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DIVISION: 03—CONCRETE
Section: 03151—Concrete Anchoring

DIVISION: 04—MASONRY
Section: 04081—Masonry Anchorage

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EVALUATION SUBJECT:

CIA-GEL 7000 EPOXY, CIA-EA EPOXY ACRYLATE AND DUC UNDERCUT ANCHORS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2000 *International Building Code*® (IBC)
- 2000 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)

Properties evaluated:

Structural

2.0 USES

The anchoring systems are alternatives to the cast-in-place anchors described in Sections 1912 and 2107.1.5 of the IBC and Sections 1923.1 and 2107 of the UBC. The anchors are permitted to be used where an engineered design is submitted in accordance with Section R301.1.2 of the IRC.

3.0 DESCRIPTION

3.1 Covert Injection Adhesive:

3.1.1 General: The Covert Injection Adhesive (CIA) is a two-component structural epoxy adhesive for anchoring stud-type, threaded steel anchor bolts or deformed steel reinforcing bars into concrete and unreinforced brick. The adhesive formulation is designated as CIA-Gel 7000. The CIA-Gel adhesive anchors consist of CIA-Gel 7000 epoxy and a threaded steel rod, with a nut and washer, or deformed steel reinforcing bars. The installation in normal-weight concrete, structural lightweight concrete, unreinforced brick masonry, reinforced brick masonry, and concrete foundation walls is described in Sections 4.1.2 through 4.1.6 in this report.

3.1.2 Materials:

3.1.2.1 Adhesive: The CIA-Gel 7000 epoxy two-component adhesive is packaged in equal-volume, side-by-side plastic cartridges. The cartridges are sealed individually with D-shaped plugs and/or a screw-on cap, which may be reused after partial use of contents. The epoxy is mixed when dispensed through a spiral motionless mixer attached to the cartridge. The epoxy shall be dispensed with either a manual or a pneumatically activated tool. The CIA-Gel 7000 epoxy adhesive components have a shelf life of one year when stored in a dry environment at a temperature of 70˚F (21˚C). The hardening times are noted in Table 3.

3.1.2.2 Threaded Rods: All threaded rods are manufactured from steel complying with ASTM A 307, Grade C [F_u = 60,000 psi (400 MPa), minimum]; ASTM A 193, Grade B7; [F_u = 125,000 psi (860 MPa), minimum]; or ASTM F 593, Grade F 593A [F_u = 115,000 psi (795 MPa), minimum], SS304. Specifications and installation details for threaded rods are noted in Table 1.

3.1.2.3 Reinforcing Bars: Deformed reinforcement bars are manufactured from steel complying with ASTM A 615, Grade 60. Specifications and installation details for reinforcing bars are noted in Table 2 in this report.

3.2 Covert Operations Ductile Undercut (DUC) Anchors:

The DUC anchor is designed to be a ductile anchor that transfers loads from the anchor stud and sleeve to the concrete through bearing. The DUC anchors consist of three main components: an expander coupling, an expansion sleeve and a threaded rod. The anchors are available in $^3/_8$-inch, $^1/_2$-inch, $^5/_8$-inch and $^3/_4$-inch (9.5 mm, 12.7 mm, 15.9 mm and 19 mm) diameters. The threaded rod used with the 60 series anchors complies with the ASTM A 36 specification. The threaded rod used with the 125 series anchors complies with the ASTM A 193, Grade B7, specification. The 60 series rods have a zinc chromate finish and the 125 series rods have a yellow chromate finish. The expanded anchor sleeve creates a mechanical interlock with the surrounding concrete. The installation data is described in Section 4.2.2 and Table 15 of this report.

3.3 CIA-EA Adhesive:

3.3.1 General: The Covert Injection Adhesive (CIA) is a two-component structural epoxy acrylate adhesive for anchoring stud-type, threaded steel anchor rods or deformed steel reinforcing bars in concrete. The adhesive formulation is designated as CIA-EA. The CIA-EA adhesive anchors consist of CIA-EA epoxy acrylate and a threaded steel rod, with a nut and washer, or deformed steel reinforcing bars. The installation in normal-weight concrete is described in Section 4.3.2 in this report.

3.3.2 Materials:

3.3.2.1 Adhesive: The CIA-EA epoxy acrylate two-component adhesive is packaged in unequal-volume, side-by-

side, plastic cartridges. The cartridges are sealed individually with D-shaped plugs and/or a screw-on cap, which may be reused after partial use of contents. The epoxy acrylate is mixed when dispensed through a spiral motionless mixing nozzle attached to the cartridge. The epoxy acrylate may be dispensed with either a manual or a pneumatically activated tool. The CIA-EA epoxy adhesive components have a shelf life of one year when stored at temperatures ranging from 40˚F to 75˚F (4.4˚C to 23.8˚C). The recommended hardening times are noted in Table 20 in this report.

3.3.2.2 Threaded Rods: Same as those described in Section 3.1.2.2 of this report.

3.3.2.3 Reinforcing Bars: Same as those described in Section 3.1.2.3 of this report.

4.0 DESIGN AND INSTALLATION

4.1 Covert Injection Adhesive:

4.1.1 Design: Design applies to both the UBC and the IBC. Allowable tension and shear values for threaded rod or reinforcing bar are described in Tables 5 through 14 and Tables 25 and 26 in this report. The CIA-Gel 7000 Adhesive anchors in concrete may be used to resist long-term loads such as dead or live loads. They may also be used to resist wind and earthquake forces for compliance under the UBC and IBC for anchors installed in accordance with Section 4.1.2 in this report. The allowable load values shown in Tables 5, 6, 7, 25 and 26 may be increased in accordance with Section 1612.3.2 of the UBC and Section 1605.3.2 of the IBC for wind or earthquake forces. The allowable loads in Table 8 may not be increased for wind or earthquake forces. The allowable tension load values noted in Tables 5 through 14 and Tables 25 and 26 shall be adjusted for in-service temperatures in accordance with Figure 1 in this report, when anchors are installed in locations where the concrete temperatures may exceed 105˚F (41˚C). Allowable loads for sill plate and close edge distances are noted in Tables 25 and 26 of this report. Allowable loads for anchors subjected to combined shear and tension forces shall be determined by the following equation:

$$\left(\frac{P_s}{P_t}\right)^n + \left(\frac{V_a}{V_t}\right)^n \le 1.0$$

where:

P_s = Applied service tensile load.

P_t = Allowable service tensile load.

V_a = Applied service shear load.

V_t = Allowable service shear load.

n = 1 for unreinforced brick masonry.

n = $^5/_3$ for concrete and concrete masonry.

CIA-GEL 7000 Adhesive Anchors installed in structural lightweight concrete, concrete masonry, and reinforced brick masonry may be used to resist long-term loads, such as dead or live loads. They may also be used to resist wind loads, but not seismic loads. The values shown in the tables of this report for these types of installations, may not be increased in accordance with Section 1612.3.2 of the UBC and Section 1605.3.2 of the IBC for wind loads.

4.1.2 Installation in Concrete:

4.1.2.1 General: A hole is drilled to the specified depth with a handheld electro-pneumatic rotary hammer drill using carbide-tipped drill bits conforming to ANSI Specification B212.15-1994. The holes shall be cleaned of dust and debris with a nylon brush and a jet of compressed air. The hole diameter, anchor embedment, spacing and edge distances shall comply with Tables 5 to 10, 13 and 14 in this report. A mixing nozzle shall be attached to the adhesive cartridge and the assembly placed into the hand or pneumatic injection tool. Before placement into the hole, a small amount of epoxy shall be pumped out of the nozzle until a uniform gray material is achieved. Holes shall be approximately half-filled with the mixed epoxy. The threaded rods or deformed reinforcement bars shall be inserted with a rotating motion until the anchor contacts the bottom of the hole. The adhesive shall be level with the concrete surface after insertion of the rod or bar. Oil, scale, and rust shall be removed from the threaded rod or reinforcing bar prior to installation. During anchor installation, the hole and surrounding location may be wet, and any standing water need not be removed from the hole. Anchors shall not be loaded until cure time has passed.

4.1.2.2 Special Considerations: The anchors may be used within fire-resistive construction, provided the anchors only resist wind and/or seismic forces. In this application, the anchors shall not resist gravity loads, unless special consideration is given to fire conditions.

4.1.3 Installation in Unreinforced Brick Masonry Walls:

4.1.3.1 General: Anchors installed in unreinforced masonry using the CIA-Gel 7000 adhesive shall be designed to resist seismic loads. The existing unreinforced brick walls shall have a minimum thickness of 13 inches [330 mm (3 wythes of brick)].

Three types of anchor assemblies can be used for seismic retrofitting. The anchor assembly resisting tension and shear loads where the outside of the wall is not accessible is the “combination” anchor. The anchor shall be installed in the wall at an angle of $22^1/_2$ degrees to the horizontal. The anchor consists of a $^3/_4$-inch-diameter (19.1 mm) ASTM A 307 prebent threaded rod used with a $^{15}/_{16}$-inch-outer-diameter (23.8 mm) screen tube, 13 inches (330 mm) long and made of steel wire cloth. The threaded rod shall be embedded a minimum of 13 inches (330 mm) at the $22^1/_2$-degree angle. Figure 2 in this report provides details of an installed “combination” anchor.

