498.67 kN 112,111 lb	577.90 kN 129,923 lb	705.23 kN 158,549 lb
1"	229 mm 9 inch	87.66 kN 19,707 lb	87.66 kN 19,707 lb	87.66 kN 19,707 lb	228.79 kN 51,437 lb	265.14 kN 59,610 lb	323.56 kN 72,743 lb
	305 mm 12 inch	116.67 kN 26,230 lb	116.67 kN 26,230 lb	116.67 kN 26,230 lb	372.01 kN 83,634 lb	431.11 kN 96,922 lb	526.09 kN 118,277 lb
	508 mm 20 inch	194.45 kN 43,717 lb	194.45 kN 43,717 lb	194.45 kN 43,717 lb	886.53 kN 199,309 lb	1027.37 kN 230,975 lb	1253.74 kN 281,865 lb
1-1/4"	286 mm 11-1/4 inch	136.85 kN 30,766 lb	136.85 kN 30,766 lb	136.85 kN 30,766 lb	356.96 kN 80,252 lb	103.42 kN 93,002 lb	126.20 kN 113,493 lb
	381 mm 15 inch	182.30 kN 40,985 lb	182.30 kN 40,985 lb	182.30 kN 40,985 lb	581.26 kN 130,678 lb	673.61 kN 151,440 lb	822.02 kN 184,807 lb
	635 mm 25 inch	303.83 kN 68,308 lb	303.83 kN 68,308 lb	303.83 kN 68,308 lb	1385.20 kN 311,420 lb	1605.27 kN 360,898 lb	1958.97 kN 440,415 lb

[1]Tabulated values are calculated in accordance with ACI 318-14

[2]Tabulated values are only valid for single anchors without close edge or anchor spacing considerations

[3]Tabulated values are only valid for anchors installed in dry / water-saturated concrete

[4]Tabulated values are based on bod/concrete failure

[5]Apply anchor spacing, edge distance and concrete structure thickness factors to the above values and compare to the steel values in table 13

[6]The lesser of concrete/bond and steel values are to be used in design calculations.

[7]Shear values are based on the critical edge distance as per IAPMO ER0490 , Section 3.1.10

[8]Linear interpolation is not permitted

[9]Extrapolation is not permitted

[10]Tabulated values are for static loading only. Seismic design is nor permitted in un-cracked concrete.

TABLE 14 - DESIGN STRENGTH FOR FRACTIONAL THREADED RODS IN CRACKED CONCRETE[1,2,3,4,5,6,7,8,9]

Anchor Size	Embedment Depth	Sustained Tension Design Strength - ϕN_n			Shear Design Strength - ϕV_n		
		3,000 psi (20.7 MPa)	4,000 psi (27.8 MPa)	6,000 psi (41.4 MPa)	3,000 psi (20.7 MPa)	4,000 psi (27.8 MPa)	6,000 psi (41.4 MPa)
3/8"	60 mm 2-3/8 inch	4.82 kN 1,084 lb	4.82 kN 1,084 lb	4.82 kN 1,084 lb	13.35 kN 3,002 lb	15.48 kN 3,470 lb	18.89 kN 4,246 lb
	86 mm 3-3/8 inch	6.91 kN 1,553 lb	6.91 kN 1,553 lb	6.91 kN 1,553 lb	24.63 kN 5,537 lb	28.54 kN 6,416 lb	34.83 kN 7,830 lb
	191 mm 7-1/2 inch	15.34 kN 3,449 lb	15.34 kN 3,449 lb	15.34 kN 3,449 lb	95.61 kN 21,496 lb	110.80 kN 24,911 lb	135.22 kN 30,400 lb
1/2"	114 mm 4-1/2 inch	16.64 kN 3,742 lb	16.64 kN 3,742 lb	16.64 kN 3,742 lb	43.35 kN 9,746 lb	65.78 kN 11,294 lb	80.29 kN 13,783 lb
	152 mm 6 inch	22.19 kN 4,989 lb	22.19 kN 4,989 lb	22.19 kN 4,989 lb	70.69 kN 15,893 lb	81.92 kN 18,418 lb	99.98 kN 22,476 lb
	254 mm 10 inch	37.09 kN 8,338 lb	37.09 kN 8,338 lb	37.09 kN 8,338 lb	169.22 kN 38,045 lb	196.11 kN 44,089 lb	239.32 kN 53,804 lb
5/8"	143 mm 5-5/8 inch	24.57 kN 5,524 lb	24.57 kN 5,524 lb	24.57 kN 5,524 lb	68.14 kN 15,319 lb	78.96 kN 17,753 lb	96.36 kN 21,664 lb
	191 mm 7-1/2 inch	32.73 kN 7,358 lb	32.73 kN 7,358 lb	32.73 kN 7,358 lb	110.95 kN 24,944 lb	128.58 kN 28,908 lb	156.91 kN 35,277 lb
	318 mm 12-1/2 inch	54.55 kN 12,264 lb	54.55 kN 12,264 lb	54.55 kN 12,264 lb	264.41 kN 59,445 lb	306.42 kN 68,890 lb	373.94 kN 84,068 lb
3/4"	171 mm 6-3/4 inch	32.99 kN 7,418 lb	32.99 kN 7,418 lb	32.99 kN 7,418 lb	97.54 kN 21,928 lb	113.03 kN 25,412 lb	137.94 kN 31,011 lb
	229 mm 9 inch	44.11 kN 9,916 lb	44.11 kN 9,916 lb	44.11 kN 9,916 lb	159.77 kN 35,920 lb	185.16 kN 41,617 lb	225.95 kN 50,799 lb
	381 mm 15 inch	73.51 kN 16,527 lb	73.51 kN 16,527 lb	73.51 kN 16,527 lb	380.75 kN 85,601 lb	441.25 kN 99,201 lb	538.47 kN 121,058 lb
1"	229 mm 9 inch	50.96 kN 11,456 lb	50.96 kN 11,456 lb	50.96 kN 11,456 lb	174.69 kN 39,274 lb	202.45 kN 45,514 lb	247.05 kN 55,542 lb
	305 mm 12 inch	67.82 kN 15,248 lb	67.82 kN 15,248 lb	67.82 kN 15,248 lb	284.04 kN 63,858 lb	329.17 kN 74,003 lb	401.69 kN 90,309 lb
	508 mm 20 inch	113.04 kN 25,413 lb	113.04 kN 25,413 lb	113.04 kN 25,413 lb	676.90 kN 152,180 lb	784.44 kN 176,357 lb	957.27 kN 215,215 lb
1-1/4"	286 mm 11-1/4 inch	66.20 kN 14,886 lb	66.20 kN 14,886 lb	66.20 kN 14,886 lb	272.55 kN 61,275 lb	315.85 kN 71,010 lb	385.45 kN 86,656 lb
	381 mm 15 inch	88.19 kN 19,826 lb	88.19 kN 19,826 lb	88.19 kN 19,826 lb	443.81 kN 99,778 lb	514.32 kN 115,630 lb	627.64 kN 141,107 lb
	635 mm 25 inch	146.98 kN 33,043 lb	146.98 kN 33,043 lb	146.98 kN 33,043 lb	1057.65 kN 237,781 lb	1225.68 kN 275,559 lb	1495.74 kN 336,273 lb

[1]Tabulated values are calculated in accordance with ACI 318-14
[2]Tabulated values are only valid for single anchors without close edge or anchor spacing considerations
[3]Tabulated values are only valid for anchors installed in dry / water-saturated concrete
[4]Tabulated values are based on bod/concrete failure
[5]Apply anchor spacing, edge distance and concrete structure thickness factors to the above values and compare to the steel values in table 14
[6]The lesser of concrete/bond and steel values are to be used in design calculations.
[7]Shear values are based on the critical edge distance as per IAPMO ER0490, Section 3.1.10
[8]Linear interpolation is not permitted
[9]Extrapolation is not permitted

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TABLE 15 - DESIGN STRENGTH FOR GRADE 400 CAN REINFORCING BARS IN UNCRACKED CONCRETE[1,2,3,4,5,6,7,8,9,10]

Anchor Size	Embedment Depth	Sustained Tension Design Strength - N_r			Shear Design Strength - V_r		
		3,625 psi (25 Mpa)	4,350 psi (30 Mpa)	5,800 psi (40 Mpa)	3,625 psi (25 Mpa)	4,350 psi (30 Mpa)	5,800 psi (40 Mpa)
10M	115 mm	24.52 kN	24.52 kN	24.52 kN	57.81 kN	63.33 kN	73.13 kN
	4-1/2 inch	5,512 lb	5,512 lb	5,512 lb	12,997 lb	14,238 lb	16,440 lb
	180 mm	38.37 kN	38.37 kN	38.37 kN	123.82 kN	135.64 kN	156.62 kN
	7-1/8 inch	3,422 lb	3,422 lb	3,422 lb	27,837 lb	30,494 lb	35,212 lb
	226 mm	48.18 kN	48.18 kN	48.18 kN	182.31 kN	199.71 kN	230.61 kN
	8-7/8 inch	10,832 lb	10,832 lb	10,832 lb	40,987 lb	44,899 lb	51,845 lb
15M	145 mm	35.48 kN	35.48 kN	35.48 kN	93.46 kN	102.38 kN	118.22 kN
	5-1/2 inch	7,978 lb	7,978 lb	7,978 lb	21,012 lb	23,018 lb	26,578 lb
	250 mm	61.18 kN	61.18 kN	61.18 kN	235.94 kN	258.46 kN	298.45 kN
	9-7/8 inch	13,754 lb	13,754 lb	13,754 lb	53,045 lb	58,108 lb	67,097 lb
	320 mm	78.31 kN	78.31 kN	78.31 kN	358.98 kN	393.24 kN	454.07 kN
	12-5/8 inch	17,606 lb	17,606 lb	17,606 lb	80,705 lb	88,408 lb	102,084 lb
20M	200 mm	56.28 kN	56.28 kN	56.28 kN	172.64 kN	189.11 kN	218.37 kN
	7-7/8 inch	12,653 lb	12,653 lb	12,653 lb	38,812 lb	42,517 lb	49,094 lb
	355 mm	99.89 kN	99.89 kN	99.89 kN	457.90 kN	501.60 kN	579.20 kN
	14 inch	22,458 lb	22,458 lb	22,458 lb	102,945 lb	112,771 lb	130,216 lb
	390 mm	109.74 kN	109.74 kN	109.74 kN	537.27 kN	588.55 kN	678.50 kN
	15-3/8 inch	24,672 lb	24,672 lb	24,672 lb	120,789 lb	132,318 lb	152,787 lb
25M	230 mm	84.14 kN	84.14 kN	84.14 kN	236.87 kN	259.47 kN	299.61 kN
	9 inch	18,916 lb	18,916 lb	18,916 lb	53,252 lb	58,335 lb	67,359 lb
	405 mm	148.63 kN	160.65 kN	160.65 kN	619.78 kN	678.94 kN	783.97 kN
	16 inch	33,308 lb	36,117 lb	36,117 lb	139,339 lb	152,639 lb	176,252 lb
	504 mm	184.37 kN	184.37 kN	184.37 kN	898.87 kN	984.66 kN	1136.99 kN
	19-7/8 inch	41,450 lb	41,450 lb	41,450 lb	202,084 lb	221,372 lb	255,619 lb
30M	260 mm	109.74 kN	109.74 kN	109.74 kN	304.55 kN	333.62 kN	385.23 kN
	10 inch	24,672 lb	24,672 lb	24,672 lb	68,470 lb	75,005 lb	86,608 lb
	455 mm	192.05 kN	192.05 kN	192.05 kN	788.55 kN	863.81 kN	997.45 kN
	12 inch	43,117 lb	43,117 lb	43,117 lb	177,282 lb	194,203 lb	224,246 lb
	600 mm	253.25 kN	253.25 kN	253.25 kN	1262.02 kN	1382.48 kN	1596.35 kN
	23-5/8 inch	56,936 lb	56,936 lb	56,936 lb	283,728 lb	310,808 lb	358,891 lb

[1]Tabulated N_r and V_r (factored resistance) values are calculated in accordance with CSA A23.3-14 Annex D
[2]Tabulated values are only valid for single anchors without close edge or anchor spacing considerations
[3]Tabulated values are only valid for anchors installed in dry / water-saturated concrete
[4]Tabulated values are based on bod/concrete failure
[5]Apply anchor spacing, edge distance and concrete structure thickness factors to the above values and compare to the steel values in table 7b
[6]The lesser of concrete/bond and steel values are to be used in design calculations.
[7]CSA G30.18 Grade 400 reinforcing bar are considered ductile steel elements
[8]Linear interpolation is not permitted
[9]Extrapolation is not permitted
[10]Tabulated values are for static loading only. Seismic design is nor permitted in un-cracked concrete.

TABLE 16 - DESIGN STRENGTH FOR GRADE 400 CAN REINFORCING BARS IN CRACKED CONCRETE[1,2,3,4,5,6,7,8,9]

Anchor Size	Embedment Depth	Sustained Tension Design Strength - N_r			Shear Design Strength - V_r		
		3,625 psi (25 Mpa)	4,350 psi (30 Mpa)	5,800 psi (40 Mpa)	3,625 psi (25 Mpa)	4,350 psi (30 Mpa)	5,800 psi (40 Mpa)
10M	115 mm 4-1/2 inch	11.64 kN 2,617 lb	11.64 kN 2,617 lb	11.64 kN 2,617 lb	41.29 kN 9,284 lb	45.24 kN 10,173 lb	52.23 kN 11,743 lb
	180 mm 7-1/8 inch	18.22 kN 4,095 lb	18.22 kN 4,095 lb	18.22 kN 4,095 lb	88.44 kN 19,884 lb	96.88 kN 21,782 lb	156.62 kN 25,151 lb
	226 mm 8-7/8 inch	22.87 kN 5,142 lb	22.87 kN 5,142 lb	22.87 kN 5,142 lb	130.22 kN 29,277 lb	142.65 kN 32,071 lb	164.72 kN 37,032 lb
15M	145 mm 5-1/2 inch	25.11 kN 5,645 lb	25.11 kN 5,645 lb	25.11 kN 5,645 lb	66.76 kN 15,009 lb	73.13 kN 16,441 lb	84.44 kN 18,985 lb
	250 mm 9-7/8 inch	43.29 kN 9,733 lb	43.29 kN 9,733 lb	43.29 kN 9,733 lb	168.53 kN 37,889 lb	184.62 kN 41,505 lb	213.18 kN 47,926 lb
	320 mm 12-5/8 inch	55.41 kN 12,458 lb	55.41 kN 12,458 lb	55.41 kN 12,458 lb	256.41 kN 57,646 lb	280.88 kN 63,148 lb	324.34 kN 72,917 lb
20M	200 mm 7-7/8 inch	40.68 kN 9,145 lb	40.68 kN 9,145 lb	40.68 kN 9,145 lb	123.31 kN 27,723 lb	135.08 kN 30,369 lb	155.98 kN 35,067 lb
	355 mm 14 inch	71.91 kN 16,167 lb	71.91 kN 16,167 lb	71.91 kN 16,167 lb	327.07 kN 73,532 lb	358.29 kN 80,551 lb	413.72 kN 93,012 lb
	390 mm 15-3/8 inch	79.00 kN 17,761 lb	79.00 kN 17,761 lb	79.00 kN 17,761 lb	383.76 kN 86,278 lb	420.39 kN 94,513 lb	485.43 kN 109,134 lb
25M	230 mm 9 inch	52.39 kN 11,778 lb	52.39 kN 11,778 lb	52.39 kN 11,778 lb	169.19 kN 38,037 lb	185.34 kN 41,668 lb	214.01 kN 48,114 lb
	405 mm 16 inch	92.25 kN 20,739 lb	92.25 kN 20,739 lb	92.25 kN 20,739 lb	442.70 kN 99,528 lb	484.96 kN 109,028 lb	559.98 kN 125,894 lb
	504 mm 19-7/8 inch	114.80 kN 25,808 lb	114.80 kN 25,808 lb	114.80 kN 25,808 lb	642.05 kN 144,346 lb	703.33 kN 158,123 lb	812.14 kN 182,585 lb
30M	260 mm 10 inch	56.86 kN 12,784 lb	56.86 kN 12,784 lb	56.86 kN 12,784 lb	217.54 kN 48,907 lb	238.30 kN 53,575 lb	275.17 kN 61,863 lb
	455 mm 12 inch	99.51 kN 22,372 lb	99.51 kN 22,372 lb	99.51 kN 22,372 lb	563.25 kN 126,630 lb	617.01 kN 38,716 lb	712.46 kN 160,176 lb
	600 mm 23-5/8 inch	131.22 kN 29,501 lb	131.22 kN 29,501 lb	131.22 kN 29,501 lb	901.44 kN 202,663 lb	987.48 kN 222,006 lb	1140.25 kN 256,350 lb

[1]Tabulated N_r and V_r (factored resistance) values are calculated in accordance with CSA A23.3-14 Annex D
[2]Tabulated values are only valid for single anchors without close edge or anchor spacing considerations
[3]Tabulated values are only valid for anchors installed in dry / water-saturated concrete
[4]Tabulated values are based on bod/concrete failure
[5]Apply anchor spacing, edge distance and concrete structure thickness factors to the above values and compare to the steel values in table 7b
[6]The lesser of concrete/bond and steel values are to be used in design calculations.
[7]CSA G30.18 Grade 400 reinforcing bar are considered ductile steel elements
[8]Linear interpolation is not permitted
[9]Extrapolation is not permitted

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TABLE 17 - ALLOWABLE AND ULTIMATE LOAD DATA IN HOLLOW CONCRETE BLOCK

Rod Dia.	Hole Dia.	Screen Length	Installation Torque	Allowable Loads				Ultimate Loads			
				Tension		Shear		Tension		Shear	
inch	inch	inch	ft. lbs	lbf	kN	lbf	kN	lbf	kN	lbf	kN
3/8	1/2	3	10	360	1.60	803	3.56	1,800	8.00	3,200	14.23
		6									
1/2	5/8	3	15	490	2.18	1,005	4.47	2,450	10.90	4,020	17.88
		6									
5/8	3/4	6	20	490	2.18	1,238	5.50	2,450	10.90	4,950	22.04
		10									

Notes:

1./All load values are for anchors installed in min. 1500 psi CMU units (using local material)
2./ Allowable loads are calculated using 5:1 safety factor
3./ Maximum two anchors shall be installed into the face of a hollow (non-grouted) CMU. Installation into mortar joints, flange and the web of the CMU is not allowed.
4./ Anchor installation must follow Ucan's installation instructions.

ALLOWABLE STRESS DESIGN (ASD)

For anchors designed using load combinations calculated in accordance with IBC Section 1605.3 (Allowable Stress Design), allowable loads must be established using the fallowing relationships:

$T_{allowable,ASD} = \varphi Nn/\alpha$
$V_{allowable,ASD} = \varphi Vn/\alpha$ where

$T_{allowable,ASD}$ = Allowable tension load (lbf or kN)
$V_{allowable,ASD}$ = Allowable shear load (lbf or kN)

φN_n = The lowest design strength for an anchor or anchor group in tension as determined in accordance with ACI 318 Appendix D as amended in the IAPMO ER0490 and 2009 IBC Sections 1908.1.9 and 1908.1.10 or 2006 IBC Section 1908.1.16, as applicable.

φV_n = The lowest design strength for an anchor or anchor group in shear as determined in accordance with ACI 318 Appendix D as amended in the IAPMO ER0490 and 2009 IBC Sections 1908.1.9 and 1908.1.10 or 2006 IBC Section 1908.1.16, as applicable.

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α must include all applicable factors to account for non-ductile failure modes and required over-strength.

The requirements for member thickness, edge distance and spacing, as described in Table 1, must apply.

Interaction of Tensile and Shear Forces

In lieu of ACI Sections D.7.1, D.7.2 and D.7.3, interaction of tension and shear loads must be calculated as follows:

For tension loads $T \leq 0.2\, T_{allowable,ASD}$, the full allowable strength in shear, $V_{allowable,ASD}$, shall be permitted.
For shear loads $V \leq 0.2\, V_{allowable,ASD}$, the full allowable strength in tension, $T_{allowable,ASD}$, shall be permitted.
For all other cases:

$$\frac{T}{T_{allowable,ASD}} + \frac{V}{V_{allowable,ASD}} \leq 1.2$$

CHEMICAL RESISTANCE

The chemical mortar has undergone extensive chemical resistance testing. The results are summarised in the table below.

Chemical Environment	Concentration	Result
Aqueous Solution Acetic Acid	10%	✓
Acetone	100%	
Aqueous Solution Aluminium Chloride	Saturated	✓
Aqueous Solution Aluminium Nitrate	10%	✓
Ammonia Solution	5%	✓
Jet Fuel	100%	✓
Benzene	100%	
Benzoic Acid	Saturated	✓
Benzyl Alcohol	100%	
Sodium Hypochlorite Solution	5 - 15%	C
Butyl Alcohol	100%	C
Calcium Sulphate Aqueous Solution	Saturated	✓
Carbon Monoxide	Gas	✓
Carbon Tetrachloride	100%	✓
Chlorine Water	Saturated	✓
Chloro Benzene	100%	
Citric Acid Aqueous Solution	Saturated	✓
Cyclohexanol	100%	✓
Diesel Fuel	100%	✓
Diethylene Glycol	100%	✓
Ethanol	95%	C
Ethanol Aqueous Solution	20%	C
Heptane	100%	✓

Chemical Environment	Concentration	Result
Hexane	100%	C
Hydrochloric Acid	10%	✓
	15%	✓
	25%	C
Hydrogen Sulphide Gas	100%	✓
Isoproyl Alcohol	100%	C
Linseed Oil	100%	✓
Lubricating Oil	100%	✓
Mineral Oil	100%	✓
Paraffin / Kerosene (Domestic)	100%	✓
Phenol Aqueous Solution	1%	
Phosphoric Acid	50%	✓
Potassium Hydroxide	10% / pH13	C
Sea Water	100%	✓
Styrene	100%	
Sulphur Dioxide Solution	10%	✓
Sulphur Dioxide (40°C)	5%	✓
Sulphuric Acid	10%	✓
	50%	✓
Turpentine	100%	C
White Spirit	100%	✓
Xylene	100%	

✓ = Resistant to 75°C with at least 80% of physical properties retained.
C = Contact only to a maximun of 25°C.
= Not Resistant.

