Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

NFPA® 75

Standard for the Fire Protection of Information Technology Equipment

2013 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

Become a Member
Subscribe to the NATIONAL FIRE CODES® SUBSCRIPTION SERVICE
Register for Seminars, Webinars, and Online Courses
Visit the NFPA Catalog

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® DOCUMENTS
NOTICE AND DISCLAIMER OF LIABILITY CONCERNING THE USE OF NFPA DOCUMENTS

NFPA® codes, standards, recommended practices, and guides ("NFPA Documents"), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Documents.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Documents. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Documents available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Documents. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

ISBN: 978-145590417-4 (Print)
ISBN: 978-145590466-2 (PDF) 8/12

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA DOCUMENTS

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Documents

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Documents") should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments. An official NFPA Document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments or corrected through the issuance of Errata, consult appropriate NFPA publications such as the National Fire Codes® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed below.

Interpretations of NFPA Documents

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Document. The users of NFPA Documents bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Documents.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards ("the ANSI Patent Policy"), and hereby gives the following notice pursuant to that policy:

NOTICE: The user's attention is called to the possibility that compliance with an NFPA Document may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Documents should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Documents are copyrighted by the NFPA. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Documents for regulatory purposes should be accomplished through adoption by reference. The term "adoption by reference" means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Documents, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Documents and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA documents during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02169-7471; email: stds_admin@nfpa.org

For more information about NFPA, visit the NFPA website at www.nfpa.org.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Copyright © 2012 National Fire Protection Association®. All Rights Reserved.

NFPA® 75

Standard for the

Fire Protection of Information Technology Equipment

2013 Edition

This edition of NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, was prepared by the Technical Committee on Electronic Computer Systems. It was issued by the Standards Council on July 9, 2012, with an effective date of July 29, 2012, and supersedes all previous editions.

This edition of NFPA 75 was approved as an American National Standard on July 29, 2012.

Origin and Development of NFPA 75

The Committee on Electronic Computer Systems was formed by the action of the NFPA Board of Directors in January 1960, following a request for standardization of fire protection recommendations by the computer industry.

The committee first submitted the *Standard for the Protection of Electronic Computer Systems* to the 1961 NFPA Annual Meeting, and it was tentatively adopted. At the 1962 Annual Meeting, it was officially adopted as an NFPA standard. Revisions were adopted in 1963, 1964, 1968, 1972, 1976, 1981, 1987, and 1989. The document was completely rewritten for the 1992 edition. The document was revised in 1995, 1999, and again in 2003. The 2003 edition incorporated the *Manual of Style for NFPA Technical Committee Documents* revisions.

In editions of this standard prior to 2003, the terms "electronic computer/data processing equipment" and "electronic computer system" were used where the current terms "information technology equipment" and "information technology equipment system," respectively, are used. Similarly, the terms "computer room" and "computer area" were replaced by "information technology equipment room" and "information technology equipment area," respectively. While the title and some terminology were changed in the 2003 edition to more closely align this standard's terminology with terminology being used in other standards, such as NFPA 70, *National Electrical Code*, and UL 60950, *Safety of Information Technology Equipment*, the scope of this standard and any definitions associated with those like terms remained the same.

For the 2009 edition, Section 4.2, Telecommunications Risks, was updated; many of the UL references were updated; new requirements were added for signage to indicate that equipment will remain energized where continuous power is provided; and flame spread indexes were provided for many of the materials listed in the standard.

For the 2013 edition, the title has again been changed to better reflect the scope of the document and to be clear that the standard is strictly for fire protection. The 2013 edition features a new section on the emerging use of aisle containment systems for information technology equipment and how these systems must be assessed for their interaction with fire protection features. A number of definitions have been extracted from *NFPA 70, National Electrical Code,* to define words used in the body of the standard that previously were not defined.

NFPA and National Fire Protection Association are registered trademarks of the National Fire Protection Association, Quincy, Massachusetts 02169.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Technical Committee on Electronic Computer Systems

Ralph E. Transue, *Chair*
The RJA Group, Inc., IL [SE]

Joseph A. Spataro, *Secretary*
Liberty Mutual Commercial Markets, NY [I]

Wayne J. Aho, Xtralis, Inc., MA [M]
Bernhard G. Bischoff, UTC/Chemetron Fire Systems, IL [M]
Rep. Fire Suppression Systems Association
Alastair R. Brown, Rushbrook Consultants, Ltd., Scotland [SE]
Thomas M. Burke, Underwriters Laboratories Inc., CA [RT]
Timothy Carman, Tyco Fire Suppression & Building Products, WI [M]
Vincent A. Crowder, Fireman's Fund Insurance Company, GA [I]
Thomas G. Deegan, The Viking Group, Inc., MI [M]
Rep. National Fire Sprinkler Association
Jeffry T. Dudley, National Aeronautics & Space Administration, FL [U]
Thomas Goonan, Tom Goonan Associates, VA [SE]
Stanley Kaufman, CableSafe, Inc./OFS, GA [M]
Rep. Society of the Plastics Industry, Inc.
Scott R. Lang, Honeywell International, IL [M]
Rep. Automatic Fire Alarm Association, Inc.
Robert L. Langer, Amerex Corporation, AL [M]
Rep. Fire Equipment Manufacturers' Association
Ronald Marts, Telcordia Technologies, NJ [U]
Rep. Alliance for Telecommunications Industry Solutions
Stephen McCluer, APC by Schneider Electric, TX [U]
George A. Petrou, J.P. Morgan Chase & Company, NJ [U]
Robert M. Pikula, Reliable Fire Equipment Company, IL [IM]
Rep. National Association of Fire Equipment Distributors
Keith J. Polasko, U.S. National Security Agency, MD [E]
Bryan K. Powell, XL Global Asset Protection Services, VA [I]
David V. Quirk, Verizon Wireless, NJ [U]
Brian P. Rawson, International Business Machines (IBM), NY [U]
Henry J. Roux, Roux International Inc., PA [SE]
Sam P. Salwan, Environmental Systems Design, Inc., IL [SE]
Mark Suski, Aon Fire Protection Engineering Corporation, IL [I]
Randy Willard, U.S. Central Intelligence Agency, MD [U]
Thomas J. Wysocki, Guardian Services, Inc., IL [SE]
David Zolotar, Oracle America, Inc., CO [M]
Rep. Information Technology Industry Council

Alternates

Thomas L. Allen, The RJA Group, MD [SE]
(Alt. to R. E. Transue)
Kerry M. Bell, Underwriters Laboratories Inc., IL [RT]
(Alt. to T. M. Burke)
Gary Girouard, Tyco/SimplexGrinnell, MA [M]
(Alt. to T. Carman)
Max McLeod, Siemens Industry, Inc., AL [M]
(Alt. to S. R. Lang)
Richard P. Puig, Fike Corporation, TX [M]
(Alt. to B. G. Bischoff)
Joseph Radakovich, Jr., U.S. Department of Defense, VA [U]
(Alt. to R. Willard)
Walter H. Schmoeller, U.S. National Security Agency, MD [E]
(Alt. to K. J. Polasko)
Robert V. Scholes, Fireman's Fund Insurance Company, CA [I]
(Alt. to V. A. Crowder)
William T. Schwartz, Liberty Mutual Commercial Markets, GA [I]
(Alt. to J. A. Spataro)
Richard B. Swartz, J.P. Morgan Chase & Company, NY [U]
(Alt. to G. A. Petrou)

Nonvoting

Edward D. Leedy, Naperville, IL [SE]
(Member Emeritus)
Donald E. Reilly, Staten Island, NY [I]
(Member Emeritus)

Jonathan Hart, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the protection of electronic computer equipment, components, and associated records.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Contents

Chapter 1 Administration 75– 4
1.1 Scope 75– 4
1.2 Purpose 75– 4
1.3 Application 75– 4
1.4 Retroactivity 75– 4
1.5 Equivalency 75– 4
1.6 Special Note on Chapter 10 ..... 75– 4

Chapter 2 Referenced Publications 75– 4
2.1 General 75– 4
2.2 NFPA Publications 75– 4
2.3 Other Publications 75– 5
2.4 References for Extracts in Mandatory Sections 75– 5

Chapter 3 Definitions 75– 5
3.1 General 75– 5
3.2 NFPA Official Definitions 75– 5
3.3 General Definitions 75– 5
3.4 Aisle Containment 75– 6

Chapter 4 Risk Considerations 75– 6
4.1 Fire Risk Analysis Factors 75– 6
4.2 Telecommunications Risks 75– 7

Chapter 5 Construction Requirements 75– 7
5.1 Building Construction 75– 7
5.2 Location of Information Technology Equipment Area Within the Building 75– 7
5.3 Information Technology Equipment Area Interior Construction Materials 75– 7
5.4 Raised Floors 75– 7
5.5 Penetrations and Openings in Fire-Resistant-Rated Enclosures 75– 8
5.6 Aisle Containment and Hot Air Collar Systems for Information Technology Equipment 75– 8

Chapter 6 Materials and Equipment Permitted in the Information Technology Equipment Area 75– 9
6.1 General 75– 9
6.2 Record Storage 75– 9
6.3 General Storage 75– 9

Chapter 7 Construction of Information Technology Equipment 75– 9
7.1 Information Technology Equipment 75– 9
7.2 Construction Features 75– 9

Chapter 8 Fire Protection and Detection Equipment 75–10
8.1 Automatic Fire Protection Systems 75–10
8.2 Automatic Detection Systems 75–10
8.3 Portable Extinguishers and Hose Lines 75–10
8.4 Gaseous Total Flooding Extinguishing Systems 75–10
8.5 Warning Signs 75–11
8.6 Training 75–11
8.7 Expansion or Renovations 75–11
8.8 Water Mist Fire Protection Systems 75–11

Chapter 9 Records Kept or Stored in Information Technology Equipment Rooms 75–11
9.1 Protection Required for Records Within the Information Technology Equipment Room 75–11
9.2 Records Stored Outside the Information Technology Equipment Room 75–11

Chapter 10 Utilities 75–11
10.1 Heating, Ventilating, and Air Conditioning (HVAC) 75–11
10.2 Coolant Systems 75–11
10.3 Electrical Service 75–11
10.4 Supply Circuits and Interconnecting Cables 75–12

Chapter 11 Emergency and Recovery Procedures 75–13
11.1 Emergency Fire Plan 75–13
11.2 Damage Control Plan 75–13
11.3 Recovery Procedures Plan 75–13

Annex A Explanatory Material 75–13

Annex B What to Do in the First 24 Hours for Damaged Electronic Equipment and Magnetic Media 75–18

Annex C Risk Considerations, Business Interruption, and Temperature Considerations 75–20

Annex D General Guidance for Gaseous Agent Systems in Information Technology Equipment Spaces 75–20

Annex E Informational References 75–22

Index 75–23

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

NFPA 75

Standard for the

Fire Protection of Information Technology Equipment

2013 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Documents." They can also be obtained on request from NFPA or viewed at www.nfpa.org/disclaimers.

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex E. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex E.

Chapter 1 Administration

1.1 Scope. This standard covers the requirements for the protection of information technology equipment and information technology equipment areas.

1.2* Purpose. The purpose of this standard is to set forth the minimum requirements for the protection of information technology equipment and information technology equipment areas from damage by fire or its associated effects — namely, smoke, corrosion, heat, and water.

1.3 Application. The application of this standard is based on the risk considerations outlined in Chapter 4.

1.3.1 A documented risk assessment shall be the basis for implementation of this standard.

1.3.2 The mere presence of the information technology equipment shall not constitute the need to invoke the requirements of this standard.

1.4 Retroactivity.

1.4.1 The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.2 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency. The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.6 Special Note on Chapter 10. Chapter 10 contains text extracted from *NFPA 70, National Electrical Code*, Article 645. The text is identified by a citation in brackets following the paragraph. Only editorial changes were made to make the text consistent with this standard. Requests for interpretations or revisions of the extracted text will be referred to Panel No. 12 of the National Electrical Code Committee.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2010 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2011 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2009 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2013 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2010 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2011 edition.

NFPA 70®, National Electrical Code®, 2011 edition.

NFPA 72®, National Fire Alarm and Signaling Code, 2013 edition.

NFPA 76, *Standard for the Fire Protection of Telecommunications Facilities,* 2012 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives,* 2013 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2012 edition.

NFPA *101®, Life Safety Code®,* 2012 edition.

NFPA 105, *Standard for Smoke Door Assemblies and Other Opening Protectives,* 2013 edition.

NFPA 220, *Standard on Types of Building Construction,* 2012 edition.

NFPA 232, *Standard for the Protection of Records,* 2012 edition.

• NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2010 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2012 edition.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

2.3 Other Publications.

2.3.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2007.

ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 1999.

ASTM E 814, *Standard Method of Fire Tests of Through-Penetration Fire Stops*, 1997.

