

# PRACTICE EXAM 6: CTS-I

## SIMULATION

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### QUESTIONS 1–125

#### Domain A — Conducting Pre-Installation Activities

1. Which code primarily governs low-voltage cable installation practices in commercial buildings in the United States?

- A. UBC (Uniform Building Code)
- B. ASHRAE 90.1
- C. NEC (National Electrical Code), NFPA 70
- D. IEEE 1394

2. NEC conduit fill requirements for three or more cables in a conduit limit the cumulative cross-sectional area of cables to what percentage of the conduit's internal area?

- A. 40%
- B. 31%
- C. 53%
- D. 25%

3. Which AVIXA standard governs audiovisual systems performance verification?

- A. ANSI/AVIXA V202.01
- B. ANSI/AVIXA F501.01
- C. ANSI/AVIXA 2M-2010
- D. ANSI/AVIXA 10:2013

4. NEC rules limit the maximum cumulative bend angle between pull points in a conduit run to:

- A. 270 degrees
- B. 360 degrees
- C. 180 degrees
- D. 540 degrees

5. An installer performing work on an active construction site must possess which safety certification as a common access requirement?

- A. OSHA 10-hour construction safety card
- B. Manufacturer-specific equipment certification
- C. State electrical license
- D. ASE mechanical certification

6. The AVIXA DISCAS standard governs which aspect of AV system design?

- A. Cable installation practices
- B. Equipment rack configuration
- C. Acoustic treatment specifications

D. Display image size for two-dimensional content

7. Plenum-rated cable is required in air-handling spaces because it meets specific requirements for:

- A. Electromagnetic interference reduction
- B. Mechanical strength during installation
- C. Flame spread and smoke generation characteristics
- D. Moisture resistance in humid environments

8. The IEEE standard family that defines Ethernet physical and data link layers is:

- A. IEEE 1394
- B. IEEE 802.3
- C. IEEE 802.11
- D. IEEE 1588

9. NEC requirements for separation between low-voltage communications cable and line-voltage electrical conductors are primarily intended to prevent:

- A. Physical cable damage from conflicts
- B. Labor coordination issues between trades
- C. Documentation confusion during installation
- D. Licensing conflicts between the trades

10. ANSI/AVIXA F501.01 governs which aspect of AV system design?

- A. Cable installation practices for low-voltage systems

- B. Audio coverage uniformity in performance venues
- C. Design and coordination of audiovisual projects
- D. Display image size for two-dimensional content

11. The OSHA standard for fall protection in construction work establishes the requirement for fall protection at what height?

- A. 10 feet or greater
- B. 8 feet or greater
- C. 4 feet or greater
- D. 6 feet or greater

12. NEC Article 800 addresses:

- A. Electrical power distribution systems
- B. Communications circuits and related equipment
- C. Fire alarm and signaling systems
- D. Emergency and standby power systems

13. A wiring schedule includes NEC-referenced cable fill calculations. For two cables in a conduit, the fill limit is:

- A. 53%
- B. 40%
- C. 25%
- D. 31%

14. The AES convention for XLR connector pin assignments references which pin for ground/shield?

- A. Pin 1
- B. Pin 2
- C. Pin 3
- D. Pin 4

15. The IEEE 802.3af standard for Power over Ethernet provides what power at the powered device?

- A. 25.5 watts
- B. 30 watts
- C. 12.95 watts
- D. 51 watts

16. The AVIXA A102.01 standard governs which aspect of AV systems?

- A. Cable installation practices
- B. Audio coverage uniformity in listener areas
- C. Equipment rack configuration
- D. Display brightness specifications

17. NFPA 70 is commonly known as:

- A. The International Building Code
- B. The Uniform Mechanical Code
- C. The Life Safety Code
- D. The National Electrical Code

18. The OSHA silica standard is codified under which CFR reference for construction work?

- A. 29 CFR 1926.1153
- B. 29 CFR 1910.134
- C. 29 CFR 1926.501
- D. 29 CFR 1910.147

19. Cat6A cable specifications under TIA/EIA-568 support a maximum frequency of:

- A. 250 MHz
- B. 350 MHz
- C. 500 MHz
- D. 100 MHz

20. NEC requirements for structural support of suspended cable assemblies require attachment to:

- A. Ceiling grid system components
- B. Structural members of the building
- C. Adjacent HVAC ductwork
- D. Finished ceiling surfaces

21. The NEC classification CMP indicates:

- A. Communications cable rated for plenum spaces
- B. Commercial Motor Protection cable
- C. Carrier-Multiplexed Power cable
- D. Category Multi-Pair cable

22. The AVIXA Code of Ethics and Conduct requires CTS-I credential holders to maintain:

- A. Active AVIXA membership only
- B. Continuous employment in AV installation roles
- C. Minimum income thresholds for certified members
- D. Honesty, confidentiality, competence, and respect for intellectual property

23. The minimum rated capacity for fall arrest anchor points per OSHA standards is:

- A. 3,500 pounds per worker
- B. 5,000 pounds per worker
- C. 2,500 pounds per worker
- D. 1,000 pounds per worker

24. NEC requirements for firestopping at penetrations through fire-rated walls require the firestop assembly to:

- A. Match the specific cable manufacturer's recommendations only
- B. Exceed the wall's rating by at least 30 minutes
- C. Match the hourly fire-resistance rating of the wall assembly
- D. Provide a universal minimum rating regardless of wall type

25. The IEEE 802.3bt Type 4 standard for Power over Ethernet provides maximum power at the powered device of:

- A. 25.5 watts
- B. 30 watts
- C. 51 watts

D. 71 watts

26. The AVIXA AV Industry Outlook and Trends (IOTA) report is published by:

A. AVIXA (Audiovisual and Integrated Experience Association)

B. NEC (National Electrical Contractors Association)

C. IEEE (Institute of Electrical and Electronics Engineers)

D. OSHA (Occupational Safety and Health Administration)

27. NEC fill limits apply to conduits primarily to protect:

A. The aesthetic appearance of finished installations

B. Labor efficiency during cable pulls

C. Documentation clarity in as-built drawings

D. Cable from damage during pulls and thermal degradation during operation

28. An installer must hold which certification to perform work that involves handling refrigerants in HVAC systems adjacent to AV equipment?

A. OSHA 10-hour card

B. EPA Section 608 certification

C. AVIXA CTS-I certification

D. IEEE 802 certification

## Domain B — Conducting Site Rough-In/First-Fix

29. OSHA's silica standard (29 CFR 1926.1153) requires which controls for silica-generating activities including concrete cutting?

