

LODI UNIFIED SCHOOL DISTRICT

**Needham Elementary School
Fire Alarm Upgrade**

**PROJECT NUMBER: 0917-8217-7
DSA #:02-118486
Needham Elementary School**

ADDENDUM NO. 1

December 23, 2020

Owner: Lodi Unified School District
1305 E. Vine Street
Lodi, CA 95240

Architect : Rainforth Grau Architects
2101 Capitol Ave Suite 100
Sacramento, CA 95816

Engineer: The Engineering Enterprise
1125 High Street
Auburn, CA 95603

Project Manager: Capital Program Management, Inc.
1851 Heritage Lane, Suite 210
Sacramento, CA 95815

This Addendum has been prepared to clarify, modify, delete, or add to the drawings and/or specifications for the above referenced project, and revisions to items listed here shall supersede description thereof prior to the above stated date. All conditions not specifically referenced here shall remain the same. It is the obligation of the Prime Contractor to make subcontractors aware of any items herein that may affect submitted bids.

Acknowledge receipt of this addendum by inserting its number and date in the bidding documents. Failure to do so may subject bidder to disqualification.

All addenda items refer to the plans and specifications unless specifically noted otherwise.

TOTAL PAGES IN THIS ADDENDUM (including attachments): 29 Pages

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ADDENDUM NO. 1

PART A - BIDDING AND CONTRACT REQUIREMENTS

1.1 N/A

PART B - TECHNICAL REQUIREMENTS

1.2 **ADD** Specification Section 26 61 16 Fire Alarm / Life Safety System Add 1

PART C - DRAWINGS

1.3 N/A

PART D – RESPONSES TO CONTRACTOR QUESTIONS

1.4 N/A

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ADDENDUM NO. 1

PART E – List of Attachments

1.5 26 61 16 Fire Alarm / Life Safety System - Addendum 1 (26 Pages)

End of Addendum

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Life safety control panel (LSCP).
 2. Initiating devices.
 3. Notification devices.
 4. Zone modules
 5. Expansion panels
 6. Remote annunciator panels.
 7. Power supplies
 8. Complete CSFM listed components
 9. Fully operational
 10. Pretesting and final testing.
 11. DSA completion certification
 12. Record Drawings.
- B. Work furnish and installed under another Section, but connected under this Section:
1. Fire sprinkler alarm system flow switches, valve monitors and post indicating valves (P.I.V.).
 2. Fire pump controller to monitor status.
 3. Fan and fire/smoke damper control system for smoke management.
- C. Work furnish and connected to life safety system under this Section, but installed and connected to HVAC system under another Section:
1. Duct mounted smoke detectors.
 2. In-duct mounted smoke detectors for fire/smoke damper control. Except that wiring for damper power, control and monitoring shall be under this contract.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. American National Standards Institute, Inc. (ANSI):
ANSI C62.41; Guide for Surge Voltage in Low-Voltage AC Power Circuits.
 2. National Fire Protection Association (NFPA):

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| NFPA 72; | National Fire Alarm Code with CSFM amendments |
| NFPA 101; | Life Safety Code. |
3. California Fire Code 2019
 4. California Building Code: 2019
CBC 905; Smoke Control.
 5. California Electrical Code: 2019
 6. Underwriters Laboratories, Inc. (UL):

UL 38;	Manual Signaling Boxes Fire Alarm Systems.
UL 268;	Smoke Detectors for Fire Alarm Signaling Systems.
UL 268 A;	Smoke Detectors for Duct Application.
UL 464;	Audible Signal Appliances.
UL 497B;	Protectors for Data Communications and Fire Alarm Circuits.
UL 521;	Heat Detectors for Fire Protective Signaling Systems.
UL 864;	Control Units and Accessories for Fire Alarm Systems.
UL 1424;	Cables for Power-Limited Fire-Alarm Circuits.
UL 1480;	Speakers for Fire Alarm, Emergency and Commercial and Professional Use.
UL 1481;	Power Supplies for Fire-Protective Signaling Systems.
UL 1638	Visual Signaling Appliances Standard.
UL 1711;	Amplifiers for Fire Protective Signaling Systems.
UL 1971	Signal Devices for Hearing Impaired.
 7. Factory Mutual System (FM) approval guide.

FM P7825	Approval Guide.
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1.03 DEFINITIONS

- A. Alarm signal: A signal that indicates a state of emergency requiring immediate notification of the fire department and building occupants.
- B. Supervisory signal: A signal that indicates the impairment of a fire protection system, which may prevent its normal operation.
- C. Trouble signal: A signal that indicates that a fault, such as an open circuit or ground, has occurred in the fire alarm system or in a separate subsystem monitored by the fire alarm system.
- D. Initiating device: A system component that originates transmission of a change of state condition, which initiates an appropriate response via the fire alarm system.

- E. Notification device circuit: A circuit to which notification devices are connected to visually and audibly indicate an alarm signal.
- F. Signaling line circuit: A circuit to which any combination of circuit interfaces, control units or transmitters are connected and over which multiple system input signals or output signals are carried.
- G. Class A wiring: A circuit that is monitored for integrity such that a single break, a single wire-to-wire short or a single loss of carrier condition will be indicated by a trouble signal on the FACP no matter where the break, short or loss of carrier condition occurs and will allow all functions of the affected circuit to remain operational. This would be Style 7 wiring for signaling line circuits.
- H. Class B wiring: A circuit that is monitored for integrity such that a single break, a single wire-to-wire short or a single loss of carrier condition will be indicated by a trouble signal on the FACP no matter where the break, short or loss of carrier condition occurs, but which would prohibit devices beyond the fault, short or carrier loss from remaining operational. This would be Style 3 wiring for signaling line circuits, Style B for initiating device circuits and Style Y for notification device circuits.