The anchor assembly for tension and shear applications where the outside of the wall is accessible is the “through-bolt” anchor. The assembly consists of $^5/_8$-inch-diameter (15.9 mm) ASTM A 307 threaded rod; a $^{13}/_{16}$-inch (20.6 mm) O.D. by $^{11}/_{16}$-inch (17.5 mm) I.D. AISI 1010 steel sleeve 8 inches (203 mm) in length; a $^{15}/_{16}$-inch-diameter-by-8-inch-long (23.8 mm by 203 mm) wire mesh screen tube; and an ASTM A 36 steel plate measuring 6 inches by 6 inches by $^3/_8$ inch (152 mm by 152 mm by 9.5 mm). The plate shall be bolted to the opposite side of the wall. The steel sleeve has a plastic plug at one end to prevent leakage of adhesive during installation. Figure 3 provides details of an installed “through-bolt” anchor.

The anchor assembly resisting shear load where the outside wall is inaccessible is the “shear” anchor. The assembly consists of a $^3/_4$-, $^5/_8$- or $^1/_2$-inch-diameter (19.1, 15.9, or 12.7 mm) ASTM A 307 threaded rod or a No. 6, No. 5 or No. 4 reinforcing bar and a $^{15}/_{16}$-inch-diameter-by-8-inch-long (23.8 mm by 203 mm) wire mesh screen tube. Figure 4 provides details of an installed “shear” anchor.

4.1.3.2 Installation: One-inch-diameter (25.4 mm) holes shall be drilled using standard carbide-tipped masonry drill bits which meet ANSI Specification B212.15-1994. A rotary drill, or rotary hammer drill set on “rotation only,” shall be used to drill the holes.

Holes for the “combination” anchors (Figure 2 in this report) shall be drilled 13 inches (330 mm) deep at a $22^1/_2$-degree angle. Holes for the “through-bolt” anchors (Figure 3) and the

"shear" anchors (Figure 4) shall be drilled perpendicular to the wall. For the "through-bolt" application, the holes shall be drilled completely through the wall. For shear anchors, the holes shall be drilled 8 inches (203 mm) deep. The holes shall be cleaned using a nylon brush and a jet of compressed air. An extension nozzle shall be used to reach the back of the hole with compressed air.

Screen tubes shall be completely filled with CIA-Gel 7000 epoxy and placed into the drilled holes. A $^3/_4$-inch-diameter (19.1 mm) threaded rod for the "combination" anchors and "shear" anchors, and $^7/_8$-inch-diameter (22 mm) steel sleeves for the "through-bolt" anchors, shall be slowly pushed into the screen tube, while being rotated continuously. The anchors or steel sleeves shall be allowed to cure for the times listed in Table 3 before anchors are loaded. Bolt-up time refers to that period of cure after which hardware may be placed and nuts tightened. Care shall be taken not to overtighten nuts nor induce tension in the bolts. Design loads may not be applied until minimum cure time has been reached.

For the through-bolted anchor, a 1-inch-diameter (25.4 mm), 8-inch-deep (203 mm) hole shall be drilled and cleaned as noted above. A $^7/_8$-inch-outside-diameter (22 mm) steel sleeve shall be pushed into an adhesive-filled screen in a manner similar to the rod. After curing, a hole shall be drilled through the sleeve and through the remainder of the masonry wall. Drilling shall be continued until the entire wall is penetrated. The $^5/_8$-inch-diameter (15.9 mm) rod shall be inserted and fitted with a plate and nut to complete the through-bolted anchor connection. See Figure 3 for additional details.

4.1.3.3 Conditions of Acceptance: Conditions of acceptance for threaded rods and reinforcing bars in unreinforced brick masonry shall be as follows:

4.1.3.3.1 Threaded Rods and Through-bolts in Tension and Shear:

a. Installation of threaded rods and through-bolts shall comply with Section 4.1.3 in this report.

b. Maximum allowable tension load for the $^3/_4$-inch-diameter (19.1 mm) bent threaded rod or the $^5/_8$-inch-diameter (15.9 mm) through-bolt shall be 1,200 pounds (5340 N), with no increase for lateral loading.

c. The maximum allowable shear load for the $^3/_4$-inch-diameter (19.1 mm) bent threaded rod shall be 1,000 pounds (4450 N) and for the $^5/_8$-inch (15.9 mm) through-bolt shall be 750 pounds (3338 N), with no increase for lateral loading permitted.

d. For the $^3/_4$-inch-diameter (19.1 mm) bent threaded rod or the $^5/_8$-inch-diameter (15.9 mm) through-bolt subjected to tension and shear, the allowable combined load shall be determined using the equation in Section 4.1.1 in this report.

e. Minimum wall thickness shall be 13 inches [330 mm (three wythes of brick)].

f. The allowable tension and shear shall be applicable only to anchors installed in walls where in-place shear tests indicate a minimum mortar strength of 50 psi (345 kPa), net.

4.1.3.3.2 Threaded Rods or Reinforcing Bars in Shear:

a. Installation of threaded rods and reinforcing bars intended to resist shear only shall comply with Section 4.1.3.

b. The allowable shear load for the $^3/_4$-inch-diameter (19.1 mm) rod shall be 1,000 pounds (4450 N), and for the No. 6, No. 5 and No. 4 reinforcing bars the allowable shear loads shall be 1,000, 750 and 500 pounds (4450, 3338 and 2225 N), respectively. No increase for lateral loading shall be permitted with the above-noted loads.

c. Minimum wall thickness shall be 13 inches [339 mm (three wythes of brick)].

d. Allowable shear value shall be applicable only to anchors installed in walls where in-place shear tests indicate a minimum mortar strength of 50 psi (345 kPa) net.

4.1.3.3.3 Field Inspection:

a. Five percent of resisting tension anchors, threaded rods, and through-bolts shall be tested in accordance with the procedure described in ASTM E 488-90, with a minimum of two tests required. Where the wall thickness varies, at least one test shall be performed on an anchor which has the minimum embedment. Tests shall show that bolts can maintain a tensile load of 3,000 pounds (13.35 kN) for five minutes. The test report shall include:

   1. Test location(s)
   2. Brick/mortar condition
   3. Bolt movement/elongation
   4. Embedment depth
   5. Applied load

b. Twenty-five percent of installed anchors resisting tension and shear shall be tested by a special inspector using a torque-calibrated wrench. The torque for the $^1/_2$-inch-diameter (12.7 mm) anchors, the $^5/_8$-inch-diameter (15.9 mm) anchors and the $^3/_4$-inch-diameter (19.1 mm) anchors shall be 40 foot-pounds, 50 foot-pounds and 60 foot-pounds (54.2 N-m, 67.8 N-m and 81.3 N-m), respectively. No visible deflection or deformation shall be permitted during the above-noted torque tests.

c. Twenty-five percent of installed threaded rods and reinforcing bar anchors resisting shear shall be tested by a special inspector using a torque-calibrated wrench. The torque for the $^3/_4$-inch-diameter (19.1 mm) rod and the No. 6 reinforcing bar shall be 60 foot-pounds (81.3 N-m). For the No. 5 and No. 4 reinforcing bars, the torque shall be 50 foot-pounds and 40 foot-pounds (67.8 N-m and 54.2 N-m), respectively.

4.1.3.4 Miscellaneous: The Covert Injection Adhesive Anchors are intended for resisting short-term lateral loads only, such as wind or seismic loads. The anchors must be approved by the responsible design engineer and installed under special inspection in accordance with Section 4.4 in this report.

The anchor edge distances and vertical and horizontal spacings for the three types of anchor assemblies described in Section 4.1.3.1, shall comply with Table 12.

4.1.4 Installation in Concrete Foundation Walls: CIA-Gel 7000 adhesive can be used in concrete foundation walls utilizing $^5/_8$-inch- and $^7/_8$-inch-diameter (15.9 mm and 22 mm) anchors. The anchors are threaded rods complying with ASTM A 193, Grade B7, A307 or SS304. The anchors shall be installed in minimum 2,500 psi (17.3 MPa) normal-weight concrete. The installation is described in Section 4.1.2. The allowable tension loads, embedment depths, end and edge distances are shown in Table 9.

4.1.5 Installation in Unreinforced, Grouted, Concrete Masonry Walls: CIA-Gel 7000 adhesive can be installed in unreinforced, grouted concrete masonry walls, utilizing $^3/_8$-inch-, $^1/_2$-inch-, $^5/_8$-inch- and $^3/_4$-inch-diameter (9.5 mm, 12.7 mm, 15.9 mm and 19.1 mm) anchors designed to resist tension and shear loads. The anchors are threaded rods as described in Section 3.1.2.2 . The anchors shall be installed

in minimum 2,300 psi (15.9 MPa) grouted concrete masonry. The existing unreinforced concrete masonry walls shall have a minimum thickness of 8 inches (203 mm). The installation is described in Section 4.1.2. Allowable loads, embedment depths, and end and edge distances are noted in Table 10.

4.1.6 Installation in Reinforced Brick Masonry Walls: CIA-Gel 7000 adhesive can be installed in brick masonry walls, utilizing $^1/_2$-inch- and $^3/_4$-inch-diameter (12.7 mm and 19.1 mm) anchors. The anchors are threaded rods complying with ASTM A 193, Grade B7. The existing reinforced brick wall shall have a minimum thickness of 9 inches (229 mm). The anchors shall be installed in masonry units having a minimum 1,300 psi (8.9 MPa) strength. Installation is described in Section 4.1.2. Allowable loads are noted in Table 11.

