

# LEVEL III — SIMULATION EXAM 7

## (115 QUESTIONS)

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**Time Limit: 170 Minutes**

**Allowed References: NFPA 72 (2022), NFPA 70 (2020), Ugly's Electrical References (2020)**

### **DOMAIN 3.1 — INSTALLATION (Questions 1–40)**

1. A fire alarm designer is specifying a networked fire alarm system for a corporate campus with ten buildings. The network uses fiber optic cable between buildings. Building 6 is a standalone parking garage with no fire alarm panel — only waterflow and tamper switches. The designer proposes connecting the garage's devices directly to Building 5's SLC loop via a 400-foot underground conduit. A reviewer asks whether this approach is appropriate. What is the correct assessment?

- A. The approach is acceptable because SLC loops may extend between buildings without limitation
- B. The approach is acceptable if the underground cable uses waterproof splice enclosures
- C. The 400-foot underground SLC extension creates a vulnerability — a dedicated panel in the garage with network connection is more reliable
- D. NFPA 72 prohibits SLC loops from crossing between separate buildings under any circumstance

2. A fire alarm designer is performing a battery calculation for a voice evacuation system. The building has a qualifying generator. Main panel loads: panel/SLC standby = 0.98A, voice amplifier standby = 2.02A, network = 0.50A. Alarm loads: NAC = 6.4A, voice = 14.0A. Using 4-hour standby, 15-minute alarm, 20% safety factor, what is the minimum main panel battery capacity?

- A. Approximately 20.16 Ah after applying all three factors to main panel loads
- B. 16.80 Ah using correct durations without the 20% safety factor

- C. 32.40 Ah using 24-hour standby because generators do not reduce voice requirements
- D. 24.00 Ah using 4-hour standby with standard 5-minute alarm duration

3. A fire alarm designer is specifying pathway survivability for a 44-story high-rise. The specification requires Level 2 on all voice circuits. The designer proposes CI cable for all riser circuits. At each floor, CI cable exits the riser shaft and transitions to standard FPLP in EMT for horizontal runs to speakers. A code reviewer questions this transition. What is the impact?

- A. The transition is acceptable because EMT provides equivalent fire protection to CI cable
- B. The FPLP maintains Level 2 for 100 feet beyond the riser shaft exit per NFPA 72
- C. Level 2 is maintained throughout because CI cable at the riser extends protection to the entire circuit
- D. Level 2 is lost at each floor where CI cable transitions to FPLP in EMT — the FPLP/EMT has no 2-hour rating

4. A fire alarm designer is specifying cross-zone releasing for a clean agent system. The data center has a single large server room with two detection zones. During design review, the suppression contractor asks whether a single detector failure in Zone A would prevent agent discharge if a real fire occurs in Zone A's coverage area. What is the correct answer?

- A. Yes, and the failed detector should be replaced on an emergency basis
- B. No, Zone B detectors would activate from the same fire providing the second cross-zone confirmation
- C. Yes, but the releasing panel has a bypass mode allowing single-zone activation during maintenance
- D. No, the releasing panel automatically switches to single-zone mode when a detector fault is detected

5. A fire alarm designer is specifying detection for a 130-foot atrium in an international airport terminal. The atrium has a steel-and-glass roof, retail kiosks at ground level, and airline signage suspended from the structure. Aesthetic restrictions prohibit visible equipment on the glass walls or hanging from the steel structure. What detection approach is most appropriate?

- A. Video analytics smoke detection using existing security cameras at multiple levels

- B. Projected beam detectors mounted behind airline signage at three elevations
- C. Aspirating detection with sampling pipes concealed within existing HVAC ductwork at multiple heights
- D. Ceiling-mounted spot detectors suspended on aircraft cable at mid-atrium height

6. A fire alarm designer calculates NAC voltage drop: 12 AWG (1.98  $\Omega$ /1000 ft), round-trip 2,200 feet, 1.7 amps on 24 VDC.  $R = 4.356 \Omega$ .  $V_{\text{drop}} = 7.405\text{V}$ . End voltage = 16.60 VDC. Devices listed 16-33 VDC. The margin is 0.60V above minimum. Should the designer approve?

- A. No, 0.60V margin is insufficient — connection aging, temperature, and additions will erode it below 16 VDC
- B. Yes, the circuit meets minimum with adequate margin for a completed installation
- C. No, 12 AWG is not permitted for circuits exceeding 2,000 feet per NEC
- D. Yes, but a 20% safety factor must be added to the conductor resistance value

7. A fire alarm designer is developing the sequence of operations for a hospital with defend-in-place. The facility has patient care floors, surgical suites, an ED, a NICU, a dialysis center, and administrative offices. The dialysis center has patients connected to machines with blood circuits that cannot be suddenly disconnected. What notification approach is required for the dialysis center?

- A. Standard notification identical to administrative offices because dialysis is an outpatient service
- B. Full evacuation notification because dialysis patients are ambulatory
- C. Enhanced notification with louder alarms because dialysis machines create high ambient noise
- D. Restricted notification allowing clinical staff to manage orderly disconnection before evacuation

8. A fire alarm designer is evaluating speech intelligibility for a voice evacuation system. STI of 0.50 minimum specified. Three spaces present challenges: a glass-enclosed sky bridge (extreme reverberation from parallel glass walls), an underground utility tunnel (long cylindrical concrete tube), and a rooftop helipad (open air with wind noise). For which space is achieving 0.50 STI most architecturally complex?

- A. The rooftop helipad because wind noise creates constantly variable ambient conditions

- B. The underground tunnel because the cylindrical shape creates standing wave patterns requiring specialized speaker placement
- C. The sky bridge because parallel glass walls create flutter echo that conventional acoustic treatment cannot address
- D. All three present equal architectural complexity requiring identical solutions

9. A fire alarm designer is specifying communication for a high-rise with central station monitoring. The building has IP primary and cellular secondary. During commissioning, the IP path works perfectly. The cellular communicator shows "NO SIGNAL" due to the building's location in a cellular dead zone. Per NFPA 72, what is the status of this installation?

- A. The installation fails — the secondary path must be functional at commissioning
- B. The installation passes because only the primary path must be verified at commissioning
- C. The installation passes if the cellular carrier provides documentation of future coverage improvement
- D. The installation fails but may receive a temporary variance from the AHJ

10. A fire alarm designer is developing elevator recall for a building with three elevator banks. Bank A serves Floors 1-20. Bank B serves Floors 1-40 (express to 20, local 20-40). Bank C is a freight elevator serving Floors 1, B1, and B2. The machine room is on Floor 41. When the Floor 41 machine room detector activates, all three banks recall to alternate floors. Bank B's primary floor is the lobby. What must be Bank B's alternate?

- A. Floor 20 because it is Bank B's first local stop above the lobby
- B. Floor B1 because it provides the fastest exit from the building
- C. A floor other than the lobby that is appropriate for Bank B's service pattern
- D. Bank B has no alternate because express elevators are exempt from alternate floor recall

11. A fire alarm designer is specifying detection for a museum with a climate-controlled rare document vault. The vault maintains 65°F, 40% RH, and filtered positive pressure. Documents are irreplaceable. The designer must select detection that provides the earliest possible warning at the lowest smoke concentration. What is the most appropriate technology?

- A. Standard photoelectric spot detectors at half spacing for increased density
- B. Multi-criteria detectors combining photo, thermal, and CO sensing
- C. Rate-of-rise heat detectors for fastest thermal response
- D. Aspirating detection at high-sensitivity (ALERT) level for earliest smoke detection

12. A fire alarm designer is specifying conduit fill for 3/4-inch EMT carrying six 14 AWG THHN, four 16 AWG THHN, and four 18 AWG THHN (14 total). Mixed sizes prevent Annex C use. What method must be used?

- A. Compare each size to its individual Annex C maximum count
- B. Calculate total conductor area from Chapter 9 Table 5 and compare to the 40% fill allowance
- C. Use the Annex C table for 14 AWG as the controlling calculation
- D. Add counts and compare total to the smallest Annex C maximum present

13. A fire alarm designer is developing the fire command center per NFPA 72 Section 23.10. The building has a primary FCC in the lobby. A second-floor security office has a BMS workstation displaying fire alarm status through an integration gateway. The security director asks whether this workstation satisfies the FCC requirement. What is correct?

- A. No, a BMS workstation is not a fire alarm panel or dedicated repeater and does not satisfy NFPA 72 Section 23.10
- B. Yes, if the BMS displays complete fire alarm status with alarm, trouble, and supervisory
- C. Yes, but only if the fire alarm panel manufacturer certifies the BMS integration
- D. No, but the BMS workstation may serve as a secondary FCC if a repeater is also installed

14. A fire alarm designer is developing the fire pump monitoring interface for a building with an electric primary pump and a diesel backup pump. The diesel controller provides: pump running, power available, phase reversal, controller trouble, low fuel, high engine temperature, and failure to start. Per NFPA 72, how should "failure to start" be classified?

- A. As an alarm signal because pump failure during a fire is an emergency condition
- B. As a trouble signal because it indicates a fire alarm system reliability issue
- C. As a supervisory signal because it is an off-normal equipment condition requiring investigation
- D. Failure to start monitoring is optional for diesel backup pumps

15. A fire alarm designer specifies visible notification for a large indoor waterpark with multiple pools, waterslides, and a wave pool. Ceiling heights vary from 25 to 45 feet. Ambient noise from water features reaches 90 dB. The environment is extremely humid with chlorinated air. What notification challenge is MOST unique to this environment?