1.04 SYSTEM DESCRIPTION

- A. Demolition of the existing Fire Alarm Control Panel, booster panels, notification devices, annunciating devices, modules, relays and fire alarm cabling. Remove all fire alarm cabling from site conduits, and building conduits to origination.
- B. A new intelligent reporting, Style 7 networked, fully peer-to-peer, microprocessor-controlled fire detection and emergency voice alarm communication system shall be installed in accordance with the specifications and as indicated on the Drawings.
- C. Each Signaling Line Circuit (SLC) and Notification Appliance Circuit (NAC): Limited to only 80 percent of its total capacity during initial installation.
- D. Basic Performance:
 - 1. Network Communications Circuit (Net SOLO) Serving Network Nodes: Wired using single twisted non-shielded 2-conductor cable and connected using existing fiber optic cable between nodes in Class A configuration.
 - 2. Signaling Line Circuits (SLC) Serving Addressable Devices: Wired Class B.
 - 3. Initiation Device Circuits (IDC) Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class B.
 - 4. Notification Appliance Circuits (NAC) Serving Strobes, and Speakers: Wired Class B.
 - 5. On Class A Configurations: Single ground fault or open circuit on Signaling Line Circuit shall not cause system malfunction, loss of operating power, or ability to report alarm.
 - 6. Transponders:

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- a. Operate in peer-to-peer fashion with other panels and transponders in system.
 - b. Each transponder shall store copy of audio evacuation messages and tones.
 - c. Systems that use centralized message storage and control at main fire alarm control panel shall not be acceptable.
7. Network Node Communications, Audio Evacuation Channels and Fire Phone Communications:
- a. Communicated between panels and transponders on fiber optic cables.
9. Signaling Line Circuits (SLC):
- a. Reside in remote transponders with associated audio zones.
 - b. SLC modules shall operate in peer-to-peer fashion with all other panels and transponders in system.
 - c. On loss of INCC Command Center, each transponder shall continue to communicate with remainder of system, including all SLC functions and audio messages located in all transponders.
 - d. Systems that provide a "Degraded" mode of operation upon loss of INCC Command Center or short in riser shall not be acceptable.
10. Audio Amplifiers and Tone-Generating Equipment: Electrically supervised for normal and abnormal conditions.
11. Amplifiers: Located in transponder cabinets serving no more than 3 floors per transponder to enhance system survivability, reduce required riser wiring, simplify installation, and reduce power losses in length of speaker circuits.
12. Speaker NAC Circuits: Arranged such that there is a minimum of 1 speaker circuit per fire alarm zone.
13. Notification Appliance Circuits (NAC), Speaker Circuits, and Control Equipment: Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
14. Speaker Circuits:
- a. Electrically supervised for open and short circuit conditions.
 - b. If short circuit exists on speaker circuit, it shall not be possible to activate that circuit.
 - c. Arranged for 70 VRMS and shall be power limited in accordance with CEC
 - d. 20 percent spare capacity for future expansion or increased power output requirements.
15. Speaker Circuits and Control Equipment:
- a. Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.

- b. Systems utilizing "bulk" audio configurations shall not be acceptable.
16. 2-Way Telephone Communication Circuits:
- a. Shall communicate digitally over the network between transponders.
 - b. Supervised for open and short circuit conditions.
 - c. Short circuit condition on 2-way telephone communications circuit shall result in trouble condition and not result in call-in condition.
17. Voice Communication:
- a. Connect telephone circuits to speaker circuits to allow voice communication over speaker circuit from telephone handset.
 - b. Capable of remote phone-to-phone conversations and party-line communications as required.
- D. Basic System Functional Operation: When fire alarm condition is detected and reported by 1 of the system alarm initiating devices, the following functions shall immediately occur:
- 1. System Alarm LEDs: Flash.
 - 2. Local Piezo-Electric Signal in Control Panel: Sound at a pulse rate.
 - 3. 80-Character LCD Display: Indicate all information associated with fire alarm condition, including type of alarm point and its location within protected premises.
 - 4. Historical Log: Record information associated with fire alarm control panel condition, along with time and date of occurrence. History Log shall have capacity for recording up to 4,100 events.
 - 5. System output programs assigned via control-by-event equations to be activated by particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
 - a. Close Fire Doors
 - b. Shut down air handlers as required by code
 - c. Notify the Central Station or Municipal Tie.
 - 6. Strobes flash synchronized continuously.
 - 7. Audio Portion of System: Sound alert tone followed by pre-recorded message determined by event and this scenario repeating or other message as approved by local authority until system is reset.
- E. Fire Alarm System Functionality:
- 1. Provide complete, electrically supervised distributed, Class A networked analog/addressable fire alarm and control system, with analog initiating devices, integral multiple-channel voice evacuation, and fire fighter's phone system.
 - 2. Fire Alarm System:

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- a. Consist of multiple-voice channels with no additional hardware required for total of 4 channels.
- b. Incorporate multiprocessor-based control panels, including model E3 Series modules includes Intelligent Network INCC Command Center(s) (INCC), Intelligent Loop Interface (ILI-MB-E3 or ILI95-MB-E3), Intelligent Network Transponders (INX), communicating over peer-to-peer token ring network with standard capacity of up to 64 nodes expandable to 122.
3. Each ILI-MB-E3 or ILI95-MB-E3 Node: Incorporate 2 Signaling Line Circuits (SLC), with capacity to support in Velociti ® mode up to 159 analog addressable detectors and 159 addressable modules per ILI-MB-E3 SLC or support in Apollo mode up to 126 detectors and modules per ILI95-MB-E3 SLC.
4. Voice, Data, and Fire Fighter's Phone Riser: Transmit over single pair of wires or fiber optic cable.
5. Each Intelligent Network Transponder: Capable of providing 16 distributed voice messages, fire fighter phones connections, SLC loop for audio control devices, and integral network interface.
6. Each Network Node: Incorporate Boolean control-by-event programming, including as a minimum AND, OR, NOT, and Timer functions.
7. Control Panels: Capability to accept firmware upgrades via connection with laptop computer, without requirement of replacing microchips.
8. Network:
 - a. Based on peer-to-peer token ring technology operating at 625 K baud, using Class A configuration.
 - b. Capability of using twisted-pair wiring, pair of fiber optic Multi-mode cable strands up to 200 microns or Single-mode optimized for 9/125 microns, or any combination, to maximize flexibility in system configuration.
9. Each Network Node:
 - a. Capability of being programmed off-line using Windows-based software supplied by fire alarm system manufacturer. Capability of being downloaded by connecting laptop computer into any other node in system. Systems that require system software to be downloaded to each transponder at each transponder location shall not be acceptable.
 - b. Capability of being grouped with any number of additional nodes to produce a "Region", allowing that group of nodes to act as 1, while retaining peer-to-peer functionality. Systems utilizing "Master/Slave" configurations shall not be acceptable.
 - c. Capability of annunciating all events within its "Region" or annunciating all events from entire network, on front panel LCD or touch screen display without additional equipment.
10. Each SLC Network Node: Capability of having integral DACT (digital alarm

