Designation: E 1512 – 93

An American National Standard

Standard Test Methods for Testing Bond Performance of Adhesive-Bonded Anchors[1]

This standard is issued under the fixed designation E 1512; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover instructions for making a variety of tests for the strength of the adhesive bond developed between a steel anchor and the surface of a hole in concrete or masonry (including masonry units and mortar joints) and for assessing the effects on such bond of a variety of factors including elevated temperature, fire, moisture, and freezing and thawing action. The specifier or manufacturer shall select those tests that are appropriate for the given anchoring system and intended application.

1.2 The adhesive-bonded anchor system refers to a smooth or deformed steel bar or threaded rod, set in a predrilled hole containing chemical bonding compounds. Loads are transferred mainly by the bond of the adhesive both to the anchor and the surrounding elements along the sides of the hole. For anchoring systems made of significantly different materials, these test methods shall be taken as a guideline.

1.3 These test methods apply to anchorages used in uncracked concrete or masonry. They do not apply to the use of the anchor in the concrete tension zone. The usual forces applied during the tests are in tension, shear, and under a combination of both tension and shear.

1.4 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing[2]

E 119 Test Methods for Fire Tests of Building Construction and Materials[3]

E 488 Test Method for Strength of Anchors in Concrete and Masonry Elements[4]

E 575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *control anchor*—the anchor tested to provide a reference value that shall be used to compare with the value obtained by the test anchor. The control anchor shall be tested in concrete of the same strength and age as that of the test anchor.

3.1.2 *epoxy resin*—a viscous liquid or brittle solid containing epoxide groups that cross-link into final form by means of a chemical reaction with a variety of setting agents used with or without heat.

3.1.3 *polyester resin*—a condensation product resulting from a chemical reaction between a dicarboxylic acid and a dihydroxy alcohol or by the polymerization of a hydroxy carboxylic acid.

3.1.4 *test anchor*—the anchor being tested to criteria to determine its load-carrying capacity.

3.1.5 *vinylester resin*—vinylesters are the reaction products of epoxy resins with ethylenically unsaturated carboxylic acids. These materials react to give crosslinking either by polymerization of the vinylester resin with itself or by copolymerization with unsaturated monomers such as styrene.

4. Significance and Use

4.1 These test methods are intended to provide information from which applicable design data and specifications are derived for a given anchorage device and for qualifying anchors or anchorage devices.

4.2 These test methods shall be followed to ensure reproducibility of the test data.

5. General Requirements

5.1 The adhesive bonded anchors to be tested shall be representative of the product made available for typical field installations. The manufacturer shall provide information on physical, mechanical, and chemical properties of the anchor system. If required by a customer or approval agency, the

[1] These test methods are under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and are the direct responsibility of Subcommittee E06.13 on Structural Performance of Connections in Building Construction.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.07.

[4] *Annual Book of ASTM Standards*, Vol 04.11.

testing laboratory shall verify, or have a specialized laboratory verify, the physical, mechanical, and chemical properties of the adhesive.

5.2 The installation equipment, instructions, and procedures shall be as specified by the manufacturer. If there are any deviations from the manufacturer's instructions when testing commercial anchors, they shall be described in the report.

5.3 The structural members shall be as described in Test Method E 488.

5.4 The test and measuring equipment for performing static tension and shear tests, as well as dynamic tests, are described in Test Method E 488. For performing long-term creep tests, equipment that will sustain the required loads without distress shall be used.

6. Materials and Manufacture

6.1 The adhesive-bonded anchors shall be installed for use in accordance with written instructions of the manufacturer. An inert filler that does not affect the performance of the components, if specified by the manufacturer, shall be uniformly incorporated in one or both bonding components.

7. Procedure

7.1 This section presents the specific tests that shall be performed as required to evaluate the chemical anchor system.

7.1.1 The tests given in 7.2-7.4 are designed to determine load capacity for the chemical anchoring system. Perform these tests in accordance with Test Method E 488 with the test reaction-force distance from the test anchor complying with the requirements of Table 2 of that test method.

