PROPOSED DRAFT

OF

NFPA 3
Standard for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems
2011 Edition

The attached draft is a Committee working document. It is being circulated to solicit input from the public prior to publication as a Report on Proposals (ROP).

To submit a proposal, please use the proposal form that is attached to this draft. Proposals must be received by the Secretary, Standards Council, at NFPA, by **5:00 PM EDST on Friday, May 29, 2009.**

Please contact the Standards Administration Department or the Staff Liaison for this document, Tim Hawthorne, if you have any questions on the document.

NFPA Document Proposal Form

NOTE: All Proposals must be received by 5:00 pm EST/EDST on the published Proposal Closing Date.

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2. Proposal Recommends (check one): ☐ new text ☐ revised text ☐ deleted text

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

4. Statement of Problem and Substantiation for Proposal: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Proposal, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

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PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

Mail to: Secretary, Standards Council · National Fire Protection Association
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3/19/2009

INSTRUCTIONS FOR SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Codes and Standards Administration for final date for receipt of Proposals on specific documents.

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1. Type or print in black ink.
2. Indicate the title, number, and edition year of the document. Also indicate the specific section or paragraph that the proposed amendment applies to.
3. Check the appropriate box to indicate whether this proposal recommends adding new text, revising existing text, or deleting text.
4. In the space identified as "Proposal," indicate the exact wording you propose as new or revised text, or the text you propose be deleted.
5. In the space identified as "Statement of Problem and Substantiation for Proposal," state the problem(s) that would be resolved by your recommendation and give the specific reason for your proposal. Include copies of test results, research papers, fire experience, or other materials that substantiate your recommendation.
6. Check the appropriate box to indicate whether or not this proposal is original material, and if it is not, indicate the source of the material.
7. Sign the proposal.

If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee. If the "Statement of Problem and Substantiation for Proposal" exceeds 200 words, the technical committee is authorized to abstract it for publication in the Report on Proposals.

NOTE: The NFPA Regulations Governing Committee Projects state in Paragraph 4.3.3: Each Proposal shall be submitted to the Council Secretary and shall include the following:

(a) Identification of the submitter and his or her affiliation (i.e., TC, organization, company), where appropriate
(b) Identification of the Document, edition of the Document, and paragraph of the Document to which the Proposal is directed
(c) Proposed text of the Proposal, including the wording to be added, revised (and how revised), or deleted
(d) Statement of the problem and substantiation for the Proposal
(e) Signature of the submitter or other means of authentication approved by the Council Secretary
(f) Two copies of any document(s) (other than an NFPA document) being proposed as a reference standard or publication

NFPA 3
Standard for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems
2011 Edition

Chapter 1 Administration

1.1 Scope. This standard shall provide the minimum requirements for procedures, methods and documentation for commissioning and the integrated testing of active and passive fire protection and life safety systems.

1.2* Purpose. The purpose of this standard shall be to provide a reasonable degree of assurance that fire protection and life safety systems function in accordance with the Basis of Design (BOD) and the Owner's Project Requirements (OPR) through standardization of the processes for commissioning and integrated testing.

1.3* Application.

1.3.1* Where required, this standard shall apply to fire protection and life safety systems including, but not limited to, the following:

(1)* Infrastructure supporting the building fire protection and life safety systems within the boundaries of the project
(2) Fixed fire suppression and control systems
(3) Fire alarm systems
(4) Emergency communications systems (ECS)
(5) Smoke control and management systems
(6) Normal and emergency power and lighting systems
(7) Explosion prevention and control systems
(8) Fire doors, windows, walls and other fire and smoke resistant assemblies
(9) Commercial cooking operations
(10) Elevator systems
(11) Fire extinguishers
(12)* Means of egress systems and components
(13) Other passive and active fire and life safety systems and equipment
(14) Other systems or installations integrated or connected to a fire or life safety system, such as but not limited to: access control, critical processes and hazardous operations.

1.3.2* Commissioning shall achieve the following:

(1) Documentation of Owners Project Requirements (OPR) and Basis of Design (BOD) is provided.
(2) Equipment and systems are installed as required.
(3) Functional performance testing for all integrated fire and life safety systems has been performed and documented.
(4) Operation and Maintenance (O&M) documentation is compiled and delivered.
(5)* Facility operating and maintenance staff are trained.
(6) Verify that the documentation is in place for maintaining system performance to meet the original design intent after initial occupancy.

1.3.3 Integrated testing shall verify and document the following:

(1) Performance in accordance with applicable codes and standards
(2) Compliance with BOD and OPR
(3)* Sequence of operation (matrix)
(4) New technology, devices or equipment
(5) Installation in accordance with manufacturers requirements
(6) Accuracy of diagrams of system interconnections and device locations prior to final acceptance

1.4 Equivalency.

1.4.1 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.

1.4.2 Nothing in this standard shall be intended to restrict new technologies or alternate arrangements, provided the level of performance prescribed by this standard is not lowered.

1.4.3 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.4 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5 Units.

1.5.1 Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

1.5.2 Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection.

1.5.3 These units are listed in Table 1.5.3 with conversion factors.

Table 1.5.3 SI Units and Conversion Factors

(Insert table 1.7.1.3 from NFPA 13 Here)

1.5.1.4 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement.

1.6* New Technology. New technology acceptable to the AHJ, proposed for installation with no published product or installation standard shall function as intended throughout its life cycle in accordance with the Owners Project Requirements, Basis of Design, or requirements of the AHJ.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code 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 1031, *Standard for Professional Qualifications for Fire Inspector and Plan Examiner,* 2009 edition.

NFPA 5000, *Building Construction and Safety Code,* 2009 edition.

2.3 Other Publications

Master Format

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* 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.

3.2.4 Shall. Indicates a mandatory requirement.

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

3.2.6 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions

3.3.1 Building. Any structure used or intended for supporting or sheltering any use or occupancy.

3.3.2 Commissioning.

3.3.2.1* Commissioning (Cx). A systematic process that provides documented confirmation that specific and interconnected fire and life safety systems function according to the intended design criteria set forth in the project documents and satisfy the owner's operational needs, including compliance requirements of any applicable laws, regulations, codes and standards requiring fire and life safety systems.

3.3.2.2* Commissioning Authority (C_xA). The qualified person, company or agency that plans, coordinates and oversees the entire commissioning process.

3.3.2.3 Commissioning Plan. The document prepared for each project that describes all aspects of the commissioning process including schedules, responsibilities, documentation requirements and communication structures.

3.3.2.4 Commissioning Record. The complete set of commissioning documentation for the project which is turned over to the Owner at the end of the construction phase.

3.3.2.5 Fire Commissioning Agent (FCxA). A person or entity identified by the owner, who leads, plans, schedules, documents, coordinates the commissioning team, and implements the commissioning process and integrated testing of fire and life safety systems.

3.3.1.6* Re-commissioning (Re-Cx). The process of verifying the performance of existing fire protection and life safety systems that have been previously commissioned to ensure that the systems continue to operate according to the design intent or current operating needs.
3.3.2.7* Retro-commissioning (RCx). The process of commissioning existing fire protection and life safety systems that were not commissioned when originally installed.
3.3.3 Component. A part or element of an architectural, electrical, mechanical, or structural system. [**NFPA 5000:** 3.3.109]
3.3.4 Construction Documents. The plans, specifications, and all other documents that describe the design of a construction project for which a permit has been issued by the authority having jurisdiction.
3.3.5 Drawings.
3.3.5.1 Record (Plan) Drawing. A design, working or as-built drawing that is submitted as the final record of documentation for the project. A drawing is also referred to as a plan.
3.3.5.2 Shop (Plan) Drawing. Scaled working drawings, equipment cut sheets, and design calculations.
3.3.5.3 Working (Plan) Drawing. Those approved plans and drawings that are used for construction of the project.
3.3.6 Fire Protection System. Systems, devices, and equipment used to detect a fire and its by-products, actuate an alarm, or suppress or control a fire and its by-products, or any combination thereof. [**NFPA 1031:** 3.3.20.1]
3.3.7 Functional Performance Test (FPT). Tests that evaluate the dynamic function and operation of equipment and systems using direct observation or other monitoring methods. Functional testing is the assessment of the system's ability to perform within the parameters set up within the OPR and BOD. Functional performance tests are performed after construction checklists are complete.
3.3.8 Inspection. A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage.
3.3.9 Issues Log. A formal and ongoing record of failures, deficiencies, or concerns, as well as associated priorities, implications and resolutions.
3.3.10 Life Safety System. Those systems that enhance or facilitate evacuation, smoke control, compartmentalization, and/or isolation. [**NFPA 1031:** 3.3.20.3]
3.3.11 Matrix. See Sequence of Operation.
3.3.12* Narrative. A written summary description of the building(s) or structure(s) including exterior property boundaries and all applicable fire protection and life safety systems and related integrated operational features.
3.3.13 Operation and Maintenance Manual. A system-focused composite document that includes the operation and maintenance requirements, and additional information of use to the Owner during the Occupancy and Operations Phase.
3.3.14 Owner's Project Requirements (OPR). The documentation that provides the owner's vision for the planned facility, functional performance requirements, expectations for how it will be used and operated, and benchmarks and criteria for performance.
3.3.15 Phase.

3.3.15.1 Construction Phase. The phase during which the systems and materials are fabricated and installed, tested and accepted.
3.3.15.2 Design Phase. The phase during which the Basis of Design is produced and drawings and calculations including those for design and fabrication are produced and testing procedures are developed.
3.3.15.3 Occupancy Phase. The phase during which the training and periodic inspection, testing and maintenance is scheduled and performed.
3.3.15.4 Pre-Design Phase. The phase during which the Commissioning Team is formed, initial project concepts and the Owners Project Requirements are developed.
3.3.16 Plans. See Drawings.
3.3.17 Registered Design Professional (RDP). In commissioning, an individual who is registered or licensed to practice his respective design profession as defined by the statutory requirements of the professional registration laws of the jurisdiction in which the project is to be constructed, or other professional with credentials acceptable to the jurisdiction in which the project is to be constructed.
3.3.18* Sequence of Operation (Matrix). An array or table of system inputs and outputs that can be used to illustrate the interactions of inter-connected fire protection systems.
3.3.19 System Connections.
3.3.19.1* Integrated System: A combination or group of fire protection and life safety systems either interconnected or separate but required to operate together as a whole to achieve the fire protection objectives.
3.3.19.2* Interconnected System: An integrated system that has physically connected component systems or devices.
3.3.19.3* Interconnections. The physical connections between interconnected systems.
3.3.20 Systems Manual. A document that includes the operations, maintenance and additional information for use by the Owner during the occupancy phase.
3.3.21 Testing.
3.3.21.1 Acceptance Testing. Tests performed in accordance with the requirements of the relevant standard by the installing contractor at the time of completion to determine compliance.
3.3.21.2* Integrated Testing. Performance verification of the interaction and coordination of multiple and separate fire and life safety systems.
3.3.21.3* Periodic Testing. A procedure used to determine the functionality of a component, system, or integrated system by conducting periodic physical checks on fire protection and life safety system equipment.
3.3.21.4* Pre-Functional Performance Testing. Testing that is done according to a checklist (generally developed by the fire commissioning agent) that verifies that new equipment and all its components are functioning as intended.

Chapter 4 Commissioning

4.1 General
4.1.1* The requirements of this Chapter shall apply to the commissioning of all fire protection and life safety systems.

4.1.2 Additional requirements for specific fire protection or life safety systems shall be based on the applicable chapter of this standard.
4.1.3 Commissioning of fire protection and life safety systems shall include, but not be limited to, the pre-design phase, design phase, construction phase and occupancy phase. See Figure 4.1.3(a), (b) & (c).

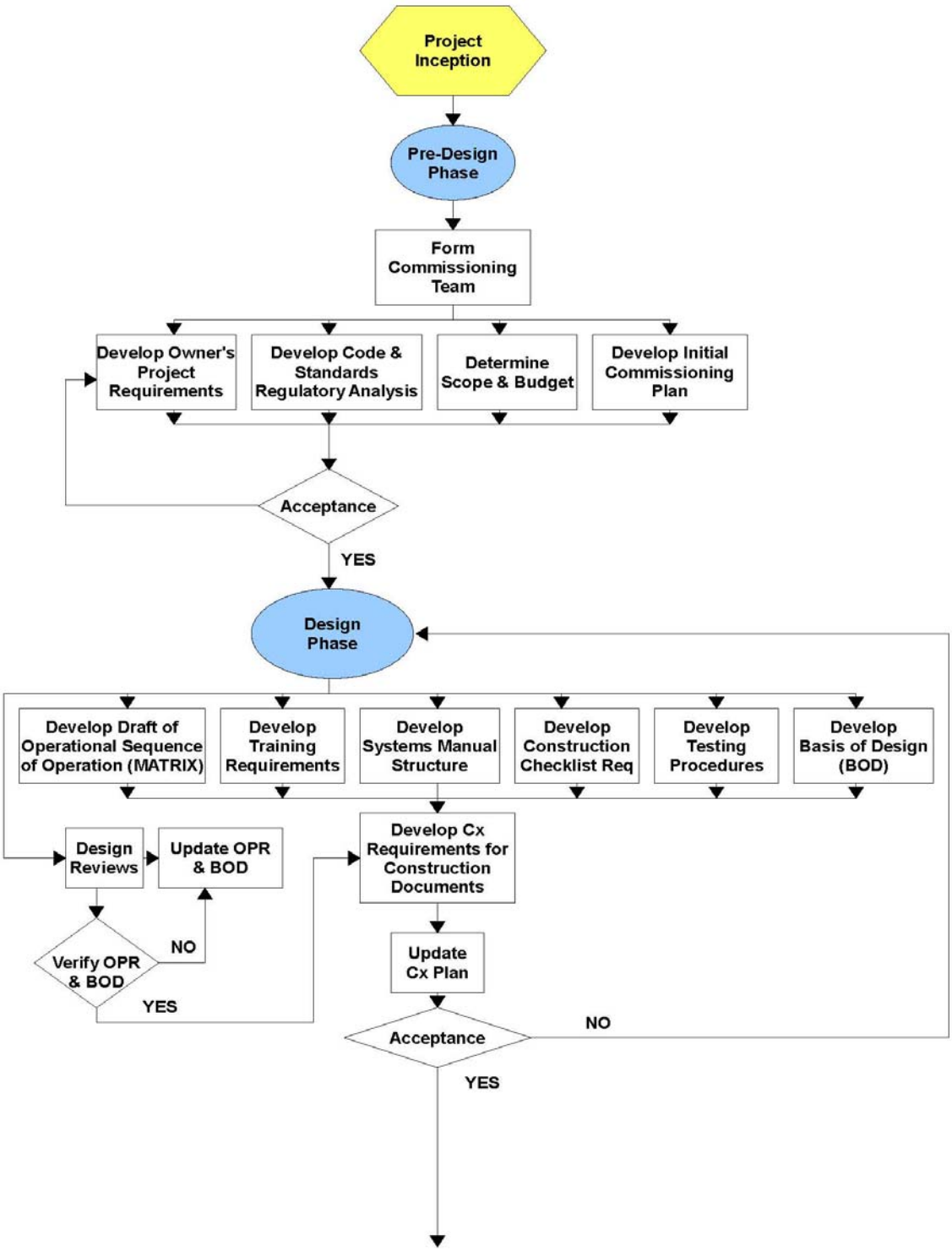


Figure 4.1.3(a) The Commissioning Process

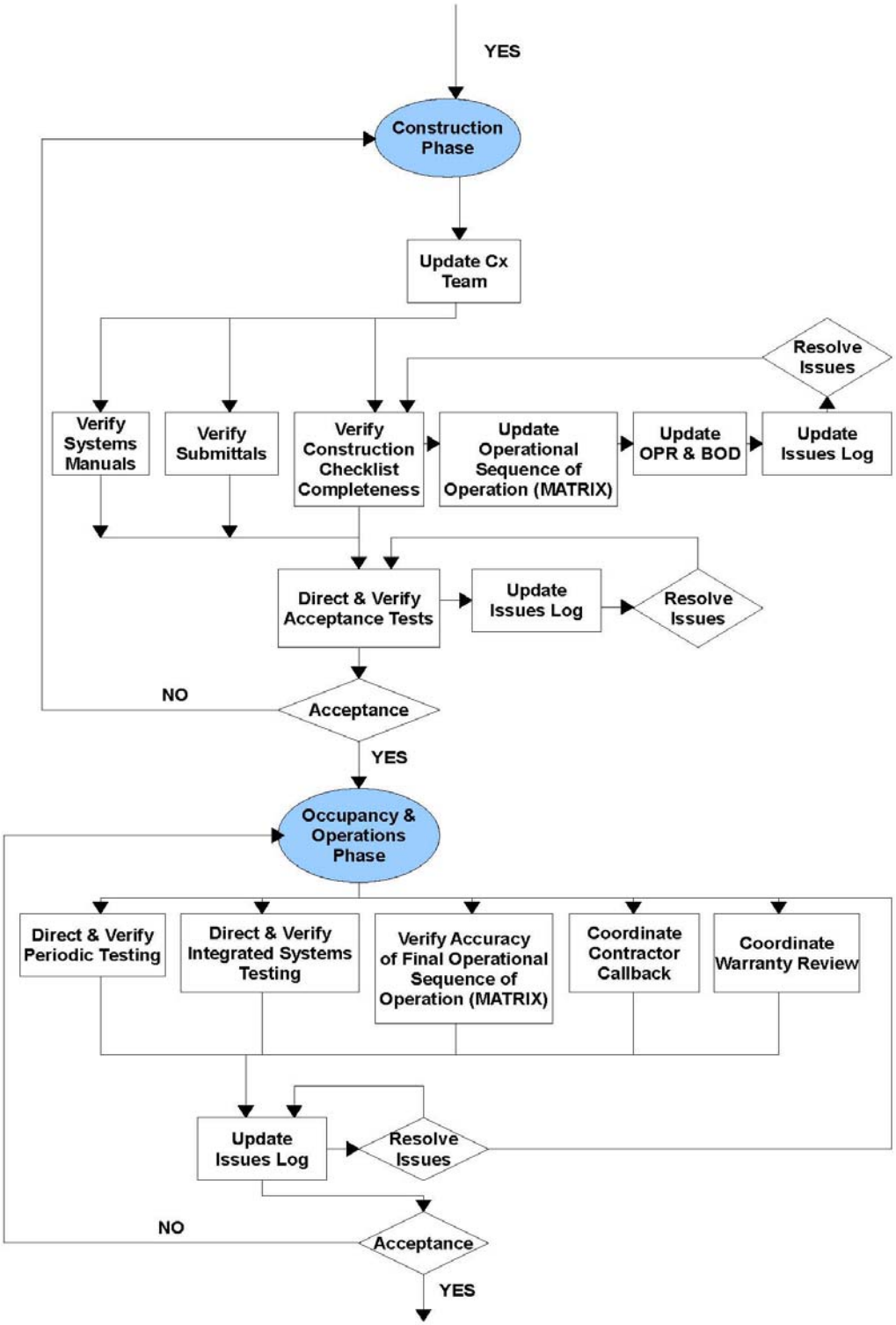


Figure 4.1.3(b) The Commissioning Process

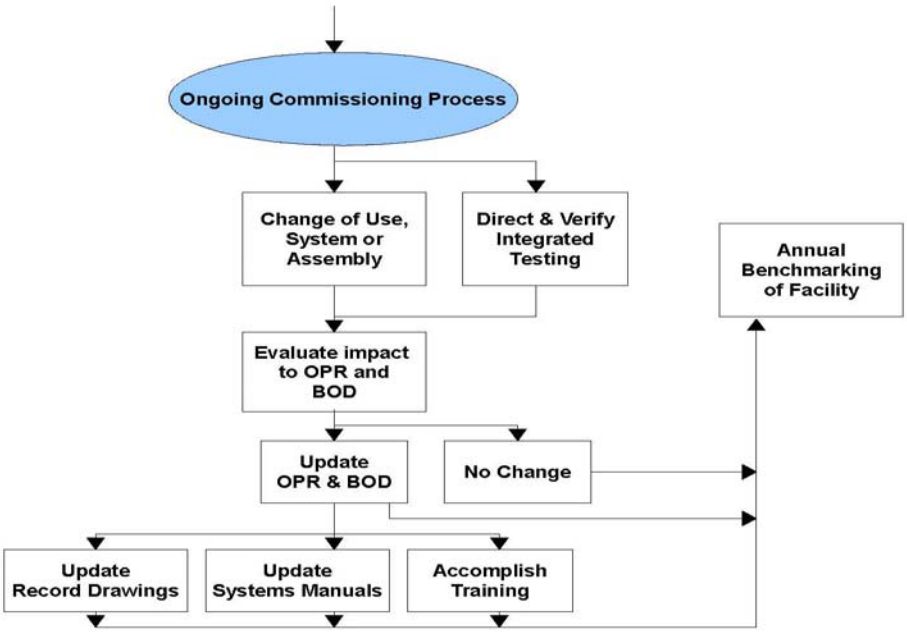


Figure 4.1.3(c) The Commissioning Process

4.2 Pre-Design Phase.

4.2.1 Activities.

4.2.1.1* The Commissioning Team shall be established during the Pre-Design Phase.