- A. Standard N95 dust masks regardless of exposure level
- B. Work performed only during favorable weather conditions
- C. Replacement of cutting blades every 100 cuts
- D. Water suppression, local exhaust ventilation, or respiratory protection matched to exposure

30. OSHA fall protection standards for construction work require fall protection at what height?

- A. 6 feet or greater
- B. 10 feet or greater
- C. 8 feet or greater
- D. 4 feet or greater

31. The 4-to-1 rule for extension ladder positioning establishes:

- A. The ladder must be 4 feet longer than the working height
- B. The ladder rungs must be at 4-inch intervals
- C. The base extends 1 foot from the structure for every 4 feet of working height
- D. The ladder angle must be 4 times greater than vertical

32. A scissor lift operator working within full-perimeter platform guardrails is generally:

- A. Required to wear personal fall arrest at all heights

- B. Provided sufficient passive fall protection by the guardrails alone
- C. Required to have a spotter on the ground at all times
- D. Required to wear personal fall arrest only above 20 feet

33. Boom lift platform fall protection requires personal fall arrest attached to:

- A. The ground-level fall arrest system
- B. An adjacent structure within reach
- C. The floor of the boom lift platform
- D. A designated anchor point on the platform itself

34. Concrete masonry walls require which fastener type for mounting AV equipment?

- A. Concrete-rated wedge anchors or sleeve anchors
- B. Wood lag bolts threaded into the masonry
- C. Standard plastic expansion anchors
- D. Sheet metal screws appropriate to the load

35. Structural blocking required to support wall-mounted AV equipment should be installed by:

- A. The AV installation crew during equipment mounting
- B. The drywall contractor during wall finishing
- C. The electrical contractor during rough-in
- D. The general contractor or framing trade during construction

36. OSHA requires fall arrest anchor points to have a minimum rated capacity of:

- A. 3,500 pounds per worker
- B. 5,000 pounds per worker
- C. 2,500 pounds per worker
- D. 1,000 pounds per worker

37. A cable pulled through a conduit must not exceed the cable manufacturer's specified maximum tension primarily to prevent:

- A. Invisible internal damage including conductor breakage and pair separation
- B. Visible damage to the cable's outer jacket
- C. Thermal expansion of the cable during operation
- D. Electromagnetic shielding degradation from pulling

38. The NEC permits cumulative bend angle in a conduit run between pull points up to:

- A. 270 degrees
- B. 180 degrees
- C. 360 degrees
- D. 540 degrees

39. Plenum-rated cable is required in air-handling spaces per:

- A. ASHRAE 90.1
- B. NEC Article 300.22 and similar code provisions
- C. OSHA 29 CFR 1926

D. AVIXA F501.01

40. Asbestos-containing materials discovered during deinstallation work in older buildings should be:

- A. Removed using standard PPE and bagged for general waste disposal
- B. Left in place and documented for future reference
- C. Cut at both ends and the suspect portion left within the pathway
- D. Left in place and reported to qualified asbestos abatement personnel

41. A ladder used as a means of access to an elevated work area must extend above the landing surface by at least:

- A. 1 foot
- B. 2 feet
- C. 3 feet
- D. 5 feet

42. An installer at a height of 22 feet on a scaffold platform requires fall protection per OSHA standards. The most appropriate configuration is:

- A. Guardrails on all open sides of the scaffold platform
- B. Spotter positioned on the ground monitoring for falls
- C. Standard leather work gloves and no fall protection
- D. Personal fall arrest using a rope positioned around a nearby beam

## Domain C — Installing Audiovisual Systems

43. The standardized vertical unit of measure for equipment racks is:

- A. 1.5 inches per rack unit
- B. 2.0 inches per rack unit
- C. 1.75 inches per rack unit
- D. 1.625 inches per rack unit

44. The standard rack mounting width measured between front mounting flanges is:

- A. 17 inches
- B. 19 inches
- C. 18 inches
- D. 21 inches

45. A 12U rack-mount device occupies what vertical mounting height?

- A. 18 inches
- B. 24 inches
- C. 15.75 inches
- D. 21 inches

46. The 80% rule applied to a 30-ampere circuit limits continuous loads to:

- A. 24 amperes
- B. 27 amperes

- C. 30 amperes
- D. 36 amperes

47. Blanking panels installed in unused rack units primarily serve to:

- A. Provide additional mounting surface for cable management
- B. Improve the rack's structural rigidity
- C. Preserve airflow paths and prevent hot exhaust recirculation
- D. Increase the rack's grounding effectiveness

48. The XLR convention assigns which pin to the hot/positive signal in professional audio?

- A. Pin 1
- B. Pin 2
- C. Pin 3
- D. Pin 4

49. Phantom power for condenser microphones is standardized at:

- A. 12 volts DC
- B. 24 volts DC
- C. 9 volts DC
- D. 48 volts DC

50. A balanced audio signal cable carries the signal using:

- A. Two conductors plus shield

- B. Three conductors plus shield
- C. One conductor plus shield
- D. Four conductors plus shield

51. A 6 dB increase in audio voltage represents:

- A. A tripling of voltage
- B. A halving of voltage with no change in power
- C. A doubling of voltage and a doubling of power
- D. A doubling of voltage and a quadrupling of power

52. The decibel formula for power ratios uses the multiplier:

- A. 20
- B. 10
- C. 15
- D. 5

53. The transformer at each loudspeaker on a 70-volt distributed audio system primarily serves to:

- A. Step down the high-voltage line to the loudspeaker's required voltage
- B. Provide phantom power to the loudspeakers
- C. Convert AC voltage to DC for solid-state drivers
- D. Boost the signal level for long cable runs

54. A 70-volt distributed audio amplifier rated at 400 watts should drive total tap loads of approximately:

- A. 500 watts
- B. 400 watts
- C. 320 watts
- D. 600 watts

55. Cat6 network cable supports a maximum frequency of:

- A. 100 MHz
- B. 500 MHz
- C. 350 MHz
- D. 250 MHz

56. The maximum permissible untwist length at the termination of Cat6A cable is:

- A. 0.5 inches
- B. 0.75 inches
- C. 0.25 inches
- D. 1.0 inches

57. 75-ohm coaxial cable is typically used for:

- A. Communications RF applications including two-way radio
- B. Video signal transport including SDI and CATV
- C. Speaker-level audio in distributed systems
- D. RS-232 serial control between devices

58. The maximum recommended copper cable distance for HDBaseT transmission of 4K video at 60 Hz is approximately:

- A. 50 meters (164 feet)
- B. 75 meters (246 feet)
- C. 100 meters (328 feet)
- D. 200 meters (656 feet)

59. EDID information flows between:

- A. The matrix switcher to the source device
- B. The control system to the video source
- C. The source device to the connected display
- D. The display to the connected video source

60. HDCP 2.2 encryption is required for protected transmission of:

- A. 4K UHD content from compatible sources
- B. 1080p content from any source
- C. Standard-definition video over coaxial cable
- D. Audio content over Dante networks

61. Multi-mode fiber OM3 specifications support 10 Gbps Ethernet transmission to approximately:

- A. 100 meters
- B. 200 meters
- C. 300 meters

D. 400 meters

62. APC fiber connectors are color-coded as:

A. Blue

B. Green

C. Beige

D. Yellow

63. The Dante audio networking protocol typically operates with latency of:

A. 50 to 100 milliseconds

B. 10 to 20 milliseconds

C. 5 to 10 milliseconds

D. 0.25 to 1 millisecond

64. SDVoE distributes uncompressed 4K60 video over which minimum network infrastructure?

A. 10 Gbps Ethernet

B. 1 Gbps Ethernet

C. 100 Mbps Ethernet

D. Wireless 802.11ac

65. The IEEE 802.3at standard for Power over Ethernet provides power at the powered device of:

A. 12.95 watts

B. 15.4 watts

- C. 25.5 watts
- D. 51 watts

66. An IPv4 address with a /24 subnet mask provides how many usable host addresses?

- A. 256 hosts
- B. 254 hosts
- C. 250 hosts
- D. 126 hosts

67. The private IPv4 address ranges defined under RFC 1918 include:

- A. Only 192.168.0.0/16
- B. Only 10.0.0.0/8
- C. Only 172.16.0.0/12
- D. 10.0.0.0/8, 172.16.0.0/12, and 192.168.0.0/16

