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**CONDUCT OF MAINTENANCE (P950)
OPERATIONS AND MAINTENANCE MANUAL
OPERATIONS & MAINTENANCE CRITERION**

TITLE: FIRE ALARM SYSTEMS

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Classification

The information in this document is within the Construction and Facilities Engineering (CONST) Designated Unclassified Subject Area (DUSA); therefore, this document is Unclassified.



RECORD OF REVISIONS

Revision No.	Date	Description
0	08/27/98	Initial Issue
1	05/17/02 7/12/02 7/29/02	<p>This revision reflects the conversion from a WordPerfect document into a Microsoft Word document and additional clarification on how to develop criteria. This revision includes:</p> <ul style="list-style-type: none"> • The addition of a Table of Contents, • The use of basis statements in Sections 6, 7 and 9. • Revision to Section 9, "Required Documents," and further clarification in the use of references. <p>Changes to Section 4.0 to address O& M Criterion written by groups other than FWO-SEM.</p> <p>Changes to Section 4.4 per Writer's Guide change</p> <p>Incorporation of wording changes from FM Council in Sections 6.0 and 9.0</p>
2	04/13/10	<p>Complete revision, including the following –</p> <ul style="list-style-type: none"> • Changes reflect current LANL organizations • Change reference to reflect P950, <i>Conduct of Maintenance</i> • Remove DOE O 430.1B references from Section 1 • Incorporate 2008 edition of NFPA 25, <i>Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems</i> • Incorporate 2010 edition of NFPA 72, <i>National Fire Alarm and Signaling Code</i> • Incorporate LASO action on cancellation and modification of 1999-era equivalencies to portions of NFPA 25 and 72 (LASO Memorandum No. SO:21WF-203741, <i>National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification</i>, January 19, 2010) • Incorporate DOE <i>Interim Guidance on Design and Operational Criteria for Safety Class and Safety Significant Wet Pipe Sprinkler Systems</i> (November 2009)

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CRITERION 720 FIRE ALARM SYSTEMS

1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of fire detection and alarm systems and equipment at LANL.

This document addresses the requirements of P 315, *Conduct of Operations Manual*, and P 950, *Conduct of Maintenance*, by defining the minimum operations and maintenance criteria for structures, systems, and components (SSCs) that it covers. The criterion lists requirements that are based on codes, standards, contract commitments, lessons learned, or business case and LASO direction on previous equivalencies to some NFPA 25 and 72 inspection, testing and maintenance (ITM) requirements (Ref. 10.7 & 10.8). Furthermore, this Criterion includes requirements and recommendations contained in DOE interim guidance for the operation of safety class (SC) and safety significant (SS) wet pipe sprinkler systems – developed in response to DNFSB Recommendation 2008-1, *Safety Classification of Fire Protection Systems* (January 29, 2008) (Ref. 10.12). It also lists recommendations based on industry practices, operational experience, or business case. Guidance for implementation of the requirements and recommendations is also provided.

Implementation of this Criterion satisfies LANL PD 1220, *Fire Protection Program* (Ref. 10.4), 10 CFR 851, Worker Safety and Health Program, Appendix A.2 "Fire Protection" and DOE Order 420.1B, Facility Safety, Chapter II "Fire Protection" ITM requirements for the subject equipment / system. Compliance with 10 CFR 851 and DOE Order 420.1B are required by the LANL Prime Contract (DOE Contract No. DE-AC52-06NA25396).

2.0 SCOPE

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of fire alarm systems. The requirements contained within this criterion are graded based in-part on the safety function assigned to the fire detection and alarm system, facility hazard categorization, and mission importance or "fire loss risk" associated with the facility. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
CAS	Central Alarm Station

CFR	Code of Federal Regulations
DACS	Digital Alarm Communications System
DOE	Department of Energy
DNFSB	Defense Nuclear Facilities Safety Board
DSA	Documented Safety Analysis
FACP	Fire Alarm Control Panel
FOD	Facility Operations Director
FPEE	Fire Protection Engineering Evaluation
ITM	Inspection, Testing, and Maintenance
LASO	Los Alamos Site Office
ML	Management Level
MM	Maintenance Manager
NFPA	National Fire Protection Association
OM	Operations Manager
O&M	Operations and Maintenance
SC	Safety Class
SS	Safety Significant
SSC	Structures, Systems, and Components
TSR	Technical Surveillance Requirement

3.2 Definitions

Management Level (ML1, ML2, ML3, ML4) - ML designation is used to grade the structures, systems, equipment, and components and associated activities based on their importance to the protection of the public, environment, and workers, security, and the Laboratory mission. See AP-341-502, *Management Level Determination* for definitions of each ML level.