4.2.1.2* During the pre-design phase of the project, the Commissioning Team shall:

(1) Develop the OPR in accordance with this Section.
(2) Select the FCxA.
(3) Identify the Commissioning scope.
(4) Develop the preliminary Commissioning Plan in accordance with this Section.
(5) Review the Pre-Design documents in accordance with this Section.
(6) Develop regulatory code analysis.
(7) Initiate the commissioning plan.

4.2.2 Fire Protection and Life Safety Commissioning Team. The fire protection and life safety commissioning team shall be identified and documented. The following entities, where included in the project, shall be part of the commissioning team.

(1) Owner
(2) Commissioning Authority
(3) Fire Commissioning Agent (FCxA)
(4) Installation Contractor(s)
(5) Manufacturer's Representatives
(6) Registered Design Professional(s)
(7) Construction Manager/General Contractor
(8) Owner's Technical Support Personnel
(9) Facility Manager or Operations Personnel
(10) Insurance Representative
(11)* AHJ

4.2.2.1* Entities listed in Section 4.2.2 not included as part of the project shall not be required to be part of the commissioning team.

4.2.2.2 Owner.

4.2.2.2.1 The Owner shall be responsible for the commissioning of all fire and life safety systems.

4.2.2.2.2 The owner shall be permitted to delegate the responsibility for commissioning to the occupant, management firm or managing individual through specific provisions in a lease, written use agreement or management contract.

4.2.2.2.3 The Owner shall be responsible for the following:

(1) Contracting the Commissioning Process.
(2) Include the Commissioning responsibility of the Registered Design Professional within the scope for design services.
(3) Assist in the development of and approve the OPR.
(4) Assign operations and maintenance personnel to participate in the commissioning process.
(5) Review and approve any changes to the OPR.
(6) Review and approve the construction documents.
(7) Review and comment on the Commissioning Process Progress Reports.
(8) Review and comment on the Commissioning Team's progress reports.
(9) Review and accept the final Commissioning Record.

4.2.2.3 Fire Commissioning Agent (FCxA): The FCxA shall be responsible for the following:

(1) Organize and lead the Fire Protection and Life Safety Commissioning Team.
(2) Coordinate Commissioning Team meetings.
(3) Facilitate the development of and document the OPR.
(4) Verify that Commissioning Process activities are clearly stated in all scopes of work.
(5) Identify and integrate the Commissioning Process activities into the project schedule.
(6) Prepare the Commissioning Plan.
(7) Prepare the Commissioning Process activities to be included in the project specifications.
(8) Execute the Commissioning Process.
(9) Review the plans and specifications during the Pre-Design and Design Phases.
(10) Attend pre-bid meeting to detail the Commissioning Contractor requirements.
(11) Review and approve the Systems Manual.
(12) Track and document issues and deviations to the OPR and log resolutions in the Issues Log.
(13) Write and review Commissioning Process Progress Reports.
(14) Witness system testing.
(15) Review installation and record documents.
(16) Recommend acceptance of the systems to the Owner.
(17) Track development, accuracy and compliance with sequence of operation (matrix).

4.2.2.4 Installation Contractor

(1) Include all Commissioning Process requirements and activities in the scope of services.
(2) Attend required Commissioning Team meetings.
(3) Include Commissioning Process milestones in the project schedule.
(4) Implement the training program as required by the Contract Documents.
(5) Provide submittals to the RDP, Owner and Commissioning Team.
(6) Develop individual system test plan, including acceptance and integrated testing.
(7) Notify the General Contractor and FCxA when systems are ready for testing.
(8) Demonstrate the performance of the systems, including integration.
(9) Complete the Construction Checklists as the work is accomplished.
(10) Continuously maintain the Record Drawings as required by the Construction Documents.

4.2.2.5 Manufacturer's Representatives

(1) Provide technical support to the Installation Contractor.
(2) Provide all information required for the operation and maintenance of the system.
(3) Provide the requirements to maintain the warranty as part of the initial submittal.
(4) Provide factory test documentation when required
(5) Assist the Installation Contractor in the development of the individual systems test plans.
(6) Assist the Installation Contractor and Commissioning Team with installation verification and testing.

(7) Assist in development and implementation of system training.

4.2.2.6 Registered Design Professional

(1) Participate and assist in the development of the OPR.
(2) Document the Basis of Design.
(3) Prepare Contract Documents.
(4) Respond to the Commissioning Team design submission review comments.
(5) Specify operation and maintenance of systems in the project specifications.
(6) Review and incorporate the Commissioning Teams comments, as appropriate.
(7) Review test procedures submitted by the installation contractor.
(8) Review and comment on the Commissioning Process Progress Reports and Issues Log reports.
(9) Review and accept record documents as required by the Contract Documents.
(10) Review and comment on the final Commissioning Record.
(11) Recommend final acceptance of the systems to the Owner.

4.2.2.7 Construction Manager/General Contractor

(1) Include Commissioning Process requirements and activities in all contracts.
(2) Obtain cooperation and participation of all subcontractors and manufacturers.
(3) Attend required Commissioning Team meetings.
(4) Include Commissioning Process milestones in the project schedule.
(5) Notify the FCxA when systems are ready for testing.
(6) Certify that all work has been completed and the facility is operational in accordance with the Contract Documents.
(7) Remedy deficiencies identified by the Commissioning Team during installation verification or testing.
(8) Review and comment on the final Commissioning Record.

4.2.2.8 Owner's Technical Support Personnel

(1) Review and comment on the OPR.
(2) Provide technical assistance to the Commissioning Team, RDP and Installation Contractor.
(3) Review any changes to the OPR.
(4) Review the construction documents.
(5) Review the Commissioning Team's Commissioning Process Progress Reports.
(6) Review the Commissioning Team's progress reports.
(7) Review the Commissioning Team's Commissioning Record.
(8) Review the Systems Manual.

4.2.2.9 Facility Manager or Operations Personnel

(1) Attend systems training sessions.
(2) Review and comment on the OPR.
(3) Review and comment on the Systems Manuals.
(4) Organize, coordinate and implement system inspection, testing and maintenance as required by the Systems Manuals.

4.2.2.10 AHJ

(1) Participate in Commissioning Team meetings as necessary.
(2) Provide all inspection, testing and performance criteria required for acceptance and issuance of Certificate of Occupancy to be included in the Commissioning Plan.

(3) Witness installation verification and system testing in conjunction with the Commissioning Team, as necessary.
(4) Identify appropriate AHJ personnel to attend training. (Personnel associated with the AHJ)

4.2.3 Owner's Project Requirements (OPR)

4.2.3.1 The OPR shall form the basis from which all design, construction, acceptance and operational decisions are made.

4.2.3.2* The OPR shall be developed with input from the Owner and all key facility users and operators.

4.2.3.3* The OPR shall be documented at the pre-design stage of the project. Each item of the OPR shall have defined performance and acceptance criteria. The OPR shall include, but is not limited to:

(1) Infrastructure requirements (utilities, roads, site access)
(2) Facility type, size, height
(3) Intended use
(4) Occupancy classification, number of occupants number and hours of operation
(5) Future expansion requirements
(6) Applicable codes and standards
(7) Specific user requirements
(8) Training requirements
(9) Warranty, Operations and Maintenance requirements
(10) Integrated System requirements in accordance with Chapter 5.
(11) Specific performance criteria
(12) Third-party requirements

4.2.3.4 The OPR shall be continuously updated by the Commissioning Team throughout the pre-design, design, construction and occupancy phases of the building life cycle.

4.2.4 Commissioning Plan

4.2.4.1* The Commissioning Plan shall identify the processes and procedures necessary for a successful Commissioning.

4.2.4.2 The Commissioning Plan shall be continuously updated by the Commissioning Team throughout the pre-design, design, construction and occupancy phases of the building life cycle.

4.2.4.3* The Commissioning Plan shall contain the following information:

(1) Commissioning scope and overview specific to the project
(2) General project information
(3) Commissioning team members, roles and responsibilities
(4) General communication plan and protocol
(5) Commissioning process tasks and activities through all phases
(6) Commissioning schedule
(7) Required commissioning process documentation and deliverables
(8) Required testing procedures
(9) Recommended training

4.2.4.4 The following materials shall be added as annex sections of the completed Commissioning Plan:

(1) A - Owner's Project Requirements
(2) B - Basis of Design

(3) C - Commissioning Specifications
(4) D - Design Review
(5) E - Submittal Review
(6) F - Issues Log
(7) G - Construction Checklists
(8) H - Site Visit and Commissioning Meeting Minutes
(9) I - Systems Manual Review
(10) J - Training
(11) K - Functional Performance and Seasonal Testing Procedures
(12) L - Warranty Review
(13) M - Test Data Reports
(14) N – Sequence of Operation (matrix)

4.2.4.5 The completed Commissioning Plan, including all Annexes, shall form the Commissioning Record turned over at the end of the construction phase.

4.2.5 Pre-Design Review

4.2.5.1 The FCxA shall review the pre-design documentation to compare the design concept with the interests and needs of the Owner as defined in the OPR.

4.2.5.2 The FCxA shall identify any improvements that can be made from the standpoint of operations and maintenance.

4.2.5.3 It shall not be the intent of the Pre-Design Review to verify compliance with local, State and Federal Codes, unless specifically identified in the commissioning scope.

4.2.6 Pre-Design Approval Documentation

4.2.6.1 The FCxA shall submit documentation stating completion and recommending acceptance of the pre-design requirements to the Owner or other designated individual.

4.2.6.2 The documentation shall include, but is not limited to, the following information.

(1) Receipt, review and approval of Pre-design submittal.
(2) Updates to the Commissioning Plan, as applicable.
(3) Any additional comments or requests for information considered by the FCxA to be appropriate to the commissioning process.
(4) Preliminary sequence of operation (matrix)

4.3* Design Phase. During the Design Phase the commissioning team develops the BOD, and reviews and approves the documents including sequence of operation matrix, drawings and calculations for the project including those used for design and fabrication.

4.3.1* Design Phase Activities. The commissioning team shall:

(1) Document the scope for commissioning activities (annex of example of scope).
(2) Document the Commissioning Procedures and create a Commissioning Activities Schedule.
(3) Verify that the construction documents comply with the requirements of the Basis of Design (BOD).
(4) Identify qualified specialists in accordance with Chapter 10 and their responsibilities.
(5) Coordinate and document Commissioning Team Meetings and progress reports.
(6)* Document issues and changes and update the Commissioning Plan.
(7) Create construction checklists.

(8) Create required project testing requirements. (include check lists requiring when AHJ's and Cx Team members are to be present during acceptance testing)
(9) Develop project training requirements

4.3.2 Basis of Design.

4.3.2.1 General

4.3.2.1.1 The basis of design shall be the documentation describing the initial design decision making process and description of systems.

4.3.2.1.2 This document shall be in the form of a narrative report and shall be submitted for review prior to the installation of any system.

4.3.2.1.3 The report shall include as a minimum a description of the building or structure, fire protection or life safety systems and components, performance assumptions, referenced codes and standards, testing and start-up requirements and, inspection, testing and maintenance requirements.

4.3.2.1.4 The basis of design shall be prepared for all systems installed in new and existing buildings or structures

4.3.2.1.5 The basis of design shall be prepared for all modifications or additions to existing systems.

4.3.2.1.6 The basis of design shall be prepared for systems that are required by code or installed voluntarily.

4.3.2.1.7 The purpose of the basis of design is to assist the commissioning authority and the authority having jurisdiction in the plan review, inspection and final acceptance process.

4.3.2.1.8 The basis of design shall be included with other required submittals to facilitate plan review and approval by the authority having jurisdiction prior to the issuance of a permit to install the system.

4.3.2.1.9 The Commissioning Team shall update the BOD in accordance with the requirements for OPR Section 4.2.3 after every revision of the design documents.

4.3.2.1.10 Basis of Design Outline The outline for the Basis of Design shall include the items in sections 4.3.2.2 through 4.3.2.8.

4.3.2.2* Applicable Standards, Laws and Regulations. This section shall identify the codes and standards that apply to the design, plan review, installation, testing, acceptance, inspection, and maintenance of the proposed fire protection and life safety systems. All codes and standards shall be referenced as they apply. Including, but not limited to, the following:

(1) NFPA Standards including edition used for the design of each fire protection / life safety system
(2) Applicable local, state and federal laws and regulations (OSHA, ADA, etc)
(3) Specialized codes and standards (HVAC, plumbing etc.)

4.3.2.3 Design Responsibility.

4.3.2.3.1 A Registered Design Professional (RDP) shall oversee completion of the plans, calculations and specifications for the system(s).

4.3.2.3.2 The RDP shall review the installing contractor's working plans and final calculations.

4.3.2.4 Building Description. This section outlines the specific features of the fire protection and life safety systems that shall be identified in the basis of design:

(1) Building use group

(2) Total area of the building
(3) Building height
(4) Number of floors above grade
(5) Number of floors below grade
(6) Area per floor
(7) Type(s) of occupancies of hazards within the building
(8) Type(s) of construction
(9) Site access arrangement for emergency response vehicles

4.3.2.5 Fire Protection and Life Safety System Objectives and Decisions.

4.3.2.5.1 The performance objectives of each fire protection and life safety system shall be described in detail. This section shall also describe whether each system is required by code or installed voluntarily, and whether it is a complete or partial installation or, an addition or modification to an existing system.

4.3.2.5.2 The decisions made and the criteria established to achieve the performance objectives for each fire protection and life safety system shall be described. This shall include, but not be limited to, the following issues:

(1) Building occupant notification and evacuation procedures.
(2) Emergency response personnel, site and systems features.
(3) Safeguards, fire prevention and emergency procedures during construction and impairment plans associated with existing system modifications.
(4) Method of inspection, testing and, maintenance of commissioned systems.

4.3.2.6 Consideration and Description of Alternative Means and Methods. This section shall identify the design intent of any alternatives to prescriptive requirements of the codes and standards. This shall include, but not be limited to:

(1) Application of performance-based design,
(2) Interpretations and clarifications.
(3) Waiver or variance sought through the regulatory appeal process.

4.3.2.7 Testing Criteria.

4.3.2.7.1 The fire commissioning agent shall be identified and shall be responsible for organizing and coordinating all acceptance testing and documentation including coordination and accuracy of sequence of operation (matrix).

4.3.2.7.2 Testing Criteria shall be established and documented.

4.3.2.7.3 The methods for pre-functional and integrated systems testing shall be documented.

4.3.2.8* Equipment and Tools. The documents and tools necessary to conduct acceptance testing shall be documented.

4.3.3 Operation and Maintenance Manuals.

4.3.3.1 Operation and Maintenance manuals (O&M's) shall be required and shall contain, but not be limited to the following information:

(1) Project name and address,
(2) Discipline (i.e.: "Fire Protection"),
(3) CSI MasterFormat® specification section number,
(4) Volume number

4.3.3.2* The RDP shall review and approve the O&M's for conformance with the OPR.

4.3.4 Training of Operations Personnel. The content, duration and learning outcomes of training for operations personnel shall be provided in the design documentation in

accordance with 4.4.

4.4 Construction Phase. During the construction phase the systems are delivered, installed and tested in accordance with the OPR and CDs. CDs in this are intended to include the shop drawings and coordination drawings.

4.4.1 Construction Phase Commissioning Activities

The fire commissioning team (FCT) shall:

(1) confirm that the commissioning schedule is still valid, update if required
(2) verify that submittals, including but not limited to, working plans and product data sheets are in conformance with the BOD.
(3) verify that materials, construction and installation are in conformance with the BOD.
(4) confirm qualified specialists are performing commissioning activities per CP.
(5) coordinate and document commissioning team meetings and progress reports
(6) document any issues and changes to the project and update the CP.
(7) perform Cx (QC) construction checklists
(8) perform required observation procedures or cause them to be performed by the responsible party.
(9) update related documents to record and adjust for any revisions and/or changes.
(10) verify and document testing performed in the Construction Phase.