ASTM E 1537, *Standard Test Method for Fire Testing of Upholstered Furniture*, 2007.

2.3.2 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 72, *Standard for Tests for Fire Resistance of Record Protection Equipment*, 2001, including revisions through November 6, 2009.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2008, including revisions through September 13, 2010.

ANSI/UL 900, *Standard for Air Filter Units,* 2004, including revisions through November 6, 2009.

ANSI/UL 60950, *Safety of Information Technology Equipment*, 2000, including revisions through October 30, 2007.

ANSI/UL 60950-1, *Information Technology Equipment — Safety — Part 1: General Requirements*, 2007.

2.3.3 Other Publications.

California Technical Bulletin 133, *Flammability Test Procedure for Seating Furniture for Use in Public Occupancies*, State of California, Department of Consumer Affairs, 3485 Orange Grove Avenue, North Highlands, CA 95660–5595.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 70®, National Electrical Code®, 2011 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2012 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Abandoned Cables. Installed cables that are not terminated at equipment and not identified for future use with a tag.

3.3.2 Air Space. The space below a raised floor or above a suspended ceiling used to circulate environmental air within the information technology equipment room/information technology equipment area.

3.3.3 Automated Information Storage System (AISS). An enclosed storage and retrieval system that moves recorded media between storage and information technology equipment systems.

3.3.4 Business Interruption. The effect on business operations from the time that equipment was initially lost or damaged until it has been restored to the former level of operation.

3.3.5 Communications Circuit. The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), outside wiring for fire alarm and burglar alarm from the communications utility to the customer's communications equipment up to and including terminal equipment such as a telephone, fax machine, or answering machine. [**70:**800.2]

3.3.6 Communications Equipment. The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries) and technical support equipment (e.g., computers). [**70:**100]

3.3.7 Detector.

3.3.7.1 ***Heat Detector.*** A fire detector that detects either abnormally high temperatures or rate of temperature rise, or both.

3.3.7.2 ***Smoke Detector.*** A device that senses visible or invisible particles of combustion.

3.3.8 Electronically Interconnected. Units that must be connected by a signal channel to complete a system or perform an operation.

3.3.9 Fire-Resistant-Rated Construction. Construction in which the structural members, including walls, partitions, columns, floors, and roof construction, have fire resistance

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

ratings of time duration not less than that specified in this standard.

3.3.10 Fire Risk Analysis. A process to characterize the risk associated with fire that addresses the fire scenario or fire scenarios of concern, their probability, and their potential consequences.

3.3.11* Information Technology Equipment (ITE). Equipment and systems rated 600 volts or less, normally found in offices or other business establishments and similar environments classified as ordinary locations, that are used for creation and manipulation of data, voice, video, and similar signals that are not communications equipment as defined in Part I of Article 100 and do not process communications circuits as defined in 800.2 [of *NFPA 70, National Electrical Code.*] [**70:**645.2]

3.3.12 Information Technology Equipment Area. An area of a building where the information technology equipment room is located, including support rooms served by the same special air-conditioning/air-handling equipment as the information technology equipment room.

3.3.13 Information Technology Equipment Room. A room within the information technology equipment area that contains the information technology equipment.

3.3.14 Information Technology Equipment System. Any electronic digital or analog computer, along with all peripheral, support, memory, programming, or other directly associated equipment, records, storage, and activities.

3.3.15 Interconnecting Cables. Signal and power cables for operation and control of a system.

3.3.16 Noncombustible. A material that, in the form in which it is used and under the conditions anticipated, will not aid combustion or add appreciable heat to an ambient fire. Materials, when tested in accordance with ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C,* and conforming to the criteria contained in Section 8 of the referenced standard, are considered as noncombustible.

3.3.17 Optical Fiber Cable. A factory assembly of one or more optical fibers, having an overall covering, that transmits light for control, signaling, and communications. [**70:**770.2]

3.3.18 Plenum. A compartment or chamber to which one or more ducts are connected and that forms part of the air distribution system. [**90A,** 2012]

3.3.19* Raceway. An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in *NFPA 70, National Electrical Code.*

3.3.20* Raised Floor. A platform with removable panels where equipment is installed, with the intervening space between it and the main building floor used to house the interconnecting cables and at times is used as a means for supplying conditioned air to the information technology equipment and the room.

3.3.21 Records.

3.3.21.1 ***Important Records.*** Records that could be reproduced only at considerable expense and labor or only after considerable delay.

3.3.21.2 ***Master Record.*** An information record on a medium that can be referred to whenever there is a need to rebuild a data base.

3.3.21.3 ***Vital Records.*** Records that are irreplaceable, such as records of which a reproduction does not have the same value as an original; records needed to sustain the business promptly or to recover monies used to replace buildings' equipment, raw materials, finished goods, and work in progress; and records needed to avoid delay in restoration of production, sales, and service.

3.3.22 Remote Disconnect Control. An electric device and circuit that controls a disconnecting means through a relay or equivalent device. [**70:**645.2]

3.3.23 Separate Fire Division. A portion of a building cut off from all other portions of the building by fire walls, fire doors, and other approved means adequate to prevent any fire that can occur in one fire division from extending to another fire division.

3.3.24* Support Equipment. Permanently installed equipment that is essential to the operation as well as equipment temporarily used for maintenance, installation or de-installation of information technology equipment.

3.3.25 Water Sensor. A device or means that will detect the presence of water.

3.3.26 Zone. A physically identifiable area (such as barriers or separation by distance) within an information technology equipment room, with dedicated power and cooling systems for the information technology equipment or systems. [**70:**645.2]

3.4 Aisle Containment.

3.4.1* Aisle. The passageway between ITE or between ITE and a wall that allows personnel access to the ITE for service or operation of the equipment.

3.4.2* Aisle Containment. An HVAC method deployed in the occupied area of an air-cooled ITE space utilizing physical separation of hot exhaust air from cooler intake air between equipment cabinets, rows of ITE, or associated power and cooling infrastructure; containment is typically above and at both ends of a hot aisle or a cold aisle, in whole or part.

3.4.3* Cold Aisle. The aisle in front of the airflow intakes on the ITE where HVAC cooling airflow is controlled.

3.4.4* Hot Air Collar. An air conveyance assembly used to direct heated exhaust air from ITE cabinet(s), enclosure(s), or rack(s) directly to a return air path.

3.4.5* Hot Aisle. The aisle at the rear of the ITE where heated exhaust air is controlled and directed into the aisle for return to the HVAC equipment.

Chapter 4 Risk Considerations

4.1 Fire Risk Analysis Factors.

4.1.1* A fire risk analysis shall be permitted to be used to determine the construction, fire protection and fire detection requirements for information technology equipment, information technology rooms, and information technology areas where specifically permitted by Chapters 5 and 8.

4.1.2 The fire risk analysis conducted in 4.1.1 shall be documented.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

4.1.3* The following factors shall be considered to determine the level of acceptable fire risk *(see also Annex C)*:

(1) Life safety aspects of the function (e.g., process controls, air traffic controls)
(2) Fire threat of the installation to occupants or exposed property
(3) Economic loss from loss of function or loss of records
(4) Economic loss from value of equipment
(5) Regulatory impact
(6) Reputation impact
(7) Redundant off-site processing systems

4.2 Telecommunications Risks.

4.2.1 Telecommunications Risks for the Private Network.

4.2.1.1 To assess and evaluate the damage and interruption potential of the loss of information technology equipment room operations, a risk evaluation shall be conducted on the impact of the loss of data and communications.

4.2.1.2 The provisions of this standard shall apply to those areas housing telecommunications equipment that are part of a private network or where the need for protection has been determined by the risk evaluation outlined in 4.2.1.1.

4.2.2 Telecommunications Risks for the Public Networks.

4.2.2.1 NFPA 76, *Standard for the Fire Protection of Telecommunications Facilities*, shall apply to telecommunications facilities that are part of the public network as outlined in the scope of NFPA 76.

4.2.2.2 The provisions of this standard shall not apply to telecommunications facilities that are part of the public network.

Chapter 5 Construction Requirements

5.1* Building Construction.

5.1.1 The information technology equipment area shall be housed in a fully sprinklered building in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, or housed in one of the following:

(1) A building constructed in accordance with NFPA 220, *Standard on Types of Building Construction*, Type I (443) or (332), or Type II (222) or (111) *(for nonsprinklered buildings, see 8.1.1.2)*
(2) A single-story building constructed in accordance with NFPA 220, *Standard on Types of Building Construction*, Type II (000) *(for nonsprinklered buildings, see 8.1.1.2)*

5.1.2* Protection for the building housing the information technology equipment area shall be provided where it is subject to damage from external exposure.

5.1.3* The information technology equipment area shall be separated from other occupancies within the building, including atria or other open-space construction, by fire-resistant-rated construction.

5.1.3.1 The information technology equipment room shall be separated from other occupancies in the information technology equipment area by fire-resistant-rated construction.

5.1.3.2 The fire resistance rating shall be commensurate with the exposure but not less than 1 hour for both.

5.1.3.3 The fire-resistant-rated enclosures shall extend from the structural floor to the structural floor above or to the roof.

5.1.3.4 Every opening in the fire-resistant-rated construction shall be protected to limit the spread of fire and to restrict the movement of smoke from one side of the fire-resistant-rated construction to the other. The fire resistance rating for doors shall be as follows:

(1) 2-hour fire-resistant-rated construction — 1½-hour fire-resistance-rated doors
(2) 1-hour fire-resistant-rated construction — ¾-hour fire-resistance-rated doors

5.1.3.5 The fire-resistant-rated construction shall be in accordance with NFPA *101*, *Life Safety Code*, and applicable building and fire codes.

5.2 Location of Information Technology Equipment Area Within the Building.

5.2.1* The information technology equipment area shall not be located above, below, or adjacent to areas or other structures where hazardous processes are located unless approved protective features are provided.

5.2.2* Access to the information technology equipment area shall be restricted to authorized persons.

5.3 Information Technology Equipment Area Interior Construction Materials.

5.3.1 All interior wall and ceiling finishes in the information technology equipment area shall have a Class A rating in accordance with NFPA *101*, *Life Safety Code*.

5.3.1.1 Interior wall and ceiling finishes in fully sprinklered information technology equipment areas shall be permitted to be Class B in accordance with NFPA *101*, *Life Safety Code*.

5.3.1.2 Interior floor finishes used in information technology equipment areas shall be Class I in accordance with NFPA *101*, *Life Safety Code*.

5.3.1.2.1 Interior floor finishes in fully sprinklered information technology equipment areas shall be permitted to be Class II in accordance with NFPA *101*, *Life Safety Code*.

5.3.1.3 Exposed cellular plastics shall not be used in information technology equipment area construction.

5.3.2* A structural floor where an information technology equipment system is located or that supports a raised floor installation shall incorporate provisions for drainage from domestic water leakage, sprinkler operation, coolant leakage, or fire-fighting operations.

5.4* Raised Floors. Where raised floors are used, they shall comply with 5.4.1 through 5.4.4.

5.4.1 Structural supporting members for raised floors shall be of noncombustible material.

5.4.2 Decking for raised floors shall be one of the following:

(1) Noncombustible
(2) Pressure-impregnated, fire-retardant-treated lumber having a flame spread index of 25 or less in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

(3) Wood or similar core material that is encased on the top and bottom with sheet, cast, or extruded metal, with all openings or cut edges covered with metal or plastic clips or grommets so that none of the core is exposed, and that has an assembly flame spread index of 25 or less in accordance with ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*

5.4.3 Access sections or panels shall be provided in raised floors so that all the space beneath is accessible. Tools needed to provide access to the underfloor space shall be located in the room, and their location shall be well marked.

5.4.4* Electric cable openings in floors shall be made smooth or shall be otherwise protected to preclude the possibility of damage to the cables.

5.5 Penetrations and Openings in Fire-Resistant-Rated Enclosures.

5.5.1 Cable penetrations or other penetrations through required fire-rated assemblies shall be firestopped with a listed firestopping material that has a fire resistance rating equal to the fire resistance rating of the penetrated barrier where tested with a minimum positive furnace pressure differential of 2.5 Pa (0.01 in. of water) under ASTM E 814, *Standard Method of Fire Tests of Through-Penetration Fire Stops.*

5.5.2 Pass-throughs or windows located in fire-resistant-rated construction shall be equipped with an automatic fire-rated shutter, a service counter fire door, or fire-rated windows installed and maintained in accordance with NFPA 80, *Standard for Fire Doors and Other Opening Protectives.*

5.5.2.1 The shutters, service counter door, or windows shall be operated automatically by the presence of either smoke or fire on either side of the wall.

5.5.2.2 The fire rating of the shutters, service counter door, or windows shall not be less than the fire rating of the wall in which it is located.

5.5.3 All air ducts and air transfer openings passing through fire-resistant-rated construction shall be provided with automatic fire and smoke dampers.