4.0 RESPONSIBILITIES

4.1 MSS-Division Leader (MSS-DL)

Receives and approves or rejects, in conjunction with the AHJ, requests for variances from this criterion. Maintains the record of decision for all variance requests.

4.2 MSS- Maintenance Programs (MSS-MP)

Responsible for the administrative content, and for monitoring applicability and implementation status of this Criterion. MSS-MP will assist organizations that are not applying or meeting the implementation expectations contained herein or will elevate their concerns to the appropriate level of LANL management.

4.3 Fire Protection Division Office (FP-DO)

FP is responsible for the technical content of this Criterion and assessing the proper implementation across the Laboratory.

FP shall provide technical assistance to support implementation of this Criterion.

4.4 Facility Operations Director (FOD)

Responsible for implementation of this O&M Criterion for identified systems/equipment within their facility boundaries.

4.5 Operations Manager (OM)

Responsible to the FOD for implementing operation portions of this Criterion and for coordinating transfer of systems/equipment to the Maintenance Manager for maintenance activities. The OM with concurrence of the FOD will prioritize implementation within budget allocations.

4.6 Maintenance Manager (MM)

Responsible to the FOD and the MSS-Division Leader for implementing the maintenance portions of this Criterion and for coordinating the transfer of systems/equipment to the Operations Manager at the conclusion of maintenance activities. The MM with concurrence of the FOD will prioritize implementation within budget allocations.

4.7 Authority Having Jurisdiction (AHJ)

4.7.1 The AHJ (Point of Contact for the Fire Protection Chapter of the LANL Engineering Manual) is responsible for providing a decision on specific technical questions regarding the systems or equipment relevant to this Criterion.

4.7.2 The LANL Fire Marshal is an approval authority for all exceptions and variances to this Criterion. The LANL Fire Marshal cannot approve deviations or exemptions to CFR, DOE Orders or NFPA Codes and Standards – the fire protection AHJ for these matter is the LASO Manager per DOE O 420.1B (see PD 1220).

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Precautions

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. However, all applicable precautions should be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work

control document in the identification of hazards and precautions that may not be immediately obvious.

5.2 Limitations

The intent of this Criterion is to identify the minimum requirements and recommendations for SSC operation and maintenance across the Laboratory. Each Criterion user is responsible for the identification and implementation of additional facility specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, manufacturer O&M requirements and guidance, etc.)

Nuclear facilities and moderate to high hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities should implement the requirements of DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities* as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order or the Code of Federal Regulations (CFR) identified above.

Nuclear facilities and certain high hazard facilities (e.g. high explosive operations) may have additional facility specific requirements beyond those presented in this Criterion which are contained in the Documented Safety Analysis (DSA), Technical Surveillance Requirements (TSR), or facility safety plans, as applicable.

6.0 REQUIREMENTS

Minimum requirements for all users are specified in this section. Requested variances to these requirements shall be prepared and submitted to MSS-MP for review and approval. The MSS Division Leader approves or denies variances. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgment, safety matters, and operations and maintenance experience drive the requirements contained in this section.

The requirements specified in this section are presented in a graded approach based on codes and standards (primarily NFPA 72), contract commitments, lessons learned and LASO direction on previous equivalencies to some NFPA 25 and 72 ITM requirements (Ref. 10.7 & 10.8). Furthermore, this Criterion includes requirements and recommendations contained in DOE interim guidance for the operation of safety class (SC) and safety significant (SS) wet pipe sprinkler systems – developed in response to DNFSB Recommendation 2008-1, *Safety Classification of Fire Protection Systems* (January 29, 2008) (Ref. 10.12).

In negotiation with LASO, FP-DO maintains the list of facilities designated as “high value” facilities for the purposes of this Criterion.