4.4.2 Construction Inspections

4.4.2.1 Pre-Installation or Preconstruction

4.4.2.1.1 Preconstruction Conference shall be held to ensure CT and those performing the work all understand the schedule, procedures and process.

4.4.2.1.2 Schedule Commissioning Process Activities shall include:

(1) Address any outstanding issues that are best resolved in this venue
(2) Verify coordination has taken place amongst trades
(3) Identify and Establish Benchmarks to be met during the Construction Phase.
(4) Verify Submittals are in accordance with design intent documents and approvals and permits are secured.
(5) Confirm integrated testing requirements are being addressed.
(6) Develop test data records.
(7) Confirm compliance with sequence of operation (matrix).

4.4.2.2 Rough-In Phase. The following tasks shall be performed prior to concealment of the installed material:

(1) Inspect and verify delivered materials meet requirements
(2) Verify installation is proceeding in accordance with coordinated, approved design (drawings)
(3) Accomplish Periodic Site Visits to Verify Compliance with owners commissioning plan.
(4) Inspect installation as outlined in the commissioning plan
(5) Perform testing as applicable.
(6) Update owner project requirements and address any outstanding issues.
(7) Update Commissioning Plan as needed.
(8) Issue Rough-In Phase Commissioning Progress Report

4.4.2.3 Finish Phase. The following tasks shall be performed after concealment of the installed materials:

(1) Inspect and verify delivered materials meet requirements
(2) Verify installation is proceeding in accordance with coordinated, approved design (drawings)
(3) Accomplish Periodic Site Visits to Verify Compliance with OPR
(4) Inspect installation as outlined in the commissioning plan
(5) Perform testing as applicable (post concealment)
(6) Update owner project requirements (OPR) and address any outstanding issues
(7) Update commissioning plan
(8) Issue Finish Phase Commissioning Progress Report

4.4.3 Completion and Acceptance Testing The following tasks shall be performed as part of the acceptance of the Fire Protection and Life Safety Systems:

(1) Verify installation is in accordance with coordinated, approved design (drawings)
(2) Inspect overall installation as outlined in the commissioning plan.
(3) Perform pre-testing of all systems to provide proper functionality and to ensure interoperability.
(4) Perform and document testing of all systems to provide proper functionality and to ensure integration.
(5) Update owner project requirements and address any outstanding issues
(6) Update commissioning plan/record.
(7) Issue Completion/Acceptance Phase Commissioning Progress Report
(8) Verify compliance and accuracy of sequence of operation.

4.4.4 Owner Training

Training shall be permitted to take place, if applicable, in the Construction Phase (See 4.4).

4.4.5 Closeout Documents

(1) Compile list of all deficiencies and resolutions. Verify resolution achieved.
(2) Operations and Maintenance Manuals
(3) Compile all test results and certificate
(4) As Built Drawings
(5) Warranty and extended warranties
(6) Spare Parts List and supplier listings
(7) Re-commissioning Plan
(8) Sequence of operation (matrix).

4.5 Occupancy Phase.

4.5.1 Occupancy phase shall be the final stage of the commissioning process for the fire protection or life safety systems.

4.5.2 The minimum requirements for occupancy phase shall include but not be limited to:

(1) Acceptance testing and inspection completion and documentation in accordance with applicable codes and standards and the design specifications for the project.
(2) Conduct testing for modifications made during the construction phase commissioning

(3) Delivery of system manual, operation and maintenance manuals, and vendor emergency contact list.
(4) Training on the use and operation of the fire protection and life safety systems.
(5) Record set drawings and documents.
(6) Test and inspection records for the fire protection and life safety systems.
(7) A digital copy of site specific software for fire protection and life safety systems that is current with the installed system.
(8)* Warranties for the systems and equipment.
(9) Recommended preventative maintenance program for fire protection and life safety systems.
(10) A list of required inspections, tests and maintenance for fire protection and life safety systems.

4.5.3 Administrative Controls. The owner shall be responsible for the continued performance of commissioned fire protection and life safety systems.

4.5.3.1* Testing shall be repeated if changes are made to commissioned fire protection or life safety systems.

4.5.3.2* When changes are made to the use of the facility, the OPR shall be re-evaluated.

4.5.3.3* The design documents shall be maintained for future reference.

4.5.3.4 Inspection, test, and maintenance shall be done as specified in the installation standard, manufacturer's instructions, section 9.2 for integrated systems, or as defined in the BOD.

4.5.4 Training.

4.5.4.1* The training shall consider the following:
(1) The systems, component systems and devices for which training will be required.
(2) The capabilities and knowledge of the occupants and maintenance personnel.
(3) The number and type of training sessions.
(4) The location and organization of operation and maintenance manuals.

4.5.4.2* Systems training shall be scheduled to be completed at or as close to final systems acceptance as possible.

4.5.4.3* Training sessions shall use attendee sign-in sheets.

4.5.4.4* Facilities personnel or their designated representatives shall receive periodic re-training as determined by the commissioning agent.

Chapter 5 Integrated Systems

5.1 General. This Chapter applies to the functions of integrated systems provided for fire protection or life safety in the design phase, construction phase and occupancy phase of the commissioning process of Chapter 4.

5.2 Design Phase.

5.2.1* The Basis of Design required by section 4.3.2 shall include system interactions.

5.2.2 The narrative report in the Basis of Design shall include the owners' expectation of how fire protection or life safety systems work together.

5.2.3 The performance objectives of system interactions shall conform to the requirements of Sections 4.9.1.8.5 through 4.9.1.8.8 to assure the various systems perform together as designed.

5.2.4* The Basis of Design shall include an analysis of the impact the interactions will have on the proper operation of each independent fire protection or life safety system.

5.2.5 Design Methodology.

5.2.5.1 The design shall take into consideration the final commissioning of the interconnections of the fire protection or life safety systems.

5.2.5.2 The minimum requirements for design consideration shall include but not be limited to:

(1) Compliance with Section 4.9.1.8.7.
(2) Materials and equipment be interconnected in such a manner that will not affect their listing or their intended use where applicable.
(3)* Materials and equipment have the capacity to perform their intended use.
(4)* Design documents or details to demonstrate how the systems operate and communicate to attain the desired outcome.
(5) Design documents or details to demonstrate how operations of integrated systems do not impair the functionality of other component systems, unless designed to impair another system.
(6)* Sequence of operation for integrated systems.
(7)* Locations of interconnections.
(8) The procedures for periodic integrated testing.
(9)* The required frequency for integrated testing.
(10) Assign responsibility for the testing and inspection of the systems and interconnections during the construction phase.
(11) Specify the deliverables, including final documentation for the conclusion of the project.
(12)* Specify the format of the deliverables

5.2.5.3 The methods for pre-functional and systems interaction testing shall be documented.

5.3 Construction Phase.

5.3.1 Construction shall take into consideration the final commissioning of the interconnections of the fire protection or life safety systems.

5.3.2 The minimum requirements for installation shall include but not be limited to:

(1) Conformance to the approved drawings and specifications.
(2) Compliance with the manufactures' published instructions.
(3) Compliance with applicable codes and standards.
(4) Review of material and equipment submittals of proper rating for the use.
(5) Coordination of all contractors submittal drawings, operational sequence (matrix) and procedures

5.3.3 Testing and Inspection.

5.3.3.1 Testing and inspection shall take into consideration the final commissioning of the interconnections of the fire protection or life safety systems.

5.3.3.2 The minimum requirements for testing and inspection shall include but not be limited to Sections 5.3.3.2.1 through 5.3.3.2.6.

5.3.3.2.1 Testing and inspection of fire protection or life safety systems shall be completed as required during construction.

5.3.3.2.2 The interconnections shall be tested and inspected for compliance with the design criteria, manufactures' instructions, and applicable codes and standards.

5.3.3.2.3 Fire protection or life safety systems shall have their functionality tested on each interconnection to demonstrate compliance with Section 5.2.5.2(5).
5.3.3.2.4* Equipment shall be operated during testing using their design function.
5.3.3.2.5 Written documentation of the testing and inspection shall be provided.
5.3.3.2.6* Testing shall be repeated if changes are made to systems.

5.4 Occupancy Phase.

5.4.1 Occupancy shall take into consideration the final commissioning of the interconnections of the fire protection or life safety systems.
5.4.2 The minimum requirements for occupancy consideration shall include but not be limited to:

(1) System and interconnection acceptance testing and inspection completed and documented in accordance with applicable codes and standards and the design specifications for the project.
(2) Any modifications made after the commissioning of the system or interconnections must be approved by the design professional and owner and retested as determined by the commissioning agent.
(3) Interconnections documented in operation and owner manuals required by Section 4.10
(4) Training as required in Section 4.3.4,4.4.4 and 4.5.4 on the use and operation of the systems and interconnections.
(5) The vendor emergency contact list.
(6) The as-built documents for the systems and interconnections.
(7) A copy of test and inspection records of the systems and interconnections.
(8) A copy of site specific software of the systems and interconnections that is current with the installed system.
(9) A copy of warranties for the systems and interconnections.
(10) A copy of a recommended preventative maintenance program for the systems and interconnections.
(11) A list of required periodic inspections and tests for the systems and interconnections.

5.4.3* Testing shall be repeated if changes are made to systems.
5.4.4 The design documents shall be maintained for future reference.
5.4.5 Integrated testing shall be repeated as required in Chapter 9.

Chapter 6 Interconnected Systems

6.1 Interconnections of systems including but not limited to those referenced in Annex B shall comply with the requirements of Chapter 5.

Chapter 7 Passive Systems

7.1 General. This Chapter applies to the requirements for passive fire protection systems including:

(1) Fire and Smoke Dampers
(2) Fire and Smoke Doors
(3) Through Penetration Fire Stops

7.2 Design Phase.

7.2.1 The Basis of Design required by section 4.3.2 shall include requirements for passive fire protection systems.
7.2.2 The narrative report in the Basis of Design shall include the owners expectation of where passive fire protection systems are to be installed.
7.2.3 Design Methodology.
7.2.3.1 The design shall take into consideration the final commissioning of the passive fire protection systems.
7.2.3.2 The minimum requirements for design consideration shall include but not be limited to:
(1) Materials and equipment are applied in such a manner that will not affect their listing or their intended use where applicable.
(3) Materials and equipment have the capacity to perform their intended use.
(4) Design documents or details to demonstrate how the systems operate and communicate to attain the desired outcome.
(5) Design documents and/or details to demonstrate the application of passive fire protection systems in the construction.
(6) Locations of passive fire protection systems.
(8) The procedures for verification of passive fire protection systems.
(10) Assign responsibility for the testing and inspection of the passive fire protection systems during the construction phase.
(11) Specify the deliverables, including final documentation for the conclusion of the project.
(12) Specify the format of the deliverables
7.3 Construction Phase.
7.3.1 Construction shall take into consideration the final commissioning of the passive fire protection systems.
7.3.2 The minimum requirements for installation shall include but not be limited to:
(1) Conformance to the approved drawings and specifications.
(2) Compliance with the manufactures' published instructions.
(3) Compliance with applicable codes and standards.
(4) Materials and equipment of proper rating for the use.
7.3.3* Testing and Inspection.
7.3.3.1 Testing and inspection shall take into consideration the final commissioning of passive fire protection systems.
7.3.3.2 The minimum requirements for testing and inspection shall include but not be limited to Sections 5.3.3.2.6 through 7.3.3.2.1.
7.3.3.2.1 Testing and inspection of passive fire protection systems shall be completed as required during construction.
7.3.3.2.2 Passive fire protection systems which have no operating components shall be inspected to verify conformance with the BOD.
7.3.3.2.3 Passive fire protection systems which have operating components shall have their functionality tested to demonstrate compliance with the BOD.
7.3.3.2.4 Written documentation of the testing and inspection shall be provided.
7.3.3.2.5 Inspection and **t**esting shall be repeated if changes are made to systems.
7.4 Occupancy Phase.
7.4.1 Occupancy shall take into consideration the final commissioning of the

passive fire protection systems.
7.4.2 The minimum requirements for occupancy consideration shall included but not be limited to:
(1) Passive fire protection systems testing and inspection completed and documented in accordance with applicable codes and standards and the design specifications for the project.
(2) Any modifications made after the commissioning of the must be approved by the design professional and owner and re-inspected and/or retested as determined by the commissioning agent.
(3) Passive fire protection systems documented in operation and owner manuals required by Section 4.4.5
(4) The as-built documents for the passive fire protection systems.
(5) A copy of test and inspection records of the passive fire protection systems.
(6) A copy of a recommended preventative maintenance program for the passive fire protection systems.
7.4.3 Inspection and testing shall be repeated if changes are made to systems.
7.4.4 The design documents shall be maintained for future reference.

Chapter 8 Re-commissioning (Re-Cx) and Retro-commissioning (RCx) of Fire Protection and Life Safety Systems.

8.1* General This Chapter covers the Re-commissioning and Retro-commissioning requirements of active and passive fire protection and life safety systems where installed in existing structures.
8.2 Re-commissioning.
8.2.1* Fire protection and life safety systems that have been commissioned upon installation in accordance with the Commissioning Process of Chapter 4 of this standard, shall be re-commissioned as specified by a re-commissioning plan developed from established documentation provided by the Commissioning Process of Chapter 4 and actual existing conditions.
8.2.2 Requirements for Re-Commissioning. The following requirements shall be met during Re-Commissioning.
8.2.2.1 A Commissioning Team shall be established and responsibilities shall be assigned in accordance with 4.2.2
8.2.2.2 The Commissioning Team shall complete the applicable requirements of sections 4.2.1.2, 4.3.1, 4.4.1, and 4.5.2.
8.3 Retro-Commissioning.
8.3.1* Fire protection and life safety systems that have not been commissioned upon installation in accordance with the Commissioning Process of Chapter 4 of this standard, shall be retro-commissioned as specified by a retro-commissioning plan from documentation developed from an investigative discovery of original systems design and actual existing conditions.
8.3.1.1 A Commissioning Team shall be established and responsibilities shall be assigned in accordance with 4.2.2
8.3.1.2 The Commissioning Team shall complete the applicable requirements of sections 4.2.1.2, 4.3.1, 4.4.1, and 4.5.2.

Chapter 9 Periodic Integrated Testing.

9.1 General.

9.1.1 This Chapter covers the Periodic Integrated Testing requirements of active and passive fire protection and life safety systems where installed in existing structures.

9.1.2* Periodic integrated testing shall verify correct operation of fire protection and life safety systems in accordance with the established design criteria, BOD, OPR, equipment performance requirements or applicable codes and standards.

9.2 Periodic Integrated Testing

9.2.1 The owner shall be responsible for the integrated testing of fire protection and life safety systems.

9.2.2 The integrated testing of fire protection and life safety systems shall be coordinated and conducted by qualified testing personnel.

9.2.3 Fire protection and life safety systems that have been commissioned upon installation in accordance with the Commissioning Process of Chapter 4 of this standard shall have periodic integrated testing performed at intervals according to the commissioning plan or at intervals not to exceed five years.

9.2.4 Integrated systems in structures that have not been commissioned in accordance with the Commissioning Process of Chapter 4 of this standard shall have Integrated Testing performed as follows:

(1) Where new component fire protection and life safety systems are installed and interconnected to existing fire protection and life safety systems.

(2) Where existing fire protection and life safety systems are modified to become component, interconnected systems.

(3) Where the interconnections or sequence of operations of existing integrated fire protection and life safety systems are modified.

(4) At intervals not to exceed five years.

9.2.5 Phased sequencing of periodic integrated testing shall be permitted subject to the approval of the AHJ.

9.3 Qualifications of testing personnel shall be acceptable to the AHJ.

9.4 Documentation

9.4.1 Completion of integrated testing shall be documented in accordance with the requirements of the individual standards of the equipment and accepted by all parties.

9.4.2 Documentation shall be maintained as part of the building records and shall be made available to the owner and AHJ.

9.5 Fire protection and life safety systems that exhibit faults, failures, or indications of such faults or failures, or those found to have deficiencies upon inspection shall be cause for an AHJ to require periodic integrated testing as specified in this chapter.

9.6 With approval from the AHJ, the frequency of integrated testing shall be permitted to be extended.

Chapter 10 Qualifications of Commissioning Personnel

10.1 Applicability. Personnel qualifications of members of the commissioning team shall meet the requirements of this section.

10.2 Qualifications

10.2.1 Fire Commissioning Agent (FCxA)

10.2.1.1* General

10.2.1.1.1 The Fire Commissioning Agent shall be knowledgeable and experienced in the proper application of commissioning requirements of this standard and general industry practices.

10.2.1.1.2 The Fire Commissioning Agent shall be individually identified on the specifications or other enabling documentation.

10.2.1.1.3 The Fire Commissioning Agent shall provide an objective and unbiased point of view.

10.2.1.2 Requisite Knowledge. At a minimum, a qualified Fire Commissioning Agent shall have an advanced understanding of the installation, operation and maintenance of all fire protection and life safety systems proposed to be installed, with particular emphasis on system integrated testing.

10.2.1.3 Requisite Skills. A Fire Commissioning Agent shall have the ability to:

(1) Read and interpret drawings and specifications for the purpose of understanding system installation, testing, operation and maintenance.
(2) Analyze and facilitate resolution of issues related to failures in fire protection and life safety systems.
(3) Provide good written, verbal, conflict resolution and organizational skills.

10.2.2 Installation Contractor

10.2.2.1 Installation contractors shall be knowledgeable and experienced in the installation of the type of system proposed to be installed.

10.2.2.2* Installation contractors shall be licensed (certified) where required by the AHJ and/or codes and standards.

10.2.3 Registered Design Professional

10.2.3.1 A Registered Design Professional (RDP) shall be a registered (licensed) professional engineer, architect, or other professional with credentials acceptable to the jurisdiction where the project is taking place.

10.2.3.2 The Registered Design Professionals (RDP) shall be individually identified in the specifications or other enabling documentation.

10.2.3.3 Requisite Knowledge. At a minimum, a qualified Registered Design Professional shall have comprehensive knowledge of the following:

(1) The design, installation, operation and maintenance of all systems proposed to be installed
(2) How individual and integrated systems operate during a fire or other emergency.

10.2.4* Construction Manager. Construction managers shall be knowledgeable and experienced in the field of construction project management.

10.2.5* Facilities Management Personnel. Facilities management personnel shall include building maintenance and service personnel, building engineering personnel, and similar job functions.