5.5.3.1* Fire and smoke dampers shall be installed in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems.*

5.5.3.2 Fire dampers shall be maintained in accordance with NFPA 80, *Standard for Fire Doors and Other Opening Protectives.*

5.5.3.3 Smoke dampers and combination fire/smoke dampers shall be maintained in accordance with NFPA 105, *Standard for Smoke Door Assemblies and Other Opening Protectives.*

5.6 Aisle Containment and Hot Air Collar Systems for Information Technology Equipment.

5.6.1 Aisle containment and hot air collar systems shall be permitted to be one of the following:

(1) Factory-packaged and aftermarket: systems designed, provided, and installed in accordance with the manufacturer's instructions
(2) Field-constructed: systems designed and constructed using common construction materials

5.6.2 Both types of aisle containment systems shall comply with 5.6.3 through 5.6.10.1.

5.6.3 Elements of aisle containment and hot air collars shall be constructed of materials that have a maximum flame spread index of 50 and a maximum smoke development of 450 in accordance with one or more of the following:

(1) ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*
(2) ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*

5.6.4* Aisle containment systems and hot air collars shall not be considered to be plenums.

5.6.5 Aisle containment systems shall be permitted to be applied to hot aisles or cold aisles of ITE.

5.6.6* Detection and suppression components within aisle containment systems shall be rated for the intended temperatures of hot aisles when installed in those locations.

5.6.7 Where aisle containment systems are installed, the existing suppression and detection systems shall be evaluated, modified, and tested as necessary to maintain compliance with the applicable codes and standards.

5.6.8 Where automatic sprinklers are present and the application of aisle containment systems or hot air collars creates obstructions to proper operation of sprinkler systems, the sprinkler system shall be modified as necessary to comply with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

5.6.8.1* Sprinkler system modifications shall not be required where all of the following conditions are met:

(1)*An automatic means of smoke detection initiates the removal of the obstruction prior to operation of the suppression system.
(2) Removing the obstruction or a portion thereof does not compromise means of egress per NFPA *101*, *Life Safety Code.*
(3) The design and installation of removable obstruction elements does not diminish the level of protection below that which existed prior to the installation of the aisle containment or hot air collar.
(4)*The releasing devices are listed for the application.
(5) All removable obstructions are removed for the entire suppression zone.

5.6.9 Where gaseous suppression systems are present, they shall be designed to develop the required concentration of agent for the entire volume they serve, in accordance with NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems.*

5.6.10 If the aisle containment prevents the gaseous suppression system, where present, from producing the required design concentrations throughout the entire volume served, the gaseous suppression system shall be modified to produce the required concentration throughout the volume served.

5.6.10.1* Gaseous suppression system modifications shall not be required where all the following conditions are met:

(1)*An automatic means of smoke detection initiates the removal of the obstruction prior to the suppression system operation.
(2) Removing the obstruction or portion thereof does not compromise means of egress per NFPA *101*, *Life Safety Code.*
(3) The design and installation of removable obstruction elements does not diminish the level of protection below that which existed prior to the installation of the aisle containment or hot air collar.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

(4)*The releasing devices are listed for the application.
(5) All removable obstructions are removed for the entire suppression zone.

Chapter 6 Materials and Equipment Permitted in the Information Technology Equipment Area

6.1 General.

6.1.1* Only information technology equipment and support equipment shall be permitted in the information technology equipment room.

6.1.2 Small work areas shall be permitted within the ITE room provided all the following conditions are met:

(1) Areas are not occupied on a full-time basis.
(2) Case furniture, including desks, is constructed of noncombustible material (e.g., metal). The construction can include a high-pressure laminate veneer on the desktop.
(3) Space dividers and system furniture panels and chairs with upholstered assemblies exhibit a maximum rate of heat release not exceeding 80 kW and a maximum total heat release not exceeding 25 MJ within the first 10 minutes of test when tested in accordance with one of the following:
   (a) ASTM E 1537, *Standard Test Method for Fire Testing of Upholstered Furniture*
   (b) California Technical Bulletin 133, *Flammability Test Procedure for Seating Furniture for Use in Public Occupancies*
(4) Paper records, manuals, drawings, and all other combustible materials are stored in fully enclosed noncombustible cabinets or cases.
(5) The quantity of records, manuals, drawings, and all other combustible materials kept in the room are limited to the absolute minimum required for essential and efficient operation.
(6) Trash receptacles, where provided, are an approved self-extinguishing type.

6.2 Record Storage.

6.2.1 The amount of records within the information technology equipment room shall be kept to the absolute minimum required for essential and efficient operation.

6.2.1.1 Only records that are essential to the information technology equipment operations shall be permitted to be kept in the information technology equipment room.

6.2.1.2 An automated information storage system (AISS) conforming to the requirements of 8.1.4 shall be permitted in the information technology equipment room.

6.2.2 Tape libraries and record storage rooms within the information technology equipment area shall be protected by an extinguishing system and separated from the information technology equipment room and other portions of the information technology equipment area by fire-resistant-rated construction. The fire resistance rating shall be commensurate with the exposure but not less than 1 hour.

6.2.3 The records storage room shall be used only for the storage of records.

6.2.3.1 All other operations, including splicing, repairing, erasing, reproducing, cataloging, and so forth, shall be prohibited in this room.

6.2.3.2 Spare media shall be permitted to be stored in this room if they are unpacked and stored in the same manner as the media containing records.

6.3 General Storage.

6.3.1 Paper stock, inks, unused recording media, and other combustibles within the information technology equipment room shall be restricted to the absolute minimum necessary for efficient operation. Any such materials in the information technology equipment room shall be kept in totally enclosed metal file cases or cabinets or, if provided for in individual machine design, shall be limited to the quantity prescribed and located in the area designated by the equipment manufacturer.

6.3.2 Reserve stocks of paper, inks, unused recording media, and other combustibles shall be stored outside the information technology equipment room.

6.3.3 The space beneath the raised floor shall not be used for storage purposes.

Chapter 7 Construction of Information Technology Equipment

7.1 Information Technology Equipment.

7.1.1 Equipment and replacement parts shall meet the requirements of ANSI/UL 60950, *Safety of Information Technology Equipment*; or ANSI/UL 60950-1, *Information Technology Equipment — Safety — Part I: General Requirements*.

7.1.2* Each individual unit shall be constructed in such a way that by limiting combustible materials or by use of enclosures, fire is not likely to spread beyond the unit where the source of ignition is located. Automatic protection shall be provided for all units not so constructed.

7.1.3 Listed information technology equipment shall be considered as meeting the requirements of 7.1.2.

7.1.4* Enclosures of floor-standing equipment having external surfaces of combustible materials of such size that can contribute to the spread of an external fire shall have a flame spread index of 50 or less in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*.

7.1.4.1 Equipment conforming to the requirements of UL 60950, *Safety of Information Technology Equipment*, shall be considered as meeting the requirements of 7.1.4.

7.1.4.2 Equipment conforming to the requirements of ANSI/UL 60950, *Safety of Information Technology Equipment*, or ANSI/UL 60950-1, *Information Technology Equipment — Safety — Part 1: General Requirements*, shall be considered as meeting the requirements of 7.1.4.

7.2 Construction Features.

7.2.1 Filters. Air filters for use in the cooling systems of individual units shall be listed. The air filters shall be arranged in such a way that they can be removed, inspected, cleaned, or replaced when necessary.

7.2.2 Liquids. If the design of the unit is such that oil or equivalent liquid is required for lubrication, cooling, or hydraulic purposes, it shall have a closed-cup flash point of

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

7.2.3 Acoustical Materials. All sound-deadening material used inside information technology equipment shall be of such material, or so arranged, that it does not increase the potential of fire damage to the unit or the potential of fire propagation from the unit.

Chapter 8 Fire Protection and Detection Equipment

8.1 Automatic Fire Protection Systems

8.1.1 Information technology equipment rooms and information technology equipment areas located in a sprinklered building shall be provided with an automatic sprinkler system.

8.1.1.1 Information technology equipment rooms and information technology equipment areas located in a nonsprinklered building shall be provided with an automatic sprinkler system, a gaseous clean agent extinguishing system, or both *(see Section 8.4)*.

8.1.1.2* An automatic sprinkler system or a gaseous fire extinguishing system shall be provided for the protection of the area below a raised floor in an information technology equipment room or information technology equipment area where one or more of the following exist:

(1) There is a critical need to protect data in the process, reduce equipment damage, and facilitate return to service.
(2) The area below the raised floor contains combustible material.

8.1.1.3 Where a gaseous fire extinguishing system is provided only under a raised floor, the gaseous system shall be either carbon dioxide or an inert gas.

8.1.1.4 Where a clean agent fire extinghishing system is provided to protect the space above the raised floor, the space under the raised floor shall be simultaneously protected by the clean agent fire extinguishing system.

8.1.2* Automatic sprinkler systems protecting information technology equipment rooms or information technology equipment areas shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

8.1.3 Sprinkler systems protecting information technology equipment areas shall be valved separately from other sprinkler systems.

8.1.4* Automated information storage system (AISS) units containing combustible media with an aggregate storage capacity of more than 0.76 m^3 (27 ft^3) shall be protected within each unit by an automatic sprinkler system or a gaseous agent extinguishing system with extended discharge.

8.1.5 Automatic sprinkler systems protecting information technology equipment rooms or information technology equipment areas shall be maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

8.2* Automatic Detection Systems. Automatic detection equipment shall be installed to provide early warning of fire. The equipment used shall be a listed smoke detection–type system and shall be installed and maintained in accordance with *NFPA 72, National Fire Alarm and Signaling Code*.

8.2.1* Automatic detection systems shall be installed in the following locations:

(1) At the ceiling level throughout the information technology equipment area
(2) Below the raised floor of the information technology equipment area containing cables

8.2.2 In the information technology equipment area, where the space above the suspended ceiling or below the raised access floor is used to circulate air to other parts of the building, automatic smoke detection shall be installed in one of the following locations to operate the smoke dampers required by 5.5.3:

(1) Throughout the above ceiling space or below raised access floor space, respectively
(2) At each smoke damper
(3) At other approved locations to detect smoke entering or exiting the information technology equipment area

8.2.3 Where interlock and shutdown devices are provided, the electrical power to the interlocks and shutdown devices shall be supervised by the fire alarm control panel.

8.2.4 Where power is required for the operation of the disconnecting means in 10.4.6, that electrical power shall be supervised by the fire alarm control panel.

8.2.5 The alarms and trouble signals of automatic detection or extinguishing systems shall be arranged to annunciate at a constantly attended location.

8.3 Portable Extinguishers and Hose Lines.

8.3.1 Listed portable fire extinguishers of the carbon dioxide type or a halogenated agent type shall be provided for the protection of electronic equipment. The extinguishers shall be maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

8.3.2* Listed extinguishers with a minimum rating of 2-A shall be provided for use on fires in ordinary combustible materials, such as paper and plastics. Dry chemical extinguishers shall not be permitted.

8.3.3 A sign shall be located adjacent to each portable extinguisher and shall plainly indicate the type of fire for which it is intended.

8.3.4 Where inside hose is provided, the hose shall be 3.81 cm (1½ in.) rubber-lined hose with shutoff and combination solid-stream and water-spray nozzles. It shall be installed and maintained in accordance with NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*. Inside hose supplied from a sprinkler system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, shall be permitted.

8.3.5 Where carbon dioxide hand hose lines are provided, the lines shall be installed and maintained in accordance with NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*.

8.4 Gaseous Total Flooding Extinguishing Systems.

8.4.1* Where there is a critical need to protect data in process, reduce equipment damage, and facilitate return to service, consideration shall be given to the use of a gaseous agent inside units or total flooding systems in sprinklered or nonsprinklered information technology equipment areas.

8.4.2 Where gaseous agent or inert gas agent total flooding systems are used, they shall be designed, installed, and maintained in accordance with the requirements of NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*; NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*; or NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*. The agent selected shall not cause damage to the information technology equipment and media. *(See Annex D.)*

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

8.4.2.1 The power to all electronic equipment shall be disconnected upon activation of a gaseous agent total flooding system, unless the risk considerations outlined in Chapter 4 indicate the need for continuous power.

8.4.3* Hot aisle or cold aisle containment systems shall not obstruct the free flow of gaseous clean agent suppression systems to the IT equipment or cooling system serving the contained aisle within an information technology equipment room or zone.

8.4.4* Gaseous agent systems shall be automatically actuated by an approved method of detection meeting the requirements of *NFPA 72, National Fire Alarm and Signaling Code*, and a listed releasing device compatible with the system.

8.4.5* Where operation of the air-handling system would exhaust the agent supply, it shall be interlocked to shut down when the extinguishing system is actuated.

8.4.6* Alarms shall be provided to give positive warning of a pending discharge and an actual discharge.