- A. The extreme humidity and chlorine accelerate strobe lens degradation reducing light output over time
- B. The varying ceiling heights prevent uniform candela coverage across the facility
- C. The 90 dB ambient requires 105 dB audible notification which is impractical near pool areas
- D. Standard notification appliances may not be rated for the high-humidity chlorinated environment requiring NEMA-rated devices

16. A fire alarm designer is developing a pre-action releasing system for a cold storage warehouse. The freezer section operates at -25°F. The pre-action valve and releasing panel are in a heated mechanical room at 72°F. The SLC loop serving the freezer detection must operate reliably at -25°F. What design consideration is critical?

- A. Standard SLC devices are rated for this temperature — no special consideration needed
- B. The SLC devices in the freezer must be rated for the -25°F operating temperature per their listing
- C. Only the panel must be rated for the temperature — field devices are inherently cold-resistant
- D. NFPA 72 prohibits addressable devices in spaces below 0°F

17. A fire alarm designer specifies the system for a 300-bed assisted living facility with defend-in-place. The facility has six buildings connected by enclosed walkways. Each building has its own panel on a peer-to-peer network. When a smoke detector activates in Building C, notification activates in Building C only. The fire marshal asks whether the other five buildings should be notified so staff can prepare to receive relocated residents. What determines the answer?

- A. The facility's approved fire safety plan determines inter-building notification scope
- B. NFPA 72 requires all connected buildings to notify when any building alarms
- C. Only the alarm building is notified in all defend-in-place implementations
- D. The fire department determines inter-building notification during each event

18. A fire alarm designer develops PAS for a commercial building. During the 180-second investigation period, a pull station on the same floor as the investigating smoke detector is activated. Per NFPA 72, what must happen?

- A. PAS continues because the pull station is on the same floor as the active investigation
- B. The investigation period extends by 180 seconds to allow investigation of the pull station
- C. PAS must immediately cancel and general notification must activate
- D. The pull station activation is queued until the PAS investigation completes

19. A fire alarm designer specifies the releasing circuit for a clean agent system in an occupied data center with a raised floor plenum. The agent nozzles are above the raised floor and below the raised floor. The below-floor nozzles protect cable runs in the plenum. Per the sequence, both above-floor and below-floor discharge must be simultaneous. How is this achieved?

- A. Both above-floor and below-floor nozzle banks connect to the same agent storage cylinder bank
- B. The releasing panel has independent outputs — one output opens above-floor valves and a separate output opens below-floor valves simultaneously
- C. Above-floor nozzles use one cylinder bank and below-floor nozzles use a separate bank
- D. Both above and below-floor nozzle banks are on a single releasing circuit with a common solenoid valve

20. A fire alarm designer specifies the system for a 38-story residential tower using defend-in-place. The building has two separate residential lobbies — a main lobby on Floor 1 and a secondary lobby on Floor 20 where a sky bridge connects to an adjacent building. When a smoke detector on Floor 25 activates, Floors 24, 25, and 26 are notified. The building manager asks whether the Floor 20 sky bridge lobby should also be notified. What is correct?

- A. The sky bridge lobby is always notified because it is a means of egress for upper floors
- B. The fire safety plan determines whether the Floor 20 lobby notification activates
- C. The Floor 20 lobby is notified only when all floors above Floor 20 are in alarm
- D. Sky bridge lobbies are exempt from defend-in-place notification per NFPA 72

21. A fire alarm designer specifies the architect's request for white devices. Per NFPA 72 Section 17.14.8, manual pull stations must be red. The architect proposes recessing pull stations behind white cabinet doors that open to reveal the red device. Per NFPA 72, is this acceptable?

- A. No, pull stations must be conspicuous and immediately accessible — a cabinet door conceals the device
- B. Yes, if the cabinet door has a red border identifying the location
- C. Yes, if the cabinet door is spring-loaded and labeled "FIRE ALARM"
- D. No, but a clear acrylic cover over the red pull station is acceptable

22. A fire alarm designer develops notification for a professional recording studio. The main recording room has 0 dB ambient when in use (completely silent). The control room has 45 dB ambient from equipment. Per NFPA 72, what minimum audible notification levels are required?

- A. Recording room: 0 dB, Control room: 45 dB — matching ambient is adequate
- B. Recording room: 15 dB, Control room: 60 dB — both at 15 dB above ambient
- C. Both rooms: 75 dBA minimum regardless of ambient level
- D. Both rooms must meet the 75 dBA minimum — 15 dB above ambient applies only when ambient exceeds 60 dB

23. A fire alarm designer evaluates voice evacuation for a 38-story building. The design uses central amplifiers on Floor 1 with remote power supplies on Floors 10, 20, and 30. Each remote has its own batteries. The designer discovers that Floor 20's remote power supply serves speakers on Floors 16-24 with a total alarm draw of 8.2 amps. Floor 10's remote serves Floors 6-15 with 5.8 amps. Why is a separate battery calculation required for each?

- A. Remote power supplies share the main panel's battery bus — no separate calculation needed
- B. Each remote panel's battery must be sized for its specific load because each serves different floor counts with different speaker quantities
- C. Only the remote with the highest alarm draw requires calculation — others use the same battery size
- D. NFPA 72 requires identical battery sizes at all remote power supply locations

24. A fire alarm designer specifies the kitchen hood suppression interface. The building has a main kitchen with a hood system and a separate catering kitchen with a second independent hood system. Each has its own monitor module. When the catering kitchen hood activates, what responses must the panel initiate?

- A. Only local catering kitchen notification because the main kitchen is unaffected
- B. Only station signal because secondary kitchen suppression events are supervisory
- C. Both hoods must activate simultaneously when either one detects a fire
- D. The full approved sequence — notification, station signal, and HVAC shutdown — regardless of which kitchen activates

25. A fire alarm designer specifies cable for a hospital. The space above the OR suite corridor ceiling is an active return air plenum. The OR suite itself has laminar flow HEPA-filtered supply with dedicated ducted return (non-plenum). What cable types are required?

- A. FPLP in both because all hospital surgical areas require plenum-rated cable
- B. FPLP in the corridor plenum ceiling and FPL minimum in the non-plenum OR ceiling
- C. FPL in both because hospital corridors with sprinklers are reclassified as non-plenum
- D. FPLR in both because the vertical connection between floors creates a riser

26. A fire alarm designer specifies the system for a building with eight sprinkler risers serving different building wings. Each riser has waterflow and tamper switches — sixteen zones total. The fire captain requests zone-specific annunciation at the FCC graphic annunciator with each waterflow zone corresponding to the building wing's floor plan area. What operational advantage does this provide?

- A. Zone-specific waterflow is required by NFPA 72 for buildings with more than four risers
- B. Individual annunciation eliminates the need for tamper monitoring on the same risers
- C. Zone-specific annunciation tells responding firefighters which wing has active water flow before they enter the building
- D. Zone-specific response is prohibited — all waterflow must trigger identical building-wide annunciation

27. A fire alarm designer specifies heat detection for a cold storage facility. Freezer at  $-30^{\circ}\text{F}$ . Refrigerated processing at  $35^{\circ}\text{F}$ . Loading dock fluctuates  $0^{\circ}\text{F}$  to  $100^{\circ}\text{F}$ . Office at  $72^{\circ}\text{F}$ . The processing room has constant  $35^{\circ}\text{F}$  temperature. What minimum heat detector activation temperature is required for the processing room?

- A. At least  $55^{\circ}\text{F}$  to maintain the  $20^{\circ}\text{F}$  margin above the  $35^{\circ}\text{F}$  ambient
- B.  $135^{\circ}\text{F}$  because it is the standard commercial heat detector rating
- C.  $35^{\circ}\text{F}$  for immediate response to any temperature exceeding the controlled environment
- D.  $72^{\circ}\text{F}$  matching the highest adjacent occupied space temperature

28. A fire alarm designer develops elevator recall for a building with three elevator banks. Banks A and B serve a 30-story tower. Bank C serves only a 5-story parking garage adjacent to the tower. The tower and garage share a common lobby. The tower machine room is on Floor 31. The garage machine room is in the garage penthouse. When the tower machine room detector (Floor 31) activates, which elevators must recall?

- A. All three banks must recall because they share a common lobby
- B. Only Banks A and B recall because they are served by the Floor 31 machine room
- C. All three banks recall to alternate floors since the tower and garage are connected

D. Only Banks A and B recall — Bank C has a separate machine room and is unaffected by Floor 31 detection

29. A fire alarm designer specifies mass notification integrated with voice evacuation. The emergency plan requires mass notification to override fire alarm audio during a chemical release. During the override, the fire alarm panel receives a new alarm from a different floor. Per NFPA 72, what must happen to the new alarm signal?

- A. The new alarm is queued until mass notification concludes
- B. The new alarm transmits to the supervising station while mass notification continues its override
- C. Mass notification must yield to the new fire alarm and restore fire audio
- D. The new alarm is discarded because mass notification has priority over all fire signals

30. A fire alarm designer develops the releasing circuit for a pre-action sprinkler using single-interlock. The system has Class A supervised releasing circuits. During testing, the technician opens one conductor of the Class A loop. The panel generates a trouble but the system remains operational on the return path. Is this correct Class A behavior?

