



Designation: C884/C884M – 23

# Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay<sup>1</sup>

This standard is issued under the fixed designation C884/C884M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This test method covers the determination of which epoxy-resin formulations are subject to debonding when used as overlays for concrete when the combination of the two is subjected to temperature changes that may be met in the field.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the specification.

1.3 The text of this standard refers to notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. A specific hazard statement is given in Section 8. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to exposed skin and tissue upon prolonged exposure.)*<sup>2</sup>

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.25 on Organic Materials for Bonding.

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<sup>2</sup> See Section on Safety Precautions, *Manual of Aggregate and Concrete Testing*, Annual Book of ASTM Standards, Vol. 04.02.

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>3</sup>

C33/C33M Specification for Concrete Aggregates

C125 Terminology Relating to Concrete and Concrete Aggregates

C150/C150M Specification for Portland Cement

C260/C260M Specification for Air-Entraining Admixtures for Concrete

C672/C672M Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals (Withdrawn 2021)<sup>4</sup>

C778 Specification for Standard Sand

C881/C881M Specification for Epoxy-Resin-Base Bonding Systems for Concrete

## 3. Terminology

3.1 *Definitions*:

3.1.1 For definitions of terms used in this test method, refer to Terminology C125.

## 4. Summary of Test Method

4.1 A layer of epoxy-sand mortar is applied to a slab of dried concrete. After the epoxy has cured, the sample is subjected to five cycles of temperature change between 23 °C [73.5 °F] and –21 °C [–6 °F]. Cracks near the bond line between the concrete and the epoxy mortar constitute failure of the test.

## 5. Significance and Use

5.1 This test method applies to materials used in making epoxy-mortar overlays for concrete pavement. If debonding occurs between the overlay and the pavement, the material is unsuitable.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> The last approved version of this historical standard is referenced on www.astm.org.

\*A Summary of Changes section appears at the end of this standard

5.2 This test method evaluates the ability of an overlay to remain bonded to a concrete substrate during repeated thermal cycling in air over a significant temperature range and is not intended to duplicate temperature fluctuations in the field.

## 6. Apparatus

6.1 *Molds*, in conformance with Test Method **C672/C672M**.

6.2 *Freezer*, in conformance with Test Method **C672/C672M**, except that the temperature of the freezer shall be  $-21\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  [ $-6\text{ }^{\circ}\text{F} \pm 3\text{ }^{\circ}\text{F}$ ].

6.3 *Retaining strips*, to retain the epoxy-mortar overlay. Pieces of wood or steel that can be attached to the 300 mm by 300 mm by 75 mm [12 in. by 12 in. by 3 in.] concrete block so as to enclose completely the top surface of the block and rise above it a uniform distance of 15 mm [0.5 in.].

## 7. Materials

7.1 *Portland Cement*, Type I or Type II, meeting the requirements of Specification **C150/C150M**.

7.2 *Standard Sand*, meeting the requirements of Specification **C778**.

7.3 *Aggregates*—Fine and coarse aggregate meeting the requirements of Specification **C33/C33M**. The coarse aggregate shall be durable under freezing exposure and shall have a maximum size of 25 mm [1 in.]. The fine aggregate shall be a natural sand.

7.4 *Air-Entraining Admixture*, meeting the requirements of Specification **C260/C260M**.

## 8. Hazards

8.1 **Warning**—Epoxy resins contain irritants, especially to the skin, eyes, and respiratory system. Persons handling these materials shall use appropriate protective clothing, including rubber or plastic gloves. If an epoxy resin should contact the skin, it shall be removed immediately with a dry cloth or paper towel, and the area of contact shall be washed thoroughly with soap and water. Solvents shall not be used, because they carry the irritant into the skin. Cured epoxy resins are considered innocuous.

## 9. Sampling

9.1 Take samples in accordance with Specification **C881/C881M**.

## 10. Preparation of Concrete Blocks

10.1 *Proportions*—Proportion an air-entrain concrete in accordance with Test Method **C672/C672M**. Prepare two blocks.

10.2 *Fabrication of Concrete Blocks*—Fabricate the concrete blocks in accordance with Test Method **C672/C672M**, except end the fabrication operations after the strike-off operation.

10.3 *Curing*—Cure the concrete blocks in accordance with Test Method **C672/C672M**, except that air-drying shall be at least 14 days.

10.4 *Surface Preparation*—Prior to the application of the epoxy mortar, sand-blast the top surface of the concrete block, and then remove any loose material with a bristle-brush.

## 11. Fabrication of Test Specimen

11.1 Assemble the retaining strips to the concrete blocks. Coat their inner surfaces with a suitable bond breaker.

11.2 *Preparation of Epoxy Mortar*—Prepare enough epoxy mortar to cover two concrete blocks. Mix the epoxy resin under test in accordance with the instructions of the manufacturer or formulator. To 1 part by volume of the mixed system add the following bulk or “loose” volumes (that is, that of the container in which it is) of standard sand and mix thoroughly:

	<i>Unfilled</i>	<i>Filled</i>
Grade 1	3 parts	2.5 parts
Grade 2	2.5 parts	2 parts
Grade 3		1 part

11.3 *Application of Epoxy Mortar*—Prime the surface of the concrete blocks with the recommended primer. Thoroughly brush on the primer in a thin coat. Apply the epoxy mortar in a layer flush with the tops of the retaining strips. Remove the retaining strips after 24 hours and allow the epoxy mortar to cure an additional 6 days at  $23\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  [ $73.5\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$ ]. It may be necessary to grind or saw cut the vertical faces so as to have a visible bond line.

## 12. Procedure

12.1 After the completion of the curing period of the epoxy mortar, place the two specimens in the freezer for 24 hours. Then remove them to room temperature,  $23 \pm 2\text{ }^{\circ}\text{C}$  [ $73.5 \pm 3.5\text{ }^{\circ}\text{F}$ ], for 24 hours. This is one test cycle. Continue for four additional cycles.

## 13. Interpretation of Results

13.1 Delamination of the epoxy-mortar layer from the concrete test block or the presence of horizontal cracks in the concrete near the interface shall constitute failure. If either of the companion specimens has failed, the epoxy-resin system under test shall be considered to have failed the test.

## 14. Report

14.1 The report shall identify the epoxy-resin system and state whether the resin system has passed or failed the test.

## 15. Precision and Bias

15.1 *Precision and Bias*—No information is presented about either precision or bias of this test method because the test result is not quantitative.

## 16. Keywords

16.1 epoxy-resin overlay; thermal compatibility