8.5 Warning Signs. Where continuous power is provided, signs shall be posted at each perimeter entrance to the information technology equipment areas warning that electrical equipment will remain energized, either upon activation of the suppression system or disconnect of main electrical service.

8.6 Training. Designated information technology equipment area personnel shall be continually and thoroughly trained in the functioning of the alarm system, desired response to alarm conditions, location of all emergency equipment and tools, and use of all available extinguishing equipment. This training shall encompass both the capabilities and the limitations of each available type of extinguisher and the proper operating procedures of the extinguishing systems.

8.7 Expansion or Renovations.

8.7.1 Whenever changes are made to the information technology equipment area — for example, size, installation of new partitions, modification of the air-handling systems, or revised information technology equipment layout — the potential impact on existing fire detection and extinguishing systems shall be evaluated and corrective changes shall be made if necessary.

8.7.2 Modifications or alterations as outlined in 8.7.1 shall be submitted to the AHJ for approval.

8.8 Water Mist Fire Protection Systems.

8.8.1 Where provided, water mist fire protection systems shall be installed in accordance with the requirements of NFPA 750, *Standard on Water Mist Fire Protection Systems.*

8.8.2 Water mist fire protection systems shall be designed and installed for the specific hazards and protection objectives specified in the listing.

8.8.3 Detection systems utilized for the operation of water mist fire protection systems shall be installed in accordance with the listing criteria.

Chapter 9 Records Kept or Stored in Information Technology Equipment Rooms

9.1* Protection Required for Records Within the Information Technology Equipment Room. Any records regularly kept or stored in the information technology equipment room shall be provided with the following protection:

(1) Vital or important records that have not been duplicated shall be stored in listed record protection equipment with a Class 150 1-hour or better fire resistance rating as outlined in ANSI/UL 72, *Standard for Tests for Fire Resistance of Record Protection Equipment.*
(2) All other records shall be stored in closed metal files or cabinets.

9.2 Records Stored Outside the Information Technology Equipment Room.

9.2.1* All vital and important records shall be duplicated. Duplicated records shall be stored in a remote location that would not be exposed to a fire involving the original records. Records shall be stored in fire-resistive rooms in accordance with NFPA 232, *Standard for the Protection of Records.*

9.2.2 The installation of portable extinguishing equipment and hose lines shall be in accordance with 8.3.1 through 8.3.5.

Chapter 10 Utilities

10.1 Heating, Ventilating, and Air Conditioning (HVAC). Any HVAC system that serves other occupancies shall also be permitted to serve the information technology equipment area.

10.1.1 Dampers in HVAC systems serving information technology equipment areas shall operate upon activation of smoke detectors and by operation of the disconnecting means required by 10.4.6. The automatic fire and smoke dampers required by 5.5.3 shall also operate upon activation of smoke detectors and by operation of disconnecting means required by 10.4.6.

10.1.2 Air ducts that pass through the information technology area and only serve other rooms shall be provided with fire dampers.

10.1.3 All duct insulation and linings, including vapor barriers and coatings, shall have a flame spread index of 25 or less without evidence of continued progressive combustion and a smoke developed index no higher than 50, in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*; or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials.*

10.1.4* Air filters for use in air-conditioning systems shall comply with the requirements of ANSI/UL 900, *Standard for Air Filter Units.*

10.2 Coolant Systems. If a separate coolant system is required for operation of an information technology equipment installation, it shall be provided with an approved alarm to indicate loss of fluid.

10.3* Electrical Service. Equipment, power-supply wiring, equipment interconnecting wiring, and grounding of information technology equipment and systems in an information technology equipment room shall comply with this section.

10.3.1 All wiring shall conform to *NFPA 70, National Electrical Code.*

10.3.2* Premise transformers installed in the information technology equipment area shall be of the dry type or the type filled with a noncombustible dielectric medium. Such transformers shall be installed in accordance with the requirements of Article 450 of *NFPA 70, National Electrical Code.*

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

10.3.3 Service entrance transformers shall not be permitted in the electronic information technology equipment area.

10.3.4* Protection against lightning surges shall be provided in accordance with the requirements of Articles 280 and 285 of *NFPA 70, National Electrical Code*.

10.3.5* Junction boxes shall be approved, completely enclosed, fastened, accessible, and grounded. No splices or connections shall be made in the underfloor area except within junction boxes or approved-type receptacles and connectors.

10.3.6 Emergency lighting shall be provided in the information technology equipment area.

10.3.7 All electrical wiring and optical fiber cabling in the air space above a suspended ceiling shall conform to NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and *NFPA 70, National Electrical Code*, when that air space is used for the movement of air.

10.3.8 Signal wiring and cabling, including optical fiber cables, listed for general-purpose and riser use shall be permitted in an air space below a raised floor.

10.3.9 Electrical power supply cords up to 4.5 m (15 ft) in length shall be permitted in an air space below a raised floor.

10.4 Supply Circuits and Interconnecting Cables.

10.4.1 Interconnecting Cables. Separate information technology equipment units shall be permitted to be interconnected by means of listed cables and cable assemblies.

10.4.2 The 4.5 m (15 ft) limitation on power cords shall not apply to interconnecting cables.

10.4.3* Abandoned Cables. The accessible portion of abandoned cables shall be removed unless contained in a raceway.

10.4.4 Securing in Place. Power cables, communications cables, connecting cables, interconnecting cables, and associated boxes, connectors, plugs, and receptacles that are listed as part of, or for, information technology equipment shall not be required to be secured in place.

10.4.5 Installed Circuits and Cables Identified for Future Use.

10.4.5.1 Circuits and cables shall be permitted to be installed in information technology equipment areas and identified for future use if they comply with 10.4.5.2 and 10.4.5.3.

10.4.5.2 The circuits and cables shall be marked with a tag of sufficient durability to withstand the environment involved.

10.4.5.3 The tags shall have the following information:

(1) Date identified for future use
(2) Date of intended use
(3) Information relating to the intended future use

10.4.6 Disconnecting Means.

10.4.6.1 An approved means shall be provided to disconnect power to all electronic equipment in the information technology equipment room or in designated zones within the room.

10.4.6.2 There shall be a similar approved means to disconnect the power to all dedicated HVAC systems serving the room or designated zones.

10.4.6.3 Activation of an HVAC disconnecting means shall cause all required fire/smoke dampers to close.

10.4.6.4 Disconnecting means shall be implemented by one of the methods listed in 10.4.6.4.1 through 10.4.6.4.2.

10.4.6.4.1 Remote Disconnect Controls.

10.4.6.4.1.1 Remote disconnect controls shall be located at approved locations readily accessible in case of fire to authorized personnel and emergency responders.

10.4.6.4.1.2 The remote disconnect controls for the control of electronic equipment power and HVAC systems shall be grouped and identified.

10.4.6.4.1.3 A single means to control both shall be permitted.

10.4.6.4.1.4 Where multiple zones are created, each zone shall have an approved means to confine fire or products of combustion to within the zone.

10.4.6.4.1.5 Additional means to prevent unintentional operation of remote disconnect controls shall be permitted.

10.4.6.4.2 Alternative Disconnecting Means. Remote disconnecting controls shall not be required when all the following criteria are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.
(2) Qualified personnel are continuously available to meet emergency responders and to advise them of disconnecting methods.
(3) A smoke-sensing fire detection system in accordance with Chapter 8.
(4) An approved fire protection system in accordance with Chapter 8.
(5) Cables installed under a raised floor, other than branch circuit wiring and power cords installed in compliance with *NFPA 70, National Electrical Code*, Sections 645.5(D)(2) or (3), or are in compliance with *NFPA 70* Sections 300.22(C), 725.154(A), and 770.113(C), and Table 770.154(A); Section 800.113(C) and Table 800.154(A); or Section 820.113(C) and Table 820.154(A).

10.4.6.5 Installations qualifying under the provisions of *NFPA 70, National Electrical Code*, Article 685, shall be permitted.

10.4.7 Uninterruptible Power Supplies (UPSs). Except for installations and constructions covered in 10.4.7(1) or 10.4.7(2), UPS systems installed within the information technology equipment room, and their supply and output circuits, shall comply with 10.4.6. The disconnecting means shall also disconnect the battery from its load.

(1) Installations qualifying under the provisions of *NFPA 70, National Electrical Code*, Article 685
(2) Power sources limited to 750 volt-amperes or less derived either from UPS equipment or from battery circuits integral to electronic equipment

[**70:**645.11]

10.4.7.1* Storage battery systems in the information technology equipment area shall comply with the requirements of *NFPA 70, National Electrical Code*, Article 480.

10.4.8* Grounding. All exposed non–current-carrying metal parts of an information technology system shall be bonded to the equipment grounding conductor in accordance with Article 250 [of *NFPA 70, National Electrical Code*], or shall be

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

double insulated. Power systems derived within listed information technology equipment that supply information technology systems through receptacles or cable assemblies supplied as part of this equipment shall not be considered separately derived for the purpose of applying 250.30 [of *NFPA 70*]. Where signal reference structures are installed, they shall be bonded to the equipment grounding conductor provided for the information technology equipment. [**70:**645.15]

10.4.9 Marking. Each unit of an information technology system supplied by a branch circuit shall be provided with a manufacturer's nameplate, which shall also include the input power requirements for voltage, frequency, and maximum rated load in amperes. [**70:**645.16]

Chapter 11 Emergency and Recovery Procedures

11.1* Emergency Fire Plan. There shall be a management-approved written, dated, and annually tested emergency fire plan.

11.1.1 Fire Safety of Fire Fighters.

11.1.1.1 Fire Department Information. Where requested by the local fire department, the following shall be provided:

(1) A general description of the information technology equipment within the building and how it is powered
(2) An up-to-date floor plan of all information technology equipment and information technology equipment areas
(3) Actions to be taken concerning ventilation and the prevention of contamination of areas not affected by the fire

11.1.1.2* Fire Service Orientation and Information. When requested by the local fire department, orientation and information shall be provided to the fire personnel by the company management as follows:

(1) A general description of the facilities and all the information technology equipment
(2) An orientation walkthrough of the facility to address all the orientation and information issues to ensure life safety and service continuity are upheld
(3) The strategy and tactics to confine, suppress, and limit an incident's impact in the information technology equipment area

11.2* Damage Control Plan. There shall be a management-approved written, dated, and annually tested damage control plan.

11.3* Recovery Procedures Plan. There shall be a management-approved written, dated, and annually tested plan covering recovery procedures for continued operations.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.2 This standard does not cover installation of information technology equipment and information technology equipment areas that can be made without special construction or protection. It can, however, be used as a management guide for the installation of electrically powered mechanical information technology equipment, small tabletop or desk-type units, and information technology equipment.

The strategic importance placed on information technology equipment and areas by the user is vitally tied to uninterrupted operation of the system. Consequently, by the partial or entire loss of this equipment, an entire operation of vital nature could be temporarily paralyzed.

Not to be overlooked are the one-of-a-kind information technology systems. These are the custom-made models that are designed to perform specific tasks. Replacement units for this type of equipment are not available, and the probability of the existence of duplicate facilities, which could be used to perform vital operations in the event that the one-of-a-kind systems are partially or totally impaired by a fire, is remote.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.11 Information Technology Equipment (ITE). The term ITE is widely used in the industry to designate electronic equipment such as computers, servers, and data storage devices. It designates equipment both for manipulating and transmitting the signals. It may also include associated power and cooling systems located in, on, or on top of the lineups.

A.3.3.19 Raceway. Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

A.3.3.20 Raised Floor. Raised floors are sometimes referred to as false floors, secondary floors, or access floors.

A.3.3.24 Support Equipment. Support equipment can mean the physical infrastructure equipment necessary for the information technology equipment, such as equipment racks, power supply and distribution equipment, air conditioning, and lighting. It can also include such things as test equipment, material-handling equipment, ladders, tools, and other equipment that may be required for installation and maintenance and that may not be permanently installed. Nonpermanent equipment should be removed from the information technology equipment space when not needed for a particular task.

A.3.4.1 Aisle. The key elements of this definition are as follows:

(1) A passageway between equipment intended for movement of people and/or equipment
(2) Typically between opposing rows of ITE enclosures or racks but could be between two free-standing pieces or racks of ITE
(3) Intended for routine human activity such as service or operation (therefore not a plenum space)

A.3.4.2 Aisle Containment. The key elements of this definition are as follows:

(1) An occupied area (excluding areas above a ceiling or below a raised floor)
(2) Utilizing "physical separation" between hot and cold air (excluding construction methods such as fire-rated walls)
(3) Can be either a "hot aisle" or a "cold aisle" or a mix of both at select portions of the aisle

A.3.4.3 Cold Aisle. The key elements of this definition are as follows:

(1) Airflow controlled
(2) Intake air cold, implying an aisle normally intended for operation of the ITE
(3) Air from the output of the HVAC

A.3.4.4 Hot Air Collar. The key elements of this definition are as follows:

(1) Air conveyance assembly, sometimes referred to as a "duct" or a "chimney"
(2) Typically from specific equipment rather that from larger areas such as aisles
(3) Hot air collar not required to be physically connected to a duct or plenum

A.3.4.5 Hot Aisle. The key elements of this definition are as follows:

(1) Airflow controlled
(2) Exhaust air hot, implying an aisle normally intended for servicing of the ITE
(3) Air returns to the input of the HVAC

A.4.1.1 The fire risk analysis should be evaluated by the stakeholders. See NFPA 551, *Guide for the Evaluation of Fire Risk Assessments*, for additional guidance.