68. A control system using RS-232 serial communication operates at typical baud rates between:

- A. 9600 and 115200 bps
- B. 1200 and 2400 bps
- C. 250000 and 500000 bps
- D. 4800 and 9600 bps

69. RS-232 communication between a controller and device requires matching configuration of:

- A. IP address, subnet mask, and gateway

- B. MAC address and VLAN configuration
- C. Baud rate, data bits, parity, and stop bits
- D. Frequency, modulation, and encryption

70. IR control of AV equipment is generally:

- A. Bidirectional with status feedback from the controlled device
- B. Unidirectional with no status feedback from the controlled device
- C. Effective at distances up to 500 feet from the controller
- D. Compatible with all consumer and professional equipment categories

71. The appropriate first diagnostic step when a control processor sending IP commands receives no response is:

- A. Update firmware on the controlled device
- B. Reboot the control processor to clear cached information
- C. Replace the network cable connecting the device
- D. Verify network connectivity using ping or similar tool

72. A loudspeaker rated at 8 ohms connected to an amplifier with total cable resistance limited to 5% of impedance can have maximum cable resistance of:

- A. 0.40 ohms
- B. 0.20 ohms
- C. 0.50 ohms
- D. 0.10 ohms

73. Three loudspeakers each rated at 8 ohms connected in parallel present what combined impedance to the amplifier?

- A. 24 ohms
- B. 4 ohms
- C. 2.67 ohms
- D. 8 ohms

74. Digital signals degrading over distance through a transmission medium typically exhibit:

- A. Gradual quality degradation similar to analog signals
- B. Full quality maintained until catastrophic failure at the digital cliff
- C. Increasing color saturation as distance increases
- D. Audible noise that grows progressively louder

75. A waveform monitor displays which video signal characteristic?

- A. Video chrominance on a polar plot
- B. Audio levels accompanying the video
- C. Network bandwidth utilization
- D. Video signal amplitude over time

76. A vectorscope displays which video signal characteristic?

- A. Video signal amplitude over time
- B. Video chrominance on a polar plot
- C. Audio frequency response across the spectrum

D. Network packet loss patterns

77. A projector with a throw ratio of 2.0:1 positioned 16 feet from the screen produces what image width?

- A. 32 feet
- B. 16 feet
- C. 8 feet
- D. 4 feet

78. The recommended target white point for video calibration is:

- A. 6500K (D65)
- B. 5500K (D55)
- C. 7500K (D75)
- D. 9300K (D93)

79. The recommended target gamma for standard video content is approximately:

- A. 1.8
- B. 2.0
- C. 2.4
- D. 2.2

80. The AVIXA DISCAS standard recommends that for basic decision-making content, the farthest viewer should be no more than:

- A. 4 times the image height

- B. 6 times the image height
- C. 8 times the image height
- D. 12 times the image height

81. A measurement microphone used for room equalization should have:

- A. Cardioid polar pattern with extended low-frequency response
- B. Flat, documented frequency response with omnidirectional polar pattern
- C. Hypercardioid pattern with maximum off-axis rejection
- D. Ribbon transducer with vintage warm sound character

82. The AES67 standard primarily provides:

- A. Encryption of audio streams for security purposes
- B. Power delivery to networked audio devices
- C. Frequency-domain analysis of audio signals
- D. Open interoperability between different manufacturers' systems

83. A polarity tester in audio system verification confirms:

- A. All loudspeakers in a system move in the same direction on the same signal
- B. The amplifier output voltage is within manufacturer specifications
- C. The audio signal level is appropriate for the connected loudspeaker
- D. The audio cable shielding is properly bonded to ground

84. Cable certification for installed Cat6A cabling tests:

- A. Length and continuity only
- B. Voltage drop and current capacity only
- C. Insertion loss, return loss, NEXT, ANEXT, propagation delay, and other parametric measurements
- D. Visual inspection of cable jacket only

85. A 1080p video signal at 60 Hz with 8-bit color requires approximately what bandwidth?

- A. 3.0 Gbps
- B. 4.5 Gbps
- C. 6.0 Gbps
- D. 9.0 Gbps

86. A 4K video signal at 60 Hz with 10-bit color and HDR requires approximately what bandwidth?

- A. 12 Gbps
- B. 18 Gbps
- C. 36 Gbps
- D. 24 Gbps

87. A 70-volt distributed audio system with 8 loudspeakers at 15-watt taps and 4 loudspeakers at 7.5-watt taps has total tap load of:

- A. 150 watts
- B. 175 watts
- C. 200 watts

D. 225 watts

88. Acoustic echo cancellation (AEC) in a video conferencing system removes:

- A. Background ambient noise from the room
- B. Distortion from the microphone's amplification stage
- C. The sound of the room loudspeakers reproducing far-end audio
- D. Reverb from hard surfaces in the conference room

**Domain D — Perform Systems Close-Out**

89. The ANSI/AVIXA 10:2013 standard governs:

- A. Cable installation practices for low-voltage AV systems
- B. Audiovisual systems performance verification
- C. Audio coverage uniformity in performance venues
- D. Display image size for two-dimensional content

90. Under ANSI/AVIXA 10:2013, A-Level verification items represent:

- A. Specialized functions present on many but not all installations
- B. Aesthetic and cosmetic checks of installed equipment
- C. Unique requirements specific to particular installations
- D. Essential system functions that must be verified on every installation

91. A punch list distinguishes between substantive and cosmetic deficiencies. A non-functional audio channel is classified as:

- A. A substantive deficiency affecting system function
- B. A cosmetic deficiency affecting appearance only
- C. A pre-existing condition outside the installation scope
- D. A user training issue requiring documentation

92. Substantial completion is the formal milestone at which:

- A. The installer's contractual obligations begin
- B. All punch list items have been completed and verified
- C. The system is ready for its intended use and the warranty period typically begins
- D. Final retention is fully released to the installer

93. A 12-month warranty effective date is generally tied to which project milestone?

- A. The original contract signing date
- B. Substantial completion when the client takes beneficial use
- C. The date equipment was originally delivered to the warehouse
- D. The first day of installation work on the project

94. As-built documentation primarily serves which purpose?

- A. To provide design intent for the installation team
- B. To establish contract scope between parties
- C. To document change orders processed during construction

D. To record the installed system's actual configuration for future reference

95. A typical client end-user training session in AV installations is best characterized by:

- A. Brief focused sessions on essential operations with hands-on practice
- B. Extended technical sessions covering all system capabilities in detail
- C. Lecture-style presentation with no hands-on participation
- D. Self-paced video training without instructor presence

96. A quick reference guide provided as a training material should include:

- A. Detailed technical specifications for each piece of equipment
- B. Complete signal flow diagrams for the entire system
- C. Essential functions with screenshots and simple instructions
- D. Manufacturer service contact information for each component

97. A service agreement typically provides:

- A. Complete installation upgrades at no additional cost
- B. Defined response times, scheduled preventive maintenance, and priority service
- C. Free equipment replacement throughout the agreement period
- D. Manufacturer warranty extension for all installed equipment

98. A typical preventive maintenance schedule for a commercial AV installation operating during standard business hours typically recommends:

- A. Monthly visits for all installations regardless of usage

- B. Quarterly visits as the universal standard regardless of environment
- C. Visits only when system problems occur
- D. Annual visits with more frequent visits for high-use environments