communicator transmitter) that can report events in either its region, or entire network to single central station monitoring account.

11. Each Control Panel: Capability of storing its entire program, and allow installer to activate only devices that are installed during construction, without further downloading of system.
12. Password Protection: Each system shall be provided with 4 levels of password protection with up to 16 passwords.
13. Have the capacity for multiple pre-recorded messages (at least sixteen (16), but more if required by local AHJ) and address a list of subjects.
 - a. Fire evacuation and relocation
 - b. Intruder or hostile person sighted within or around the building grounds
 - c. Directions to occupants to take cover within building
 - d. Emergency weather conditions appropriate for local area
 - e. All Clear

1.05 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 3. Describe system operation, equipment and dimensions and indicate features of each component.
 4. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 5. Shop Drawings shall include:
 - a. Basic:
 - 1) Name of Owner and occupant.
 - 2) Address of the building.
 - 3) Contractor's name, address, telephone number and license number.
 - b. Symbols legend.
 - c. Equipment list showing quantity, make, model and CSFM listing number for each device.
 - d. Wire and cable schedule.

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- e. Scope of Work with overall system description.
 - f. Sequence of operation matrix with system inputs signals and output functions.
 - g. Code summary and Building type.
 - h. Assignment of Class and/or Style designation for device circuits.
 - i. Plot plan and floor plans of building with partitions, walls and room identification, showing locations of each device and control/monitoring equipment, communication equipment, conduit routing and size and cable/conductor type and quantity. Field devices shall all have a discrete identification designation located adjacent to each device on the Drawings.
 - j. Point-to-point wiring diagram in block or riser format showing all fire alarm components, device designations, conduit, wire types and sizes.
 - k. Provide 1/4" scale plan of equipment layout in main fire control room.
 - l. Include elevations of control panels, fireman's fan and damper control panel, voice communications panel, graphic annunciator panel and remote annunciator panel.
 - m. Overall description of smoke control system based on Smoke Control Report, developed by others.
 - n. Smoke control operation matrix by individual initiating device for fan and damper control/monitoring as well as ancillary equipment controlled.
 - o. Elevation indicating mounting heights for manual pull stations, audible and visual devices and combination audible/visual devices.
 - p. Rated penetration details.
 - q. Typical wiring diagram details of field devices.
 - r. Detector mounting details at HVAC ducts.
 - s. Battery standby calculations showing total standby power needed to meet the specified system requirements.
 - t. Voltage drop calculations for system wiring circuits.
6. Furnish structural calculations for equipment anchorage as required for the installation of fire alarm panels:
 7. Submit Manufacturer's installation instructions.
 8. Complete bill of materials listing all components.
 9. Provide California State Fire Marshal 'CSFM' listing sheet for each device.
 10. Warranty.
- B. Contractor shall submit approved Shop Drawings for review by State/Local Fire Marshal prior to the purchase and installation of equipment. Provide quantities of

Drawing sets as required by jurisdiction. Drawings shall be wet stamped and signed by a registered professional Engineer.

C. Record Drawings:

1. Furnish Record Drawings utilizing Shop Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
 - a. Plot plans and building floor plans, showing point-to-point wiring location of and conduit routing to all devices.
 - b. Block diagram/riser diagram showing the LSCP, system components and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the Engineer has approved the Record Drawings.

1.06 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and part numbers.
4. Schematic Drawings of wiring system, including all initiation and annunciation devices, control panel, annunciators, communication system, fan control system, printer/terminal, etc.
5. Telephone numbers for the authorized parts and service distributors.

1.07 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Fire alarm/life safety system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged

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units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.09 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1 year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.
- B. The warranty package shall include, but not be limited to the following:
 - 1. Emergency maintenance service.
 - 2. Service by factory trained service representative of system Manufacturer.
 - 3. Replacement of any defective components.

1.10 SYSTEM START-UP

- A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the fire alarm/life safety system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

1.11 MAINTENANCE

- A. Extra Material:
 - 1. Provide the following fire alarm system components as extra materials, matching the products installed and packaged for storing.
 - a. Manual pull station: Furnish a quantity equal to 10 percent of the number installed.
 - b. Detectors: Furnish a quantity equal to 10 percent, for each type, of the number installed.
 - c. Strobes and Speaker/strobes: Furnish a quantity equal to 10 percent of the number installed.
 - d. Speakers: Furnish a quantity equal to 10 percent of the number installed.
- B. Maintenance Service:
 - 1. For a period of one year following acceptance the equipment Supplier shall have a person(s) familiar with this Project attend four quarterly meetings with the Owner's Representative to review system performance, operation and any system problems. That person shall provide a written summary of the items discussed in each meeting and a schedule of when the system problems will be corrected. The report is due within 7 working days after each meeting.
 - 2. During the eleventh month following system acceptance, on a weekend day, the equipment Supplier shall perform a complete test of the system, in a manner similar to the acceptance test. A written report shall be submitted to the Owner certifying that each initiating device has been tested. A copy of these test forms shall be submitted to the Engineer for review and acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturer shall be provided per the districts standards.
 - 1. Gamewell/FCI.
- B. Substitutions: Substitutions will not be accepted.