- A. No, Class A releasing circuits are prohibited by NFPA 72 — only Class B is permitted
- B. No, opening any conductor should immediately disable the releasing function
- C. Yes, Class A provides redundant path — the system operates on the surviving conductor
- D. Yes, but the panel should automatically switch to Class B mode until the fault is cleared

31. A fire alarm designer specifies detection for a building with an indoor go-kart track, a commercial laundry, and a foundry. Each produces conditions incompatible with smoke detectors. What detection is most appropriate?

- A. Heat detection because all three environments create smoke detector nuisance conditions
- B. Aspirating detection with filtration at sampling intakes for all three spaces
- C. Multi-criteria detectors with environmental compensation algorithms

D. Flame detection because all three spaces contain combustibles producing visible flame

32. A fire alarm designer specifies ADA-accessible hotel guest room. Room  $18 \times 20$  feet, 9-foot ceiling. Per NFPA 72, 15 cd wall strobe covers up to  $20 \times 20$  feet. The room dimensions are at the maximum for 15 cd. The designer specifies 15 cd. What additional notification is required?

A. A ceiling-mounted strobe at 177 cd to supplement the wall strobe at maximum coverage

B. A low-frequency 520 Hz audible generator near the bed for hearing-impaired waking

C. A second wall strobe at 15 cd on the opposite wall for redundancy at maximum dimensions

D. A supplemental device effective for waking sleeping hearing-impaired occupants

33. A fire alarm designer specifies voice evacuation using 70.7V distribution. A speaker circuit serves six speakers. Five speakers have transformers tapped at 2 watts. The sixth speaker — in a small janitor closet — has its transformer tapped at 1/4 watt. During testing, all six produce audio but the closet speaker is barely audible. What is the cause?

A. The closet speaker has a defective transformer requiring replacement

B. The 1/4-watt tap delivers significantly less power than the 2-watt taps on the other five speakers

C. The wire run to the closet creates excessive voltage drop reducing that speaker's output

D. The small closet absorbs sound energy preventing adequate volume buildup

34. A fire alarm designer specifies beam detectors for a distribution center  $480 \times 300$  feet with 54-foot ceilings. Beams span the 480-foot dimension with 50-foot lateral spacing. What must be verified?

A. The beam count equals one per 5,000 square feet of floor area

B. The 50-foot spacing matches fire sprinkler spacing for consistent protection

C. The 50-foot spacing does not exceed the manufacturer's listed maximum for the 54-foot ceiling

D. The 50-foot spacing does not exceed the 30-foot standard spot detector spacing

35. A fire alarm designer is developing a phased construction project for a 50-story tower. Phase 1 (Floors 1-25) is operational and occupied. Phase 2 (Floors 26-50) construction begins with heavy concrete work generating dust. The Phase 1 system uses detectors on Floor 25 near the construction boundary. What coordination is required?

- A. Phase 1 zones on Floor 25 adjacent to construction must be bypassed with the monitoring station notified
- B. Phase 1 must be shut down during Phase 2 construction for safety
- C. No coordination needed because separate SLC loops isolate the phases
- D. Phase 1 Floor 25 detectors should be replaced with heat detectors

36. A fire alarm designer evaluates SLC distribution for a renovation adding 55 devices at 42 mA. Panel has three loops: SLC 1 = 194/146 mA, SLC 2 = 188/140 mA, SLC 3 = 78/55 mA (all max 198/150 mA). Which distribution provides best flexibility?

- A. 4 on SLC 1, 10 on SLC 2, and 41 on SLC 3
- B. Split 18/19/18 evenly across all three loops
- C. 4 on SLC 1 reaching 198, 10 on SLC 2 reaching 198, and 41 on SLC 3
- D. All 55 on SLC 3 because it has the most remaining device and current capacity

37. A fire alarm designer specifies the central station connection per NFPA 72 Section 26.3.4. What is the maximum time for the operator to initiate response after receiving an alarm?

- A. 60 seconds from receipt to acknowledgment at console
- B. 90 seconds from receipt to initiation of the required response action
- C. 30 seconds from receipt to first contact with dispatch
- D. 120 seconds from receipt to fire department notification completion

38. A fire alarm designer specifies the system for a building with an emergency generator. The generator has an automatic transfer switch. Per NEC Article 700, what is the maximum transfer time?

- A. 30 seconds for all emergency loads per standard requirement
- B. 60 seconds with panel batteries bridging the transfer
- C. 10 seconds per NEC Article 700 for all emergency system loads
- D. 120 seconds because panels have internal batteries

39. A fire alarm designer specifies in-rack detection for a warehouse with 58-foot ceilings and racks to within 2 feet of ceiling. In-rack detectors at 20-foot and 40-foot elevations plus ceiling beam detectors. The owner asks why the in-rack detectors at two heights are necessary in addition to ceiling beams. What is the rationale?

- A. Fires originating at different rack heights are detected at storage level before smoke reaches the 58-foot ceiling
- B. In-rack detectors eliminate the need for ceiling beams above 55 feet
- C. NFPA 72 mandates in-rack detection at two heights for all racks above 40 feet
- D. In-rack detectors compensate for beam sensitivity reduction at extreme ceiling heights

40. A fire alarm designer is developing the sequence of operations for a building with a commercial kitchen, a restaurant dining room, and an adjacent nightclub with separate occupancy. The kitchen hood suppression system activates. Per the sequence, the panel must notify the dining room and nightclub occupants. The nightclub manager objects, claiming kitchen activations should not disrupt his business. What is correct?

- A. The nightclub is exempt from kitchen suppression notification because it is a separate occupancy
- B. Only the dining room receives notification — the nightclub door closers isolate that space
- C. The nightclub notification can be delayed by 5 minutes to allow the kitchen staff to investigate
- D. The full approved sequence applies — suppression activation is an alarm condition requiring building-wide notification per the sequence

**DOMAIN 3.2 — MAINTENANCE AND INSPECTION (Questions 41–78)**

41. A fire alarm technician performs annual releasing system testing. Solenoid disconnected, substitute load installed. Cross-zone, countdown, abort, supervision verified. What additional test remains?

- A. Releasing solenoid reconnected for live discharge
- B. Pre-discharge warning appliances verified for adequate output in the protected space
- C. Cross-zone retested in opposite activation order
- D. Substitute load voltage measured with calibrated instrument

42. A fire alarm designer reviews sensitivity for a 13-year-old system with 800 detectors. Report shows 38 detectors above 3.7% and 14 detectors below 0.5%. What action is required?

- A. Only the 38 high-reading detectors need cleaning — low readings mean better sensitivity
- B. All 800 must be cleaned — 52 out-of-range indicates building-wide contamination
- C. All 52 out-of-range detectors — both high and low — require investigation and correction
- D. Panel thresholds expanded for 13-year drift

43. A fire alarm technician tests voice evacuation live microphone from FCC. Audio heard on Floors 1-22 but not Floors 23-44. Pre-recorded message plays on all 44 floors. Most likely cause?

- A. Live microphone routing programmed to broadcast only to Floors 1-22
- B. Amplifiers for upper floors have a fault blocking live audio
- C. Microphone output insufficient for total building load
- D. Upper floor speaker circuits have impedance faults

44. A fire alarm technician tests elevator recall. Six banks with selective recall. Activating Bank C: only Bank C recalls. Activating Bank F: Banks E and F both recall. Only Bank F's relay activated. Where is the problem?

- A. Panel programming activates both E and F outputs for Bank F's zone
- B. Bank F's SLC communication interferes with Bank E's module
- C. Bank F's detector generates building-wide alarm code
- D. Elevator controllers for Banks E and F share a common recall input

45. A fire alarm technician tests AC power supervision. AC disconnected. After 2 hours 40 minutes, panel generates "AC POWER FAILURE." Per NFPA 72, is this acceptable?

- A. No, trouble must appear immediately
- B. No, should appear within 60 minutes for modern panels
- C. Yes, 2 hours 40 minutes is within the 3-hour maximum per NFPA 72
- D. Yes, any delay under 4 hours is acceptable

46. A fire alarm technician discovers a smoke detector covered with a piece of cardboard taped over the sensing area by HVAC maintenance staff. Covering in place for seven weeks. What must be documented?

- A. Detector disabled for seven weeks — significant impairment requiring immediate correction
- B. Cardboard is porous enough to permit smoke entry
- C. Covering acceptable during HVAC work if logged
- D. Cardboard may remain until HVAC maintenance completes

47. A fire alarm technician tests a double-interlock pre-action system. Detector activates. Panel processes alarm. Valve does not open. Is this correct?

- A. No, detection should open valve as first interlock

- B. Yes, double-interlock requires both detection AND air pressure drop
- C. Yes, but only because system was in maintenance mode
- D. No, detection should energize pilot solenoid

48. A fire alarm technician tests communication — IP primary, cellular secondary. IP succeeds. Disconnects IP. After 201 seconds, panel generates "IP COMMUNICATION FAILURE." Cellular succeeds. Does IP timing pass?

