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## **ADHESIVE BONDING CLICK BOND, INC. FASTENERS TO STEEL, ALUMINUM, CRES, AND COMPOSITE SUBSTRATES USING CB200 AND CB420 ACRYLIC ADHESIVES.**

### **1.0 Scope**

This document establishes design guidelines and installation procedures for installing Click Bond adhesively bonded fasteners to steel, aluminum, corrosion resistant steel (CRES) and composite substrates using CB200 and CB420 acrylic adhesives.

### **2.0 Bonding process flow**

- Step 1. Assemble Materials (Section 5.1)
- Step 2. Verify Conditions (Section 5.3)
- Step 3. Solvent Wipe Fastener Base (Section 7.0)
- Step 4. Solvent Clean and Abrade Substrate (Section 6.0)
- Step 5. Prepare Adhesive (Section 8.0)
- Step 6. Apply Adhesive and Install Fastener (Section 9.0)

The adhesive fastener bonding process flow is shown in Figure 4 (external fixture), Figure 5 and Figure 6 (internal fixture). All personnel bonding fasteners must be trained to follow each installation procedure in detail. Bonding surfaces **MUST BE CLEAN** and **OXIDES, SCALE, RUST, and MOLD RELEASE MUST BE REMOVED BEFORE BONDING TAKES PLACE.**



### 3.0 Recommended Design Loads

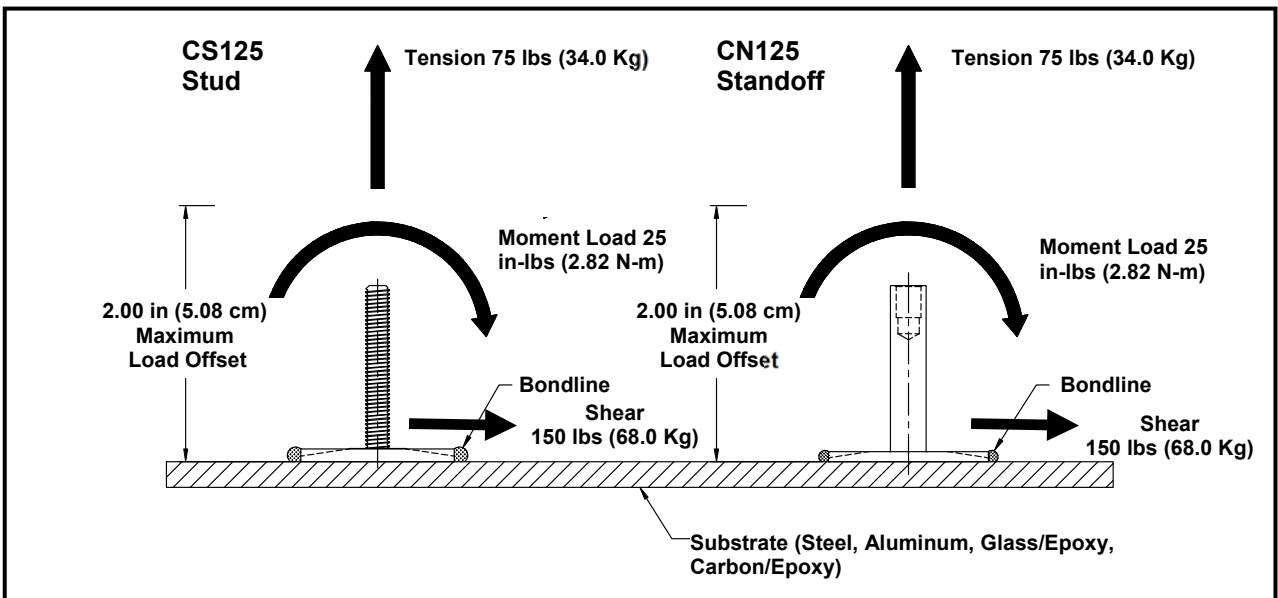
The surface area of the Click Bond fastener base (bond surface), substrate material, its thickness and the adhesive selection are the defining factors which govern load carrying capacity. The design and application of Click Bond fasteners should consider the maximum applied loads and the number of fasteners and placement of those fasteners to support those applied loads. Table 1 lists the Design Service Loads based on applying the recommended adhesives and following the service restrictions.

