
Standard Method of Test for Macrocell Slab Chloride Threshold

AASHTO Designation: T 376M/T 376-24¹

Technically Revised: 2024

Technical Subcommittee: 4f, Metals



**American Association of State Highway and Transportation Officials
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Standard Specification for

Macrocell Slab Chloride Threshold

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1.
- SCOPE
- 1.1.

This test method describes procedures to measure the chloride threshold concentration to initiate active corrosion of reinforcing bars in concrete using a macrocell slab type specimen.
- 1.2.

Test measurement of chloride threshold concentration can be used to project service life of various reinforced concrete structural members when placed in corrosive environments.
- 1.3.

The quality of the results produced by this standard is dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

2.
- REFERENCED STANDARDS
- 2.1.

AASHTO Standards:

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M 31M/M 31, Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

■

M 43, Sizes of Aggregate for Road and Bridge Construction

■

M 85, Portland Cement

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M 334M/M 334, Uncoated, Corrosion-Resistant, Deformed and Plain Chromium Alloyed, Billet-Steel Bars for Concrete Reinforcement and Dowels

■

M 339M/M 339, Thermometers Used in the Testing of Construction Materials

■

R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories

■

R 39M/R 39, Making and Curing Concrete Test Specimens in the Laboratory

■

T 22M/T 22, Compressive Strength of Cylindrical Concrete Specimens

■

T 119M/T 119, Slump of Hydraulic Cement Concrete

■

T 121M/T 121, Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

■

T 152, Air Content of Freshly Mixed Concrete by the Pressure Method

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T 196M/T 196, Air Content of Freshly Mixed Concrete by the Volumetric Method

■

T 277, Electrical Indication of Concrete’s Ability to Resist Chloride Ion Penetration
- 2.2.

ASTM Standards:

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C33/C33M, Specification for Concrete Aggregates

- C1152/C1152M, Test Method for Acid-Soluble Chloride in Mortar and Concrete
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E230, Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers
- G193, Standard Terminology and Acronyms Relating to Corrosion

2.3. *Other Standard:*

- IEC 60584-1: 2013, Thermocouples - Part 1: EMF Specifications and Tolerances

3. TEST EQUIPMENT AND MATERIALS

- 3.1. *Voltmeter*—High impedance voltmeter (at least one M Ω) capable of measuring 0.001 mV.
- 3.2. *Reference Electrode*—Saturated calomel electrode, as defined in ASTM G193.
- 3.3. *Resistor*—10-ohm ($\pm 0.3 \Omega$) electrical resistor.
Note 1—Agency may also select a 100- Ω resistor— noting that a 100- Ω resistor will be more sensitive than a 10- Ω , recognizing for a given current the measured voltage drop (the product of resistance and current) will be ten times higher. It should also be noted that a 100- Ω resistor has a higher load on the circuit, so the current flows less easily.
- 3.4. *Terminal Box*—Terminal boxes house the electrical connection to the reinforcing bars.
- 3.5. *Wire*—16-gauge [1.5-mm²] insulated copper wire is used to make the electrical connections to the bars.
- 3.6. *Epoxy Sealer*—A two part impermeable epoxy sealer shall be used to cover the sides of the specimens and the electrical connections. It shall be applied in accordance with manufacturer's recommendations.
- 3.7. *Concrete Mix*—Cement shall be Type I or II per M 85. Coarse aggregate shall conform to ASTM C33 and M 43, with nominal maximum size between 9.5 and 12.5 mm [$\frac{3}{8}$ and $\frac{1}{2}$ in.]. (See Section 4.9.)
- 3.8. *Sodium Chloride Solution*—3.0 wt. percent sodium chloride solution is prepared by adding 30 g [1 oz.] of NaCl to 970 g [34 oz.] of distilled or deionized water.
- 3.9. Plastic Dams, 100-mm [4.0-in.] wide and 150-mm [6.0-in.] long with a minimum height of 75 mm [3.0 in.] for placement on the test specimens. The wall thickness shall be 3 ± 1 mm [$\frac{1}{8} \pm \frac{1}{32}$ in.].
- 3.10. *Marine (Medium- or High-Strength) Polyurethane Adhesive*—for sealing the outside of the plastic dam to the top of the concrete specimen.
Note 2—The user shall determine an adhesive that is appropriate for a marine environment.
- 3.11. *Rebar Test Specimens*—The tested rebars will include both the selected candidate test bar specimens conforming to M 334M/M 334, Table 1 and an uncoated comparator “black steel” M 31M/M 31 bar. All rebar test specimens shall be No. 16 [No. 5] steel bars as-received from the manufacturer under normal delivery conditions. Each bar shall be tapped to receive a 10-24 bolt.
Note 3—All reinforcing bars shall be as sold and provided by the manufacturer, with or without mill scale.