IN-LB Inch-Pound Units

An ACI/TMS Standard

ACI/TMS 216.1-14(19)

Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

Reported by ACI/TMS Committee 216

Reapproved 2019

American Concrete Institute
Always advancing

THE MASONRY SOCIETY

First Printing November 2014
Errata as of February 9, 2021
ISBN: 978-0-87031-954-9

This document is the intellectual property of ACI and the cosponsor, and both have copyright. All rights reserved. This material may not be reproduced or copied, in whole or in part, in any printed, mechanical, electronic, film, or other distribution and storage media, without written consent. ACI is the lead sponsor of this joint committee and its operating procedures were followed. ACI's information is below; the cosponsor's information is on the inside back cover of this document.

Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

Copyright by the American Concrete Institute, Farmington Hills, MI. All rights reserved. This material may not be reproduced or copied, in whole or part, in any printed, mechanical, electronic, film, or other distribution and storage media, without the written consent of ACI.

The technical committees responsible for ACI committee reports and standards strive to avoid ambiguities, omissions, and errors in these documents. In spite of these efforts, the users of ACI documents occasionally find information or requirements that may be subject to more than one interpretation or may be incomplete or incorrect. Users who have suggestions for the improvement of ACI documents are requested to contact ACI via the errata website at http://concrete.org/Publications/DocumentErrata.aspx. Proper use of this document includes periodically checking for errata for the most up-to-date revisions.

ACI committee documents are intended for the use of individuals who are competent to evaluate the significance and limitations of its content and recommendations and who will accept responsibility for the application of the material it contains. Individuals who use this publication in any way assume all risk and accept total responsibility for the application and use of this information.

All information in this publication is provided "as is" without warranty of any kind, either express or implied, including but not limited to, the implied warranties of merchantability, fitness for a particular purpose or non-infringement.

ACI and its members disclaim liability for damages of any kind, including any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits, which may result from the use of this publication.

It is the responsibility of the user of this document to establish health and safety practices appropriate to the specific circumstances involved with its use. ACI does not make any representations with regard to health and safety issues and the use of this document. The user must determine the applicability of all regulatory limitations before applying the document and must comply with all applicable laws and regulations, including but not limited to, United States Occupational Safety and Health Administration (OSHA) health and safety standards.

Participation by governmental representatives in the work of the American Concrete Institute and in the development of Institute standards does not constitute governmental endorsement of ACI or the standards that it develops.

Order information: ACI documents are available in print, by download, on CD-ROM, through electronic subscription, or reprint and may be obtained by contacting ACI.

Most ACI standards and committee reports are gathered together in the annually revised ACI Manual of Concrete Practice (MCP).

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331
Phone: +1.248.848.3700
Fax: +1.248.848.3701

www.concrete.org

ACI 216.1-14
(Reappoved 2019)

Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

An ACI and TMS Standard

Reported by ACI Committee 216 joint with TMS

Venkatesh Kumar R. Kodur, Chair

Charles B. Clark Jr.
Donald O. Dusenberry
William L. Gamble
Dennis W. Graber
Thomas F. Herrell
Robert Iding
Joel R. Irvine
Phillip J. Iverson
T. D. Lin
Richard J. McGrath
John D. Perry
Stephen Pessiki
Long T. Phan
Walter J. Prebis
John P. Ries
Thomas J. Rowe
Jay G. Sanjayan
Jeffrey F. Speck
Stephen S. Szoke

Consulting Members
Max Kalafat
Wasseem Khan
Steven K. Rowe
Phillip J. Samblanet

Fire resistance of building elements is an important consideration in building design. While structural design considerations for concrete and masonry at ambient temperature conditions are addressed by ACI 318 and TMS 402, respectively, these codes do not consider the impact of fire on concrete and masonry construction. This standard contains design and analytical procedures for determining the fire resistance of concrete and masonry members and building assemblies. Where differences occur in specific design requirements between this standard and ACI 318 and TMS 402, as in the case of cover protection of steel reinforcement, the more stringent of the requirements shall apply.

Keywords: beams; columns; compressive strength; concrete slabs; fire endurance; fire ratings; fire resistance; fire tests; masonry walls; modulus of elasticity; prestressed concrete; prestressing steels; reinforced concrete; reinforcing steel; structural design; temperature distribution; thermal properties; walls.

ACI Committee Reports, Guides, and Commentaries are intended for guidance in planning, designing, executing, and inspecting construction. This document is intended for the use of individuals who are competent to evaluate the significance and limitations of its content and recommendations and who will accept responsibility for the application of the material it contains. The American Concrete Institute disclaims any and all responsibility for the stated principles. The Institute shall not be liable for any loss or damage arising therefrom.

Reference to this document shall not be made in contract documents. If items found in this document are desired by the Architect/Engineer to be a part of the contract documents, they shall be restated in mandatory language for incorporation by the Architect/Engineer.

CONTENTS

PREFACE, p. 2

CHAPTER 1—GENERAL, p. 2
1.1—Scope, p. 2
1.2—Alternative methods, p. 2

CHAPTER 2—NOTATION AND DEFINITIONS, p. 2
2.1—Notation, p. 2
2.2—Definitions, p. 3

CHAPTER 3—REFERENCED STANDARDS, p. 5

CHAPTER 4—CONCRETE, p. 6
4.1—General, p. 6
4.2—Concrete walls, floors, and roofs, p. 6
4.3—Concrete cover protection of steel reinforcement, p. 9
4.4—Analytical methods for calculating structural fire resistance and cover protection of concrete flexural members, p. 10
4.5—Reinforced concrete columns, p. 18
4.6—Structural steel columns protected by concrete, p. 19
4.7—Hollow structural steel columns filled with concrete, p. 20

ACI 216.1-14 supersedes ACI 216.1-07, was adopted October 30, 2014, and published November 2014.

Copyright © 2014, American Concrete Institute.

All rights reserved including rights of reproduction and use in any form or by any means, including the making of copies by any photo process, or by electronic or mechanical device, printed, written, or oral, or recording for sound or visual reproduction or for use in any knowledge or retrieval system or device, unless permission in writing is obtained from the copyright proprietors.