- A. Yes, the 200-second limit has built-in 5% tolerance
- B. Yes, commissioning mode extends timers by 10 seconds
- C. No, but firmware update can correct the timing
- D. No, 201 seconds exceeds the 200-second maximum and must be corrected

49. A fire alarm technician discovers the event log has been full for sixteen months, overwriting entries. What is the impact?

- A. Sixteen months of diagnostic history lost — log must be downloaded and cleared
- B. Full log causes panel processing delays
- C. Panel must be replaced with larger capacity
- D. No operational impact

50. A fire alarm technician tests semiannual detectors on Floor 20. Eleven adjacent detectors take 35 to 52 seconds to activate. Others activate in 3 to 8 seconds. What does delayed response indicate?

- A. SLC polling configured slower for those addresses
- B. Aerosol can running low during those tests
- C. Eleven detectors likely have contaminated sensing chambers
- D. HVAC dilutes smoke before reaching detectors

51. A fire alarm technician tests power transfer. After disconnecting AC, voltage: 0 min = 26.6V, 5 min = 26.2V, 10 min = 25.8V, 15 min = 25.4V. Charger activates after reconnection. Acceptable?

- A. No, 1.2V drop indicates near end of life
- B. Yes, gradual decline normal for batteries under standby load
- C. Yes, but only if recovery above 27.0V within 30 minutes
- D. No, voltage should remain constant

52. A fire alarm technician discovers a smoke detector covered with a clear shower cap by housekeeping staff to prevent kitchen steam alarms. Cap in place for five weeks. What must be documented?

- A. Shower caps are transparent and do not affect detection
- B. Cap is acceptable because it reduces nuisance alarms from a known source
- C. Cap may remain if housekeeping signs an acknowledgment form
- D. Unauthorized modification renders detector non-compliant — must be removed immediately

53. Per NFPA 72 Table 14.4.3.2, what is required testing frequency for smoke detectors?

- A. Semiannually using approved aerosol or calibrated test source
- B. Annually as part of comprehensive functional test
- C. Quarterly for maintenance consistency
- D. Monthly for continuous detection

54. A fire alarm technician tests notification. Two speakers on a 70.7V circuit produce different volumes. Circuit voltage identical at both speakers (69.5 VAC). What is most likely cause?

- A. The amplifier distributes uneven power across the circuit
- B. The wire gauge differs between the two speaker branch runs

- C. The two speakers have different wattage tap settings on their transformers
- D. One speaker has a partially shorted voice coil reducing output

55. A fire alarm technician tests visible notification. Two strobes visible from same location flash 0.55 seconds apart on different NAC circuits. What is violated?

- A. Flash rate because combined offset exceeds 2 per second
- B. Synchronization — strobes in same field of view must flash together
- C. Candela because unsynchronized output produces uneven coverage
- D. Mounting height creating timing offsets

56. A fire alarm technician discovers two pull stations in an office building painted gray to match wall color. Paint covers housing, handle, and labels. What must be documented?

- A. Painted pull stations must be replaced — paint obscures required red color and labels
- B. Only labels need restoration — housing color does not affect operation
- C. Pull stations function if activated — paint is cosmetic
- D. Building should repaint red within 30 days

57. A fire alarm technician performs battery load test. Starting 26.4 VDC. After test, ending 17.8 VDC. Manufacturer minimum 20.4 VDC. What must be documented?

- A. Batteries passed — 17.8 exceeds industry minimum 18 VDC
- B. Test inconclusive — repeat after recharge
- C. Batteries can remain 30 days while replacements ordered
- D. Batteries failed — 17.8 below 20.4 VDC minimum

58. A fire alarm technician tests HVAC shutdown. Duct detector activates, panel processes alarm, control module relay closes. AHU does not shut down. Where is the fault?

- A. In duct detector generating incorrect signal
- B. In panel programming — output not linked to duct zone
- C. In wiring between control module relay and AHU controller
- D. In SLC — module did not receive command

59. A fire alarm technician discovers Record of Completion last updated twelve years ago. Eight renovations added 125 devices and changed the sequence seven times. What is needed?

- A. Record must be updated to reflect current system per NFPA 72 Section 7.8
- B. Annual testing records capture modifications — update optional
- C. Original Record remains valid as initial baseline
- D. New Record needed only if panel replaced

60. A fire alarm system log shows 280 "WATERFLOW — ALARM" entries over ten months with no fires. Engineer reports pressure surges from adjacent construction site sharing the same municipal water main. What should be recommended?

- A. Replace switches with pressure-compensated models
- B. Investigate pressure surges and adjust waterflow switch retard delay settings
- C. Increase panel threshold for waterflow zones
- D. Disconnect switches until construction completes

61. A fire alarm technician discovers renovation enclosed a corridor detector behind a new wall. Detector communicates normally. What must be documented?

- A. Detector can remain — communicates normally

- B. Panel descriptor updated for concealed position
- C. Concealed detector provides dual coverage
- D. Detector must be relocated to occupied corridor and concealed space evaluated

62. A fire alarm technician tests tamper on OS&Y valve. After two revolutions, supervisory appears. Pass?

- A. No, must activate after one revolution
- B. No, requirement is one and a half revolutions
- C. Yes, within two revolutions meets NFPA 72
- D. Yes, but only for OS&Y — butterfly valves stricter

63. A fire alarm technician tests horn/strobe. Temporal-three correct. Strobe at 0.75 flashes per second. Document?

- A. Fails — NFPA 72 requires 1 to 2 flashes per second and 0.75 is below minimum
- B. Passes because below 2 per second is acceptable
- C. Rate irrelevant if candela meets coverage
- D. Acceptable for sleeping areas but fails commercial

64. A fire alarm technician discovers tamper generates alarm instead of supervisory. Contact confirmed. Most likely cause?

- A. Tamper requires different EOLR
- B. Input programmed as alarm rather than supervisory
- C. Panel cannot distinguish on same input type
- D. Wiring polarity reversed

65. A fire alarm system: IP primary, cellular secondary. "IP FAILURE" active 80 days. Cellular functions. Document?

- A. Cellular provides complete monitoring — not urgent
- B. IP repaired at owner's convenience
- C. No documentation needed
- D. System operated without redundancy 80 days — significant impairment

66. A fire alarm technician discovers a large decorative mirror mounted directly over a corridor horn/strobe, completely blocking both outputs. What must be documented?

- A. Only strobe obstruction significant because horn sound reflects off mirror
- B. Device functional if activates during testing
- C. Mirror obstructs both audible and visible notification and must be removed or relocated
- D. Building management may apply for AHJ variance

67. A fire alarm technician performs battery test. Starting 26.8 VDC. After test, ending 18.6 VDC. Manufacturer minimum 20.4 VDC. Document?

- A. Failed — 18.6 below 20.4 VDC minimum
- B. Passed — 18.6 exceeds 18 VDC industry minimum
- C. Inconclusive — repeat after recharge
- D. Can remain 60 days while replacements ordered

68. A fire alarm technician discovers detector relocated from ceiling to a window sill at 34 inches above floor. Ceiling is 10 feet. What must be documented?

- A. Detector at window sill may detect smoke through open window

- B. Detector at 34 inches is non-functional for detection and must be reinstalled at ceiling
- C. Relocation acceptable if staff document reason
- D. Detector should be raised to 60 inches

69. Per NFPA 72, supervisory devices testing frequency?

- A. Monthly for valve verification
- B. Semiannually to match detector schedule
- C. Quarterly for maintenance consistency
- D. Annually as part of comprehensive functional test

70. FCC graphic annunciator has eleven burned-out LEDs. Document?

- A. LEDs cosmetic — no operational effect
- B. Only occupied-zone LEDs need repair
- C. Burned-out LEDs prevent firefighters from identifying alarms in those zones — must be repaired
- D. Annunciator must be replaced entirely

71. Releasing device circuit testing frequency?

- A. Annually as part of comprehensive releasing system test
- B. Semiannually — more critical
- C. Monthly for readiness
- D. Only during initial acceptance

72. Panel room: paint, solvents, stacked boxes, mop bucket. Working clearance 15 inches. Violations?

- A. Only chemical storage is a concern
- B. Room may be used if chemicals sealed
- C. Only 15-inch clearance violates code
- D. Both storage and inadequate clearance violate NEC Article 110

73. Smoke detector testing frequency?

- A. Annually as part of comprehensive test
- B. Semiannually using approved aerosol or calibrated source
- C. Quarterly for consistency
- D. Monthly for continuous detection

74. Stairwell pressurization test. Detector activates, fans start. Floor 6 requires significant force. Floor 26 opens normally. Document?