A.4.1.3 The protection for information technology equipment and information technology equipment areas should be specific to the nature and anticipated fire risks of each facility. The risk analysis should consider the risk and hazards associated with the site and services provided for a given fire safety problem. Additional considerations can include the following:

(1) Availability of alternative information technology equipment or information technology equipment rooms
(2) Permitted downtime of information technology equipment
(3) Presence of additional fire protection and detection equipment proximate to information technology equipment room
(4) Survivability of the information technology equipment and information technology equipment room environment
(5) Number and training of emergency response personnel
(6) Building construction

It is not the intent of the risk analysis to permit any deviation from an existing installation requirement.

A.5.1 The structural floor supporting the information technology equipment area should have sufficient floor loading capacity to sustain the expected floor load.

A.5.1.2 NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, details one method of providing exposure protection.

A.5.1.3 Experience with fires affecting information technology equipment rooms has demonstrated that the fire often starts in areas other than the information technology equipment area and that the fire and its related products, including smoke, soot, and heat, can enter the information technology equipment room if it is not adequately separated by sealed, rated walls. Consideration should be given to raising the rating of perimeter walls to 2 hours where adjacent walls are already rated 2 hours or greater.

The prudent facilities manager would do well to limit the exposure fire hazard by locating an information technology equipment facility in a fully sprinklered building and install self-contained HVAC systems within the information technology area.

The rooms shown in Figure A.5.1.3 are symbolic and do not denote size, shape, or location, nor are the rooms in Figure A.5.1.3 necessarily required in the information technology equipment area. The information technology equipment area includes only those support rooms served by the same special air-conditioning/air-handling equipment as the information technology equipment room. Information technology equipment rooms frequently have a raised floor.

A.5.2.1 Steam, water, or horizontal drain piping, other than for sprinkler system use, should not be in the space above the suspended ceiling and over information technology equipment.

The information technology equipment area should be located to minimize exposure to fire, water, corrosive fumes, heat, and smoke from adjoining areas and activities. Battery rooms, if constructed and ventilated in accordance with NFPA 1, *Fire Code*, can be adjacent to the information technology equipment room.

Basement areas should not be considered for the location of an information technology equipment area. If information technology equipment is located in a basement, precautions should be taken to facilitate smoke venting and to prevent flooding from interior and exterior sources that can occur, including a fire on an upper floor.

A.5.2.2 Many information technology equipment installations have become prime targets for sabotage and arson. The location and construction should be designed to minimize the possibility of penetration by an explosive or incendiary device. It is essential that access be restricted to only those persons absolutely necessary to the operation of the equipment. A

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

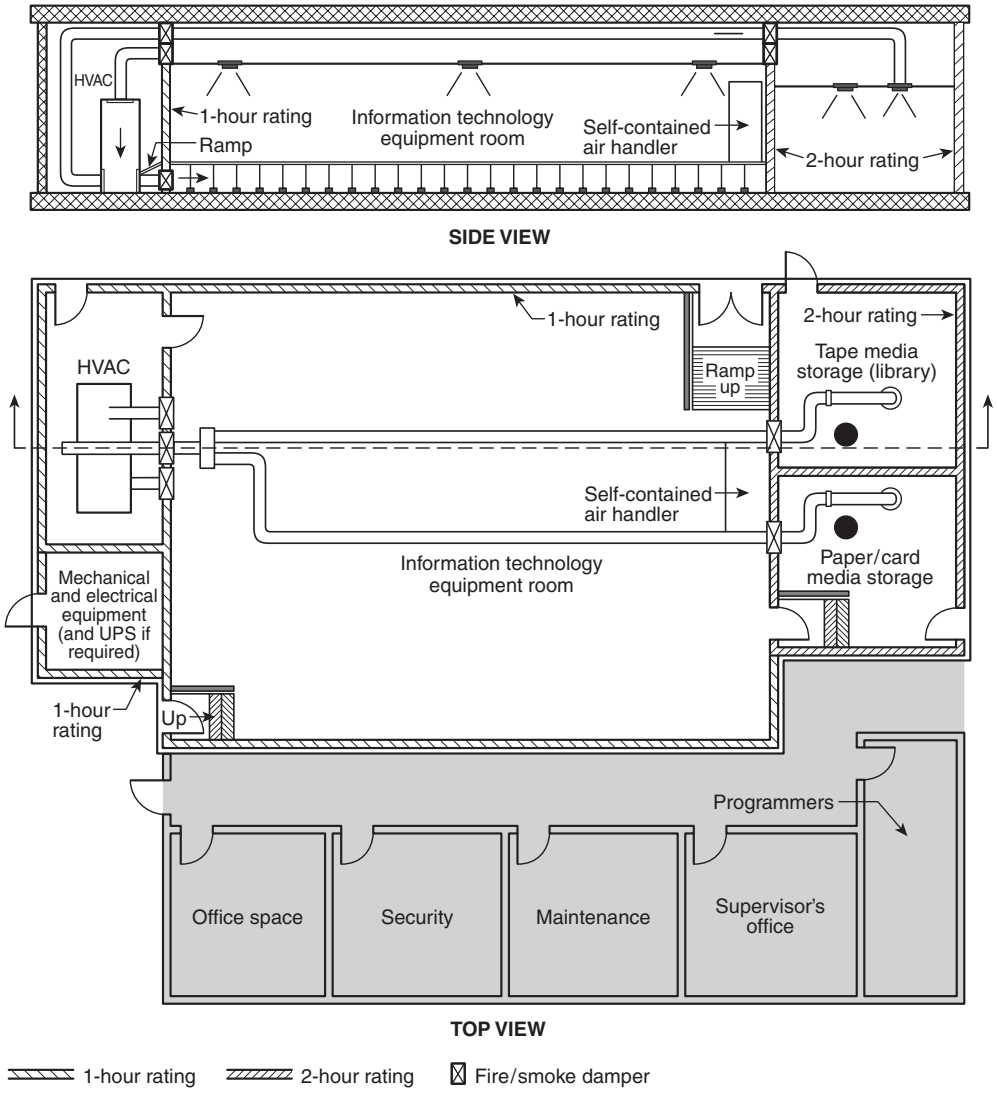


FIGURE A.5.1.3 Diagram of Information Technology Equipment Area.

controlled-access system of admittance through positive identification should be maintained at all times. For additional guidance, see NFPA 730, *Guide for Premises Security*, and NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*.

A.5.3.2 In multistoried buildings, the floor above the information technology equipment room should be made reasonably watertight to avoid water damage to equipment. Any openings, including those for beams and pipes, should be sealed to watertightness. Where drainage is installed in an area containing an underfloor extinguishing system, provisions should be made for maintaining the drain piping as a closed system unless water is present. These provisions are required to ensure the integrity of a gaseous extinguishing system and allow for maintenance of the necessary concentration level. Because water will evaporate from the standard plumbing trap, mineral oil or another substitute should be considered.

Underfloor spaces should be provided with a leak detection system where any utility or computer auxiliary cooling fluids are piped into the information technology equipment room or are capable of entering the room from adjoining areas. The system should be capable of generating a silenceable supervisory signal upon sensor contact with water. The system should continuously supervise all sensors and interconnecting components for electrical continuity. It should also include a self-test capability.

A.5.4 The determination of the depth of the raised floor should take into consideration air movement and fire detection and extinguishing systems requirements (if installed), as well as building construction restrictions.

A.5.4.4 Openings in raised floors for electric cables or other uses should be protected to minimize the entrance of debris or other combustibles.

A.5.5.3.1 NFPA 75 requires smoke or fire dampers in locations where NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, may not.

A.5.6.4 Where plenums are present, the space above the raised floor and below the suspended ceiling is typically accessible to

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

both occupants and first responders for maintenance access, firefighting activities, and so forth, and therefore does not need to be classified as a plenum. The addition of aisle containment systems installed in accordance with this standard does not change the hazards contained within those containment areas and therefore does not necessitate different construction materials as required in plenum spaces as defined elsewhere in this standard and others.

A.5.6.6 Temperatures of 38°C (100°F) are possible in hot aisles. Temporary increases in temperature above 38°C (100°F) in hot aisles can occur during normal facility operations. Some smoke detectors are listed for maximum operating temperature of 38°C (100°F). Where smoke detectors are located in hot aisles or in the airstream exhausted from hot aisles, detectors should have appropriate listing for temperatures above 38°C (100°F).

Where heat detectors are located in hot aisles, consideration of the operating temperatures within the hot aisles should be made when selecting the temperature rating of the detectors. *NFPA 72, National Fire Alarm and Signaling Code*, and manufacturer's instruction should be consulted for guidance.

During startup of IT equipment, the rate of temperature rise within hot aisles could cause rate-of-rise detectors to activate. Detection systems should be designed to avoid unwanted alarm during IT equipment startup.

The normally elevated temperatures within hot aisles should be taken into account when selecting sprinklers for installation in these aisles. NFPA 13, *Standard for the Installation of Sprinkler Systems*, should be consulted for guidance.

Abnormal conditions can result in even higher temperatures than described above. For example, temperatures as high as 66°C (150°F) have been observed in hot aisles upon failure of the HVAC system.

A.5.6.8.1 This paragraph addresses removable curtains and aisle containment materials, which are otherwise referred to as "removable obstructions." Fixed obstructions are clearly addressed for suppression systems within NFPA 13, *Standard for the Installation of Sprinkler Systems*. Means other than automatic smoke detection used for removing the obstructions (e.g., thermal, mechanical, and fusible links) still need further research by the industry and are not clearly demonstrating the capability of activating without impacting the timed response effective performance of suppression systems.

A.5.6.8.1(1) This action can be compared to readying the space before suppression, such as initiating the closing of fire doors, dampers, and the like.

A.5.6.8.1(4) The releasing devices can be similar to those used for initiating fire doors, dampers, and the like.

A.5.6.10.1 This paragraph addresses removable curtains and aisle containment materials, which are otherwise referred to as "removable obstructions." Fixed obstructions are clearly addressed for suppression systems within NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*. Means other than automatic smoke detection used for removing the obstructions (e.g., thermal, mechanical, and fusible links) still need further research by the industry and are not clearly demonstrating the capability of activating without impacting the effective performance of suppression systems.

A.5.6.10.1(1) This action can be compared to readying the space before suppression, such as initiating the closing of fire doors, dampers, and the like.

A.5.6.10.1(4) The releasing devices can be similar to those used for initiating fire doors, dampers, and the like.

A.6.1.1 Support equipment, such as high-speed printers, that utilize large quantities of combustible materials should be located outside the information technology equipment room whenever possible.

A.7.1.2 All nonelectrical parts, such as housings, frames, supporting members, and so forth, should not constitute additional fire hazards to the equipment.

A.7.1.4 See ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*.

A.8.1.1.2 The use of carbon dioxide systems for the protection of spaces beneath raised floors is discussed in Section B.5 of NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, wherein it is pointed out that the design of such systems requires compensation for leakage and provision for a soft discharge to minimize turbulence and agent loss through perforated tiles. These same concerns exist for other inert gas clean agent systems installed in accordance with NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*. Since these spaces are usually of a very limited height, this type of fire suppression system might be easier to design and install than sprinklers.

The use of halocarbon agents for protection of the spaces under a raised floor where the room is not simultaneously protected is not recommended. However, where a room is protected by a halocarbon system, the space beneath its raised floor needs to be included in the system coverage.

A.8.1.2 In facilities that are under the supervision of an operator or other person familiar with the equipment, during all periods that equipment is energized, the normal delay between the initial outbreak of a fire and the operation of a sprinkler system will provide adequate time for operators to shut down the power by use of the electrical disconnecting means as prescribed in Section 10.4. In other instances where a fire can operate sprinkler heads before discovery by personnel, a method of automatic detection should be provided to automatically de-energize the electronic equipment as quickly as possible.

To minimize damage to electronic computer equipment located in sprinkler-protected areas, it is important that power be off prior to the application of water on the fire.