2.02 FIRE ALARM AND DETECTION SYSTEM

- A. Control panel:
 - 1. The panel shall comply with applicable requirements of UL864 and shall provide power, annunciation, supervision and control for the complete fire alarm system. The panel shall be modular in construction, installed in a surface mounted steel cabinet with hinged door and cylinder lock, containing all modules necessary to operate as indicated herein.
 - 2. Addressable devices shall be individually identified by the system and any quantity of addressable devices may be in alarm at any time up to the total number connected to the system.
 - 3. The panel annunciator shall be a minimum of an 80 character alphanumeric display, which shall provide a user definable custom message associated with each detection device or zone.
 - 4. Dynamic supervision of system electronics, wiring, initiating devices and software shall be provided by the control system. Failure of system hardware or wiring shall be indicated by type and location on the alphanumeric annunciator. Software and processor operation shall be monitored by a independent hardware watchdog, which will indicate their failure. The panel shall provide failsafe operation, i.e. all incoming alarms shall override all other modes of operation.
 - 5. Provide a service mode to permit the arming and disarming of individual initiating or output devices as well as manually operating output devices. Status of these devices shall be displayed upon command from the control panel. The panel shall automatically return to the normal mode in the event the panel remains unattended in the service mode.
 - 6. The panel shall be capable of measuring and adjusting the sensitivity of addressable detectors upon request. An alphanumeric display shall be provided to display custom messages and give readings of detector sensitivity detector by detector. Each device on an addressable initiating circuit shall be checked continuously to include the following:
 - a. Sensitivity.
 - b. Response.
 - c. Opens.
 - d. Shorts.

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- e. Ground faults.
 - f. Functionality.
 - g. Status.
7. The panel shall monitor the addressable smoke detectors in such a manner that if the detectors become dirty and reach and maintain 80% of alarm threshold for five (5) consecutive hours, a trouble condition indicating exactly which device needs service shall be automatically annunciated. If the device becomes too insensitive for a period of 10 seconds, the trouble indication will read: "Input device response too low."
 8. The panel shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.
 9. The panel shall automatically indicate the total quantity of alarms and troubles that have occurred prior to reset at the control unit.
 10. No alarm or trouble indication shall be resettable until it has been acknowledged. It shall not be possible to reset the system until all alarms have been acknowledged.
 11. The panel shall be capable of:
 - a. Counting the number of addressable devices within a designated area or "zone" which are in alarm.
 - b. Counting "zones" which are in alarm.
 - c. Counting the number of addressable devices which are in alarm on the system.
 - d. Differentiating among types of addressable devices such as smoke detectors, manual stations, water-flow switches and heat detectors.
 - e. Assigning priorities to types of devices, zones or groups of devices.
 - f. Cross-Zoning.
 12. Each addressable device shall report its condition to the panel control unit every three (3) seconds in a manner such that failure of the connections to or internal electronics of the device will result in a trouble signal that identifies the specific device involved.
 13. The panel shall also be capable of operating non-addressable Class A or B initiating circuits.
 14. Alarm and trouble from non-addressable initiating circuits (zones) shall be annunciated and cause output functions in the same manner as addressable detection devices including a location message for each zone.
 15. Panel output circuits shall be supervised and capable of providing 1.5 amp at 24 VDC.

16. Provision for programmable control relays in panel shall be included having dry contacts rated 120 VAC, 5 amp, inductive.
 17. Programmable remote relays shall be controlled in the same manner as panel mounted relays.
- B. Initiation/notification modules:
1. All modules shall be plug-in, dynamically supervised and easily replaceable. Field wiring shall be connected to the panel with removable multi-conductor connectors to facilitate rapid removal and replacement of both the module and wiring for ease of serving the panel. The modules shall be system interconnected by a card edge connector.
 2. Provide zone input addressable modules for monitoring non-addressable initiating circuits.
 3. Provide programmable signal modules on output circuits for operation of DC audible devices.
 4. Provide, as needed, programmable supplementary relay modules containing four independent relays fitted with form "C" contacts, rated at 120 VAC, 5 amps inductive.
- C. Printer/terminal:
1. The control panel shall support one printer/terminal. This terminal shall be used for permanent records of the Control Panel status and detector chamber voltages and shall also be capable of system control as configured. The printer/terminal shall interface to the control panel via a 20ma supervised serial loop shielded cable.
 2. The printer (and the terminal) shall be capable of listing, upon request, all functions indicated at panel digital annunciator.
- D. Power supply: Emergency generator feed adequate to serve panel modules, initiating devices, annunciating devices, remote annunciators, door hold-open/closure devices, roll-down fire doors or shutters, fire/smoke dampers. All power connections whether AC or DC shall be separately fused within panel.
- E. Uninterruptible power supply (batteries):
1. Provide an uninterruptible power source for all volatile system components including control panel, peripherals and remote annunciators. Power source shall consist of but not be limited to all necessary conduit, wire, outlets, transformers, panels and connections to each piece of equipment as required.
 2. Uninterruptible power shall be required such that loss of power shall not cause the system operator to be required to restart the system or any part thereof upon return of power. The uninterruptible power supply shall be NFPA approved for applications and shall provide a 24 hour backup of the system;andthen, at the end of that period, operate all alarm indicating devices used for evacuation for 30 minutes.

3. Provide a dual rate battery charger capable of recharging batteries to 80% capacity in 8 hours.
- F. Remote station signal transmitter: Electrically supervise, capable of transmitting alarm and trouble signals over telephone lines to remote monitoring station receiver.
- G. Auxiliary relays: Provide sufficient SPDT auxiliary relay contacts for each initiating device zone to provide accessory functions specified.