Note: Discovery of SSC with a degraded or non-conforming condition is a triggering input to the Operability Determination and Functional Assessment process defined in AP-341-516. Degraded or non-conforming conditions include, but are not limited to, failed equipment or components, unsatisfactory readings, code or standard violations and fire protection impairments. Personnel performing tests or inspections under this O&M Criterion are not responsible nor authorized to perform the Operability Determination. Any degraded or non-conforming condition discovered under this O&M Criterion shall be communicated to the FOD Representative for input to the AP-341-516 process. While that process may not apply in Low Hazard Non-Nuclear and Office facilities, the same concept applies. The FOD organization is responsible to determine the response (taking equipment out of service, establishing fire watches, limiting operations, etc.) to SSC degraded and non-conforming conditions.

6.1 Operations Requirements

6.1.1 Operations Checklist

The fire alarm system must remain in service at all times. The fire alarm system shall be deemed operational when the following conditions are met (including automatic transmission of signals to CAS):

- Alternating current (AC) is supplied to the system (normal power).
- Direct current (DC) is supplied to the system (emergency/backup power).
- All required alarm initiation devices are installed and operational.
- All required alarm notification appliances are installed and operational.
- The control panel is clear of any faults, alarms, supervisory signals, and trouble conditions.
- Sprinkler waterflow alarms are operational.
- Supervisory devices are operational.

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code, Chapter 14 and NFPA 25, 2008 Edition, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, Chapter 5. Compliance with these Codes are required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II "Fire Protection," both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program.

6.2 Maintenance Requirements

6.2.1 Testing (including transmission of alarm)

- Fire alarm systems and other systems and equipment that are associated with fire alarm systems and accessory equipment shall be tested using methods described in NFPA 72, Table 14.4.2.2.

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code.

- Testing of audible or visual notification appliances shall verify the alarm can be heard and/or seen from all areas. During this testing, consideration must be given to the normal ambient noise in the area (e.g., fans, motors, etc.).

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code

- Testing of fire alarm equipment/system related batteries & chargers should be performed with the use of Stone Technologies Model #4110 Battery Testers and respective FP-DO Guidance – see Appendix C.

Basis: FP-DO Fire Protection Engineering Evaluation FPEE #09-004 and Fire Alarm Equipment “Charger Test” Recommendations.

6.2.1.1 Nuclear Facilities, High Hazard Non-Nuclear Facilities and “High Value” Facilities

Fire alarm system testing shall be conducted in accordance with Appendix B to this Criterion (equivalent to NFPA 72, Table 14.4.5).

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code, and NFPA 25, 2008 Edition, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems. Compliance with these Codes are required per 10 CFR 851, Appendix A.2, and DOE O 420.1B Chapter II “Fire Protection,” both of which are required per the LANL Prime Contract as part of implementing a comprehensive fire protection program. See also LASO Memorandum No. SO:21WF-203741, National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation / Modification (1/19/2010). See also DOE Interim Guidance on Design and Operational Criteria for Safety Class and Safety Significant Wet Pipe Sprinkler Systems, November 2009.

6.2.1.2 Balance of LANL Facilities

Fire alarm system testing shall be conducted in accordance with Appendix B to this Criterion (equivalent to NFPA 72, Table 14.4.5), EXCEPT Heat Detectors, Smoke Detectors, and Manual Pull Stations (alarm only) may be tested every 2 years.

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code, NFPA 25, 2008 Edition, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, and DOE-approved Equivalencies to NFPA 25 and 72 (Ref. 10.7 & 10.8). See also LASO Memorandum No. SO:21WF-203741, National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification (1/19/2010).

6.2.2 Inspection

Visually inspect fire alarm system components as described in NFPA 72 Table 14.3.1. Appendix A of this Criterion lists the equipment required to be visually inspected and required inspection frequencies.

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code.

6.2.3 Maintenance

Repair or replace any device that fails a test or inspection in accordance with the manufacturer's instructions.

Basis: NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code and NFPA 25, 2008 Edition, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protections Systems.

6.2.3.1 Smoke Detectors

- Using one of the methods described in NFPA 72 Table 14.4.2.2, Test Methods, check the sensitivity of each smoke detector within 1 year of installation and every 2 years thereafter in accordance with the manufacturer's instructions. Use manufacturer approved equipment to conduct test. Clean any smoke detector found to be outside its listed and marked sensitivity range (or 4% obscuration light gray smoke, if not marked) per manufacturer's recommendations and recheck for correct sensitivity before reinstalling the unit.
- A smoke detector/control unit arrangement whereby the detector causes a signal at the control unit when its sensitivity is outside its listed sensitivity range, is an allowable method and does not require performing a physical sensitivity test.
- See NFPA 72 14.4.2.2, Test Methods, for additional information.