**Table 1: Design Service Load Limits for Click Bond Fasteners.**

Fastener	Base Dimensions In (mm)	Material	Tension Lbs (Kg)		Shear Lbs (Kg)		Moment Load In-lbs (N-m)	
CS125 and CN125	1.25 (31.8) Dia Base	316SS Base	75	(34.0)	150	(68.0)	25	(2.82)
CS450	1.25 (31.8) Dia Base	316SS Stud & Base	75	(34.0)	150	(68.0)	25	(2.82)
CS200 and CN200	2.00 (50.8) Dia Base	316SS Base	200*	(90)	450	(204.0)	50	(5.9)
CB3019/CM319	1.25 (31.8) Dia Base	PEI Saddle	30	(13.6)	25	(11.3)		NA
CB9120/CM920	0.75 (19.1) x 1.13 (28.7) Base	PEI	50	(22.7)	75	(34.0)		NA
CB9151/CM951	0.75 (19.1) x 1.13 (28.7) Base	PEI	50	(22.7)	75	(34.0)		NA
CB9205/CM905	3.25 (82.5)X 1 (25.4) Base	PEI	125	(56.7)	125	(56.7)		NA
CB9715/CS915	2.38 (60.3) Dia Base	316SS Stud & Base	200*	(90)	450	(204.0)	50	(5.9)
CB9522/CS922	2.63 (66.7) Dia Base	316SS Stud & Base	500*	(226.8)	900	(408.2)		NA
CS120	1.20 (30.5) Dia Base	300 Series SS	25	(11.3)	25	(11.3)		NA
CB9788/CM988	2.63 (67) Dia Base	316SS Base	400*	(181.4)		NA		NA
CB9789/CM989	2.00 (50.8) Dia Base	316SS	400*	(181.4)	550	(249.5)		NA
CB4595 / CM459 1A	1.18 (30) x 1.46 (37) Base	316SS Base	60	(27.2)	40	(18.1)		NA
CB4595 / CM459 2	1.18 (30) x 1.65 (42) Base	316SS Base	60	(27.2)	40	(18.1)		NA
CB4595 / CM459 3	1.18 (30) x 1.97 (50) Base	316SS Base	60	(27.2)	40	(18.1)		NA
CB4595 / CM459 4	1.18 (30) x 2.32 (59) Base	316SS Base	70	(31.8)	40	(18.1)		NA
CB4595 / CM459 5	1.18 (30) x 2.90 (71) Base	316SS Base	80	(36.3)	40	(18.1)		NA
CB4595 / CM459 6	1.18 (30) x 3.39 (86) Base	316SS Base	100	(45.4)	40	(18.1)		NA
CB4595 / CM459 7	1.18 (30) x 4.76 (121) Base	316SS Base	100	(45.4)	40	(18.1)		NA
CB4595 / CM459 8	1.18 (30) x 5.79 (147) Base	316SS Base	100	(45.4)	40	(18.1)		NA

\*Fire Safety 100 Lbs (45 kg) Tension and Shear Limitation for Bulkhead Fastener with 2" Base

**FIGURE 1. DESIGN LOAD DIAGRAM FOR CS125 & CN125**



#### 4.0 Application and Service Restrictions

- 4.0.1 Continuous Service Temperature -40°F to 250°F (-40°C to 120°C), Application Temperature 32°F to 105°F (0°C to 40°C). (For applications at temperatures above or below recommended range contact Click Bond).
- 4.0.2 Structural thickness 1/8" (3 mm) or greater to achieve design loads. Consult the factory for applications where the substrate is less than 1/8"(3 mm).
- 4.0.3 Loads greater than 100 Lbs. (45 kg) shall be restricted to a height no greater than 6 feet for bulkhead applications. For overhead wire, cable and pipe runs that exceed 25 lb (10 kg) per fastener, every 4<sup>th</sup> fastener in the span shall be a hard mount. (A fire safety restriction)

#### 5.0 REQUIREMENTS

##### 5.1 Materials

##### 5.1.1 Adhesives (Refer to Adhesive MSDS/SDS)

##### 5.1.1.1 Pre-proportioned Adhesive Dispenser Kit Click Bond CB200-40 Kit contains:

Click Bond, Inc.

1 ea. 40-ml Dual Pack Cartridge (Accelerator and Adhesive)

##### 5.1.1.2 Pre-proportioned Adhesive Dispenser Kit Click Bond CB420-50(E) Kit contains:

Click Bond, Inc.

1 ea. 35-ml Dual Pack Cartridge (Accelerator and Adhesive)

##### 5.1.2 Cleaning Solvent (Refer to solvent MSDS/SDS)

##### 5.1.2.1 CB911 Solvent Wipe

Click Bond, Inc.

##### 5.1.2.2 Acetone, ASTM D 329 General Specification

commercial

##### 5.1.3 Gloves

##### 5.1.3.1 Rubber nitrile

commercial

##### 5.1.4 Miscellaneous (Abrasion/Material Requirements and Options)

##### 5.1.4.1 Aluminum Oxide abrasive paper (100 – 180 grit)

commercial

##### 5.1.4.2 DHP120 (120 Grit Diamond Hand Pad)

C.R. Laurence Co./3M

##### 5.1.4.3 Right Angle Grinder

commercial

##### 5.1.4.4 Grinding Disc A24R

commercial

##### 5.1.4.5 Fiber Disc 36 Grit

commercial

##### 5.1.4.6 Clean, dry, lint free cloth

commercial

##### 5.2 Equipment

##### 5.2.1 Manual Dispensing Tool, CB100-81

Click Bond, Inc.