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EPOXY USAGE ESTIMATING TABLES[1]

TABLE 18 - Holes per FR5MAX–10

Rod dia.	Hole dia.	Embedment (inch)											
		1	2	3	4	5	6	7	8	9	10	15	20
1/4	5/16	302.1	151.1	100.7	75.5	60.4	50.4	43.2	37.8	33.6	30.2	20.1	15.1
	3/8	178.8	89.4	59.6	44.7	35.8	29.8	25.5	22.4	19.9	17.9	11.9	8.9
3/8	7/16	182.4	91.2	60.8	45.6	36.5	30.4	26.1	22.8	20.3	18.2	12.2	9.1
	1/2	117.1	58.5	39.0	29.3	23.4	19.5	16.7	14.6	13.0	11.7	7.8	5.9
1/2	9/16	131.6	65.8	43.9	32.9	26.3	21.9	18.8	16.5	14.6	13.2	8.8	6.6
	5/8	84.7	42.4	28.2	21.2	16.9	14.1	12.1	10.6	9.4	8.5	5.6	4.2
5/8	11/16	96.2	48.1	32.1	24.1	19.2	16.0	13.7	12.0	10.7	9.6	6.4	4.8
	3/4	65.9	33.0	22.0	16.5	13.2	11.0	9.4	8.2	7.3	6.6	4.4	3.3
3/4	13/16	77.2	38.6	25.7	19.3	15.4	12.9	11.0	9.7	8.6	7.7	5.1	3.9
	7/8	54.5	27.3	18.2	13.6	10.9	9.1	7.8	6.8	6.1	5.5	3.6	2.7
7/8	61/64	67.1	33.5	22.4	16.8	13.4	11.2	9.6	8.4	7.5	6.7	4.5	3.4
	1	44.5	22.3	14.8	11.1	8.9	7.4	6.4	5.6	4.9	4.5	3.0	2.2

TABLE 19 - Holes per FR5MAX–28

Rod dia.	Hole dia.	Embedment (inch)											
		1	2	3	4	5	6	7	8	9	10	15	20
1/4	5/16	891.9	446.0	297.3	223.0	178.4	148.7	127.4	111.5	99.1	89.2	59.5	44.6
	3/8	27.9	264.0	176.0	132.0	105.6	88.0	75.4	66.0	58.7	52.8	35.2	26.4
3/8	7/16	538.3	269.2	179.4	134.6	107.7	89.7	76.9	67.3	59.8	53.8	35.9	26.9
	1/2	345.6	172.8	115.2	86.4	69.1	57.6	49.4	43.2	38.4	34.6	23.0	17.3
1/2	9/16	388.5	194.3	129.5	97.1	77.7	64.8	55.5	48.6	43.2	38.9	25.9	19.4
	5/8	250.1	125.0	83.4	62.5	50.0	41.7	35.7	31.3	27.8	25.0	16.7	12.5
5/8	11/16	284.0	142.0	94.7	71.0	56.8	47.3	40.6	35.5	31.6	28.4	18.9	14.2
	3/4	194.6	97.3	64.9	48.7	38.9	32.4	27.8	24.3	21.6	19.5	13.0	9.7
3/4	13/16	228.0	114.0	76.0	57.0	45.6	38.0	32.6	28.5	25.3	22.8	15.2	11.4
	7/8	161.0	80.5	53.7	40.2	32.2	26.8	23.0	20.1	17.9	16.1	10.7	8.0
7/8	61/64	198.0	99.0	66.0	49.5	39.6	33.0	28.3	24.7	22.0	19.8	13.2	9.9
	1	131.5	65.7	43.8	32.9	26.3	21.9	18.8	16.4	14.6	13.1	8.8	6.6
1	1 1/16	143.9	72.0	48.0	36.0	28.8	24.0	20.6	18.0	16.0	14.4	9.6	7.2
	1 1/8	108.1	54.1	36.0	27.0	21.6	18.0	15.4	13.5	12.0	10.8	7.2	5.4
1 1/4	1 3/8	83.7	41.9	27.9	20.9	16.7	14.0	12.0	10.5	9.3	8.4	5.6	4.2
	1 1/2	55.0	27.5	18.3	13.8	11.0	9.2	7.9	6.9	6.1	5.5	3.7	2.8
Rebar size													
10M	9/16	391.6	195.8	130.5	97.9	78.3	65.3	55.9	49.0	43.5	39.2	26.1	19.6
15M	3/4	268.4	134.2	89.5	67.1	53.7	44.7	38.3	33.6	29.8	26.8	17.9	13.4
20M	61/64	173.8	86.9	57.9	43.4	34.8	29.0	24.8	21.7	19.3	17.4	11.6	8.7
25M	1 1/4	84.7	42.3	28.2	21.2	16.9	14.1	12.1	10.6	9.4	8.5	5.6	4.2
30M	1 1/2	58.8	29.4	19.6	14.7	11.8	9.8	8.4	7.3	6.5	5.9	3.9	2.9
35M	1 3/4	48.3	24.2	16.1	12.1	9.7	8.1	6.9	6.0	5.4	4.8	3.2	2.4

[1] For correct epoxy usage, add 20% waste (multiply the tabulated number by 0.80)

TABLE 20 - Epoxy usage in hollow concrete block or brick using SS screens

Screen Part #	Rod Diameter	Screen Size	Screen per cartridge[1]	
			10 oz.	28 oz.
SFR 383	3/8"	1/2 X 3"	22	80
SFR 386	3/8"	1/2 X 6"	11	40
SFR 3810	3/8"	1/2 X 10"	7	24
SFR 123	1/2"	5/8 X 3"	14	51
SFR 126	1/2"	5/8 X 6"	7	26
SFR 1210	1/2"	5/8 X 10"	4	15
SFR 583	5/8"	3/4 X 3"	10	35
SFR 586	5/8"	3/4 X 6"	5	18
SFR 5810	5/8"	3/4 X 10"	3	11
SFR 5813	5/8"	5/8 X 13"	2	8
SFR 34512	3/8"	7/8 X 5-1/2"	4	14
SFR 348	3/4" - 7/8"	1 X 8"	2	7
SFR 3413	3/4" - 7/8"	1 X 13"	1	5

[1]The usage may vary based on excessive screen overfill and mixing waste

FLO-ROK FRG ANCHORING CEMENT

DESCRIPTION

FLO-ROK FRG is a fast setting, high strength, hydraulic type anchoring cement. As it hardens, it expands to fill voids and develops 2000 psi compressive strength in 2 hours at room temperature. Controlled water additions allow the product to be used in packable (vertical) or pourable (horizontal) applications. To ensure optimal performance of FRG, the hole diameter should be at least 1" (25 mm) larger than the post being fastened. The minimum recommended embedment is 2" (50 mm).

TYPICAL APPLICATIONS

- Anchoring of wood or metal sign posts, fence posts, parking meters
- Dowel and rod installation
- Handrail installation
- Setting appliances, machinery and processing equipment
- Door stops
- Ornamental ironwork installation

LIMITATIONS

- Hot temperature will speed up setting
- At colder temperatures, below 10 °C (50 °F) use warm water
- Do not apply over surfaces that are frozen or contain frost.

FEATURES

- High strength, rapid-setting material
- Suitable for horizontal and vertical applications (controlled water additions)
- Gray color
- As it hardens, it expands to fill voids
- Non corrosive, non rusting, waterproof

MATERIAL SPECIFICATIONS

Composition and Materials: FRG Anchoring Cement is a combination of special cements and silica sand

Yield: 50 lbs pail (22.7 kg) will yield 0.42 cu.ft (0.012m3) mixed anchoring material

Color: Grey

Sizes: 11.9 lbs (FRG-12) and 50 lbs (FRG-50)

Physical Properties: Setting time: (ASTM C 191)
Final set – 10 to 30 min.

Compressive Strength (ASTM C109)	
2 hrs.	2,000 psi (13.8 MPa)
24 hrs.	4,000 psi (27.6 MPa)
7 days	6,000 psi (41.4 MPa)
28 days	7,000 psi (48.3 MPa)

FLO-ROK FR6-SD INJECTION ADHESIVE ANCHOR

DESCRIPTION

The UCAN FLO-ROK® FR6-SD high performance pure epoxy adhesive is a two-component (resin and hardener) epoxy-based adhesive, supplied in dual chamber cartridges separating the chemical components, which are combined in a 1:1 ratio by volume when dispensed through the systems static mixing nozzle.

The FLO-ROK® FR6-SD anchoring adhesive is specifically formulated for continuously threaded steel rod and deformed steel reinforcing bar anchoring to resist static, wind or earthquake (Seismic Design Categories A through F) tension and shear loads in cracked and un-cracked, normal-weight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa).

The FLO-ROK® FR6-SD adhesive anchors are designed to be used for floor (vertically down), wall (horizontal) anchoring applications.

FEATURES

- ICC-ES® listed ESR - 3584
- ACI 318 category 1 anchor for cracked or uncracked concrete
- Tested in accordance to AC 308 for long term sustained load at standard and elevated temperature
- High strength pure epoxy adhesive
- Suitable for dynamic and vibration loading
- Seismic resistance
- Close to edge fastening
- Ideal for deep hole applications
- Smooth flowing
- Low odour
- Styrene and VOC free
- Extended working time
- Suitable for water saturated concrete on water filled hole anchoring

TYPICAL APPLICATIONS

- Structural steel base plate anchoring
- Vibratory loading applications
- Rebar doweling
- Safety barriers
- Cranes and lifting equipment
- Racking
- Heavy machinery and robotics installation
- Road and bridge construction
- Parking structure rehabilitation

LISTINING AND APPROVALS

ICC-ES® - ESR 3584

NSF/ANSI Std 61(cerficate for use in potable water)

MTO MI 120

MTQ Approved

LEED® COMPLIANCE

Credit 4.1 - Low Emitting Materials

COMPLIANCE WITH THE FOLLOWING CODES

- 2009, 2006, 2003 International Building Code® (IBC)
- 2009, 2006, 2003 International Residential Code® (IRC)

FLO-ROK FR6-SD INJECTION ADHESIVE ANCHOR

MATERIAL SPECIFICATIONS

CURED EPOXY

Property		Unit	Value	Test Standard
Density		lb/ft^2	106	ASTM D 1875 @ 22˚C/72˚F
		g/cm^3	1.7	
Compressive Strength	24 hrs	psi	8,550	ASTM D 695 @ 22˚C/72˚F
		MPa	59	
	7 days	psi	12,375	
		MPa	85	
Tensile Strength	24hrs	psi	2,610	ASTM D 638 @ 22˚C/72˚F
		MPa	18	
	7 days	psi	3,325	
		MPa	25	
Elongation at Break	24 hrs	%	6.6	ASTM D 638 @ 22˚C/72˚F
	7 days		5.9	
Tensile Modulus	24 hrs	psi	827,000	ASTM D 638 @ 22˚C/72˚F
	7 days	psi	798,000	
Flexural Strength	24 hrs	psi	6,525	ASTM D 790 @ 22˚C/72˚F
		MPa	45	
HDT	7 days	˚F	120	ASTM D 648 @ 22˚C/72˚F
		˚C	49	
Bond Strength	2 days	psi	2,656	ASTM C 882-91
		MPa	18.3	
	14 days	psi	2,736	
		MPa	18.9	
Linear Coefficient of Shrinkage	-	inch	0.0003	ASTM D 2566-86
Water Absorption	-	%	0.08	ASTM D570-98
VOC Content		g/l	4.5	ASTM D2369

ANCHOR RODS

Standard Threaded Rod / Carbon steel	F_u	psi	72,500	ISO 898 Grade 5.8
		MPa	500	
	F_y	psi	58,000	
		MPa	400	
High Strength Threaded Rod/Carbon Steel	F_u	psi	125,000	ASTM A193, Grade B7
		MPa	862	
	F_y	psi	105,000	
		MPa	724	
Stainless Steel Threaded Rod	F_u	psi	100.000	ASTM F 593 (AISI 304/316)
		MPa	689	
	F_y	psi	65,000	
		MPa	448	
Carbon Steel Nuts	-	-	-	ASTM A 563
Stainless Steel Nuts	-	-	-	ASTM F 594
Carbon and Stainless Steel Washers	-	-	-	ASTM B18.22.1 Type A Plain

STRENGTH DESIGN

General: The design strength of anchors must be determined in accordance with ACI 318-11 Appendix D and the ESR- 3584 report.

The strength design of anchors must comply with ACI 318 D.4.1, except as required in ACI 318 D.3.3.

Design parameters, including strength reduction factors, φ, corresponding to each limit state, are provided in Tables 2 through 12. Strength reduction factors, φ, as described in ACI 318 Section D.4.4 must be used for load combinations calculated in accordance with Section 1605.2 of the IBC or Section 9.2 of ACI 318. Strength reduction factors, φ, described in ACI 318 Section D.4.5 must be used for load combinations calculated in accordance with Appendix C of ACI 318.

Interaction of Tensile and Shear Forces: For designs that include combined tension and shear forces, the interaction of the tension and shear loads must be calculated in accordance with ACI 318 Section D.7.

ALLOWABLE STRESS DESIGN (ASD):

General: For anchors designed using load combinations calculated in accordance with IBC Section 1605.3 (Allowable Stress Design), allowable loads must be established using the following relationships:

$T_{allowable,ASD} = \varphi N_n / \alpha$ Eq. (4-2)

$V_{allowable,ASD} = \varphi Vn/\alpha$ Eq. (4-3)

where

$T_{allowable,ASD}$ = Allowable tension load (lbf or kN)
$V_{allowable,ASD}$ = Allowable shear load (lbf or kN)
φN_n = The lowest design strength of an anchor or anchor group in tension as determined in accordance with ACI 318 Appendix D as amended in this report and 2009 IBC Sections 1908.1.9 and 1908.1.10 or 2006 IBC Section 1908.1.16, as applicable.
φV_n = The lowest design strength of an anchor or anchor group in shear as determined in accordance with ACI 318 Appendix D as amended in this report and 2009 IBC Sections 1908.1.9 and 1908.1.10 or 2006 IBC Section 1908.1.16, as applicable.
α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α must include all applicable factors to account for non-ductile failure modes and required over-strength.
Table 11 provides an illustration of calculated Allowable Stress Design (ASD) values for each anchor diameter at minimum embedment depth.
The requirements for member thickness, edge distance and spacing, as described in Table 1, must apply. An example of allowable stress design values for illustrative purposes is shown on page 13.
Interaction of Tensile and Shear Forces: In lieu of ACI Sections D.7.1, D.7.2 and D.7.3, interaction of tension and shear loads must be calculated as follows:
For tension loads $T \leq 0.2\ T_{allowable,ASD}$, the full allowable strength in shear, $V_{allowable,ASD}$, shall be permitted.
For shear loads $V \leq 0.2\ V_{allowable,ASD}$, the full allowable strength in tension, $T_{allowable,ASD}$, shall be permitted.
For all other cases:

$$\frac{T}{T_{allowable,ASD}} + \frac{V}{V_{allowable,ASD}} \leq 1.2 \qquad \text{Eq. (4-4)}$$

LIMIT STATE DESIGN (CSA A23.3-14, ANNEX D)

The design strength of anchors in Limit State Design (Canada) shall comply with CSA A23.3-14, Annex D.
Design parameters are provided in Tables through. Strength Reduction Factors (R) and Material Resistance Factors (Φ) are provided in Table1. The requirements for member thickness edge distance and spacing shown in Table must apply. For designs that include tension and shear forces, the interaction of the loads must be calculated in accordance with CSA A23.3-14, Annex D.

FLO-ROK FR6-SD INJECTION ADHESIVE ANCHOR

IN SERVICE TEMPERATURE RANGE

Short Term : -40°C (-40°F) to +80°C (+176° F) Cat. A / +55°C (+130° F) Cat. B1 / +72°C (+162° F) Cat. B2

Long Term : -40°C (-40°F) to +43°C (+110° F) Cat A;B1 and B2

DESIGN DATA

TABLE1 - RESISTANCE FACTORS FOR LIMIT STATE DESIGN IN ACCORDANCE WITH CSA A23.3-14, ANNEX D[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)						
			3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
			10M	15M	20M	25M	30M		
Concrete material resistance factor (dry concrete)	Φ_c	-	0.65						
Steel material resistance factor	Φ_s	-	0.85						
Strength reduction factor for tension, steel failure modes (carbon steel threaded rod)	R		0.80						
Strength reduction factor for tension, steel failure modes (stainless steel threaded rod and reinforcing bar)	R		0.70						
Strength reduction factor for shear, steel failure modes (carbon steel threaded rod)	R		0.75						
Strength reduction factor for shear, steel failure modes (stainless steel threaded rod and reinforcing bar)	R		0.65						
Strength reduction factor for tension, concrete failure modes	R	Cond. A	1.15						
		Cond. B	1.00						
Strength reduction factor for Shear, concrete failure modes	R	Cond. A	1.15						
		Cond. B	1.00						
Coefficient for factored concrete breakout in tension, cracked concrete	k	-	7						
Modification factor concrete resistance to account uncracked concrete	$\Psi_{c,N}$	-	1.4						

[1]For strength reduction factors in other than dry installation conditions please contact UCAN.

TABLE 2 - FR6 SD ANCHOR SYSTEM INSTALLATION INFORMATION

Characteristic		Symbol	Units	Nominal Anchor Element Diameter						
Fractional Threaded Rod	Size	d_o	inch	3/8	1/2	5/8	3/4	7/8	1	1-1/4
	Drill Size	d_{hole}	inch	1/2	9/16	3/4	7/8	1	1-1/8	1-3/8
Fractional Re-bar	Size	d_o	inch	#3	#4	#5	#6	#7	#8	#10
	Drill Size	d_{hole}	inch	9/16	5/8	3/4	7/8	1	1-1/8	1-3/8
Metric Threaded Rod	Size	d_o	mm	M10	M12	M16	M20	-	M24	M30
	Drill Size	d_{hole}	mm	1	14	18	22	-	26	35
Metric Re-bar(CAN)	Size	M	-	10M	-	15M	20M	-	25M	30M
	Drill Size	d_{hole}	inch	9/16	-	3/4	1	-	1-1/4	1-1/2
Maximum Tightening Torque		T_{inst}	ft lb	15	30	60	100	125	150	200
Embedment Depth Range		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/8	3-3/4	4	4	5
		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15	17-1/2	20	25
Minimum Concrete Thickness		h_{min}	inch	$1.5 \cdot h_{ef}$						
Critical Edge Distance		c_{ac}		ACI 318-11 D.8.6						
				CSA A23.3-14 D6.5.1						
Minimum Edge Distance		c_{min}	inch	1-1/2	1-1/2	1-3/4	1-7/8	2	2	2-1/2
Minimum Anchor Spacing		s_{min}	inch	1-1/2	1-1/2	1-3/4	1-7/8	2	2	2-1/2

Installation:
Installation parameters are provided in Tables 2. Anchor locations must comply with this report and the plans and specifications approved by the building official. Installation of the FR6 SD adhesive anchor system must conform to the manufacturer's published installation instructions (MPII) included in each package unit and as described on page 14-15. Installation of anchors may be vertically down (floor), horizontal (walls) and vertically overhead. Use of nozzle extension tubes and resin stoppers must be in accordance with installation instructions.

TABLE 3 - GEL AND CURING TIME

Substrate Temperature (°C)	Substrate Temperature (°F)	Gel Time	Cure Time
4 to 9	40 to 49	20 mins	24 hours
10 to 15	50 to 59		12 hours
15 to 22	59 to 79	15 mins	8 hours
22 to 25	72 to 77	11 mins	7 hours
25 to 30	77 to 86	8 mins	6 hours
30 to 35	86 to 95	6 mins	5 hours
35 to 40	95 to 104	4 mins	4 hours
40	104	3 mins	3 hours

FLO-ROK FR6-SD INJECTION ADHESIVE ANCHOR

TABLE 4—STEEL DESIGN INFORMATION FOR FRACTIONAL CARBON STEEL AND STAINLESS STEEL THREADED ROD[1,2,3]

	Characteristic	Symbol	Units	Nominal Rod Diameter, d_o						
	Nominal Size	do	inch	3/8	1/2	5/8	3/4	7/8	1	1-1/4
	Stress Area[1]	Ase	in.2	0.0775	0.1419	0.226	0.334	0.462	0.606	0.969
Carbon Steel Threaded Rod	**Reduction Factor for Tension Steel Failure[2]**	φ	-	0.75						
	Strength Reduction Factor for Shear Steel Failure[2]	φ	-	0.65						
	Reduction for Seismic Tension	$\alpha_{N,seis}$	-	1.00						
	Reduction for Seismic Shear	$\alpha_{V,seis}$	-	0.58	0.57	0.57	0.57	0.42	0.42	0.42
	Tension Resistance of Carbon Steel ISO 898-1 Class 5.8	Nsa	lb (kN)	5,620 (25.0)	10,290 (45.8)	16,385 (72.9)	24,250 (107.9)	33.475 (148.9)	43,910 (195.3)	70,260 (312.5)
	Tension Resistance of Carbon Steel ASTM A193 B7	Nsa	lb (kN)	9,690 (43.1)	17,740 (78.9)	28,250 (125.7)	41,750 (185.7)	57,750 (256.9)	75,750 (337.0)	121,125 (538.8)
	Shear Resistance of Carbon Steel ISO 898-1 Class 5.8	Vsa	lb (kN)	2,810 (12.5)	6,175 (27.5)	9,830 (43.7)	14,550 (64.7)	20,085 (89.3)	26,345 (117.2)	42,155 (187.5)
	Shear Resistance of Carbon Steel ASTM A193 B7	Vsa	lb (kN)	4,845 (21.6)	10,645 (47.4)	16,950 (75.4)	25,050 (111.4)	34,650 (154.1)	45,450 (202.2)	72,675 (323.3)
Stainless Steel Threaded Rod	**Strength Reduction Factor for Tension Steel Failure[2]**	φ	-	0.65						
	Strength Reduction Factor for Shear Steel Failure[2]	φ	-	0.60						
	Reduction for Seismic Tension	$\alpha_{N,seis}$	-	1.00						
	Reduction for Seismic Shear	$\alpha_{V,seis}$	-	0.51	0.50	0.49	049	0.43	0.43	0.43
	Tension Resistance of Stainless Steel ASTM F593 CW1	Nsa	lb (kN)	7,750 (34.5)	14,190 (63.1)	22,600 (100.5)	--	--	--	--
	Tension Resistance of Stainless Steel ASTM F593 CW2	Nsa	lb (kN)	--	--	--	28,390 (126.3)	39,270 (174.7)	51,510 (229.1)	82,365 (366.4)
	Tension Resistance of Stainless Steel ASTM F593 SH1	Nsa	lb (kN)	8,915 (39.7)	16,320 (72.6)	25,990 (115.6)	--	--	--	--
	Tension Resistance of Stainless Steel ASTM F593 SH2	Nsa	lb (kN)	--	--	--	35,070 (156.0)	48,510 (215.8)	63,630 (283.0	--
	Tension Resistance of Stainless Steel ASTM F593 SH3	Nsa	lb (kN)	--	--	--	--	--	--	92,055 (409.5)
	Shear Resistance of Stainless Steel ASTM F593 CW1	Vsa	lb (kN)	3,875 (17.2)	7,095 (31.6)	11,300 (50.3)	--	--	--	--
	Shear Resistance of Stainless Steel ASTM F593 CW2	Vsa	lb (kN)	--	--	--	14,195 (63.1)	19,635 (87.3)	25,755 (114.6)	41,185 (183.2)
	Shear Resistance of Stainless Steel ASTM F593 SH1	Vsa	lb (kN)	4,455 (19.8)	9,790 (43.5)	15,595 (69.4)	--	--	--	--
	Shear Resistance of Stainless Steel ASTM F593 SH2	Vsa	lb (kN)	--	--	--	17,535 (78.0)	24,255 (107.9)	31,815 (141.5)	--
	Shear Resistance of Stainless Steel ASTM F593 SH3	Vsa	lb (kN)	--	--	--	--	--	--	46,030 (204.8)

For **SI**: 1 inch = 25.4 mm, 1 in.2 = 645.16 mm2, 1 lb = 0.004448 kN

[1]Values provided for steel threaded rod are based on minimum specified strengths and calculated in accordance with ACI 318 Eq. (D-3) and Eq. (D-20).

