

CODE APPLICATION NOTICE

Subject: Field Tests for Post-Installed Anchors in Concrete

FILE NO: 2-1916A.8

EFFECTIVE: 07/01/08

CODE SECTION: Section 1916A.8, 2007 California Building Code (CBC)

1916A.8 Tests for Post-Installed Anchors in Concrete. *When drilled-in expansion-type anchors or other post-installed anchors acceptable to enforcement agency are used in lieu of cast-in place bolts, the allowable shear and tension values and installation verification test loads shall be acceptable to the enforcement agency.*

When expansion-type anchors are listed for sill plate bolting applications, 10 percent of the anchors shall be tension tested.

When expansion-type anchors are used for other structural applications, all such expansion anchors shall be tension tested. Expansion-type anchors shall not be used as hold down bolts.

When expansion-type anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tension tested.

The tension testing of the expansion anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency. If any anchors fail the tension-testing requirements, the additional testing requirements shall be acceptable to the enforcement agency. The above requirements shall also apply to other post-installed anchors acceptable to enforcement agency and bolts or anchors set in concrete with chemical if the long-term durability and stability of the chemical material and its resistance to loss of strength and chemical change at elevated temperatures are established to the satisfaction of the enforcement agency.

PURPOSE:

Section 1916A.8 of the 2007 CBC requires that the enforcement agency establish allowable shear and tension values and installation verification test loads for post-installed anchors. This CAN establishes installation verification test loads for post-installed anchors installed in health care facilities subject to Section 1916A.8.

See CAN 2-1912A.1 for allowable shear and tension values for post-installed anchors.

INTERPRETATION:**1.0 Testing Requirements**

Anchors shall be field tested in place for installation verification in accordance with Section 1916A.8, 2007 CBC. Test loads and torques and acceptance criteria shall be shown on the approved construction documents.

Exceptions:

- a. Undercut anchors that allow visual confirmation of full set need not be tested.
- b. Where the design tension on anchors is less than 75 lbs. and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors need be tested.
- c. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25% of the dowels need be tested if all the following conditions are met:
 1. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
 2. The number of dowels in any one member equals or exceeds twelve (12).
 3. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/ Inspector Of Record (IOR).

- d. Testing of shear dowels across cold joints in slabs on grade where the slab is not part of the lateral force-resisting system is not required.
- e. Testing is not required of power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.

If any anchor fails testing, test all anchors of the same type installed by the same trade and not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

For the purposes of field testing, screw anchors and torque controlled chemical/adhesive anchors shall be considered as a mechanical anchor.

1.1 Testing Criteria

The following criteria shall apply for the acceptance of installed anchors:

1.1.1 Mechanical Anchors

The test load may be applied by any method that will effectively transmit a measured tension load to the anchor. Acceptable methods include:

1. Hydraulic jack, either unconfined or confined testing.
2. Calibrated spring loaded devices.
3. Calibrated torque wrench for torque-controlled expansion anchors.

Internally threaded shell-type anchors and displacement-controlled anchors (e.g., drop-in anchors), screw anchors, and adhesive anchors shall not be tested using a torque wrench.

Screw anchors may be loosened a maximum of one full turn to facilitate the positioning of a tension test collar. Following the tension test, the anchor shall be re-torqued in accordance with the manufacturer's installation instructions.

Required test loads shall be determined by one of the following methods:

1. One and one-half (1-1/2) times the calculated design strength for static tension load or two times design strength for seismic tension loads as determined in accordance with Appendix D of ACI 318 (not applicable to screw anchors) using coefficient of basic concrete breakout strength in tension ($K_c = 17$).
2. Twice the maximum allowable tension load or one and a quarter (1-1/4) times the maximum design strength of anchors as provided in ICC-ESR.
3. The manufacturer's recommended installation torque or recommended torque in ICC-ESR (not applicable to displacement-controlled anchors and screw anchors).

Tension test load need not exceed 80% of the nominal yield strength of the anchor element ($= 0.8 A_{se} f_{ya}$).

Acceptance Criteria:

A. Hydraulic Ram Method:

Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

B. Torque Wrench Method:

Anchors tested with a calibrated torque wrench must attain the specified torque within ½ turn of the nut.

Exceptions:

1. Wedge or Sleeve type:

One-quarter (1/4) turn of the nut for a 3/8 in. sleeve anchor only.

2. Threaded type:

One-quarter (1/4) turn of the screw after initial seating of the screw head.

1.1.2 Chemical/Adhesive Anchors

A hydraulic cylinder shall be used to apply the tension test load to the anchor with the cylinder supported on a loading plate having a hole diameter equal to 1.5 to 2.0 times the anchor hole diameter (confined configuration) unless otherwise approved by OSHPD.

Exception: Anchors that are de-bonded over their upper length may be tested with wide supports (unconfined testing).

Required test loads shall be the greater of twice the maximum allowable tension load or one and a half times the maximum design strength of anchors as provided in ICC-ESR. Tension test load need not exceed 80% of the nominal yield strength of the anchor element ($= 0.8 A_{se} f_{ya}$).

Exception: Where it is intended that the embedment develop the yield strength of the anchor bolt or reinforcing bar, the test load shall not be less than $0.8A_{se}F_{ya}$.

Acceptance Criteria:

Anchors shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut or by continuous loss of jacking pressure. Where other than bond is being tested, the testing device shall not restrict the concrete shear cone type failure mechanism from occurring.

1.1.3 Power Actuated Fasteners

The test load may be applied by any method that will effectively measure the tension in the fastener, such as direct pull with a hydraulic jack, calibrated spring loaded devices, etc.

Power actuated fasteners shall be tension tested to twice the allowable tension load as listed in ICC-ESR.

Acceptance Criteria:

The anchor should have no observable movement at the applicable test load.

2.0 Testing Procedure

1. Apply proof test loads to mechanical anchors without removing the nut, if possible. If not, remove nut and install a threaded coupler to the same tightness as the original nut using a torque wrench and apply load.
2. For internally threaded anchors (e.g. drop-ins, etc), verify that the anchor is not prevented from withdrawing by a baseplate or other fixtures prior to testing. If restraint is found, loosen and shim or remove fixture(s) prior to testing.
3. Reaction loads from test fixtures may be applied close to the anchor being tested, if the anchor is not restrained from withdrawing by the fixture(s).
4. Shell Type (expansion and undercut) anchors shall be tested by one of the following methods:
 - a. Visually inspect 25% for full expansion as evidenced by the location of the expansion plug indicator in the anchor body. Plug location of a fully expanded anchor should be as recommended by the manufacturer or in the absence of such recommendation, as determined on the job site following the manufacturer's installation instructions. At least 5% of the expansion anchors shall be proof loaded, but not less than three anchors per day for each different person or crew installing anchors or
 - b. Test 50% of the installed anchors in accordance with Section 1916A.8, 2007 CBC.
5. Test equipment (including torque wrenches) shall be calibrated by an approved testing laboratory in accordance with recognized standard procedures.
6. Testing shall occur a minimum of 24 hours after installation of the subject anchors.
7. All tests shall be performed in the presence of the special inspector/ Inspector of Record.

Original Signed
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7/01/08
Date