Basis: NFPA 72, 2010 Edition National Fire Alarm and Signaling.

6.3 Impairments and Modifications

If one or more of the operational requirements listed in Section 6.1 above are not met, follow the requirements in Criterion 733, Fire Protection System Impairment Control Program.

6.3.1 *Inspection (following an Impairment or Modification)*

Visually inspect the system before returning it to service (see Appendix A).

6.3.2 *Testing (following an Impairment or Modification)*

Test the device(s) affected to verify they are operating properly [included transmission of alarms to propriety fire alarm system (DACs)]. See NFPA 72, 14.4.1.2, *Reacceptance Testing* for additional information.

Basis: All requirements regarding impairments are based upon NFPA 72, 2010 Edition, National Fire Alarm and Signaling Code and NFPA 25, 2008 Edition, Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, Chapter 15.

6.4 Personnel Qualifications

Service personnel shall meet the qualification and experience requirements of NPFA 72. LANL will use personnel certified by a nationally recognized fire alarm certification organization.

7.0 RECOMMENDED AND GOOD PRACTICES

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each Criterion user based on the unique application and operating history of the subject systems/equipment.

7.1 Operations Recommendations

Operational testing and alarm verification should be conducted by MSS Fire Protection Maintenance personnel, in compliance with PD 1220, Fire Protection Program.

Where operational testing for specialty fire suppression systems or unique fire detection and alarm equipment is provided by an off-site vendor, MSS personnel are required to provide support for this operational testing by managing alarm signal verifications and communications at and from the building DACS fire alarm control panel with the LANL proprietary fire alarm system.

Basis: PD 1220, Fire Protection Program

7.2 Maintenance Recommendations

As a core function, MSS provides inspection, testing, and maintenance services for complex fire protection systems and shall remove systems from service for testing, drills, modifications, repairs and related activities.

Basis: PD 1220, Fire Protection Program

8.0 GUIDANCE

8.1 Operations Guidance

None

8.2 Maintenance Guidance

None

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained by the FOD for fire alarm systems to include, as a minimum, the parameters listed in the Table 9-1 below:



Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	ML 1	ML 2	ML 3	ML 4
Fire Alarm Maintenance Activities				
Repair / Adjustments	X	X	X	X
PM Activities	X	X	X	X
Fire Alarm Equipment Problems				
Failure Dates	X	X	X	X
Failure Root Cause	X	X	X	X
Fire Alarm Inspection Results (per this Criterion)				
Inspection Date	X	X	X	X
SSC Condition	X	X	X	X

Basis: Documentation of the parameters listed in Table 9-1 above satisfies the requirements of P 950, Section 3.5.15 which states, "A maintenance history and trending program is maintained to document data, provide historical information for maintenance planning, and support maintenance and performance trending of facility systems and components."

10.0 REFERENCES

The following references, and associated revisions, were used in the development of this document.

- 10.1 P 315, *Conduct of Operations Manual*
- 10.2 P 950, *Conduct of Maintenance*
- 10.3 PD 311, "Requirements System and Hierarchy", Rev. 1
- 10.4 PD 1220, *Fire Protection Program*
- 10.5 NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems*, 2008 Edition
- 10.6 NFPA 72, *National Fire Alarm and Signaling Code*, 2010 Edition
- 10.7 LANL Equivalency to NFPA 72, consisting of: (a) LANL Memorandum No. FSS-21-98-009, *Proposed Equivalency to NFPA Standard 72*, March 27, 1998; (b) DOE AOO Memorandum No. OSS/ESH/D (Inlow to Gurule), *Equivalency for Testing Frequencies of Initiating Devices in NFPA 72, National Fire Alarm Code*, April 8, 1999; and (c) DOE AOO/LAAO Memorandum No. LAAMFO:3KZ-050 (Zamora to Gourdoux), *Transmittal Letter for NFPA 25 Equivalency Requests*, January 26, 2000.

