

**Specification for Tightness Testing of
Environmental Engineering Concrete
Containment Structures
(ACI 350.1-10) and Commentary**

Reported by ACI Committee 350



American Concrete Institute®



First Printing
February 2011

American Concrete Institute®
Advancing concrete knowledge

Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures (ACI 350.1-10) and Commentary

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. Proper use of this document includes periodically checking for errata at www.concrete.org/committees/errata.asp 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.

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
U.S.A.

Phone: 248-848-3700
Fax: 248-848-3701

www.concrete.org

ISBN 978-0-87031-418-6

Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures (ACI 350.1-10) and Commentary

An ACI Standard

Reported by ACI Committee 350

Satish K. Sachdev
Chair

Jon B. Ardahl*
Vice Chair

John W. Baker
Secretary

Iyad M. Alsamsam
Steven R. Close*
Robert E. Doyle
Anthony L. Felder
Carl A. Gentry

Charles S. Hanskat
Keith W. Jacobson
M. Reza Kianoush
Ramon E. Lucero

Daniel J. McCarthy
Andrew R. Minogue
Javed Manshi
Jerry

Andrew R. Philip
Risto Protic
William C. Sherman
Lawrence M. Tabat

*Subcommittee members who produced this specification.
The committee would like to thank David Poole, Paul Hedli, and Kyle Loyd for their contributions to this specification.

These test methods give procedures and criteria for tightness testing of environmental engineering concrete structures. They are applicable to liquid and gas containment structures constructed with concrete or a combination of concrete and other materials. This document includes hydrostatic, surcharged hydrostatic, and pneumatic tests.

These test methods may involve hazardous materials, operations, and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.

Keywords: containment structures; hydrostatic; leakage; pneumatic; reservoirs; tests; tightness; tightness criteria.

ACI Committee Reports, Guides, Manuals, 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

(mandatory portion follows)

SPECIFICATION

Section 1—General requirements, p. 3

- 1.1—Scope
 - 1.1.1—Work specified
 - 1.1.2—Work not specified
- 1.2—Definitions
- 1.3—Description
- 1.4—Submittals
 - 1.4.1—General
 - 1.4.2—Repair procedures
 - 1.4.3—Test reports
- 1.5—Quality assurance
 - 1.5.1—Duties and responsibilities of Contractor

ACI 350.1-10 supersedes 350.1-01, was adopted October 25, 2010, and published January 2011.

Copyright © 2011, 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.

Section 2—Hydrostatic tightness test for open or covered containment structures, p. 4

- 2.1—General
 - 2.1.1—Scope
- 2.2—Products
 - 2.2.1—Materials
- 2.3—Execution
 - 2.3.1—Test preparation
 - 2.3.2—Hydrostatic tightness test—Part 1: Qualitative criteria
 - 2.3.3—Hydrostatic tightness test—Part 2: Quantitative criteria
 - 2.3.4—Retesting

Section 3—Surcharged hydrostatic tightness test for closed containment structures, p. 5

- 3.1—General
 - 3.1.1—Scope
- 3.2—Products
 - 3.2.1—Materials
- 3.3—Execution
 - 3.3.1—Test preparation
 - 3.3.2—Surcharged hydrostatic tightness test—Part 1: Qualitative criteria
 - 3.3.3—Surcharged hydrostatic tightness test—Part 2: Quantitative criteria
 - 3.3.4—Retesting

Section 4—Pneumatic tightness test for closed containment structures, p. 7

- 4.1—General
 - 4.1.1—Scope
- 4.2—Products
 - 4.2.1—Materials
- 4.3—Execution
 - 4.3.1—Test preparation
 - 4.3.2—Pneumatic tightness test—Part 1: Qualitative criteria
 - 4.3.3—Pneumatic tightness test—Part 2: Quantitative criteria
 - 4.3.4—Retesting

Section 5—Combination hydrostatic-pneumatic tightness test for closed containment structures, p. 8

- 5.1—General
 - 5.1.1—Scope
 - 5.1.2—Submittals
- 5.2—Products
 - 5.2.1—Materials
- 5.3—Execution
 - 5.3.1—Test preparation
 - 5.3.2—Hydrostatic tightness testing—Parts 1 and 2 and retesting
 - 5.3.3—Pneumatic tightness testing—Parts 1 and 2 and retesting

*(nonmandatory portion follows)***Notes to Specifier, p. 9**

- General notes
- Foreword to Checklists
- Mandatory Requirements Checklist
- Optional Requirements Checklist
- Submittals Checklist

COMMENTARY**Section R1—General requirements, p. 11**

- R1.1—Scope
 - R1.1.2—Work not specified
- R1.3—Description

Section R2—Hydrostatic tightness test for open or covered containment structures, p. 11

- R2.1—General
 - R2.3.1—Test preparation
 - R2.3.2—Hydrostatic tightness test—Part 1: Qualitative criteria
 - R2.3.3—Hydrostatic tightness test—Part 2: Quantitative criteria
 - R2.3.4—Retesting

Section R3—Surcharged hydrostatic tightness test for closed containment structures, p. 13