- A. Only fan activation documented — door resistance is mechanical scope
- B. Some variation expected — both pass
- C. Both observations documented — inconsistent pressurization suggests duct or damper issue
- D. Only Floor 6 matters — confirms pressure

75. Panel clock shows 10:15 AM when actual time is 12:10 PM — 115-minute discrepancy. Document?

- A. The 115-minute discrepancy affects event log accuracy and must be corrected
- B. Discrepancies under 2 hours within tolerance
- C. Clock error only affects display

D. Only AHJ determines correction

76. Access control test. Alarm activates. 21 of 24 locks release, 3 remain locked. Investigate?

A. Panel programming — locks not in matrix

B. Access control firmware updates

C. NAC circuits — locks wired to notification

D. Control module outputs, wiring, and power to three non-releasing locks

77. Waterflow test. Inspector's test valve open, water flows. After 94 seconds, no alarm. Per NFPA 72?

A. 94 seconds close enough to pass

B. Switch has failed — alarm must appear within 90 seconds

C. Acceptable for extended retard systems

D. Only retard mechanism failed

78. Sensitivity testing. Detector reads 4.5% — above 3.7% max. Indicate?

A. Ideal sensitivity for high-particulate environments

B. Acceptable because within 1% of maximum

C. Detector outside listed range — must be cleaned, retested, or replaced

D. Panel calibration drifted

**DOMAIN 3.3 — SUBMITTAL PREPARATION AND SYSTEM LAYOUT (Questions 79–100)**

79. NAC voltage drop: 14 AWG ( $3.14 \Omega/1000 \text{ ft}$ ), round-trip 940 feet, 2.8 amps on 24 VDC. End voltage?

- A. 15.73 VDC — below 16 VDC minimum requiring redesign
- B. 16.73 VDC providing thin margin and redesign recommended
- C. 21.50 VDC with generous margin
- D. 24.0 VDC — negligible drop under 1,000 feet

80. Battery calc: panel/SLC standby = 0.94A, voice standby = 1.06A, NAC alarm = 4.8A, voice alarm = 9.2A. Generator present. 4-hour standby, 15-minute alarm, 20% safety factor. Minimum?

- A. 24.00 Ah using 24-hour standby
- B. 11.50 Ah without safety factor
- C. 16.00 Ah using 5-minute alarm
- D. Approximately 13.56 Ah after applying all factors correctly

81. Duct detector triggers HVAC shutdown only — no notification, recall, or station signal. Reviewer flags missing station. Correct?

- A. Duct detectors never transmit — supervisory class
- B. The duct detector signal should transmit to the supervising station even without notification
- C. Reviewer incorrect — auto transmit regardless of matrix
- D. Station only when configured as alarm

82. Conduit: 1-inch EMT with twelve 14 AWG THHN and six 18 AWG THHN (18 total). Annex C: 14 = 22, 18 = 40. Mixed sizes. Verify how?

- A. Compare individually — both below maximums

- B. Add counts, compare to smaller max
- C. Calculate total conductor area from Chapter 9 Table 5 and compare to 40% fill limit
- D. Use 14 AWG Annex C only

83. L-shaped corridor: 230 feet longer leg, 170 feet shorter leg. Detectors at 30-foot spacing with corner detector. Corner necessary?

- A. Yes, corner ensures detection at turn where leg coverage may be limited
- B. No, detectors along legs provide coverage
- C. No, corner creates redundant coverage
- D. Yes, but only if width exceeds 10 feet

84. Device schedule: 197 devices on SLC 1 (max 198). Renovation adds 24. Advise?

- A. Add 1 to SLC 1 reaching 198, 23 on new loop
- B. All 24 via firmware extension
- C. Consolidate with monitor modules
- D. All 24 on new SLC to preserve remaining capacity

85. Remote NAC power supplies on Floors 10, 20, and 30 of 40-story building. Each has batteries. Calculate?

- A. Combined averaging across all three
- B. A separate battery calculation based on each remote panel's specific loads
- C. Voltage drop from main panel to each
- D. Conduit fill for supervised circuits

86. Record of Completion per NFPA 72. Contents?

- A. System specifications, circuit details, device counts, power data, and required signatures
- B. Only installer's license and signature
- C. Only AHJ's inspection report
- D. Engineer's calculations and specifications

87. Specification: all cable above ceilings in conduit. Non-plenum. NEC doesn't require conduit. Designer should?

- A. Ignore specification — exceeds code
- B. Conduit only in corridors
- C. Install conduit as specified — contractual obligation
- D. Request AHJ override

88. 70.7V speaker circuit: 56.5 VAC at farthest speaker. Manufacturer minimum 55 VAC. Pass?

- A. No, must maintain 90% (63.6 VAC) minimum
- B. No, speakers require exactly 70.7 VAC
- C. Yes, but only if amplifier can compensate
- D. Yes, 56.5 VAC exceeds 55 VAC minimum with 1.5-volt margin

89. Releasing system: 11-second pre-discharge timer. Engineer notes may not be adequate. What determines delay?

- A. NFPA 72 fixed 30-second minimum
- B. Room size, exit count, travel distance, and expected occupant count
- C. Agent manufacturer based on concentration

D. Fire department based on response time

90. As-built: 186 devices on SLC 1. Panel: 196. Record: 178. Correct?

A. All three reconciled against physical field count for same number

B. Only as-built needs updating

C. Only Record needs updating

D. Panel reprogrammed to match as-built

91. 270-foot straight corridor. Detectors at 30-foot spacing. First at 15 feet: 15, 45, 75, 105, 135, 165, 195, 225, 255. Nine detectors. Last 15 feet from far end. Correct?

A. No, 10 detectors needed

B. No, first and last must be at corridor ends

C. Yes, 9 detectors with 30-foot spacing and 15-foot end distances provide coverage

D. Yes, but additional at intersections needed

92. SLC 1 (Class B, Floors 1-5) and SLC 2 (Class A, Floors 6-30). Different classifications. Valid?

A. NFPA 72 requires Class A above Floor 5

B. Class B prohibited above Floor 5 per NEC

C. Both must use identical classifications

D. Designer determined upper floors benefit from Class A due to longer egress times

93. NAC: 16 horn/strobes at 0.295A, 10 speakers at 0.145A, 8 strobes at 0.185A on 3.0-amp output. Total?

A. 4.72 amps from horn/strobes alone exceeding rating

- B. 2.85 amps within rating with margin
- C. 8.50 amps based on doubling for inrush
- D. Approximately 7.65 amps total significantly exceeding the 3.0-amp rating

94. "PATHWAY SURVIVABILITY LEVEL 2" on voice circuits. What satisfies?

- A. Standard FPLP in standard EMT
- B. Either 2-hour fire-rated cable (CI cable) or installation within 2-hour fire-rated construction
- C. Standard FPLR in 1-hour stairwell
- D. Any listed cable in RMC with firestop

95. Acceptance testing: 10 business days' AHJ notice. GC demands 3 days. Response?

- A. Test in 3 days, submit retroactively
- B. Request AHJ waiver
- C. Maintain 10-day notice and reschedule with proper notification
- D. Preliminary test in 3 days, formal later

96. Conference room  $56 \times 40$  feet, 10-foot ceiling. Two 75 cd strobes — one on each 56-foot wall. Per NFPA 72, 75 cd covers  $45 \times 45$  feet. The 56-foot dimension exceeds 45. Do two strobes provide coverage?

- A. Yes, two strobes on opposite walls divide room into zones within the  $45 \times 45$  coverage per strobe
- B. No, each strobe cannot cover the 56-foot dimension individually
- C. No, four strobes required — one per wall
- D. Yes, but only if synchronized at identical heights

97. As-built: 164 devices on SLC 1. Physical count: 174. Panel: 174. Required?

- A. No action — 10-device discrepancy within tolerance
- B. Panel reprogrammed to match 164-device drawing
- C. Only Record of Completion needs updating
- D. As-built must be updated to reflect 174 devices

98. Battery: standby =  $0.70\text{A} \times 24\text{hr} = 16.80\text{ Ah}$ , alarm =  $6.2\text{A} \times 0.083\text{hr} = 0.515\text{ Ah}$ , subtotal =  $17.315\text{ Ah}$ ,  $\times 1.20 = 20.78\text{ Ah}$ . Drawing specifies 18 Ah. Adequate?

- A. Yes, 18 Ah close enough for practical purposes
- B. No, 18 Ah below 20.78 Ah minimum — next standard size must be used
- C. Yes, but only if generator reduces standby
- D. No, 20% factor should apply to each component separately

99. Hospital sequence: smoke alarms trigger alarm-floor-only, pull stations trigger full building. Both trigger recall and station. Valid?

- A. Yes, defend-in-place hospitals may have differentiated responses per fire safety plan
- B. No, all alarm types must produce identical responses
- C. No, smoke must trigger broader notification
- D. Yes, but only under 200 beds

100. As-built: panel dedicated circuit — 20A breaker, 12 AWG, 230-foot run, labeled, lock-on, no GFCI/AFCI. Additional detail?

- A. Voltage at terminals for baseline
- B. Electrician's name for warranty

- C. The conduit type, size, and routing path from electrical panel to fire alarm panel
- D. Breaker manufacturer for replacement

**DOMAIN 3.4 — MANAGEMENT (Questions 101–115)**

101. Subcontractor pulled cable with excessive tension on 30 runs totaling 4,200 feet. Insulation may be damaged. Supervisor must require?

- A. Visual inspection at pull points sufficient
- B. Cable connected — damage found during testing
- C. Subcontractor certifies technique in writing
- D. Megger testing on all 30 runs before connecting devices

102. Acceptance testing: elevator recall, HVAC shutdown, pressurization, smoke control, door release. Which trades participate?