10.2.6* Authority Having Jurisdiction

10.2.6.1 The AHJ shall be knowledgeable in the applicable codes, ordinances and standards as they relate to the fire protection and life safety systems installed.

10.2.6.2 The AHJ shall have the ability to interface with the Registered Design Professional and the commissioning authority in all phases of the commissioning process.

10.2.6.3 The AHJ shall have the ability to determine the operational readiness of the fire protection and life safety systems installed.

10.2.6.4 The AHJ shall have the ability to interface with the Commissioning Team in order to verify completion of integrated testing for the purpose of system acceptance.

Chapter 11 Commissioning Documentation and Forms

11.1 Approved commissioning documents and forms shall be used to record commissioning and integrated testing of fire and life safety systems.

11.2 Documents from NFPA and other approved installation standards referenced in the Basis of Design shall be utilized.

11.3 Where no form or checklist exists, the Commissioning Team shall be responsible for developing a form or checklist.

11.4 Test documents shall be retained by the owner, on site, for the life of the system.

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. System commissioning and integrated testing is critical to ascertain that systems are installed and function in accordance with the BOD and OPR and that testing is documented. It is not the intent of this standard to supplant the existing requirements of other codes and standards, but this standard can provide the appropriate guidance for a specific system or component where testing is not otherwise addressed. Such guidance should be developed by the Commissioning Team.

A.1.3 Planning for fire protection and life safety in and around a building or structure involves an integrated system approach that enables the system designer to analyze all of the components as a total fire safety system package**.**

A.1.3.1 This standard is not intended to be applied where not required by applicable Codes or other requirements of the Owners Project Requirements (OPR) or AHJ.

A.1.3.1(1) Project infrastructure should include those systems and utilities necessary for the support and operation of the fire protection and life safety systems of the proposed project. These infrastructure items can include the following:

a) Access roadways for general ingress and egress and those necessary for fire department access in accordance with local codes, standards, and policies.

b) Utility systems for the provisions of electric power, fuel gas, water, and waste water; communication systems, and any other utility system deemed essential for the support of project operations.
c) On-site combined heat and power generation systems, electric power generation plants or systems, fuel gas storage facilities, water supply and storage facilities, and environmental or waste management systems.

A.1.3.1(12) Egress system and egress components should include the following:

- Emergency lighting and exit signs
- Egress components (e.g., corridors, stairs, etc.)
- Major egress components – such as corridors, stairs, ramps, etc.
- Exit path marking systems

A.1.3.2 Fire and life safety systems can have problems during startup and installation. When implemented correctly, a realistic commissioning plan minimizes startup and long-term problems, reduces operational costs, and minimizes future maintenance requirements.

A.1.3.2(5) Consideration should be given to providing training for emergency response personnel.

A.1.3.3(3) See Figure A.3.17 for a sample fire alarm system matrix.

A.1.6 This section provides guidance for new technologies or alternate materials, devices, methods or arrangements that are not covered by other sections of this document. The purpose of this section is to ensure new technology proposed for installation with no or limited performance history will function as intended throughout its life cycle in accordance with the owner's project requirements.

New technology designs submitted to the authority having jurisdiction for review and approval should include documentation, in an approved format, of each performance objective and applicable scenario, together with any calculations, modeling, or other technical substantiation used in establishing the proposed design's fire protection and life safety performance.

Design Documentation. Supporting data and tests, where necessary to assist in the approval of materials or assemblies not specifically provided for in this Standard, should consist of valid research reports from approved sources. Any tests submitted in support of an application must have been performed by an agency approved by the building official based on evidence that the agency has the technical expertise, test equipment and quality assurance to properly conduct and report the necessary testing. To provide the basis on which the AHJ can make a decision regarding an alternative material or method, sufficient technical data, test reports and documentation must be provided for evaluation. In the absence of recognized and accepted test methods, the AHJ should approve the tests methods required in this section.

The burden of proof of equivalency lies with the applicant who proposes the use of alternative materials or methods. The authority having jurisdiction should be permitted to require the submission of any additional information and data to assist in the determination of equivalency consistent with this section.

The authority having jurisdiction should determine whether identified performance objectives of the proposed new technology are appropriate and have met the intent of the performance objectives of this Standard, the OPR, BOD, and applicable codes and

ordinances of the jurisdiction. Reports providing evidence of this equivalency should be required to be supplied by an approved source, meaning a source that the AHJ confirms is considered to be reliable and accurate.

The AHJ should make the final determination as to whether the provisions of the OPR and BOD have been met. The AHJ should be authorized to require design submittals for new technologies to bear a third party review and approval when the complexity of the design exceeds the capabilities of the AHJ to determine whether the proposed design, operation, process, or interoperability has met the Code requirements. The type of information required includes test data in accordance with referenced standards, evidence of compliance with the referenced standard specifications and design calculations. A research report issued by an authoritative agency is particularly useful in providing the building official with the technical basis for evaluation and approval of new and innovative materials and methods of construction.

Acceptance Requirements. Upon completion of the installation, functional and interoperability testing should be conducted demonstrating performance consistent with the OPR and the BOD in a method acceptable to the authority having jurisdiction. Acceptable methods of testing should be preapproved by the authority having jurisdiction prior to testing.

Maintenance Documentation. The applicant should provide system design and operational documentation. The applicant should provide a detailed document containing inspection, maintenance, testing methods and intervals to assist in the continued operation and interoperability of system components and associated equipment.

A.3.2.1 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 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.3.2.3 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.3.3.1.1 Commissioning is achieved in the design phase by documenting the design intent and continuing throughout construction, acceptance, and the warrantee period with actual verification of performance, operation and maintenance (O&M) documentation verification and the training of operating personnel.
A.3.3.1.2 A Commissioning Authority is typically provided and leads the overall commissioning team when more than one building system is commissioned, i.e. Total Building Commissioning. When only fire and life safety systems are commissioned, the Fire Commissioning Agent (FCxA) may assume the role of the Commissioning Authority.
A.3.3.1.6 Re-commissioning can be initiated periodically or in response to building renovation or a change in building use.
A.3.3.1.7 Retro-commissioning is a process that ensures that building systems perform interactively according to the design intent and/or to meet the owner's current operational needs. This is achieved by documenting the design intent where possible and the current operational needs, measuring the existing performance, implementing necessary operational and/or system modifications, followed by actual verification of performance, verification of Operation and Maintenance (O&M) documentation, and the training of operating personnel.
Explains the analogy and methodology used by the designers in the design of the systems for the protection of the building, occupants and emergency response personnel.
A.3.13 The Narrative is written to assist and expedite the plan review and inspection process by the Authority Having Jurisdiction. It is maintained on file for use at the time of final inspection and for periodic reviews during future field inspections. It is referenced by the building owner and authority having Jurisdiction to insure that all future modifications, alterations, additions or deletions to the original systems are current and that the original system's protection and required system performance are not compromised or have not been altered without building or fire official prior review. The Narrative should be recognized by all entities that the it is one of the key documents associated with the commissioning process.
Building owners benefit by knowing how their building's fire protection and life safety systems work. The Narrative provides a procedure including methods for testing and maintenance. A copy of the Narrative Report should be kept on the premises and should be available for review prior to testing and proposed modifications to any portion of the building's fire protection and life safety systems.
Development Format.
The Narrative is prepared by a qualified, identified individual who has "taken charge" in the development of an entire coordinated narrative which includes all information regarding the design basis, sequence of operation and testing criteria associated with all required or non-required fire protection systems set forth by applicable laws, codes, regulations, and local ordinances of the jurisdiction and applicable national and or international standards.
The Narrative should be submitted with plans and specifications for review and approval by the Authority Having Jurisdiction prior to the issuance of a building permit. The

Narrative should be written in a clear conversational format. The construction specification should not be considered a Narrative, however some applicable portions of the construction specifications could be included to support or clarify the intent of the Narrative. The Narrative is a stand-alone document, it should be 8-1/2" x 11" for filing and ease of use by the Authority having Jurisdiction and building owners including an administrative cover page identifying the project name, building address, name, address and phone number of the individual who has "taken charge" in the preparation of the Narrative.

Commentary

Codes and standards are written in a way to require uniformity in design and construction for all buildings and structures. The codes and standards can be subjective and are subject to interpretation by building owners, designers and the Authority Having Jurisdiction; uniformity is not always necessarily achieved.

The Narrative should attempt to clarify to the Authority Having Jurisdiction the designer's intent and interpretation of the code and standards The Authority Having Jurisdiction can agree or disagree with the designer's interpretation.

Historically, the requirements for fire protection and life safety systems have become site specific and building code requirements are not uniformly enforced. The size of the community, fire department staffing, fire department equipment availability and suppression tactics established by the local fire department have affected the uniformity of enforcement. Site specific requirements more or less than that of the building code can have reasonable intent, however, this type of enforcement in some cases has proven to be controversial in the applicability of code uniformity.

The Narrative can be and should be a valuable instrument when accurately prepared, it will establish a line of communication between the designer and the Authority Having Jurisdiction resulting in what the building codes and standards mandate which is uniformity and consensus in the interpretation of the codes and standards.

The Narrative should be written in a three sectional format and sub-sections as necessary (methodology, sequence of operation and testing criteria sections) for clarity and should be limited to a summary. A sample narrative outline can be found in Annex D.

A.3.19 See Figure A.3.19 Sequence of Operation (matrix).

1. FIVE (5) STORY OFFICE BUILDING, USE GROUP B. CAFETERIA (USE GROUP A) ON FIRST FLOOR EQUIPPED WITH AN ANSUL SYSTEM. COMPUTER ROOM ON THIRD FLOOR EQUIPPED WITH A PRE-ACTION SYSTEM.
2. UPON ACTIVATION OF ELEVATOR RECALL THE ELEVATOR SHALL STOP AT PRIMARY RECALL FLOOR. IF FIRE IS ON PRIMARY RECALL FLOOR THE ELEVATOR SHALL STOP AT AN ALTERNATE RECALL FLOOR. PRIMARY AND ALTERNATE RECALL FLOOR SHALL BE COORDINATED WITH FIRE DEPARTMENT.
3. SHUT DOWN OF MECHANICAL EQUIPMENT SHALL BE INTERFACED WITH BUILDING AUTOMATION SYSTEM.

SYSTEM INPUTS					SYSTEM OUTPUTS: FIRE ALARM CONTROL CENTER									NOTIFICATION		OTHER REQUIRED FIRE SAFETY					
					ACTUATE COMMON ALARM SIGNAL INDICATOR	ACTUATE AUDIBLE ALARM SIGNAL	ACTUATE COMMON SUPERVISORY SIGNAL INDICATOR	ACTUATE AUDIBLE SUPERVISORY SIGNAL	ACTUATE COMMON TROUBLE SIGNAL INDICATOR	ACTUATE AUDIBLE TROUBLE SIGNAL	DISPLAY AND PRINT CHANGE OF STATUS AND TIME OF INITIATING EVENT	TRANSMIT ALARM TO FIRE DEPARTMENT AND TO CENTRAL STATION - MASTERBOX	ILLUMINATE ASSOCIATED DETECTOR LED INDICATOR	ACTUATE ASSOCIATED EXTERIOR FIRE ALARM BEACON(S)	ACTUATE ALL EVACUATION SIGNALS FOR THE BUILDING	RELEASE ALL MAGNETICALLY HELD DOORS	RECALL ASSOCIATED ELEVATOR IN ACCORDANCE WITH RECALL SEQUENCE. REFER TO NOTE #2.	SHUTDOWN ASSOCIATED MECHANICAL EQUIPMENT. REFER TO NOTE #3	RELEASE PRE-ACTION VALVE (CHANGE OF STATE)	ELEVATOR HOISTWAY VENT OPEN	
					A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
SYSTEM INPUTS	FIRE ALARM SYSTEM	FIRE ALARM INPUTS	1	TYPICAL MANUAL PULL STATION (BY DEVICE) - LEVELS 1-5	X	X					X	X		X	X	X					1
			2	TYPICAL ELEVATOR RECALL SMOKE DETECTOR (BY DEVICE) - BY FLOOR (LOBBY)	X	X					X	X		X	X	X	X			X	2
			3	ELEVATOR MACHINE ROOM SMOKE DETECTOR	X	X					X	X	X	X	X	X				X	3
			4	TYPICAL SMOKE DETECTOR (BY DEVICE) - COMPUTER ROOM (THIRD FLOOR) - PREACTION SYSTEM	X	X					X	X		X	X	X	X				4
			5	TYPICAL WET SPRINKLER SYSTEM FLOW CONTROL VALVE ASSEMBLY FLOW SWITCH - BY FLOOR	X	X				X	X	X		X	X	X					5
			6	TYPICAL WET SRPINKLER SYSTEM FLOW CONTROL VALVE ASSEMBLY TAMPER SWITCH - BY FLOOR			X	X			X										6
			7	TYPICAL PREACTION SPRINKLER SYSTEM FLOW CONTROL VALVE ASSEMBLY FLOW SWITCH - BY FLOOR	X	X				X	X	X			X	X					7
			8	TYPICAL PREACTION SPRINKLER SYSTEM FLOW CONTROL VALVE ASSEMBLY TAMPER SWITCH - BY FLOOR			X	X			X										8
			9	KITCHEN CAFETERIA ANSUL SYSTEM - FIRST FLOOR	X	X					X	X				X				X	9
			10	TYPICAL DUCT-IN SMOKE DETECTOR(BY DEVICE) - BY FLOOR							X							X			10
	FIRE ALARM SYSTEM INPUTS	BUILDING	11	FIRE PUMP RUNNING			X	X			X										11
			12	FIRE PUMP POWER FAILURE			X	X			X										12
			13	FIRE PUMP PHASE REVERSAL			X	X			X										12
			14	FIRE PUMP CONNECTED TO EMERGENCY POWER			X	X			X										14
			15	FIRE PUMP CIRCUIT BREAKER AT GENERATOR OUTPUT			X	X			X										15
		FACP	16	FIRE ALARM SYSTEM OPEN CIRCUIT					X	X	X										16
			17	FIRE ALARM SYSTEM GROUND FAULT					X	X	X										17
			18	FIRE ALARM SYSTEM BATTERY DISCONNECT					X	X	X										18
			19	FIRE ALARM SYSTEM LOW BATTERY					X	X	X										19
			20	FIRE ALARM SYSTEM AC POWER FAILURE					X	X	X										20
			21	FIRE ALARM SYSTEM AMPLIFIER FAILURE					X	X	X										20
		MISC.	22	GENERATOR STATUS INDICATOR					X	X											21
					A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	

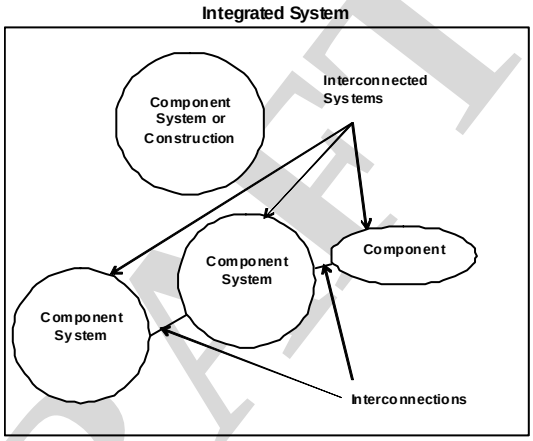
Figure A.3.19 Sequence of Operation (matrix)

A.3.20.1 An integrated system contains systems that are physically connected and others that are not. To achieve the fire protection objectives, the basis of design will expect the interaction of different systems in such ways that systems have to work together, but may not be physically connected. For example, a smoke control system is often activated by waterflow in a sprinkler system. But the sprinkler system is not physically connected to the HVAC system. The physical connection is from the sprinkler system to the fire alarm system and then to the building automation system. Another example is the need for wall integrity when using total flooding suppression agents. Or automatic door closures that won't close upon activation of smoke control systems or stair pressurization systems. See Figure A.3.20.1 for integrated systems.

Figure A.3.20.1 Integrated System

A.3.20.2 Interconnected systems are connected so that a binary output from one system causes a binary input in another system or systems. One example is a waterflow switch which is either open or closed (binary output) which when connected to the input of a fire alarm system can cause multiple outputs in the fire alarm system including sounding the waterflow bell and notification appliances, starting smoke control systems, etc.

Combined systems are connected so that data from one component system is shared with other component systems, which then make independent decisions to achieve a desired result. The communication can be one-way or two-way, serial or parallel. A combined system may have components that are interconnected too. An integrated system in which component systems communicate between multiple data processing units.



A.3.20.3 Interconnections could consist of electrical binary connections or data transfer protocols. Example of data transfers are BACnet or other data exchange protocols.

A.3.22.2 Integrated testing can include other building systems integrated to fire and life safety systems such as elevator recall or HVAC control.

A.3.22.3 Such testing should follow the original acceptance test at intervals specified in the applicable installation or maintenance standard, and may include procedures recommended by the manufacturer's published documentation.

A.3.22.4 Pre-functional testing is conducted in preparation for other types of testing. A pre-functional testing checklist is often incorporated into the startup process.

A.4.1.1 Not all systems or components require commissioning, however, acceptance and integrated testing should be performed. The commissioning team should review with the owner and AHJ to determine what systems should be subject to commissioning. A reasonable degree of protection for life and property can be provided by acceptance and integrated testing for small or independent systems.

A.4.2.1.1 The Fire Protection and Life Safety Commissioning Team can be part of a larger Total Building Commissioning Team with team members whose focus is on commissioning electrical, mechanical, plumbing and, electronics systems. The overall team can be led by a Commissioning Authority whose responsibility is defined in ASHRAE Guideline 0. The individuals and entities listed are not all inclusive and should be modified on a project by project basis. If the entity listed is not part of the project, it is not the intent of this standard to require those entities to become part of the project commissioning team. The number of members of the commissioning team should be determined by project type, size and complexity. For example, a multiple building project may require more than one FCxA, all of which are overseen by a single FCxA.
A.4.2.1.2 Commissioning Team members should be selected as their role in the project is established. For example, manufacturer's representatives may not be identified until the design phase and therefore may not participate during the pre-design phase.