[2]The tabulated value of φ applies when the load combinations of Section 1605.2 of the IBC, or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.4. If the load combinations of ACI 318 Appendix C are used, the appropriate value of φ must be determined in accordance with ACI 318 D.4.5.

[3]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (Ø) and resistance modification factors (R) in Table 1 shall be used.

TABLE 5—STEEL DESIGN INFORMATION FOR FRACTIONAL STEEL REINFORCING BAR[1,2,3]

	Characteristic	Symbol	Units	Nominal Reinforcing Bar size, d_o						
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
Reinforcing bar	Nominal bar diameter	d_o	inch	0.375	0.500	0.625	0.750	0.875	1.000	1.250
	Stress Area	A_{se}	in.^{2}	0.11	0.20	0.31	0.44	0.60	0.79	1.27
	Strength Reduction Factor for Tension, Steel Failure	Ø		0.65						
	Strength Reduction for Shear Steel Failure	Ø		0.65						
	Reduction for Seismic Tension	$\alpha_{N,seis}$	-	1.00						
	Reduction for Seismic Shear	$\alpha_{N,seis}$	-	0.70	0.70	0.82	0.82	0.42	0.42	0.42
	Tension Resistance of Carbon Steel ASTM A615 Grade 40	N_{sa}	lb (kN)	6,600 (29.4)	12,000 (53.4)	18,600 (82.7)	26,400 (117.4)	36,000 (160.1)	47,400 (210.8)	76,200 (339.0)
	Tension Resistance of Carbon Steel ASTM A615 Grade 60	N_{sa}	lb (kN)	9,900 (44.0)	18,000 (80.1)	27,900 (124.1)	39,600 (176.1)	54,000 (240.2)	71,100 (316.3)	114,300 (508.4)
	Tension Resistance of Carbon Steel ASTM A615 Grade 40	V_{sa}	lb (kN)	3,960 (17.6)	7,200 (32.0)	11,160 (49.6)	15,840 (70.5)	21,600 (96.1)	28,440 (126.5)	45,720 (203.4)
	Tension Resistance of Carbon Steel ASTM A615 Grade 60	V_{sa}	lb (kN)	5,940 (26.4)	10,800 (48.0)	16,740 (74.5)	23,760 (105.7)	32,400 (144.1)	42,660 (189.8)	68,580 (305.1)

TABLE 6—STEEL DESIGN INFORMATION FOR CANADIAN METRIC REINFORCING BAR[1,2,3]

	Characteristic	Symbol	Units	Reinforcing Bar Size				
				10M	15M	20M	25M	30M
Reinforcing bar	Nominal bar diameter	d_o	mm	11.3	16	19.5	25.2	29.9
	Stress Area	A_{se}	mm.^{2}	100	200	300	500	700
	Strength Reduction Factor for Tension, Steel Failure	Ø				0.65		
	Strength Reduction for Shear Steel Failure	Ø				0.65		
	Reduction for Seismic Tension	$\alpha_{N,seis}$	-	1.00				
	Reduction for Seismic Shear	$\alpha_{V,seis}$	-	0.70	0.82	0.82	0.42	0.42
	Tension Resistance of Carbon Steel CSA G 30.18 Grade 500	N_{sa}	lb (kN)	12,140 (54)	24,279 (108)	36,419 (162)	60,699 (270)	84,978 (378)
	Tension Resistance of Carbon Steel CSA G 30.18 Grade 500	N_{sa}	lb (kN)	15,175 (67.5)	30,349 (135)	45,524 (202.5)	75,873 (337.5)	106,223 (472.5)
	Shear Resistance of Carbon Steel CSA G30.18 Grade 400	V_{sa}	lb (kN)	7,284 (32.4)	14,568 (64.8)	21,872 (97.2)	36,419 (162)	50,978 (226,8)
	Shear Resistance of Carbon Steel CSA G30.18 Grade 500	V_{sa}	lb (kN)	16,403 (40.5)	32,805 (81)	49,208 (121.5)	82,013 (202.5)	114,818 (283.5)

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Values provided for steel threaded rod are based on minimum specified strengths and calculated in accordance with ACI 318 Eq. (D-3) and Eq. (D-20).

[2]The tabulated value of φ applies when the load combinations of Section 1605.2 of the IBC, or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.4. If the load combinations of ACI 318 Appendix C are used, the appropriate value of φ must be determined in accordance with ACI 318 D.4.5.

[3]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (Ø) and resistance modification factors (R) in Table1 shall be used.

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TABLE 7—FRACTIONAL THREADED ROD AND REINFORCING BAR CONCRETE BREAKOUT STRENGTH DESIGN INFORMATION[1,2]

Characteristic		Symbol	Units	Nominal Anchor Element Diameter						
US Threaded Rod	Size	d_o	inch	3/8	1/2	5/8	3/4	7/8	1	1-1/4
	Drill Size	d_{hole}	inch	1/2	9/16	3/4	7/8	1	1-1/8	1-3/8
US Re-bar	Size	d_o	inch	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
	Drill Size	d_{hole}	inch	9/16	5/8	3/4	7/8	1	1-1/8	1-3/8
Embedment Depth Range		$h_{ef,min}$	inch	2-3/8	2-3/4	3-1/8	3-3/4	4	4	5
		$h_{ef,max}$	inch	7-1/2	10	12-1/2	15	17-1/2	20	25
Minimum Anchor Spacing		s_{min}	inch	1-1/2	1-1/2	1-3/4	1-7/8	2	2	2-1/2
Minimum Edge Distance		c_{min}	inch	inch	1-1/2	1-1/2	1-3/4	1-7/8	2	2-1/2
Minimum Concrete Thickness		h_{min}	inch	$1.5 \cdot h_{ef}$						
Critical Edge Distance		c_{ac}		ACI 318-11 d.8.6						
				CSA A23.3-14 D6.5.1						
Effectiveness Factor for Uncracked Concrete, Breakout		$k_{c,uncr}$	-- (SI)	24 (10)						
Effectiveness Factor for Cracked Concrete, Breakout		$k_{c,cr}$	-- (SI)	17 (7.1)						
$k_{c,uncr} / k_{c,cr}$		–	--	1.41						
Strength Reduction Factor for Tension, Concrete Failure Modes, Condition B[1]		Ø	--	0.65						
Strength Reduction Factor for Shear, Concrete Failure Modes, Condition B[1]		Ø	--	0.70						

TABLE 8—CANADIAN METRIC REINFORCING BAR CONCRETE BREAKOUT STRENGTH DESIGN INFORMATION[1,2]

Characteristic	Symbol	Units	Bar size				
			10M	**15 M**	**20M**	**25M**	**30M**
Embedment Depth Range	$h_{ef,min}$	inch	2-3/8	3-1/8	3-1/2	4	5
	$h_{ef,max}$	inch	7-1/2	12-1/2	15	20	25
Minimum Anchor Spacing	s_{min}	inch	1-1/2	1-3/4	1-7/8	2	2-1/2
Minimum Edge Distance	c_{min}	inch	1-1/2	1-3/4	1-7/8	2	2-1/2
Minimum Concrete Thickness	h_{min}	inch	$1.5 \cdot h_{ef}$				
Critical Edge Distance	c_{ac}	mm	CSA A23.3-14, Annex D				
Effectiveness Factor for Uncracked Concrete, Breakout	$k_{c,uncr}$	-- (SI)	24 (10)				
Effectiveness Factor for Cracked Concrete, Breakout	$k_{c,cr}$	-- (SI)	17 (7.1)				
$k_{c,uncr} / k_{c,cr}$	–	--	1.41				
Strength Reduction Factor for Tension, Concrete Failure Modes, Condition B[1]	Ø	--	0.65				
Strength Reduction Factor for Shear, Concrete Failure Modes, Condition B[1]	Ø	--	0.70				

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN
[1]Condition B applies where supplemental reinforcement is not provided as set forth in ACI 318 D.4.4.
The tabulated value of ø applies when the load combinations of Section 1605.2 of the IBC, or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.4. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ø must be determined in accordance with ACI 318 D.4.5.
For limit state design as per CSA A23.3-14, Annex D, material resistance factors (Ø) and resistance modification factors (R) in Table 1 shall be used.

TABLE 9—FRACTIONAL THREADED ROD BOND STRENGTH DESIGN INFORMATION[1,9]

Design Information		Symbol	Units	Nominal Threaded Rod Diameter						
				3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
Minimum Effective Installation Depth		$h_{ef,min}$	in.	2-3/8	2-3/4	3-1/8	3-1/2	4	4	5
			mm	60	70	79	89	102	102	127
Maximum Effective Installation Depth		$h_{ef,max}$	in.	7-1/2	10	12-1/2	15	17-1/2	20	25
			mm	191	254	318	381	445	508	635
Temperature Category A[2,5]	Characteristic Bond Strength in Non-cracked Concrete	$t_{k,uncr}$	psi	725						
			N/mm²	5.0						
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	620	585	550	520	485	450	385
			N/mm²	4.3	4.0	3.8	3.6	3.3	3.1	2.7
Temperature Category B, Range 1[3,5]	Characteristic Bond Strength in Non-cracked Concrete	$t_{k,uncr}$	psi	1,350						
			N/mm²	9.3						
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	1,150	1,090	1,025	965	900	840	715
			N/mm²	7.9	7.5	7.0	6.7	6.2	5.8	4.9
Temperature Category B, Range 2[4,5]	Characteristic Bond Strength in Non-cracked Concrete	$t_{k,uncr}$	psi	1,350						
			N/mm²	7.1						
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	875	830	780	735	685	640	545
			N/mm²	6.1	5.7	5.4	5.1	4.7	4.4	3.8
Anchor Category, Dry Concrete		-	-	1	1	1	1	1	1	1
Strength Reduction factor[6,8]		$Ø_d$	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Bond strength values correspond to concrete compressive strength f'_c = 2,500 psi. Bond strength values must not be increased for increased concrete compressive strength.

[2]Temperature Category A: Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 176°F (80°C)

[3]Temperature Category B, Range 1 = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 130°F (55°C)

[4]Temperature Category B, Range 2 = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 162°F (72°C)

[5]Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

[6]The tabulated value of ø applies when the load combinations of Section 1605.2 of the IBC, or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ø must be determined in accordance with ACI 318 D.4.4.

[7]For sustained loads, bond strengths must multiplied by 0.73.

[8]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (Ø) and resistance modification factors (R) in Table 1 shall be used.

[9]Tabulated values are for dry concrete installation with periodic special inspection only. For other installation conditions, please see ICC-ES ESR - 3584.

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TABLE 10 - FRACTIONAL REINFORCING BAR BOND STRENGTH DESIGN INFORMATION[1,9]

Design Information		Symbol	Units	Nominal Reinforcing Bar Diameter						
				No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 10
Minimum Effective Installation Depth		$h_{ef,min}$	in.	2-3/8	2-3/4	3-1/8	3-1/2	4	4	5
			mm	60	70	79	89	102	102	127
Maximum Effective Installation Depth		$h_{ef,max}$	in.	7-1/2	10	12-1/2	15	17-1/2	20	25
			mm	191	254	318	381	445	508	635
Temperature Category A[2,5]	**Characteristic Bond Strength in Non-cracked Concrete**	$t_{k,uncr}$	psi	725						
			N/mm²	5.0						
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	620	585	550	520	485	450	385
			N/mm²	4.3	4.0	3.8	3.6	3.3	3.1	2.7
Temperature Category B, Range 1[3,5]	**Characteristic Bond Strength in Non-cracked Concrete**	$t_{k,uncr}$	psi	1,350						
			N/mm²	9.3						
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	1,150	1,090	1,025	965	900	840	715
			N/mm²	7.9	7.5	7.0	6.7	6.2	5.8	4.9
Temperature Category B, Range 2[4,5]	**Characteristic Bond Strength in Non-cracked Concrete**	$t_{k,uncr}$	psi	1,350						
			N/mm²	7.1						
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	875	830	780	735	685	640	545
			N/mm²	6.1	5.7	5.4	5.1	4.7	4.4	3.8
Anchor Category, Dry Concrete		-	-	1	1	1	1	1	1	1
Strength Reduction factor[6,8]		$Ø_d$	-	0.65	0.65	0.65	0.65	0.65	0.65	0.65

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Bond strength values correspond to concrete compressive strength f'_c = 2,500 psi. Bond strength values must not be increased for increased concrete compressive strength.

[2]Temperature Category A: Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 176°F (80°C)

[3]Temperature Category B, Range 1 = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 130°F (55°C)

[4]Temperature Category B, Range 2 = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 162°F (72°C)

[5]Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

[6]The tabulated value of ø applies when the load combinations of Section 1605.2 of the IBC, or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ø must be determined in accordance with ACI 318 D.4.4.

[7]For sustained loads, bond strengths must multiplied by 0.73.

[8]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (Ø) and resistance modification factors (R) in Table 1 shall be used.

[9]Tabulated values are for dry concrete installation with periodic special inspection only. For other installation conditions, please see ICC-ES ESR - 3584.

TABLE 11 - CANDIAN METRIC REINFORCING BAR BOND STRENGTH DESIGN INFORMATION[1,9]

Design Information		Symbol	Units	Reinforcing Bar Size				
				10M	15M	20M	25M	30M
Minimum Effective Installation Depth		$h_{ef,min}$	in.	2-3/8	3-1/8	3-1/8	4	5
			mm	60	79	89	102	127
Maximum Effective Installation Depth		$h_{ef,max}$	in.	7-1/2	12-1/2	15	20	25
			mm	191	318	381	508	635
Temperature Category A[2,5]	**Characteristic Bond Strength in Non-cracked Concrete**	$t_{k,uncr}$	psi	725				
			N/mm^2	5.0				
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	615	550	520	450	385
			N/mm^2	4.2	3.8	3.6	3.1	2.7
Temperature Category B, Range 1[3,5]	**Characteristic Bond Strength in Non-cracked Concrete**	$t_{k,uncr}$	psi	1,350				
			N/mm^2	9.3				
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	1,150	1,025	965	840	715
			N/mm^2	7.9	7.0	6.7	5.8	4.9
Temperature Category B, Range 2[4,5]	**Characteristic Bond Strength in Non-cracked Concrete**	$t_{k,uncr}$	psi	1,030				
			N/mm^2	7.1				
	Characteristic Bond Strength in Cracked Concrete	$t_{k,cr}$	psi	875	780	735	640	545
			N/mm^2	6.1	5.4	5.1	4.4	3.8
Anchor Category, Dry Concrete		-	-	1	1	1	1	1
Strength Reduction factor[6,8]		$Ø_d$	-	0.65	0.65	0.65	0.65	0.65

For **SI**: 1 inch = 25.4 mm, 1 in.^{2} = 645.16 mm^2, 1 lb = 0.004448 kN

[1]Bond strength values correspond to concrete compressive strength f'_c = 2,500 psi. Bond strength values must not be increased for increased concrete compressive strength.

[2]Temperature Category A: Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 176°F (80°C)

[3]Temperature Category B, Range 1 = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 130°F (55°C)

[4]Temperature Category B, Range 2 = Maximum Long Term Temperature: 110°F (43°C); Maximum Short Term Temperature: 162°F (72°C)

[5]Short-term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long-term concrete temperatures are roughly constant over significant periods of time.

[6]The tabulated value of ø applies when the load combinations of Section 1605.2 of the IBC, or ACI 318 Section 9.2 are used in accordance with ACI 318 D.4.3. If the load combinations of ACI 318 Appendix C are used, the appropriate value of ø must be determined in accordance with ACI 318 D.4.4.

[7]For sustained loads, bond strengths must multiplied by 0.73.

[8]For limit state design as per CSA A23.3-14, Annex D, material resistance factors (Ø) and resistance modification factors (R) in Table 1 shall be used.

[9]Tabulated values are for dry concrete installation with periodic special inspection only. For other installation conditions, please see ICC-ES ESR - 3584.

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TABLE 12—EXAMPLE OF ALOWABLE STRESS DESIGN (ASD) TENSION VALUES FOR ILLUSTRATIVE PURPOSES

Calculated Allowable Tension Load for Illustrative Purposes				
Anchor Diameter (in.)	**Embedment Depth Max / Min (in.)**	**Characteristic Bond Strength $\tau_{k,uncr}$ (psi)**	**Alowable Tension Load (lb) 2,500 psi Concrete**	**Controlling Failure Mode**
3/8"	2.375	1,350	1,658	Bond Strength
	7.500	1,350	5,239	Bond Strength
1/2"	2.750	1,350	2,403	Breakout Strength
	10.00	1,350	9,313	Bond Strength
5/8"	3.125	1,350	2,911	Breakout Strength
	12.50	1,350	14,552	Bond Strength
3/4"	3.50	1,350	3,451	Breakout Strength
	15.00	1,350	20,955	Bond Strength
7/8"	4.000	1,350	4,216	Breakout Strength
	17.50	1,350	24,448	Bond Strength
1"	4.000	1,350	4,216	Breakout Strength
	20.00	1,350	37,253	Bond Strength
1-1/4"	4.000	1,350	4,216	Breakout Strength
	25.00	1,350	58,208	Bond Strength

Design Assumptions:

1. Single anchor in static tension only, Grade B7 threaded rod.
2. Vertical downwards installation.
3. Inspection regimen = Periodic.
4. Installation temperature category B1
5. Dry condition (carbide drilled hole).
6. Embedment (h_{ef}) = min / max for each diameter.
7. Concrete determined to remain uncracked for life of anchor.
8. Load combinations from ACI 318 Section 9.2 (no seismic loading).
9. 30% dead load and 70% live load. Controlling load combination 1.2D + 1.6L
10. Calculation of weighted average for $\alpha = 1.2(0.3) + 1.6(0.7) = 1.48$
11. f'_c = 2,500 psi (normal weight concrete)
12. $c_{ac1} = c_{ac2} \geq c_{ac}$
13. $h \geq h_{min}$

ILLUSTRATIVE PROCEDURE TO CALCULATE ALLOWABLE STRESS DESIGN TENSION VALUE

Anchor 1/2" Diameter, using an enbedment of 2.75", with the design assumptions given in table 12

Procedure		Calculation
Step 1:	Calculate steel strength of a single anchor in tension per ACI 318 D 5. 1. 2 Table 2 of this report.	$\varphi N_{sa} = \varphi N_{sa}$ $= 0.65 \times 17740$ **= 13305**
Step 2:	Calculate breakout strength of a single anchor in tension per ACI 318 D 5. 2 Table 5 of this report	$N_b = k_{c,uncr} \sqrt{(f'c)}\ h_{ef}^{1.5}$ $= 24 \times (2500)\ 0.5 \times 2.75\ 1.5$ $= 5472$ $\varphi N_{cb} = (A_{nc} / A_{nco})\ \Psi_{ed,N}\Psi_{c,N}\ \Psi_{cp,N}N_b$ $= 0.65 \times 1 \times 1 \times 1 \times 1 \times 5472$ **= 3557**
Step 3:	Calculate bond strength of a single anchor in tension per Eq D-16a and Table 7 of this report.	$N_{ao} = \tau_{k,uncr}\pi\ dh_{ef}$ $= 1350 \times 3.141 \times 0.5 \times 2.75$ $= 5830$ $\varphi N_{ao} = (A_{na} / A_{na0})\ \Psi_{ed,Na}\Psi_{c,Na}N_{ao}$ $= 0.65 \times 5830$ **= 3790**
Step 4:	Determine controlling resistance strength in tension per ACI 318 D 4. 1. 1. and D 4. 1. 2.	**3557** lbs = controlling resistance (concrete breakout)
Step 5:	Calculate Allowable Stress Design conversion factor for loading condition per ACI 318 Section 9. 2.	$\alpha = 1.2DL + 1.6LL$ $= 1.2*0.3 + 1.6*0.7$ **= 1.48**
Step 6:	Calculate Allowable Stress Design value per Section 4. 2 of this report.	$T_{allowable,ASD} = 3557 / 1.48$ **= 2403 lbs**

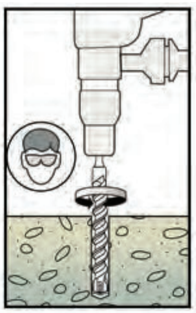
FLO-ROK FR6-SD INJECTION ADHESIVE ANCHOR

UCAN FLO-ROK® FR6-SD INSTALLATION DETAILS

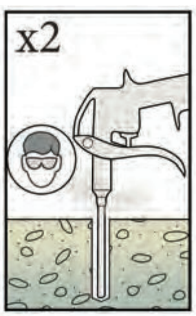
Before beginning installation ensure the worker is equipped with appropriate personal protection equipment, rotary hammer drill, compressed air nozzle, hole cleaning brush, good quality dispensing tool – either manual or power operated, chemical cartridge with mixing nozzle and extension tube, if needed. Refer to technical data "Installation information" (table 1) for parts specication or guidance for indiidual items or dimensions.

Important: check the expiration date on the cartridge (do not use expired material) and that the cartridge has been stored in its original packaging, port up, in cool conditions (10°C to 25°C) out of direct sunlight.

Hole Preparation

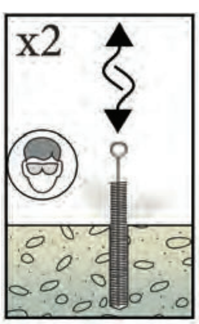


1. Drill the hole to the specied hole diameter and depth using rotary hammer drill in hammer "ON" mode with a UCAN carbide tipped drill bit, conforming to ANSI B212.15-1994 of the appropriate size.



2. Select the correct compressed air nozzle, insert to the bottom of the hole and pull the trigger for 2 seconds. The compressed air must be clean – free from water and oil – and at a minimum pressure of 90psi (6bar).

Perform the blowing operation twice.



3. Select the correct size hole cleaning brush. Ensure that the brush is in good condition and the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom of the hole and withdraw with a twisting motion. There should be positie interaction between the steel bristles of the brush and the sides of the drilled hole.

Perform the brushing operation twice.

4. Repeat 2
5. Repeat3
6. Repeat 2

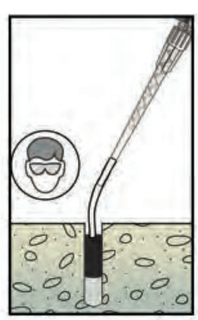
Injection Cartridge preparation

7. Select the appropriate static mixer nozzle, checking that the mixing elements are present and correct (do not modify the mixer). Remoe port closure and attach mixer nozzle to the cartridge. Check the dispensing tool is in good working order. Place the cartridge into the dispensing tool.