4.2 Covert Operations Ductile Undercut (DUC) Anchors:

4.2.1 Design General: The DUC Undercut anchors may be used to resist wind and earthquake forces for compliance under the UBC and the IBC, when installed in accordance with this report. The load values may be adjusted in accordance with Sections 1909.2 and 1923.2 of the UBC for strength design and Section 1612.3 of the UBC for service design. The load values may be adjusted in accordance with Section 1605.2 of the IBC for strength design and Section 1605.3.2 of the IBC for service design.

4.2.1.1 1997 *Uniform Building Code* (UBC): Allowable service loads in tension and shear under the UBC are noted in Tables 16 and 17, respectively. Strength design tension and shear values under the UBC are noted in Tables 18 and 19, respectively.

Loads for DUC undercut anchors subjected to combined shear and tension loads shall be determined by the following equation:

$$(P_s/P_t) + (V_s/V_t) \leq 1$$

where:

P_s = Applied tension load.

P_t = Design tension load.

V_s = Applied shear load.

V_t = Design tension load.

4.2.1.2 2000 *International Building Code* (IBC): Strength design of DUC anchors for tension and shear loads under the IBC shall comply with Section 1913 of the IBC. The following conditions shall apply:

a. Installation shall be limited to regions where analysis indicates no cracking at service loads.

b. Installation is permitted only in normal-weight concrete.

c. Design values in Table 15 shall be used.

d. The term "*l*" is the lesser of $8d_o$ or h_{ef}.

e. Only Condition B defined in Sections 1913.4.4 and 1913.4.5 of the IBC shall be used for design regardless of whether supplementary reinforcement is provided.

f. Special inspection in accordance with Section 4.4 of this report is provided.

4.2.2 Installation of DUC Anchors: A hole shall be drilled with a carbide-tipped drill bit with the same nominal diameter as the required hole diameter (see Table 15). The drill bit shall conform to the tip diameter tolerances of ANSI Specification B212.15-1994. The hole shall be drilled to the minimum depth required in Table 15. Dust and debris shall be cleaned from the hole using a nylon brush and a blowout bulb or compressed air. The undercutting drill bit shall be attached to a small rotary hammer drill. The drill shall be set into the rotary hammer mode and inserted into the hole. The drill shall be turned on and the drill bit pushed slowly into the hole. The undercutting process begins once the drill bit bottoms out in the hole, and shall be completed when the spring-loaded collar is fully compressed (gap closed). Dust and debris shall be cleaned out of the hole using a blowout bulb or compressed air. A washer and nut shall be placed on the anchor. The anchor shall be driven through the material to be anchored and into the work surface until the nut and washer are snug with the material to be attached or until the anchor bottoms out in the hole. The nut shall be turned until finger-tight, then turned several full turns using a wrench until the expansion sleeve is set. Should the threaded rod spin inside the sleeve, a screw driver or similar tool shall be placed in the slot to prevent the threaded rod from spinning. A torque wrench shall be used to apply the appropriate amount of installation torque as listed in Table 15 of this report.

4.3 CIA-EA Adhesive:

4.3.1 Design: Allowable tension and shear values for threaded rod or reinforcing bar are described in Tables 21 through 24 and Tables 27 and 28 of this report. The anchors may be used to resist live, dead, wind and seismic loads. The allowable shear and tension load values noted in Tables 21 through 24 and Tables 27 and 28 shall be adjusted for in-service temperatures in accordance with Figure 2, when anchors are installed in locations where the concrete temperatures may exceed 70˚F (21.1˚C). Tabulated values shown in Tables 21 through 24 and Tables 27 and 28 may be increased in accordance with Section 1612.3.2 of the UBC or Section 1605.3.2 of the IBC for wind or seismic loads. Allowable loads for anchors subjected to combined shear and tension forces shall be determined by the following equation:

$$\left(\frac{P_a}{P_t}\right) + \left(\frac{V_a}{V_t}\right) \leq 1.0$$

where:

P_a = Applied service tensile load.

P_t = Allowable service tensile load.

V_a = Applied service shear load.

V_t = Allowable service shear load.

4.3.2 Installation in Concrete: A hole shall be drilled to the specified depth with a handheld electro-pneumatic rotary hammer drill using carbide-tipped drill bits conforming to ANSI Specification B212.15-1994. The embedment shall be less than 1.5 times the concrete thickness. The hole shall be cleaned of dust and debris with a nylon brush and a jet of compressed air. The hole diameter, anchor embedment, spacing and edge distances shall comply with Tables 1 and 2 and 21 to 24. A mixing nozzle shall be attached to the adhesive cartridge and the assembly placed into the hand or pneumatic injection tool. Before placement into the hole, a small amount of adhesive shall be pumped out of the nozzle until a uniform gray material is achieved. Holes shall be approximately half-filled with the mixed adhesive. The threaded rods or deformed reinforcement bars shall be inserted with a rotating motion until the anchor contacts the bottom of the hole. The adhesive shall be level with the concrete surface after insertion of the rod or bar. Oil, scale, and rust shall be removed from the threaded rod or reinforcing bar prior to installation. During anchor installation, the hole and surrounding location shall be surface dry. Anchors shall not be loaded until adhesive cure time has passed.

4.4 Special Inspection:

Adhesive anchor installations require continuous special inspection in accordance with Section 1701 of the UBC and Section 1704 of the IBC. The special inspector shall record product description (including product name), adhesive expiration date, concrete type and strength, anchor diameter and steel grade, compliance of drill bit with this report, hole diameter and location, cleanliness of hole and anchor, adhesive application, anchor embedment, and verification that anchor installation is in accordance with the manufacturer's published installation instructions and this report. The manufacturer's instructions shall be included in each package.

For the DUC Undercut anchors, compliance with Section 1701 of the UBC and Section 1704 of the IBC is necessary when special inspection is required. The special inspector shall be on the jobsite continuously during anchor installation to verify anchor type, anchor dimensions, concrete type, concrete compressive strength, hole dimensions, hole cleanliness, anchor spacings, edge distances, slab thickness, anchor embedment and tightening torque.

5.0 CONDITIONS OF USE

The anchoring systems described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The anchors are installed in accordance with this report and the manufacturer's installation instructions. The anchor size, minimum embedment depths, spacing and edge distances shall conform to applicable tables in this report.

5.2 Calculations and construction drawings verifying compliance with the applicable code and this report shall be submitted to the building official. The calculations and construction drawings shall be prepared by a registered design professional where required by the statues of the jurisdiction in which the project is to be constructed.

5.3 The CIA-Gel 7000 adhesive anchors installed in unreinforced masonry walls in accordance with Section 2.1.5 of this report may only be used to resist short-term lateral loads, such as wind or seismic loads.

5.4 Since an ICC-ES acceptance criteria for adhesive and undercut anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under these conditions is beyond the scope of this report.

5.5 Anchors are not permitted for use in conjunction with fire-resistive construction. Exceptions would be: anchors resist wind or seismic loading only; for other than wind or seismic loading, special consideration is given to fire exposure conditions.

5.6 Since an ICC-ES acceptance criteria for anchors in cracked concrete or masonry is unavailable at this time, the use of anchors is limited to installation in uncracked concrete or masonry. Cracking occurs when $f_t > f_r$ due to service loads or deformations.

5.7 Adhesive anchors may be used to resist tension and shear forces in overhead or wall installations only if consideration is given to the effects of elevated temperature conditions on anchor performance. Figure 1 describes load reductions for elevated temperatures.

5.8 The use of the CIA-Gel 7000 adhesive anchors in conjunction with carbon steel threaded rods and/or reinforcing bars is limited to interior exposure. Installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 21-1-1 of UBC Standard 21-1 or Figure 1 of ASTM C 62-97a (IBC or IRC), are permitted where SS304 stainless steel anchors are used. The use of the DUC Undercut anchors is limited to interior use.

5.9 Special inspection in accordance with Section 2.3 shall be provided for all adhesive anchor installations. Special inspection is required for DUC anchors under the conditions described in Section 2.3 of this report.

5.10 For CIA-GEL 7000 adhesive anchors, during anchor installation, the hole and surrounding location are permitted to be dry, damp, or wet, including the presence of standing water.

5.11 The use of CIA-EA adhesive anchors shall be limited to interior use locations or areas of moderate or negligible exterior weather conditions as defined by Figure 21-1-1 of UBC Standard 21-1 or Figure 1 of ASTM C 62-97a.

5.12 For CIA-EA adhesive anchors, standing water shall be removed from drilled holes.

5.13 The CIA-Gel 7000 and CIA-EA adhesive anchors and the DUC Undercut anchors are manufactured in Signal Hill, California, under a quality control program with inspections by CEL Consulting (AA-639).

6.0 EVIDENCE SUBMITTED

In addition to a quality control manual, the following evidence was submitted:

6.1 CIA-GEL 7000 Anchors: Data in accordance with the ICC-ES Acceptance Criteria for Adhesive Anchors in Concrete or Masonry Elements (AC58), dated November 2001, including reports of seismic tests, freezing and thawing tests, creep tests, and damp and water-filled hole tests.

6.2 CIA-GEL 7000 Anchors in Unreinforced Masonry: Data in accordance with the ICC-ES Acceptance Criteria for Unreinforced Masonry Anchors (AC60), dated January 1995.