A.4.2.2 (11) The definition of AHJ encompasses a large range of individuals and entities and could include local building/fire department representatives, insurance representatives, other governmental entities. Any and all AHJ's should be included as part of the commissioning team to the extent they need to be involved.
A.4.2.2.1 At a minimum, the Owner, FCxA and Registered Design Professional should be part of the Commissioning Team at this phase. Other key team members will be identified and selected as the project progresses and as their roles and responsibilities require their participation.
A.4.2.3.2 The OPR development should include the AHJ in order to provide input regarding issues of fire department operations and access to the site and facility. Other appropriate issues for review might include emergency medical response and police issues.
A.4.2.3.3 The OPR documentation should include concept architectural documentation with a focus on fire and life safety. The applicable codes and standards must recognize any state, county, city, or local amendments to the codes and standards. The AHJ should be included in the development of the OPR as early as possible in the process recognizing project confidentiality. The OPR may also incorporate budget and schedule issues. The OPR format should include the following sections: Introduction; Owners Key Project Requirements (i.e., insurance underwriter's standards); General Project Description; Project Objectives; Functional Uses; Occupancy Requirements; Budget Considerations and Limitations; Performance Criteria; and Project History. This OPR may be a portion of the overall Total Building Commissioning OPR. See Annex C for a sample OPR. The OPR is intended to be a living document that is regularly updated and modified. During the Design Phase the OPR may change significantly based on the needs of the proposed design. Variances to code requirements may be sought in order to meet project needs and will need to be appropriately documented in the OPR. The construction phase will include record drawings of the installed conditions of the fire and life safety systems. The OPR will then have the base documentation necessary to aid the building operators in any upgrades or changes to the building fire and life safety systems.
A.4.2.4.1 The Commissioning Plan establishes the framework for how commissioning will be handled and managed on a given project. This includes a discussion of the

commissioning process, OPR, schedule, budget, team and team member responsibilities, communication structures and a general description of the systems to be commissioned.

A.4.2.4.3 All information in the Commissioning Plan must be project specific. The suggested structure of the Commissioning Plan is as follows.

(1) Introduction - purpose and general summary of the Plan.
(2) Commissioning Scope - The commissioning scope including which building assemblies, systems, subsystems and equipment will be commissioned on this project.
(3) General Project Information - Overview of the project, emphasizing key project information and delivery method characteristics. The OPR and project BOD should be included.
(4) Team Contacts - Project specific Commissioning Team members and contact information
(5) Communication Plan & Protocols – Documentation of the communication channels to be used throughout the project.
(6) Commissioning Process - Detailed description of the project specific tasks to be accomplished during the Planning, Design, Construction and Tenant Occupancy Stages with associated roles & responsibilities.
(7) Commissioning Documentation - List of commissioning documents required to identify expectations, track conditions and decisions and validate/certify performance.
(8) Commissioning Schedule - Specific sequences of events and relative timeframes, dates and durations.

A.4.3 The design phase documents are intended to include working plans, shop drawings or fabrication drawings, as well as operations and maintenance manuals. It is understood that these documents may be created at different phases of a project but fall under the design phase in the commissioning process.

A.4.3.1 If commissioning starts later in the design or construction process, the requirements of the previous commissioning phases should be reviewed and implemented to the extent practical. (More discussion on the benefits of going back to the pre-design/design stage reviews and implementation, particularly with the OPR).

A.4.3.1(6) The issues and changes should be included in a log which, as a minimum, documents the date the issue was raised, the responsibility for resolution of the issue, the resolution of the issue and the date the issue was resolved.

A.4.3.2.2 Editions referenced in this document are the latest available during the development of this standard. The user should always consult the AHJ to ensure compliance with local requirements.

A.4.3.2.8 Some of the tools that may be needed:

a) Approved Basis of Design
b) Approved test procedures
c) Approved impairment procedures
d) Manufacturers instructions
e) Project specifications

f) Temperature Measuring Instruments
g) Sound meters
h) Light meters
i) Fire hose / nozzles
j) Flow measuring devices
k) Gauges (calibrated)
l) Amperage & Volt meters
m) Communication radios
n) Special tools
o) Notification announcements
p) Fire department equipment

A.4.3.3.2 O&M's should be organized and written in a complete and concise manner to improve the ability of the building operator or maintenance technician to fully understand the performance characteristics of the system and the maintenance requirements necessary to achieve the intended performance.

O&M's should be of durable materials, and contain complete project identification including, but not limited to:

a) Title sheet including the complete name and address of the project, complete name and address of the installing contractor (including telephone number for emergency service).
b) Complete table of contents
c) Systems design intent documentation
d) Complete list of equipment
e) List of equipment suppliers and/or manufacturers
f) Operation and maintenance instructions for major components
g) Inspection and test reports
h) Recommended spare parts
i) Riser diagrams or schematic drawings
j) "As-built" drawings and calculations
k) Warranty
l) Other special requirements of the installation specification or installation standard such as valve tags and charts, hydraulic data nameplate information (for sprinkler systems) etc.

A.4.5.2(8) Facilities personnel or their designated representative should place the building systems through inspection, testing, and maintenance prior to the expiration of the warranty. This helps identify needed repairs.

A.4.5.3.1 Additions, modifications, or alterations to systems can cause unintended consequences systems. The testing procedure should be re-evaluated to make sure that the repeat testing is adequate to determine the correctness of the revision.

A.4.5.3.2 Significant changes to the OPR may precipitate a need to do a re-commission process.

A.4.5.3.3 Design documents should be kept for the life of the facility. When there is a change in ownership the documents should be transferred to the new owner.

A.4.5.4.1 A quality training session for system operation and maintenance will generally include the following components:

1. Practical examples and hands-on operation of the system.

2. A course agenda,
3. The expected system performance
4. Problems or modifications encountered during construction
5. Routine testing and maintenance requirements
6. Operation and maintenance manuals

Additional training should be conducted after several years. This will allow the facility staff to be trained on system upgrades or modifications. This can be accomplished in conjunction with lesson- learned workshops.

A.4.5.4.2 An appropriate time to schedule the initial training is at system final acceptance in order to maximize its value to the participants. Secondary systems training should be held after the system is commissioned to allow follow-up questions and the opportunity to ask questions about situations and problems that have occurred after final acceptance.

A.4.5.4.3 Sign-in sheets are useful for the contractor and commissioning team to demonstrate that training was conducted.

A.4.5.4.4 Continuous training can ensure the systems are maintained and tested properly and the building or structure operates successfully.

A.5.2.1 Interactions include physical interconnections and impacts between systems that are not physically connected. Passive fire protection features can be impacted by active systems.

A.5.2.4 For individual systems to work together there must be consideration of the various interconnections that may occur. Some interconnections can be directly connected and others can be more remotely involved. An example of the first is an Emergency Power Off (EPO) system that in its operation causes loss of power to a fire protection system or the EPO system itself.

An example of the second is an atrium smoke control system that functions correctly mechanically, but the air movement prevents the automatic doors from closing.

A.5.2.5.2(3) Examples of equipment capacity ratings:

(1) Electrical: amperage, voltage, wattage, etc.

(2) Strength: working pressure, tensile, structural, etc.

(3) Life expectancy: years, number of cycles, etc.

A.5.2.5.2(4) A system description should be produced as an engineering document to describe system integration and functions. Each component system within the integrated system should be defined. Each interconnection should be defined. A fire hazard analysis should be produced to describe active and passive fire protection features and describe the interactions between the fire protection features of the building.

A.5.2.5.2(6) This is often done by using a matrix to plot inputs and outputs.

A.5.2.5.2(7) In addition to noting the location of the interconnection on the drawing, it is helpful to have a labeling system to identify the interconnections in the installation.

A.5.2.5.2(9) The interactions within integrated systems need to be tested often enough to ensure reliability. This needs to be determined by the design authority.

A.5.2.5.2(12) Examples of formats for deliverables:

(1) Drawings on paper or electronic format.

(2) Electronic format such as PDF or DWG.

(3) Media format such as floppy disk, flash drive, CD, or FTP.
(4) Owner's manuals on paper, accessible from Internet hyperlink, etc.

A.5.3.3.2.4 Fire protection or life safety systems may operate equipment that is not necessarily part of the fire protection or life safety system. One such example are shunt trip breakers that should be tested for proper operation.

A.5.3.3.2.6 Additions, modifications, or alterations to systems can cause unintended consequences to the interactions of systems. The testing procedure needs to be re-evaluated to make sure that repeat testing is adequate to determine the correctness of the revision.

A.5.4.3 Additions, modifications, or alterations to systems can cause unintended consequences to the interactions of systems. The testing procedure needs to be re-evaluated to make sure that repeat testing is adequate to determine the correctness of the revision.

A.7.3.3 Verify the egress system and egress components through the following methods:

- Review design drawings and plans to determine compliance with life safety requirements
- Inspect and test emergency lighting and exit signs under normal power conditions
- Inspect and test emergency lighting and exit signs under emergency power conditions
- Inspect egress components (e.g., corridors, stairs, etc.) for general compliance
- Inspect major egress components – such as corridors, stairs, ramps, etc. – for compliance with design
- Field validate exit signs and egress lighting are illuminated under normal operating conditions. Simulate emergency conditions to determine whether exit signs and emergency lighting illuminate under those conditions.

A.8.1 Re-commissioning and Retro-commissioning should be considered where expansions, improvements or additions to existing structures require commissioning of the new fire protection and life safety systems in accordance with the Commissioning Process of Chapter 4 of this standard. Periodic integrated testing should be considered at intervals appropriate to the structure and systems present.

A.8.2.1 The Integrated testing should be considered as a coordination of the required annual or other periodic fire protection and life safety systems testing with each other and with those interconnected fire protection and life safety systems for which no periodic testing is required. Intervals for periodic integrated testing can be phased or adjusted based upon the building size and complexity.

A.8.3.1 On-site surveys should determine if or how new modifications, repairs reprogram have impacted existing systems or functions and should include the Commissioning Process tasks of Sections 4.3.2.2.4, 4.3.5 and 4.3.5.4.

A.9.1.2 Periodic integrated testing is intended to verify correct operation of the components and interconnection of the fire protection and life safety systems. It is not the intent of this section to reevaluate the original system design.

A.10.2.1.1 Examples of individuals qualified to provide fire commissioning agent services may include, but not be limited to, those individuals who are:

(1) Registered professional fire protection engineers.
(2) Registered professional engineers in other disciplines with sufficient knowledge in the applicable fire protection and life safety systems.
(3) Professionals experienced in the design, operation, or construction of the type of facility to be commissioned.
(4) Professionals experienced in the design, operation, or installation of the type of fire and life safety systems installed.

The Fire Commissioning Agent should have no business relationships (owner, partner, operating officer, distributor, salesman, or technical representative) with any fire protection or life safety equipment manufacturers, suppliers or installers for any such equipment provided as part of this project. As such, qualified independent third party firms or individuals should be considered for designation as the Fire Commissioning Agent. The Fire Commissioning Agent should have a minimum of five (5) years experience in facility construction, inspection, acceptance testing or commissioning as it relates to fire protection and life safety systems.

A.10.2.2.2 Installation contractors should be certified by an organization responsible for certification of technical installation personnel and approved by the AHJ.

A.10.2.4 Construction managers should possess skills in the following categories of construction management:

(1) Project Management Planning
(2) Cost Management
(3) Time Management
(4) Quality Management
(5) Contract Administration
(6) Safety Management
(7) Professional Practice

This should include specific activities such as defining the responsibilities and management structure of the project management team, organizing and leading by implementing project controls, defining roles and responsibilities and developing communication protocols, and identifying elements of project design and construction likely to give rise to disputes and claims.

A.10.2.5 Facilities management personnel should have the ability to assess a facility's need for building systems, recommend building systems, oversee the operation of building systems, establish practices and procedures, administer the allocation of building systems resources, monitor and evaluate how well building systems perform, manage corrective, preventative and predictive maintenance of building systems, develop and implement emergency procedures and disaster recovery plans. Facilities management personnel should also be knowledgeable and qualified in the operation and maintenance of the fire protection and life safety systems installed in their facility. The level of knowledge required should be commensurate with the level of interaction with the systems. Facilities management personnel who will actually perform the on-going system operation, inspection, testing and maintenance should be thoroughly familiar with the required and recommended operation and maintenance tasks. Facilities management personnel who will be responsible for management of a contract

for system operation, inspection, testing and maintenance should be thoroughly familiar with the tasks to be performed and the frequency of such tasks, but not necessarily the implementation of those tasks.

A.10.2.6 Governmental AHJs (fire inspection personnel) should have the ability to determine the operational readiness of fire detection and alarm systems and fire suppression systems, given test documentation and field observations, so that systems are in an operational state.

Fire inspection personnel should be able to verify code compliance of heating, ventilating and air conditioning (HVAC) equipment and operations so that the systems and other equipment are maintained in accordance with applicable codes and standards.

In addition, fire inspection personnel involved in fire protection system commissioning should be able to witness an acceptance test for integrated fire protection systems so that the test is conducted in accordance with the approved design, applicable codes and standards and the system performance can be evaluated for compliance.

Individuals should be able to demonstrate knowledge of the codes and standards related to the installation and operational requirements of integrated fire and life safety systems, such as elevator recall or operation of a smoke removal system upon activation of fire detection devices, or other integrated operations of fire protection systems in a structure in accordance with the applicable building, mechanical and/or fire codes of the jurisdiction.

Annex B Related Codes and Standards for Interconnected Systems

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

B.1.1 This annex includes extracted material for information only. The intent is to provide information to the commissioning team from other NFPA codes and standards.

B.1.2 Other codes, standards or documents can be referenced as applicable.

B.1.3 General. Interconnections of systems, including but not limited to, systems covered in this Annex should comply with the requirements of Chapter 5 and this Annex. Interconnected systems are a sub-set of integrated systems. This information is provided for reference to systems that are typically interconnected.

B.2 Water-based Systems. Interconnections with water-based fire suppression systems and fire detection or life safety systems shall be installed in accordance with NFPA 72® and as specified in the related systems installations standards as referenced in Chapter 2.

B.2.1 Water Flow Switch

B.2.1.1 The provisions of Section 6.2.1 shall apply to devices that initiate an alarm indicating a flow of water in a sprinkler system. [**72:**5.11.1*]

Piping between the sprinkler system and a pressure actuated alarm-initiating device should be galvanized or of nonferrous metal or other approved corrosion-resistant material of not less than 9.5 mm (3/8 in.) nominal pipe size. [**72:**A.5.11.1]

B.2.1.2 Activation of the initiating device shall occur within 90 seconds of waterflow at the alarm-initiating device when flow occurs that is equal to or greater than that from a single sprinkler of the smallest orifice size installed in the system. [**72:**5.11.2*]
The waterflow device should be field adjusted so that an alarm is initiated no more than 90 seconds after a sustained flow of at least 40 L/min (10 gpm).
Features that should be investigated to minimize alarm response time include the following:

(1) Elimination of trapped air in the sprinkler system piping
(2) Use of an excess pressure pump
(3) Use of pressure drop alarm-initiating devices
(4) A combination thereof

Care should be used when choosing waterflow alarm-initiating devices for hydraulically calculated looped systems and those systems using small orifice sprinklers. Such systems might incorporate a single point flow of significantly less than 40 L/min (10 gpm). In such cases, additional waterflow alarm-initiating devices or the use of pressure drop-type waterflow alarm-initiating devices might be necessary.
Care should be used when choosing waterflow alarm-initiating devices for sprinkler systems that use on–off sprinklers to ensure that an alarm is initiated in the event of a waterflow condition. On–off sprinklers open at a predetermined temperature and close when the temperature reaches a predetermined lower temperature. With certain types of fires, waterflow might occur in a series of short bursts of a duration of 10 seconds to 30 seconds each. An alarm-initiating device with retard might not detect waterflow under these conditions. An excess pressure system or a system that operates on pressure drop should be considered to facilitate waterflow detection on sprinkler systems that use on–off sprinklers.
Excess pressure systems can be used with or without alarm valves. The following is a description of one type of excess pressure system with an alarm valve.
An excess pressure system with an alarm valve consists of an excess pressure pump with pressure switches to control the operation of the pump. The inlet of the pump is connected to the supply side of the alarm valve, and the outlet is connected to the sprinkler system. The pump control pressure switch is of the differential type, maintaining the sprinkler system pressure above the main pressure by a constant amount. Another switch monitors low sprinkler system pressure to initiate a supervisory signal in the event of a failure of the pump or other malfunction. An additional pressure switch can be used to stop pump operation in the event of a deficiency in water supply. Another pressure switch is connected to the alarm outlet of the alarm valve to initiate a waterflow alarm signal when waterflow exists. This type of system also inherently prevents false alarms due to water surges. The sprinkler retard chamber should be eliminated to enhance the detection capability of the system for short duration flows. [**72:**A.5.11.2]
B.2.1.3 Movement of water due to waste, surges, or variable pressure shall not initiate an alarm signal. [**72:**5.11.3]
B.2.2 Control Valve Supervisory Signal-Initiating Device. [**72:**5.15.1]
B.2.2.1 Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position (off-normal) and the other indicating restoration of the valve to its normal position. [**72:**5.15.1.1]

B.2.2.2 The off-normal signal shall be initiated during the first two revolutions of the hand wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position. [**72:**5.15.1.2]
B.2.2.3 The off-normal signal shall not be restored at any valve position except normal. [**72:**5.15.1.3]
B.2.2.4 An initiating device for supervising the position of a control valve shall not interfere with the operation of the valve, obstruct the view of its indicator, or prevent access for valve maintenance. [**72:**5.15.1.4]
B.2.3 System supervisory switches.
B.2.3.1 Pressure Supervisory Signal-Initiating Device. [**72:**5.15.2]
B.2.3.1.1 Two separate and distinct signals shall be initiated: one indicating that the required pressure has increased or decreased (off-normal) and the other indicating restoration of the pressure to its normal value. [**72:**5.15.2.1]
B.2.3.1.2 The following requirements shall apply to pressure supervisory signal-initiating devices: [**72:**5.15.2.2]
(1) A pressure tank supervisory signal-initiating device for a pressurized limited water supply, such as a pressure tank, shall indicate both high- and low-pressure conditions. The off-normal signal shall be initiated when the required pressure increases or decreases by 70 kPa (10 psi)
(2) A pressure supervisory signal-initiating device for a dry-pipe sprinkler system shall indicate both high- and low-pressure conditions. The off-normal signal shall be initiated when the pressure increases or decreases by 70 kPa (10 psi).
(3) A steam pressure supervisory signal-initiating device shall indicate a low-pressure condition. The off-normal signal shall be initiated prior to the pressure falling below 110 percent of the minimum operating pressure of the steam-operated equipment supplied.
(4) An initiating device for supervising the pressure of sources other than those specified in 6.2.3.1.2(1) [**13:**5.15.2.2(1)] through 6.2.3.1.2(3) [**13:**5.15.2.2(3)] shall be provided as required by the authority having jurisdiction.
B.2.3.2 Water Level Supervisory Signal-Initiating Device. [**72:**5.15.3]
B.2.3.2.1 Two separate and distinct signals shall be initiated: one indicating that the required water level has been lowered or raised (off-normal) and the other indicating restoration. [**72:**5.15.3.1]
B.2.3.2.2 A pressure tank signal-initiating device shall indicate both high- and low-water level conditions. The off-normal signal shall be initiated when the water level falls 76 mm (3 in.) or rises 76 mm (3 in.). [**72:**5.15.3.2]
B.2.3.2.3 A supervisory signal-initiating device for other than pressure tanks shall initiate a low-water level signal when the water level falls 300 mm (12 in.). [**72:**5.15.3.3]
B.2.3.3 Water Temperature Supervisory Signal-Initiating Device. A temperature supervisory device for a water storage container exposed to freezing conditions shall initiate two separate and distinctive signals. One signal shall indicate a decrease in water temperature to 4.4°C (40°F) and the other shall indicate its restoration to above 4.4°C (40°F). [**72:**5.15.4]
B.2.3.4 Room Temperature Supervisory Signal-Initiating Device. A room temperature supervisory device shall indicate a decrease in room temperature to 4.4°C (40°F) and its restoration to above 4.4°C (40°F). [**72:**5.15.5]