Note: FR6 SD may only be installed in base material that is between the temperatures of 5°C and 40°C. The product must be conditioned to a minimum of 10°C. For gel and cure time data, refer to products label or UCAN's Technical Manual (Table 2)

8. Dispense a small amount of resin to waste until an even-colored mixture is extruded. The cartridge is now ready for use.

Floor and Wall Anchoring

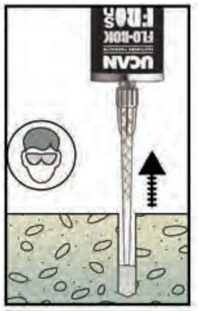


9. **Deep hole (10" & over)**
As specied in "Installation Parameters" (Refer to UCAN Technical Manual), attach an extension tube with resin stopper to the end of the mixing nozzle with a push fit. (The extension tubes may be pushed into the resin stoppers and are held in place with a coarse internal thread).

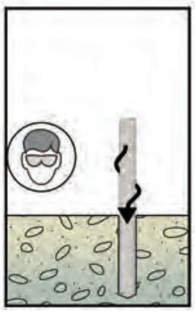
Note: The PAM 6HF nozzle is supplied in two sections. One section contains the mixing elements and the other section is an extension piece. Connect the two sections by pushing them firmly together until a positie engagement is felt.

FLO-ROK F6-SD INJECTION ADHESIVE ANCHOR

Floor and Wall Anchoring - Continued

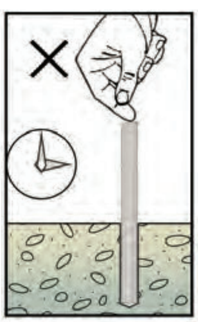


10. Insert the mixing nozzle or extension tube with resin stopper (see figure 9) to the bottom of the hole. Dispense the resin and slowly withdraw the nozzle from the hole. Ensure no air voids are created as the nozzle is withdrawn. Inject resin until the hole is approximately 1/2 - 2/3 full and remove the nozzle from the hole.

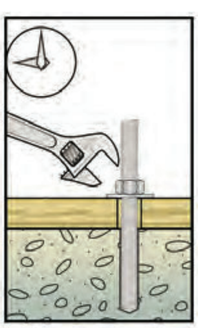


11. Select the threaded rod or rebar ensuring it is free from oil or other contaminants, and mark with the required embedment depth. Insert the threaded rod or rebar into the hole using a back and forth twisting motion to ensure complete cover, until it reaches the bottom of the hole. Excess resin will be pushed out from the hole evenly around the threaded rod or rebar and there shall be no air gaps between the threaded rod or rebar and the wall of the drilled hole.

12. Clean any excess resin from around the mouth of the hole.



13. Do not disturb the anchor until at least the minimum cure time has elapsed. Refer to the Working and Load Timetable (UCAN Technical Manual) to determine the appropriate cure time.



14. Position the fixture and tighten the anchor to the appropriate installation torque.

Do not over-torque the anchor as this could adversely affect its performance.

FLO-ROK FR6-SD INJECTION ADHESIVE ANCHOR

CHEMICAL RESISTANCE

The chemical mortar has undergone extensive chemical resistance testing. The results are summarised in the table below.

Chemical Environment	Concentration	Result
Aqueous Solution Acetic Acid	10%	C
Acetone	100%	✗
Aqueous Solution Aluminium Chloride	Saturated	✓
Aqueous Solution Aluminium Nitrate	10%	✓
Ammonia Solution	5%	✓
Jet Fuel	100%	C
Benzene	100%	C
Benzoic Acid	Saturated	✓
Benzyl Alcohol	100%	✗
Sodium Hypochlorite Solution	5 - 15%	✓
Butyl Alcohol	100%	C
Calcium Sulphate Aqueous Solution	Saturated	✓
Carbon Monoxide	Gas	✓
Carbon Tetrachloride	100%	C
Chlorine Water	Saturated	✗
Chloro Benzene	100%	✗
Citric Acid Aqueous Solution	Saturated	✓
Cyclohexanol	100%	✓
Diesel Fuel	100%	C
Diethylene Glycol	100%	✓
Ethanol	95%	✗
Ethanol Aqueous Solution	20%	C
Heptane	100%	C

Chemical Environment	Concentration	Result
Hexane	100%	C
Hydrochloric Acid	10%	✓
	15%	✓
	25%	C
Hydrogen Sulphide Gas	100%	✓
Isoproyl Alcohol	100%	✗
Linseed Oil	100%	✓
Lubricating Oil	100%	✓
Mineral Oil	100%	✓
Paraffin / Kerosene (Domestic)	100%	C
Phenol Aqueous Solution	1%	C
Phosphoric Acid	50%	✓
Potassium Hydroxide	10% / pH13	✓
Sea Water	100%	C
Styrene	100%	C
Sulphur Dioxide Solution	10%	✓
Sulphur Dioxide (40°C)	5%	✓
Sulphuric Acid	10%	✓
	50%	✓
Turpentine	100%	C
White Spirit	100%	✓
Xylene	100%	C

✓ = Resistant to 75°C with at least 80% of physical properties retained.
C = Contact only to a maximun of 25°C.
✗ = Not Resistant.

EPOXY USAGE ESTIMATING TABLE

Holes per FR6-20 SD

Rod dia.	Hole dia.	Embedment (inch) 1	2	3	4	5	6	7	8	9	10	15	20
3/8	7/16	399.4	199.7	133.1	99.8	79.9	66.6	57.1	49.9	44.4	39.9	26.6	20.0
	1/2	256.4	128.2	85.5	64.1	51.3	42.7	36.6	32.1	28.5	25.6	17.1	12.8
1/2	5/8	185.5	92.8	61.8	46.4	37.1	30.9	26.5	23.2	20.6	18.6	12.4	9.3
5/8	3/4	144.4	72.2	48.1	36.1	28.9	24.1	20.6	18.0	16.0	14.4	9.6	7.2
3/4	7/8	119.4	59.7	39.8	29.9	23.9	19.6	17.1	14.9	13.3	11.9	8.0	6.0
7/8	1	97.5	48.8	32.5	24.4	19.5	16.3	13.9	12.2	10.8	9.8	6.5	4.9
1	1-1/8	80.2	40.1	26.7	20.1	16.0	13.4	11.5	10.0	8.9	8.0	5.3	4.0
1-1/4	1-3/8	62.1	31.1	20.7	15.5	12.4	10.4	8.9	7.8	6.9	6.2	4.1	3.1
	1-1/2	40.8	20.4	13.6	10.2	8.2	6.8	5.8	5.1	4.5	4.1	2.7	2.0

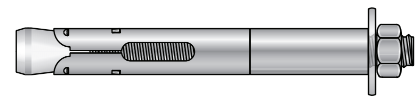
Rebar size	Hole dia.	Embedment (inch) 1	2	3	4	5	6	7	8	9	10	15	20
10M	9/16	290.5	145.3	96.8	72.6	58.1	48.4	41.5	36.3	32.3	29.1	19.4	14.5
15M	3/4	199.1	99.6	66.4	48.8	39.8	33.2	28.4	24.9	22.1	19.9	13.3	10.0
20M	61/64	128.9	64.5	43.0	32.2	25.8	21.5	18.4	16.1	14.3	12.9	8.6	6.4
25M	1-1/4	62.8	31.4	20.9	15.7	12.6	10.5	9.0	7.9	7.0	6.3	4.2	3.1
30M	1-1/2	43.6	21.8	14.5	10.9	8.7	7.3	6.2	5.4	4.8	4.4	2.9	2.2
35M	1-3/4	35.9	17.9	12.0	9.0	7.2	6.0	5.1	4.5	4.0	3.6	2.4	1.8

Epoxy usage contains no waste and is based on the following usable cartridge volume: 20.3 oz. (600 ml)
For correct expoxy usage use, add 20% installation waste (multiply the tabulated number by 0.8)

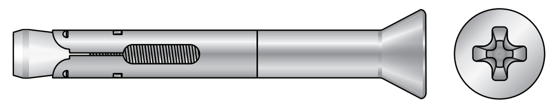
SLEEVE ANCHOR

DESCRIPTION

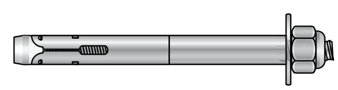
The UCAN sleeve anchor is a light-medium duty anchor ideal for applications in concrete, hollow block and brick. It is a mechanical expansion anchor assembled with an expansion sleeve, spacer, nut and washer. It is also available with flat head and hex bolt head types.



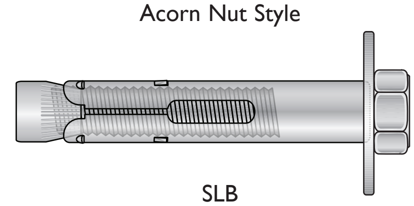
SLE/SLS
Hex Nut Style



SLF - Phillips
Flat Head Style



SLE
Acorn Nut Style



SLB
Hex Bolt (6.8) Style

FEATURES

- Through fastening
- Anchor size is same as drill bit size
- Greater expansion than other types of anchors
- Suitable for hollow materials
- Long expansion sleeve
  (less concentration of stress on masonry)

LIMITATIONS

- Not recommended for uncured concrete (less than 7 days old), lightweight concrete, masonry block or brick

TYPICAL APPLICATIONS

- Fastening into block and brick
- Shelving and racking
- Window and door frames
- Sill plates
- Cable trays

MATERIAL SPECIFICATIONS

Anchor Component	Material Standard	Mechanical Properties	
		F_y	F_u
Carbon steel anchor body	AISI C 1008-C1010	248.2 MPa (36 ksi)	413.7 MPa (60 ksi)
Carbon steel spacer and expansion sleeves	cold rolled steel		
Stainless steel (304) anchor body, spacer and expansion sleeves	AISI grade 304	241.3 MPa (35 ksi)	586.1 MPa (85 ksi)
Corrosion protection (carbon steel anchors)	ASTM B633 - 98e1	0.0002" (5 micron) electrodeposited	

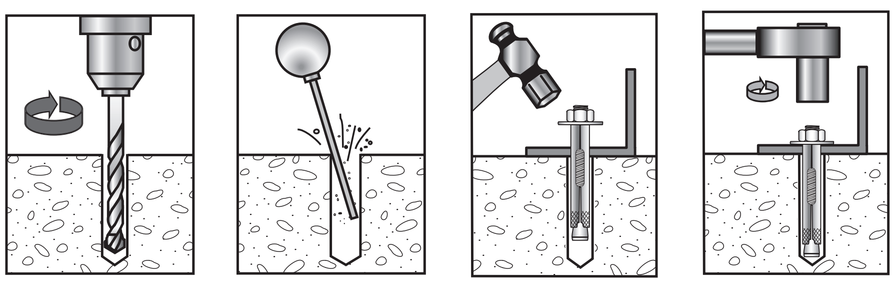
SLEEVE ANCHOR

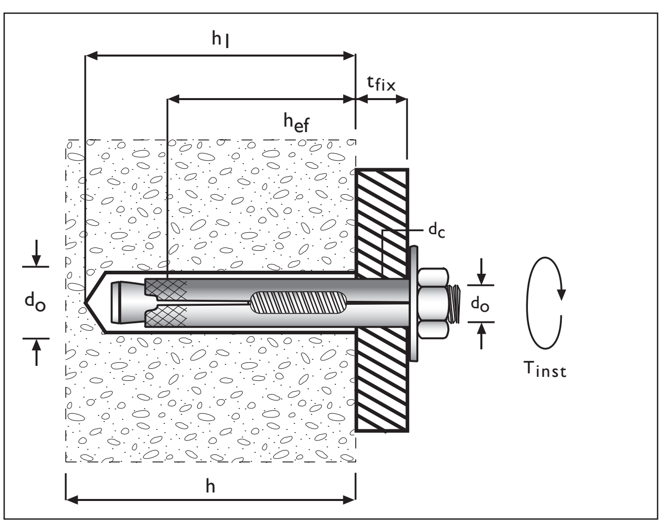
INSTALLATION

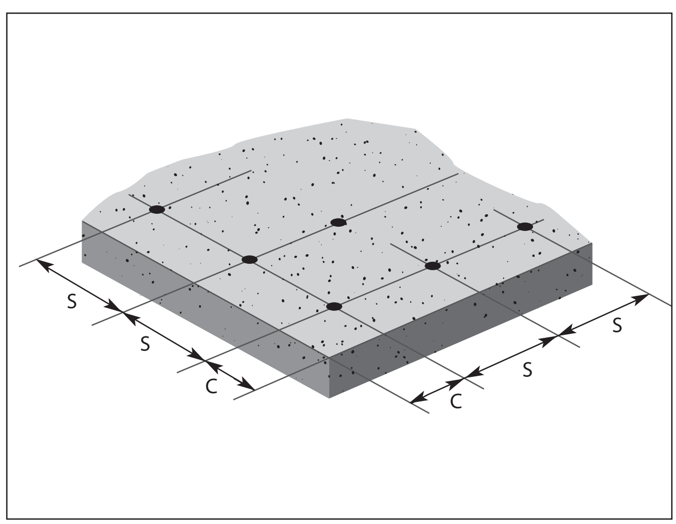
SLEEVE ANCHOR SETTING DETAILS

Details	Anchor size					
	1/4	5/16	3/8	1/2	5/8	3/4
Anchor size / Drill bit / hole nominal diameter d_o (in)	1/4	5/16	3/8	1/2	5/8	3/4
Internal thread dia. d_a (in)	3/16	1/4	5/16	3/8	1/2	5/8
Clearance hole dia. d_c (in)	5/16	3/8	7/16	9/16	11/16	13/16
Effective embedment / hole depth h_{ef} / h_1 (in)	1-1/8	1-7/16	1-1/2	2-1/4	2-3/4	3-3/8
Required anchor spacing for 100% performance s (in)	2-1/2	3	3-3/4	5	6-1/4	7-1/2
Minimum anchor spacing s_{min}	1-1/4	1-1/2	1-7/8	2-1/2	3-1/8	3-3/4
Required edge distance for 100% performance c (in)	1-1/4	1-1/2	1-3/4	2-1/4	3-1/8	3-3/4
Minimum edge distance c_{min}	5/8	3/4	1	1-1/4	1-1/2	1-7/8
Minimum base material thickness h (in)	3	3	3	4	4-1/2	5
Max. installation torque T_{inst} (ft x lbf)	3	5	12	20	50	85

Note: Carbide tipped drill bits shall conform to ANSI B 212.15







DESIGN DATA

AVERAGE ULTIMATE LOADS
Normal weight stone aggregate concrete

Anchor Size	Embedment	2000 psi (14.0 MPa)				4000 psi (27.6 MPa)			
		Tension		Shear		Tension		Shear	
in	inch (mm)	lbf	kN	lbf	kN	lbf	kN	lbf	kN
1/4	1-1/8 (28)	959	4.3	1,428	6.4	1,342	6.0	1,428	6.4
5/16	1-7/16 (36)	1,248	5.6	2,169	9.7	1,327	5.9	2,169	9.7
3/8	1-1/2 (38)	1,625	7.2	3,064	13.6	3,080	13.7	3,064	13.6
1/2	2-1/4 (57)	3,172	14.1	5,017	22.3	4,743	21.1	5,017	22.3
5/8	2-3/4 (69)	4,556	20.3	8,552	37.9	6,179	27.5	8,552	37.9
3/4	3-3/8 (76)	6,943	30.9	10,036	44.6	9,525	42.4	10,036	44.6

ALLOWABLE LOADS
Normal weight stone aggregate concrete

Anchor Size	Embedment	2000 psi (14.0 MPa)				4000 psi (27.6 MPa)			
		Tension		Shear		Tension		Shear	
in	inch (mm)	lbf	kN	lbf	kN	lbf	kN	lbf	kN
1/4	1-1/8 (28)	240	1.1	357	1.6	335	1.5	357	1.6
5/16	1-7/16 (36)	312	1.4	542	2.4	332	1.5	542	2.4
3/8	1-1/2 (38)	406	1.8	766	3.4	770	3.42	766	3.4
1/2	2-1/4 (57)	793	3.6	1,254	5.6	1,185	5.3	1,254	5.6
5/8	2-3/4 (69)	1,139	5.1	2,138	9.5	1,545	6.9	2,138	9.5
3/4	3-3/8 (76)	1,736	7.7	2,509	11.2	2,381	10.6	2,509	11.2

LOAD ADJUSTMENT FACTORS - ANCHOR SPACING

Anchor Spacing	Anchor Diameter					
(inch)	1/4	5/16	3/8	1/2	5/8	3/4
1-1/4	0.70					
1-1/2	0.76	0.70				
1-7/8	0.85	0.78	0.70			
2-1/2	1.00	0.90	0.80	0.70		
2-3/4	1.00	0.95	0.84	0.73		
3		1.00	0.88	0.76		
3-1/8			0.92	0.79	0.70	
3-3/4			1.00	0.85	0.75	0.70
4-1/4				0.91	0.80	0.74
5				1.00	0.88	0.81
5-3/4					0.95	0.87
6-1/4					1.00	0.91
7						0.98
7-1/2						1.00

SLEEVE ANCHOR

LOAD ADJUSTMENT FACTORS - EDGE DISTANCE

SHEAR							TENSION						
Edge Dist.	Anchor Diameter						Edge Dist.	Anchor Diameter					
inch	1/4	5/16	3/8	1/2	5/8	3/4	inch	1/4	5/16	3/8	1/2	5/8	3/4
5/8	0.50						5/8	0.60					
3/4	0.60	0.50					3/4	0.72	0.60				
1	0.93	0.63	0.50				1	0.86	0.69	0.60			
1-1/4	1.00	0.83	0.67	0.50			1-1/4	1.00	0.87	0.69	0.60		
1-1/2		1.00	0.80	0.60			1-1/2		1.00	0.83	0.76	0.60	
1-3/4			0.93	0.70	0.50		1-3/4			0.93	0.83	0.62	
1-7/8			1.00	0.75	0.55	0.50	1-7/8			1.00	0.85	0.73	0.60
2-1/4				0.90	0.68	0.60	2-1/4				0.90	0.74	0.62
2-1/2				1.00	0.77	0.67	2-1/2				1.00	0.76	0.66
2-3/4					0.86	0.73	2-3/4					0.88	0.74
3-1/8					1.00	0.83	3-1/8					1.00	0.87
3-1/2						0.93	3-1/2						0.95
3-3/4						1.00	3-3/4						1.00

ANCHOR SELECTION

Hex Nut Style

Part No.	Bolt Dia. (inch)	Anchor Dia. (inch)	Anchor Length (inch)	Min. Embedment (inch)	Fastens material up to (inch)
SLE14138*	3/16	1/4	1-3/8	1	3/8
SLE14214*	3/16	1/4	2-1/4	1	1-1/4
SLE516112	1/4	5/16	1-1/2	1	1/2
SLE516212	1/4	5/16	2-1/2	1	1-1/2
SLE38178	5/16	3/8	1-7/8	1-1/4	5/8
SLE383	5/16	3/8	3	1-1/4	1-3/4
SLE12214	3/8	1/2	2-1/4	1-1/2	3/4
SLE123	3/8	1/2	3	1-1/2	1-1/2
SLE124	3/8	1/2	4	1-1/2	2-1/2
SLE126	3/8	1/2	6	1-1/2	4-1/2
SLE58214	1/2	5/8	2-1/4	2	1/4
SLE58414	1/2	5/8	4-1/4	2	2-1/4
SLE586	1/2	5/8	6	2	4
SLE34212	5/8	3/4	2-1/2	2-1/4	1/4
SLE34414	5/8	5/8	4-1/4	2-1/4	2
SLE34614	5/8	3/4	6-1/4	2-1/4	4

*Acorn Nut

Hex Bolt Style

Part No.	Bolt Dia. (inch)	Anchor Dia. (inch)	Anchor Length (inch)	Min. Embedment (inch)	Fastens material up to (inch)
SLB38178	5/16	3/8	1-7/8	1-3/8	1/4
SLB38214	5/16	3/8	2-1/4	1-3/8	7/8
SLB383	5/16	3/8	3	1-3/8	1-5/8
SLB12214	3/8	1/2	2-1/4	1-3/4	1/2
SLB12234	3/8	1/2	2-3/4	1-3/4	1
SLB124	3/8	1/2	4	1-3/4	2-1/4

ANCHOR SELECTION CONT'D

Flat Head Style

Part No.	Bolt Dia. (in)	Anchor Dia. (in)	Anchor Length (in)	Min. Embedment (in)	Fastens material up to (in)
SLF14138	3/16	1/4	1-3/8	1	3/8
SLF142	3/16	1/4	2	1	1
SLF143	3/16	1/4	3	1	2
SLF144	3/16	1/4	4	1	3
SLF14514	3/16	1/4	5-1/4	1	4-1/4
SLF516212	1/4	5/16	2-1/2	1	1-1/2
SLF516312	1/4	5/16	3-1/2	1	2-1/2
SLF38234	5/16	3/8	2-3/4	1-1/4	1-1/2
SLF384	5/16	3/8	4	1-1/4	2-3/4
SLF385	5/16	3/8	5	1-1/4	3-3/4
SLF386	5/16	3/8	6	1-1/4	4-3/4

Hex Nut Style (Stainless Steel)

Part No.	Bolt Dia. (inch)	Anchor Dia. (inch)	Anchor Length (inch)	Min. Embedment (inch)	Fastens material up to (inch)
SLS14138	3/16	1/4	1-3/8	1	3/8
SLS516112	1/4	5/16	1-1/2	1	1/2
SLS516212	1/4	5/16	2-1/2	1	1-1/2
SLS38178	5/16	3/8	1-7/8	1	7/8
SLS383	5/16	3/8	3	1-1/4	1-3/4
SLS123	3/8	1/2	3	1-1/2	1-1/2

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Square brackets [...] indicate alternatives, data required, or need for the specifier to fill in information.

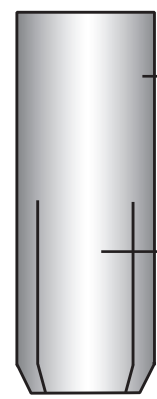
ANCHORS (FASTENERS)

Expansion anchors shall be [diameter and length to suit load and fixture requirements] UCAN Sleeve Anchors, supplied by UCAN Fastening Products. Anchors to be [zinc plated and have grade ASTM A307 carbon steel] [Type 304 Stainless Steel] anchor body, and installed according to the manufacturers published instructions.

DROP-IN ANCHOR

DESCRIPTION

The UCAN drop-in anchor is an internally threaded anchor which is pre-assembled with an internal expansion plug. These fire resistant anchors are available in both carbon steel and stainless steel. The carbon steel anchor is zinc plated to extend corrosion protection. The stepped installation tool allows for correct anchor setting. The anchor is designed to deliver consistent holding power at shallow embedment.