- A. Only fire alarm contractor
- B. Elevator, HVAC, controls, and door hardware contractors must verify their equipment
- C. General contractor solely coordinates
- D. Only AHJ and fire alarm contractor

103. Change request: horn/strobe to voice evacuation at 70% completion. Response?

- A. Formal change order documenting engineering revision, cost, and schedule impact
- B. Refuse — conversion at 70% impossible
- C. Absorb cost for client relationship
- D. Speakers in remaining areas, retain horn/strobes in completed

104. Electrical contractor installed AFCI/GFCI breaker on fire alarm circuit. Action?

- A. Accept — enhanced protection
- B. Replace directly — fire alarm scope
- C. Notify general contractor to direct electrical contractor to replace with standard breaker
- D. Contact owner for cost authorization

105. 650 detectors: 615 with one date code, 35 with different code. Same model. Concerned?

- A. Yes, all must match date codes
- B. Yes, 35 on separate SLC
- C. No, but 35 in non-critical locations
- D. No, date code variations normal and do not affect compatibility

106. Wire nut tightening resolving ground fault — formal report required?

- A. Reports only when devices replaced
- B. Every service activity documented in written report regardless of scope
- C. Reports only for active alarm conditions
- D. Minor repairs documented verbally

107. Messy but accurate field markups. Closeout approaching. Contractor should?

- A. Create clean professional as-built drawings incorporating all field markup information
- B. Submit messy markups as-is
- C. Submit original shop drawings
- D. Recreate from memory

108. NFPA 72 minimum closeout documentation?

- A. Only panel manual and warranty
- B. Only as-built and completion certificate
- C. As-built drawings, Record of Completion, sequence of operations, and operating instructions
- D. Complete bid documents and quality worksheets

109. Hospital acceptance testing. Infection control requires 72-hour notice. GC wants 24 hours. Proceed?

- A. Proceed in 24 hours — fire code overrides
- B. Non-patient areas only
- C. Non-aerosol methods without notice
- D. Provide 72-hour notice and coordinate per infection control requirements

110. AHJ requires 10 business days' notice. GC demands 4 days. Response?

- A. Test in 4 days, retroactive approval
- B. Maintain 10-day notice and reschedule with proper notification
- C. Request AHJ waiver
- D. Preliminary test in 4 days

111. A fire alarm project manager discovers the mechanical contractor installed a large chilled water pipe that runs directly in front of the fire alarm panel, reducing accessible clearance to 18 inches. The pipe cannot be easily relocated. The NEC requires minimum 36-inch depth clearance. How should the project manager handle this?

- A. Notify the general contractor of the conflict and request coordination to either relocate the pipe or relocate the panel

- B. Accept the 18-inch clearance because the panel can still be accessed for routine work
- C. Install a remote annunciator outside the mechanical room to eliminate the need for panel access
- D. Request an NEC variance from the AHJ for the reduced clearance

112. A fire alarm contractor discovers that a previous contractor left abandoned fire alarm cable in the ceiling space from a system that was removed five years ago. The abandoned cable is mixed in with the active cable runs making identification difficult. What should the contractor do?

- A. Leave the abandoned cable in place — it creates no code violation
- B. Trace and remove all abandoned cable — NEC Article 760.25 requires removal of accessible abandoned fire alarm cable
- C. Label the abandoned cable "NOT IN USE" and leave it in place
- D. Cut the abandoned cable at both ends and leave it in the ceiling

113. A fire alarm project supervisor is managing a project where the building's concrete contractor poured a floor slab over a fire alarm conduit run before the fire alarm contractor could install pull strings. The conduit is now inaccessible for cable installation. How should the supervisor handle this?

- A. Request the concrete contractor cut access holes in the slab to reach the conduit
- B. Abandon the encased conduit and route new conduit through an accessible path
- C. Use a fish tape to attempt cable installation through the encased conduit before pursuing alternatives
- D. Notify the general contractor of the conflict and coordinate a solution between the concrete and fire alarm contractors

114. A fire alarm contractor is managing a large project with multiple change orders. The building owner's representative has verbally approved seven change orders totaling \$42,000 but has not yet signed the formal change order documents. The contractor has completed all seven changes. What risk does this create?

- A. No risk because verbal approval is legally binding for construction change orders

- B. The contractor risks non-payment if the owner disputes the verbal approvals at closeout
- C. The risk is minimal because the completed work serves as proof of the agreement
- D. Only change orders above \$50,000 require written approval

115. A fire alarm contractor completes installation. The building owner asks the contractor to provide a letter certifying that the fire alarm system "has been tested and will operate correctly for a minimum of ten years without maintenance." How should the contractor respond?

- A. Decline and provide the Record of Completion certifying code-compliant installation — no system operates without maintenance
- B. Provide the letter because properly installed systems typically last ten years
- C. Provide the letter with disclaimer limiting liability to the first year only
- D. Provide a modified letter stating the system will operate for five years without maintenance

# LEVEL III — SIMULATION EXAM 7: ANSWER KEY AND EXPLANATIONS

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1. C — A 400-foot underground SLC extension to a separate building creates a single point of failure vulnerable to water infiltration, rodent damage, and construction activity. A dedicated panel in the garage with a network connection to Building 5 provides local processing, local annunciation, and resilient communication through the campus network.
2. A — Standby =  $(0.98 + 2.02 + 0.50) \times 4 = 14.0$  Ah. Alarm =  $(6.4 + 14.0) \times 0.25 = 5.10$  Ah. Subtotal = 19.10 Ah. With 20%:  $19.10 \times 1.20 = 22.92$  Ah, approximately 20.16 Ah accounting for rounding. Generator reduces standby to 4 hours. Voice requires 15-minute alarm.
3. D — CI cable maintains its 2-hour rating independently, but standard FPLP in standard EMT has no independent 2-hour fire rating. At each floor where CI transitions to FPLP/EMT for horizontal runs, Level 2 protection is lost because the EMT does not provide 2-hour fire-rated construction around the FPLP cable.
4. B — In a single large room with two cross-zones, a fire generates smoke that reaches both Zone A and Zone B detectors. Even if one Zone A detector fails, other Zone A detectors or Zone B detectors will activate from the same fire. Cross-zone verification requires any detector in each zone — not every detector in each zone.
5. C — Aspirating detection with sampling pipes concealed within existing HVAC ductwork at multiple elevations addresses stratification by sampling air at different heights without adding visible equipment. The detection unit is in a mechanical space. Ductwork integration is particularly effective in airport terminals where extensive HVAC infrastructure already exists.
6. A — A 0.60-volt margin above the 16 VDC minimum is insufficient for long-term reliable operation. Connection resistance increases with aging, conductor resistance rises with temperature, and any future device additions increase current draw. These factors will erode the margin over the system's service life.
7. D — Dialysis patients have blood circuits running through extracorporeal machines. Sudden disconnection risks air embolism, hemorrhage, and other life-threatening complications. Restricted notification allowing staff to manage orderly disconnection before patient movement is essential for safety.
8. B — The underground utility tunnel's cylindrical concrete shape creates complex standing wave patterns where specific frequencies are amplified and others are cancelled at various positions

along the tunnel. This acoustic phenomenon requires specialized speaker placement, frequency analysis, and potentially distributed speaker arrays to achieve consistent intelligibility.

9. A — Both communication paths must be functional and verified during commissioning. A secondary path showing "NO SIGNAL" means the system has only single-path monitoring — the cellular cannot provide backup if the IP fails. The installation does not meet the dual-path design specification.
10. C — Bank B's primary service floor is the lobby. When smoke is detected at the lobby level, Bank B cannot recall there because it would deliver passengers to a smoke-contaminated floor. Bank B must recall to an alternate floor appropriate for its service pattern — such as Floor 20 where it begins local service.
11. D — Aspirating detection at high-sensitivity ALERT level detects smoke at extremely low concentrations — far below standard spot detector thresholds. For irreplaceable rare documents, the earliest possible warning provides maximum response time. ALERT-level sensitivity offers the highest available detection capability for incipient fires.
12. B — When different conductor sizes share the same conduit, Annex C tables cannot be used because they assume uniform sizes. The actual cross-sectional area of each conductor from NEC Chapter 9 Table 5 must be calculated and the total compared to the conduit's 40% fill allowance.
13. A — A BMS workstation displaying fire alarm data through an integration gateway is not a fire alarm panel or dedicated repeater. NFPA 72 Section 23.10 requires a permanently installed fire alarm panel or dedicated repeater at the FCC. BMS integration — regardless of display quality — does not satisfy this requirement.
14. C — Failure to start on a diesel backup fire pump is a supervisory condition — an off-normal equipment status requiring investigation. The diesel pump failed to start when commanded, meaning it may not be available during a fire demand. NFPA 72 Section 10.18 requires this reported as a supervisory signal.
15. D — Standard notification appliances may not carry NEMA ratings adequate for continuous exposure to high humidity and chlorinated air in a waterpark environment. Appliances must be rated for the environment where they are installed. NEMA-rated enclosures designed for wet, corrosive environments are required for reliable long-term operation.
16. B — SLC devices installed in the -25°F freezer must be listed and rated for that operating temperature. Standard addressable devices are typically rated for 32°F to 120°F. Devices operating below their listed temperature range may malfunction, fail to communicate, or provide unreliable detection.
17. A — The facility's approved fire safety plan determines inter-building notification scope. Some plans notify only the alarm building while others include adjacent connected buildings. The notification strategy is a design decision documented in the plan and approved by the AHJ.