2.03 ADDRESSABLE INITIATING DEVICES

- A. Manual pull stations: Shall conform to the applicable requirements of UL 38. Addressable manual stations shall be connected into addressable initiating circuits. Stations shall be dual action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Control panel shall monitor the station by address and function. The use of a key or wrench shall be required to reset the station. Stations shall have a separate screw terminal for each conductor and be capable of field programming for its "address" location on a initiating circuit.
- B. Heat detectors: Shall conform to the applicable requirements of UL 521. Addressable detectors shall be electronic designed for detection of fire by combination fixed temperature and rate-of-rise principle. Detectors shall be connected into addressable initiating circuits. All electronics shall be contained within detector head and shall plug-in to terminal base. Detector shall be field programmable and contain external indication that is readily visible. The detector shall be dynamically supervised and individually identified by LSCP, as well as sensitivity adjustable. Rating for fixed temperature portion shall be 135 degrees F. Detectors shall have screw terminals in base for making all wiring connection.
- C. Smoke detectors: Shall conform to the applicable requirements of UL 268:
 1. Photoelectric detectors: Addressable detectors shall be electronic designed for detection of abnormal smoke densities. Detectors shall consist of separate transmitter and receiver units. The transmitter unit shall emit an infrared beam to the receiver unit. When the signal at the receiver falls below a preset sensitivity, the detector shall initiate an alarm. The receiver shall contain an LED that is powered upon an alarm condition. Long-term changes to the received signal caused by environmental variations shall be automatically compensated. Detectors shall be connected into addressable initiating circuits. All electronics shall be contained within detector head and shall plug-in to terminal base. Detectors shall be field programmable and contain external indication that is readily visible. The detector shall be dynamically supervised and individually identified by LSCP, as well as sensitivity adjustable. Detectors shall have multiple sensitivity settings in order to meet UL listings for the different distances covered by the beam. Detectors shall have screw terminals in base for making all wiring connections.
 2. Duct smoke detectors: Addressable detector shall have a duct housing, mounted exterior to the duct and with perforated sampling tubes. Activation of a detector shall cause shutdown of the associated air-handling unit via auxiliary contact base. Detectors shall be rated for the air velocity to be expected.

3. In-duct smoke detector: Addressable detector shall have external mounted box with relay output, remote test station with LED status indicator and keyed test switch and sensor head mounted within duct. Activation of detector shall cause associated fire/smoke damper to close via auxiliary relay base.
- D. Interface modules: Addressable interface module shall be connected into addressable initiating circuits. This device shall be used for interfacing normally open or normally closed direct shorting contact devices to an addressable initiating circuit (i.e. waterflow, tamper switches, non-addressable initiating devices, etc.). Module shall be dynamically supervised and individually identified by LSCP.
- E. Programmable relay modules: Addressable interface module containing a programmable control relay with contacts rated at 2.0 amps at 30VDC, 0.6 amps at 120 VAC.

2.04 NOTIFICATION DEVICES

- A. Speakers, strobes and combination speaker strobes:
 1. These units shall be mounted flush in all finished areas and surface mounted in unfinished equipment areas. White enamel grill for units mounted in finished (public) areas; red for units mounted in unfinished (mechanical) areas.
 2. Maximum loading: The loading on both the strobe and audio circuits shall not exceed 75% of its rated capacity. Verify that strobe in-rush currents are safely within the maximum rated capacity of the circuit.
 3. Speaker: Wall or ceiling mounted units shall include a blocking capacitor for line supervision and screw terminals for in and out wiring. The back of the speaker cone shall be covered to protect the cone from damage and dust. The speakers shall operate over a frequency range of 400 - 4000Hz and shall have field selectable power taps of 1/8 to 8 watts with sound output up to 92dBA at 10 feet measured per UL standard 1480 when set on the 8 watt tap. Speaker shall be rated for operation on a 70.7-volt audio system.
 4. Strobe: Wall mounted units shall incorporate 15, 30, 75, 110 candela strobe lights that flash once per second with 24 VDC input with a maximum current draw of .088 amps.
 5. Strobe/speaker: Wall mounted units with speaker Specifications listed above and shall incorporate 15, 30, 75, 110 candela strobe lights that flash once per second with 24 VDC input with a maximum current draw of .088 amps.
 6. Remote power supplies for strobe circuits:
 - a. Provide quantity of remote power supplies required for system. Power supplies shall be mounted in hinged NEMA 1 enclosures, maximum 24" wide, with locking handle and the following items:
 - 1) Back-up emergency batteries, sized per NFPA standards. Provide separate enclosure for batteries if required to prevent damage from corrosive gases.

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- 2) Provide a automatic dual rate (high rate and float charge) battery charger capable of recharging batteries to 80% capacity in 8 hours. The charger output shall be supervised and fused.
 - 3) Supervised programmable relays or network interface module to control strobe lights on a floor-by-floor basis.
 - b. Power supplies shall be connected to emergency power 120 VAC circuits.
 - c. If the power supply loses AC power, a system trouble shall occur.
 - d. Locks shall be keyed the same as all other life safety panels.
- B. Bells: Shall be 6 inch10 inch surface mounted with matching mounting back box. Bells shall be of vibrating type, suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a sound output rating of at least 84 dBA87 dBA at 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and provided with metal housing and protective grilles.
- C. Fireman's remote LCD annunciator: Shall have a two line by 40-character LCD display. Dedicated LED lamps shall light upon activation of any alarm, supervisory or trouble condition and a tone-alert shall sound. The backlit alphanumeric liquid crystal display (LED) shall indicate type of alarm, number of alarms, supervisory conditions and troubles in the system and a custom location designation. Annunciator shall include control switches for system acknowledgments, alarm silence and system reset. Information is transmitted to the annunciator over a single twisted, shielded pair cable. Annunciator shall be flush mounted in NEMA 13R enclosure for interior applications.
- D. Remote graphic annunciator: Shall have a plan view elevation of each building. A lamp indicated in its relative position in the building shall indicate each zone. Three individual lamps shall be provided for each zone and shall illuminate for an abnormal condition in that zone. Lamps shall be red for alarm condition; blue for supervisory condition and amber for trouble condition. Plan views shall be approximately to scale and in no case smaller than 12 inches15 inches in length or width. Annunciator shall have a door with piano hinge and two point cylinder lock or two cylinder locks. Lock shall be open using the same key as the control panel. A lamp test switch shall be provided. Annunciator shall be flush mounted.
- E. Life safety command center annunciator:
1. Provide a surface mounted panel, sized as required to contain the following features:
 - a. Graphic silk-screened representation of the buildings in vertical cross-section.
 - b. LED indicating lights that shall illuminate the respective floor's LED indicator light for an occurrence in that building:
 - 1) System trouble. Illuminates on any component failure or abnormal condition for both the fire alarm and communication systems. (Yellow LED, only on floors with equipment.)

