A PCI Standard

PCI 124-18

SPECIFICATION FOR FIRE RESISTANCE

of Precast/Prestressed Concrete

PCI Precast/Prestressed Concrete Institute

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FOREWORD

The Precast/Prestressed Concrete Institute (PCI) first issued a manual for the design for fire resistance of precast/prestressed concrete in 1977. A second edition was prepared in 1989 and a third edition in 2011. The recommended design procedures in those three editions were based on fire test data and reports for precast/prestressed concrete dating back to the 1960s. Little has changed since then in fundamental design for fire resistance. While fire resistance is discussed in other publications as "calculated" fire resistance, those provisions have generally been prescriptive. That is, tables of information are used to select concrete mass or protection for steel. Since the first edition of the PCI manual, rational design, which is truly a fire resistance calculation procedure, has been demonstrated. Though not a standard, the first edition of the *International Building Code* in 2000 referenced the procedures in the PCI fire design manual as being acceptable for prestressed concrete slabs not covered elsewhere.

With the 2014 designation of PCI as an ANSI (American National Standards Institute) Accredited Standards Developer, the material for fire resistance of precast and precast, prestressed concrete was deemed important enough to the precast concrete industry that the newest edition of the provisions would be developed in a consensus standard form. Thus, the design procedures would be referenced in the 2021 *International Building Code* as a standard developed through an ANSI consensus process.

PREFACE

This standard was developed following the protocols required by the PCI Group Operations Manual. The provisions were first generated and balloted in the PCI Fire Committee. A review and comment by the PCI Technical Activities Council (TAC) followed and resulted in substantive changes to the document. These changes were balloted by the PCI Fire Committee and finally accepted by the PCI TAC. The document was then submitted to the PCI Standards Committee where additional review and balloting took place. The membership of that committee is balanced according to the rules of ANSI accreditation. In addition, a public review period was provided and public comments were resolved through the PCI Standards Committee. The entire process is a consensus process involving PCI members, nonmembers of PCI, and the general public.

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CHAPTER 1—GENERAL

1.1 Scope. This document specifies requirements for the design of precast and precast, prestressed concrete elements to resist fire and provide fire protection. For the purposes of this standard, "precast concrete element" shall mean a plant-cast concrete member reinforced with any combination of nonprestressed deformed reinforcement or prestressed strand. This standard provides acceptable methods to determine the fire resistance of precast concrete structural elements, including walls, floor and roof slabs, beams, and columns, and the fire protection for structural steel columns with precast concrete covers. The fire exposure and applicable end-point criteria of ASTM E119 shall be used in the application of these methods for design. Except where the requirements of this standard are more stringent, elements shall conform to the requirements of ACI 318.

1.2 Definitions. The following definitions shall apply for the purposes of this standard:

approved—approved by the building official responsible for enforcing the legally adopted building code of which this standard is a part, or approved by some other authority having jurisdiction.

bar, high-strength alloy steel—steel bar conforming to the requirements of ASTM A722/A722M.

beam—a structural member with a primary load demand in flexure or shear.

blanket, ceramic fiber—mineral wool insulating material made of alumina-silica fibers and having a density of 4 to 8 lb/ft^3 (64 to 128 kg/m^3).

board, mineral—a rigid, felted thermal insulation board complying with ASTM C726.

building code—a legal document that establishes the minimum requirements necessary for building design and construction to provide for public health and safety.

concrete, carbonate aggregate—concrete made with coarse aggregate consisting mainly of calcium or magnesium carbonate or a combination of calcium and magnesium carbonate (for example, limestone or dolomite).

concrete, lightweight-aggregate—concrete having a unit weight of 90 to 105 lb/ft^3 (1440 to 1680 kg/m^3) and made with aggregates conforming to ASTM C330/ C330M.

concrete, normalweight—concrete having a unit weight above 120 lb/ft^3 (1920 kg/m^3) and made with aggregates conforming to ASTM C33/C33M.

concrete, perlite—nonstructural lightweight insulating concrete having a density of approximately 30 lb/ft^3 (481 kg/m^3) and made by mixing perlite aggregate complying with ASTM C332 with portland cement slurry.

concrete, sand-lightweight—concrete having a unit weight of 105 to 120 lb/ft^3 (1680 to 1920 kg/m^3) and made with lightweight coarse aggregate conforming to ASTM C330/C330M and normalweight fine aggregate conforming to ASTM C33/C33M.

concrete, siliceous aggregate—normalweight concrete having aggregates composed mainly of silica or silicate compounds other than calcium or magnesium carbonate (for example granite).

concrete, vermiculite—nonstructural lightweight insulating concrete having a density of approximately 30 lb/ft^3 (481 kg/m^3) in which the aggregate consists of exfoliated vermiculite.

end-point criteria—conditions of acceptance for an ASTM E119 fire test.

end-point, heat transmission—an acceptance criterion of ASTM E119 limiting the temperature rise of the unexposed surface to an average of 250°F (121°C) for all measuring points or a maximum of 325°F (163°C) at any one point.

end-point, integrity—an acceptance criterion of ASTM E119 prohibiting the passage of flame or gases hot enough to ignite cotton waste before the end of the desired fire-endurance period. This term also applies to the hose-stream test of a fire-exposed wall.