- 10.8 LANL Equivalency to NFPA 25, consisting of: (a) LANL Memorandum No. FE-21-98-005, *Proposed Equivalency to NFPA Standard 25*, dated June 9, 1998; (b) DOE AOO/LA00 Memorandum No. LAAMFO:3TR-021, *Fire Protection Inspection, Test, and Maintenance Requirements*, dated 6/9/1998; and (c) DOE AOO Memorandum No. T ASD:98-068:pc, *Disposition of LANL Equivalency Requests to NFPA 25 – Inspection, Testing, and Maintenance (ITM) Frequencies for Water-Based Fire Protection Systems*, dated July 24, 1998.
- 10.9 LASO Memorandum No. SO:21WF-203741, *National Fire Protection Association 25 and National Fire Protection Association 72 Equivalency Cancellation/Modification*, January 19, 2010
- 10.10 FP-DO Fire Protection Engineering Evaluation #FP EE-09-004, *Evaluation of Stone Technologies Model #4110 Battery Tester*, 7/8/09.
- 10.11 May 21, 2009 e-mail from Roger Cardon to Jim Streit – SUBJECT: RE: Fire Alarm Equipment “Charger Test” Recommendations, which includes FP-DO Guidance to MSS for acceptable voltage ranges for the Annual “Charger Test” Procedure.
- 10.12 DOE NNSA Memorandum for Thomas P. D’Agostino, Ines R. Triay and Steven E. Koonin, *Deliverable for Defense Nuclear Facilities Safety Board Recommendation 2008-1, Safety Classification of Fire Protection Systems*, dated December 9, 2009, including: (a) Attachment 2 – *Interim Guidance on Design and Operational Criteria for Safety Class and Safety Significant Wet Pipe Sprinkler Systems, Milestone 5.3.1 Deliverable, Defense Nuclear Facilities Safety Board Recommendation 2008-1, Safety Classification of Fire Protection Systems*, November 2009; and (b) Attachment 3 - *Interim Guidance on Design and Operational Criteria for Water Supply Systems Supporting Safety Class and Safety Significant Wet Pipe Sprinkler Systems, Milestone 5.3.1 Deliverable, Defense Nuclear Facilities Safety Board Recommendation 2008-1, Safety Classification of Fire Protection Systems*, November 2009.

11.0 APPENDICES

Appendix A: Visual Inspection List

Appendix B: Testing Frequencies

Appendix C: Fire Alarm Equipment Battery Testing Criteria



APPENDIX A VISUAL INSPECTION LIST

Requirement: Visually inspect to ensure that there are no changes that can affect equipment operations. (Ref. NFPA 72 Table 14.3.1)

Component	Initial/ Reacceptance	Monthly	Quarterly	Semi- Annually	Annually
1. Control Equipment: fire alarm systems monitored for alarm, supervisory, and trouble signals					
a. Fuses	X	--	--	--	X
b. Interfaced equipment	X	--	--	--	X
c. Lamps and LEDs	X	--	--	--	X
d. Primary (main) power supply	X	--	--	--	X
2. Control Equipment : fire alarm systems unmonitored for alarm, supervisory, and trouble signals					
a. Fuses	X (weekly)	--	--	--	--
b. Interfaced equipment	X (weekly)	--	--	--	--
c. Lamps and LEDs	X (weekly)	--	--	--	--
d. Primary (main) power supply	X (weekly)	--	--	--	--
3. Batteries					
a. Sealed lead-acid	X	--	--	X	--
4. Transient Suppressors	X	--	--	X	--
5. Fire Alarm Control Unit Trouble Signals	X (weekly)	--	--	X	--
6. Fiber-Optic Cable Connections	X	--	--	--	X
7. In-Building Fire Emergency Voice / Alarm Communications Equipment	X	--	--	X	--
8. Remote Annunciators	X	--	--	X	--
9. Initiating Devices					
a. Air sampling	X	--	--	X	--
b. Duct detectors	X	--	--	X	--
c. Electromechanical releasing devices	X	--	--	X	--
d. Fire extinguishing system(s) or suppression system(s) switches	X	--	--	X	--
e. Manual fire alarm boxes	X	--	--	X	--
f. Heat detectors	X	--	--	X	--
g. Radiant energy fire detectors	X	--	X	--	--
h. Smoke detectors	X	--	--	X	--
i. Supervisory signal devices	X	--	X	--	--
j. Waterflow devices	X	--	X	--	--