99. The signed sign-off documentation at project completion serves the primary purpose of:

- A. Creating a formal written record of the client's acceptance of the installation
- B. Authorizing manufacturer warranty registration for equipment
- C. Documenting installation date for tax depreciation purposes
- D. Triggering the next phase of the construction project

100. A walk-through performed during the substantial completion process typically involves:

- A. Only the lead installer reviewing their own work
- B. Manufacturer representatives observing the installation
- C. The installer, client representative, and sometimes the general contractor
- D. The client's accounting staff reviewing equipment costs

101. A certificate of substantial completion documents:

- A. That the system is ready for its intended use even though minor work may remain
- B. The original cost of equipment installed in the project
- C. The serial numbers of all installed equipment
- D. The expected service life of installed components

102. Project closeout deliverables on larger AV installations typically include:

- A. Only the equipment manuals
- B. Only the as-built drawings
- C. As-built drawings, equipment manuals, warranty documentation, and verification reports
- D. Only the warranty cards

**Domain E — Conducting Ongoing Project Responsibilities**

103. The primary purpose of daily progress reports is to:

- A. Calculate weekly invoice amounts for billing purposes
- B. Document equipment serial numbers as they are installed
- C. Track individual installer productivity for performance reviews
- D. Document activities, labor, materials, and issues for the project record

104. A request for information (RFI) is most appropriately used to:

- A. Document materials consumed during the previous work day
- B. Obtain clarification or direction on a field-discovered issue from the design team
- C. Request additional labor resources from the project manager
- D. Submit invoices for completed work to the client's accounting

105. A field engineering decision involving substituting equivalent accessories during installation is typically:

- A. A minor adaptation within the installer's authority but requiring documentation

- B. A code violation requiring building inspector notification
- C. A breach of contract requiring immediate work stoppage
- D. A major adaptation requiring formal change order and client approval

106. Trade coordination on a construction project is primarily managed through:

- A. Direct communication between AV and electrical workers without supervisor involvement
- B. The client's facilities director who coordinates all trades
- C. The architect who provides daily schedule updates to all trades
- D. The general contractor's superintendent and structured coordination meetings

107. A change order is required when:

- A. Materials are consumed faster than originally estimated
- B. The installer must perform work during evening hours
- C. Work scope expands beyond the original contract specifications
- D. Equipment fails during installation and requires replacement

108. The "clean as you go" practice in AV installation means:

- A. The installation crew cleans the entire jobsite at the end of each work week
- B. Cable scraps, packaging, and debris are managed continuously
- C. Specialized cleaning contractors handle all jobsite cleanup activities
- D. Cleanup activities are deferred until the project's final close-out phase

109. Construction debris from AV installation is typically disposed of through:

- A. The AV installation firm's own dedicated dumpster brought to the site
- B. The client's regular building trash service
- C. Personal disposal by individual installers at the end of each shift
- D. The general contractor's construction waste management system

110. A delay caused by another trade's incomplete work should be reported by the AV installer through:

- A. The project manager who can coordinate appropriate response
- B. Direct confrontation with the other trade's foreman
- C. Posting on the project's social media or messaging platforms
- D. Filing a formal grievance with the building owner

111. OSHA's silica standard (29 CFR 1926.1153) requires which controls during concrete cutting in AV installations?

- A. Using N95 dust masks and accepting normal dust generation
- B. Performing all cutting outside the building during favorable weather
- C. Water suppression, local exhaust ventilation, or respiratory protection
- D. Using only carbide-tipped blades to minimize cutting friction

112. A coordination drawing developed through Building Information Modeling (BIM) primarily supports:

- A. Marketing presentations to potential clients
- B. Conflict identification and resolution between MEP, fire protection, and technology systems
- C. Building permit applications submitted to local authorities

D. Insurance documentation for the construction project

113. An AV installer who discovers an unexpected condition that affects the original design has the responsibility to:

- A. Modify the installation to accommodate the condition without notifying others
- B. Wait for the design team to discover the condition during their next site visit
- C. Document the condition for the as-built drawings only
- D. Report the condition through appropriate channels for engineering review

114. Reporting a delay to the project manager should occur:

- A. As soon as the potential delay is identified, even if impact is uncertain
- B. Only after the delay has caused a missed schedule milestone
- C. During the next scheduled coordination meeting regardless of timing
- D. Only when the cause of the delay can be definitively documented

115. A scope change identified during installation should:

- A. Be implemented immediately to maintain project schedule
- B. Be ignored if it represents a small amount of additional work
- C. Be routed through the project manager for change order processing
- D. Be assigned to the next available installer without documentation

116. Work performed on AV equipment beyond the original contract scope without formal change order approval typically results in:

- A. Reimbursement at premium emergency rates

- B. Automatic addition to the next monthly invoice
- C. Default acceptance by the client at the original contract rate
- D. Labor and materials consumed without compensation to the installer

117. The professional documentation captured during field engineering decisions supports:

- A. Direct communication between the installer and equipment manufacturers
- B. Both as-built records and traceability of decisions made under installer authority
- C. Sales discussions with future potential clients
- D. Performance reviews of individual installation crew members

118. The installer's responsibility regarding firestopping at fire-rated wall penetrations is to:

- A. Either perform the firestopping correctly or coordinate with the firestop contractor
- B. Defer all firestopping to the general contractor without coordination
- C. Apply silicone caulk as a temporary measure pending professional firestop
- D. Use the same firestop material regardless of the wall's fire rating

119. An installer who discovers asbestos-containing material during cable removal should:

- A. Continue work using respiratory protection and document the finding
- B. Notify only the client without involving regulatory authorities
- C. Cap both ends of the affected cable and continue with remaining work
- D. Stop work immediately and contact qualified asbestos abatement personnel

120. The professional purpose of root-cause analysis after a service incident is to:

- A. Determine which crew member is responsible for the failure
- B. Document the failure for future legal proceedings
- C. Understand why the failure occurred so the same failure does not recur
- D. Calculate the warranty coverage applicable to the failure

121. A typical AV installation's expected service life before major refresh is approximately:

- A. 2 to 3 years
- B. 7 to 10 years
- C. 15 to 20 years
- D. 25 to 30 years

122. End-of-life indicators for an AV installation typically include:

- A. Increasing service frequency, declining reliability, and parts unavailability
- B. Increased user satisfaction with system performance
- C. Decreased frequency of preventive maintenance visits
- D. Reduced electricity consumption by aging equipment

123. Decommissioned AV equipment containing configuration data should be:

- A. Returned to the manufacturer in original packaging for credit
- B. Donated to charitable organizations without modification
- C. Stored in the client's facility for potential future use
- D. Factory-reset or data-wiped before leaving the client's site

124. The Restriction of Hazardous Substances (RoHS) directive primarily addresses:

- A. Workplace safety requirements for AV installation work
- B. Building code requirements for AV equipment installation
- C. Restricted materials in electronic equipment requiring responsible handling
- D. Manufacturer warranty terms for installed AV equipment

125. The relationship between an installer and an installation typically extends:

- A. Only through the initial installation phase to client handover
- B. Through the entire service life of the system via maintenance and service activities
- C. Through manufacturer warranty period only
- D. Until the next election of building management