##### 5.2.2 Static Mixer Dispensing Tip, CB106

Click Bond, Inc.

##### 5.2.3 Axial Tensile Tester, CB609 (1-1/4" (31,8 mm) dia. base fasteners)

Click Bond, Inc.

##### 5.2.4 Axial Tensile Tester, CB634 (2" (50,8 mm) or larger dia. base fasteners)

Click Bond, Inc.

- |       |                                      |                  |
|-------|--------------------------------------|------------------|
| 5.2.5 | Deck Ring Proof Load Tester, CB656   | Click Bond, Inc. |
| 5.2.6 | Deck Ring Proof Load Tester, CB676   | Click Bond, Inc. |
| 5.2.7 | Adhesive Bond Strength Tester, CB670 | Click Bond, Inc. |

### 5.3 Verify Conditions

- 5.3.1 **Safety** - Follow all site safety requirements for working with solvents, adhesives, and power tools (if used). Follow all safety procedures for handling flammable solvents safely, especially when HOT WORK is occurring in the near vicinity. *(Consult local safety regulations for clarification of procedures not defined in this process specification.)*
- 5.3.2 **Environmental** - Adhesive and surface bonding temperatures must be between 32°F to 105°F (0°C to 40°C). Bonding surfaces must be dry; if in doubt and for surface sweating, follow paint requirements: bonding surface must be 5°F (2°C) above dew point.
- 5.3.3 **Atmosphere** - The bonding surfaces must be CLEAN. If dust, particulates, spills, etc. contaminate the bonding surfaces after they have been cleaned, they must be re-cleaned before bonding. If clean surfaces cannot be maintained, postpone bonding until conditions are suitable.

### 6.0 Surface Preparation (Ref. Figure 2.)

- 6.1.1 **General** – All surfaces to be bonded shall be clean and free of oil, dirt, and other foreign materials.
- 6.1.2 **Abrading** – Remove all oxides (metallic surfaces should be bright), for Composites remove all mold release and scuff/abrade the surface to remove the gloss. Caution: Do not abrade into the Composite fiber matrix.
- 6.1.3 **Substrate Material Preparation**
- 6.1.4 **Steel**
- 6.1.4.1.1 Solvent wipe substrate to remove surface contaminants.
- 6.1.4.1.2 Use a grinder (A24R grinding disc) to remove all surface coatings and oxides to expose bare metal. Acceptable surface condition shall be bright metal appearance, SP-11.
- 6.1.4.1.3 Solvent wipe abraded area with a CB911 wipe or solvent saturated cloth, using single stroke motion while rolling wipe away from surface. Immediately after solvent wiping, dry wipe with a clean cloth.
- 6.1.4.2 **Primed/Painted Steel-Light Loads, 2 lb. (1 kg), or less**  
*(This alternate method may be used when testing has confirmed that the primer adhesion exhibits adequate strength to carry the loads supported by the installed fastener.)*
- 6.1.4.2.1 Solvent wipe substrate to remove surface contaminants.
- 6.1.4.2.2 Lightly abrade the primed/painted surface with 120-180 grit Aluminum oxide to thin out, and remove the gloss without removing the primer/paint.
- 6.1.4.2.3 Solvent wipe abraded area with a CB911 wipe or solvent saturated cloth, using single stroke motion while rolling wipe away from surface. Immediately after solvent wiping, dry wipe with a clean cloth.
- 6.1.4.2.4 **Primed/Painted Steel- Loads greater than 2 lb. (1 kg)**

- 6.1.4.2.5 Solvent wipe substrate to remove surface contaminants.
- 6.1.4.2.6 Use a grinder (36 Grit Fiber disc) to remove all surface coatings and oxides to bare metal. Acceptable surface condition shall be bright metal appearance, SP-11.
- 6.1.4.2.7 Solvent wipe abraded area with a CB911 wipe or solvent saturated cloth using single stroke motion while rolling wipe away from surface. Immediately after solvent wiping, dry wipe with a clean cloth.
- 6.1.4.3 **Bare Aluminum**
- 6.1.4.3.1 Solvent wipe substrate to remove surface contaminants.
- 6.1.4.3.2 Remove the oxide surface layer and any surface treatments or coatings, such as Alodine, by abrading with 120 grit aluminum oxide.
- 6.1.4.3.3 Solvent wipe abraded area with CB911 wipe solvent saturated cloth, using single stroke motion while rolling wipe away from surface. Immediately after solvent wiping, dry wipe with a clean cloth.
- 6.1.4.4 **Primed Aluminum Light loads 2 lb. (1 kg). or less**  
(This alternate method may be used only when testing has confirmed that the primer adhesion exhibits adequate strength to carry the loads to be supported by the installed fastener.)
- 6.1.4.4.1 Solvent wipe substrate to remove surface contaminants.
- 6.1.4.4.2 Lightly abrade primed surfaces with 120-180 grit Aluminum oxide to thin out, but not remove, the primer.
- 6.1.4.4.3 Solvent wipe abraded area with CB911 Wipe solvent saturated cloth, using single stroke motion while rolling wipe away from surface. Immediately after solvent wiping, dry wipe with a clean cloth.
- 6.1.4.5 **Primed Aluminum – Loads greater than 2 lb. (1 kg).**
- 6.1.4.5.1 Solvent wipe substrate to remove surface contaminants.
- 6.1.4.5.2 Remove all surface coatings and oxides to expose bare metal with grinder (36 Grit Fiber Disc). The acceptable surface condition is a bright metal appearance, SP-11.
- 6.1.4.5.3 Solvent wipe with a CB911 wipe solvent saturated cloth using a single stroke motion while rolling wipe away from surface to remove abraded material. Rotate wipe or after each stroke to ensure a clean wipe surface. Immediately after solvent wiping, dry wipe with a clean cloth.