A.8.1.4 It is not intended that small automatic media loaders or AISS units be provided with protection within the unit. The decision of whether to install protection within the unit should be based on the combustible load being added to the room or area. In the absence of further information, it is reasonable to assume that units that handle in the range of 0.76 m^3 (27 ft^3) of combustible storage space or less need not be provided with protection within the unit. The 0.76 m^3 (27 ft^3) volume assumes that no single dimension is larger than 0.9 m (3 ft) [for example, 0.9 m × 0.9 m × 0.9 m (3 ft × 3 ft × 3 ft)].

A.8.2 Fire detection and extinguishing systems should be selected after a complete evaluation of the exposures. The amount of protection provided should be related to the building construction and contents, equipment construction, business interruption, exposure, and security need. For amplification of the important need of fire protection, see Chapter 4.

A.8.2.1 The detection system selection process should evaluate the ambient environmental conditions in determining the

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

appropriate device, location, and sensitivity. In high airflow environments, air-sampling detection devices should be considered.

A.8.3.2 For more information, see NFPA 10, *Standard for Portable Fire Extinguishers*.

A.8.4.1 If major concerns over potential fire loss of specific critical data or equipment or serious interruption to operations cannot be resolved or alleviated by equipment redundancy, subdivision of the information technology equipment area, or use of leased facilities, automatic gaseous agent total flooding might be the only feasible approach to handling an incipient fire situation with an acceptable minimum amount of damage. At the same time, this sophisticated protection approach requires that all environmental design criteria — for example, damper closure, fan shutdown, and sealed openings — be carefully maintained to ensure that the needed concentration for extinguishment will be achieved.

A.8.4.3 Various methods of isolating the aisles between rows of equipment racks, known as hot aisle or cold aisle containment, are employed to prevent mixing of hot exhaust air or cold intake air through the information technology equipment. In the event that a fire triggers the release of a clean agent gaseous suppression system, the gas suppressant should be able to penetrate all of the IT equipment. In most cases of whole room total flooding systems, the flow of air through the IT equipment normally would be sufficient to satisfy this requirement, but the method should be evaluated on a case-by-case basis.

A.8.4.4 The gaseous extinguishing system can be actuated by the automatic fire detection system required in Section 8.2 when designed to do so.

A.8.4.5 This provision requires that all environmental design criteria — for example, damper closure, fan shutdown, and sealed openings — be carefully maintained to ensure that needed concentration for extinguishment will be achieved. It is preferable, but not essential, to de-energize information technology equipment prior to discharge if information technology equipment shutdown does not cause major service interruptions.

A.8.4.6 Predischarge and discharge alarms are provided to facilitate evacuation of all occupants if considered necessary.

A.9.1 The protection of records storage with an extinguishing system does not reduce the need for duplicate records. In the event of a fire, some damage to the records can occur prior to operation of the extinguishing system.

The evaluation of records should be a joint effort of all parties concerned with the safeguarding of information technology equipment operations. The amount of protection provided for any record should be directly related to its importance in terms of the mission of the information technology equipment system and the reestablishment of operations after a fire. It is assumed that information technology equipment capable of properly using the records will be available. *(See Chapter 11.)*

A.9.2.1 The size of record storage rooms should be determined by an engineering evaluation of the operation and the application of sound fire protection engineering principles. The evaluation should include, but not be limited to, the following:

(1) Classification of records
(2) Quantity of plastic-based records and type of container
(3) Type and capacity of fire suppression system
(4) Venting available for removal of products of combustion
(5) Type and arrangement of fire detection system
(6) Building construction materials

A.10.1.4 Electric reheat units can collect dust over a period of time. When heat is applied after several months of nonuse and a significant amount of dust and lint has accumulated on the heating elements, energizing of the elements can cause sufficient smoke particles to actuate a sensitive smoke detector in the smoke exhaust (air discharge) area. These reheat units should be set up with a weekly timer circuit to burn off the small amounts of dust that have collected to maintain these reheat units in a clean condition.

A.10.3 The requirements in Section 10.3 apply to all power and service wiring supplying the information technology equipment. The requirements of Section 10.3 do not apply to wiring and components within the actual equipment or to wiring connecting various units of equipment. The equipment and interconnected wiring requirements are set forth in Chapter 7.

A.10.3.2 It is recommended that premise transformers not be installed in the information technology equipment area.

A.10.3.4 Besides providing protection against lightning surges as required in *NFPA 70, National Electrical Code*, it is recommended that the building housing an information technology equipment area be protected against lightning in accordance with NFPA 780, *Standard for the Installation of Lightning Protection Systems*.

A.10.3.5 The number of junction boxes in underfloor areas should be kept to a minimum.

A.10.4.3 Abandoned cable can interfere with airflow and extinguishing systems. Abandoned cable also adds to the fuel loading.

A.10.4.7.1 The installation of certain types of storage battery systems can create concerns about hydrogen gas generation, which can accumulate if not ventilated properly and present a fire hazard. Certain types of storage battery systems can also present an acid spill hazard. For these installations, the design of the facilities to mitigate these hazards is appropriate.

A.10.4.8 The bonding requirements in the product standards governing this listed equipment ensure that it complies with Article 250 [of *NFPA 70, National Electrical Code*]. [**70:**645.15 Informational Note 1]

Where isolated grounding-type receptacles are used, see 250.146(D) and 406.3(D) [of *NFPA 70, National Electrical Code*]. [**70:**645.15 Informational Note 2]

A.11.1 A written emergency fire plan should be prepared for and posted at each installation that assigns specific responsibilities to designated personnel. This plan should be coordinated with all responding emergency agencies. Personnel should receive continuing instructions in at least the following:

(1) The method of turning off all electrical power to the following:
    (a) The information technology equipment under both normal and emergency conditions
    (b) The air-conditioning systems serving the area
(2) Alerting the fire department or fire brigade
(3) Evacuation of personnel and designated assembly area

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

(4) The operations of all fire-extinguishing and damage control equipment, including automatic detection equipment
(5) The use of extinguishers through actual operation on a practice fire
(6) Control of hazardous materials
(7) Coordination with the fire department or other emergency responders

A.11.1.1.2 Fire service orientation and information might include the review of the information technology equipment placement, depowering issues, and how to perform depowering. Additionally, it might be in the best interest of the facility manager to initiate the fire service orientation. Figure A.11.1.1.2 is an example of a pre-fire plan drawing.

A.11.2 A damage control plan should provide a means for at least the following:

(1) Preventing or minimizing damage to electronic equipment
(2) Preventing or minimizing damage to operations and other equipment

For example, whenever electronic equipment or any type of record is wet, smoke damaged, or otherwise affected by the results of a fire or other emergency, it is vital that immediate action be taken to clean and dry the electronic equipment. If water, smoke, or other contamination is permitted to remain in the equipment longer than absolutely necessary, the damage can be grossly increased.

In addition, a means should be provided for preventing water damage to electronic equipment. The proper method of doing this will vary according to the individual equipment design. Consideration should be given to the provision of waterproof covers, which should be stored in easily accessible locations.

A.11.3 Emergency procedures for the continued operation of an information technology equipment system should include, but not be limited to, the following:

(1) A program to protect records in accordance with their importance as set forth by Chapter 9
(2) An analysis of the workload and its effect on continuity of operations
(3) A written set of requirements for the backup site, including the following:
  (a) Backup files and equipment required
  (b) Configuration of mainframe computer and peripheral units
  (c) Alternative locations for backup processing
  (d) Availability of backup system
  (e) Telecommunications required at backup site
  (f) Files, input work, special forms, and so forth, needed
  (g) Personnel staffing and transportation
  (h) Agreements and procedures for the emergency use of information technology equipment at a contingency site

Annex B What to Do in the First 24 Hours for Damaged Electronic Equipment and Magnetic Media

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 The following material is extracted from the BMS CAT publication "Electronics & Magnetic Media Recovery."

B.2 This plan attempts to detail the necessary recovery steps to be taken after a disaster has occurred to electronic equipment. The plan considers fire, heat, smoke, and water damage and is designed to limit and mitigate potential losses. The equipment under discussion includes office computers, word processors, telephone switching equipment, test equipment, audio-video equipment, and other electrical and electronic apparatus.

> **WARNING:** It is most important that power be disconnected from all wet and smoke contaminated electronic equipment immediately. Not only is there a continuing danger from electrical shorts to the equipment, but voltage potential within the circuitry tends to plate contaminants onto printed circuit boards and backplanes.

B.3 Smoke Damage. Primary damage to electronic equipment is caused by smoke that contains corrosive chloride and sulfur combustion by-products. Smoke exposure during the fire for a relatively short period of time does little immediate damage. However, the particulate residue left after the smoke has dissipated contains the active by-product that will corrode metal contact surfaces in the presence of moisture and oxygen.

The ultimate objective in restoration is the removal of the contaminant. Since all of the equipment cannot be cleaned simultaneously, it is most important that immediate steps be taken to arrest the corrosion process.

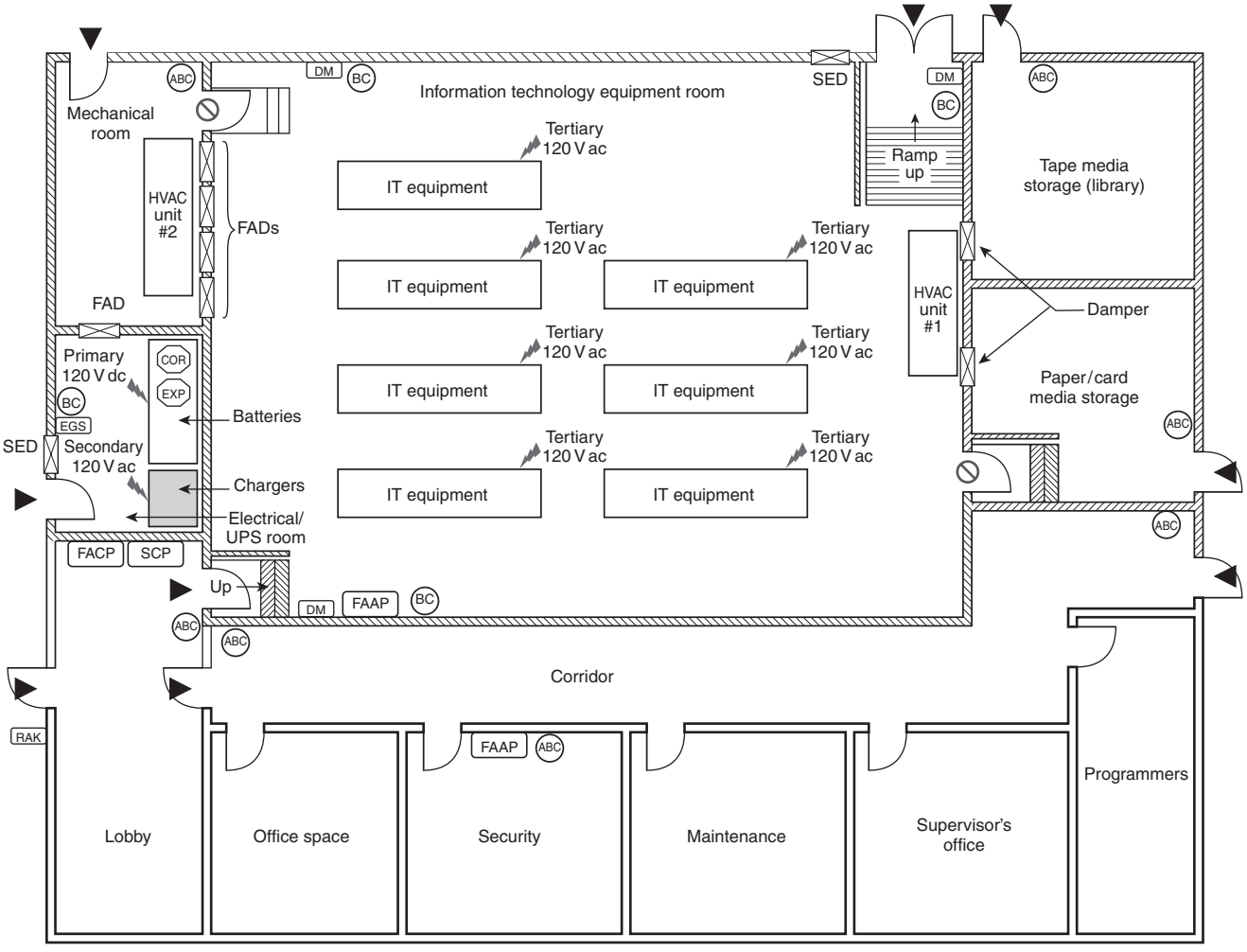
(1) Move the exposed equipment into an air-conditioned and humidity controlled environment as soon as possible (40–50 percent relative humidity will generally prevent an acceleration of corrosive activity).
(2) If moving the equipment is not possible, make sure the equipment area is sealed off from outside elements. (Caution: do not wrap the individual pieces of equipment in any material that tends to trap moisture inside the chassis.)
(3) Spray connectors, backplanes and printed circuit board surfaces with Freon or Freon-alcohol solvents for preliminary cleanup.
(4) Follow up with any corrosion inhibiting aerosol spray to stabilize metal contact surfaces. This will leave a thin but easily removable coating helping to prevent oxygen and moisture from activating the corrosion process.