6.3 DUC Undercut Anchors: Reports of static and seismic tests in both shear and tension.

6.4 CIA-EA Anchors: Data in accordance with the ICC-ES Acceptance Criteria for Adhesive Anchors in Concrete or Masonry Elements (AC58), dated November 2001, including reports of creep tests and low-temperature tests.

7.0 IDENTIFICATION

The CIA-Gel 7000 shall be identified by a label on the cartridge displaying the name and address of the manufacturer (USP Structural Connectors), the words "CIA-Gel 7000," general installation instructions, the expiration date, the weight and the evaluation report number (ESR-1702). Steel sleeves and screen tubes are identified by a label on boxes displaying the name and address of the manufacturer (USP Structural Connectors) and size and quantity of the contents. Threaded rods and bars shall be identified by material certification. The DUC anchors shall be identified by a label on the boxes displaying the name and address of the manufacturer (USP Structural Connectors), size and quantity of the contents, evaluation report number (ER-1702) and name of the inspection agency (CEL Consulting).

TABLE 1—SPECIFICATION AND INSTALLATION DETAILS FOR THREADED ROD INSTALLED WITH COVERT INJECTION ADHESIVES

PARAMETER	ROD DIAMETER, *d* (inches)						
	$^3/_8$	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$
d_{o1} Nominal bit diameter (in.)/CIA-GEL	$^1/_2$	$^5/_8$	$^3/_4$	$^7/_8$	1	$1^1/_4$	$1^1/_2$
d_{o2} Nominal bit diameter (in.)/CIA-EA	$^7/_{16}$	$^9/_{16}$	$^{11}/_{16}$	$^{13}/_{16}$	$^{15}/_{16}$	$1^1/_8$	$1^3/_8$
A_s Tensile stress area (in.^{2})	0.0775	0.142	0.226	0.334	0.462	0.606	0.969
A_b Nominal area of rod (in.^{2})	0.1042	0.1867	0.2935	0.4246	0.6013	0.7854	1.227
T_{max} Maximum tightening torque (ft.-lbs.)	15	30	70	150	200	310	375

For **SI:** 1 inch = 25.4 mm, 1 in.^{2} = 645 mm^2, 1 ft-lbf = 1356 N-mm.

TABLE 2—SPECIFICATION AND INSTALLATION DETAILS FOR REINFORCING BAR (REBAR) INSTALLED WITH COVERT INJECTION ADHESIVE CIA-GEL 7000

PARAMETER	REBAR SIZE, d_r							
	#3	#4	#5	#6	#7	#8	#9	#10
A_{br} Nominal area of rebar (in.^{2})	0.11	0.20	0.31	0.44	0.60	0.79	1.0	1.27
d_o Nominal bit diameter hole size (in.)	$^1/_2$	$^5/_8$	$^3/_4$	1	$1^1/_8$	$1^1/_4$	$1^3/_8$	$1^1/_2$

For **SI:** 1 inch = 25.4 mm.

TABLE 3—RECOMMENDED HARDENING TIMES FOR COVERT INJECTION ADHESIVE CIA-GEL 7000

TEMPERATURE (°F)[1]	BOLT-UP TIME (hours)[2]	CURE TIME (hours)[3]
40-50	12	72
51-60	8	48
61-70	6	36
71-80	4	24
>80	4	24

For **SI:** 1°C = 0.555(t°F - 32).

[1]Installation in substrates colder than 40°F is beyond the scope of this report since data has not been submitted for such applications.
[2]Section 4.1.3.2, third paragraph, explains bolt-up time.
[3]Minimum cure time is the time required for the adhesive to achieve full strength.

TABLE 4—REDUCTION FACTORS FOR REDUCED SPACING AND EDGE DISTANCES FOR CIA-GEL 7000 ANCHORS INSTALLED IN CONCRETE[1,2]

TENSION CAPACITY		SHEAR CAPACITY			
Spacing (*s*) and Edge Distance (*c*)	Factor (F_t)	Spacing (*s*) and Edge Distance (*c*)	Direction of Load	Factor (F_v)	
				Threaded Rod	Reinforced Steel
s_{min} = 0.25 *s*	0.65	c_{min} = 0.50 *c*	Toward edge Not toward edge	0.73 0.73	0.65 0.65
c_{min} = 0.50 *c*	0.85	c_{min} = 0.25 *c*	Toward edge Not toward edge	0.25 0.4	0.20 0.40
		s_{min} = 0.25 *s*	Toward edge Not toward edge	0.6 1.0	0.6 1.0

[1]Linear interpolation is allowed for edge distances which fall between 0.25 *c* and 0.5 *c* or 0.5 *c* and 1.0 *c*, and anchor spacing which falls between 0.25 *s* and 1.0 *s*.
[2]Load reduction factors must be combined where applicable. In the case where three or more anchors are used, spacing reduction factors must be multiplied together. Where two or more edge distances affect performance, edge reduction factors must be multiplied together. When a group is affected by both reduced spacing and reduced edge distances, the edge and spacing reduction factors must be multiplied together.

TABLE 5—ALLOWABLE TENSILE LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6,7,8]

STUD DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH		BASED ON STEEL STRENGTH		
				f'_c = 2,000 psi	f'_c = 4,000 psi	A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	F 593 SS 304
3/8	3 3/8 1 7/8	5 2 7/8	2 1/2 1 1/2	2150 1190	2590 1190	2185	4580	2732
1/2	2 1/2 4 1/2	3 3/4 6 3/4	1 7/8 3 3/8	1940 3495	1940 3780	3885	8210	4860
5/8	3 1/8 5 5/8	4 3/4 8 1/2	2 3/8 4 1/4	2600 5400	2600 5525	6070	12910	7590
3/4	3 3/4 6 3/4 7 1/2	5 5/8 10 11 1/4	2 7/8 5 5 5/8	3915 6685 6685	3915 7840 9505	8740	18680	10925
7/8	7 7/8	11 7/4	6	8492	9725	11900	25510	14875
1	9 11	13 1/2 13 1/2	6 3/4 8 1/4	12330 12330	12700 16740	15540	33390	19428

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N, 1°C = 0.555(t°F - 32).

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (c) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-7000 anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 5 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]The anchors cannot be used to resist pullout forces in overhead and wall installations, unless proper consideration is given to fire conditions.
[6]Allowable load based on bond strength may be interpolated for compressive strengths between f'_c = 2,000 psi and f'_c = 4,000 psi.
[7]Allowable loads may be increased in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC by 33 1/3% for short- term loading due to earthquakes or wind.
[8]Bond strength values are based on a safety factor of 4.

TABLE 6—ALLOWABLE SHEAR LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6]

STUD DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON STEEL STRENGTH		
				f'_c = 2,000 psi	A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	F 593 SS 304
3/8	3 3/8	5	5	1470	1125	2350	1400
1/2	4 1/2	6 3/4	6 3/4	3555	2000	4170	2500
5/8	5 1/2	6 1/2	6 1/2	4765	3125	6520	3900
3/4	6 3/4	10	10	6905	4500	9390	5610
7/8	7 7/8	11 7/8	11 7/8	8687	6130	12775	8687
1	8 3/4	13 1/2	13 1/2	11180	8000	16700	10000

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N, 1˚C = 0.555(t˚F - 32).

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-7000 anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values when the anchors are installed in locations where the concrete temperatures may exceed 105°F .
[5]Allowable loads may be increased in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC by 33 1/3 % for short-term loading due to earthquakes or wind.
[6]Bond values are based on a safety factor of 4.

TABLE 7—ALLOWABLE TENSILE LOADS FOR ASTM A 615 GRADE 60 REINFORCING BAR (REBAR) INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6]

BAR SIZE	DRILL BIT DIAMETER, d_o (inches)	MINIMUM EMBEDMENT, h_{ef} (inches)	SPACING, s (inches)	EDGE DISTANCE, c (inches)	BASED ON BOND STRENGTH	BASED ON BOND STRENGTH	BASED ON STEEL STRENGTH
					f'_c = 2,000 psi	f'_c = 4,000 psi	ASTM A 615 Grade 60
#3	1/2	4	6	3	1925	1925	2650
#4	5/8	4 1/2	6 3/4	3 3/8	3700	3700	4710
#5	3/4	5 5/8	8 1/2	4 1/4	4870	4870	7365
#6	1	6 3/4	10 1/8	5	7270	7270	10605
#6	1	7 1/2	11 1/4	5 5/8	—	9705	10605
#7	1 1/8	7 7/8	12	6	8720	8720	14430
#8	1 1/4	9	13 1/2	6 3/4	12265	12265	18850
#8	1 1/4	10	15	7 1/2	—	14610	18850
#10	1 1/2	11	16 1/2	8 1/4	14085	14085	30480

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N, 1°C = 0.555(t°F - 32).

[1]The tabulated values are for rebar installed in concrete having the designated compressive strength or higher at the time of installation.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The anchors cannot be used to resist pullout forces in overhead and wall installations unless proper consideration is given to fire conditions.
[4]CIA -7000 anchors experience a reduction in capacity with increased ambient temperatures. The load factors noted in Figure 1 must be applied to the values noted in Table 7 when the anchors are installed in locations where the concrete temperature may exceed 105°F.
[5]Allowable loads may be increased 33 1/3 percent in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC for short-term loading due to wind or seismic forces.
[6]Bond strength values are based on a safety factor of 4.
[7]Allowable load must be the lesser of bond or steel strength.