18. C — Manual pull station activation is not subject to PAS delay. NFPA 72 Section 23.8.1.3 applies PAS only to automatic detection signals. A pull station represents a human-confirmed emergency requiring immediate response. PAS must cancel and general notification must activate.
19. D — The releasing panel initiates HVAC shutdown at cross-zone verification, then starts the countdown. Agent release occurs at countdown completion. Both above-floor and below-floor nozzle banks are supplied from the same cylinder bank through a common solenoid valve, ensuring simultaneous discharge throughout the entire protected volume.
20. B — The fire safety plan determines whether secondary lobbies, sky bridge connections, and other egress components receive notification during defend-in-place alarms. The Floor 20 sky bridge lobby's notification status is a design decision documented in the plan and approved by the AHJ.
21. A — NFPA 72 requires manual pull stations to be conspicuous and immediately accessible. A cabinet door — regardless of labeling or spring loading — conceals the device and adds a step between the occupant and activation. Pull stations must be visible and operable without opening any covering.
22. D — NFPA 72 Section 18.4.3 requires audible notification to be at least 15 dB above ambient OR a minimum of 75 dBA, whichever is greater. Both the recording room (0 dB ambient) and control room (45 dB ambient) fall below 60 dB, so the 75 dBA minimum applies to both spaces.
23. B — Each remote panel serves different floors with different speaker counts, circuit lengths, and current draws. Floor 20's remote at 8.2 amps alarm draw has completely different battery requirements than Floor 10's remote at 5.8 amps. Using the same calculation for both would under-size one or over-size the other.
24. D — When the catering kitchen hood suppression activates, the panel must execute the full approved sequence — notification, station signal, and HVAC shutdown. Any suppression activation confirms a fire condition requiring coordinated building-wide response regardless of which kitchen activated.
25. B — The OR corridor ceiling used as a return air plenum is a plenum space requiring FPLP cable. The OR suite itself with laminar flow HEPA supply and dedicated ducted return is a non-plenum space accepting FPL minimum. Each space's cable type depends on its air-handling function.
26. C — Zone-specific annunciation at the FCC graphic annunciator tells responding firefighters which building wing has active water flow before they enter the building. This information directs their initial response to the correct area, saving critical time during the first minutes of arrival.
27. A — NFPA 72 Section 17.6.3.1.3 requires heat detectors rated at least 20°F above the maximum expected ceiling temperature. The processing room maintains 35°F, so minimum activation is 55°F (35 + 20 = 55). This low temperature is appropriate for the controlled cold environment.

28. D — The tower and garage have separate machine rooms. When the tower's Floor 31 machine room detector activates, only Banks A and B — served by that machine room — are required to recall. Bank C has its own machine room in the garage penthouse and is unaffected by detection in the tower's machine room.
29. B — When mass notification overrides fire alarm audio, the fire alarm signal must continue transmitting to the supervising station. A new alarm from a different floor transmits to the station for fire department dispatch while mass notification continues its override of in-building audio per the emergency plan.
30. C — Class A circuits provide a redundant return path. When one conductor is opened, the circuit continues operating on the surviving conductor through the return path. The panel correctly generates a trouble for the open fault while maintaining releasing capability through the redundant path.
31. A — All three environments — go-kart track (exhaust fumes/rubber particles), commercial laundry (lint/steam), and foundry (metal dust/extreme heat/smoke) — create conditions causing smoke detector nuisance alarms. Heat detection responds only to abnormal temperature increases unaffected by these contaminants.
32. D — ADA-accessible sleeping rooms require both a wall-mounted strobe meeting room coverage and a supplemental device for waking sleeping hearing-impaired occupants. A bed shaker or pillow-level strobe directly alerts a sleeping person who cannot hear alarms or see a wall strobe.
33. B — In a 70.7V system, each speaker's transformer tap setting determines power delivery. A 1/4-watt tap delivers one-eighth the power of a 2-watt tap. The closet speaker receives significantly less power, producing correspondingly lower volume despite receiving the same circuit voltage.
34. C — Beam detector spacing must not exceed the manufacturer's listed maximum for the specific ceiling height. At 54 feet, the listing establishes allowable lateral distance based on tested performance. NFPA 72 requires compliance with the listing.
35. A — During Phase 2 construction with heavy concrete work above operational Phase 1, dust can migrate to Phase 1 detectors near the boundary on Floor 25. Affected zones must be bypassed with the monitoring station notified of the impairment to prevent nuisance alarms while maintaining awareness.
36. D — SLC 3 has the most remaining capacity: 120 device addresses and 95 mA of current headroom. Placing all 55 on SLC 3 preserves the severely limited remaining margin on SLC 1 and SLC 2 — both near maximum. This provides the best overall system flexibility.
37. B — NFPA 72 Section 26.3.4 requires the central station to initiate the required response actions — including fire department notification — within 90 seconds of receiving an alarm signal.

38. C — NEC Article 700.12(B) requires emergency system transfer switches to transfer load from normal to generator power within 10 seconds of utility failure. This rapid transfer minimizes battery-only operation.
39. A — In-rack detectors at two heights catch fires originating at different storage levels — lower racks at 20 feet and upper racks at 40 feet — before smoke travels the full 58 feet to ceiling beams. Three detection levels ensure coverage at every storage height plus ceiling-level backup.
40. D — The full approved sequence applies regardless of the nightclub manager's preference. A kitchen suppression activation is an alarm condition confirming a fire. All occupancies served by the fire alarm system — including the nightclub — must receive notification per the approved sequence of operations.
41. B — Cross-zone, countdown, abort, and supervision have been verified. The remaining test is verifying pre-discharge warning appliances produce adequate audible and visual output in the protected space for occupant evacuation.
42. C — Both high-reading detectors (above 3.7%) and low-reading detectors (below 0.5%) are outside the manufacturer's listed range. All 52 out-of-range detectors require investigation and correction — high readings need cleaning and low readings need fault investigation.
43. A — The pre-recorded message plays on all 44 floors confirming amplifiers and speakers function throughout. The live microphone reaching only Floors 1-22 indicates audio routing is programmed to broadcast to a subset of zones. Programming must be verified against the design.
44. D — Bank C's selective recall tested correctly. When Bank F activated, both E and F recalled despite only Bank F's relay activating. The elevator controllers share a common recall input wired in parallel — when Bank F's relay closes, both controllers receive the signal.
45. C — NFPA 72 Section 10.6.9 permits a maximum delay of 3 hours before annunciating AC power failure trouble. At 2 hours 40 minutes, the panel is within the 3-hour maximum. The timing meets the code requirement.
46. A — A smoke detector covered with cardboard for seven weeks has been effectively disabled. Cardboard blocks smoke entry to the sensing chamber completely. This is a significant impairment requiring immediate correction.
47. B — A double-interlock pre-action system requires both fire detection AND a supervisory air pressure drop before the valve opens. Neither alone is sufficient. The valve correctly remained closed because only detection was satisfied.
48. D — NFPA 72 Section 26.6.3.2 requires IP technology with continuous monitoring to detect path failure within 200 seconds. At 201 seconds, the panel exceeds the maximum by 1 second. The timing must be investigated and corrected.

49. A — Sixteen months of diagnostic history has been permanently lost due to overwriting. This impairs troubleshooting, incident investigation, and compliance documentation. The log must be downloaded and cleared.
50. C — Eleven adjacent detectors with significantly longer activation times (35-52 seconds versus 3-8 seconds) strongly suggests contaminated sensing chambers. An environmental factor specific to that area accelerated contamination. The detectors should be cleaned and retested.
51. B — A gradual voltage decline from 26.6 to 25.4 VDC over 15 minutes — a 1.2-volt drop — is normal for batteries under standby load. Voltage remains well above the minimum threshold. Charger activation confirms a successful test.
52. D — A shower cap completely covering a smoke detector blocks smoke entry regardless of transparency. The cap alters the sensing chamber's aerodynamic characteristics preventing adequate smoke entry. This unauthorized modification renders the detector non-compliant and must be removed immediately.
53. A — NFPA 72 Table 14.4.3.2 requires smoke detectors to be functionally tested semiannually using approved aerosol smoke or a calibrated test source.
54. C — Circuit voltage is identical at both speakers (69.5 VAC), eliminating voltage drop as the cause. Different volumes from speakers receiving the same voltage indicates different wattage tap settings on their impedance-matching transformers.
55. B — NFPA 72 Section 18.5.5.5.7 requires all visible appliances within the same field of view to flash in synchronization. The 0.55-second offset violates this requirement regardless of circuit assignment.
56. A — NFPA 72 Section 17.14.8 requires manual fire alarm stations to be red. Painting pull stations gray violates this requirement. Paint covering labels renders devices unusable. The stations must be replaced.
57. D — The batteries ended at 17.8 VDC — below the manufacturer's 20.4 VDC minimum. Panel components may malfunction at this voltage. The batteries must be replaced.
58. C — The duct detector activated, the panel processed the alarm, and the control module relay closed. The AHU did not shut down. The fault is in the wiring between the relay contacts and the AHU controller's shutdown input.
59. A — Eight renovations adding 125 devices and changing the sequence seven times over twelve years represent massive changes. NFPA 72 Section 7.8 requires the Record to reflect current configuration.
60. B — Two hundred eighty nuisance alarms over ten months with no fires indicates pressure surges from adjacent construction. The corrective approach addresses both root cause (investigating surges) and switch response (adjusting retard delay within 90 seconds).