# PRACTICE EXAM 6: ANSWER KEY

## WITH FULL ANSWER EXPLANATIONS

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### Questions 1–125

#### Domain A — Conducting Pre-Installation Activities

1. C — NEC (National Electrical Code), NFPA 70. The National Electrical Code, published by the NFPA as NFPA 70, is the primary code governing low-voltage communications cable installation in commercial buildings in the United States. Articles 725 (Class 1, 2, 3 circuits), 770 (optical fiber cables), and 800 (communications circuits) are especially relevant to AV installers.
2. A — 40%. NEC fill rules permit cables to occupy up to 40% of conduit internal cross-sectional area when three or more cables share the conduit. Single cables may fill to 53%, and two cables are limited to 31% — knowing these three specific percentages is fundamental for take-off calculations.
3. D — ANSI/AVIXA 10:2013. This is the industry standard governing how AV systems are verified against design specifications during commissioning. The standard defines the verification framework including A-Level, B-Level, and C-Level verification items and establishes the documentation structure for professional verification.
4. B — 360 degrees. NEC Chapter 9 limits the cumulative bend angle between pull points to 360 degrees, equivalent to four 90-degree bends. Conduit runs exceeding this limit require intermediate pull boxes to prevent cable damage from excessive pulling tension.
5. A — OSHA 10-hour construction safety card. The OSHA 10-hour card certifies completion of standardized construction safety training and is commonly required for general worker access on commercial construction jobsites. The 30-hour card is typically required for supervisory personnel.
6. D — Display image size for two-dimensional content. The AVIXA DISCAS standard (ANSI/AVIXA V202.01) establishes recommended image size relative to viewing distance and content type, distinguishing between basic decision-making content and analytical decision-making content requirements.
7. C — Flame spread and smoke generation characteristics. Plenum-rated cable (CMP classification) meets stringent flame spread and smoke generation requirements for installation in air-handling

spaces. Air movement through plenums can rapidly spread fire and smoke, so fire-resistant cable is required to prevent smoke contamination of occupied spaces.

8. B — IEEE 802.3. The IEEE 802.3 standard family defines Ethernet physical and data link layers, including all current Ethernet standards from 10 Mbps through 400 Gbps. This standard is the foundation of modern networked AV systems.
9. A — Physical cable damage from conflicts. NEC separation requirements between low-voltage communications cable and line-voltage conductors primarily prevent physical damage from conflicts during installation or operation, as well as electrical interference that can couple between parallel conductors. These requirements are documented in NEC Articles 725 and 800.
10. C — Design and coordination of audiovisual projects. ANSI/AVIXA F501.01 establishes the standard for AV project design and coordination, providing the framework for professional AV design documentation. This standard is commonly referenced in AV contract specifications.
11. D — 6 feet or greater. OSHA construction standards (29 CFR 1926 Subpart M) require fall protection at heights of 6 feet or greater. This is stricter than the general industry standard of 4 feet under 29 CFR 1910, and AV installers working in construction environments must comply with this specific requirement.
12. B — Communications circuits and related equipment. NEC Article 800 covers communications circuits including telephone, data, and video systems, establishing requirements for cable types, separation, supports, and firestopping. This article is the primary NEC reference for AV installation work.
13. D — 31%. NEC fill rules specifically limit two cables in a conduit to 31% fill, which is more restrictive than the 40% limit for three or more cables and the 53% limit for a single cable. The two-cable limit exists because of geometric jamming concerns with two cables.
14. A — Pin 1. The AES convention for XLR connector pin assignments is universally adopted in professional audio: Pin 1 carries the shield/ground, Pin 2 carries the hot/positive signal, Pin 3 carries the cold/negative signal. This standardization ensures XLR cables function consistently.
15. C — 12.95 watts. The IEEE 802.3af standard (basic PoE) provides 12.95 watts at the powered device, with 15.4 watts at the power source. This is the original PoE standard and is still widely used for lower-power devices like IP phones and basic cameras.
16. B — Audio coverage uniformity in listener areas. ANSI/AVIXA A102.01 (audio coverage uniformity) establishes requirements for consistent audio levels across listening areas in spaces with multiple loudspeakers. This standard supports professional audio system design and verification.
17. D — The National Electrical Code. NFPA 70 is formally titled the National Electrical Code, published and maintained by the National Fire Protection Association. This code governs electrical

installations throughout the United States and includes the primary requirements for low-voltage communications cable.

18. A — 29 CFR 1926.1153. OSHA's silica standard for construction work is codified under 29 CFR 1926.1153, establishing engineering controls, respiratory protection, and exposure monitoring requirements for silica-generating activities including concrete cutting and drilling.
19. C — 500 MHz. Cat6A cable under TIA/EIA-568 supports a maximum frequency of 500 MHz, twice the 250 MHz of Cat6 cable. This bandwidth supports 10GBase-T data rates and modern HDBaseT 4K60 video applications.
20. B — Structural members of the building. NEC requirements specify that cable supports must attach to structural members of the building, not to ceiling grid, ductwork, plumbing, or other non-structural elements. This requirement ensures support systems are stable and compliant with applicable codes.
21. A — Communications cable rated for plenum spaces. NEC classification CMP (Communications Multipurpose Plenum) indicates cable rated for installation in plenum spaces, meeting the flame spread and smoke generation requirements for air-handling environments. This classification is essential for proper cable selection.
22. D — Honesty, confidentiality, competence, and respect for intellectual property. The AVIXA Code of Ethics establishes professional obligations including honesty in business dealings, confidentiality of client information, maintaining professional competence, and respecting intellectual property. These principles define the professional standards that credential holders agree to uphold.
23. B — 5,000 pounds per worker. OSHA 29 CFR 1926.502 requires fall arrest anchor points to have minimum rated capacity of 5,000 pounds per worker, providing safety margin needed to arrest a falling worker without failure. Engineered systems with documented lower capacity may be used but must be specifically designed.
24. C — Match the hourly fire-resistance rating of the wall assembly. NEC and similar code requirements mandate that firestopping at fire-rated wall penetrations must match the wall's hourly rating. A 2-hour rated wall requires firestopping tested to 2-hour performance, ensuring the wall's life-safety function is preserved.
25. D — 71 watts. IEEE 802.3bt Type 4 provides up to 71 watts at the powered device, with 100 watts at the power source equipment. This represents the highest power level in current PoE standards, supporting high-power devices including some displays and lighting.
26. A — AVIXA (Audiovisual and Integrated Experience Association). The AV Industry Outlook and Trends (IOTA) report is published by AVIXA, the trade association that also maintains the CTS certification family. AVIXA is the primary professional organization for the AV industry.

27. D — Cable from damage during pulls and thermal degradation during operation. NEC fill limits protect cables from mechanical damage during pulls (where overfilled conduit causes excessive friction and tension) and from thermal issues during operation (where heat from densely packed cables cannot dissipate adequately). Both protections extend cable service life.
28. B — EPA Section 608 certification. EPA Section 608 certification is required for anyone who handles refrigerants, including disposal of equipment containing refrigerants. AV installers working around HVAC systems typically coordinate with certified HVAC technicians rather than handling refrigerants directly.