TABLE 8—ALLOWABLE SHEAR LOADS FOR ASTM A 615 GRADE 60 REINFORCING BAR (REBAR) INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6]

BAR SIZE	DRILL BIT DIAMETER, d_o (inches)	MINIMUM EMBEDMENT, h_{ef} (inches)	SPACING, s (inches)	EDGE DISTANCE, c (inches)	BASED ON CONCRETE f'_c = 2,000 psi	BASED ON STEEL STRENGTH
						ASTM A 615 Grade 60
#3	1/2	4	6	6	2090	1700
#4	5/8	4 1/2	6 3/4	6 3/4	3795	3030
#5	3/4	5 5/8	8 1/2	8 1/2	5885	5150
#6	1	6 3/4	10 1/8	10 1/8	8350	7530
#7	1 1/8	7 7/8	12	12	11390	8800
#8	1 1/4	9	13 1/2	13 1/2	11580	9620
#10	1 1/2	11	16 1/2	16 1/2	13275	18200

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The tabulated values are for rebar installed in concrete having the designated compressive strength or higher at the time of installation.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge distances (*c*). Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The anchors cannot be used to resist pullout forces in overhead and wall installations unless proper consideration is given to fire conditions.
[4]Allowable loads shall not be increased for short-term loading due to wind or earthquake.
[5]Bond strength values are based on a safety factor of 4.
[6]Allowable load must be the lesser of bond or steel strength.
[7]CIA-Gel 7000 anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 8 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.

TABLE 9—ALLOWABLE TENSILE LOADS FOR THREADED ROD INSTALLED IN CONCRETE FOUNDATION WALL USING CIA-GEL ADHESIVE (pounds)[1,2,3,4,5,6,7]

STUD DIAMETER, *D* (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	MINIMUM WALL/FTG. WIDTH (inches)	MINIMUM EDGE DISTANCE, c_1 (inches)	MINIMUM ANCHOR SPACING, *s* (inches)	MINIMUM END DISTANCE (inches)	BASED ON BOND OR CONCRETE STRENGTH f'_c = 2,500 psi (minimum)
5/8	9	5	1 3/4	9	5	2,780
5/8	9	5	1 3/4	9	12	3,460
7/8	12 1/4	8	2 3/4	12	5	4,760
7/8	12 1/4	8	2 3/4	12	12	5,910
7/8	18	12	1 3/4	18	10	8,850
7/8	18	12	1 3/4	18	15	10,380

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge distances (c_1).
[3]Minimum wall depth is 18 inches or 1 1/2 times embedment, whichever is less. Cover requirements in Section 1907.7 of the UBC or Section 7.7 of ACI 318-99 apply.
[4]CIA anchors experience a reduction in capacity with increased ambient temperatures. The load factors noted in Figure 1 must be applied to the values noted in table 9 when the anchors are installed in locations where the concrete temperature may exceed 105°F (41.1˚C).
[5]Allowable loads may be increased by 33 1/3% in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC for short-term loading due to wind or earthquake forces.
[6]Allowable load must be the lesser of bond or steel strength. See Table 5 for loads based on steel strength.
[7]Bond strength values are based on a safety factor of 4.

TABLE 10—ALLOWABLE TENSION AND SHEAR LOADS FOR THREADED ROD INSTALLED IN GROUT-FILLED NORMAL-WEIGHT CONCRETE MASONRY UNITS USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6]

STUD DIAMETER (inch)	DRILL DIAMETER (inch)	EMBEDMENT, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	TENSION		SHEAR CELL (pounds)
					Cell (pounds)	Joint (pounds)	
3/8	1/2	3 1/2	6 3/4	3 3/8	1255	790	1170
1/2	5/8	4 1/4	9	4 1/2	1610	1060	1880
5/8	3/4	4 7/8	11 1/4	5 5/8	1980	1360	2270
3/4	7/8	6 1/2	13 1/2	6 3/4	1910	2495	2975

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N. 1°C = 0.555(t°F - 32).

[1]Values are for 6- and 8-inch-wide, Grade N type, lightweight, medium-weight, or normal-weight concrete masonry units conforming to UBC Standard 21-4 or ASTM C 90-99 (IBC or IRC), with a minimum compressive strength of 2,300 psi. Grout shall meet the proportions of Table 21-B of the UBC, Table 2103.10 of the IBC, or Table R609.1.1 of the IRC.
[2]Allowable load must be the lesser of bond or steel strength. See Tables 5 and 6 for steel strength values.
[3]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate spacings.
[4]The CIA-Gel 7000 experiences a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the Table 12 tension values when anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]The allowable loads are based on a factor of safety of 5. The tabulated allowable loads may be increased by 25 percent for installations under the UBC.
[6]Mortar must be Type N mortar complying with UBC Section 2103.3 and UBC Standard 21-15 for compliance under the UBC, IBC Section 2103.7 for compliance under the IBC, or Section R607.1 for compliance under the IRC.

TABLE 11—ALLOWABLE TENSION AND SHEAR VALUES IN CLAY BRICK MASONRY FOR THREADED RODS USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6,7,8]

STUD DIAMETER (inch)	DRILL DIAMETER (inch)	EMBEDMENT, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	TENSION BASED ON BOND STRENGTH (pounds)	SHEAR BASED ON BOND STRENGTH (pounds)
1/2	5/8	6	12	6	3090	2385
3/4	7/8	7 3/4	15	7 3/4	4485	3790

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1°C = 0.555(t°F - 32).

[1]Allowable load must be the lesser of bond or steel strength. See Tables 5 and 6 for allowable loads based on steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear Interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in minimum 9-inch-thick reinforced clay brick masonry with a minimum f'_m = 1,300 psi. The brick units shall conform to UBC Standard 21-1 or ASTM C 62-97a (IBC or IRC). Grout shall meet the proportions of Table 21-B of the UBC, Table 2103.10 of the IBC, or Table R609.1.1 of the IRC.
[4]The CIA-Gel 7000 experiences a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values when anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]The anchors cannot be used to resist pullout forces in overhead and wall installations, unless proper consideration is given to fire conditions.
[6]Anchors may be installed in the brick face or the mortar joint.
[7]The allowable loads are based on a factor of safety of 5 and may be increased by 25 percent for applications under the UBC.
[8]Mortar must be Type N mortar complying with UBC Section 2103.3 and UBC Standard 21-15 for compliance under the UBC, IBC Section 2103.7 for compliance under the IBC, or Section R607.1 for compliance under the IRC.

TABLE 12—MINIMUM SPACING AND EDGE DISTANCE FOR COVERT INJECTION ADHESIVE ANCHORS IN UNREINFORCED MASONRY (inches)

ANCHOR TYPE	MINIMUM VERTICAL SPACING	MINIMUM HORIZONTAL SPACING	MINIMUM EDGE DISTANCE
All types[1]	16	16	16

For **SI:** 1 inch = 25.4 mm.

[1]"All types" refers to the three types of anchor assemblies described in Section 4.1.3.1 and Figures 3, 4 and 5 of this report.

TABLE 13—ALLOWABLE TENSILE LOADS FOR THREADED ROD INSTALLED IN LIGHTWEIGHT AGGREGATE CONCRETE USING CIA-GEL 7000 (pounds)[1,2,3,4,5,6]

STUD DIAMETER, *d* (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON BOND OR CONCRETE STRENGTH f'_c = 2,500 psi (minimum)		
				f'_c = 3,000 psi	A 307	A 193 Gr. B7	SS 304
3/8 3/8	1 3/4 3 3/8	5 8	2 3/4 4	820 2020	2185	4580	2730
1/2 1/2	2 1/2 4 1/2	5 9	2 3/8 4 1/2	1075 2245	3885	8210	4860
5/8	5 5/8	11	6	2545	6070	12910	7290

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N, 1°C = 0.555(t°F - 32).

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate spacings.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 13 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]The anchors cannot be used to resist pullout forces in overhead and wall installations, unless proper consideration is given to fire conditions.
[6]Bond strength values are based on a safety factor of 4.

TABLE 14—ALLOWABLE SHEAR LOADS FOR THREADED ROD INSTALLED IN LIGHTWEIGHT AGGREGATE CONCRETE USING CIA-GEL 7000 (pounds)[1,2,3,4,5]

STUD DIAMETER, *d* (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON BOND OR CONCRETE STRENGTH f'_c = 2,500 psi (minimum)		
				f'_c = 3,000 psi	A 307	A 193 Gr. B7	SS 304
3/8 3/8	1 3/4 3 3/8	5 8	2 3/4 4	726 726	1125	2347	1400
1/2 1/2	2 1/2 4 1/2	5 9	2 3/8 4 1/2	677 677	2000	4170	2500
5/8	5 5/8	11	6	3027	3125	6520	3900

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate spacings.
[2]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[3]Allowable load must be the lesser of bond or steel strength.
[4]Bond strength values are based on a safety factor of 4.
[5]CIA anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 14 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.