- R3.1—General
 - R3.3.1—Test preparation
 - R3.3.2—Surcharged hydrostatic tightness test—Part 1: Qualitative criteria
 - R3.3.3—Surcharged hydrostatic tightness test—Part 2: Quantitative criteria
 - R3.3.4—Retesting

Section R4—Pneumatic tightness test for closed containment structures, p. 14

- R4.1—General
 - R4.3.1—Test preparation
 - R4.3.2—Pneumatic tightness test—Part 1: Qualitative criteria
 - R4.3.3—Pneumatic tightness test—Part 2: Quantitative criteria
 - R4.3.4—Retesting

Section R5—Combination hydrostatic-pneumatic tightness test for closed containment structures, p. 15

- R5.1—General
 - R5.3.1—Test preparation
 - R5.3.2—Hydrostatic tightness testing—Parts 1 and 2 and retesting
 - R5.3.3—Pneumatic tightness testing—Parts 1 and 2 and retesting

Section R6—References, p. 15*(mandatory portion follows)*

SPECIFICATION

SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 Work specified—This Specification covers tightness testing of liquid and gaseous environmental containment structures designed to resist liquid or gaseous loads. Provisions of this Specification shall govern except where other provisions are specified in Contract Documents.

1.1.1.1 These test methods are for the tightness testing of concrete environmental engineering liquid and gaseous containment structures. The included tests are:

- (a) Hydrostatic tightness test for open or covered containment structures.
- (b) Surcharged hydrostatic tightness test for closed containment structures.
- (c) Pneumatic tightness test for closed containment structures.
- (d) Combination hydrostatic-pneumatic tightness test for closed containment structures.

1.1.1.2 The tightness testing procedures and requirements contained herein are applicable to reservoirs, basins, and tanks constructed of concrete or a combination of concrete and other materials. Preparatory items indicated are required, unless otherwise specified, but the waiver of such items shall not change the test criteria.

1.1.1.3 Each cell of multi-cell containment structures shall be considered a single containment structure and tested individually unless otherwise permitted.

1.1.1.4 The hydrostatic tightness testing procedures and requirements herein are also applicable for tightness testing of open concrete liquid transmission structures such as cast-in-place concrete channels and conduits.

1.1.1.5 The hydrostatic tightness testing procedures and requirements herein, where applicable, can be used for tightness testing of concrete paved structures, such as channels and impoundments.

1.1.2 Work not specified—These provisions are not intended for hazardous material primary or secondary containment structures, cryogenic storage structures, high-pressure gas tanks, or miscellaneous precast concrete structures such as culverts, pipes, and manholes.

1.2—Definitions

accepted—determined to be satisfactory by Architect/Engineer.

Architect/Engineer—the Architect, Engineer, architectural firm or engineering firm, developing Contract Documents, or administering the Work under Contract Documents, or both.

containment structure—a basin, reservoir, channel, or conduit to be tightness tested regardless of whether it has a closed or open top or is constructed partially or entirely of concrete.

containment structure, closed—a containment structure where the roof or cover is used to prevent the escape of the contents, including gases emanating from the contents, to the outside atmosphere.

containment structure, covered—a containment structure where the contents are protected from exterior contamination by the presence of a cover or roof over the top of the containment structure.

containment structure, open—a containment structure where the top surface of the containment structure's contents is exposed to the atmosphere.

Contract Documents—a set of documents supplied by Owner to Contractor as the basis for construction; the documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.

Contractor—the person, firm, or entity under contract for construction of the Work.

environmental engineering concrete structures—as used in this Specification, concrete structures intended for conveying, storing, or treating water, wastewater, or other nonhazardous liquids.

fitting—an object that passes through the concrete or is embedded in the concrete to facilitate a connection to the containment structure.

Owner—the corporation, association, partnership, individual, public body or authority for whom the Work is constructed.

permitted, accepted by or acceptable to Architect/Engineer—usually pertaining to a request by Contractor, or where specified in Contract Documents.

Project Drawings—graphic presentation of project requirements.

Project Specifications—the written documents that detail requirements for the Work in accordance with service parameters and other specific criteria.

Reference Specification—a specification that is intended to be a reference standard for Contractor to use in the construction of the Work.

reference standards—standards of a technical society, organization, or association, including the codes of local or state authorities, which are referenced in Contract Documents.

required—mandatory in this Specification or Contract Documents.

soap suds—water impregnated with soap or synthetic detergent used to indicate air passage through joints or defects by the formation of soap bubbles.

submit—provide to Architect/Engineer for review or acceptance.

submittal—document or material provided to Architect/Engineer for review or acceptance.

vacuum box—a box with a transparent top, open bottom, and air sealing bottom edges used in conjunction with an air pump capable of creating at least a 3 psi vacuum within the box.

Work—the entire construction or separately identifiable parts thereof required to be furnished under Contract Documents.

1.3—Description

1.3.1 The structural adequacy of the containment structure shall be verified for the test pressure or pressures to be applied. One type of test shall not be substituted for another type of test without acceptance of the Architect/Engineer.