FEATURES

- Pre-assembled design
- Can be used in flush or countersunk applications

LIMITATIONS

- Not recommended for uncured concrete (less than 7 days old), light weight concrete, masonry block or brick

TYPICAL APPLICATIONS

- Sprinkler systems
- Cable trays
- Pipes and valves support
- Pallet racking
- Machinery Installation
- Precast wall inserts

APPROVAL / LISTINGS

- FM (Factory Mutual) - IPA3812, IPA1258, IPA5878
  Project identifier # 3015451

MATERIAL SPECIFICATIONS

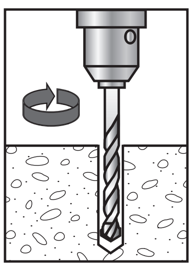
Anchor Component	Material Standard	Mechanical Properties	
		F_y	F_u
Carbon steel anchor body	AISI C 1008R	248.2 MPa (36 ksi)	413.7 MPa (60 ksi)
Stainless steel (304) anchor body	AISI grade 304	241.3 MPa (35 ksi)	586.1 MPa (85 ksi)
Corrosion protection (carbon steel anchors)	ASTM B633 - 07	0.0002" (5 micron) electrodeposited	

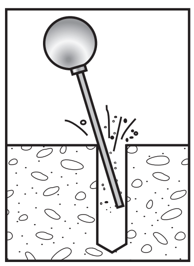
DROP-IN ANCHOR

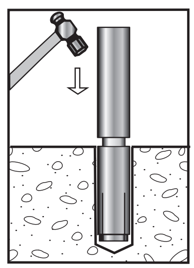
INSTALLATION

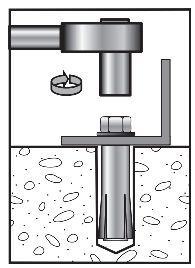
Details	Anchor size				
	1/4	**3/8**	**1/2**	**5/8**	**3/4**
Anchor size / Internal thread dia. d_a (in)	1/4	3/8	1/2	5/8	3/4
Drill bit / hole nominal diameter d_o (in)	3/8	1/2	5/8	7/8	1
Drill bit / hole nominal diameter for metric drop-ins d_o (mm)	8	12	n/a	20	n/a
Effective embedment / hole depth h_{ef} / h_1 (in)	1	1-1/2	2	2-1/2	3
Required anchor spacing for 100% performance s (in)	2-1/2	3-3/4	5	6-1/4	7-1/2
Minimum anchor spacing s_{min}	1-1/4	1-3/4	2-1/2	3-1/8	3-3/4
Required edge distance for 100% performance c (in)	3	4-1/2	6	7-1/2	9
Minimum edge distance c_{min}	1-1/2	3	4	5	6
Minimum bas material thickness h (in)	3	3-1/2	4	5	6
Max. installation torque T_{inst} (ft x lbf)	4	10	22	35	80

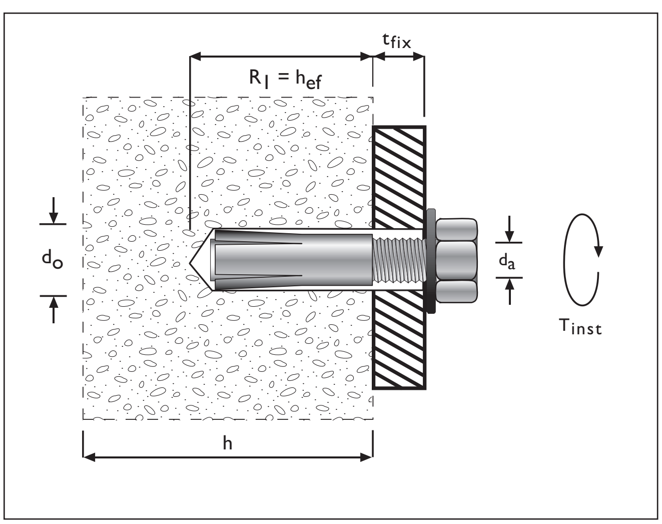
Note: Carbide tipped drill bits shall conform to ANSI B 212.15

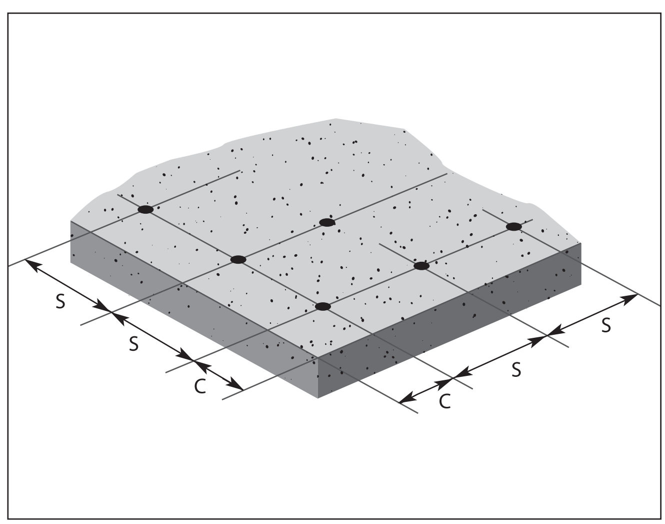

Set drilling depth so that anchor will be flush with concrete.




Use proper setting tool to drive plug down until tool's shoulder is flush with top of anchor.







ANCHOR SELECTION

Size	Part Number	Thread Size inch	Thread Depth inch	Drill (hole) dia. inch	Anchor length inch
Carbon Steel / Zinc Plated					
1/4	IPA 1438	1/4 -20	7/16	3/8	1
1/4	IPA 14516	1/4 -20	7/16	8 mm	1
3/8	IPA 3812	3/8 -16	5/8	1/2	1-1/2
3/8	IPA 381532	3/8 -16	5/8	12 mm	1-1/2
1/2	IPA 1258	1/2 -13	3/4	5/8	2
5/8	IPA 5878	5/8 -11	1	7/8	2-1/2
3/4	IPA 341	3/4 -10	1-1/4	1	3-1/8
Stainless Steel / AISI 304					
1/4	IPS 1438	1/4 -20	7/16	3/8	1
3/8	IPS 3812	3/8 -16	5/8	1/2	1-1/2
1/2	IPS 1258	1/2 -13	3/4	5/8	2
5/8	IPS 5878	5/8 -11	1	7/8	2-1/2
3/4	IPS 341	3/4 -10	1-1/4	1	3-1/8

***Notes:** Use only UCAN ANSI spec drill bits + setting tools.
IPA 341 requires a UCAN ANSI spec 4 cutter drill bit.

DESIGN DATA

AVERAGE ULTIMATE LOADS
Normal weight stone aggregate concrete

Anchor Size	Emb.	2000 psi (14 MPa)				4000 psi (27.6 MPa)				6000 psi (41 MPa)			
		Tension		Shear		Tension		Shear		Tension		Shear	
inch	inch	lbs	kN	lbs	kN	lbs	kN	lbs	kN	lbs	kN	lbs	kN
1/4	1	2,115	9.41	1,850	8.23	2,167	9.64	2,150	9.56	3,045	13.54	2,350	10.45
3/8	1-1/2	2,630	11.70	3,950	17.57	3,960	17.61	5,250	23.35	5,367	23.87	5,300	23.58
1/2	2	5,045	22.44	6,090	27.09	6,239	27.75	8,150	36.25	8,814	39.21	9,420	41.90
5/8	2-1/2	5,450	24.24	10,068	44.78	8,681	38.61	13,000	57.83	13,553	60.29	14,700	65.39
3/4	3	10,665	47.44	16,500	73.40	12,080	53.73	19,500	86.74	16,028	71.30	21,200	94.30

Notes: The ultimate shear values are based on SAE Grade 5 (F_u=120ksi) bolts.

DROP-IN ANCHOR

DESIGN DATA

ALLOWABLE LOADS
Normal weight stone aggregate concrete

Anchor Size	Emb.	2000 psi (14 MPa)				4000 psi (27.6 MPa)				6000 psi (41 MPa)			
		Tension		Shear		Tension		Shear		Tension		Shear	
inch	inch	lbs	kN	lbs	kN	lbs	kN	lbs	kN	lbs	kN	lbs	kN
1/4	1	529	2.35	463	2.06	542	2.41	538	2.39	761	3.39	588	2.61
3/8	1-1/2	658	2.92	988	4.39	990	4.40	1,313	5.84	1,342	5.97	1,325	5.89
1/2	2	1,261	5.61	1,523	6.77	1,560	6.94	2,038	9.06	2,204	9.80	2,355	10.48
5/8	2-1/2	1,363	6.06	2,517	11.20	2,170	9.65	3,250	14.46	3,388	15.07	3,675	16.35
3/4	3	2,666	11.86	4,125	18.35	3,020	13.43	4,875	21.69	4,007	17.82	5,300	23.58

Note: The allowable shear values are based on SAE Grade 5 (F_u=120ksi) bolts.

LOAD ADJUSTMENT FACTORS ANCHOR SPACING
(Tension & Shear Loads)

Anchor Spacing	Anchor Diameter				
inch	1/4	3/8	1/2	5/8	3/4
1-1/4	0.50				
1-1/2	0.60				
1-3/4	0.70	0.50			
2	0.80	0.65			
2-1/2	1.00	0.69	0.50		
3-1/8		0.84	0.63	0.50	
3-3/4		1.00	0.75	0.60	0.50
4-1/4			0.85	0.68	0.57
5			1.00	0.80	0.67
5-3/4				0.92	0.77
6-1/4				1.00	0.83
7					0.93
7-1/2					1.00

LOAD ADJUSTMENT FACTORS - EDGE DISTANCE (Tension Load)

Edge Distance	Anchor Diameter				
inch	1/4	3/8	1/2	5/8	3/4
1-1/2	0.80				
2	0.87				
2-1/2	0.93				
3	1.00	0.80			
3-1/2		0.87			
4		0.93	0.80		
4-1/2		1.00	0.85		
5			0.90	0.80	
6			1.00	0.88	0.80
6-1/2				0.92	0.83
7				0.96	0.87
7-1/2				1.00	0.90
8					0.93
9					1.00

LOAD ADJUSTMENT FACTORS - EDGE DISTANCE (Shear Load)

Edge Distance	Anchor Diameter				
inch	1/4	3/8	1/2	5/8	3/4
1-1/2	0.50				
2	0.67				
2-1/2	0.83				
3	1.00	0.50			
3-1/2		0.67			
4		0.83	0.50		
4-1/2		1.00	0.63		
5			0.75	0.50	
6			1.00	0.70	0.50
6-1/2				0.80	0.58
7				0.90	0.67
7-1/2				1.00	0.75
8					0.83
9					1.00

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Square brackets [...] indicate alternatives, data required, or need for the specifier to fill in information.

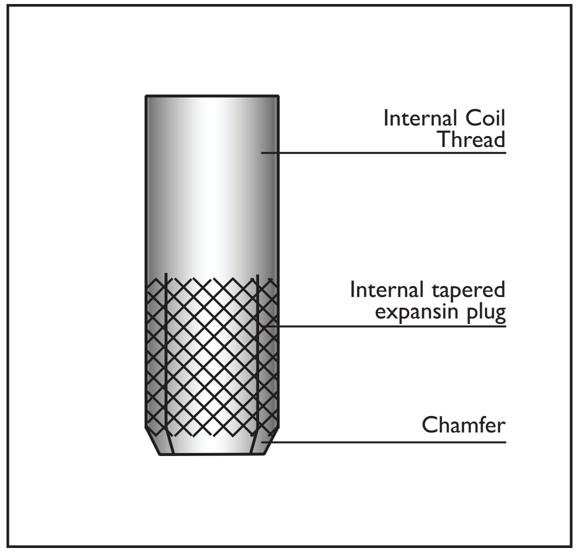
ANCHORS (FASTENERS)

Expansion anchors shall be [diameter and length to suit load and fixture requirements] UCAN Drop-in Anchors, supplied by UCAN Fastening Products. Anchors to be [zinc plated and have grade AISI C1008R carbon steel]
[Type 304 Stainless Steel] anchor body, and installed according to the manufacturers published instructions.

COIL THREADED DROP-IN ANCHOR

DESCRIPTION

The UCAN Coil Threaded Drop-In Anchor is an internally threaded anchor which is preassembled with an internal expansion plug. The anchor is zinc plated to extend corrosion protection. The stepped installation tool allows for reliable anchor setting. The anchor is designed to deliver consistent holding power at shallow embedment.



FEATURES

- Pre-assembled design for use with coil or rope threaded rod
- Can be used in flush or countersunk applications

LIMITATIONS

- Not recommended for uncured concrete (less than 7 days old), light weight concrete, masonry block or brick.

TYPICAL APPLICATIONS

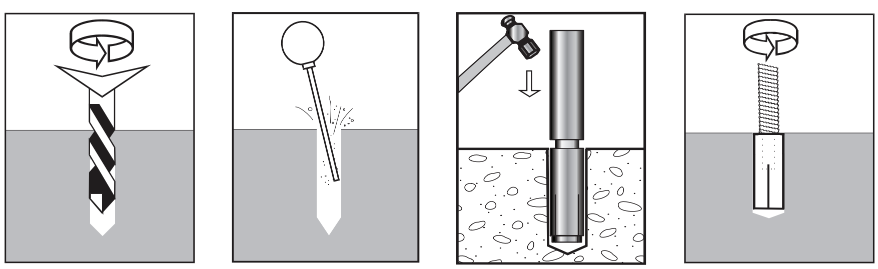
- Concrete formwork

MATERIAL SPECIFICATIONS

Grade AISI C1008 Carbon Steel

- Minimum Tensile Strength - 60,000 psi (420 MPa)
- Average Yield Strength - 36,000 psi (250 MPa)

INSTALLATION



Installation Details

Coil Thread Size	Recommended		Tightening Torque
	Edge Distance	Anchor Spacing	
inch	inch	inch	ft. lbs
1/2	6	5	22
3/4	9	7-1/2	90

COIL THREADED DROP-IN ANCHOR

Anchor Selection

Part No.	Coil Thread Size	Thread Length inch	Anchor/Hole Diameter inch	Anchor Length inch
CTD1258	1/2" - 6	3/4	5/8	2
CTD341	3/4" - 4.5	1-1/4	1	3-1/8

DESIGN DATA

Average Ultimate Tension Loads

Anchor Size	Embedment	Tension	
		4,000 psi Concrete	2,000 psi Concrete
inch	inch (mm)	lbs (kN)	lbs (kN)
1/2	2 (50)	6,239 (27.7)	5,045 (22.4)
3/4	3 (76)	12,080 (53.7)	n/a (n/a)

Apply Safety Factor (reduction factor) as per CAN/CSA-S269.3-M92 guidelines for concrete formwork. For all other applications, ensure the working load per anchor does not exceed 1/4 of the tabulated ultimate load, under static loading conditions.

SPECIFICATION

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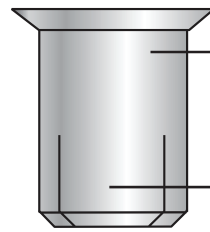
ANCHORS (FASTENERS)

Expansion anchors shall be [diameter and length to suit load and fixture requirements] UCAN Coil Threaded Drop-in Anchors, supplied by UCAN Fastening Products. Anchors to be zinc plated and have grade AISI C1008R carbon steel anchor body , and installed according to the manufacturers published instructions.

STUBI DROP-IN ANCHOR

DESCRIPTION

The UCAN STUBi Drop-in Anchor is an internally threaded, flush mounted expansion anchor, which is pre-assembled with an internal expansion plug. The anchor is zinc plated in accordance with ASTM B633, SC-1, Type III standard. The matching UCAN setting tool allows for correct anchor setting. The anchor is designed to provide reliable fastening in hollow core panels, precast and post tension slabs.



FEATURES

- Pre-assembled with expansion plug
- Lip ensures flush installation
- Shallow embedment design

LIMITATIONS

- Not recommended for uncured concrete (less than 7 days old), lightweight concrete or brick

TYPICAL APPLICATIONS

- Overhead fastenings into hollow core, precast and post tensioned slabs

MATERIAL SPECIFICATIONS

Anchor Body
- AISI C 1008 carbon steel
- Min. Tensile Strength - 60,000 psi (413.7 MPa)

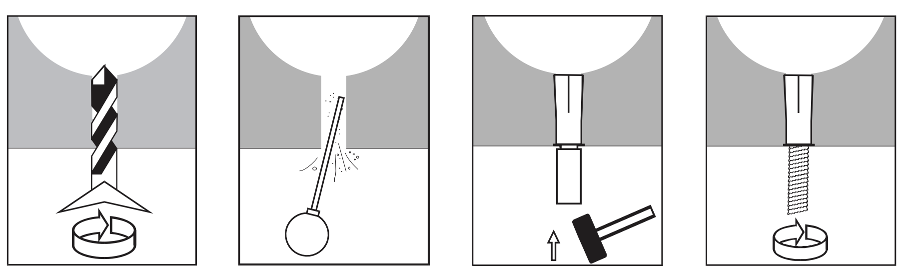
Corrosion Protection
Zinc Plated
- ASTM B633 SC-1, Type III

TECHNICAL DATA

Average Ultimate Loads in 4,000 psi Concrete

Anchor size	Hole Dia.	Emb.	Tension		Shear	
inch	inch	inch	lbs	kN	lbs	kN
3/8	1/2	3/4	1850	8.23	2950	13.12

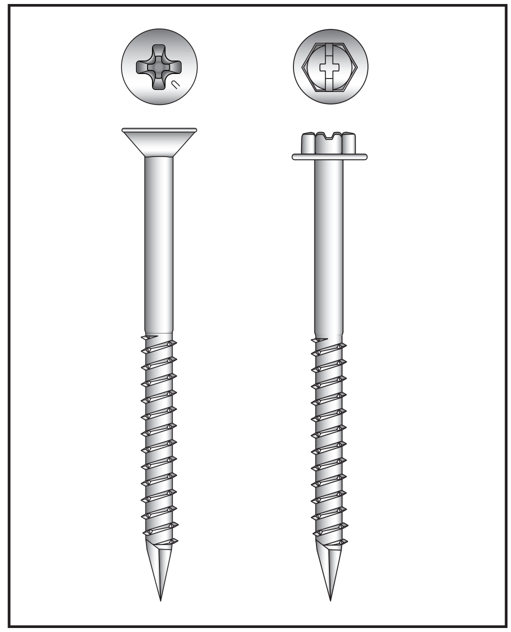
INSTALLATION



SCRU-IT™

DESCRIPTION

The UCAN Scru-it™ masonry anchor is manufactured to strict specifications from high quality steel. The proprietary, UCAN designed, scalloped thread cuts deep grooves in a wide variety of masonry materials (solid concrete, block, brick etc.) producing up to three times the holding power of comparable anchors.



FEATURES

- High strength
- Close to edge fastening
- No spalling, cuts cleanly into pre-drilled hole
- Fast and easy installation
- Removable
- Diamond point for easy centering
- RUSPRO™ coated for maximum corrosion resistance
- Available in Stainless Steel
- Available head styles (Hex head, Flat head with Phillips and Square socket)
- Available in bulk

TYPICAL APPLICATIONS

- Conduit clips
- Strapping or 2x4 studs
- Metal shelf - uprights
- Cladding
- Window frames
- Brick ties

MATERIAL SPECIFICATIONS

Anchor Body

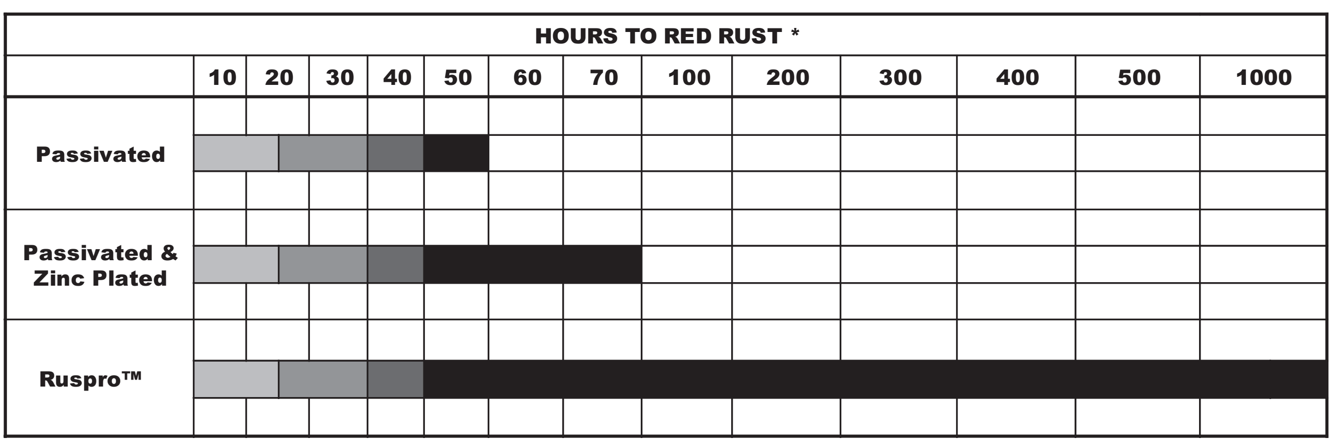
Carbon Steel: AISI C1022 UTS: 73 ksi (503 MPa)
Case Hardened (HRC: 30 - 42)

Stainless Steel: AISI 410 C UTS: 78 ksi (538 MPa)

CORROSION PROTECTION

Ruspro™ coating:

Multi layer coating provides superior corrosion resistance to sulphur dioxide, salt spray, acids and alkalis as well as having excellent abrasion resistance. Available in blue and silver (Square socket type) colours.



- Per ASTM B117. Test performed on uninstalled fasteners.