- 2) Sprinkler Waterflow. (Blue LED)
 - 3) Smoke Detector. (Red LED)
 - 4) Duct Smoke Detector. (Red LED)
 - 5) Manual Pull Station (Yellow LED)
 - 6) Annunciation Devices Activated. (Green LED)
 - 7) Tamper Valve or PIV. (Blue LED)
 - 8) Fire Pump Running (Yellow LED)
 - 9) Fire Pump Trouble. (Yellow LED)
 - 10) Jockey Pump Running (basement floor only) (Yellow LED)
 - 11) Generator Running (Yellow LED)
 - 12) Generator Trouble (Red LED)
 - 13) Public Emergency Phone Activated. (Yellow LED)
- c. Sonalert Horn.
 - d. Lamp test pushbutton.
 - e. Horn silence pushbutton. This pushbutton shall be momentary type and shall allow a subsequent alarm to ring the horn again. On/off switch is not acceptable.
 - f. Black silk-screened lettering describing the function of each device and light.
 - g. Brush stainless steel faceplate with continuous piano hinge to access wiring compartment and 1/4 turn captive fasteners.
 - h. Annunciator shall be UL and CSFM listed.
2. This annunciator shall annunciate alarm and trouble conditions it shall not contain any control capability over the fire alarm and communication system. All system horn silence and acknowledge shall be performed at the control equipment itself.
 3. All control power shall be battery backed up and originate from the life safety control panel.

2.05 AUXILIARY EQUIPMENT CONTROL AND SUPERVISION

- A. Under this Section, provide connections to the following equipment to activate control sequence of operation:
 1. Fire sprinkler system components: Provide a pair of wires from a remote mounted addressable interface module (2'-6" maximum wire length) for each of the following devices:
 - a. Each waterflow switch to initiate a alarm signal.
 - b. Each valve monitor switch (tamper switch) to initiate a Supervisory signal.

- c. Each P.I.V. to initiate a Supervisory signal.
 - d. Fire pump to initiate a trouble signal for fire pump "running", "loss of power," and "phase reversal."
 2. Door hold-open/closure devices: Provide a pair of wires from a set of dry contacts in the LSCP or remote mounted programmable relays to each door hold-open/closure device for power to and release of doors.
 3. Roll-down fire doors and shutters: Provide a pair of wires from a set of dry contacts in the LSCP or remote mounted programmable relays to each roll-down fire door or shutter for release of door.
 4. Building energy management system (EMS) interface: Provide a pair of wires from a set of dry contacts in LSCP or remote mounted programmable relays to EMS system control panel. Contacts shall be normally closed and shall open upon any alarm condition.
- B. Fire/smoke dampers: Provide the following at FLCP for manual override control and annunciation of each smoke management damper:
1. Three position (open-auto-closed), heavy-duty, industrial grade control switch for damper control as follows:
 - a. The "OPEN" and "CLOSED" modes shall override the normal operation of the HVAC control system.
 - b. The "AUTO" mode shall be used for normal damper operation when not in override mode.
 2. LED indicator lights shall be provided adjacent to each control switch for status annunciation as listed below. Provide wiring and panel or remote mounted interface/relay modules for each damper controlled. "Open" and "Closed" indication shall be via connection to end switches furnished by Division 23.
 - a. Green = "OPEN"
 - b. Yellow = "CLOSED"
 - c. Red = "OVERRIDE" (at LSCP)
 3. Provide graphic quality lettering on engraved nameplate to identify each switch and LED light.

2.06 LIFE SAFETY COMMUNICATIONS AND PUBLIC ADDRESS SYSTEM

- A. System operation:
1. Provide a modular, fully supervised, zone selective voice communication system in the Life Safety Command Center Room. The page alarm system shall be utilized for automatic pre-recorded voice signaling and manual voice override paging.
 2. Output zones shall be as follows:
 - a. One zone for each building.