APPENDIX A
VISUAL INSPECTION LIST

Component	Initial/ Reacceptance	Monthly	Quarterly	Semi- Annually	Annually
10. Combination Systems					
a. Fire extinguisher electronic monitoring device / systems	X	--	--	X	--
b. Carbon monoxide detectors / systems	X	--	--	X	--
11. Interface Equipment	X	--	--	X	--
12. Alarm Notification Appliances - Supervised	X	--	--	X	--
13. Supervising Station Alarm Systems -- Transmitters					
a. DACT	X	--	--	X	--
14. Special Procedures	X	--	--	X	--
15. Supervising Station Alarm Systems -- Receivers*	X	--	--	X	--

*Reports of automatic signal receipt shall be verified daily.



APPENDIX B
TESTING FREQUENCIES
(Based on NFPA 72, Table 14.4.5)

Testing Frequencies

Component	Initial/ Reacceptance	Monthly	Quarterly	Semi- Annually	Annually	Table 14.4.2.2 Reference
1. Control Equipment – Building Systems Connected to Supervising Station						1, 7, 18, 19
a. Functions	X	--	--	--	X	--
b. Fuses	X	--	--	--	X	--
c. Interfaced equipment	X	--	--	--	X	--
d. Lamps and LEDs	X	--	--	--	X	--
e. Primary (main) power supply	X	--	--	--	X	--
f. Transponders	X	--	--	--	X	--
2. Engine-Driven Generator – Central Station Facilities and Fire Alarm Systems	X	X	--	--	--	--
3. Batteries – Central Station Facilities						
a. Sealed lead-acid test						6d
1. Charger test (Replace battery within 5 years after manufacture or more frequently as needed.)	X	X	X	--	--	--
2. Discharge test (30 minutes)	X	X	--	--	--	--
3. Load voltage test	X	X	--	--	--	--
4. Batteries – Fire Detection and Alarm Systems						
a. Sealed lead-acid type						6d
1. Charger test (Replace batteries within 5 years after manufacture or more frequently as needed.)	X	--	--	--	X	--
2. Discharge test (30 minutes) – see App C	X	--	--	--	X	--
3. Load voltage test - see Appendix C	X	--	--	X	--	--
5. Fiber-Optic Cable Power	X	--	--	--	X	13b
6. Control Unit Trouble Signals	X	--	--	--	X	10
7. Conductors – Metallic	X	--	--	--	--	12
8. Conductors – Nonmetallic	X	--	--	--	--	13
9. In-Building Fire Emergency Voice / Alarm Communications Equipment	X	--	--	--	X	20
10. Retransmission Equipment (The requirements of 14.4.10 shall apply.)	X	--	--	--	--	--
11. Remote Annunciators	X	--	--	--	X	11

APPENDIX B
TESTING FREQUENCIES
(Based on NFPA 72, Table 14.4.5)

Testing Frequencies (continued)

Component	Initial/ Reacceptance	Monthly	Quarterly	Semi- Annually	Annually	Table 14.4.2.2 Reference
12. Initiating Devices*						14
a. Duct detectors	X	--	--	--	X	--
b. Electromechanical releasing device	X	--	--	--	X	--
c. Fire-extinguishing system(s) or suppression system(s) switches	X	--	--	--	X	--
d. Fire-gas and other detectors	X	--	--	--	X	--
e. Heat detectors (The requirements of 14.4.5.5 shall apply.)	X	--	--	--	X	--
f. Manual fire alarm boxes (pull stations)	X	--	--	--	X	--
g. Radiant energy fire detectors	X	--	--	X	--	--
h. System smoke detectors – functional test	X	--	--	--	X	--
i. Smoke Detectors – Sensitivity (The requirements of 14.4.5.3 shall apply.)	--	--	--	--	--	--
j. Supervisory signal devices						
1. Valve supervisory switches	X	--	--	X	--	--
2. Pressure supervisory indicating devices	X	--	X	--	--	--
3. Water level supervisory indicating devices	X	--	X	--	--	--
4. Water temperature supervisory indicating devices	X	--	X	--	--	--
5. Room temperature supervisory indicating devices	X	--	X	--	--	--
6. Other suppression system supervisory initiating devices	X	--	X	--	--	--
7. Other supervisory initiating devices	X	--	--	--	X	--
k. Waterflow devices	X	--	--	X	--	--
13. Combination Systems						
a. Fire extinguisher electronic monitoring device / systems	X	--	--	--	X	21a
b. Carbon monoxide detectors / systems	X	--	--	--	X	
14. Interface Equipment and Emergency Control Functions	X	--	--	--	X	22, 23
15. Special Hazard Equipment	X	--	--	--	X	17
16. Alarm Notification Appliances						15
a. Audible devices	X	--	--	--	X	--
b. Audible textual notification appliances	X	--	--	--	X	--
c. Visible devices	X	--	--	--	X	--