B.3 Signal Initiation — Fire Pump. [**20:**6.8.5.9]
B.3.1 Where fire pumps are required to be monitored and a building fire alarm system is installed, a pump running signal shall be permitted to be a supervisory or alarm signal. [**20:**6.8.5.9.1]
B.3.2 Where fire pumps are required to be monitored and a building fire alarm system is installed, signals other than pump running shall be supervisory signals. [**20:**6.8.5.9.2]
B.3.3 Electric Drive Controller.
B.3.3.1 Fire Pump Alarm and Signal Devices Remote from Controller. [**20:**10.4.7*]
B.3.3.1.1 Where the pump room is not constantly attended, audible or visible signals powered by a source not exceeding 125 V shall be provided at a point of constant attendance. [**20:**10.4.7.1]
Where unusual conditions exist whereby pump operation is not certain, a “failed-to-operate” fire pump alarm is recommended. In order to supervise the power source for the fire pump alarm circuit, the controller can be arranged to start upon failure of the supervised alarm circuit power. [**20:**A.10.4.7]
B.3.3.1.2. Pump or Motor Running. The signal shall actuate whenever the controller has operated into a motor-running condition. This signal circuit shall be energized by a separate reliable supervised power source or from the pump motor power, reduced to not more than 125 V. [**20:**10.4.7.2.1]
B.3.3.1.3 Loss of Phase. [**20:**10.4.7.2.2]
B.3.3.1.3.1 The fire pump alarm shall actuate whenever any phase at the line terminals of the motor contactor is lost. [**20:**10.4.7.2.2.1]
B.3.3.1.3.2 All phases shall be monitored. Such monitoring shall detect loss of phase whether the motor is running or at rest. [**20:**10.4.7.2.2.2]
B.3.3.1.3.3 When power is supplied from multiple power sources, monitoring of each power source for phase loss shall be permitted at any point electrically upstream of the line terminals of the contactor, provided all sources are monitored. [**20:**10.4.7.2.2.3]
B.3.3.1.4 Phase Reversal. [**20:**10.4.6.2]
B.3.3.1.4.1 This fire pump alarm circuit shall be energized by a separate reliable supervised power source or from the pump motor power, reduced to not more than 125 V. The fire pump alarm shall actuate whenever the three-phase power at the line terminals of the motor contactor is reversed. [**20:**10.4.7.2.3]
B.3.3.1.4.2 Phase reversal of the power source to which the line terminals of the motor contactor are connected shall be indicated by a visible indicator. [**20:**10.4.6.2.1]
B.3.3.1.4.3 When power is supplied from multiple power sources, monitoring of each power source for phase reversal shall be permitted at any point electrically upstream of the line terminals of the contactor, provided all sources are monitored. [**20:**10.4.6.2.2]
B.3.3.1.5 Controller Connected to Alternate Source. Where two sources of power are supplied to meet the requirements of [**20:**9.3.2], this signal shall indicate whenever the alternate source is the source supplying power to the controller. This signal circuit shall be energized by a separate, reliable, supervised power source, reduced to not more than 125 V. [**20:**10.4.7.2.4]
B.3.4 Engine Drive Controller.
B.3.4.1 Signal Devices Remote from Controller. [**20:**12.4.2]

B.3.4.1.1 Where the pump room is not constantly attended, audible or visible signals powered by a source other than the engine starting batteries and not exceeding 125 V shall be provided at a point of constant attendance. [**20:**12.4.2.1]
B.3.4.1.2 The remote panel shall indicate the following: [**20:**12.4.2.2]
(1) The engine is running (separate signal).
(2) The controller main switch has been turned to the off or manual position (separate signal).
(3)* There is trouble on the controller or engine (separate or common signals). (See [**20:**12.4.1.4 and 12.4.1.5].)
The following signals should be monitored remotely from the controller: [**20:**A.12.4.2.2(3)]
(1) A common signal can be used for the following trouble indications: the items in [**20:**12.4.1.4(1)] through [**20:**12.4.1.4(7)] and loss of output of battery charger on the load side of the dc overcurrent protective device.
(2) If there is no other way to supervise loss of power, the controller can be equipped with a power failure circuit, which should be time delayed to start the engine upon loss of current output of the battery charger.
(3) The arrangement specified in NFPA 20:A.12.4.2.2(3)(2) is only permitted where approved by the authority having jurisdiction in accordance with Section 1.5 and allows, upon loss of the ac power supply, the batteries to maintain their charge, activates ventilation in case conditions require cooling the engine, and/or maintains engine temperature in case conditions require heating the engine. (See also [**20:**A.5.6.4] and [**20:**A.11.4.3.1].)
B.3.4.1.3 These fire pump alarms and signals shall indicate the information in 6.3.3.1.2.1 [**20:**10.4.7.2.1] through 6.3.3.1.2.4 [**20:**10.4.7.2.4]. [**20:**10.4.7.2]
B.4 Releasing systems.
B.4.1 Fire Alarm and Supervisory Signal Initiation — Releasing Service Control Units. [**72:**6.8.5.10]
B.4.1.1 Releasing service control units shall be connected to the protected premises fire alarm system. [**72:**6.8.5.10.1]
B.4.1.2 Fire alarm and supervisory signals generated at the releasing control unit shall be annunciated at a protected premises fire alarm unit. [**72:**6.8.5.10.2]
B.4.1.3 If a valve is installed in the connection between a suppression system and an initiating device, the valve shall be supervised in accordance with Chapter 5. [**72:**6.8.5.10.4]
B.4.2 Disconnect Switches. Where provided, a disconnect switch that interrupts the releasing circuit to the suppression system shall be supervised.
B.4.3 Solenoids. Solenoids shall be compatible with the releasing panel. Releasing devices for water-based suppression systems shall be listed for use with releasing service control units. [**72:**6.12.2]
B.4.4 Abort Switches.
B.4.4.1 Abort Switches. Where provided, abort switches shall be located within the protected area near the means of egress. [**2001:**6.4.5.3*]
B.4.4.2 The abort switch shall be of a type that requires constant manual pressure to cause abort. [**2001:**6.4.5.3.2]

B.4.4.3 The manual emergency control shall override the abort function. [**2001:**6.4.5.3.4]
B.4.4.4 Operation of the abort function shall result in both audible and visual indication of system impairment. [**2001:**6.4.5.3.5]
B.4.4.5 The abort switch shall be clearly recognizable for the purpose intended. [**2001:**6.4.5.3.6]
B.4.5 Power supervision.
B.4.5.1 Control circuits requiring electrical power to perform the function shall be monitored for presence of operating voltage.
B.4.5.2 Control circuits that operate on loss of power shall be considered self-monitoring for integrity.
B.4.5.3 Loss of power to a monitored control circuit shall cause a supervisory signal to be indicated at the control unit and required remote annunciators.
B.5 Chemical and Gaseous Agent Extinguishing Systems.
B.5.1 Electrical Releasing Systems should be in accordance with Section B.4.1.
B.5.2 Solenoids should be in accordance with Section B.4.3.
B.5.3 Abort switches should be in accordance Section B.4.4.
B.6 Fire Alarm Systems.
B.6.1 General
B.6.1.1 Fire safety functions shall be permitted to be performed automatically. The performance of automatic fire safety functions shall not interfere with power for lighting or for operating elevators. The performance of automatic fire safety control functions shall not preclude the combination of fire alarm services with other services requiring monitoring of operations. [**72:**6.16.2.1]
B.6.1.2 A listed relay or other listed appliance connected to the fire alarm system used to initiate control of protected premises fire safety functions shall be located within 1 m (3 ft) of the controlled circuit or appliance. [**72:**6.16.2.2*]
B.6.1.3 The relay or other appliance shall function within the voltage and current limitations of the fire alarm control unit. [**72:**6.16.2.3]
B.6.1.4 The installation wiring between the fire alarm control unit and the relay or other appliance shall be monitored for integrity.
B.6.1.4.1 Relays or appliances that operate on loss of power shall be considered self-monitoring for integrity. [**72:**6.16.2.4]
B.6.1.5 Power For Control Circuits.
B.6.1.5.1 Control circuits requiring electrical power to perform the function shall be monitored for presence of operating voltage.
B.6.1.5.2 Loss of voltage to the control circuit shall cause a trouble signal at the fire alarm control unit.
B.6.1.6 Fire safety functions shall not interfere with other operations of the fire alarm system. [**72:**6.16.2.5]
B.6.1.7 The operation of all fire safety functions shall be verified by an operational test at the time of system acceptance. [**72:**6.16.2.8]
B.6.2 Elevator Control.

B.6.2.1 Separate outputs from the fire alarm systems to the elevator controller(s) shall be provided to implement elevator Phase I Emergency Recall Operation in accordance with Section 2.27 of ASME A17.1, Safety Code for Elevators and Escalators, as required in NFPA 72:6.16.3.12.

B.6.2.2 An output shall be provided for each of the following elevator recall functions.

(1) Designated Level Recall
(2) Alternate Level Recall
(3) Visual Warning Signal
(4) Other functions as required

B.6.3 Elevator Shutdown. [**72:**6.16.4]

B.6.3.1 Where elevator shutdown is required, an output from the fire alarm system shall be provided to cause the shutdown.

B.6.3.2 If pressure or waterflow switches are used to shut down elevator power immediately upon or prior to the discharge of water from sprinklers, the use of devices with time-delay switches or time-delay capability shall not be permitted. [**72:**6.16.4.3*]

B.6.3.3 Control circuits to shut down elevator power shall be monitored for presence of operating voltage. Loss of voltage to the control circuit for the disconnecting means shall cause a supervisory signal to be indicated at the control unit and required remote annunciators. [**72:**6.16.4.4*]

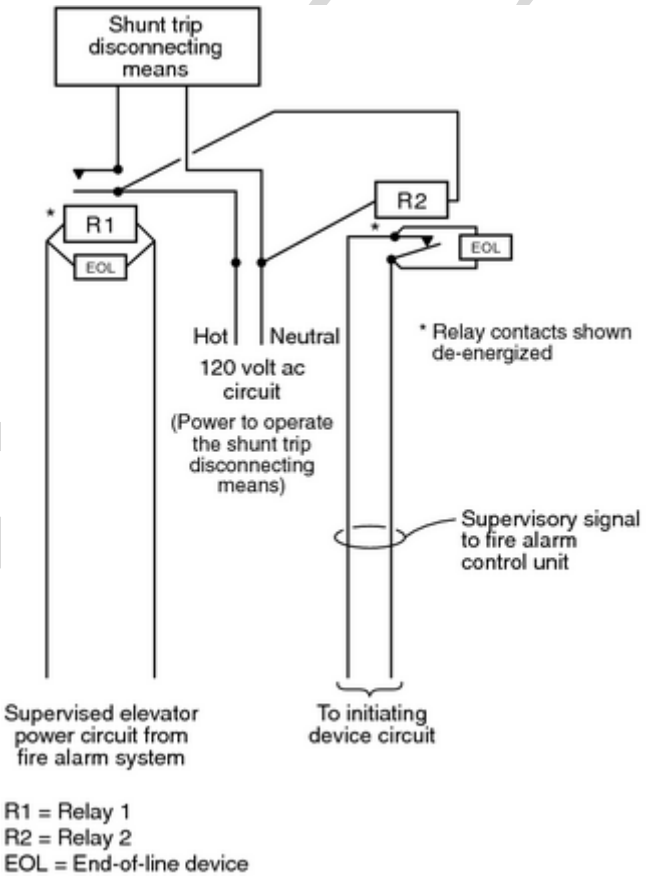


FIGURE B.6.3.3 Typical Method of Providing Elevator Power Shunt Trip Supervisory Signal.

B.6.4 HVAC Systems. [**72:**6.16.5]

B.6.4.1 If connected to the fire alarm system serving the protected premises, all detection devices used to cause the operation of HVAC systems smoke dampers, fire dampers, fan control, smoke doors, and fire doors shall be monitored for integrity in accordance with NFPA 72:4.4.7. [**72:**6.16.5.2*]
B.6.4.2 If the fire alarm control unit actuates the HVAC system for the purpose of smoke control, the automatic alarm-initiating zones shall be coordinated with the smoke-control zones they actuate. [**72:**6.16.5.4]
B.6.4.3 Where interconnected as a combination system, a Firefighter's Smoke Control Station (FSCS) shall be provided to perform manual control over the automatic operation of the system's smoke control strategy. [**72:**6.16.5.5]
B.6.4.4 Where interconnected as a combination system, the smoke control system programming shall be designed such that normal HVAC operation or changes do not prevent the intended performance of the smoke control strategy. [**72:**6.16.5.6]

B.6.5 Door Releasing Service.

B.6.5.1 The provisions of 5.5.3.5 shall apply to the methods of connection of door hold-open release devices and to integral door hold-open release, closer, and smoke detection devices. [**72:**6.16.6.1]
B.6.5.2 All detection devices used for door hold-open release service shall be monitored for integrity in accordance with NFPA 72:4.4.7. [**72:**6.16.6.2]

> **Exception:** Smoke detectors used only for door release and not for open area protection.

B.6.5.3 All door hold-open release and integral door release and closure devices used for release service shall be monitored for integrity in accordance with 5.5.3.5.2. [**72:**6.16.6.3]
B.6.5.4 Magnetic door holders that allow doors to close upon loss of operating power shall not be required to have a secondary power source. [**72:**6.16.6.4]

B.6.6 Door Unlocking Devices.

B.6.6.1 Any device or system intended to actuate the locking or unlocking of exits shall be connected to the fire alarm system serving the protected premises. [**72:**6.16.7.1]
B.6.6.2 All exits connected in accordance with Section 6.6.6.1 shall unlock upon receipt of any fire alarm signal by means of the fire alarm system serving the protected premises. [**72:**6.16.7.2]

> **Exception:** Where otherwise required or permitted by the authority having jurisdiction or other codes.

B.6.6.3 For all exits connected in accordance with 6.6.6.1 and where batteries are used in accordance with NFPA 72:4.4.1.5.1(1) as the secondary power supply, the batteries shall not be utilized to maintain these doors in the locked condition unless the fire alarm control unit is arranged with circuitry and sufficient secondary power to ensure the exits will unlock within 10 minutes of loss of primary power. [**72:**6.16.7.3*]
B.6.6.4 Locks powered by independent power supplies dedicated to lock power and access control functions and which unlock upon loss of power shall not be required to comply with Section 6.6.6.3. [**72:**6.16.7.4]
B.6.6.5 If exit doors are unlocked by the fire alarm system, the unlocking function shall occur prior to or concurrent with activation of any public-mode notification appliances in the area(s) served by the normally locked exits. [**72:**6.16.7.5]

B.6.6.6 All doors that are required to be unlocked by the fire alarm system in accordance with 5.5.3.4.2.1 through 5.5.3.4.2.5 shall remain unlocked until the fire alarm condition is manually reset. [**72:**6.16.7.6]
B.6.6.7 Fire doors or shutters that are unlocked by the fire alarm system shall remain latched.
B.7 Smoke-Control Systems Utilizing Barriers and Pressure Differences.
B.7.1 Controls. [**92A:**6.4]
B.7.1.1 Coordination. A single control system shall coordinate the smoke-control functions provided by the fire alarm system, fire fighters' smoke-control system, and any other related systems with the operation of the building HVAC systems and dedicated smoke-control equipment. [**92A:**6.4.1]
B.7.1.2 HVAC System Controls. Operating controls of the HVAC system shall be designed or modified to provide the smoke-control mode with the highest priority over all other control modes. [**92A:**6.4.2*]
B.7.1.3 Smoke-Control System Activation and Deactivation. [**92A:**6.4.3]
B.7.1.3.1 Smoke-control systems shall be activated automatically. [**92A:**6.4.3.1]
B.7.1.3.2 Where approved by the authority having jurisdiction, manual activation shall be permitted. [**92A:**6.4.3.2]
B.7.1.3.3 When operating under either automatic or manual activation, the smoke-control system shall be capable of being manually overridden and manually deactivated. [**92A:**6.4.3.3]
B.7.1.3.4 Smoke-control systems shall be automatically activated in response to signals received from a specific fire detection device or a combination of fire detection devices. [**92A:**6.4.3.4*]
B.7.1.3.5 Manual Activation and Deactivation. [**92A:**6.4.3.5]
B.7.1.3.5.1 Manual activation and deactivation shall be permitted to be at a controlled device, at a local control panel, at the building's main control center, or at the fire command station. [**92A:**6.4.3.5.1*]
B.7.1.3.5.2 Manual fire alarm pull stations shall not be used to activate smoke-control systems that require information on the location of the fire. [**92A:**6.4.3.5.2*]
B.7.1.3.5.3 Stairwell pressurization systems or other smoke-control systems where the response of the system is identical for all zone alarms shall be permitted to be activated from a manual fire alarm pull station. [**92A:**6.4.3.5.3*]
B.7.1.3.6 Response Time. [**92A:**6.4.3.6]
B.7.1.3.6.1 The smoke-control mode shall be initiated within 10 seconds after an automatic or manual activation command is received at the smoke-control system. [**92A:**6.4.3.6.1]
B.7.1.3.6.2 Smoke-control systems shall activate individual components (e.g., dampers, fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts, and other equipment. [**92A:**6.4.3.6.2*]
B.7.1.3.6.3 The time necessary for individual components to achieve their desired state or operational mode from when the component receives the signal shall not exceed the following time periods: [**92A:**6.4.3.6.3*]
(1) Fan operation at the desired state: 60 seconds
(2) Completion of damper travel: 75 seconds
B.7.1.3.7 Fire Fighters' Smoke-Control Station (FSCS). [**92A:**6.4.3.7]