#### **Domain B — Conducting Site Rough-In/First-Fix**

29. D — Water suppression, local exhaust ventilation, or respiratory protection matched to exposure. OSHA's silica standard (29 CFR 1926.1153) requires specific controls matched to the specific activity and exposure level, including engineering controls (water suppression, local exhaust with HEPA filtration) or respiratory protection. Standard dust masks are insufficient for silica exposure.
30. A — 6 feet or greater. OSHA construction fall protection standards (29 CFR 1926.501) require fall protection at heights of 6 feet or greater. This is the standard trigger for fall protection requirements on commercial construction jobsites.
31. C — The base extends 1 foot from the structure for every 4 feet of working height. The 4-to-1 rule sets the ladder angle so that it is stable while remaining safe to climb. A 16-foot working height requires the ladder base positioned 4 feet from the supporting surface.
32. B — Provided sufficient passive fall protection by the guardrails alone. Scissor lifts equipped with full-perimeter guardrails permit operators to remain within the platform without personal fall arrest. Boom lifts, which can experience whipping motion, do require personal fall arrest in addition to guardrails.
33. D — A designated anchor point on the platform itself. Boom lifts can experience whipping motion that ejects workers from the platform, and OSHA requires personal fall arrest attached to designated anchor points on the platform. Anchoring to ground systems or adjacent structures defeats the protection and is not permitted.
34. A — Concrete-rated wedge anchors or sleeve anchors. Concrete masonry walls require anchors specifically designed for concrete materials with installation per anchor manufacturer specifications. Wood screws and lag bolts cannot effectively engage masonry, and plastic expansion anchors lack adequate capacity for substantial AV mounts.
35. D — The general contractor or framing trade during construction. Structural blocking is a construction activity that must be installed during framing, before walls are closed with drywall. Coordination with the general contractor ensures blocking is in place when AV mounting begins.

36. B — 5,000 pounds per worker. OSHA 29 CFR 1926.502 requires fall arrest anchor points to have minimum rated capacity of 5,000 pounds per worker. Engineered systems with documented lower capacity may be used but must be specifically designed for fall arrest.
37. A — Invisible internal damage including conductor breakage and pair separation. Excessive pulling tension stretches and damages cable internals through the jacket, breaking conductors or separating twisted pairs. This damage degrades signal performance even though external visual inspection appears normal.
38. C — 360 degrees. NEC Chapter 9 limits cumulative bend angle between pull points to 360 degrees, equivalent to four 90-degree bends. This limit exists because exceeding it dramatically increases pulling friction and can cause cable damage during pulls.
39. B — NEC Article 300.22 and similar code provisions. NEC Article 300.22 covers wiring in spaces used for environmental air (plenums), establishing requirements for cable ratings and installation methods. This article is the primary code reference for plenum cable requirements.
40. D — Left in place and reported to qualified asbestos abatement personnel. Asbestos must be handled only by qualified abatement personnel because exposure causes diseases that emerge decades after exposure. Standard PPE and bagging are not appropriate, and informal handling creates long-term health hazards.
41. C — 3 feet. OSHA requires ladders used for access to an elevated surface to extend at least 3 feet above the landing surface, providing stable handholds as the worker transitions from ladder to surface. Ladders not extending 3 feet above create unsafe access conditions.
42. A — Guardrails on all open sides of the scaffold platform. Scaffolding with perimeter guardrails on all open sides provides passive fall protection for workers on the platform. This guardrail system is the standard fall protection method for scaffold work and is often sufficient without personal fall arrest.

### **Domain C — Installing Audiovisual Systems**

43. C — 1.75 inches per rack unit. The standardized rack unit (RU) measure is 1.75 inches of vertical mounting height. This standard allows equipment from any manufacturer to mount into any compatible rack and is the foundation of the modular rack ecosystem.
44. B — 19 inches. The 19-inch width measured between front mounting flanges is the global standard for professional AV, broadcast, data, and telecommunications equipment racks. This standardization allows compatible equipment from any manufacturer to mount into any compatible rack.
45. D — 21 inches. A 12U device occupies  $12 \times 1.75$  inches, which equals 21.0 inches of vertical mounting height. Multiplying RU count by 1.75 gives the precise vertical space requirement for any equipment.

46. A — 24 amperes. The 80% rule limits continuous loads to 80% of circuit rating, so a 30-ampere circuit is limited to  $30 \times 0.80 = 24$  amperes. This rule prevents breaker tripping and equipment damage from sustained near-rated current draw.
47. C — Preserve airflow paths and prevent hot exhaust recirculation. Blanking panels close unused rack units and maintain the rack's pressurized front-to-back airflow path. Without them, hot exhaust can recirculate back through gaps to be re-ingested by equipment intakes, causing thermal degradation.
48. B — Pin 2. The XLR connector convention assigns Pin 1 to ground/shield, Pin 2 to the hot/positive signal, and Pin 3 to the cold/negative signal. This AES standard ensures XLR cables function consistently across professional audio equipment.
49. D — 48 volts DC. Phantom power for condenser microphones is standardized at 48 volts DC, delivered through balanced audio cables in a configuration that does not affect the audio signal. Lower voltages exist for specific microphones, but 48V is the dominant standard.
50. A — Two conductors plus shield. Balanced audio uses two signal conductors (hot and cold) carrying the signal as a voltage difference, plus a shield/ground conductor. This three-wire configuration enables common-mode rejection that distinguishes balanced from unbalanced audio.
51. D — A doubling of voltage and a quadrupling of power. A 6 dB increase represents  $2\times$  voltage and  $4\times$  power, because power scales with voltage squared. This reference value is one of the key decibel facts for audio calculations.
52. B — 10. The decibel formula for power ratios uses the multiplier 10 ( $10 \times \log(P1/P2)$ ), while the formula for voltage ratios uses 20 (because power scales with voltage squared). Understanding which formula applies to which quantity prevents calculation errors.
53. A — Step down the high-voltage line to the loudspeaker's required voltage. The transformer at each loudspeaker on a 70V distributed audio system steps down the 70-volt line to the lower voltage that the loudspeaker driver requires, with a tap selector determining the power the loudspeaker draws.
54. C — 320 watts. Professional practice sizes amplifiers at approximately 125% of total tap load, meaning a 400-watt amplifier should drive no more than approximately 320 watts of total tap load ( $400 \div 1.25 = 320$ ). This headroom ensures reliable operation.
55. D — 250 MHz. Cat6 cable supports a maximum frequency of 250 MHz, midway between Cat5e's 100 MHz and Cat6A's 500 MHz. Each category's bandwidth determines the data rates and applications it can support.
56. A — 0.5 inches. Cat6A cable specifications permit only half an inch of untwist at termination because excess untwist degrades high-frequency performance and crosstalk rejection. Maintaining this minimum is essential for certified performance.