- b. All call (includes all zones).
 - 3. All zone selector switches shall be toggle type with adjacent on/off LED light and clearly identified by floor, elevator or stairwell number.
 - 4. Manual override via the hand-held microphone shall take priority over any and all alarm signals to assure communication of one-way voice instructions.
 - 5. "Phone Patch" control shall be provided for the firefighter in control to allow voice instructions to be initiated from any remote fireman's telephone.
- B. Communication amplifiers:
- 1. The unit shall be solid state complete with microphone and volume control.
 - 2. The total harmonic distortion shall be less than 2% at 100% of rated output.
 - 3. Amplification equipment shall be sized to provide sufficient power to drive one speaker per 1,000 square feet of building area on each floor with the speakers set on a wattage tap that allows 15dB above the ambient noise level in all areas of a normal 45dB office environment. Plus an additional 25 percent per amplifier. I.E. provide amplifiers rated for the maximum number of speakers possible in the building plus 25 percent spare capacity.
 - 4. Provide output terminals mounted on a heavy-duty terminal strip for making all required connections.
 - 5. Outputs shall be compatible with multi-tap speakers as required.
 - 6. Electronic circuit protection shall be incorporated in the amplifier that provides automatic limiting against short circuits and overloads on its outputs. A thermostatic control shall protect the amplifier from operation at excessive temperatures and a circuit breaker for overcurrent protection shall be provided.
 - 7. The front panel of the amplifier shall have a power indicator and a thermal overload indicator.
 - 8. The amplifier shall operate from a 105 - 125 volt 60 Hz power source.
 - 9. The unit shall be ruggedly constructed, temperature stable and be capable of operating in ambient temperatures ranging from -20 degrees C to +55 degrees C. The power transformers shall be heavy duty, fully enclosed and designed for continuous operation. The chassis shall be heavy-gauge steel with a perforated enclosure and both shall be finished in low luster black enamel.
 - 10. Provide speaker zone supervision such that any zone in "trouble" shall be annunciated at the remote annunciator and the printer.
 - 11. The amplifiers shall be mounted in the Life Safety Command Center Room.
 - 12. Amplifiers shall be provided in 120 or 250-watt RMS increments at 70VRMS output voltage levels. Amplifiers shall be continuously supervised and be configured for single channel operation and redundancy for backup. All amplifiers shall have 60 to 15 KHz frequency response and be equipped with a

battery saver feature to minimize supervisory current drain when operating on the 24VDC standby batteries.

13. Each speaker circuit shall be electrically supervised for opens and ground faults in the wiring and for short circuit faults on the speaker circuit wiring and shall be so arranged that a fault condition in any circuit or groups of circuits will not cause an alarm to be sounded. A short circuit on the speaker circuit wiring will automatically disconnect only the affected circuit thereby insuring the integrity of all other speaker circuits to receive an alarm signal and protect the system amplifiers, pre-amplifiers and taped voice or tone generators. The occurrence of any fault will light a trouble LED and sound the Sonalert but will not interfere with the proper operation of any circuit that does not have a fault condition. Initiating and speaker circuits shall be wired using Class B supervised circuits (a break or ground fault in any conductor will be reported as a trouble condition).
 14. Digital message repeater module (DRM) shall be provided for a pre-recorded general instruction message. The standard operating sequence shall be thirty seconds of alarm tone, followed by a 30 - 60 second digitized general instruction message. After the message is sent or has been interrupted by the hand-held microphone, before the tape message is completed or failure of the MRM, the alarm tone will again sound continuously until the system is reset or the tone silenced. The DRM will be supervised for EPROM memory and general status. Message shall be settable to be continuous repeatable or 1 - 3 times.
 15. Redundant tone generators (RTM) shall be provided for alarm and auxiliary tone generation (slow whoop). RTM's shall be continuously supervised for operation and placement.
- C. Remote switch bank and microphone panel:
1. Provide push-to-talk override microphone for life safety paging.
 2. A bank of switches shall be provided within reach of the microphone for selective paging of each zone and a complete building page.
 3. Provide a means for each toggle switch to accept an identification tag in the faceplate. Provide graphic quality lettering or Kroy lettering on each I.D. tag. Do not hand letter.
 4. The microphone and switches shall be mounted in a panel on the wall in the Administration building.

2.07 VOICE COMMUNICATION BACK-UP POWER SUPPLY (BATTERIES)

- A. Provide a back-up power source for all system components including but not limited to, amplifiers, digital message units and microphone circuits. Power source shall consist of but not be limited to all necessary conduit, batteries, wire, outlets, transformers, panels and connections to each piece of equipment as required.
- B. Back-up power shall be required such that loss of utility power shall not cause the system operator to be required to restart the system or any part thereof upon return of power. The back-up power supply shall be NFPA approved for life safety

applications and shall provide a 4-hour backup of the maximum load possible on the system as required by NFPA 72.

- C. During power failure the amplifiers shall be automatically shut off to minimize drain on batteries but will turn on automatically during alarm or manual activation.
- D. Provide a automatic dual rate (high rate and float charge) battery charger capable of recharging batteries to 80% capacity in 8 hours. The charger output shall be supervised and fused.
- E. If the system loses AC power, a system trouble shall occur.
- F. A solid-state power transfer circuit that shall switch to standby power automatically and instantaneously if normal power fails or falls below 15% of normal ("brown out" conditions). This electronic circuit shall allow the batteries to be effectively "floated" on the operating system to avoid upsetting the normal microprocessor scan and minimize resultant nuisance troubles and/or alarms.

2.08 LIFE SAFETY COMMAND CENTER

- A. The life safety remote annunciator shall be the operations center for fire fighter's and shall consist of the following:
 - 1. Public address system and microphone.
 - 2. Firefighter's and public emergency telephone communication system and remote handset cabinet.
 - 3. Fire alarm detection and control panel as well as graphic annunciator.
 - 4. Controls and annunciation for all auxiliary equipment control.
 - 5. Telephone for fire departments use with access to public telephone system.

