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RESEARCH REPORT: RR 24927
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GENERAL APPROVAL - Epcon Ceramic 6 System Anchors for use in unreinforced solid masonry walls

DETAILS

The Epcon Ceramic 6 System Anchors are approved for use in resisting short duration lateral loading conditions, such as seismic and wind loads. The system shall not be used for sustained gravity loading conditions.

The system consists of a ceramic-filled VOC free epoxy (Epcon Ceramic 6) and a hardener which are contained in a plastic cartridge with a plastic mixing nozzle. An injection tool is needed to force the two components through the nozzle thoroughly mixing them in the process. The stud assemblies consist of zinc plated 3/4" and 5/8"-diameter threaded rods which meet ASTM A307 specifications. The threaded rods are used in conjunction with steel sleeves and wire cloth screen tubes. Reinforcing bars or other dowels may not be substituted for the threaded rods specified in this approval. The threaded rods are supplied in various lengths and are stamped at the end to identify ITW Ramset/Red Head as the manufacturer and to provide the rod's length. Specific details of the anchorage systems may be found within this report.

The Epcon System Anchors are approved for installation in existing unreinforced solid masonry walls subject to the following conditions:

1. Each anchor rod shall bear a permanent identification indicating the manufacturer's name or symbol.
2. Use of the Epcon System anchors shall be approved by the engineer of record.
3. Anchors shall not be installed in overhead applications such as in the soffit of a beam or arch or similar conditions.

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4. Installation of the anchors shall be in accordance with the manufacturer's instructions stated in the "Discussion" portion of this report.
5. Weld connections to the zinc plated threaded rods are allowed only if all of the zinc coating is removed from the weld area prior to welding. Welded connections shall comply with Section 91.2205.10, Chapter 22 Div. 1 of the 2002 Los Angeles City Building Code. Welds shall be made prior to installation of the anchors in the wall. An approved equivalent corrosion resistant coating (such as hot-dip zinc coating or red oxide paint) must be reapplied after welding.
6. Wall thickness shall be minimum of 3 wythes and 13".
7. The minimum mortar quality in 80% of the in-place shear tests shall not be less than the total of 50psi plus the axial stress in the wall at the point of the test.
8. The anchors may be installed above the intersection of the roof sheathing with the wall, only where:
 - a) Additional in-plane shear tests have been performed above the roof intersection at representative locations. One test per each wall direction shall be performed.
 - b) The minimum quality mortar in each of the tests shall not be less than 50 psi.
9. A called building inspection is required prior to the installation of bolts to verify:
 - a) Installer qualification.
 - b) Component identification.
10. Drilling holes for bolt installations shall be done with a non-impact electric rotary drill. Impact tools shall not be used for drilling holes or tightening anchors rod nuts.
11. The installed anchor shall not be disturbed until the adhesive has cured. See Table No. 1 for minimum cure time.

**Table No. 1
 Recommended hardening times for Epcon Epoxy Anchors**

Concrete Temperature (F)	Working Life (min.)	Minimum Cure Time ¹ (hours)	Cure Time (hours)
40	45	3	48
50	20	2	36
60	10	1.5	24
68	7	1	24
90	5	1	24

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12. No gaps shall appear between the anchoring device and the masonry. Any adjustments shall be made during the "working life" of epoxy. See Table No. 1 for work life.
13. The excess adhesive shall be removed before the working life time period has expended. See Table No. 1 for working life.
14. For use of the wall anchor in tension and/or shear:
 - a) Design tension loads shall not exceed 1200 pounds. Design shear loads shall not exceed 1000 pounds. No increase for lateral loading is allowed.
 - b) The stud assembly used for tension and/or shear applications where the outside of the wall is accessible consists of a length of zinc-plated $\frac{5}{8}$ "- diameter threaded rod which meets ASTM A 307 specifications. It is used in conjunction with a $\frac{7}{8}$ "-O.D. by $\frac{3}{4}$ "-I.D. steel sleeve 8" in length, and a $\frac{29}{32}$ "-diameter screen tube made of electro galvanized steel wire cloth. The $\frac{5}{8}$ "-diameter rod anchor shall be installed through the steel sleeve on the interior side of the wall bolted with a $\frac{3}{8}$ " x 6" x 6" steel gusset plate on the exterior side of the wall.
 - c) The stud assembly used to resist tension and/or shear loads where the outside of the wall is not accessible consists of a length of zinc-plated $\frac{3}{4}$ "-diameter threaded rod which meets ASTM A307 specifications pre-bent to a 22.5 degree angle. The threaded rod is used in conjunction with a $\frac{29}{32}$ "-diameter screen tube made of electro galvanized steel wire cloth. The screen tube shall be installed in a 1"-diameter hole drilled at an angle of 22.5 degrees downward from the horizontal plane only. The anchor shall be embedded to within one inch of the exterior wall surface without penetrating the exterior wall surface.
 - d) Tension tests shall be performed on anchors installed at an angle of 22.5 degrees. Testing shall be performed by a testing laboratory approved by the City of Los Angeles for in-place anchor testing. A minimum of 5% of the anchors shall be tested with a minimum of two tests. Where the wall thickness varies, at least one test shall be performed on an anchor which has the least amount of embedment. All tension tests must be performed without blocking, ledgers or hardware in place. The tests shall show that anchors can maintain a tensile load of 3000 pounds for a period of 5 minutes, using the equipment and procedures as follows. Load dissipation shall be no more than 10% deviation from the initially applied load.