TABLE 15—INSTALLATION AND DESIGN INFORMATION FOR DUC UNDERCUT ANCHORS

CATALOG NUMBER	STUD DIA., *d* (in.)	HOLE/SLEEVE DIA., d_o (in.)	MIN. HOLE DEPTH, *h* (in.)	ANCHOR EMBED., h_{ef} (in.)	NOMINAL SLEEVE AREA (in.^{2})	BOLT TENSILE STRESS AREA, A_{se} (in.^{2})	NOMINAL BOLT AREA (in.^{2})	SLEEVE TENSILE STRESS (f_u) (psi)	BOLT TENSILE STRESS (f_u) (psi)	BOLT YIELD STRESS, f_y (psi)	UNDERCUT BEARING AREA[1], A_b (in.^{2})
DUC 38-275	3/8	5/8	3 1/2	2 3/4	0.307	0.0775	0.110	80,000	58,000	36,000	0.308
DUC 38-450	3/8	5/8	5 1/4	4 1/2	0.307	0.0775	0.110	80,000	125,000	—	0.308
DUC 12-400	1/2	3/4	4 3/4	4	0.442	0.1419	0.196	80,000	58,000	36,000	0.499
DUC 12-600	1/2	3/4	6 3/4	6	0.442	0.1419	0.196	80,000	125,000	—	0.499
DUC 58-450	5/8	1	5 1/2	4 1/2	0.785	0.226	0.307	80,000	58,000	36,000	0.665
DUC 58-750	5/8	1	8 1/2	7 1/2	0.785	0.226	0.307	80,000	125,000	—	0.665
DUC 34-500	3/4	1 1/8	6 1/4	5	0.994	0.334	0.442	80,000	58,000	36,000	0.876
DUC 34-900	3/4	1 1/8	10 1/4	9	0.994	0.334	0.442	80,000	125,000	—	0.876

[1]Bearing area conforms to Section 1923.3.1 of the UBC.

TABLE 16—UBC ALLOWABLE TENSION VALUES (SERVICE LOAD OR ALLOWABLE STRESS DESIGN METHOD), DUC UNDERCUT ANCHORS INSTALLED IN MINIMUM 2,500 psi STONE-AGGREGATE CONCRETE (pounds)[1,2]

CATALOG NUMBER	STUD DIAMETER, *d* (inch)	HOLE DIAMETER, d_o (inches)	MINIMUM HOLE DEPTH[3], *h* (inches)	MINIMUM ANCHOR EMBEDMENT[4], h_{ef} (inches)	ANCHOR SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	INSTALLATION TORQUE, T_1 (foot-pounds)	TENSION[5,6]
60 (A36) Series								
DUC38-275	3/8	5/8	3 1/2	2 3/4	5 1/2	2 3/4	20	1,130
DUC12-400	1/2	3/4	4 3/4	4	8	4	55	1,800
DUC58-450	5/8	1	5 1/2	4 1/2	9	4 1/2	90	2,730
125 (B7) Series								
DUC38-450	3/8	5/8	5 1/4	4 1/2	9	4 1/2	35	1,900
DUC12-600	1/2	3/4	6 3/4	6	12	6	100	3,090
DUC58-750	5/8	1	8 1/2	7 1/2	15	7 1/2	140	5,360
DUC34-900	3/4	1 1/8	10 1/4	9	18	9	300	7,085

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced using the provisions of Section 1923.3 of the 1997 UBC.
[2]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[3]Hole depth is measured from the concrete surface to the bottom of the hole.
[4]Anchor embedment is measured from the concrete surface to the bottom of the expansion sleeve.
[5]These tension values are only applicable when the anchors are installed without special inspection. Where special inspection is provided, allowable tension loads are twice the tabulated values.
[6]The DUC anchors may be used to resist wind and earthquake forces for compliance with the UBC. The load values may be adjusted in accordance with Section 1612.3 of the UBC for service (allowable stress) design.

TABLE 17—UBC ALLOWABLE SHEAR VALUES (SERVICE LOAD OR ALLOWABLE STRESS DESIGN METHOD), DUC UNDERCUT ANCHORS INSTALLED IN MINIMUM 2,500 psi STONE-AGGREGATE CONCRETE (pounds)[1,2]

CATALOG NUMBER	STUD DIAMETER, *d* (inch)	HOLE DIAMETER, d_o (inches)	MINIMUM HOLE DEPTH[3], *h* (inches)	MINIMUM ANCHOR EMBEDMENT[4], h_{ef} (inches)	ANCHOR SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	INSTALLATION TORQUE T_1 (foot-pounds)	SHEAR[5,6]
60 (A36) Series								
DUC38-275	3/8	5/8	3 1/2	2 3/4	5 1/2	2 3/4	20	1,400
DUC12-400	1/2	3/4	4 3/4	4	8	4	55	2,510
DUC58-450	5/8	1	5 1/2	4 1/2	9	4 1/2	90	3,910
125 (B7) Series								
DUC38-450	3/8	5/8	5 1/4	4 1/2	9	4 1/2	35	2,460
DUC12-600	1/2	3/4	6 3/4	6	12	6	100	3,970
DUC58-750	5/8	1	8 1/2	7 1/2	15	7 1/2	140	6,320
DUC34-900	3/4	1 1/8	10 1/4	9	18	9	300	9,806

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced using the provisions of Section 1923.3 of the UBC.
[2]The tabulated values are for anchors installed in normal-weight concrete having the designated compressive strength or higher at the time of installation.
[3]Hole depth is measured from the concrete surface to the bottom of the hole.
[4]Anchor embedment is measured from the concrete surface to the bottom of the expansion sleeve.
[5]The DUC anchors may be used to resist wind and earthquake forces for compliance with the UBC. The load values may be adjusted in accordance with Section 1612.3 of the UBC for service (allowable stress) design.
[6]These shear values apply with or without special inspection.

TABLE 18—UBC STRENGTH DESIGN METHOD TENSION VALUES FOR DUC UNDERCUT ANCHORS INSTALLED IN STONE-AGGREGATE CONCRETE[1,2,3,4,5,6]

CATALOG NUMBER	ANCHOR DIAMETER (in.)	HOLE DIAMETER, d_o (in.)	ANCHOR EMBEDMENT, h_{ef} (in.)	ANCHOR SPACING, s (in.)	EDGE DISTANCE, c (in.)	ϕP_c ANCHOR TENSILE STRENGTH (lbf)				P_{ss} STEEL STRENGTH (lbf)
						CONCRETE STRENGTH (psi)				
						2,000	3,000	4,000	5,000	
A 36 Series										
DUC38-275	3/8	5/8	2.75	5.50	2.75	2765	3385	3905	4370	4045
DUC12-400	1/2	3/4	4.00	8.00	4.00	5845	7158	8266	9240	7410
DUC58-450	5/8	1	4.50	9.00	4.50	7397	9060	10461	11695	11795
DUC34-500	3/4	1 1/8	5.00	10.00	5.00	9130	11185	12915	14440	17435
B7 Series										
DUC38-450	3/8	5/8	4.50	9.00	4.50	7395	9060	10460	11695	8720
DUC12-600	1/2	3/4	6.00	12.00	6.00	13150	16105	18600	20795	15975
DUC58-750	5/8	1	7.50	15.00	7.50	20550	25165	29060	32490	25425
DUC34-900	3/4	1 1/8	9.00	18.00	9.00	29590	36240	41845	46785	37575

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]The tabulated values are for anchors installed at the specified spacing (s) and edge (c) distances. Spacing and edge distances may be reduced using the provisions of Section 1923.3 of the UBC. Additional strength design static tension loads may be determined in accordance with Sections 1923.3, 1923.3.3 and 1923.4 of the UBC.
[2]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[3]P_{ss} values are calculated using the formulas in Section 1923.3.2 of the UBC where A_b is the bolt tensile area.
[4]Anchor embedment is measured from the concrete surface to the bottom of the expansion sleeve.
[5]Use the lesser of P_{ss} and ϕP_c.
[6]The tabulated are based on special inspection in accordance with Section 2.3.

TABLE 19—UBC STRENGTH DESIGN METHOD SHEAR VALUES FOR DUC UNDERCUT ANCHORS INSTALLED IN STONE-AGGREGATE CONCRETE[1,2,3,4,5,6,7,8]

CATALOG NUMBER	ANCHOR DIAMETER, d (in.)	HOLE DIAMETER, d_o (in.)	ANCHOR EMBEDMENT, h_{ef} (in.)	ANCHOR SPACING, s (in.)	EDGE DISTANCE, c (in.)	ϕV_c ANCHOR SHEAR STRENGTH (pounds)				V_{ss} STEEL STRENGTH (lb)	V_{sss} STEEL STRENGTH (lb)
						CONCRETE STRENGTH (psi)					
						2,000	3,000	4,000	5,000		
A 36 Series											
DUC38-275	3/8	5/8	2.75	5.50	4.375	3110	3805	4395	4915	3370	15425
DUC12-400	1/2	3/4	4	8.00	6	6575	8055	9300	10395	6175	22210
DUC58-450	5/8	1	4.5	9.00	6.75	8320	10190	11770	13160	9830	39440
DUC34-500	3/4	1 1/8	7.5	10.00	7.5	10275	12585	14530	16245	14530	49948
B7 Series											
DUC38-450	3/8	5/8	6.25	9.00	3.75	7135	8740	10090	11280	7265	15425
DUC12-600	1/2	3/4	7.5	12.00	5.00	10275	12585	14529	16245	13305	22210
DUC58-750	5/8	1	10	15.0	6.25	18265	22370	25830	28880	21190	39445
DUC34-900	3/4	1 1/8	11.25	18.00	7.50	23115	28310	32690	36550	31315	49950

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]The tabulated values are for anchors installed at the specified spacing (s) and edge (c) distances. Spacing and edge distances may be reduced using the provisions of Section 1923.3 of the 1997 UBC. Additional strength design static shear loads may be determined in accordance with Sections 1923.2, 1923.3.2, 1923.3.3 and 1923.4 of the UBC.
[2]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[3]V_{ss} is calculated using the formulas in Section 1923.3 of the UBC where A_b is the bolt tensile area. V_{ss} is for pre-set anchor applications.
[4]V_{sss} is calculated using the formulas in Section 1923.3 of the UBC where A_b is the nominal sleeve area. V_{sss} is for through-bolt anchor applications.
[5]V_c is calculated using the formulas in Section 1923.3 of the UBC where A_b is the nominal sleeve area. V_c is for pre-set anchor through-bolt anchor applications.
[6]Anchor embedment is measured from the concrete surface to the bottom of the expansion sleeve.
[7]Use the lesser of V_{ss} and V_c, or V_{sss} and V_c.
[8]The tabulated values are based on special inspection in accordance with Section 2.3.