2.09 FIBER OPTIC PATCH CORDS

- A. The fiber nodes shall utilize new 62.5/125 micron fiber. The fiber shall be terminated with ST fiber connectors
 - 1. Provide ST-ST Duplex fiber jumpers to connect the FACP and Remote nodes TX/RX fiber ports (4 fiber).
 - 2. Provide SC-SC duplex fiber jumpers to patch fiber from one node to the next at the IDF location. Quantity as required.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of fire alarm/life safety system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. General:

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1. Install fire alarm/life safety system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
 2. The 120/208-volt, 3 wire, 60 cycles AC emergency power supply required to power the system. Connect to red colored circuit breaker(s) in panel board. Identify circuit as "Fire Alarm Circuit Control".
- B. Wiring:
1. Individual input and output device addressability as well as remote sensitivity measurement, supervision and power shall all be performed on the same pair of wires. Wiring shall be Class B.
 2. Each Class B initiating circuit shall consist of a two (2)-wire circuit, allowing multiple T-taps and not requiring any end-of- line device for supervision. Each initiating circuit shall accommodate up to thirty (30) addressable programmable initiating devices. On the initial installation, only 21 devices are to be allowed per circuit to allow for future expansion.
 3. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the Manufacturer's current requirements.
 4. All cabling when concealed above accessible ceiling can be routed free air and supported every 48" in J-Hooks. J-hooks shall be sized for a maximum 40% fill and shall be color coded red, and not used for any other cable.
 5. J-hooks shall be supported by independent 12 gauge steel wire or directly to building structure. Support to other disciplines support structure such as electrical conduit, mechanical ducting, ceiling wire, ATR, unistrut etc... will not be accepted and will require the contractor to install an independent support system.
 6. All wiring shall be installed in a steel conduit when in exposed areas, and through walls and shall be of the size recommended by the equipment Supplier. Wire color-coding shall remain the same throughout the system.
 7. No wiring other than that directly associated with life safety/fire alarm detection, alarms or auxiliary fire protection functions (no 120 VAC), shall be permitted in life safety/fire alarm support systems and pathways.
 8. Make conduit and wiring connections to sprinkler flow switches, PIV's, sprinkler valve monitors, door hold-open/closure devices, smoke management fans, smoke dampers, fire pump controller, etc.
 9. All wiring shall be checked and tested to ensure that there are no grounds, opens or shorts.
 10. All life safety/fire alarm junction boxes shall be color-coded and marked. Wire nut splices are not allowed.
 11. Wires shall be numbered at each connection, termination and junction point. Wire numbering tags shall be Brady Perma-Code, Westline or equal wire makers. Each group of wires shall be tagged with its destination at each panel, terminal box or junction box.

12. All wire used on the life safety/fire alarm and communication system shall have a minimum insulation rating of 105 degrees C. Bell wire or thermostat wire is not acceptable.
13. All above ceiling and under floor devices if not accessible shall be made accessible using access panels.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the fire alarm/life safety system.
- B. Contractor testing: Contractor shall perform all quality control electrical testing, calibration and inspection required herein. Testing objectives shall be to:
 1. Assure fire alarm/life safety system installation conforms to specified requirements and operates within specified tolerances.
 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 3. Prepare final test report including results, observations, failures, adjustments and remedies.
 4. Apply label on fire alarm/life safety system control panel upon satisfactory completion of tests and results.
 5. Verify settings and make final adjustments.
- C. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- D. Prefunctional testing:
 1. Provide testing technician with Contract Documents and Manufacturer instructions for installation and testing.
 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers and doors are secure.
 3. Electrical tests:
 - a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit

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the required signal correctly to the LSCP. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.

- b. Testing shall include each and every device in the system. Coordinate with other trades as necessary for testing.
 - 1) Sprinkler flow switches: Record time delay from water flow to alarm and adjust as necessary for a 30-50 second delay.
 - 2) Tamper switches: Verify "trouble" signal is received and alarmed on closing of each valve.
 - 3) Smoke detectors and duct smoke detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function. Perform pressure differential test on all duct-mounted smoke detectors.
 - 4) Door release: Verify that proper alarm activates every held-open door, roll-down doors and shutters, to ensure doors close completely to the closed position.
 - 5) Elevator recall: Verify that elevators recall to designated floor by testing elevator lobby detectors with smoke. This is necessary on the ground floor and one other only.
 - 6) Firefighter's phone: Verify that each phone jack and supervisory circuit is fully operational and annunciates properly at the paging panel in the Life Safety Command Center Room.
 - 7) Public emergency phone: Verify that each phone is operative and annunciates properly at the paging panel at the remote annunciator panels.
 - 8) Voice communication systems: Verify that each building and/or floor can be selected.
 - 9) Tone and prerecorded message generation: Activate by means of an alarm initiating device on each floor and verify that they are clearly audible in all occupied spaces including elevator lobbies, toilets, core areas, stairwells, mechanical rooms and garage. Adjust power taps at speakers to obtain proper +15 dBA level above ambient noise. Verify the override capability of the microphone paging system.
 - 10) FFCP: Verify correct fan and damper control and status annunciation for each life safety fan and damper.
 - 11) Central station notification: Verify that one set of conductors in the terminal cabinet becomes a short circuit on any "trouble" condition and that the other set becomes a short circuit on any "alarm" condition. Verify that the conductor groups are labeled properly.

- 12) Printer and remote annunciators: Verify that all alarm and trouble conditions print on the printer and annunciate at the remote annunciation panels.
 - 13) Emergency generator power, fire pump and jockey pump status: Verify these annunciate their respective "Trouble" and "Running" conditions.
- c. Test Report:
- 1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
 - 2) Submit two typed copies of the test report on 8- 1/2" x 11" paper in a neatly bound folder to the Engineer for approval. Failure to comply with this will result in a delay of final testing and acceptance.
- E. Functional performance testing:
1. After the approval of the test report, provide a schedule of final testing to be done in the presence of the Fire Marshal and Owner's Representative. The schedule must be received by the Engineer a minimum of 2 weeks prior to the Final Test Date and must list the dates and time slots in which the various systems can be tested.
 2. Coordination of the Final Test dates with all parties (General Contractor, Mechanical Contractor, Electrical Contractor, Owner and others) shall be the sole responsibility of the Contractor. If a party is required to be present during any phase of testing to activate a device, ensure that the party or a qualified representative of the party is present throughout that phase of the testing.
- F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
- G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- H. Contractor shall submit the Testing Agency's final report to the Engineer for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 TRAINING

- A. Factory authorized service representative shall conduct a 4 hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance and testing of equipment with both classroom training and hands-on instruction.
- B. Contractor shall schedule training with a minimum of 7 days advance notice.

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END OF SECTION