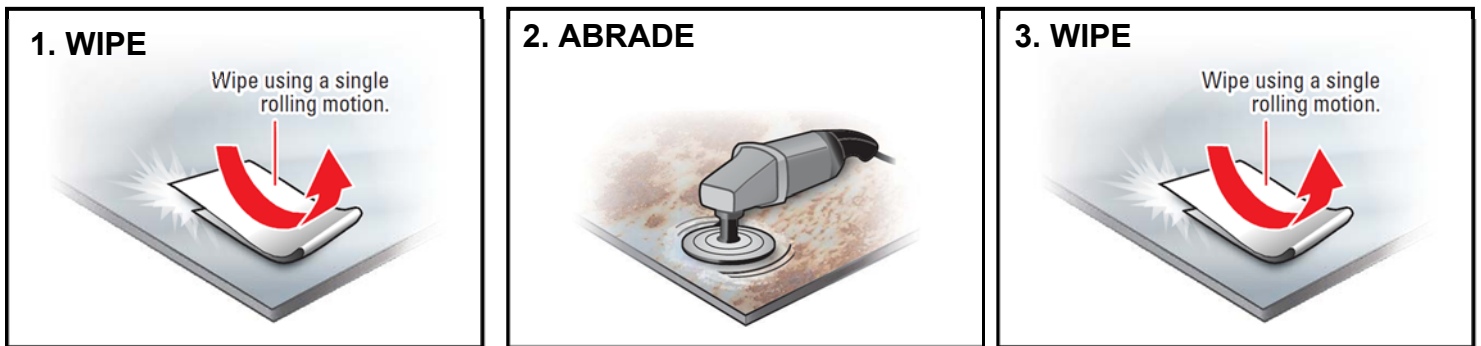
#### 6.1.4.6 Composite Material

6.1.4.6.1 Solvent wipe substrate to remove any surface contaminants.

6.1.4.6.2 Abrade bare fiberglass/epoxy or carbon/epoxy laminates or other composites with 120-180 grit aluminum oxide abrasive paper to remove surface gloss and mold release from surface resin. Do not abrade into the glass fiber or carbon fiber matrix.

6.1.4.6.3 Solvent wipe abraded area with a CB911 wipe or solvent saturated cloth, using single stroke motion while rolling wipe away from surface. Immediately after solvent wiping, dry wipe with a clean cloth.

**FIGURE 2. SURFACE PREPARATION PROCEDURE**



#### 7.0 Fastener Surface Preparation

7.0.1 Prepare only those fasteners that will be bonded at this time.

7.0.2 Wipe the base of the fastener using a CB911 wipe or a solvent saturated clean wipe cloth.

7.0.3 Prevent fastener contamination by placing the fastener in a clean location until use.

#### 8.0 Adhesive Mixing

##### 8.0.1 Pre-proportioned Adhesive Dispenser Kit

8.0.1.1 Insert the CB81 slide into the receiving end of the CB100 Manual Powered Dispenser as shown in Figure 3.

8.0.1.2 Remove back plate on cartridge and place the adhesive cartridge into the retaining slot of the tool and lock the cartridge in place with the retainer.