TABLE 20—RECOMMENDED HARDENING TIMES FOR CIA-EA EPOXY ACRYLATE

TEMPERATURE (˚F)	BOLT-UP TIME[2]	CURE TIME[3]
20	6 hours	24 hours
30	4 hours	12 hours
40	2 hours	6 hours
60	15 minutes	1 hour
70	10 minutes	30 minutes

For **SI:** 1˚C = 0.555 (t˚F – 32).

[1]Installation in substrates colder than 20˚F is beyond the scope of this report since data has not been submitted for such applications.
[2]Bolt-up time refers to that period of cure after which hardware may be placed and nuts tightened.
[3]Minimum cure time is the time required for the epoxy acrylate to achieve full strength. Design loads may not be applied until minimum cure time has transpired.

TABLE 21—ALLOWABLE TENSION LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-EA EPOXY ACRYLATE (pounds)[1,2,3,4,5]

STUD DIAMETER, *d* (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	MINIMUM SPACING, *s* (inches)	MINIMUM EDGE DISTANCE, *c* (inches)	BASED ON STEEL STRENGTH			BOND STRENGTH: f'_c = 2,500 psi
				A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	SS 304 F 593	
3/8	3 3/8	7 1/2	3 3/8	2,185	4,580	2,732	1,700
1/2	4 1/2	9	4 1/2	3,885	8,210	4,860	2,895
5/8	5 3/4	11 1/2	5 3/4	6,070	12,910	7,590	5,845
3/4	6 3/4	13 1/2	6 3/4	8,740	18,680	10,925	7,115
1	9	18	9	15,540	33,390	19,428	11,050

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of anchor installation.
[4]CIA-EA anchors experience a reduction in tensile capacity with increased ambient temperatures. The temperature load factors noted in Figure 2 must be applied to the values in Table 21 when the anchors are installed in locations where the concrete temperatures may exceed 70˚F (21.1˚C).
[5]Bond strength based on a safety factor of 4.
[6]Allowable load may be increased 33 1/3% in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC for short-term wind loads.

TABLE 22—ALLOWABLE SHEAR LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-EA EPOXY ACRYLATE (pounds)[1,2,3,4,5,6]

STUD DIAMETER, *d* (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	MINIMUM SPACING, *s* (inches)	MINIMUM EDGE DISTANCE, *c* (inches)	BASED ON STEEL STRENGTH			BOND STRENGTH: f'_c = 2,500 psi
				A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	SS 304 F 593	
3/8	3 3/8	5	5	1,125	2,347	1,400	1,485
1/2	4 1/2	6 3/4	6 3/4	2,000	4,170	2,500	2,560
5/8	5 3/4	6 1/2	7	3,125	6,520	3,900	4,410
3/4	6 3/4	10	10	4,500	9,390	5,610	6,325
1	8 3/4	13 1/2	13 1/2	8,000	16,700	10,000	10,245

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-EA anchors experience a reduction in tensile capacity with increased ambient temperatures. The temperature load factors noted in Figure 2 must be applied to the values in Table 22 when the anchors are installed in locations where the concrete temperature may exceed 70˚F (21.1˚C).
[5]Allowable loads may be increased 33 1/3% in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC for short-term wind loads.
[6]Bond strength values are based on a safety factor of 4.

TABLE 23—ALLOWABLE TENSILE LOADS FOR ASTM A 615 GRADE 60 REINFORCING BAR INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-EA EPOXY ACRYLATE (pounds)[1,2,3,4,5,6]

REBAR SIZE	DRILL BIT DIAMETER (inches)	MINIMUM EMBEDMENT, h_{ef} (inches)	MINIMUM SPACING, *s* (inches)	MINIMUM EDGE DISTANCE, *c* (inches)	BASED ON CONCRETE f'_c = 2,500 psi	BASED ON STEEL STRENGTH: ASTM A 615, GRADE 60
#3	1/2	3 3/8	6	3	933	2,650
#4	5/8	4 1/2	6 3/4	3 3/8	3,298	4,710
#5	3/4	5 5/8	8 1/2	4 1/4	4,398	7,365
#6	7/8	6 3/4	10 1/8	5	4,837	10,605
#8	1 1/8	9 5/8	13 1/2	6 3/4	10,320	18,850

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The tabulated values are for rebar installed in concrete having the designated compressive strength or higher at the time of installation.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances. Spacing and edge distances may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate distances.
[3]CIA-EA anchors experience a reduction in tensile capacity with increased ambient temperatures. The load factors noted in Figure 2 must be applied to the values noted in Table 23 when the anchors are installed in locations where the concrete temperature may exceed 70˚F (21.1˚C).
[4]Bond strength values are based on a safety factor of 4.
[5]Allowable loads may be increased 33 1/3% in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC for short-term wind loads.
[6]Allowable load must be the lesser of bond or steel strength.

TABLE 24—ALLOWABLE SHEAR LOADS FOR ASTM A 615 GRADE 60 REINFORCING BAR INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-EA EPOXY ACRYLATE (pounds)[1,2,3,4,5,6]

DOWEL SIZE	DRILL BIT DIAMETER (inches)	MINIMUM EMBEDMENT, h_{ef} (inches)	MINIMUM SPACING, *s* (inches)	MINIMUM EDGE DISTANCE, *c* (inches)	BASED ON CONCRETE f'_c = 2,500 psi	BASED ON STEEL STRENGTH: ASTM A 615, GRADE 60
#3	1/2	3 3/8	5	5	1,492	1,700
#4	5/8	4 1/2	6 3/8	6 3/4	2,549	3,030
#5	3/4	5 5/8	7	7	3,655	5,150
#6	7/8	6 3/4	10 1/8	10 1/8	5,844	7,530
#8	1 1/8	9	13 1/2	13 1/2	8,617	9,620

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.45 N.

[1]The tabulated values are for rebar installed in concrete having the designated compressive strength or higher at the time of installation.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge (*c*) distances.
[3]Bond strength values are based on a safety factor of 4.
[5]Allowable loads may be increased 33 1/3% in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC for short-term wind loads.
[5]Allowable load must be the lesser of bond or steel strength.
[6]CIA-EA anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 2 must be applied to the values in Table 24 when the anchors are installed in locations where the concrete temperature may exceed 70˚F (21.2˚C).

TABLE 25—ALLOWABLE TENSILE LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-GEL 7000 FOR SILL PLATE AND OTHER CLOSE EDGE DISTANCE APPLICATIONS (pounds)[1,2,3,4,5,6,7]

STUD DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON STEEL STRENGTH		
				f'_c = 2,000 psi	A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	F 593 SS 304
3/8	1 7/8	2 7/8	1 1/2	1190	2185	4580	2732
	3 3/8	5	1 3/4	1957			
1/2	2 1/2	3 3/4	1 3/4	1901	3885	8210	4860
	4 1/2	6 3/4	1 3/4	2790			
5/8	3 1/8	4 3/4	1 3/4	2395	6070	12910	7590
	5 1/2	8 1/4	1 3/4	3603			
	9	13 1/2	1 3/4	5040			
3/4	3 3/4	5 5/8	1 3/4	3454	8740	18680	10925
	6 3/4	10 1/8	1 3/4	4485			
7/8	7 3/4	11 5/8	1 3/4	6853	11900	25520	14875
	13	19 1/2	1 3/4	8775			
1	9	13 1/2	1 3/4	8725	15540	33390	19428
	15	22 1/2	1 3/4	10480			

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge distances (*c*). Spacing may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-7000 anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 25 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]The anchors cannot be used to resist pullout forces in overhead and wall applications unless proper consideration is given to fire.
[6]Allowable loads may be increased in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC by 33 1/3% for short-term loading due to earthquake or wind.
[7]Bond values are based on a factor of safety of 4.

TABLE 26—ALLOWABLE SHEAR LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-GEL 7000 FOR SILL PLATE AND OTHER CLOSE EDGE DISTANCE APPLICATIONS (pounds)[1,2,3,4,5,6]

STUD DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON STEEL STRENGTH		
				f'_c = 2,000 psi	A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	F 593 SS 304
3/8	3 3/8	5	1 3/4	706	1125	2350	1400
1/2	4 1/2	6 3/4	1 3/4	1448	2000	4170	2500
5/8	5 3/4	8 1/2	1 3/4	2700	3125	6520	3900
3/4	5 3/4	8 1/2	1 3/4	2700	4500	9390	5610
7/8	5 3/4	8 1/2	1 3/4	2700	6130	12775	7650
1	5 3/4	8 1/2	1 3/4	2700	8000	16700	10000

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

[1]Allowable load must be the lesser of bond or steel strength. Loads based on bond strength are for anchors loaded parallel to the edge.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge distances (*c*). Spacing may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-7000 anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 26 When the anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]Allowable loads may be increased in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC by 33 1/3% for short-term loading due to earthquake or wind.
[6]Bond values are based on a factor of safety of 4.

