

An ACI and TMS Standard

Thermal Properties of Concrete and Masonry for Use in Determining Energy Code Compliance Except for Low- Rise Residential Buildings— Code Requirements and Commentary

Reported by Joint ACI-TMS Committee 122



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Thermal Properties of Concrete and Masonry for Use in Determining Energy Code Compliance Except for Low-Rise Residential Buildings—Code Requirements and Commentary

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This Code prescribes minimum design and construction requirements for energy efficiency of building envelopes of new buildings and additions to buildings. It applies to buildings having concrete walls, roofs, or floors; masonry walls; and masonry veneer, including veneer attached to frame walls as part of the building envelope. It also provides minimum thermal properties for these assemblies for code compliance.

This Code is applicable to commercial and medium high-rise residential buildings that use either electricity from any generation source or fossil fuel. It can be used with applicable energy codes and standards such as ASHRAE 90.1 and the International Energy Conservation Code (IECC).

Keywords: energy efficiency; specific heat; thermal conductivity; thermal diffusivity; thermal resistance; thermal transmittance.

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PREFACE

This Code provides procedures that can be used to meet the requirements of energy efficiency codes and standards that have been adopted by the authority having jurisdiction. This Code has three alternative paths: 1) a prescriptive path; 2) a building envelope trade-off methodology; and 3) a whole building energy simulation trade-off methodology.

CODE

COMMENTARY

CHAPTER 1—GENERAL

R1—GENERAL

1.1—Scope

1.1.1 This Code provides design and construction requirements to establish a minimum level of energy efficiency in new buildings and additions to buildings constructed with building envelopes of concrete or masonry construction. This Code is only applicable to commercial and mid- to high-rise residential buildings. For low-rise residential buildings, refer to **ACI/TMS CODE-122.2**, “Thermal Properties of Concrete and Masonry for Use in Determining Energy Code Compliance for Low-Rise Residential Buildings—Code Requirements and Commentary.” This Code also lists thermal properties for these assemblies for use in code compliance. This Code shall be used with all applicable energy-efficiency codes and standards.

1.2—General

1.2.1 The provisions of this Code apply to:

- (a) Portions of buildings having above-grade and below-grade walls consisting of concrete; masonry; or masonry veneer, including veneers attached to frame walls
- (b) Portions of buildings having concrete floors above unconditioned space and slab-on-ground floors

1.2.2 The provisions of this Code do not apply to:

- (a) Single-family houses and residential structures with three stories or less above grade
- (b) Buildings that do not use electricity or fossil fuel

1.3—Purpose

The purpose of this Code is to establish the minimum energy efficiency requirements for buildings with concrete and masonry envelope components. This purpose is accomplished by providing the following for compliance with energy codes and standards:

- (a) Criteria for prescriptive and performance methods applicable to concrete and masonry
- (b) Thermal properties of concrete and masonry
- (c) A method of determining thermal properties of concrete and masonry by test or calculation

1.4—Applicability

1.4.1 This Code shall not be used to circumvent any safety, health, or environmental requirements contained in other applicable codes or ordinances.

1.4.2 This Code does not address moisture control or provide criteria to prevent moisture migration.

R1.1—Scope

R1.1.1 This Code applies to buildings having concrete walls, roofs, or floors; masonry walls; or masonry veneer, including veneer attached to frame walls.

This Code applied to commercial and mid- to high-rise residential buildings that use either electricity from a power generation source or fossil fuel. It can be used with applicable energy codes and standards such as **ASHRAE 90.1** or the **International Energy Conservation Code (IECC)**.

Criteria covered includes above-grade walls, below-grade walls, and floors above unconditioned space and slab-on-ground floors.

R1.2—General

The code compliance of concrete and masonry walls and floors, with or without insulation, is complex because heat loss and heat gain through the building envelope depend on thermal inertia (thermal mass) as well as thermal resistance.

This Code does not consider the potential for moisture or condensation on or within the assemblies that comply nor does it provide criteria to prevent moisture migration or condensation. Condensate has the potential to accumulate between some dissimilar materials in some climate conditions. In addition, some insulation materials are moisture-sensitive. When these insulation materials become wet due to condensation or moisture infiltration, their rated R-value may decrease, the insulation may degrade, or both. A separate analysis is recommended to ensure that the assemblies used in design do not have the potential for condensation or moisture-related issues. The **ASHRAE Handbook—Fundamentals** provides guidance on methods of analysis.