8.0.1.3 Remove the endcap on the adhesive cartridge by turning the endcap counterclockwise. Retain endcap for later use.

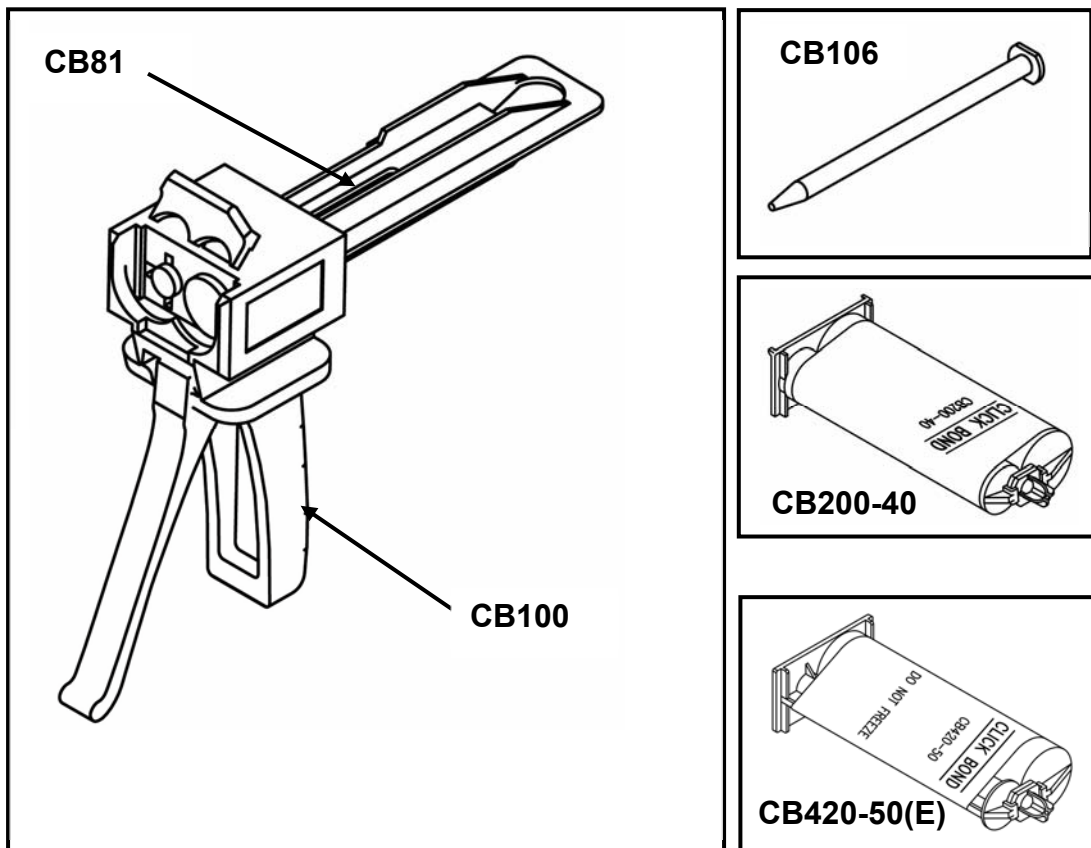
8.0.1.4 Actuate the tool to dispense a small amount of adhesive into the plastic packaging bag. Ensure that both components are flowing from the cartridge. Visually inspect the condition of the adhesive materials by examining through the plastic bag and kneading the adhesive bag wall with your fingers. Both components should have an even consistency and be free of striations and lumps.

8.0.1.5 Attach the static mixer dispensing tip to the end of the cartridge and secure the mixing tip by turning clockwise until the mixing tip stops.

8.0.1.6 Insert the end of the mixing tip into the plastic bag and actuate the tool until approximately one gram (approximately 2 inches (51mm)) of adhesive flows from the mixing tip.

- 8.0.1.7 Apply adhesive to the attachment part by dispensing from the mixing tip. The applicator ejects the proper component ratio from the cartridge and the tip mixes the adhesive as it is dispensed.
- 8.0.1.8 To keep the adhesive from curing in the mixing tip, plan your work to ensure that at least one gram (approximately 2 inches (51 mm)) of adhesive is continually dispensed within a 3-minute time period. If necessary, dispense waste adhesive into the plastic bag for disposal. If adhesive cures in tip, replace mixing tip. Warning: Do not cut/shorten mixing tip to regain flow.
- 8.0.1.9 At the end of use, remove the dispensing tip on the cartridge. Wipe the residual adhesive from the end of the cartridge and replace the endcap to preserve the unmixed adhesive for later use with another dispensing tip. When ready to reuse the cartridge, remove the endcap, and repeat all steps of Section 8.0. Squeeze out a small portion of adhesive into a plastic bag to ensure the flow of both components. Attach a new mixing tip and proceed as in (8.0.1.5). Place the used dispensing tip in the plastic bag with the waste adhesive for disposal. Also any unmixed adhesive components in the bag may be mixed by kneading the bag. This will result in the eventual cure of the material and allow for disposal as a solid waste.

**FIGURE 3. ADHESIVE DISPENSING TOOLS**



**9.0 Adhesive Application**

**9.0.1 Externally Fixtured Fasteners**

9.0.1.1 Figure 4 indicates the sequential steps required to attach the Click Bond Pressure Application Fixture (PAF) to the substrate and to activate the fixture to put bonding pressure on the fastener baseplate.