TABLE 27—ALLOWABLE TENSILE LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-EA ACRYLATE FOR SILL PLATE AND OTHER CLOSE EDGE DISTANCE APPLICATIONS (pounds)[1,2,3,4,5,6,7]

STUD DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON STEEL STRENGTH		
				f'_c = 2,000 psi	A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	F 593 SS 304
3/8	3 3/8	5	1 3/4	1454	2185	4580	2732
1/2	3 3/8	5	1 3/4	1454	3885	8210	4860
5/8	5 1/2	8 1/4	1 3/4	2627	6070	12910	7590
	9	13 1/2	1 3/4	4439			
3/4	6 3/4	10	1 3/4	3054	8740	18680	10925
	11	16 1/2	1 3/4	5987			
7/8	7 3/4	11 5/8	1 3/4	5642	11900	25520	14875
1	9	13 1/2	1 3/4	6515	15540	33390	19428
	15	20	1 3/4	7627			

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

[1]Allowable load must be the lesser of bond or steel strength.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge distances (*c*). Spacing may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-EA anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 27 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]The anchors cannot be used to resist pullout forces in overhead and wall applications unless proper consideration is given to fire.
[6]Allowable loads may be increased in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC by 33 1/3% for short-term loading due to earthquake or wind.
[7]Bond values are based on a factor of safety of 4.

TABLE 28—ALLOWABLE SHEAR LOADS FOR THREADED ROD INSTALLED IN NORMAL-WEIGHT CONCRETE USING CIA-EA FOR SILL PLATE AND OTHER CLOSE EDGE DISTANCE APPLICATIONS[1,2,3,4,5,6]

STUD DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH, h_{ef} (inches)	SPACING, *s* (inches)	EDGE DISTANCE, *c* (inches)	BASED ON BOND STRENGTH	BASED ON STEEL STRENGTH		
				f'_c = 2,000 psi	A 307 (SAE 1018)	A 193 Gr. B7 (SAE 4140)	F 593 SS 304
3/8	3 3/8	5	1 3/4	790	1125	2350	1400
1/2	4 1/2	6 3/4	1 3/4	1040	2000	4170	2500
5/8	4 1/2	6 3/4	1 3/4	1040	3125	6520	3900
3/4	4 1/2	6 3/4	1 3/4	1040	4500	9390	5610
7/8	4 1/2	6 3/4	1 3/4	1040	6130	12775	7650
1	4 1/2	6 3/4	1 3/4	1040	8000	16700	10000

For **SI:** 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

[1]Allowable load must be the lesser of bond or steel strength. Loads based on bond strength are for anchors loaded parallel to the edge.
[2]The tabulated values are for anchors installed at the specified spacing (*s*) and edge distances (*c*). Spacing may be reduced in accordance with Table 4. Linear interpolation may be used for intermediate dimensions.
[3]The tabulated values are for anchors installed in concrete having the designated compressive strength or higher at the time of installation.
[4]CIA-EA anchors experience a reduction in capacity with increased ambient temperatures. The temperature load factors noted in Figure 1 must be applied to the values in Table 28 when the anchors are installed in locations where the concrete temperatures may exceed 105°F.
[5]Allowable loads may be increased in accordance with Section 1612.3.3 of the UBC or Section 1605.3.2 of the IBC by 33 1/3% for short-term loading due to earthquake or wind.
[6]Bond values are based on a factor of safety of 4.

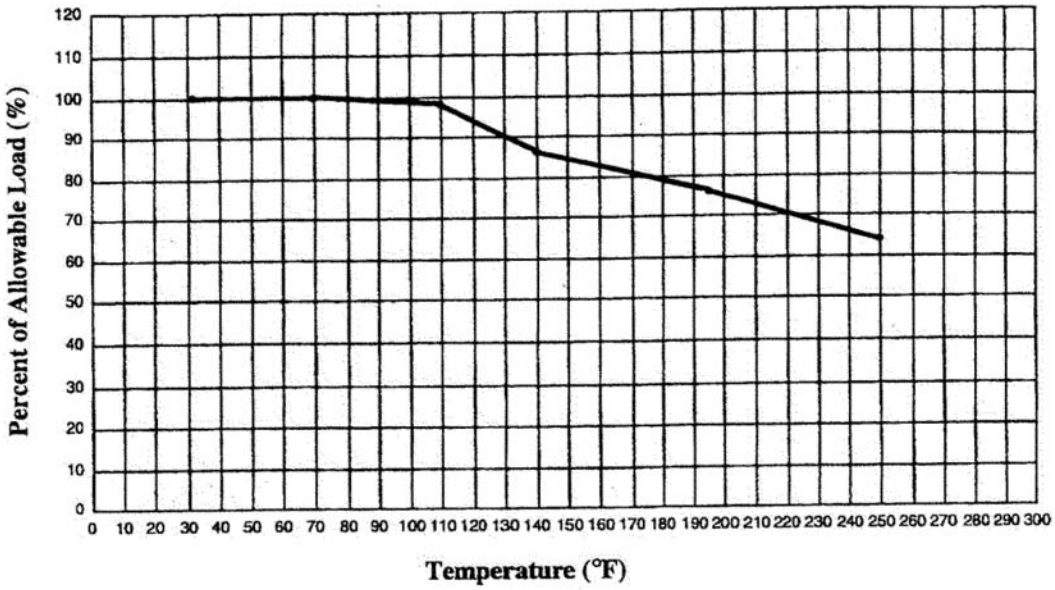

FIGURE 1—CONCRETE TEMPERATURE SENSITIVITY TENSION AND SHEAR LOAD FACTOR FOR CIA ANCHORS

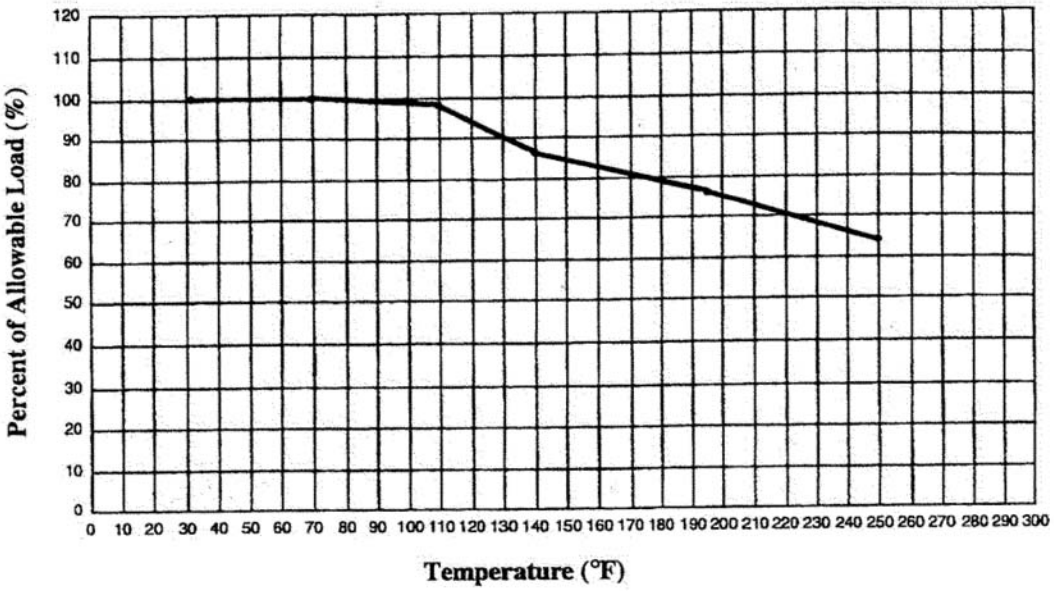

FIGURE 2—CONCRETE TEMPERATURE SENSITIVITY LOAD FACTOR FOR CIA-EA ANCHORS

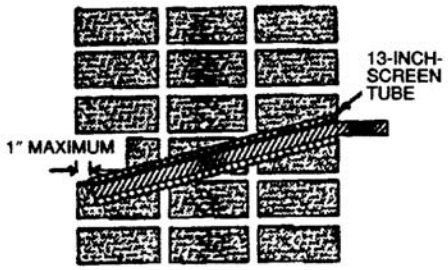

FIGURE 3
THE COMBINATION ANCHOR

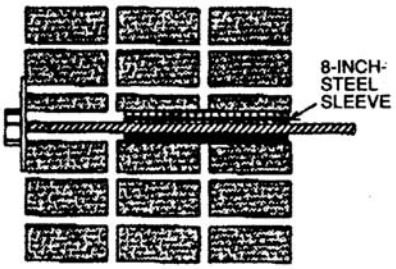

FIGURE 4
THE THRU-BOLT ANCHOR

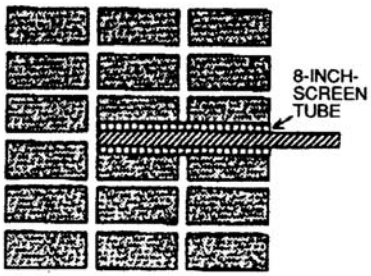

FIGURE 5
THE SHEAR ANCHOR