Once the corrosion process is stabilized, an analysis can be made of the contaminants, and appropriate decontamination processes can be applied.

B.4 Water Damage. It is a popular misconception that electronic equipment exposed to water and moisture is permanently damaged. Water that is sprayed, splashed, or dripped onto electronic equipment can be easily removed. Even equipment that has been totally submerged can be restored. However, in every case of water damage, immediate countermeasures are imperative. It is most important to turn off all electrical power to the equipment; i.e., DO NOT ENERGIZE ANY WET EQUIPMENT.

(1) Open cabinet doors, remove side panels and covers, and pull out chassis drawers to allow water to run out of equipment.
(2) Set up fans to move room temperature air through the equipment for general drying. Move portable equipment to dry air conditioned areas.
(3) Use compressed air at no higher than 50 psi to blow out trapped water.
(4) Use hand-held dryers on lowest setting to dry connectors, backplane wirewraps, and printed circuit cards. (Caution: Keep the dryer well away from components and wires. Overheating of electronic parts can cause permanent damage.)

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.



Note: Drawing is intended to convey some of the items that should be documented as part of the pre-fire plan. It is not intended to demonstrate good design practice nor compliance with any code or standard.

LEGEND

Symbol	Description	Symbol	Description
FACP	Fire alarm control panel	EGS	Emergency generator shutoff switch
FAAP	Fire alarm annunciator panel	ABC	Type ABC portable fire extinguisher
SCP	Smoke control panel	BC	Type BC portable fire extinguisher
▶	Fire fighter access		Damper
⊘	No fire fighter access—contamination hazard	SED	Smoke exhaust damper
	Power supply and voltage	FAD	Fresh air damper
COR	Corrosive material	RAK	Rapid access keyboard
EXP	Explosive gas potential		1-hour rating
	Equipment containing PCBs		2-hour rating
DM	IT and HVAC disconnecting means		

FIGURE A.11.1.1.2 Pre-Fire Plan Drawing.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

(5) Use cotton-tipped swabs for hard-to-reach places. Lightly dab the surfaces to remove residual moisture. Do not use cotton tipped swabs on wirewrap terminals.
(6) Water displacement aerosol sprays containing Freon-alcohol mixtures are effective in first step drying of critical components.
(7) Follow up with professional restoration as soon as possible.

B.5 Tape/Disk Drive. The most important asset to be preserved following the loss is the corporate media (company database).

Severe damage to disk read/write heads and tape transport mechanisms is probable if an attempt is made to operate with media that is not clean. A "head-crash" caused by particulate on the surface of a disk will not only damage the drive but result in a loss of data. Dirty tapes will stick and break causing loss of data. Emergency one-time cleaning of contaminated tapes and disks, for data recovery, is possible. The damaged media is then discarded after data recovery.

First step emergency procedures are:

(1) Place all contaminated magnetic media in air conditioned area to remove water and stabilize media surfaces.
(2) Remove media from wet and contaminated containers where possible. Identify all media as to type, application, and location.
(3) Wipe exterior surfaces with alcohol or Freon-alcohol solutions to remove contamination.
(4) Data recovery from contaminated floppy disks, tapes, hard disks, and all associated drive and read/record equipment.

Annex C Risk Considerations, Business Interruption, and Temperature Considerations

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Risk Considerations.

C.1.1 Information technology equipment is a vital and commonplace tool for business, industry, government, and research groups. The use of such equipment is a direct result of the increased complexity of modern business, industrial, governmental, and research needs. Particularly pertinent are the increasing number of variables that must be taken into consideration in everyday decisions — overlooking any one item can spell the difference between profit and loss, success and failure, and life and death. To keep track of all these variables, information technology equipment offers practical answers.

C.1.2 Information technology equipment has become the accepted tool to research, store, and exchange information, to process large amounts of statistical, problematical, or experimental information, and to print out or display information in very short periods of time. Reliance is placed on the equipment to perform the repetitive, the experimental, and, in some cases, even the whole programming operation for business, industry, government, and research groups.

C.1.3 Risk considerations include the selection of proper equipment, preparation of areas to receive the equipment, requirements for utilities, orientation and training of personnel to operate the equipment, as well as consideration for expansion of the initial facility. One other factor should be included in this vital study, namely, protection against fires of either accidental or deliberate origin, such as sabotage and incendiary.

C.1.4 Information technology equipment and materials for data recording and storage can incur damage where exposed to sustained elevated ambient temperatures. The degree of such damage will vary depending upon the exposure, equipment design, and composition of materials for data recording and storage.

C.2 Business Interruption. Business interruption is the effect on business operations from the time that equipment was initially lost or damaged until it has been restored to the former level of operation.

C.3 Temperature Considerations. The following are guidelines concerning sustained high ambient temperatures.

(1) Damage to functioning information technology equipment can begin at a sustained ambient temperature of 79.4°C (175°F), with the degree of damage increasing with further elevations of the ambient temperature and exposure time.
(2) Damage to magnetic tapes, flexible discs, and similar media can begin at sustained ambient temperatures above 37.8°C (100°F). Damages occurring between 37.8°C (100°F) and 48.9°C (120°F) can generally be reconditioned successfully, whereas the chance of successful reconditioning lessens rapidly with elevations of sustained ambient temperatures above 48.9°C (120°F).
(3) Damage to disc media can begin at sustained ambient temperatures above 65.6°C (150°F), with the degree of damage increasing rapidly with further elevations of sustained ambient temperatures.
(4) Damage to paper products, including punched cards, can begin at a sustained ambient temperature of 176.7°C (350°F). Paper products that have not become brittle will generally be salvageable.
(5) Damage to microfilm can begin at a sustained ambient temperature of 107.2°C (225°F) in the presence of steam or at 260°C (500°F) in the absence of steam.

Annex D General Guidance for Gaseous Agent Systems in Information Technology Equipment Spaces

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1 Gaseous Agents. The use of gaseous agents provides the potential for automatic fire suppression in the incipient fire stage so that the information technology system can continue to perform its mission with little or no interruption. Where coupled with a well-designed early warning detection system, the gas can be automatically released in the early stages of a fire scenario and, being three dimensional, it will penetrate all portions of the space protected, including internal volumes of key components of the system when they are ventilated from the room. Thus an operator does not have to be present or, if present, does not have to determine if and where the fire is occurring and how to deal with it.

Gaseous agents fall into the following two general categories: inert gases and chemical agents.

D.1.1 Inert Gases. Inert gases include gases that extinguish fires by reducing the oxygen level to a point where it will not support combustion. The inert gases found in NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, generally consist of a single gas (nitrogen or argon), blends of gases (nitrogen and argon), or blends with carbon dioxide as a secondary

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

component. See NFPA 2001 for specific agent and system design guidance.

Carbon dioxide also falls into the category of inert gases; however, at the concentration normally used for total flooding of protected spaces, the resulting environment is hazardous to personnel. The use of carbon dioxide systems is contained in NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*.

D.1.2 Chemical Agents. Chemical agents include gases that have been found to be effective in suppressing fires by chemical means or, in some cases, by a combination of chemical reaction and cooling. See NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, for specific agent and system design guidance.

While these systems have proven to be effective and relatively trouble-free when installed as approved, it is prudent to consider the following factors in integrating such systems into a facility:

(1) Effectiveness of agent on types of fires expected
(2) Energized versus de-energized equipment
(3) Possible effect of "neat" agent discharges on the equipment and/or space that is being protected
(4) Dealing with products of combustion and/or products of decomposition created in a fire and fire suppression
(5) Potential hazard to personnel
(6) Long-term availability of agent and/or system components
(7) Compatibility of system operation with facility operation
(8) Selection of detection system

D.2 Effectiveness of Fire-Suppressing Agent. The effectiveness can vary depending on combustibles present and certain characteristics of the hazard protected. Systems are tested and listed or approved so they will afford protection of most hazards when the system is installed in accordance with the system manual. An owner should become familiar with the system design parameters as given in the manual. Certain combustibles can need higher concentrations than the standard combustibles used in the approval process. Refer to information giving recommended concentrations for specific materials.

Total flooding agents are effective when the gas envelops the protected equipment at the proper concentration, a minimum concentration is held until the ignition source is removed, and any smoldering fire that remains after flame extinguishment is controlled. This statement generally means that the enclosure to be flooded needs to be enclosed as much as possible to retain the gas discharged. Integrity of the space protected can need verification and means taken to close off openings to ensure an adequate gas concentration holding time.

The removal of an ignition source in an information technology equipment room generally means the shutting off of power. Continued application of electrical power to information technology equipment can result in ongoing electrical arcing or sustained high temperature "hot spots" in equipment. Such arcing can decompose halogenated agents into toxic and corrosive by-products such as hydrochloric acid, hydrofluoric acid, and possibly carbonyl halides. High temperatures such as those present in flame or glowing metal surfaces also may decompose halogenated agents into quantities of toxic and corrosive by-products. Although some decomposition of halogenated agents occurs in the process of extinguishing fire, the quantity of the toxic and corrosive by-products is limited if the following conditions exist:

(1) The system is designed in accordance with applicable NFPA standards.
(2) Continued arcing or hot spots in excess of the agent's thermal decomposition temperature are not present.

If electrical power is not to be shut down to the protected space upon discharge of a halogenated gaseous agent, operators, fire fighters, and the owner of the facility need to be aware of the possibility of increased quantities of toxic and corrosive by-products being generated by decomposition of the halogenated agent.

D.3 Agent Discharge. When the stored energy of compressed gases is released, high-velocity discharges can result. These discharges can move ceiling tiles, cause undue turbulence, and so forth. Proper system selection arrangement and design that minimizes these effects should be used.

The rapid introduction of gas can cause a pressure buildup in a confined space. This rapid pressure buildup can be a concern for well-sealed spaces, and venting might be needed. When released, some gases, especially carbon dioxide, will rapidly expand in a room or enclosure, causing significant cooling of air and small-mass material. Where significant cooling can be a problem, techniques to minimize this cooling should be employed.

D.4 Products of Combustion and Products of Extinguishing Agent Breakdown. In the course of fire suppression, products of combustion are created, and products formed as chemical agents break down during the fire-extinguishing process. These products can be toxic, noxious, and corrosive, so it is imperative that their creation be minimized. Decomposition products are kept to a minimum by the detection and suppression of fires while they are small, quick extinguishment of open burning, and elimination of all ignition sources. Systems that have been approved and installed according to the NFPA standards referenced have been shown to do this. Delaying suppression by having systems manually released or by aborting and delaying discharge can significantly raise the level of these products resulting from a fire. A method to purge these products after fire extinguishment is needed.

D.5 Hazard to Personnel. In normally occupied spaces, agents or agent concentration that can cause hazards to personnel require a predischarge warning and evacuating system. In the event of a fire, all protected space should be evacuated as soon as possible.

D.6 Halon 1301 Agent and System Availability. The production of halons has stopped in the industrialized world. However, even though no new gas is being produced, recycled gas is still available. An owner who wants to use a system with halon should have a plan to ensure future gas availability in case of a system discharge and the need for refill. See NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*.

D.7 Compatibility to Facility Operation. Gaseous systems work best where the power can be turned off to eliminate all electrical faults that could serve as a continuing ignition source. If a facility is arranged so that power cannot be shut off, then normal gaseous agent system designs can be inadequate. A higher gas concentration and the ability to hold that concentration long enough to allow operator intervention to isolate and eliminate the continuing ignition source are required.

Similarly, if a protected space does not have a dedicated air-conditioning system and ventilation of the protected space cannot be shut down, these conditions should be considered in the system design.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Annex E Informational References

E.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

E.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2012 edition.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2010 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2011 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2009 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2013 edition.

NFPA 70®, *National Electrical Code®*, 2011 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*, 2013 edition.

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 2012 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2012 edition.

• NFPA 551, *Guide for the Evaluation of Fire Risk Assessments*, 2010 edition.

NFPA 730, *Guide for Premises Security*, 2011 edition.

NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2011 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2011 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2012 edition.

E.1.2 Other Publications.

E.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P. O. Box C700, West Conshohocken, PA 19428–2959.

ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2007.

E.1.2.2 BMS CAT Electronics and Magnetic Media Recovery Services. Blackmon-Mooring-Steamatic Catastrophe, Inc., International Headquarters, 303 Arthur Street, Fort Worth, TX 76107.

"Electronics & Magnetic Media Recovery," n.d.

E.1.2.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2008, including revisions through September 13, 2010.