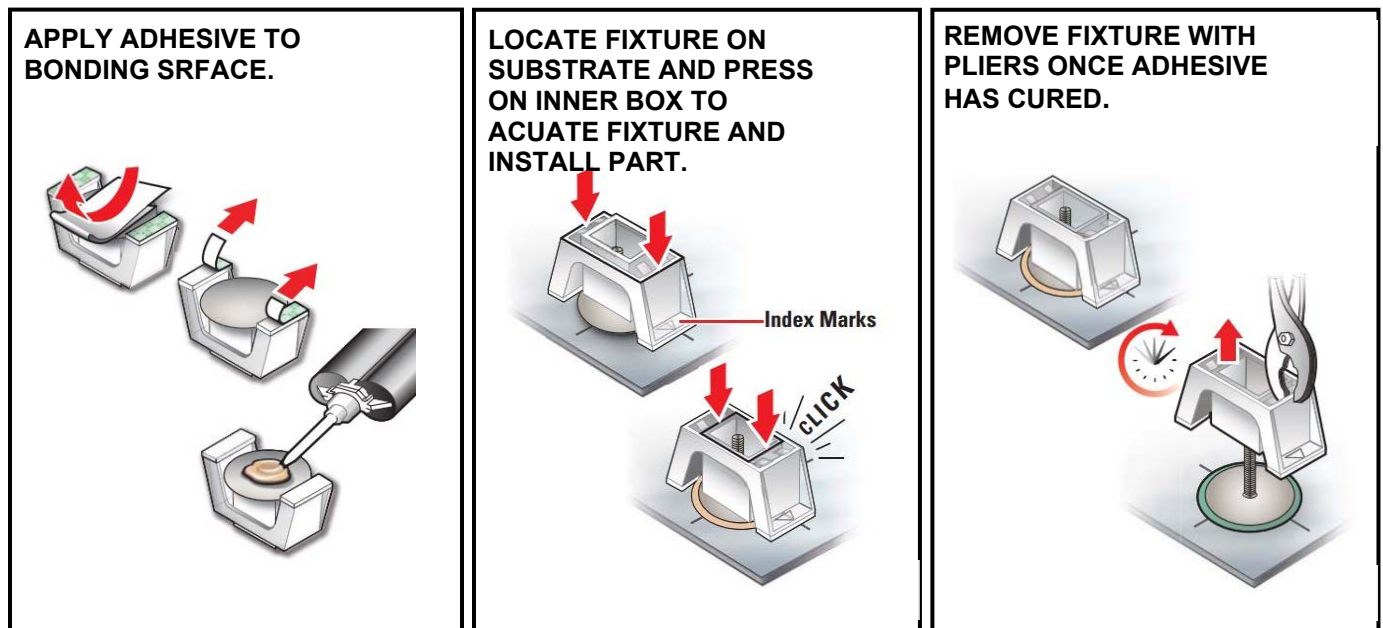
**TABLE 2. BASEPLATE DIAMETER vs. ADHESIVE SPOT DIAMETER (INCHES)**

BASEPLATE DIAMETER In (mm)	ADHESIVE SPOT DIAMETER In (mm)
1.25 (31.7)	0.62 (15.7)
2.00 (50.8)	1.00 (25.4)

**Note:** When bonding CB9205, CB9120, CB9151 or other non-circular base parts, care should be taken to apply adhesive so a complete circumferential squeeze-out of adhesive is present when the part is installed per 9.0.2.6 or 10.1.2.)

- 9.0.1.2 Solvent wipe the fastener base. Remove the peel ply from foam tape pads and discard.
- 9.0.1.3 Apply a bead of adhesive to the center of the fastener baseplate. The quantity of adhesive applied should be sufficient to provide a squeeze-out of a small excess of adhesive completely around the edge of the baseplate. (Table 2 is offered for reference.)
- 9.0.1.4 Locate the fixture on the substrate using a template or by aligning the index marks on the fixture with the fastener location centerlines. Press down on the outer body of the fixture to adhere the foam tape to the surface.
- 9.0.1.5 Press down lightly on the inner body of the fixture until it actuates. Caution: Do not press on the protruding fastener. Note: The clamping pressure of the fixture promotes an optimal bond line during the adhesive squeeze out, and holds the fastener in place with positive pressure during the adhesive cure.
- 9.0.1.6 After the adhesive has cured, remove the fixture by grasping with hand or pliers and pulling it off the substrate. Discard the fixture.