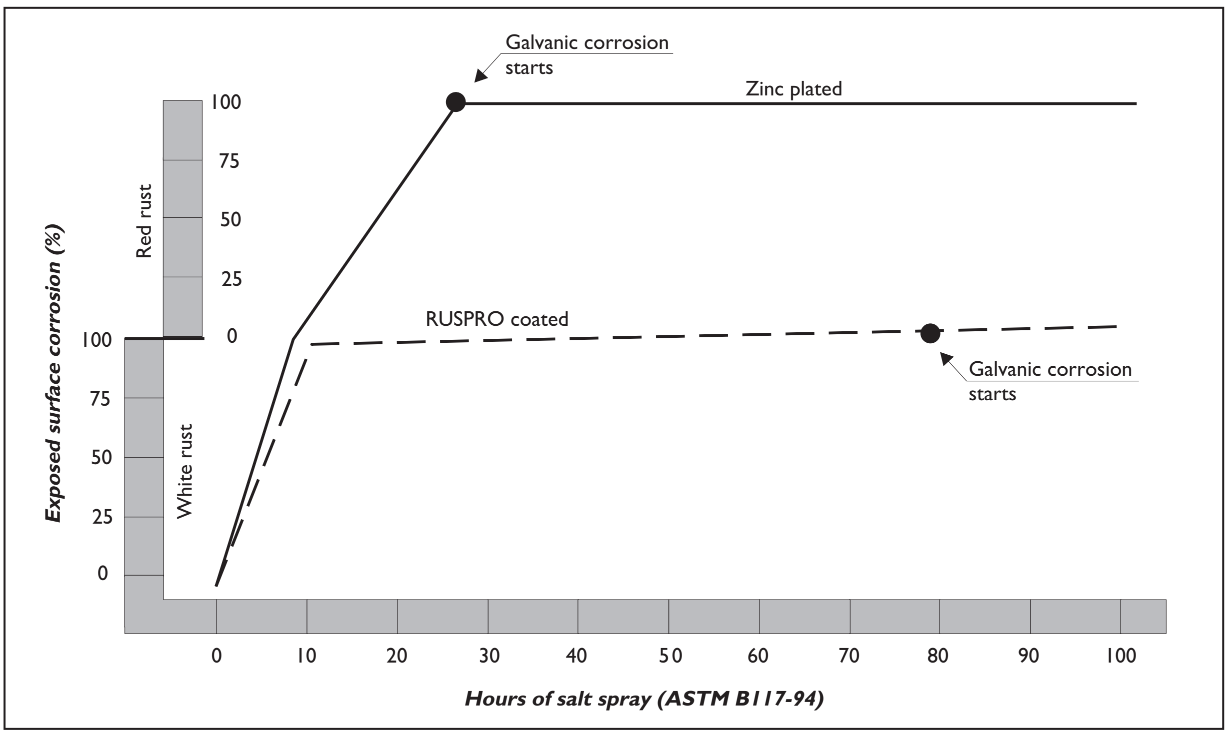
SCRU-IT™

DESIGN DATA FOR INSTALLATIONS AFFECTED BY VARIOUS ENVIRONMENTAL CONDITIONS

Reliable fastener design requires fastener performance data in various environmental conditions since the fastening assemblies cannot always be inspected and maintained. UCAN Fastening Products engaged in a comprehensive test program to provide these important data to support correct fastener selection. ORTECH Corporation, an ISO 9002 Canadian Testing Agency performed the following test program:

- Tension and Shear Loading in three different substrates i.e. 30 MPa concrete, concrete hollow and solid block under the following environmental conditions: (see details on page 3)
  - ambient laboratory conditions
  - 100% saturation to simulate exposure of substrate and fastener to rain
  - cold temperature exposure of substrate and fastener at -20°C
- Abrasion resistance testing
- Galvanic corrosion test

Galvanic corrosion test data



Abrasion Resistance Test

RUSPRO™ coated fasteners were installed into hollow concrete block under normal and over-torque conditions. The fasteners were examined under binocular microscope at 7x magnification. After the visual inspection, the specimens were cut to reveal their cross section and were examined metallographically. The test results indicated slight removal of coating at the points of the hex head. None of the specimens displayed damage to the case hardening, indicating the fasteners excellent resistance to abrasion.

Average Ultimate Loads for Installations of 1/4" diameter Scru-it™ in Various Canadian Application Conditions

Hollow Concrete Block

Embedment	Installation Conditions					
	Normal (Ambient)		100% Saturated		Cold (-20°)	
	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1"	767 (3.4)	915 (4.1)	847 (3.8)	700 (3.1)	940 (4.2)	679 (3.0)
1-1/2"	1,155 (5.1)	762 (3.4)	1,329 (5.9)	551 (2.5)	1,404 (6.3)	886 (3.9)

Solid Concrete Block

Embedment	Installation Conditions					
	Normal (Ambient)		100% Saturated		Cold (-20°)	
	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1"	1,121 (5.0)	1,349 (6.0)	1,159 (5.2)	1,570 (7.0)	1,077 (4.8)	956 (4.3)
1-1/2"	2,257 (10.0)	1,056 (4.7)	1,886 (8.4)	1,155 (5.2)	2,004 (8.9)	1,401 (6.2)

30 MPa Concrete

Embedment	Installation Conditions					
	Normal (Ambient)		100% Saturated		Cold (-20°)	
	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)	Tension lbs (kN)	Shear lbs (kN)
1"	1,521 (6.8)	2,200 (9.8)	1,289 (5.7)	1,452 (6.5)	1,209 (5.4)	946 (4.2)
1-1/2"	2,444 (10.9)	1,456 (6.5)	2,439 (10.9)	1,575 (7.0)	2,611 (11.0)	1,607 (7.2)

The above technical data is based on the Ortech test report No.: 96-J53-M0163

SCRU-IT™

TECHNICAL DATA

Screw Size	Embedment	5,000 psi Concrete		Hollow Concrete Block	
		Tension	Shear	Tension	Shear
		lbs	lbs	lbs	lbs
inch	inch	(kN)	(kN)	(kN)	(kN)
3/16	1	1,055 (4.69)	1,181 (5.25)	684 (3.04)	1,248 (5.55)
	1-1/2	2,033 (9.04)	- -	770 (3.42)	- -
1/4	1	1,919 (8.54)	1,932 -	912 (4.06)	2,361 (10.50)
	1-1/2	2,798 (12.45)	- -	1,995 (8.87)	- -

Note: * 1-1/2" embedment is not recommended in extreme hard or dense materials.

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Brackets [ ] indicate alternatives, data required, or need for the specifier to fill in information.

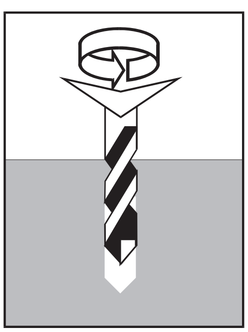
ANCHORS (FASTENERS)

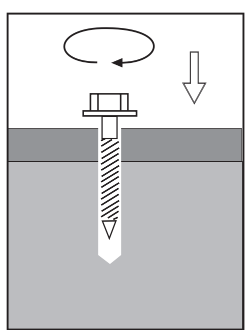
Masonry anchors shall be (diameter, length to suit load and fixture requirements) UCAN SCRU-IT™ Anchors, supplied by Ucan Fastening Products. Anchors to be (type of corrosion protection), and installed according to the manufacturer's published instructions.

ANCHOR SELECTION

Size	Hex Washered Head		Phillips Flat Head		Square Socket Flat Head	Drill Bit
	Blue Ruspro™	Stainless Steel	Blue Ruspro™	Stainless Steel	Silver Ruspro™	(incl.)
3/16 x 3/4	SCH 31634	-	-	-	-	5/32
3/16 x 1-1/4	SCH 316114	-	SCP 316114	SSP 316114	SCR 316114	5/32
3/16 x 1-3/4	SCH 316134	-	SCP316134	-	SCR 316134	5/32
3/16 x 2-1/4	SCH 316214	-	SCP 316214	-	SCR 316214	5-32
3/16 x 2-3/4	SCH 316234	-	SCP 316234	SSP 316234	SCR 316234	5/32
3/16 x 4	SCH 3164	-	SCP 3164	-	-	5/32
1/4 x 1-1/4	SCH 14114	SSH 14114	SCP 14114	-	SCR 14114	3/16
1/4 x 1-3/4	SCH 14134	-	SCP14134	-	SCR 14134	3/16
1/4 x 2-1/4	SCH 14214	-	SCP 14214	-	SCR 14214	3/16
1/4 x 2-3/4	SCH 14234	SSH 14234	SCP 14234	-	SCR 14234	3/16
1/4 x 3-1/4	SCH 14314	-	SCP 14314	-	SCR 14314	3/16
1/4 x 4	SCH 144	-	SCP 144	-	-	3/16
1/4 x 5	SCH 145	-	SCP 145	-	-	3/16
1/4 x 6	-	-	SCP 146	-	-	3/16

INSTALLATION





NOTE:
Apply Sfety Factor to ensure the working load per anchor does not exceed 1/4 of the tablulated ultimate load, under static loading conditions.

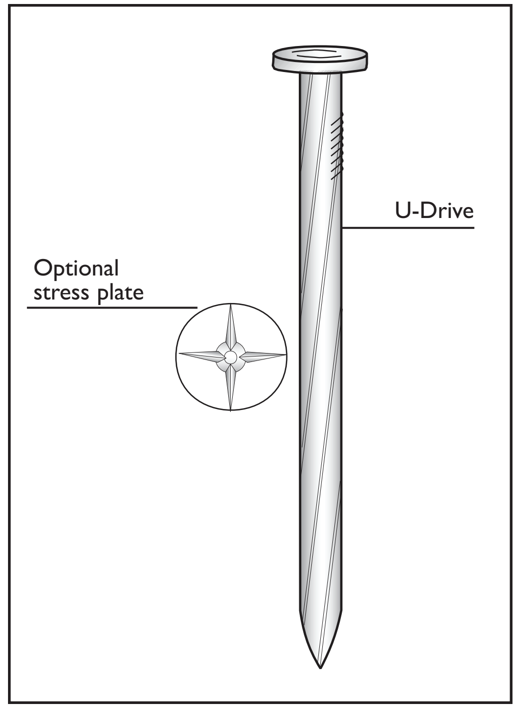
U-DRIVE

DESCRIPTION

The UCAN U-Drive anchor system is a quick, easy and economical method for securely fastening insulation panels, sheet metal and wood to concrete and most masonry.

U-Drive anchors have spiral shanks and are heat treated to facilitate installation.They are also hot dip galvanized for maximum corrosion resistance. When used in conjunction with the special close tolerance U-Drive carbide drill bits, these anchors consistently produce fastenings with superior holding power.

May be used together with U-Drive plastic stress plate for fastening insulation to concrete or masonry.



MATERIAL SPECIFICATIONS

Anchor body	**Heat Treated AISI C1035**
- Minimum tensile strength	175,000 psi
- Average yield strength	150,000 psi
- Hardness (Rc)	33-38

Corrosion protection

- The anchor body is hot dip galvanized to a nominal thickness of 0.0018".

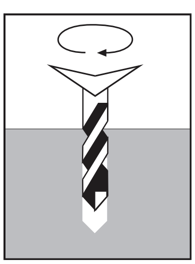
FEATURES

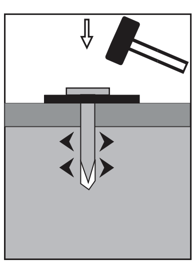
- No special tools required
- Hot dip galvanized
- No head shearing
- Control of embedment
- Excellent shear strength
- High performance at low cost
- Can be used in most types of masonry
- Available in lengths of 1-1/8" - 5"
- Stocked in 100 packs and bulk cartons

TYPICAL APPLICATIONS

- 2 X 4 Sleepers
- Plates
- Stud wall
- Drywall track
- Rigid Insulation
- Lightweight brackets
- Conduit fittings
- Hollow concrete block applications
- Brick tie systems
- Lathing strips

INSTALLATION





ANCHOR SELECTION

Part Number	Anchor Length	Fastens up to	Drill Bit Diameter
	inch	inch	inch
INS118	1-1/8	1/8	0.202
INS112	1-1/2	½	0.202
INS2	2	1	0.202
INS212	2-1/2	1-1/2	0.202
INS3	3	2	0.202
INS312	3-1/2	2-1/2	0.202
INS4	4	3	0.202
INS412	4-1/2	3-1/2	0.202
INS5	5	4	0.202

U-DRIVE

TECHNICAL DATA

Ultimate Tension and Shear Data

Embedment	3000 psi Concrete		Hollow Concrete Block
	Tension	Shear	Tension
	lbs	lbs	lbs
inch	(kN)	(kN)	(kN)
3/4	749 (3.33)	- -	576 (2.56)
1	1,214 (5.40)	1,270 (5.65)	873 (3.75)

STRESS PLATE DATA

Stress Plate	Size	Type	FM Wind Uplift Load Type
SP 1 (100 pack)	3" Round	Plastic	Class 1 insulated concrete roof Construction, Design wind uplift Load: 1-60; 1-90
SP 1M (1000 pack)	3" Round	Plastic	

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Brackets [...] indicate alternatives, data required, or need for the specifier to fill in information.

ANCHORS (FASTENERS)

Masonry Fastener shall be UCAN U - Drive [Part number], supplied by UCAN Fastening Products. The hole depth shall be [...] and the U-Drive fastener shall be hot dip galvanized to provide extended corrosion protection. The installation must follow the manufacturer's published instructions.

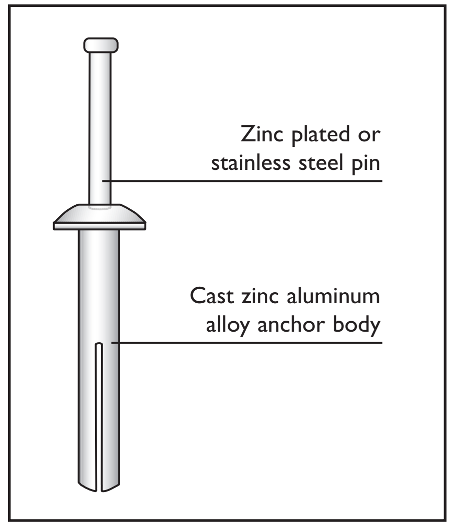
NOTE:

Apply Safety Factor to ensure the working load per anchor does not exceed 1/4 of the tablulated ultimate load, under static loading conditions.

ZAMAC PIN BOLT

DESCRIPTION

The UCAN Zamac pinbolt is a light duty, tamperproof anchor which has a zinc plated or stainless steel pin preassembled with a body made from a corrosion resistant zinc/aluminum alloy. They are ideal for all masonry materials including concrete, hollow block, brick and precast.



TYPICAL APPLICATIONS

- Flashing
- Brick ties
- Stud wall
- Lightweight fixtures, signs
- HVAC straps
- Conduit fittings

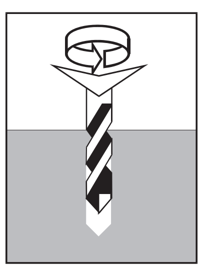
FEATURES

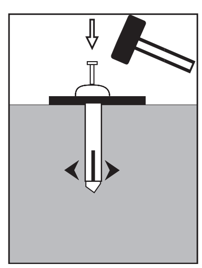
- Tamperproof
- One piece construction
- Anchor size is hole size
- Through fastening
- Corrosion resistant body
- Available with stainless steel nail

ANCHOR SELECTION

Part Number		Length	Fastens up to	Drill bit Diameter
Zinc Plated Pin	Stainless Steel Pin	inch	inch	inch
ZAM 31678	-	7/8	1/4	3/16
ZAM 141	ZAM 141SS	1	1/4	1/4
ZAM 14114	ZAM 14114SS	1-1/4	1/2	1/4
ZAM 14112	ZAM 14112SS	1-1/2	3/4	1/4
ZAM 142	ZAM 142SS	2	1-1/4	1/4
ZAM 143	-	3	2-1/4	1/4

INSTALLATION





ZAMAC PIN BOLT

DESIGN DATA

Average Ultimate Loads

Diameter	Embedment	3600 psi (25 MPa) Concrete	
		Pullout	Shear
inch	inch	lbs (kN)	lbs (kN)
3/16	3/4	500 (2.22)	725 (3.23)
1/4	3/4	710 (3.16)	1,100 (4.89)
1/4	1	1,020 (4.54)	1,100 (4.8)

NOTE:
Apply Safety Factor to ensure the working load per anchor does not exceed 1/4 of the tablulated ultimate load, under static loading conditions.

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Brackets [...] indicate alternatives, data required, or need for the specifier to fill in information.

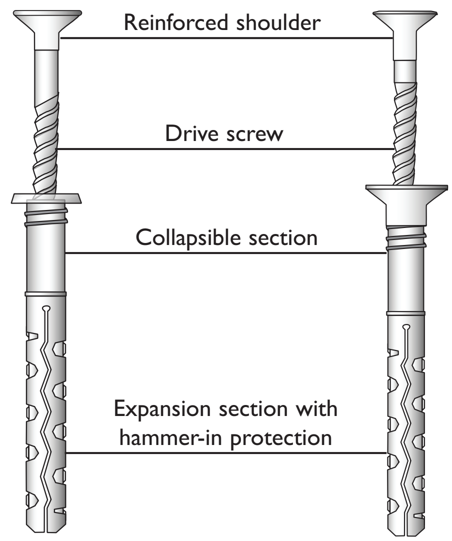
ANCHORS (FASTENERS)

Masonry Fastener shall be UCAN Zamac Pin bolt [Part number], supplied by UCAN Fastening Products. The hole depth shall be [...] and the Zamac Pinbolt shall be tamper proof type with zinc aluminum alloy body and zinc plated [stainless] steel setting pin to provide extended corrosion protection. The installation must follow the manufacturer's published instructions.

DRIVE SCREW ANCHOR

DESCRIPTION

The UCAN Drive Screw Anchor is manufactured from a tough and durable Nylon-6 and is preassembled with a zinc plated phillips head screw nail. The reinforced screw head holds the fixture firmly in place. This anchor is suitable for all masonry and concrete base materials.



FEATURES

- Ready to use, assembled fasteners for through fastening
- Impact expansion by hammer
- Removable with a screwdriver
- Environmentally friendly - contains no Cadmium
- Reinforced screw shoulder firmly grips the nylon body neck

TYPICAL APPLICATIONS

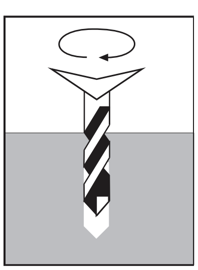
- Conduit clips
- Electrical boxes
- Brick ties
- Flashing
- Tilt-up forms
- Wood sleepers
- Drywall "hat" track

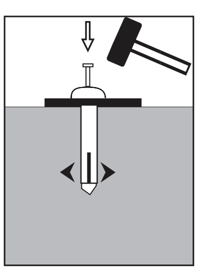
ANCHOR SELECTION

Head Style	Part Number	Anchor Length	Fastens up to	Drill Bit Diameter
		inch	inch	mm
	MNA530	1-1/4	1/4	5
	MNA540	1-1/2	1/2	5
Round	MNA550	2	1	5
Head	MNA635	1-3/8	3/8	6
	MNA650	2	1	6
	MNA670	2-3/4	1-3/4	6
	MNA850	2	1	8
Countersunk	MNA860	2-3/8	1	8
Head	MNA880	3-3/16	1-3/4	8
	MNA8100*	4	2-3/8	8

*This size is not assembled

INSTALLATION





MATERIAL SPECIFICATIONS

Anchor body

- Cadmium free nylon
  - In-place temperature: -40°C to +80°C
  - Installation temperature: -10°C to +40°C

Drive screw

- Steel, zinc plated

DRIVE SCREW ANCHOR

TECHNICAL DATA

Average Ultimate Loads

Size	Minimum Embedment	3000 psi Concrete		Hollow Concrete Block*
		Tension	Shear	Tension
		lbs	lbs	lbs
mm	mm	(kN)	(kN)	(kN)
5	25	330 (1.50)	516 (2.3)	225 (1.00)
6	25	560 (2.50)	762 (3.4)	450 (2.00)
8	25	720 (3.20)	1255 (5.6)	670 (3.00)

*Actual results may vary depending on concrete strength and installation conditions.

NOTE:
Apply Safety Factor to ensure the working load per anchor does not exceed 1/5 of the tablulated ultimate load, under static loading conditions.

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Brackets [...] indicate alternatives, data required, or need for the specifier to fill in information.

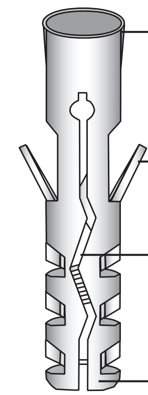
ANCHORS (FASTENERS)

Masonry anchors shall be [diameter, length to suit load and fixture requirements] UCAN Drive Screw Anchors, supplied by UCAN Fastening Products. Anchor shell to be nylon with no cadmium content, and installed according to the manufacturer's published instructions.

MUN NYLON PLUG

DESCRIPTION

The Mungo Nylon Plug is made of a tough and durable Nylon-6 which will not crack under impact at low temperatures. It is also suitable for light - medium duty applications in a wide range of base materials.



FEATURES

- Internal screw stop prevents premature expansion
- Collar-free design allows push through installation
- Offset block profile ensures even expansion and firm grip
- Suitable in temperatures (in-place) of -40°C to +80°C.

TYPICAL APPLICATIONS

- Aluminum window frames and supports
- Sign support
- Conduit clips
- Cable clips
- Metal building flashings to concrete

DESIGN DATA

Size	Ultimate Tension Loads	
	Solid Concrete 25 MPa	Solid Brick
	lbs	lbs
mm	(kN)	(kN)
5	420 (2.0)	404 (1.8)
6	675 (3.0)	562 (2.5)
8	1,120 (5.0)	1,010 (4.5)
10	2,023 (9.0)	1,120 (5.0)
12	2,810 (12.5)	1,570 (7.0)

Note: Actual results may vary depending on concrete strength and installation conditions.

ANCHOR SELECTION

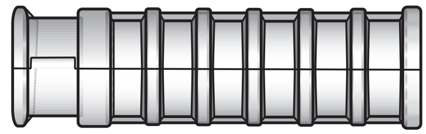
Part No.	Length inch	Screw size	Drill bit mm
MUN 5	1	4 - 6	5
MUN 6	1-1/8	6 - 8	6
MUN 8	1-1/2	10 - 12	8
MUN 10	2	14 - 18	10
MUN 12	2-1/4	3/8"	12

NOTE:
Apply Safety Factor to ensure the working load per anchor does not exceed 1/5 of the tablulated ultimate load, under static loading conditions.

LAG SHIELDS

DESCRIPTION

Screw type expansion anchor cast from rust proof zamac alloy. The lag shield is ideally suited for base materials of questionable integrity. The lag shield consists of die cast sleeves with formed internal threads and designed for use with lag bolts. Lag shields offer significant expansion, and well suited for fastening applications in old masonry structures.



TYPICAL APPLICATIONS

- Ornamental iron rails
- Light duty shelving
- Residential sill and deck plates
- Precast step mounts
- Park benches

TENSILE AND SHEAR DATA FOR LAG SHIELDS

Following were obtained by using holes drilled in 2000-4000 psi, unreinforced concrete.

Part Number	SIZE	TENSILE	SHEAR
LAS 14	1/4 S	1,450 lbs.	1,850 lbs
LAS 516	5/16 S	1,500 lbs.	2,500 lbs.
LAS 38	3/8 S	1,600 lbs.	5,500 lbs.
LAS 12	1/2 S	2,000 lbs.	8,000 lbs.
LAL 14	1/4 L	1,600 lbs.	1,850 lbs.
LAL 516	5/16 L	1,700 lbs.	2,500 lbs.
LAL 38	3/8 L	1,860 lbs.	5,600 lbs.
LAL 12	1/2 L	2,770 lbs.	8,000 lbs.

MATERIAL SPECIFICATIONS

BODY: Z50 A - ZAMAC 5

Physical Properties

Density: 66430 (6.6 x 10^4) kg/m^3

Melting Point: 380/386°C

Coef. of Thermal Expansion: 27.4mm/mm x°C

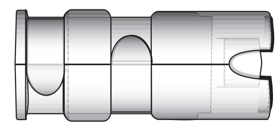
Thermal Conductivity: 27

SINGLE & DOUBLE EXPANSION SHIELD

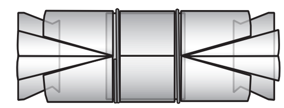
DESCRIPTION

Rust proof zamac alloy machine type expansion anchor ideally suited for base materials of questionable strength. The single and double expansion anchor consists of pre-assembled sets of shields and an internally threaded expander cone.