57. B — Video signal transport including SDI and CATV. 75-ohm coaxial cable is the standard for video applications including composite video, SDI broadcast video, CATV, and other baseband and broadband video signals. The 50-ohm version is used for communications RF applications.
58. C — 100 meters (328 feet). The HDBaseT specification supports 4K60 video transmission over Cat6A cable up to 100 meters (328 feet), matching general Ethernet limits. This long-distance capability is one of HDBaseT's key advantages for commercial AV.
59. D — The display to the connected video source. EDID information flows from the display to the source, telling the source what resolutions, refresh rates, and color depths the display can handle. The source then produces signals the display can show.
60. A — 4K UHD content from compatible sources. HDCP 2.2 (and later versions) is required for 4K content because the original HDCP 1.x standard was not designed for 4K bandwidth. Every device in the signal path must support the required HDCP version, or protected content will not display.
61. C — 300 meters. OM3 multimode fiber specifications support 10 Gbps Ethernet transmission to 300 meters, substantially exceeding the 100-meter limit for copper. OM4 extends this to 400 meters, and OM5 to even greater distances.
62. B — Green. APC (Angled Physical Contact) fiber connectors are color-coded green to distinguish them from PC and UPC connectors which are blue or beige. This distinct color coding prevents accidental mating of incompatible connector types.
63. D — 0.25 to 1 millisecond. Dante audio networking operates with extremely low latency at standard settings, typically 0.25 to 1 millisecond depending on the specific configuration. This low latency is essential for professional audio applications where noticeable delay would degrade user experience.
64. A — 10 Gbps Ethernet. SDVoE distributes uncompressed 4K60 video over 10 Gbps Ethernet, which provides the bandwidth required for the uncompressed stream plus headroom for protocol overhead. This requirement is substantially greater than the 1 Gbps of typical office networks.
65. C — 25.5 watts. The IEEE 802.3at standard (PoE+) provides 25.5 watts at the powered device, with 30 watts at the power source equipment. The difference between source output and PD input accounts for cable losses during transmission.
66. B — 254 hosts. A /24 subnet provides 256 total addresses, minus 2 reserved for network and broadcast, leaving 254 usable host addresses. This is the standard subnet size for many local network deployments.
67. D — 10.0.0.0/8, 172.16.0.0/12, and 192.168.0.0/16. RFC 1918 defines three private IPv4 address ranges reserved for internal networks and not routable on the public internet. All three ranges are used in commercial AV installations depending on the client's network architecture.

68. A — 9600 and 115200 bps. RS-232 serial communication operates at typical baud rates between 9600 and 115200 bits per second, with 9600 being the most common default. Higher rates support greater throughput but require shorter cable lengths.
69. C — Baud rate, data bits, parity, and stop bits. RS-232 communication requires matching configuration of these four serial parameters between the controller and the controlled device. Mismatched configurations prevent communication between the devices.
70. B — Unidirectional with no status feedback from the controlled device. IR control transmits commands from controller to device but receives no feedback, making it limited compared to bidirectional protocols. IR also requires line of sight, further limiting its application.
71. D — Verify network connectivity using ping or similar tool. Ping testing is the most efficient first diagnostic step because it quickly identifies whether the device is reachable on the network. This eliminates the most common cause of communication failures before pursuing more complex diagnostics.
72. A — 0.40 ohms. The 5% of 8 ohms equals 0.40 ohms maximum cable resistance. Maintaining this limit preserves power transfer efficiency and prevents the amplifier from seeing reduced effective impedance that could trigger protection circuits.
73. C — 2.67 ohms. Three 8-ohm loudspeakers in parallel combine as  $8 \div 3$ , which equals approximately 2.67 ohms. Parallel impedance is always lower than any individual element, and dropping below amplifier minimum specification can cause damage.
74. B — Full quality maintained until catastrophic failure at the digital cliff. Digital signals tolerate degradation without quality loss up to the point where binary ones and zeros become indistinguishable, then fail completely. This binary success/failure characteristic distinguishes digital from analog signal behavior.
75. D — Video signal amplitude over time. A waveform monitor displays video signal voltage as a waveform on a time-axis display, useful for verifying signal levels, sync timing, and amplitude-based characteristics. Modern software waveform monitors integrate with capture hardware in many verification workflows.
76. B — Video chrominance on a polar plot. A vectorscope displays video chrominance (color information) as a polar plot showing color hue (angle) and saturation (radius from center). This display format is essential for color verification across multiple video sources.
77. C — 8 feet. The throw ratio formula is image distance divided by image width, so image width =  $16 \div 2.0 = 8$  feet. Throw ratio calculations determine projector positioning to achieve specific image sizes.

78. A — 6500K (D65). The D65 white point references 6500 Kelvin and is the standard white point for video content calibration. Calibrating to D65 ensures that white content appears correctly without warm or cool tints.
79. D — 2.2. Standard video content is encoded for gamma 2.2, establishing the nonlinear relationship between input signal and displayed brightness that matches human visual perception. Display calibration adjusts gamma to match this standard so midtones appear correctly bright.
80. C — 8 times the image height. The AVIXA DISCAS standard recommends maximum viewing distance of 8 times image height for basic decision-making content (where text must be readable from the back of the room). Analytical decision-making content requires shorter distances of 4 times image height.
81. B — Flat, documented frequency response with omnidirectional polar pattern. Measurement microphones are designed for analytical accuracy rather than performance coloration, with flat frequency response and omnidirectional sensitivity producing measurements that reflect the room's actual sound.
82. D — Open interoperability between different manufacturers' systems. AES67 is an open standard from the Audio Engineering Society that enables networked audio systems from different manufacturers to exchange audio. Modern Dante implementations include AES67 compatibility as the common interoperability layer.
83. A — All loudspeakers in a system move in the same direction on the same signal. A polarity tester verifies that every loudspeaker responds with correct polarity to a reference signal. Polarity errors cause destructive interference and substantial loss of low-frequency output that the test identifies.
84. C — Insertion loss, return loss, NEXT, ANEXT, propagation delay, and other parametric measurements. Category-rated cable certification tests multiple parameters that together demonstrate the cable's high-frequency performance meets the specified category. Simple continuity tests are insufficient for verified performance.
85. B — 4.5 Gbps. 1080p60 at 8-bit color depth requires approximately 4.5 Gbps of bandwidth. Cable infrastructure must support this bandwidth because inadequate cable produces signal failure rather than gradual degradation as occurs with analog signals.
86. D — 24 Gbps. 4K60 with 10-bit color and HDR requires approximately 24 Gbps of bandwidth, exceeding the 18 Gbps capacity of Premium High Speed HDMI. Ultra High Speed HDMI or equivalent infrastructure is required for this signal specification.
87. A — 150 watts.  $8 \text{ loudspeakers} \times 15 \text{ watts} = 120 \text{ watts}$ , plus  $4 \text{ loudspeakers} \times 7.5 \text{ watts} = 30 \text{ watts}$ , totaling 150 watts. Tap load calculations determine the total power demand on the amplifier and verify it falls within amplifier capacity with appropriate headroom.

88. C — The sound of the room loudspeakers reproducing far-end audio. Acoustic echo cancellation removes the room loudspeaker audio from the microphone signal so that far-end participants hear only the near-end voices rather than echoes of their own speech. This processing is essential for effective hands-free conferencing.

#### **Domain D — Perform Systems Close-Out**

89. B — Audiovisual systems performance verification. ANSI/AVIXA 10:2013 is the industry standard governing how AV systems are verified against design specifications during commissioning. The standard defines the verification framework including A-Level, B-Level, and C-Level verification items.
90. D — Essential system functions that must be verified on every installation. A-Level verification items are the fundamental capabilities that every AV installation must demonstrate, including system power-on, source selection, content display, audio reinforcement, and control system function.
91. A — A substantive deficiency affecting system function. A non-functional audio channel prevents the system from performing its intended function, making it substantive rather than cosmetic. Substantive deficiencies typically receive higher priority than items affecting only appearance.
92. C — The system is ready for its intended use and the warranty period typically begins. Substantial completion is the milestone where the installation is usable for its intended purpose, even though minor work may remain. This triggers warranty effective dates, beneficial use, and final payment becoming due.
93. B — Substantial completion when the client takes beneficial use. Warranty periods typically begin at substantial completion because that is when the system is placed in service and wear begins to accumulate. Tying warranties to original installation dates would unfairly disadvantage clients.
94. D — To record the installed system's actual configuration for future reference. As-built documentation captures the system as it actually exists, supporting future service work, modifications, and expansions throughout the installation's service life. The documentation is the authoritative reference for what is installed.
95. A — Brief focused sessions on essential operations with hands-on practice. End-user training is most effective when concise, focused on essential operational tasks rather than detailed technical knowledge, and includes hands-on practice. Users who actually operate the system during training retain knowledge better than passive observers.
96. C — Essential functions with screenshots and simple instructions. Quick reference guides are typically one or two pages providing brief, accessible instruction on essential functions with screenshots and simple language. They serve as the most-used training material long after training sessions conclude.