**FIGURE 4. PROCEDURE FOR ATTACHMENT OF EXTERNALLY FIXTURED CLICK BOND FASTENER**



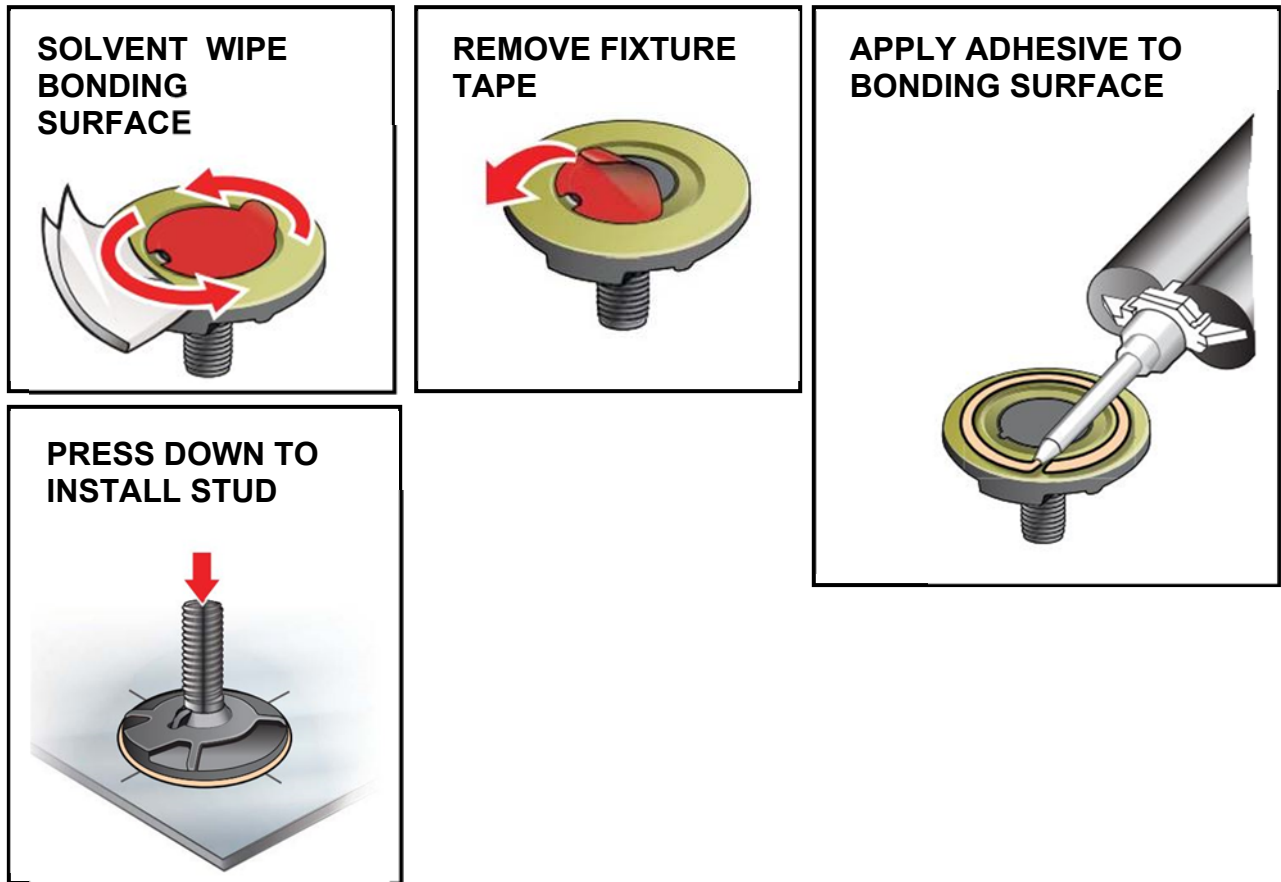
**9.0.2 Internally Fixtured Fasteners**

- 9.0.2.1 Figure 5 and Figure 6 show the sequential steps required to attach the fasteners supplied with internal fixture(s) that maintain pressure on the fastener baseplate while the adhesive cures.
- 9.0.2.2 Solvent wipe the fastener base.