Acceptable test equipment includes any suitable testing or loading system which permits the following conditions to be met. Test equipment must not bear against the epoxy. The testing device shall be of sufficient capacity to prevent yielding of its various components and shall ensure that the applied tension load remains parallel to the axis of the anchor during testing. Forces applied to the test rod must be perpendicular to the surface of the brick wall. A continuous increase in load must be applied to the test anchor until the final test load is reached. Any suitable measurement device accurate to at least 0.001" shall be used to measure horizontal

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displacement of the anchor relative to the face of the wall. The loading system must be calibrated and be capable of measuring forces to an accuracy within $\pm 2\%$ of the applied load.

Test procedures are as follows:

- 1) Measure projection of rod from face of wall to verify anchor embedment.
- 2) Attach test system and measuring device to anchor. The measuring device shall be positioned on the anchor as close to the wall as possible.
- 3) Measure and record the initial displacement between a marked point on wall and reference point on anchor.
- 4) Apply 3000 pound test load.
- 5) After 5 minutes, record the remaining test load and record the final displacement between the marked point on wall and reference point on anchor.

The test report shall include:

- 1) Test location(s).
- 2) Brick/mortar condition.
- 3) Wall thickness.
- 4) Embedment depth of anchor.
- 5) Applied load.
- 6) Remaining tension test load after 5 minutes.
- 7) Anchor displacement: Allowable displacement is no more than $\frac{1}{8}$ ".
- 8) Calibration of the tension load test system.

Should any of the anchors fail the above criteria, all of the anchors shall be tested and replaced or substituted as necessary. The test results shall be submitted directly to the Inspection Section of the Earthquake Safety Section for all jobs tested.

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- e) One-fifth (20%) of the installed anchors and steel sleeves shall be tested by a registered deputy building inspector using a torque calibrated wrench to a minimum torque of 60 foot-lbs. All requirements of Earthquake Safety Section, Guideline No. 3, "Torque Testing Grouted Bolts and Anchors" shall be met.

15. For use of the wall anchor in shear:

- a) Design shear shall not exceed 1000 pounds with no increase for lateral loading.
- b) The stud assembly used to resist only shear loads consists of a length of zinc-plated $\frac{3}{4}$ "-diameter threaded rod which meets ASTM A 307 specifications. It is used in conjunction with $\frac{29}{32}$ "-diameter by 8" long screen tube made of electro galvanized steel wire cloth. The straight anchor rod shall be embedded a minimum of 8" into a 1"-diameter hole drilled into the wall.
- c) One-fourth (25%) of the anchors shall be tested by a Registered Deputy Building Inspector using a torque calibrated wrench to a minimum torque of 60 foot-lbs.

16. All requirements of Earthquake Safety Section, Guideline No. 3, "Torque Testing Grouted Bolts and Anchors" shall be met.

DISCUSSION

The approval is based on tests. The tests were performed on three existing unreinforced solid masonry buildings.

The manufacturer's recommended cure times are listed in Table No. 1. Working life is the time after mixing during which the epoxy retains sufficient workability for proper use. Minimum cure time is the time required prior to application of allowable (design) tensile and shear loads. The anchors should not be disturbed (torqued, proof-loaded, or bolted-up) for the minimum cure time specified. Cure time is the time required for the epoxy to reach ultimate strength. The anchors are not recommended for installation in a substrate with temperature lower than 40° F.

The manufacturer's instructions for the anchor installations are as follows:

One inch diameter holes are drilled in the "T" joints of the mortar for all three types of anchors. The drill bits used must meet ANSI Specifications B94.12-77. Impact tools shall not be used.

The holes are cleaned of dust and debris using a nylon brush and compressed air. Epoxy is injected into the screen tubes until the tubes are completely full and then placed into the drilled holes. Threaded rod or steel sleeves (depending upon application) are then slowly pushed into the screen tube while continuously rotating. If no epoxy is forced back out of the hole, the rod or sleeve should be removed and more epoxy injected into the screen. The rod or sleeve should be reinserted into the screen as soon as possible.

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Holes for the through-bolted combination tension/shear anchors are drilled completely through the wall. After the sleeve has been installed and the epoxy has been given time to cure, a $\frac{5}{8}$ "-diameter drill bit is used to drill through the plastic plugs in the steel sleeves. A $\frac{5}{8}$ "-diameter threaded rod is then pushed through to the other side. A metal plate and nut are attached to the end of the rod on the exterior side of the wall.

Holes for the combination tension/shear anchors installed at 22.5 degrees are drilled using a 22.5 degree guide to keep the drill bit at the correct angle. The angled hole is to be drilled in the vertical plane only. The holes are drilled a minimum of 13" deep and must extend to within one inch of the outer face without going all the way through the wall.

Holes for the $\frac{3}{4}$ "-diameter anchors resisting only shear loads are drilled to a depth of 8" and are installed with a screen as described above.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this approval have been met in the project in which it is to be used.



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