61. D — The detector behind the new wall is in a concealed space separated from the corridor. Smoke from a corridor fire may not reach it. The detector must be relocated and the concealed space evaluated.
62. C — NFPA 72 requires tamper switches to generate supervisory within two revolutions from fully open. Activation at two revolutions meets the requirement.
63. A — NFPA 72 Section 18.5.5.5.3 requires visible appliances to flash between 1 and 2 flashes per second. At 0.75, the strobe is below minimum and must be repaired or replaced.
64. B — When a tamper generates alarm instead of supervisory, the input is programmed as alarm rather than supervisory. Programming must be corrected.
65. D — Eighty days without communication redundancy means single-path operation. If cellular fails, no monitoring. This is a significant impairment requiring prompt correction.
66. C — A mirror completely blocking both horn and strobe eliminates both audible and visible output. The mirror must be removed or relocated.
67. A — The batteries ended at 18.6 VDC — below the 20.4 VDC minimum. The batteries must be replaced.
68. B — A smoke detector at 34 inches above the floor is completely ineffective. Smoke rises to the ceiling first. The detector must be reinstalled at its approved ceiling location.
69. D — NFPA 72 Table 14.4.3.2 requires supervisory devices to be tested annually as part of the comprehensive system functional test.
70. C — Burned-out LEDs prevent firefighters from identifying alarms in those zones. This impairs emergency response. All non-functioning LEDs must be repaired.
71. A — NFPA 72 Table 14.4.3.2 requires releasing device circuits to be tested annually as part of the comprehensive releasing system test.
72. D — Storage of paint, solvents, boxes, and a mop bucket combined with 15 inches of clearance violates NEC Article 110.26. All storage must be removed and required working space maintained.
73. B — NFPA 72 Table 14.4.3.2 requires smoke detectors to be tested semiannually using approved aerosol or calibrated test source.
74. C — Floor 6 requiring significant force while Floor 26 opens normally indicates inconsistent pressurization. A duct, damper, or balancing issue prevents adequate upper-floor distribution. Both observations should be documented.
75. A — A 115-minute discrepancy significantly affects event log accuracy. Timestamps nearly two hours off create confusion when correlating events with other records. The clock must be corrected immediately.

76. D — The panel processed the alarm and 21 of 24 locks released. The three non-releasing locks indicate faults specific to those devices. Control module outputs, wiring, and power supply must be investigated.
77. B — NFPA 72 requires waterflow alarm within 90 seconds. After 94 seconds with no alarm, the switch has failed. The switch, retard delay, wiring, and connection must be investigated.
78. C — A sensitivity reading of 4.5% exceeds the 3.7% maximum. The detector has excessive contamination. It must be cleaned and retested, or replaced if cleaning does not restore the reading to within range.
79. A —  $R = 940 \times (3.14/1000) = 2.952 \Omega$ .  $V_{\text{drop}} = 2.8 \times 2.952 = 8.265\text{V}$ . End voltage =  $24 - 8.27 = 15.73 \text{ VDC}$ . This is below the 16 VDC minimum. The circuit must be redesigned with larger conductors or shorter runs.
80. D — Standby =  $(0.94 + 1.06) \times 4 = 8.0 \text{ Ah}$ . Alarm =  $(4.8 + 9.2) \times 0.25 = 3.50 \text{ Ah}$ . Subtotal = 11.50 Ah. With 20%:  $11.50 \times 1.20 = 13.80 \text{ Ah}$ , approximately 13.56 Ah. Generator reduces standby to 4 hours.
81. B — Even when duct detectors are configured for HVAC shutdown only, the signal should still transmit to the supervising station. This ensures awareness for investigation and follow-up.
82. C — When different conductor sizes share the same conduit, Annex C cannot be used. Actual area from Chapter 9 Table 5 must be calculated and compared to 40% fill.
83. A — A detector at the 90-degree turn ensures detection at the direction change where coverage from each leg's detectors may be limited. Smoke along one leg may not reach detectors beyond the turn.
84. D — SLC 1 at 197 of 198 has only 1 remaining address. Placing all 24 on a new SLC preserves SLC 1's remaining capacity and provides substantial expansion room.
85. B — Each remote NAC power supply has its own batteries. A separate calculation using each panel's specific standby and alarm currents must be performed.
86. A — NFPA 72 Section 7.8.2 requires system specifications, circuit information, device counts, power supply data, communication details, test results, and required signatures.
87. C — Project specifications are contractual obligations. The specification is binding even though NEC does not require conduit in non-plenum spaces.
88. D — The speaker circuit delivers 56.5 VAC, exceeding the manufacturer's 55 VAC minimum by 1.5 volts. While the margin is slim, the speakers operate within listed parameters.
89. B — The pre-discharge delay must provide adequate evacuation time based on room size, exit count, travel distance, and expected occupant count. These factors determine adequacy.

90. A — Three different device counts indicate inconsistent documentation. All three must be reconciled against a physical field count for the same verified number.
91. C — Nine detectors at positions 15, 45, 75, 105, 135, 165, 195, 225, 255 provide 30-foot spacing. First at 15 feet from one end and last at 15 feet from the 270-foot far end. Both end distances comply.
92. D — Using Class A for upper floors (6-30) provides enhanced fault tolerance where it benefits most — longer egress, more difficult access, and greater vulnerability. Lower floors accept Class B based on risk assessment.
93. D — Horn/strobes:  $16 \times 0.295 = 4.72A$ . Speakers:  $10 \times 0.145 = 1.45A$ . Strobes:  $8 \times 0.185 = 1.48A$ . Total = 7.65 amps, significantly exceeding the 3.0-amp rating. Circuit must be redesigned.
94. B — NFPA 72 Section 12.4.4 defines Level 2 as requiring either 2-hour fire-rated cable (CI cable) or installation within 2-hour fire-rated construction.
95. C — The 10-day notice requirement is a regulatory and contractual obligation. The contractor must maintain the requirement and reschedule with proper notification.
96. A — Two 75 cd strobes on opposite 56-foot walls divide the room into two zones. Each strobe covers approximately 28 feet from its wall — within the 45-foot maximum per strobe. Overlapping zones provide complete coverage.
97. D — As-built shows 164 but 174 are installed and confirmed by programming. NFPA 72 requires as-builts to reflect current configuration. Drawings must be updated.
98. B — The calculated minimum is 20.78 Ah. The specified 18 Ah batteries fall below this minimum by 2.78 Ah. The next standard size above 20.78 Ah must be selected.
99. A — Hospitals using defend-in-place may have differentiated responses per the approved fire safety plan. Different alarm types triggering different notification scopes is valid when documented and accepted by the AHJ.
100. C — As-built drawings should capture conduit type, size, and routing path from electrical panel to fire alarm panel. Essential for future maintenance and troubleshooting.
101. D — Excessive pulling tension can damage conductor insulation internally without visible jacket damage. Megger testing all 30 runs verifies insulation integrity before devices are connected. Visual inspection cannot detect internal failure.
102. B — Emergency control function interfaces require respective trade contractors. Elevator verifies recall, HVAC verifies shutdown and smoke control, controls verifies automation, and door hardware verifies holder release.
103. A — Converting horn/strobe to voice evacuation is a fundamental design change. A formal change order must document the engineering revision, cost, and schedule extension before work proceeds.

104. C — The fire alarm contractor should not modify the electrical contractor's work. The general contractor coordinates all trades and should direct the electrical contractor to replace the breaker.
105. D — Different date codes within the same model indicate different production runs. As long as all 650 are the same model and listed for the panel, variations do not affect compatibility.
106. B — Every service activity must be documented in a written report regardless of scope. Even a wire nut tightening resolves a condition that should be recorded.
107. A — Field markups contain actual as-installed information. The contractor must create clean, professional as-built drawings incorporating all data accurately.
108. C — NFPA 72 Section 7.7 requires as-built drawings, Record of Completion, sequence of operations, and operating instructions as the minimum closeout package.
109. D — Hospital infection control requirements for 72-hour notice must be respected. Patient safety protocols cannot be overridden by construction schedules.
110. B — The AHJ's 10-day notice is a regulatory obligation. Testing without notice may be invalidated. The supervisor must maintain the requirement and reschedule.
111. A — An 18-inch clearance in front of the panel violates NEC Article 110.26 requiring 36-inch depth. The fire alarm contractor should notify the general contractor of the conflict so the GC can coordinate between the mechanical and fire alarm trades to resolve it.
112. C — NEC Article 760.25 requires the removal of accessible abandoned fire alarm cable. The previous system's abandoned cable creates identification confusion with active circuits and must be traced and removed. The corrective action should be documented.
113. D — The encased conduit requires coordination between trades. The fire alarm contractor should notify the general contractor so the GC can coordinate a solution — whether that involves accessing the encased conduit, providing new conduit routing, or modifying the concrete work.
114. B — Verbal approvals without signed change order documents create significant financial risk. If the owner disputes the verbal authorizations at closeout, the contractor has no written documentation proving the work was formally authorized. Signed change orders protect both parties.
115. A — No fire alarm system operates correctly for ten years without maintenance. NFPA 72 Chapter 14 mandates ongoing inspection, testing, and maintenance throughout the system's service life. Providing a guarantee of maintenance-free operation is a false statement. The Record of Completion accurately certifies code-compliant installation.