SINGLE EXPANTION SHIELD



DOUBLE EXPANTION SHIELD



TYPICAL APPLICATIONS

- Timber frames to concrete
- Steel or wood fastening in corrosive environment
- Fastening to brick and block walls

SINGLE EXPANSION SHIELD PERFORMANCE DATA IN 3000psi CONCRETE

Part Number	SIZE	ULTIMATE TENSION LOAD	ULTIMATE SHEAR LOAD
USA 14	1/4	1,800	2,150
USA 516	5/16	2,000	3,300
USA 38	3/8	2,260	3,950
USA 12	1/2	3,500	8,000
USA 58	5/8	5,800	13,500
USA 34	3/4	8,500	15,000

DOUBLE EXPANSION SHIELD PERFORMANCE DATA IN 3000psi CONCRETE

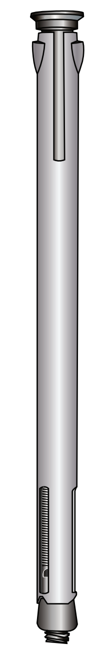
Part Number	SIZE	ULTIMATE TENSION LOAD	ULTIMATE SHEAR LOAD
UDA 14	1/4	1,900	2,800
UDA 516	5/16	2,150	3,750
UDA 38	3/8	4,000	4,500
UDA 12	1/2	4,500	9,000
UDA 58	5/8	5,600	13,000
UDA 34	3/4	9,000	15,900

UCAN Fastening Products, a division of British Fastening Systems Ltd. | 155 Champagne Dr., Unit 10, Toronto, ON M3J 2C6 | Tel.: 416.631.9400 | Fax: 416.631.9426

METAL FRAME ANCHOR

DESCRIPTION

As the name implies, these anchors are suited for door frames and allows easy spacing of frame. They are galvanized and fire resistant.



FEATURES

- Applications in solid materials
- Expansion cone is secured against twist and dropt
- Zinc plated > 5μm
- Through fixing.
- Indoor applications.

ANCHOR SELECTION

Combination Head Screw Type

APPLICATION

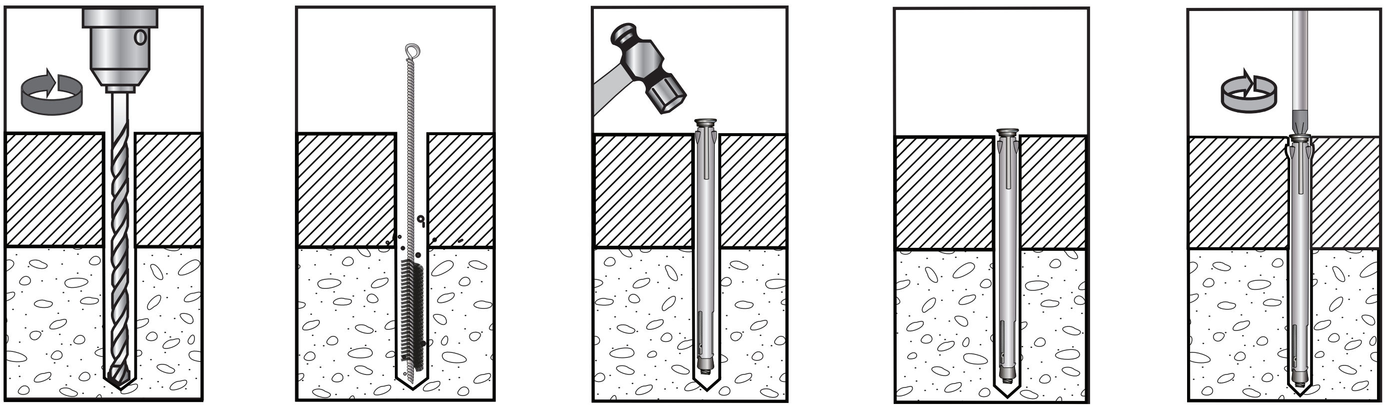
- Windows
- Substructures
- Frames

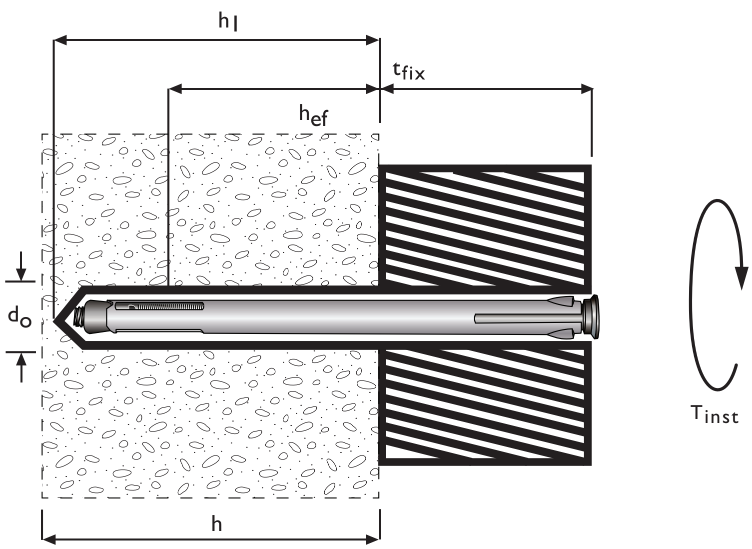
TECHNICAL DATA

Installation Details (mm)		
Anchor length	110	130
Minimum embedment	40	
Usable frame thickness (t_{fix})	70	90
Hole diameter (d_0)	10	
Drilling depth (h_l)	55	
Minimum edge distance	100	
Min thickness of structure	105	
Installation torque (Nm)	8	

Allowable Loads *	Tension(kN)	Shear (kN)
Concrete f_c > 20 MPa	1	0.5
Brick	0.5	0.5
Lightweight concrete	0.1	n/a
Bending moment	2.6 Nm	
* Safety factor of 5 included		

INSTALLATION





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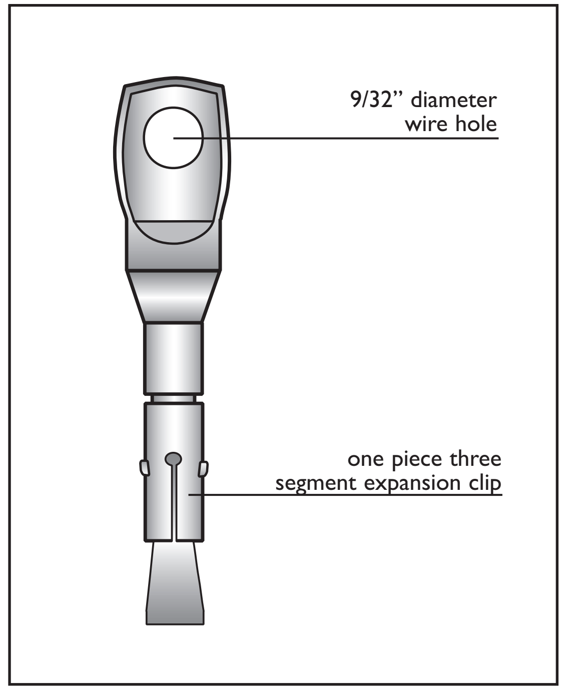
TIE WIRE WEDGE ANCHOR

DESCRIPTION

The UCAN Tie Wire Wedge Anchor is a steel fastener, designed primarily for suspended ceiling installation. The anchor consists of a steel body with 9/32" diameter wire hole and a one piece wrap around expansion clip.



FEATURES

- Wrap around expansion clip provides true 360° expansion
- Non-bottom bearing type
- Fast, simple installation by hammer
- Anchor has follow-up expansion feature
- Rigid, one piece fastening
- Zinc Plated

LIMITATIONS

Not recommended for uncured concrete (less than 7 days of curing).

MATERIAL SPECIFICATIONS

Anchor body
- Grade AISI C1022
  - Minimum tensile strength - 75,000 psi
  - Average yield strength - 60,000 ps

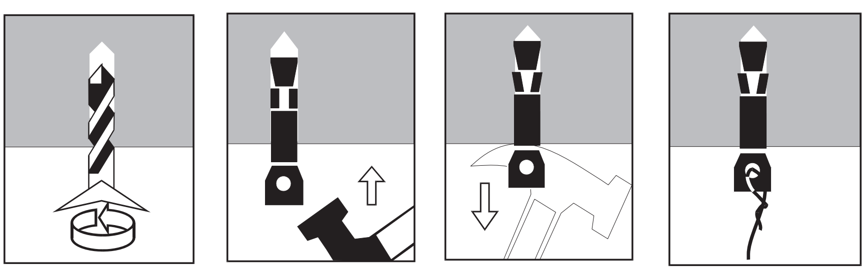
Sleeve
- Cold rolled steel, AISI C1050

Corrosion protection
- The anchor body and expansion clip are zinc plated.

TECHNICAL DATA

Drilled Hole Diameter	1/4"
Embedment	1-1/8"
Ultimate Tension Load In 2,500 psi Concrete	1,800 lbs
	8.00 kN
Ultimate Tension Load In 4,000 psi Concrete	2,200 lbs
	9.79 kN
Note: Load data is provided as a guide only.	

INSTALLATION



NOTE:
Apply Safety Factor to ensure the working load per anchor does not exceed 1/4 of the tabulated ultimate load, under static loading conditions.

METAL HOLLOW WALL ANCHOR

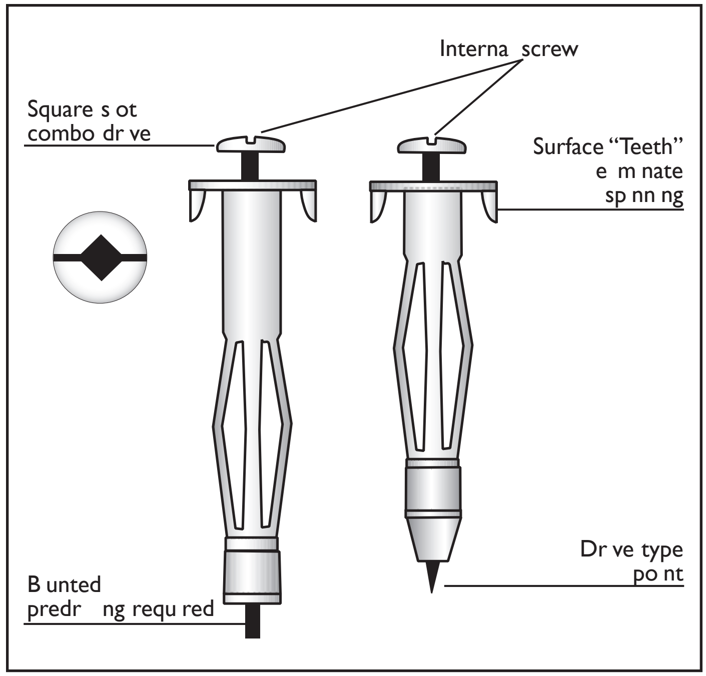
DESCRIPTION

The UCAN Hollow Wall anchor is a light duty screw type expansion anchor designed specifically for fastening to cavity walls, constructed of drywall, plaster or wallboard. It is available in 1/8" to 1/4" screw sizes.

Once installed, the anchor creates a bearing surface with expanded arms guaranteeing a secure and reliable fixture.

This anchor comes complete with a combination head for both Robertson and slot screw drivers. It is also available in 1/8" size as a drive type which does not require a predrilled hole.

The MWA installation tool is available for easy one step expansion of the anchor. This tool eliminates the need to expand the anchor with a screw driver.



FEATURES

- One piece unit for fast installation
- Can be installed with a hollow wall anchor installation tool or a screw driver
- Drive type does not require predrilled hole
- Zinc plated


Insta at on Too MWAT 1

TYPICAL APPLICATIONS

- Fastening into hollow material
- Light loading applications
- Fastening into panel-boards
- Light shelving

ANCHOR SELECTION

Combination Head Screw Type

Part No.	Size	Board Thickness (Grip Range)	Drill Bit
	inch	inch	inch
MWA 18XS	1/8 XS	0 - 1/2	5/16
MWA 18S	1/8 S	1/8 - 1/2	5/16
MWA 18SL	1/8 SL	1/8 - 3/4	5/16
MWA 18L	1/8 L	5/8 - 7/8	5/16
MWA 316S	3/16 S	1/8 - 5/8	7/16
MWA 316L	3/16 L	5/8 - 1-1/4	7/16
MWA 14S	1/4 S	1/8 - 5/8	1/2
MWA 14L	1/4 L	5/8 - 1-1/4	1/2

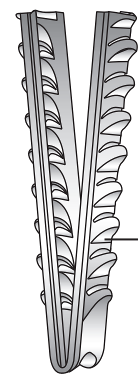
Drive Type

Part No.	Size	Board Thickness (Grip Range)
	inch	inch
MWD 18S	1/8 S	1/8 - 1/2
MWD 18SL	1/8 SL	1/8 - 3/4
MWD 18L	1/8 L	1/8 - 3/4

ALEX PLUG

DESCRIPTION

The UCAN Alex Plug is a corrosion resistant aluminum plug designed for use in all masonry base materials. The unique body design provides a firm grip of both the screw and base material. The Alex Plug is available exclusively from UCAN Fastening Products. This anchor comes in lengths ranging from 1" to 1-1/2" and can be cut to any desired length.



FEATURES

- Corrosion resistant plug
- Suitable for light duty fastening in a broad range of base materials
- Can be cut to any size
- Withstands elevated temperatures

TYPICAL APPLICATIONS

- Light duty fastenings
- Cable clips
- Electric light fixtures

LIMITATIONS

- Not designed for heavy, vibratory or impact loads.

ANCHOR SELECTION

Part No.	Length	Screw size	Drill Bit
	inch		inch
ALE 141	1	6 - 10	1/4
ALE 14114	1-1/4	6 - 10	1/4
ALE 14112	1-1/2	6 - 10	1/4

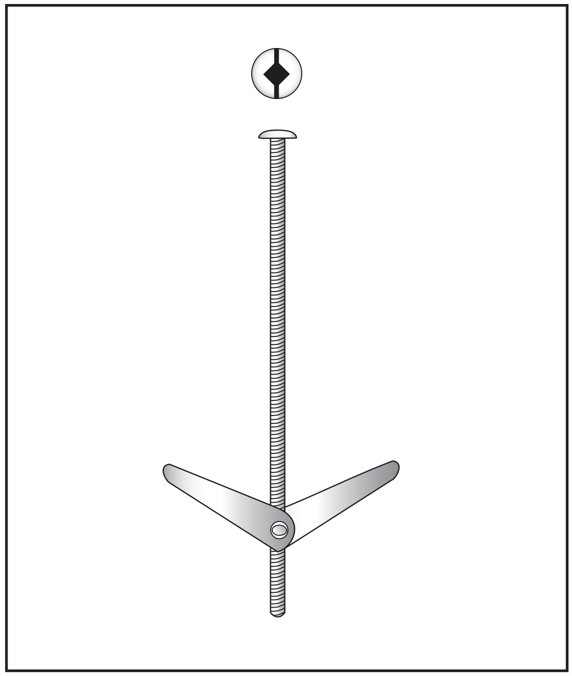
DESIGN DATA

Part No.	Size	Ultimate Tension Load
ALE 141	1/4 X 1	166 lbs (0.79 KN)
ALE 14114	1/4 X 1-1/4	178 lbs (0.74 KN)
ALE 14112	1/4 X 1-1/2	325 lbs (1.45 KN)

TOGGLE BOLT

DESCRIPTION

The UCAN Toggle Bolt is an ideal anchor for fastening into any hollow material. This fastener is manufactured from high quality zinc plated steel with wide bearing arms to create excellent load transfer on the back of the base material. The toggle bolt is available in diameters ranging from 1/8" to 3/8" and bolt lengths up to 6". Its truss combination head style is suitable for Robertson or slot drivers. Toggle heads only are also available.



FEATURES

- Heavy duty nut, redesigned wing and spring
- Fully assembled unit
- Suitable for fastening into hollow base materials
- Removable

TYPICAL APPLICATIONS

- Light fixtures
- Wall or ceiling hangings
- Decorative fixtures
- Hand rails
- Toggle heads can be used with threaded rods for metal deck applications

ANCHOR SELECTION

Part No.	Bolt Diameter	Drill Bit Diameter	Bolt Length
	inch	inch	inch
TOG 182	1/8	3/8	2
TOG183	1/8	3/8	3
TOG184	1/8	3/8	4
TOG3162	3/16	1/2	2
TOG3163	3/16	1/2	3
TOG3164	3/16	1/2	4
TOG3165	3/16	1/2	5
TOG3166	3/16	1/2	6
TOG143	1/4	5/8	3
TOG144	1/4	5/8	4
TOG145	1/4	5/8	5
TOG146	1/4	5/8	6
TOG384	3/8	1	4
TOG385	3/8	1	5
TOG386	3/8	1	6

DESIGN DATA

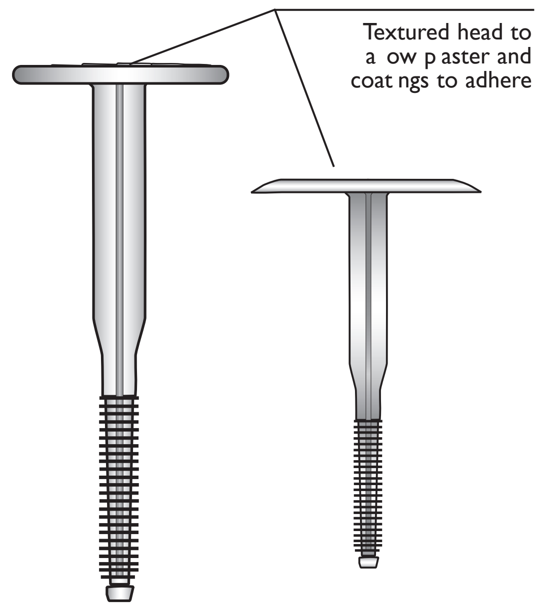
Bolt Size	Ultimate Tension Load Tension	
	Block	Drywall
	lbs	lbs
inch	(kN)	(kN)
1/8	300 (1.33)	120 (0.53)
3/16	470 (2.09)	165 (0.73)
1/4	1,090 (4.87)	175 (0.78)
3/8	1,170 (5.20)	190 (0.85)

Note: Use as guide values only. Actual results may vary depending on base material quality and installation conditions.

MJP INSULATION FASTENER

DESCRIPTION

The UCAN MJP Insulation fastener is made from an impact resistant low density Polyethylene or Polypropylene copolymer material and is used for fastening insulation board to concrete and masonry.



FEATURES

- Simple installation
- No heat loss or transfer
- Special head design ensures bonding of plaster or stucco finishing coats.

TYPICAL APPLICATIONS

- Various types of insulation materials to concrete or masonry

MATERIAL SPECIFICATION

High density Polypropylene Copolymer, UV resistant
High density Polyethylene, UV resistant (MJP614 only)

- in place temperature range - 40 C to +80 C
- installation temperature - 0 C to +40 C

ANCHOR SELECTION

Part Number	Anchor Length inch	Head Diameter inch	Fastens up to inch	Drill bit Diameter inch
MJP234	2-3/4	1-1/2	1-1/2	5/16
MJP512	5-1/2	1-1/2	4	5/16
MJP614	6-1/4	1-1/2	5	5/16
MJX3	3-1/4	1-1/2	2	5/16
MJX4	4-1/2	1-1/2	3-1/2	5/16
MJL234	2-3/4	2-3/8	1-1/2	5/16
MJL332	3-3/4	2-3/8	2-1/2	5/16
MJL412	4-1/2	2-3/8	3	5/16
MJL512	5-1/4	2-3/8	4	5/16

MJP INSULATION FASTENER

DESIGN DATA

Ultimate Loads

Base Material	Tension lbs (kN)	Shear lbs (kN)
Solid Concrete	112 (0.5)	200 (0.9)
Concrete Block	101 (0.4)	170 (0.8)

* The quality of concrete block varies.
Loads are provided as guide value only.

NOTE:
Apply Safety Factor to ensure the working load per anchor does not exceed 1/5 of the tablulated ultimate load, under static loading conditions.

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Brackets [...] indicate alternatives, data required, or need for the specifier to fill in information.

ANCHORS (FASTENERS)

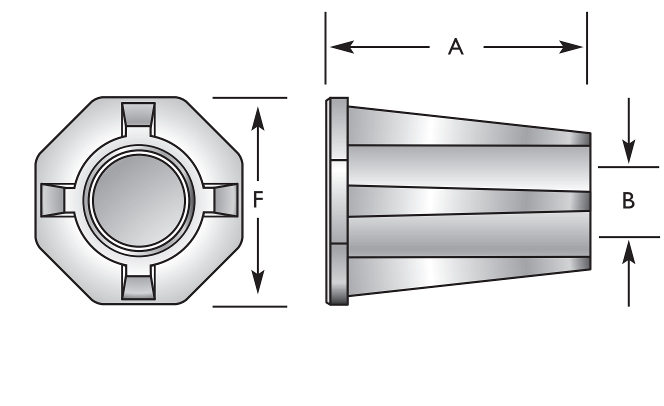
Rigid (soft) insulation shall be installed with UCAN *[MJP, MJX, MJL] Insulation Fastener*, supplied by UCAN Fastening Products. The insulation fastener shall be all plastic and shall be installed according to the manufacturer's instructions.

UCAN astening Products, a division of British astening Systems Ltd. | 55 Champagne Dr., Unit 0, Toronto, ON M3J 2C6 | Te .: 4 6.63 .9400 | ax: 4 6.63 .9426

CAST-IN ZAMAC INSERT

DESCRIPTION

The UCAN Cast-in Place Zamac Insert is designed for pre-planned fastening in concrete. The insert provides rustproof threaded metal holes in precast, pre-stressed or poured-in-place concrete. It is die cast of a zinc alloy (ZAMAC 5), which provides excellent resistance to atmospheric conditions and will not mar or stain finished installations.



FEATURES

- Fastening is simplified when inserts are cast-in prestressed units, slabs and poured in concrete structures
- Preplanned location of inserts eliminates costly concrete drilling and masonry anchor installation
- 100% Rust Proof.

MATERIAL SPECIFICATION

BODY: ZAMAC 5

TYPICAL APPLICATIONS

- Heavy Machinery
- Railings
- Park Benches
- Utility Poles
- Line Machinery
- Air Ducts
- Traffic Lights
- Theater Chairs
- Conveyor Systems
- Electrical

NOTE:

Apply *Safety Factor* to ensure the working load per anchor does not exceed 1/4 of the tablulated ultimate load, under static loading conditions.