97. B — Defined response times, scheduled preventive maintenance, and priority service. Service agreements typically combine response time commitments, preventive maintenance visits at scheduled intervals, remote support, priority over ad-hoc service requests, and discounted rates for work outside the agreement scope.
98. D — Annual visits with more frequent visits for high-use environments. Professional preventive maintenance schedules typically recommend annual visits for most installations, with more frequent visits for high-use, demanding, or mission-critical environments. The annual baseline captures most preventive needs cost-effectively.
99. A — Creating a formal written record of the client's acceptance of the installation. Signed sign-off documents create the contractual record that the client has inspected, observed, received training on, and accepted the installation as meeting requirements. This record protects both parties from later disputes.
100. C — The installer, client representative, and sometimes the general contractor. The substantial completion walk-through is a formal event where the installer, client representative, and on larger projects the general contractor or commissioning authority walk through together to verify the installation and document any remaining items.
101. A — That the system is ready for its intended use even though minor work may remain. The certificate of substantial completion formally documents that the installation has reached the milestone where the client takes beneficial use, with any remaining punch list items scheduled for resolution before final completion.
102. C — As-built drawings, equipment manuals, warranty documentation, and verification reports. Comprehensive project closeout includes documentation of the actual installed configuration, equipment operational and service information, warranty terms, and verification results. Each component supports the installation throughout its service life.

#### **Domain E — Conducting Ongoing Project Responsibilities**

103. D — Document activities, labor, materials, and issues for the project record. Daily progress reports create the ongoing record of installation work that supports schedule tracking, change management, billing, and historical reference. The reports become particularly valuable when disputes arise about what was accomplished when.
104. B — Obtain clarification or direction on a field-discovered issue from the design team. RFIs are formal questions submitted to the design team requesting clarification or direction on issues encountered during installation. The RFI documents both the question and the response, becoming part of the project record.
105. A — A minor adaptation within the installer's authority but requiring documentation. Substituting equivalent accessories is typically a minor adaptation within installer authority that does not

require formal change orders. However, even minor changes should be documented in daily reports and as-built drawings.

106. D — The general contractor's superintendent and structured coordination meetings. The general contractor's superintendent coordinates across all trades on construction projects and is the primary point of contact for schedule coordination, site access, and conflict resolution. Coordination meetings provide the structured forum for trade interactions.
107. C — Work scope expands beyond the original contract specifications. Change orders are required when work scope expands beyond the original contract, whether through client requests, field discoveries, design modifications, or coordination requirements. The change order documents the addition, impact, and obtains client approval.
108. B — Cable scraps, packaging, and debris are managed continuously. Clean-as-you-go integrates debris management into installation work, placing cable scraps and packaging into appropriate containers as they are produced. This continuous practice prevents the accumulation that requires time-consuming end-of-day cleanup.
109. D — The general contractor's construction waste management system. Construction debris from AV installation is typically disposed of through the general contractor's waste management infrastructure, which provides general construction waste containers, recyclable material containers, and appropriate disposal routes.
110. A — The project manager who can coordinate appropriate response. Issues with other trades should be routed through the project manager who has the authority and relationship with the general contractor to coordinate resolution. Direct conflict between trades typically damages working relationships and rarely produces effective solutions.
111. C — Water suppression, local exhaust ventilation, or respiratory protection. OSHA's silica standard (29 CFR 1926.1153) requires specific dust controls during silica-generating activities including water suppression at the point of cutting, local exhaust ventilation with HEPA filtration, or respiratory protection appropriate for the exposure level.
112. B — Conflict identification and resolution between MEP, fire protection, and technology systems. BIM coordination drawings show how all building systems fit into ceiling and wall spaces without conflicts. Coordination drawings are developed collaboratively during design, but coordination issues continue to emerge in the field and require real-time resolution.
113. D — Report the condition through appropriate channels for engineering review. Field-discovered conditions affecting design must be reported for engineering review rather than being silently absorbed into the installation. Professional escalation enables design modifications to be properly authorized rather than becoming undocumented improvisations.
114. A — As soon as the potential delay is identified, even if impact is uncertain. Delays reported early permit the project manager to develop mitigation strategies and communicate with the client before

commitments are missed. Late reporting deprives the project manager of options and produces surprise schedule slips.

115. C — Be routed through the project manager for change order processing. Scope changes must flow through formal change order processes with project manager coordination, cost and schedule impact assessment, and client approval. Performing scope-change work without authorization consumes labor and materials that may not be recovered through payment.
116. D — Labor and materials consumed without compensation to the installer. Unauthorized scope expansion typically results in labor and materials consumed without recovery, because the work was not part of the original contract and was not authorized through change order. Professional installation firms refuse to perform unauthorized scope expansion.
117. B — Both as-built records and traceability of decisions made under installer authority. Field engineering documentation supports both the as-built record of what was actually installed and the professional record of decisions made during installation. This dual function makes documentation valuable for service support and demonstrating professional judgment.
118. A — Either perform the firestopping correctly or coordinate with the firestop contractor. Firestopping is life-safety work requiring proper materials and installation methods matched to the specific wall assembly rating. The installer must either perform the work correctly with appropriate training and materials or coordinate with qualified firestop contractors.
119. D — Stop work immediately and contact qualified asbestos abatement personnel. Asbestos exposure causes diseases that may emerge decades after exposure, and only qualified asbestos abatement contractors should disturb suspect materials. Continuing work informally creates exposure with consequences that may not be apparent for years.
120. C — Understand why the failure occurred so the same failure does not recur. Root-cause analysis seeks the fundamental cause of failures so that addressing the cause prevents recurrence rather than just restoring function. Repairs that address symptoms without root causes typically produce repeat failures that consume support resources over time.
121. B — 7 to 10 years. Professional AV installations typically have a service life of 7 to 10 years before substantial refresh is required, with individual components having varying lives within that range. Planning for refresh helps clients budget for system updates and installation firms plan service capacity.
122. A — Increasing service frequency, declining reliability, and parts unavailability. End-of-life indicators include increasing service calls, failures occurring during use rather than being caught by preventive maintenance, inability to support current needs, and unavailability of replacement parts.
123. D — Factory-reset or data-wiped before leaving the client's site. Decommissioned equipment containing configuration data, credentials, network information, or proprietary client information

must be reset before disposal to protect that information from exposure. Professional decommissioning includes data removal as a standard step.

124. C — Restricted materials in electronic equipment requiring responsible handling. RoHS (Restriction of Hazardous Substances) restricts the use of certain hazardous materials in electronic equipment and requires responsible handling at end of life. Combined with WEEE directives, RoHS shapes how decommissioned AV equipment must be processed.
125. B — Through the entire service life of the system via maintenance and service activities. The professional installer's relationship with an installation extends through maintenance, service, upgrades, and eventually decommissioning across the system's full service life. This long-term relationship is the foundation of recurring revenue and client loyalty.