



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

This standard is issued under the fixed designation C 884/C 884M; 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 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 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

1.3 *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 determine the applicability of regulatory limitations prior to use.* A specific hazard statement is given in Section 7.

## 2. Referenced Documents

### 2.1 ASTM Standards:

C 33 Specification for Concrete Aggregates<sup>2</sup>

C 150 Specification for Portland Cement<sup>3</sup>

C 260 Specification for Air-Entraining Admixtures for Concrete<sup>2</sup>

C 672 Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals<sup>2</sup>

C 778 Specification for Standard Sand<sup>3</sup>

C 881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete<sup>2</sup>

## 3. Summary of Test Method

3.1 A layer of epoxy-sand mortar is applied to a slab of cured and dried concrete. After the epoxy has cured, the sample is subjected to five cycles of temperature change between 77°F

[25°C] and – 6°F [–21°C]. Cracks near the bond line between the concrete and the epoxy mortar constitute failure of the test.

## 4. Significance and Use

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

## 5. Apparatus

5.1 *Molds*, in conformance with Test Method C 672.

5.2 *Freezer*, in conformance with Test Method C 672, except that the temperature of the freezer shall be  $-6 \pm 3^\circ\text{F}$  [ $-21 \pm 2^\circ\text{C}$ ].

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

## 6. Materials

6.1 *Portland Cement*, Type I or Type II, meeting the requirements of Specification C 150.

6.2 *Standard Sand*, meeting the requirements of Specification C 778.

6.3 *Aggregates*—Fine and coarse aggregate meeting the requirements of Specification C 33. The coarse aggregate shall be durable under freezing exposure and shall have a maximum size of 1 in. [25 mm]. The fine aggregate shall be a natural sand.

6.4 *Air-Entraining Admixture*, meeting the requirements of Specification C 260.

## 7. Hazards

7.1 **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

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.01.

the irritant into the skin. Cured epoxy resins are considered innocuous.

## 8. Sampling

8.1 Take samples in accordance with Specification C 881.

## 9. Preparation of Concrete Blocks

9.1 *Proportions*—Proportion an air-entrain concrete in accordance with Test Method C 672. Prepare two blocks.

9.2 *Fabrication of Concrete Block*—Fabricate the concrete block in accordance with Test Method C 672, except end the fabrication operations after the strike-off operation.

9.3 *Curing*—Cure the concrete blocks in accordance with Test Method C 672, except that air-drying shall be at least 14 days.

9.4 *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.

## 10. Fabrication of Test Specimen

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

10.2 *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

10.3 *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 h and allow the epoxy mortar to cure an additional 6 days at  $73 \pm 2^\circ\text{F}$  [ $23 \pm 1^\circ\text{C}$ ]. It may be necessary to grind or saw cut the vertical faces so as to have a visible bond line.

## 11. Procedure

11.1 After the completion of the curing period of the epoxy mortar, place the two specimens in the freezer for 24 h. Then remove them to room temperature ( $73 \pm 2^\circ\text{F}$  [ $23 \pm 1^\circ\text{C}$ ]) for 24 h. This is one test cycle. Continue for four additional cycles.

## 12. Interpretation of Results

12.1 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.

## 13. Report

13.1 The report shall state whether the resin system has passed or failed the test.

## 14. Precision and Bias

14.1 No statement is made about either precision or the bias of this test method for measuring thermal compatibility between concrete and an epoxy-resin overlay since the result merely states whether there is conformance to the criteria for success specified in the procedure.

## 15. Keywords

15.1 epoxy-resin overlay; thermal compatibility

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