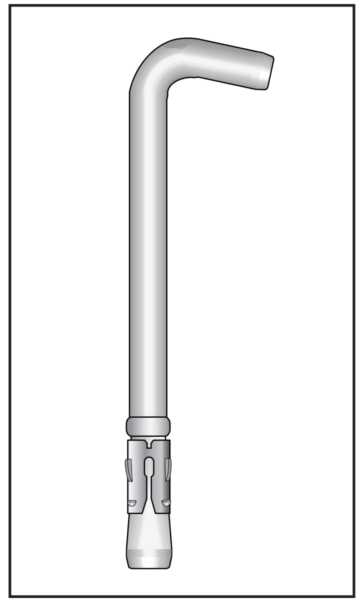
Part No.	Size	Insert Length (A)	Thread Size (B)	Base Width (F)	Full Thread Engagement	Bolt/Rod Dia.	Installation Torque	Ultimate Tension Load (lbf)	
	inch	inch	inch	inch	inch			2,500 psi concrete	5,000 psi concrete
PZI 10	10 24 x 11/16	11/16	10–24	7/16	5/8	10–24	10 inch lbs	642	850
PZI 15	1/4 x 1 1/2	1 1/2	1/4–20	13/16	7/8	1/4	32 inch lbs	2,250	1,240
PZI 24	3/8 x 1	1	3/8–16	7/8	7/8	3/8	8 ft lbs	1,850	2,600
PZI 25	3/8 x 1 3/8	1 3/8	3/8–16	7/8	1 1/8	3/8	8 ft lbs	2,900	4,600
PZI 35	1/2 x 1 1/2	1 1/2	1/2–13	1 1/4	1 1/4	1/2	19 ft lbs	5,068	5,430
PZI 36	1/2 x 2 7/8	2 7/8	1/2–13	1 3/8	2 1/2	1/2	19 ft lbs	6,288	8,995
PZI 45	5/8 x 1 11/16	1 11/16	5/8–11	1 3/8	1 3/8	5/8	40 ft lbs	6,672	6,835
PZI 46	5/8 x 2 7/8	2 7/8	5/8–11	1 9/16	2 1/2	5/8	40 ft lbs	13,375	15,490
PZI 55	3/4 x 1 11/16	1 11/16	3/4–10	1 9/16	1 1/2	3/4	58 ft lbs	6,910	8,205
PZI 56	3/4 x 3	3	3/4–10	1 3/4	2 1/2	3/4	58 ft lbs	14,145	16,375

Note: Loads are provided as guide values only.

HOOK WEDGE ANCHOR (HW 38414B)

DESCRIPTION

The UCAN Hook Wedge Anchor is a high grade steel fastener, designed primarily for wire mesh installation. The anchor consists of a steel body with 1" hooked end and a one piece three segment wrap around expansion clip.



FEATURES

- Wrap around expansion clip provides true 360 expansion
- Non-bottom bearing type
- Fast, simple installation by hammer
- Anchor has follow-up expansion feature
- Rigid, one piece fastening
- Zinc Plated

LIMITATIONS

Not recommended for uncured concrete (less than 7 days of curing).

MATERIAL SPECIFICATIONS

Anchor body
- Grade AISI C1035
  - Minimum tensile strength - 84,000 psi
  - Average yield strength - 56,000 psi

Clip
- Cold rolled steel, AISI C1010 - C118

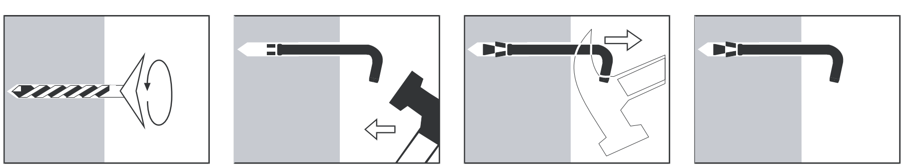
Corrosion protection
- The anchor body and expansion clip are zinc plated.

TECHNICAL DATA

Drilled Hole Diameter	3/8"
Embedment	3-1/2"
Ultimate Tension Load In 5,000 psi Concrete	1,950 lbs
	8.70 kN
Ultimate Shear Load In 2,000 psi Concrete	2,580 lbs
	11.50 kN

Note: Load data is provided as a guide only.

INSTALLATION



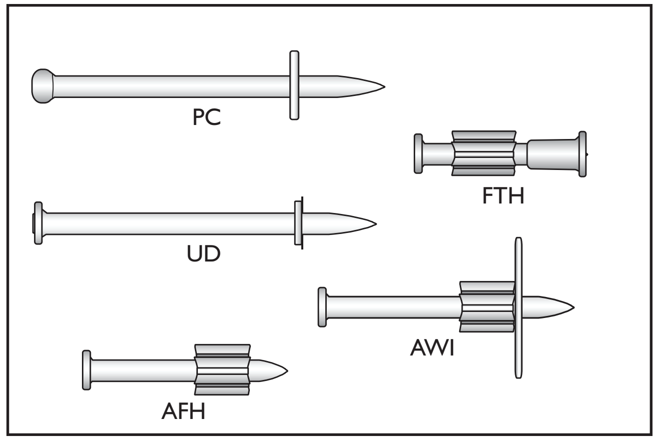
NOTE:

Apply Safety Factor to ensure the working load per anchor does not exceed 1/4 of the tablulated ultimate load, under static loading conditions.

POWDER ACTUATED FASTENING SYSTEM

DESCRIPTION

UCAN powder actuated fasteners are manufactured from high quality spring steel wire. For optimum hardness and toughness, all fasteners are heat treated to a core hardness of RC 50 - 54. To provide protection against corrosion, fasteners are zinc plated to a thickness of minimum 0.0003" (7.5μm).

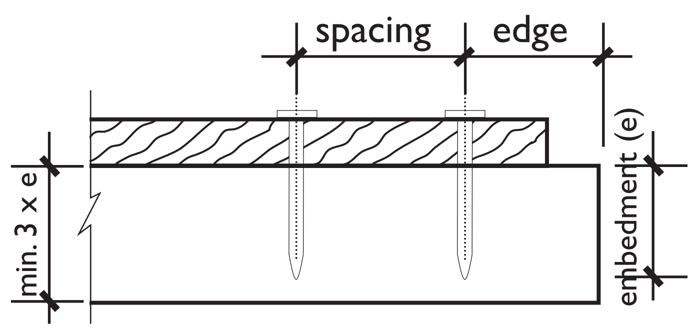


MECHANICAL PROPERTIES

Tensile Strength = 1,800 MPa (269,700 psi)
Shear Strength = 1,160 MPa (168,200 psi)

APPLICATION LIMITS FOR FASTENING TO CONCRETE

1. Do not fasten into cracks or spalled areas
2. Concrete thickness > 4" (100 mm)
3. Min. distance between fasteners > 3" (75 mm)
4. Min. edge distance > 3" (75 mm)
5. Shank Diameter = 0.145"
6. Other influencing factors are: concrete strength, age of concrete, aggregate size.
7. The optimal fastener penetration (e) for maximum holding power in concrete:
   - less than 2000 psi 1-1/2"
   - 2000 psi 1"
   - 5000 psi 3/4"



ALLOWABLE WORKING LOADS IN CONCRETE (LBS)

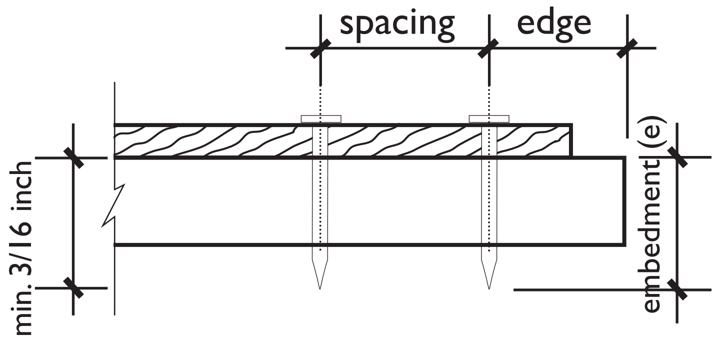
Shank Diameter	Penetration	Concrete Compressive Strength					
		2000 psi		3500 psi		5000 psi	
		Tension	Shear	Tension	Shear	Tension	Shear
0.145”	1”	110	150	180	180	215	200
	1-1/4”	128	180	190	200	222	234
All values shown includes the safety factor of 8:1							

POWDER ACTUATED FASTENING SYSTEM

APPLICATION LIMITS FOR FASTENING TO STEEL

1. Do not fasten into steel thinner than the shank diameter
2. Min. steel thickness = 3/16"
3. Min. distance between fasteners > 2" (50 mm)
4. Min. edge distance > 1/2" (13 mm)
5. Fastener penetration = 3/16" to 1/2"
6. Shank Diameter = 0.145"
7. Other influencing factors are: steel
8. Min. distance from weld > 2" (50 mm)

Do not fasten into pre drilled holes unless the tool is equipped with an alignment device!



ALLOWABLE WORKING LOADS IN STEEL (LBS)

Shank Diameter	Steel thickness (inch)					
	1/4"		3/8"		1/2"	
	Tension	Shear	Tension	Shear	Tension	Shear
0.145"	453	645	511	705	690	705

All values shown includes the safety factor of 5:1

SPECIFICATION

The following sample specification clause is arranged for inclusion in any one of a variety of master specification sections utilizing the Construction Specifications Canada (CSC) format. Square brackets[] indicate alternatives, data required, or need for the specifier to fill in information.

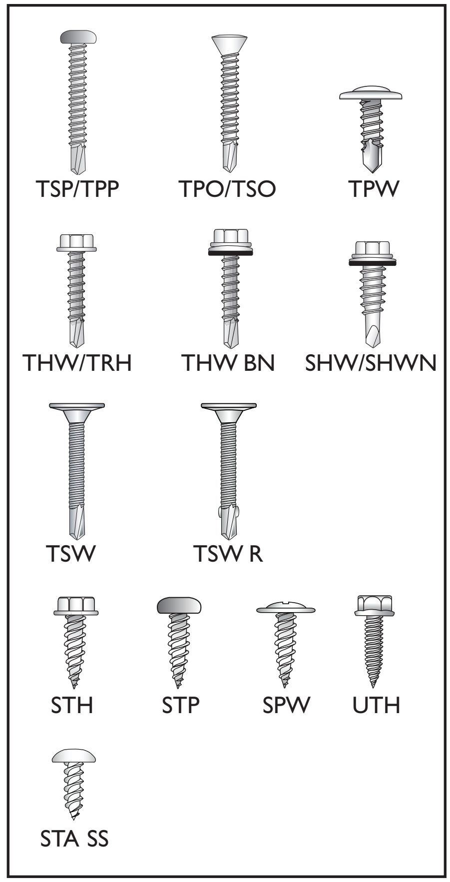
FASTENERS

Fasteners shall be [type and length to suit load and fixture requirements] *Ucan Powder Actuated Fasteners*, supplied by Ucan Fastening Products. Fasteners shall be manufactured from AISI C1062 steel wire, heat treated to a minimum core hardness of 50RC, and zinc plated to a nominal thickness of 0.0003". Fastener installation shall follow Ucan's installation instructions.

U-DRILLS®
SELF DRILLING
SELF TAPPING SCREWS

DESCRIPTION

UCAN U-DRILLS® SDS Self drilling screws and U-DRILLS® STS Self tapping screws are available in an extensive variety of sizes, head styles and point configurations and are capable of drilling a wide range of steel materials. Supplied in carbon or stainless steel, and with optional RUSPRO® coating, U-DRILLS® are well suited to most self drilling and self tapping screw applications. U-DRILLS® are also ideal for use in manufacturing facilities where consistent fastener quality and speed are essential. For custom jobs, U-DRILLS® can be made to order. U-DRILLS® are produced to SAE J78-1998 specifications.



MATERIAL SPECIFICATION

Material Cold heading quality wire
Carbon steel: AISI C1022
Stainless steel: AISI 410
316 (STA 812BSS)

Heat treatment Tempered and case hardened
Case depth: Size #6 - 0.002" -0.007"
Size #8-12 - 0.004" -0.009"
Size 1/4" - 0.005" -0.011"

Surface Hardness 50-56 HRC equivalent
Core Hardness 32-40 HRC equivalent

Corrosion protection
Zinc plating - Plating thickness (0.0002" - 0.00035") as per ASTM F 1941-00
RUSPRO® coating - Non-metallic, multi-layer ceramic coating, resists galvanic corrosion
Corrosion resistance: 1000 hrs salt spray per ASTM B117
20 cycles SO_2 per DIN 50018 - 2.0L SO_2

TECHNICAL DATA

Screw Strength Data

Size	Min. Tensile Capacity (lbf)	Min. Shear Capacity (lbf)	Min. Torsional Strength* (lb-in)	Recommended Drill Speed (rmp)
6-20	1102	652	30	1800 - 2500
8-18	1575	1000	42	
10-16	2100	1400	61	1000 - 1800
10-24	2350	1500	65	
12-14	2800	2000	92	
1/4-14	3850	2600	150	
1/4-20	4275	2700	168	
1/4-28	5033	3310	210	

Note: * Minimum Torsional Strength is as per SAE J78-98

U-DRILLS® SDS SELF DRILLING SCREWS

Ultimate Pullout Values (lbs)

Size	Point	26 ga	24 ga	22 ga	20 ga	18 ga	16 ga	14 ga	12 ga	1/8"	3/16"	1/4"
8-18	2	119	193	265	298	491	703	959	1558			
	3	120	191	239	285	470	663	910	1424	2287		
10-16	2				368	547	784	1033	1653			
	3	124	208	266	299	499	708	967	1474	2077		
10-24	3	121	200	251	333	495	701	900	1375	2070	2612	
	2	156	243	283	375	605	848	1181	1856	2568	3520	
12-14	3	142	211	289	341	551	757	1063	1631	2420	2998	
12-24	4					495	697	986	1532	2441	3485	3844
	5					487	699	913	1527	2207	3701	3999
1/4-14	3	141	231	293	293	613	880	1145	1858	2406	4550	5033
1/4-28	5						615	872	1434	1990	4129	5054

Ultimate Shear Values (lbs)

Size	Point	26 ga	24 ga	22 ga	20 ga	18 ga	16 ga	14 ga	12 ga	1/8"	3/16"	1/4"
8-18	2	294	496	560	740	1060	1078					
	3				730	1090	1210	1214				
10-16	2	312	479	589	830	1206	1268					
	3				728	1266	1540	1552				
12-14	3				769	1358	1620	1970	1986			
1/4-14	1	511	849	885	1244	1764						
	3				930	1442	2100	2584	2650	2820		
12-24	4								2048	2030		
	5									2700	2720	2762
1/4-28	5									3550	3598	3626

INSTALLATION

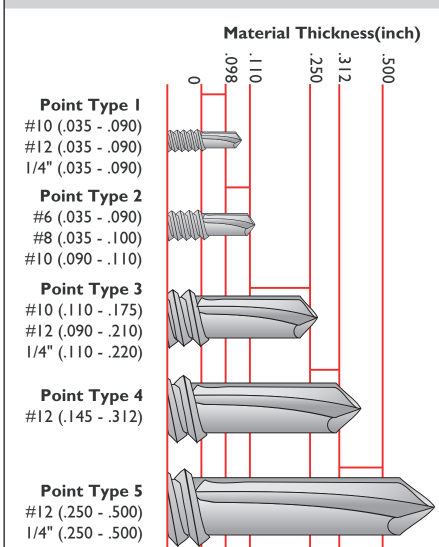
U-Drills self drilling screws are installed into the base material (steel/aluminum) without pre-drilling. The length of the drill point determines the thickness of material to be drilled. For effective drilling use an 1800 – 2500 RPM electric screw gun.

- Always drive self-drilling screws perpendicular to the work surface
- Use torque control when fastening into thin sheet metal

DRIVER SIZES FOR UCAN U-DRILLS®

U-DRILLS®	Magnetic Nut Setter	Square Recess Bit	Phillips Bit
#6	1/4	1	2
#8	1/4	2	2
#10	5/16	2	2
#12	5/16	3	3
#14	3/8	3	3

DRILL POINT CAPACITY



RESISTANCE TO CHEMICALS

UCAN Capsule Anchor's Chemical Resistance (ASTM C 581 -87)

Chemical / Liquid	Conc.(%)	Resistant	Not Resistant
Acetic acid	10	♦	
Acetic acid	98		♦
Acetone	–		♦
Battery acid	–	♦	
Beer	–	♦	
Butanol	100	♦	
Calcium cloride, aqueous solution	any	♦	
Calcium hydroxide, aqueous solution	–	♦	
Carbon tetrachloride	100	♦	
Citric acid	any	♦	
Common salt solution	any	♦	
Communal waste water	–	♦	
Diesel fulel	100	♦	
Engine oil	100	♦	
Ethanol	96		♦
Formaldehyde, aqueous solution	30	♦	
Formic acid	10	♦	
Gasoline	100	♦	
Glycol	100	♦	
Hydrocloric acid	20	♦	
Hydrogen peroxide	30		♦
Lactic acid	any	♦	
Machine oil	100	♦	
Methanol	100		♦
Nitric acid	10	♦	
Petroleum	100	♦	
Phosphoric acid	85	♦	
River water	–	♦	
Sea water	–	♦	
Sodium carbonate, aqueous solution	any	♦	
Sodium chloride, aqueous solution	any	♦	
Sodium hydroxide	20		♦
Sodium silicate	any	♦	
Sulphuric acid	30	♦	
Tap water	–	♦	
Toluene	100		♦
Turpentine	–	♦	
Water	–	♦	

CONVERSION FACTORS

CONVERTING FROM		CONVERTING TO		MULTIPLY BY
LENGTH				
meter	m	yard	yd	1.0936133
meter	m	foot	ft	3.2808399
millimeter	mm	inch	in	0.0393701
yard	yd	meter	m	0.9144
foot	ft	meter	m	0.3048
inch	in	millimeter	mm	25.4
AREA				
square meter	m^2	square foot	sq. ft	10.763910
square millimeter	mm^2	square inch	sq. in.	0.00155
square foot	sq. ft	square meter	m^2	0.092903
square inch	sq. in.	square millimeter	mm^2	645.16
VOLUME				
cubic centimeter	cm^2	[US] fluid ounce	oz. fl.	0.033814
cubic centimeter	cm^3	cubic inch	in^3	0.061024
[US] fluid ounce	oz. fl.	cubic centimeter	cm^3	29.57373
cubic inch	in^3	cubic centimeter	cm^3	16.38706
cubic inch	in^3	[US] fluid ounce	oz. fl.	0.5541
[US] fluid ounce	oz. fl.	cubic inch	in^3	1.8047
FORCE				
kilonewton	kN	kilo-pound (force)	kip	0.2248089
newton	N	pound (force)	lbf	0.2248089
kilo-pound (force)	kip	kilonewton	kN	4.44822
pound (force)	lbf	newton	N	4.44822

CONVERTING FROM		CONVERTING TO		MULTIPLY BY
PRESSURE OR STRESS (FORCE PER AREA)				
megapascal	MPa	pound (force) / square inch	psi	145.0377
megapascal	MPa	kilo-pound (force) / square inch	ksi	0.1450377
kilopascal	kPa	pound (force) / square inch	psi	0.1450377
megapascal	MPa	newton / square millimeter	N/mm^2	1
pound (force) / square inch	psi	megapascal	MPa	0.006895
pound (force) / square inch	psi	kilopascal	kPa	6.895
kilo-pound (force) / square inch	ksi	megapascal	MPa	6.895
BENDING MOMENT / TORQUE				
newton - meter	Nm	foot - pound	ft lbs	0.737562
foot - pound	ft lbs	newton - meter	Nm	1.355818
TEMPERATURE				
degree Fahrenheit	°F	degree Celsius	°C	5/9 x (°F - 32)
degree Celsius	°C	degree Fahrenheit	°F	[9/5 x (°C)] + 32
OTHER				
mass per unit area	lb./sq.ft	mass per unit area	kg/m^2	4.882
mass per unit length	lb./ft	mass per unit length	kg/m	1.48

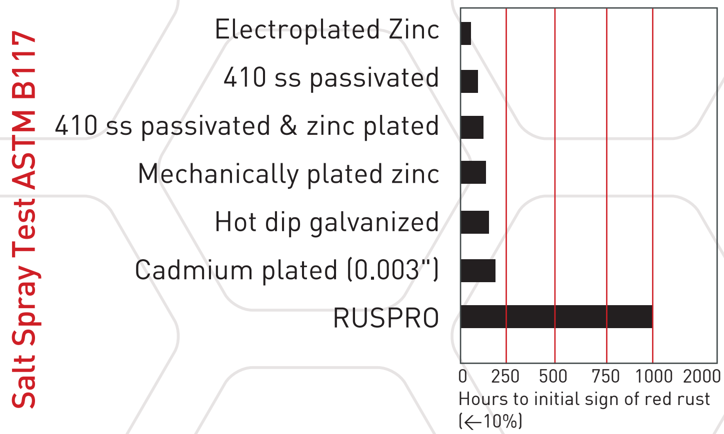
DATA SHEET

UCAN FASTENING PRODUCTS

RUSPRO® COATING

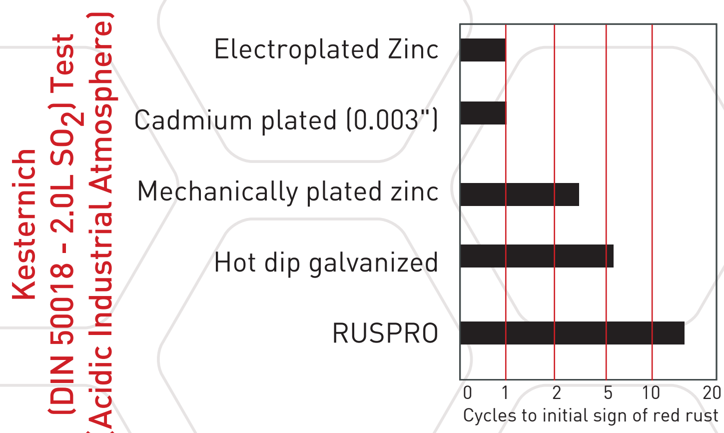
DESCRIPTION

The UCAN RUSPRO® multi layer coating was developed to provide outstanding resistance against road salt, humidity, solvents and other corrosive elements. This protective coating consists of successive layers of zinc and phosphate as well a baked-on top coat of ceramic silicon resin. In addition to the superior corrosion protection, the UCAN RUSPRO® coating has excellent resistance to abrasion and galvanic corrosion.



KEY ADVANTAGES

- Exceptional corrosion resistance
- Excellent acid (SO_2) resistance
- Bonded multi layer coating to resist abrasion
- Available in a variety of colours such as silver, blue and white



PERFORMANCE DATA

Salt Spray Resistance (ASTM B117 - 03)	1,000 hours (5-10% red rust)
Kesternich Test DIN 50028 - (2.0 liter SO2)	15-20 cycles (←10% red rust)
Typical coating composition:	4.0 microns (0.00016") zinc plating 1.0 microns (0.00004") phosphate 5.0 microns (0.0002") ceramic top coat

QUALITY | INNOVATION | SERVICE

UCAN FASTENING PRODUCTS
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