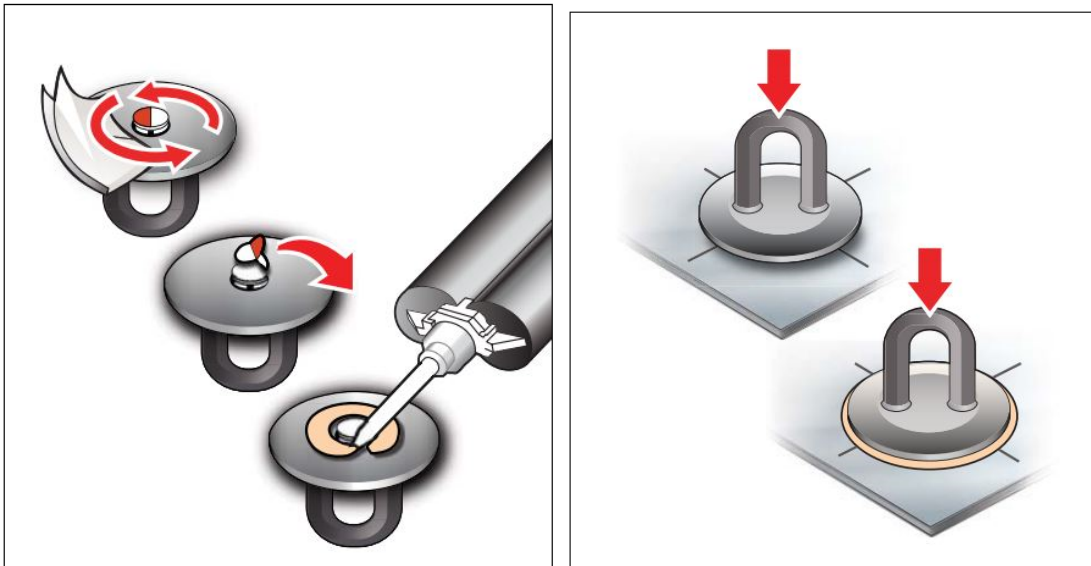


- 9.0.2.3 Remove the peel ply from the centrally located tape disk or fixture tape and discard.
- 9.0.2.4 Apply a bead of adhesive to the outer ring of the baseplate. The quantity of adhesive applied should be sufficient to fully cover the baseplate. Caution: Do not apply adhesive on fixture tape or so close to the fixture so that when attaching the fixture the adhesive is spread over it before it attaches to the substrate.
- 9.0.2.5 Locate the fastener on the substrate using a template or by centering the baseplate on cross marks placed on substrate. Press down on the threaded portion of the fastener to actuate the internally located fixture. Note: The action of the fixture squeezes out the adhesive and holds the fastener in place with positive pressure during the adhesive cure.
- 9.0.2.6 Verify adhesive coverage by observing a visible adhesive ring around the entire perimeter of fastener base.
- 9.0.2.7 Let cure. Caution: Do not disturb part until adhesive is cured.

**FIGURE 5. PROCEDURE FOR ATTACHMENT OF LARGE INTERNALLY FIXTURED CLICK BOND FASTENER**



**FIGURE 6. PROCEDURE FOR ATTACHMENT OF STANDARD INTERNALLY FIXTURED CLICK BOND FASTENER**



- 9.1 Adhesive Cure** – The approximate cure time to achieve handling strength for CB200 or CB420 at 75°F (25° C) is 2 hours. Full cure requires 24 hours at this temperature. Since the curing rate of the adhesive is sensitive to the ambient temperature at the application site, it is recommended that the surrounding adhesive bead be checked for firmness (hard to the touch) before removing the external fixture.
- 9.2 Surface Touch Up** – After completion of the cure, all exposed surfaces where the finish was removed may have that finish reapplied. Note: fastener/adhesive may be primed/painted. Ensure all contaminants and oxides are removed prior to surface touch-up.
- 9.3 In-Process Removal Procedure for Fasteners**
- 9.3.1** Refer to CBPS-207 for the procedure to remove Click Bond fasteners.
- 9.3.2** If replacement of fastener is required after removing the fastener, remove remaining adhesive, and apply a new fastener in accordance with this specification.
- 10.0 QUALITY ASSURANCE PROVISIONS**
- 10.1 Visual Examination**
- 10.1.1** Visual examination of the adhesive components as they are dispensed from the pre-proportioned adhesive kits shall indicate that the material has not gelled, become hard, lumpy, or settled out. The consistency of the material shall be tested manually as described in Section 8.0.1.4 to ensure that it is suitable for application.
- 10.1.2** All exposed edges of bonded parts shall show a continuous adhesive bead squeeze out along the fastener base perimeter surface.
- 10.1.3** Excess adhesive squeezed out of the joint shall be tested with a fingernail for cure.
- 10.1.4** The adhesive shall feel tough and offer resistance to penetration and shall not be tacky.

**11.0 Adhesive Bond Verification Test**

- 11.0.1 Following adhesive cure, bond strength can be verified by conducting a proof load test.
- 11.0.2 For 1-1/4" (31,8 mm) diameter base fasteners, proof load test by using CB609 tool per instructions shown on drawing.
- 11.0.3 For 2" diameter or larger base fasteners, use a 3" (76,2 mm) diameter pipe with a 3/8" (9,53 mm) thick steel plate placed on top with a hole to allow for the stud thread to protrude, Figure 7. Place mating nut over the top and apply a torque load per the Table 3.

**TABLE 3. PROOF LOAD TORQUE VALUES**

Fastener	Base Diameter In (mm)	Stud Thread Diameter	Torque Load In-lbs (N-m)
CS200	2.00 (50.8)	.250 or 6M	60 (6.78)
		.312 or 8M	66 (7.46)
		.375 or 10M	66 (7.46)
		.500 or 12M	66 (7.46)
CB9715/CS915	2.38 (60.5)	.375 or 10M	360 (40.67)
CB9522/CS922	2.63 (66.7)	.625 or 14M/16M	442 (49.93)

**FIGURE 7. PROCEDURE FOR PROOF LOADING BONDED STUD**