E.2 Informational References. (Reserved)

E.3 References for Extracts in Informational Sections. *NFPA 70®*, *National Electrical Code®*, 2011 edition.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Index

Copyright © 2012 National Fire Protection Association. All Rights Reserved.

The copyright in this index is separate and distinct from the copyright in the document that it indexes. The licensing provisions set forth for the document are not applicable to this index. This index may not be reproduced in whole or in part by any means without the express written permission of NFPA.

-A-

Abandoned Cables
Definition ... 3.3.1
Administration ... Chap. 1
Application ... 1.3
Equivalency ... 1.5
Purpose ... 1.2, A.1.2
Retroactivity ... 1.4
Scope ... 1.1
Special Note on Chapter 10 ... 1.6
Air Space
Definition ... 3.3.2
Aisle
Definition ... 3.4.1, A.3.4.1
Aisle Containment
Definition ... 3.4.2, A.3.4.2
Approved
Definition ... 3.2.1, A.3.2.1
Authority Having Jurisdiction (AHJ)
Definition ... 3.2.2, A.3.2.2
Automated Information Storage System (AISS)
Definition ... 3.3.3

-B-

Business Interruption
Definition ... 3.3.4

-C-

Cold Aisle
Definition ... 3.4.3, A.3.4.3
Communications Circuit
Definition ... 3.3.5
Communications Equipment
Definition ... 3.3.6
Construction of Information Technology Equipment ... Chap. 7
Construction Features ... 7.2
Acoustical Materials ... 7.2.3
Filters ... 7.2.1
Liquids ... 7.2.2
Information Technology Equipment ... 7.1
Construction Requirements ... Chap. 5
Aisle Containment and Hot Air Collar Systems for Information Technology Equipment ... 5.6
Building Construction ... 5.1, A.5.1
Information Technology Equipment Area Interior Construction Materials ... 5.3
Location of Information Technology Equipment Area Within the Building ... 5.2
Penetrations and Openings in Fire-Resistant-Rated Enclosures ... 5.5
Raised Floors ... 5.4, A.5.4

-D-

Definitions ... Chap. 3
Detector
Definition ... 3.3.7
Heat Detector
Definition ... 3.3.7.1
Smoke Detector
Definition ... 3.3.7.2

-E-

Electronically Interconnected
Definition ... 3.3.8
Emergency and Recovery Procedures ... Chap. 11
Damage Control Plan ... 11.2, A.11.2
Emergency Fire Plan ... 11.1, A.11.1
Fire Safety of Fire Fighters ... 11.1.1
Fire Department Information ... 11.1.1.1
Fire Service Orientation and Information ... 11.1.1.2, A.11.1.1.2
Recovery Procedures Plan ... 11.3, A.11.3
Explanatory Material ... Annex A

-F-

Fire Protection and Detection Equipment ... Chap. 8
Automatic Detection Systems ... 8.2, A.8.2
Automatic Fire Protection Systems ... 8.1
Expansion or Renovations ... 8.7
Gaseous Total Flooding Extinguishing Systems ... 8.4
Portable Extinguishers and Hose Lines ... 8.3
Training ... 8.6
Warning Signs ... 8.5
Water Mist Fire Protection Systems ... 8.8
Fire Risk Analysis
Definition ... 3.3.10
Fire-Resistant-Rated Construction
Definition ... 3.3.9

-G-

General Guidance for Gaseous Agent Systems in Information Technology Equipment Spaces ... Annex D

-H-

Hot Air Collar
Definition ... 3.4.4, A.3.4.4
Hot Aisle
Definition ... 3.4.5, A.3.4.5

-I-

Information Technology Equipment (ITE)
Definition ... 3.3.11, A.3.3.11
Information Technology Equipment Area
Definition ... 3.3.12
Information Technology Equipment Room
Definition ... 3.3.13
Information Technology Equipment System
Definition ... 3.3.14
Informational References ... Annex E
Interconnecting Cables
Definition ... 3.3.15

-L-

Labeled
Definition ... 3.2.3
Listed
Definition ... 3.2.4, A.3.2.4

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

-M-

Materials and Equipment Permitted in the Information Technology Equipment Area ..... Chap. 6
General 6.1
General Storage 6.3
Record Storage 6.2

-N-

Noncombustible
Definition 3.3.16

-O-

Optical Fiber Cable
Definition 3.3.17

-P-

Plenum
Definition 3.3.18

-R-

Raceway
Definition 3.3.19, A.3.3.19
Raised Floor
Definition 3.3.20, A.3.3.20
Records
Definition 3.3.21
Important Records
Definition 3.3.21.1
Master Record
Definition 3.3.21.2
Vital Records
Definition 3.3.21.3
Records Kept or Stored in Information Technology Equipment Rooms ..... Chap. 9
Protection Required for Records Within the Information Technology Equipment Room 9.1, A.9.1
Records Stored Outside the Information Technology Equipment Room 9.2
Referenced Publications ..... Chap. 2
General 2.1
NFPA Publications 2.2
Other Publications 2.3
References for Extracts in Mandatory Sections 2.4

Remote Disconnect Control
Definition 3.3.22
Remote Disconnect Controls 10.4.6.4.1
Risk Considerations ..... Chap. 4
Fire Risk Analysis Factors 4.1
Telecommunications Risks 4.2
Telecommunications Risks for the Private Network 4.2.1
Telecommunications Risks for the Public Networks 4.2.2
Risk Considerations, Business Interruption, and Temperature Considerations ..... Annex C

-S-

Separate Fire Division
Definition 3.3.23
Shall
Definition 3.2.5
Should
Definition 3.2.6
Support Equipment
Definition 3.3.24, A.3.3.24

-U-

Utilities ..... Chap. 10
Coolant Systems 10.2
Electrical Service 10.3, A.10.3
Heating, Ventilating, and Air Conditioning (HVAC) 10.1
Supply Circuits and Interconnecting Cables 10.4
Abandoned Cables 10.4.3, A.10.4.3
Disconnecting Means 10.4.6
Grounding 10.4.8, A.10.4.8
Installed Circuits and Cables Identified for Future Use ... 10.4.5
Interconnecting Cables 10.4.1
Marking 10.4.9
Securing in Place 10.4.4
Uninterruptible Power Supplies (UPSs) 10.4.7

-W-

Water Sensor
Definition 3.3.25
What to Do in the First 24 Hours for Damaged Electronic Equipment and Magnetic Media ..... Annex B

-Z-

Zone
Definition 3.3.26

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Sequence of Events Leading to Issuance of this NFPA Committee Document

Step 1: Call for Proposals

- Proposed new Document or new edition of an existing Document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2: Report on Proposals (ROP)

- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Proposals (ROP) is published for public review and comment.

Step 3: Report on Comments (ROC)

- Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.
- Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Comments (ROC) is published for public review.

Step 4: Technical Report Session

- "*Notices of intent to make a motion*" are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
- NFPA membership meets each June at the Annual Meeting Technical Report Session and acts on Technical Committee Reports (ROP and ROC) for Documents with "certified amending motions."
- Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5: Standards Council Issuance

- Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.
- Standards Council decides, based on all evidence, whether or not to issue Document or to take other action, including hearing any appeals.

Committee Membership Classifications

The following classifications apply to Technical Committee members and represent their principal interest in the activity of the committee.

M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

I/M *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

L *Labor:* A labor representative or employee concerned with safety in the workplace.

R/T *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.

I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.

C *Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.

SE *Special Expert:* A person not representing any of the previous classifications, but who has a special expertise in the scope of the standard or portion thereof.

NOTES:
1. "Standard" connotes code, standard, recommended practice, or guide.
2. A representative includes an employee.
3. While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.
4. Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

Stay Up-To-Date. Join NFPA® Today!

☑ **YES** Please enroll me as a member of NFPA for the term checked below. Activate all benefits, and ship my *Member Kit* including the *Benefits Guide* and other resources to help me make the most of my NPFA membership.

Please allow three to four weeks for the kit to arrive.

Billing Information:

Name _____ Title _____

Organization _____

Address _____

City _____ State _____ Zip/Postal Code _____

Country _____

Phone _____ E-mail _____

Priority Code: 8J-MIS-1Z

Please Answer The Following Questions:

Job Title *(check one)*

- ❑ Architect, Engineer, Consultant, Contractor (C17)
- ❑ Facilities Safety Officer (F14)
- ❑ Fire Chief, Other Fire Service (A11)
- ❑ Loss Control, Risk Manager (L11)
- ❑ Inspector, Building Official, Fire Marshal (F03)
- ❑ Owner, President, Manager, Administrator (C10)
- ❑ Other (please specify): (G11)_____

Type of Organization *(check one)*

- ❑ Architecture, Engineering, Contracting (A14)
- ❑ Commercial Firm (Office, Retail, Lodging, Restaurant) (G13)
- ❑ Electrical Services, Installation (J11)
- ❑ Fire Service, Public and Private (AA1)
- ❑ Government (C12)
- ❑ Industrial Firm (Factory, Warehouse) (C11)
- ❑ Institutional (Health Care, Education, Detention, Museums) (B11)
- ❑ Insurance, Risk Management (B12)
- ❑ Utilities (G12)
- ❑ Other (please specify): (G11)_____

4 Easy Ways to Join

Fax: 1-800-593-6372, Outside the U.S. +1-508-895-8301
Mail: NFPA Membership Services Center,
11 Tracy Drive, Avon, MA 02322-9908
Online: nfpa.org
Call: 1-800-344-3555
Outside the U.S. call +1-617-770-3000

6/12-D

Terms and Payment:

- ❑ 1 year ($165)
- ❑ 2 years ($300) SAVE $30
- ❑ 3 years ($430) SAVE $65

Annual membership dues include a $45 subscription to *NFPA Journal*®. Regular membership in NFPA is individual and non-transferable. NFPA Journal is a registered trademark of the National Fire Protection Association, Quincy, MA 02169. Voting privileges begin after 180 days of individual membership. Prices subject to change.

Payment Method:

Check One:

- ❑ Payment Enclosed *(Make check payable to NFPA.)*
- ❑ Purchase Order *(Please attach this form to your P.O.)*
- ❑ Bill Me Later *(Not available on International memberships.)*

Charge My: ❑ VISA ❑ MasterCard ❑ AmEx ❑ Discover

Card #_____

Expiration Date _____

Name on Card _____

Signature _____

International members: Please note prepayment is required on all International orders. Be sure to enclose a check or select your preferred credit card option.

100% Money-Back Guarantee

If anytime during your first year you decide membership is not for you, let us know and you'll receive a 100% refund of your dues.

Copyright 2014 National Fire Protection Association (NFPA). Licensed, by agreement, for individual use and download on October 4, 2014 to LEADER and READER for designated user PATTARAPORN SRITRAKOOL. No other reproduction or transmission in any form permitted without written permission of NFPA. For inquires or to report unauthorized use, contact licensing@nfpa.org.

"Member-Only" Benefits
Keeps You Up-To-Date!

FREE! Technical Support — Technical Support by Phone/Email. Get fast, reliable answers to all code-related questions—from electrical safety for employee workplaces to carbon dioxide extinguishing systems—from NFPA's team of fire protection specialists.

NFPA Journal® — THE journal of record for fire protection, this bi-monthly publication will keep you abreast of the latest fire prevention and safety practices, as well as new technologies and strategies for protecting life and property from fire.

NFPA Update — This easy-to-read monthly e-newsletter will keep you up-to-date on important association programs such as the annual meeting; bring you times of interest from NFPA's regional offices; and alert you to nationwide events and opportunities you won't want to miss.

NFPA News — From new standards for dry cleaning plants to warning equipment for household carbon monoxide, this monthly online update keeps you abreast of additions of changes that could impact how you do you work.

NFPA Standards Directory — The NFPA Standards Directory is your complete guide to NFPA's code-making process. Simply access your online NFPA member profile for document revision guidelines, the revision cycle schedule, and forms for submitting Proposals and Comments. Your online NFPA member profile and access to the NFPA Standards Directory is automatically generated once you join NFPA.

FREE! Section Membership — Share YOUR expertise with others in any of 16 industry-specific sections covering your own field of interest.

Member Kit — Includes Membership Certificate, Pin, Decals, ID Card, and Camera-ready Logo Art. Display the NFPA member logo proudly on your business correspondence, literature, website, and vehicles.

10% Discounts — Save hundreds of dollars each year on the many products and services listed in the NFPA Catalog, including codes and standards publications, handbooks, training videos, and other education materials to increase your knowledge and skills.

Voting Rights — Your chance to help shape the future direction of fire prevention codes and standards. Voting rights go into effect 180 days from the start of individual membership.

Conference Invitation— Invitation to the NFPA Conference and Expo. Attend this important meeting at discounted rates as a member of NFPA.

Join NFPA today!
www.nfpa.org

NFPA® and *NFPA Journal*® are registered trademarks of the National Fire Protection Association, Quincy, MA 02169-7471