B.7.1.3.7.1 A fire fighters' smoke-control station (FSCS) shall be provided for all smoke-control systems. [**92A:**6.4.3.7.1]
B.7.1.3.7.2 The FSCS shall provide status indication, fault condition indication, and manual control of all smoke-control system components. [**92A:**6.4.3.7.3*]
B.7.1.3.7.3 Operator controls, status indication, and fault indication shall be provided for each smoke-control zone, each piece of equipment capable of activation for smoke control, or a combination of these approaches. [**92A:**6.4.3.7.5]
B.7.1.3.7.4 Positive status indication (on and off) shall be provided individually or by zone in accordance with 6.4.3.7.5 for the following: [**92A:**6.4.3.7.6]
(1) Dedicated smoke-control system fans
(2) Nondedicated fans used for smoke control having a capacity in excess of 2000 ft^3/min (57 m^3/min)
B.7.1.3.7.5 “On” status shall be sensed by a pressure difference, an airflow switch, or some other positive proof of airflow. [**92A:**6.4.3.7.7*]
B.7.1.3.7.6 Positive status indication (fully open and fully closed) of damper position shall be provided if individual controls for the damper are provided on the FSCS. [**92A:**6.4.3.7.8]
B.7.1.3.7.7 The FSCS shall have the highest priority control over all smoke-control systems and equipment. [**92A:**6.4.3.7.11]
B.7.1.3.7.8 Where manual controls for control of smoke-control systems are also provided at other building locations, the control mode selected from the FSCS shall prevail. [**92A:**6.4.3.7.12]
B.7.1.3.7.9 FSCS control shall override or bypass other building controls such as hand-off-auto and start/stop switches located on fan motor controllers, freeze detection devices, and duct smoke detectors except as provided by Section 6.7.1.3.7.9.1. [**92A:**6.4.3.7.13]
B.7.1.3.7.9.1 The FSCS fan control capability shall not be required to bypass hand-off-auto or start/stop switches located on motor controllers of nondedicated smoke-control system fans, where both of the following conditions exist: [**92A:**6.4.3.7.13.1]
(1) Such fan motor controllers are located in mechanical or electrical equipment rooms or in other areas accessible only to authorized personnel.
(2) The use of such a motor controller switch to turn a fan on or off will cause an off-normal indication at the building's main control center during normal HVAC or building control operations of the nondedicated fan.
B.7.1.3.7.10 FSCS control shall not take precedence over fire suppression, electrical protection, or personnel protection devices. [**92A:**6.4.3.7.14]
B.7.1.4 Controls for Stairwell Pressurization Systems. Stairwell pressurization systems shall be as activated as described in Sections 6.7.1.4.1 through 6.7.1.4.3. [**92A:**6.4.4]
B.7.1.4.1 Automatic Activation. Operation of any zone of the building fire alarm system shall cause all stairwell pressurization fans to start except as indicated in Section 6.7.1.4.1.1. [**92A:**6.4.4.1*]
B.A.6.7.1.4.1 In limited instances, it can be desirable to pressurize only some stairwells due to particular building configurations and conditions. [**92A:**A.6.4.4.1]

B.7.1.4.1.1 Where an engineering analysis determines that operation of all stairwell pressurization fans is not required to achieve the design objective, only the stairwell pressurization fans identified during the analysis shall be required to be activated. [**92A:**6.4.4.1.1]
B.7.1.4.2 Smoke Detection. [**92A:**6.4.4.2]
B.7.1.4.2.1 A smoke detector shall be provided in the air supply to the pressurized stairwell. [**92A:**6.4.4.2.1]
B.7.1.4.2.2 On detection of smoke in the air supply, the supply fan(s) shall be stopped. [**92A:**6.4.4.2.2]
B.7.1.4.3 Manual Activation. Manual activation and deactivation control of the stairwell pressurization systems shall be provided at the FSCS. [**92A:**6.4.4.3]
B.7.1.4.4 Manual Override. A manual override switch shall be permitted to be provided at the FSCS to restart the stairwell pressurization fan(s) after shutdown from the smoke detector. [**92A:**6.4.4.4]
B.7.1.5 Controls for Zoned Smoke-Control Systems. [**92A:**6.4.5]
B.7.1.5.1 Automatic Activation. Zoned smoke-control systems shall be automatically activated in response to signals received from a device or combination of devices that responds to products of combustion. [**92A:**6.4.5.1.1]
B.7.1.5.1.1 When signals from fire alarm systems are used to activate the zoned smoke-control system(s), the fire alarm zones shall be arranged to coincide with the smoke-control zones. [**92A:**6.4.5.1.1.1*]
B.7.1.5.1.2 Where a waterflow switch or heat detector is used to activate a zoned smoke-control system, zoning of such systems shall coincide with the smoke-control zone. [**92A:**6.4.5.1.1.4]
B.7.1.5.2 Manual Activation. [**92A:**6.4.5.1.2]
B.7.1.5.2.1 Zoned smoke-control systems shall not be activated from manual fire alarm pull stations. [**92A:**6.4.5.1.2.1*]
B.7.1.5.2.2 Fire alarm pull stations shall be permitted to cause doors in smoke barrier walls to close. [**92A:**6.4.5.1.2.2]
B.7.1.5.2.3 Key-operated manual switches located within a smoke zone that are clearly marked to identify their function shall be permitted to manually activate the zone's smoke-control system. [**92A:**6.4.5.1.2.3]
B.7.1.5.2.4 Zoned smoke-control systems shall be capable of being manually activated from the FSCS by switches clearly marked to identify the zone and function. [**92A:**6.4.5.1.2.4]
B.7.1.5 3 Sequence of Control and Priorities. Automatic activation, manual activation, and manual deactivation of zoned smoke-control systems shall be subject to the sequences of control and priorities given in Sections 6.7.1.5.3.1, 6.7.1.5.3.2, and 6.7.1.5.3.3. [**92A:**6.4.5.2*]
B.7.1.5.3.1 Automatic Activation. Automatic activation of systems and equipment for zoned smoke control shall have the highest priority over all other sources of automatic control within the building. [**92A:**6.4.5.2.1]
B.7.1.5.3.1.1 Except as provided for in Section 6.7.1.5.3.1.2, where equipment used for smoke control is also used for normal building operation, control of this equipment shall be preempted or overridden as required for smoke control. [**92A:**6.4.5.2.1.1*]

B.7.1.5.3.1.2 The following controls shall not be automatically overridden: [**92A:**6.4.5.2.1.2]

(1) Static pressure high limits

(2) Duct smoke detectors on supply air systems

B.7.1.5.3.2 Manual Activation and Deactivation. Manual activation or deactivation of zoned smoke-control systems and equipment shall have priority over automatic activation of smoke-control systems and equipment, as well as over all other sources of automatic control within the building. [**92A:**6.4.5.2.2]

B.7.1.5.3.3 If equipment used for zoned smoke control is subject to automatic activation in response to an alarm from an automatic fire detector of a fire alarm system, or if such equipment is subject to automatic control according to building occupancy schedules, energy management strategies, or other nonemergency purposes, such automatic control shall be preempted or overridden by manual activation or deactivation of the smoke-control equipment. [**92A:**6.4.5.2.3]

B.7.1.5.4 Automatic Response to Multiple Signals. In the event that signals are received from more than one smoke zone, the system shall continue automatic operation in the mode determined by the first signal received except as provided for in Section 6.7.1.5.4.1. [**92A:**6.4.5.5*]

B.7.1.5.4.1 For systems designed for operation of multiple zones using only heat-activated detection devices, it shall be permitted to expand the control strategy to accommodate additional zones, up to the limits of the mechanical system design. [**92A:**6.4.5.5.1*]

B.7.1.6 Control System Verification. [**92A:**6.4.6*]

B.7.1.6.1 Every dedicated smoke-control system and each dedicated smoke-control subsystem in a nondedicated smoke-control system shall have a means of verifying correct operation when activated. [**92A:**6.4.6.1]

B.7.1.6.2 Verification shall include positive confirmation of actuation, testing, manual override, and the presence of operating power downstream of all circuit disconnects. [**92A:**6.4.6.2]

B.7.1.6.3 Failure to receive positive confirmation after activation or cessation of such positive confirmation while the system or subsystem remains activated shall result in an off-normal indication at the smoke-control system within 200 seconds. [**92A:**6.4.6.3]

B.7.1.6.4 Fire alarm signaling paths to the smoke-control system shall be monitored for integrity in accordance with 4.4.7.1 of NFPA 72, with trouble annunciation provided at the FSCS except as permitted by Section 6.7.1.6.4.1. [**92A:**6.4.6.4]

B.7.1.6.4.1 Monitoring for integrity shall not be required when the interconnecting wiring between the fire alarm system and the smoke-control system is located within 20 ft (6.1 m) of each other where the conductors are installed in conduit or equivalently protected against mechanical injury. [**92A:**6.4.6.4.1]

B.7.2 Energy Management. Energy management systems, particularly those that cycle supply, return, and exhaust fans for energy conservation, shall be overridden when their control or operation is in conflict with a smoke-control mode. [**92A:**6.5]

B.8 Smoke Management Systems in Malls, Atria, and Large Spaces.

B.8.1 Manual Override. [**92B:**4.5.4]

B.8.1.1 A means of manually starting and stopping the smoke management system shall be provided at an approved location accessible to the fire department. [**92B:**4.5.4.1]
B.8.1.2 Manual controls shall be able to override automatic system operation. [**92B:**4.5.4.2]
B.8.2 Coordination. The control system shall fully coordinate the smoke management system interlocks and interface with other related systems. [**92B:**7.3.2]
B.8.3 HVAC System Controls. Operating controls for the HVAC system shall accommodate the smoke management mode, which shall have the highest priority over all other control modes. [**92B:**7.3.3]
B.8.4 Sequencing. The smoke management system shall activate individual components, such as dampers and fans, in sequence as necessary to avoid physical damage to the equipment. [**92B:**7.3.5]
B.9 Emergency Power Systems.
B.9.1 Emergency and Standby Power Systems.
B.9.1.1 Where fire suppression systems are installed in EPS equipment rooms or separate buildings, the following systems shall not be used: [**110:**7.11.2*]
(1) Carbon dioxide or halon systems, unless prime mover combustion air is taken from outside the structure
(2) An automatic dry chemical system, unless the manufacturers of the EPS certify that the dry chemical system cannot damage the EPS system, hinder its operation, or reduce its output
B.9.1.2 Where the EPS rooms or separate buildings are equipped with fire detection systems, the installation shall be in accordance with NFPA 72, National Fire Alarm Code. [**110:**7.11.3]
B.9.1.3 Outdoor and/or rooftop Level 1 EPS installations shall be protected from lightning in accordance with applicable standards. [**110:**7.11.4]
B.9.2 Stored Electrical Energy Emergency and Standby Power Systems.
B.9.2.1 Where SEPSS equipment rooms or separate buildings are equipped with fire suppression, one of the following systems shall be used: [**111:**7.4.2]
(1) Carbon dioxide systems
(2) Halon systems
(3) Other systems acceptable to the authority having jurisdiction
B.9.2.2 Where SEPSS equipment rooms are equipped with fire detection systems, the installation shall be in accordance with applicable standards. (See NFPA 72, National Fire Alarm Code.) [**111:**7.4.3]
B.9.2.3 The SEPSS equipment shall be protected from voltage transients due to lightning. [**111:**7.4.4]
B.10 Other Fire Protection Systems.
B.10.1 Explosion Prevention
B.10.1.1 Power and Control Units. [**69:**9.3.4]
B.10.1.1.1 A power and control unit shall supply energy to accomplish all of the following processes: [**69:**9.3.4.1]
(1) Power all sampling devices, sample preparation unit, control processor, etc.
(2) Energize all electrically actuated extinguishing and control systems
(3) Energize visual and audible alarms

(4) Transfer all auxiliary control and alarm contacts
(5) Control system-disabling interlock and process shutdown circuits

B.10.1.1.2 The power and control unit shall, as a minimum, fully and continuously supervise all of the following components: [**69:**9.3.4.2]

(1) Wiring circuits for opens and other faults
(2) AC power supply (primary)
(3) System safety interlock circuitry
(4) System-disabling interlock circuitry
(5) Releasing outputs
(6) Electrical extinguishing actuators
(7) Air sampler flow (gas sensing only)
(8) Visible and audible alarms
(9) Circuit ground fault

B.10.1.1.3 In addition to noncritical trouble alarms, the power and control unit shall have separate contacts capable of initiating an orderly shutdown of the protected process upon receipt of any trouble signal that indicates a potentially disabled protection system. [**69:**9.3.4.3]

B.10.1.1.4 The supervisory signal circuits shall be provided with visual and audible trouble signals. [**69:**9.3.4.4]

B.10.1.2 Actuation of Other Devices and Systems. The detection and control system shall be permitted to actuate other devices and systems such as high-speed isolation valves, chemical or mechanical isolation devices, or deluge valves as applicable. [**69:**9.7.1]

B.10.1.3 Process Shutdown. [**69:**9.8]

B.10.1.3.1 Upon activation, the detection and control system shall be permitted to initiate an immediate, automatic shutdown of the protected process. [**69:**9.8.1]

B.10.1.3.2 Upon receipt of a trouble signal from the detection and control system, the protected process shall be permitted to initiate an immediate, automatic, and orderly shutdown. [**69:**9.8.2]

B.10.1.4 Personnel Safety. [**69:**10.3]

B.10.1.4.1 Disarming and Lockout and Tagout Procedures.

B.10.1.4.1.1 The deflagration suppression system shall be disarmed and locked out and tagged out prior to performing maintenance operations on the protected enclosure or suppression system if discharging the suppressant could result in injury. [**69:**10.3.1.2]

B.10.1.4.1.2 Suppressors protecting unoccupied enclosures shall meet applicable OSHA requirements. [**69:**10.3.1.3]

B.10.1.4.1.2.1 All suppressors shall be provided with a means to prevent release of stored energy into the protected enclosure. [**69:**10.3.1.3.1]

B.10.1.4.1.2.2 The suppression system shall be configured to prevent arming while such means are in place. [**69:**10.3.1.3.2]

B.10.1.4.1.2.3 Locks and tagging shall be used to identify suppressors that have such prevention means in place. [**69:**10.3.1.3.3]

B.10.1.4.1.3 Operation of the protected process shall be interlocked through the suppression system control panel so that operation cannot be resumed until the suppression system is armed. [**69:**10.3.1.4]

B.10.1.4.2 Warning Signs. [**69:**10.3.2]

B.10.1.4.2.1 Suppression systems shall be equipped with warning signs indicating that the enclosure is protected with a suppression system. [**69:**10.3.2.1]
B.10.1.4.2.2 These warning signs shall be applied to suppression system components, the enclosure, or both. [**69:**10.3.2.2]
B.10.1.5 Actuation of Other Devices and Systems. The deflagration suppression system shall be permitted to actuate other devices and systems such as high-speed isolation valves, chemical or mechanical isolation devices, or deluge valves as applicable. [**69:**10.4.5]
B.10.1.6 Process Shutdown. Upon activation, the suppression system shall initiate an immediate, automatic shutdown of the protected process. [**69:**10.4.6]
B.10.1.6.1 Upon receipt of a trouble signal from the suppression system, which indicates the protection system could be compromised, the protected process shall initiate an immediate, automatic, and orderly shutdown. [**69:**10.4.6.1]
B.10.1.6.2 Upon receipt of a supervisory signal from the suppression system, which indicates that a problem exists but that the protection system is not compromised, qualified personnel shall investigate and repair the problem at the next shutdown period. [**69:**10.4.6.2]
B.10.1.6.3 It shall be permitted to manually shut down the protected process in lieu of automatic shutdown when supported by a hazard analysis approved by the AHJ. [**69:**10.4.6.3]
B.10.1.7 Control Panels. [**69:**10.5]
B.10.1.7.1 A control panel with a standby battery backup of no less than 24 hours shall be provided with each suppression system that supplies energy to accomplish the following actions: [**69:**10.5.1]

- **(1)** Power all detection devices
- **(2)** Energize all electrically operated actuating devices
- **(3)** Energize local visual and audible alarms
- **(4)** Transfer all auxiliary control and alarm contacts
- **(5)** Control system–disabling interlock and process shutdown circuits

B.10.1.7.2 The control panel shall, as a minimum, fully and continuously supervise the following components: [**69:**10.5.2]

- **(1)** Wiring circuits for opens and other faults
- **(2)** ac power supply (primary)
- **(3)** Battery voltage, presence, and polarity
- **(4)** System safety interlock circuitry
- **(5)** System-disabling interlock circuitry, including lockout and tagout status
- **(6)** Releasing outputs
- **(7)** Electrically operated actuating devices
- **(8)** Detection devices
- **(9)** Local visual and audible alarms
- **(10)** Circuit ground fault
- **(11)** Suppressor pressure indicators

B.10.1.7.2.1 The minimum number of detection devices shall be either one device that is a transducer with a continuously monitored process parameter output, or two devices that are switches or transducers that are not continuously monitored, where the two switches are connected such that an alarm condition on either switch will activate the system. [**69:**10.5.2.1]
B.10.1.7.2.2 Additional detection devices shall be permitted for the purpose of reducing spurious failures. [**69:**10.5.2.2*
B.10.1.7.3 The supervisory circuits in 10.5.2 shall be provided with a visual and an audible signal. [**69:**10.5.3*]
B.10.1.7.4 Control panel contacts shall be provided that enable the owner or operator to initiate an orderly, automatic shutdown of the process and protection system should unauthorized entry of a protected enclosure be attempted. [**69:**10.5.4]
B.10.1.8 Detection Devices. [**69:**10.6]
B.10.1.8.1 The deflagration shall be detected by the sensing of one or more of a specified pressure, a specified rate of pressure rise, a vent burst, or the radiant energy from the combustion process. [**69:**10.6.1*]
B.10.1.8.2 Provisions shall be made to minimize obscuration of radiant energy detectors. [**69:**10.6.2]
B.10.1.8.3 Detection devices shall be located to minimize accumulation of foreign material that would affect functioning. [**69:**10.6.3]
B.10.1.8.4 Detection devices shall be mounted so that their maximum temperature rating, as specified by the manufacturer, is not exceeded. [**69:**10.6.4]
B.10.1.9 Electrically Operated Actuating Devices. [**69:**10.7]
B.10.1.9.1 Electrically operated actuating devices shall be mounted so that their maximum temperature rating, as specified by the manufacturer, is not exceeded. [**69:**10.7.1*]
B.10.1.9.2 The operating characteristics of the as-installed actuating device circuits shall be within the manufacturer's specifications. [**69:**10.7.2]
B.10.1.10 Electrical Installation. [**69:**15.5]
B.10.1.10.1 Wiring for input and output control circuits shall be isolated and shielded and protected from other wiring to prevent possible induced currents. [**69:**15.5.4]
B.10.1.10.2 Class A or Class B circuits as described in NFPA 72, National Fire Alarm Code, shall be employed when the following components are connected to the control panel: [**69:**15.5.5.2*]

- **(1)** Concentration measurement devices, explosion detection devices, and other initiating devices
- **(2)** Concentration controlling valves
- **(3)** Releasing devices, solenoids, or actuators
- **(4)** Supervisory devices that monitor critical elements or functions such as low pressure switches
- **(5)** Notification appliances
- **(6)** Signaling line circuits

B.10.1.10.3 A signaling line circuit used as part of an explosion protection or suppression system shall not be shared by other operating systems. [**69:**15.5.5.3]
B.10.1.10.4 A signaling line circuit shall not be used by more than one explosion prevention system unless certified by the original manufacturer. [**69:**15.5.5.4]

B.10.2 Fire Doors.