7.1.2 The tests given in 7.5-7.10 are designed to determine the influence of loading and environmental influences on the bond strength of the adhesive. To ensure evaluation of the adhesive bond strength, use steel of sufficiently high strength to prevent steel failure for the anchor. The reaction force shall be close to the anchor to preclude concrete or masonry failure, but allow bond failure. To provide comparative standardized data, anchors shall have a diameter of ½ in. (12 mm). Test anchors of other diameters where specified by the purchaser.

7.1.3 Perform all tests in accordance with Test Method E 488 under continuous load application, with continuous measurement of both load and displacement (deformation). The load application rate shall cause failure between 2 and 5 min. Concrete compressive strength shall be between 2500 psi (17 MPa) and 3500 psi (24 MPa), unless otherwise specified, at the time of testing with a minimum concrete age of 28 days. In addition, for smooth bars, the surface finish shall be typical for the standard anchor and, for threaded or deformed bars, the deformation pattern shall be typical for the standard anchor to ensure a true bond strength. Unless otherwise specified, install anchors at a room temperature between 65 and 75°F (18 and 24°C). Install and cure anchors according to the manufacturer's instructions unless otherwise specified.

7.2 *Static Tests*—Perform static shear and tension tests in accordance with Test Method E 488.

7.3 *Fatigue Tests*—Perform fatigue tests in accordance with Test Method E 488.

7.4 *Seismic Tests*—Perform seismic tests in accordance with Test Method E 488.

7.5 *Long-Term Load (Creep) Tests*:

7.5.1 Test a minimum of three ½ in. (12 mm) diameter anchors in tension.

7.5.2 The test duration shall be a minimum of 120 days. Maintain the temperature of the test specimens between 65 and 75°F (18 and 24°C).

7.5.3 Load each anchor to a minimum constant static tensile force of 0.4 times the manufacturer's published ultimate load for the full test duration. Typical test setups are shown in Figs. 1 and 2.

7.5.4 Load-displacement response for each specimen shall be monitored at sufficient intervals to develop a representative curve for the system. Since a large portion of the movement occurs in the very early stages of the test, readings small be

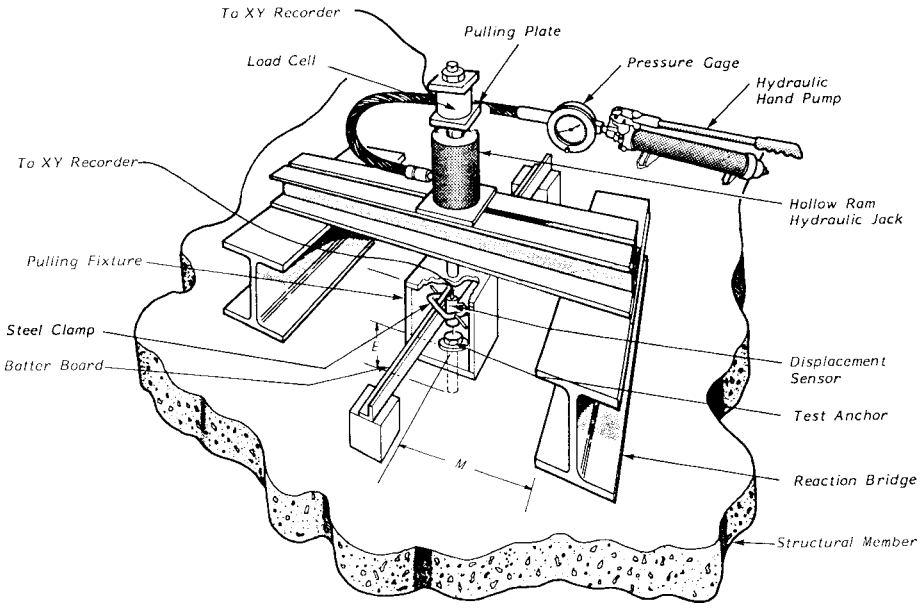

FIG. 1 Tension Creep Test Arrangement