APPENDIX B
TESTING FREQUENCIES
(Based on NFPA 72, Table 14.4.5)

Testing Frequencies (continued)

Component	Initial/ Reacceptance	Monthly	Quarterly	Semi- Annually	Annually	Table 14.4.2.2 Reference
17. Exit Marking Notification Appliances	X	--	--	--	X	16
18. Supervising Station Alarm Systems – Transmitters	X	--	--	--	X	18
19. Special Procedures	X	--	--	--	X	25
20. Supervising Station Alarm System–Receivers	--	--	--	--	--	19
a. DACR	X	X	--	--	--	--
*See A.14.4.5.						

Appendix C

FP-DO Guidance for Annual FACP "Charger Test" Procedure (5/12/09)

Below are the LANL FP-DO Fire Protection Group's recommendations for acceptable voltage ranges that should be utilized in the Annual FACP "Charger Test" Procedure. These ranges are based on the specifications of a specific manufacturer's Battery Test Equipment (Stone Technologies Corporation) --- not the battery manufacturer, fire alarm equipment manufacturer, or NFPA's lower & upper limits.

Below are the prerequisite verifications that are required prior to performing the charger test and need to be documented accordingly:

- ❖ Verification that the existing battery(s) are properly sized per NFPA 72 requirements (via design calculations and/or actual Standby/Alarm values) for the respective system.
- ❖ Verification that the existing batteries are less than 5 years old per code requirements. If the batteries are greater than 4 years old and will be greater than 5 years old by the next scheduled "Charger Test" --- battery replacement is recommended.
- ❖ Verification if the fire alarm equipment manufacturer allows the adjustment of the respective battery charger without voiding respective UL Listings.
- ❖ Verification that the Fire Alarm System is in "Normal Condition" (no trouble conditions present) and all initiating and notification appliances are not impaired.

The following measurements will be taken with a properly calibrated electrical multi-meter.

12V SYSTEMS	CRITERIA	ACTION REQUIRED
Too Low to Test	<12.10V	Stop and determine the path forward. May require battery replacement and/or equipment manufacturer's supporting documentation..
Normal Charged Battery	12.10V-13.5V	Record actual reading & proceed to "Annual Discharge Test".
Normal Charging Voltage	13.5V-14.20V	Record actual reading & proceed to "Annual Discharge Test".
Overcharging/Open Battery	>14.20V	Stop and determine the path forward. May require battery replacement and/or equipment manufacturer's supporting documentation.



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24V SYSTEMS	CRITERIA	ACTION REQUIRED
Too Low to Test	<24.20V	Stop and determine the path forward. May require battery replacement and/or equipment manufacturer's supporting documentation..
Normal Charged Battery	24.20-27.0V	Record actual reading & proceed to "Annual Discharge Test".
Normal Charging Voltage	27V-28.4V	Record actual reading & proceed to "Annual Discharge Test".
Overcharging/Open Battery	>28.4V	Stop and determine the path forward. May require battery replacement and/or equipment manufacturer's supporting documentation.

- ❖ If the results above determine that it is acceptable in proceeding to the "annual Discharge Test" and the Discharge Test "Passes" ---- the "Charger Test" should be considered "Satisfactory".
- ❖ If the results above determine that it is unacceptable, the first step would be to replace the batteries with new batteries and allow at least 48 hours before attempting the test again.
- ❖ If the results with the new batteries still do not meet the above criteria – formal documentation from the fire alarm equipment manufacturer will be required – detailing the path forward on whether the actual readings are acceptable or if the respective equipment needs to be replaced (even though the FACP does not indicate a "trouble" condition).

Older panels, such as some Autocall, FCI, & Fenwal equipment, present some other issues related to "charger adjustments" and U.L. Listing issues that should be addressed on a case by case basis with FP-DO.