B.10.2.1 Power-Operated Fire Doors. Power-operated fire doors shall be equipped with a releasing device that shall automatically disconnect the power operator at the time of fire, allowing a self-closing or automatic device to close the door regardless of power failure or manual operation. [**80:**6.1.4.4]

B.10.2.2 Releasing Devices. [**80:**8.4.2*]

B.10.2.2.1 General. [**80:**8.4.2.1]

B.10.2.2.1.1 Power-operated doors not equipped with standby or emergency power shall be equipped with an integral or a separate listed releasing device that shall automatically disconnect the door from the control of the power operator at the time of a fire. [**80:**8.4.2.1.1]

B.10.2.2.1.2 The releasing device shall be activated at the time of the fire by detectors or fusible links installed on both sides of the wall and interconnected so that the operation of the single detector or fusible link shall allow the door to be disconnected and closed. [**80:**8.4.2.1.2]

B.10.2.2.1.3 If closing is achieved by power operation, standby or emergency power shall be provided. [**80:**8.4.2.1.3]

B.10.2.2.1.4 The time delay from failure of normal power operation to emergency power operation shall not exceed 10 seconds. [**80:**8.4.2.1.4]

B.10.2.2.1.5 The standby or emergency power source shall have capacity to operate a minimum of 50 closing cycles of the door. [**80:**8.4.2.1.5]

B.10.2.2.1.6 If door opening also is achieved by power operation, the standby or emergency power source shall have capacity to operate a minimum of 50 opening and closing cycles of the door. [**80:**8.4.2.1.6]

B.10.2.2.2 Power operation shall not allow opening if temperatures on either side of the door reach 500°F (260°C). [**80:**8.4.2.2]

B.10.3 Commercial Cooking

B.10.3.1 Fuel Shutoff. [**96:**10.4]

B.10.3.1.1 Upon activation of any fire-extinguishing system for a cooking operation, all sources of fuel and electrical power that produce heat to all equipment requiring protection by that system shall automatically shut off. [**96:**10.4.1]

B.10.3.1.2 Steam supplied from an external source shall not be required to automatically shut off. [**96:**10.4.2]

B.10.3.1.3 Any gas appliance not requiring protection but located under the same ventilating equipment shall also automatically shut off upon activation of any extinguishing system. [**96:**10.4.3]

B.10.3.1.4 Shutoff devices shall require manual reset. [**96:**10.4.4]

B.10.3.2 System Annunciation. [**96:**10.6]

B.10.3.2.1 Upon activation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has activated. [**96:**10.6.1]

B.10.3.2.2 Where a fire alarm signaling system is serving the occupancy where the extinguishing system is located, the activation of the automatic fire-extinguishing system shall activate the fire alarm signaling system. [**96:**10.6.2]

B.10.3.3 System Supervision. [**96:**10.7]

B.10.3.3.1 Where electrical power is required to operate the automatic fire-extinguishing system, the system shall be monitored by a supervisory alarm, with a standby power supply provided. [**96:**10.7.1]
B.10.3.3.2 System supervision shall not be required where an automatic fire-extinguishing system(s) includes automatic mechanical detection and actuation as a backup detection system.
B.10.3.3.3 System [**96:**10.7.2] supervision shall not be required where a fire-extinguishing system(s) is interconnected or interlocked with the cooking equipment power source(s) so that if the fire-extinguishing system becomes inoperable due to power failure, all sources of fuel or electrical power that produce heat to all cooking equipment serviced by that hood shall automatically shut off. [**96:**10.7.3]
B.10.3.3.4 System supervision shall not be required where an automatic fire-extinguishing system, including automatic mechanical detection and actuation, is electrically connected to a listed fire-actuated water-wash system for simultaneous operation of both systems. [**96:**10.7.4]
B.11 Data Exchange.
B.11.1 If a fire alarm system is a component of a life safety network and it communicates data to other systems providing life safety functions or it receives data from such systems, the following shall apply:

(1) The path used for communicating data shall be monitored for integrity. This shall include monitoring the physical communication media and the ability to maintain intelligible communications.
(2) Data received from the network shall not affect the operation of the fire alarm system in any way other than to display the status of life safety network components.
(3) Where non-fire alarm systems are interconnected to the fire alarm system using a network or other digital communication technique, a signal (e.g., heartbeat, poll, ping, query) shall be generated between the fire alarm system and the non-fire alarm system. Failure of the fire alarm system to receive confirmation of the transmission shall cause a trouble signal to indicate within 200 seconds. [**72:**6.16.2.7]

Annex C Sample Narrative Report

C.1 The Narrative should be written in a three section format including sub-sections as necessary (methodology, sequence of operation and testing criteria sections) for clarity and should be limited to a summary. This annex presents a sample format for a Narrative Report.

C.2 A) Methodology Section

C.2.1 Sub-section 1: Description. This section should identify specific features of a building that contributes to the overall understanding of the fire protection and life safety systems and features to be provided as part of the design and construction.

a) Building and or structure Use Group classification in accordance with applicable building code of the jurisdiction

b) Total aggregate square footage of building
c) Building height
d) Number of floors above grade
e) Number of floors below grade
f) Square footage per floor
g) Type(s) of occupancies, hazard classifications, processes
h) Type(s) of construction
i) Hazardous material usage and storage
j) Method of storage arrangements of commodities
k) Site access arrangement for emergency response vehicles
l)

C.2.2 Sub-section 2: Applicable laws, regulations, codes, ordinance's and standards This section identifies regulatory requirements of the jurisdiction that have or may have an impact in the design and approval of fire protection and life safety systems. This section requires the preparer of the Narrative to conduct a comprehensive regulatory research such as:

a) Building code fire Protection and life safety system requirements
b) NFPA Standards or other applicable recognized Standards and Edition used for design and or installation of each specific fire protection system
c) Applicability of any special laws of the jurisdiction that may supersede a code or standard
d) Applicability of local by-laws, or ordinances of the jurisdiction
e) Applicability of other codes such as plumbing, elevator, electrical codes that may have an impact on the design, installation and testing of the fire protection and life safety systems
f) Applicability of any Federal Laws such as OSHA, ADA or other governmental entity

C.2.3 Sub-section 3: Design responsibility for fire protection and life safety systems This section identifies the accountability (required by the jurisdiction) for a specific fire protection and life safety system design and the accountability for the integration of the fire protection systems constituting a building or structures fire protection and life of safety system(s). There could be options permitted by the jurisdiction.

a) The Registered Design Professional fully designs (complete layout and calculation) and specifies the fire protection and life safety system or systems to be installed, reviews and approves the installing contractor's shop drawings and certifies system installation (s) for code compliance at completion. There could be multiple registered design professional associated with a project and should be identified as appropriate.
b) The Registered Design Professional provides a partial design and specifies the design criteria to be used by the installing contractor(s), who finalizes the system layout, provides calculations to confirm the design criteria. The

Registered Design Professional certifies system installation for code compliance at completion.

c) Design-build, the installing contractor for a specific fire protection and life safety system completely designs and specifies if permitted by the governmental jurisdiction (develops a full system layout, design criteria and calculations) installs the system and certifies system installation for regulatory and applicable standard compliance at completion. There may be a Registered Design Professional involved but not necessarily.

Whichever above method is selected, the project requires a qualified person to assume responsibility for the coordination of fire protection and life safety systems requiring integration, forming an entire building fire protection and life safety system.

C.2.4 Sub-section 4: Fire protection and life safety systems to be installed This section should identify key performance design criteria and features for each specific fire protection system.

a) Water supply, fire mains and hydrants, such municipal, private, storage tank, fire pumps.
b) Automatic sprinkler systems, such as wet, dry, pre-action.
c) Standpipe systems, such as wet, dry and classification.
d) Fire alarm systems, such as manual, automatic detection, evacuation signals.
e) Automatic fire extinguishing systems, such as dry chemical, clean agent.
f) Manual suppression systems, such as fire extinguishers types.
g) Smoke control/management systems, such as automatic smoke exhaust, stair pressurization.
h) Kitchen cooking suppression and exhaust systems, such as wet chemical, sprinklers.
i) Emergency power systems, such as applicability to fire protection and life safety systems.
j) Hazardous material and process protection, special protection
k) System supervision, such as method of 24 monitoring conditions of fire protection and life safety systems.

The description (specific features) for the above fire protection systems should also indicate if the system(s) are:

- Required by laws, codes, standards, ordinance, etc.
- Non-required, building owner provides voluntarily and or requirement of insurance entity
- A complete new system
- An addition or expansion to existing system
- A modification/repair to existing system

- Level of protection to be provided, 100% or partial protection or exempt by regulatory code

C.2.5 Sub-section 5: Consideration used in the design methodology. This section identifies the designer's intent in the overall design and criteria development of the fire protection and life safety systems.

a) Building occupant notification and evacuation procedures
b) Emergency response personnel, site and systems features
c) Safeguards, fire prevention and emergency procedures during new construction and impairment plans associated with new and or existing system modifications
d) Method for future testing and maintenance of systems and documentation
e) Special requirements or request of the Authority Having Jurisdiction

C.2.6 Sub-section 6, Alternatives. This section identifies the designer's intent to deviate from prescriptive requirements of regulatory codes and standards with alternative methods.

a) Application of performance-based design in lieu of prescriptive code requirement
b) Interpretation/clarification between designer and Authority Having Jurisdiction.
c) Waiver or variance sought and or required by the Authority Having Jurisdiction through the regulatory appeal process.

C.3 B) Sequence of Operation Section. This portion of the Narrative is generally a difficult section to write as it entails the specific operation of the fire protection and life safety systems, system devices and equipment and their related integration depending on the complexity of the systems installed. The preparer of the Narrative should have an overall understanding and knowledge of how all the fire protection and life safety systems should function when integrated together.

C.3.1 Sub-section 1

a) An operational description of either a system or specific devices within a system and the resulting action associated with the operation of the system or specific devices.
b) The operational description should include all interconnected (integrated) fire protection and life safety systems and devices required or non-required forming an entire building fire protection and life safety system.
c) All signage indicating equipment location, operational and design features and certified documents attesting to system installation integrity.

d) The Narrative sequence of operation description should be specifically coordinated with the input and output matrix developed for the systems operation.

This section of the Narrative Report can be brief as in a simple system such as a one-story 15,000 sq. ft. mercantile building with only a sprinkler system and manual fire alarm pull box's, notification devices and system supervision. Or complex, such as in a 25 story high-rise story with fire pumps, emergency generator, fire alarm and sprinkler zones, automatic standpipes, automatic voice and manual evacuation signals, smoke management system, automatic elevator recall, special extinguishing systems, remote annunciation, automatic locking devices, alarm retransmission methods and emergency response procedures.

The sequence of operation of a building fire protection and life safety system, particularly with complicated systems must be reviewed and understood by the building owner, Authority Having Jurisdiction and the entities responsible for installation (generally the fire alarm and building automated systems programming technicians) and future testing and maintenance after the building has been issued a Certificate of Occupancy. A team approach should be used by developers, designers, equipment suppliers, contractors including the Authority Having Jurisdiction (more specifically emergency response personnel, such as the local fire department) to clearly describe and understand the proper operation and use of the integrated fire protection and life safety systems.

When a complex system is proposed, the initial narrative report of the sequence of operation should be viewed as a draft. At various stages of system installation(s), modifications may be or could be made due to design changes, equipment changes, new technology availability and or changes to codes and standards that would require system modifications. The preparer of the Narrative should be familiar with any and all changes to the systems and submit a final accurate Narrative for approval and or acceptance by the Authority Having Jurisdiction, building owner and other entities prior to witnessing system(s) operational acceptance and commissioning testing.

Communication between the building owner, designers, builders and the Authority Having Jurisdiction is an important element particularly in this phase, as the Codes and the Standards tend to be flexible and interpretative relative to operational sequences of the integrated fire protection and life safety systems.

C.4 C) Testing Criteria Section. This section of the narrative report should be broken down into the following three sections.

C.4.1 Sub-section 1 – Testing Criteria This section identifies the individual in charge who will coordinate the final acceptance testing and witnessing by the Authority Having Jurisdiction.

Personnel

(a) Identification of qualified person(s) in charge (should be the fire commissioning agent and or multiple agents if applicable) for setting up and coordinating all pre-testing and final testing.
(b) Method of verification and confirmation by the qualified person (s) in charge that all fire protection systems, equipment and devices have been individually tested and tested as an entire system when specific systems are integrated to form a building fire protection and life safety system.
(c) Method of coordination by qualified person in charge of all designers, contractors, equipment distributors, owners representatives and the Authority Having Jurisdiction required to perform and or witness all testing, testing dates and times, notification to public utilities, personnel required to perform all required testing as a system or individual system component testing.

C.4.2 Sub-section 2, Equipment and Tools. This section will identify the necessary equipment available on site at time of witnessing the operational features and or integrated performance of the fire protection and life safety systems that require validation by the owner and or the Authority Having Jurisdiction to expedite the acceptance and commissioning testing.

a) Identification of equipment, documents and procedures to be used to verify system performance, confirm design methodology and specifications, code and standards compliance and accuracy of fire protection and life safety system(s) operational sequence (matrixes).

b)

Example but not limited to:

Manufacturer's instructions

Specification instructions

Requirements of the Authority Having Jurisdiction

Narrative, sequence of operation section

Smoke machines, smoke candles

Sound meters

Fire hoses, nozzles

Flow measuring devices

Gauges

Air balancing and air measuring meters

Door force closing and opening measuring devices

Voltage meters

Magnets

Communication radios

Fire department equipment

Special tools, keys

Ladders

Safety equipment

Notifications announcements

Signs

Charts, forms, checklist, logs

Acceptance test forms

C.4.3 Sub-section 3, Approval Requirements This section identifies all the close out documents required by the owner and the Authority Having Jurisdiction as part of the overall commissioning process.

a) Identify method of approval (acceptance) required (verbal or written) from the owner and the Authority Having Jurisdiction if system satisfied all applicable code and standards compliance requirements.
b) Identify method of remedial action when a system or portion of a system fails to operate as specified and or as required by codes and standards or the sequence of operations (matrix).
c) Documentation to be submitted at completion verifying that systems are in compliance with all applicable codes and standards, requirements of the authority Having Jurisdiction, narrative, design and specifications and sequence of operations (matrix).
d) Documentation to be submitted to the Authority Having Jurisdiction listing names, addresses and telephone number of personnel for emergency notification

Annex D Additional Publications

D.1 General. The documents or portions thereof listed in this Annex are referenced within this standard and should be considered for use in the commissioning process.

D.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2007 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2005 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2008 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2004 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2007 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2007 edition.

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 2007 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2007 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2007 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2007 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2008 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2008 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2007 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2008 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2007 edition.

NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems*, 2008 edition.

NFPA 69, *Standard on Explosion Prevention Systems*, 2008 edition.

NFPA 72®, *National Fire Alarm Code*®, 2007 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows*, 2007 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2002 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2006 edition.

NFPA 92A, *Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences*, 2006 edition.

NFPA 92B, *Standard for Smoke Management Systems in Malls, Atria, and Large Spaces*, 2005 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2008 edition.

NFPA 101®, *Life Safety Code*®, 2006 edition.

NFPA 101A, *Guide on Alternative Approaches to Life Safety*, 2007 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2005 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2005 edition.

NFPA 115, *Standard for Laser Fire Protection*, 2003 edition.

NFPA 720, *Standard for the Installation of Carbon Monoxide (CO) Warning Equipment in Dwelling Units*, 2005 edition.

NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2006 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2006 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2008 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2007 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2008 edition.

NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*, 2006 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2006 edition.

D.3 Other Publications

D.3.1 ASHRAE Publication. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle NE, Atlanta, GA 30329

ASHRAE Guideline 0 The Commissioning Process, 2005

D.3.2 ASME Publication. American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

ANSI/ASME A17.1 Safety Code for Elevators and Escalators, 2000.

D.3.3 NIBS Publication. National Institute of Building Sciences, 1090 Vermont Avenue, NW, Suite 700 | Washington, DC 20005-4905

Using the Commissioning Process Guidelines (NIBS)

D.3.4 CEN, European Committee for Standardization, 36 rue de Stassart, B-1050, Brussels.

EN12845.

D.3.5 Standards Australia Publications. Standards Australia, Level 10 The Exchange centre, 20 Bridge St., Sydney / GPO Box 476. Sydney, NSW 2001.

AS 1670.1-2004 Fire Detection, Warning, Control and Intercom Systems – System Design, Installation and Commissioning.

AS 2419.1-2005 Fire Hydrant Installations – System Design, Installation and Commissioning.

AS 2665-2001 Smoke/Heat Venting Systems – Design, Installation and Commissioning.

AS 4528.1-1999 Water Mist Fire Protection Systems – System Design, Installation and Commissioning.

D.3.6 ULC Publications. Underwriters' Laboratories of Canada, 7 Underwriters' RD., Toronto, ON M1R3B4

ULCS537 Verification of Fire Alarm Systems

CAN/ULC-S575 Commissioning of Life Safety and Fire Protection Systems