

SECTION 28 31 00
FIRE ALARM AND SMOKE DETECTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire alarm with voice evacuation notification and smoke detection systems

1.2 REFERENCES

- A. NFPA 72
- B. NFPA 101

1.3 REGULATORY REQUIREMENTS

- A. System: UL listed
- B. Conform to requirements of NFPA 101
- C. Conform to requirements of NFPA 72
- D. Florida Building Code (FBC)
- E. Americans with Disabilities Act (ADA)

1.4 SYSTEM DESCRIPTION

- A. Fire Alarm System: Non-coded, supervised, electrically impulse, manually operated fire alarm system with voice evacuation notification.
- B. Additions to a system: U.L. listed for use with the existing system manufacturer's control panel.
- C. System Supervision
 - 1. Provide electrically supervised system, with supervised alarm initiating and alarm signaling circuits.
 - 2. Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode.
 - 3. Component or power supply failure places system in TROUBLE mode.
 - 4. Occurrence of single ground or open condition on alarm initiating circuit does not disable that circuit from transmitting in ALARM.
 - 5. Occurrence of single ground or open condition on signaling circuit does not disable that circuit from transmitting in ALARM.
- D. Alarm Sequence of Operation: Actuation of manual fire alarm station or automatic initiating device causes system to enter ALARM, which includes the following operations:
 - 1. Sound and display local fire alarm signaling devices with non-coded march time signal.
 - 2. Transmit non-coded signal to remote security monitoring equipment.
 - 3. Indicate location of device that is in alarm on fire alarm control panel and the alarm zone on remote annunciator panel.
 - 4. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor.
 - 5. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
 - 6. Transmit signal to release door hold-open devices.
 - 7. Transmit signal to all gas-valve shutoff devices, and other auxiliary equipment.
 - 8. Accomplish all incidental functions required by FBC, NFPA 72, and NFPA 101.
 - 9. The system shall provide a three-pulse temporal signal to the horns or voice evacuation system. A switch shall be provided on the control panel for silencing the alarm devices. Any additional incoming alarm shall operate normally. Each alarm shall be represented on the control panel by an audio and visual indication.
- E. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm-initiating circuits have cleared.

- F. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following:
 - 1. Visual and audible trouble alarm by specific device at control panel
 - 2. Visual common trouble signal at annunciator panel
 - 3. Manual ACKNOWLEDGE function at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.
 - 4. Transmit common trouble signal to remote security monitor control.
- G. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- H. A connection to the chemical fire extinguisher system of the kitchen so that the auxiliary alarm contacts of the extinguisher control initiates the fire alarm system.
- I. Provide for future circuit wiring a compliment of all the conductors needed for all types of initiation, signal, and auxiliary functions from the control panel to designated future portable locations.
 - 1. Provide the termination point in the closest building terminal boxes to the future site.
 - 2. Provide one extra initiation point or address for future feeds in the program.
 - 3. Provide one extra notification circuit for future feeds in the program.

1.5 QUALIFICATIONS

- A. Manufacturer:
 - 1. Fire alarm systems
 - a. "Simplex Model 4100ES"
 - b. "Notifier Model NFS2-3030"
 - c. "Edwards Systems Technology EST3"
 - d. "Cerberus Pyrotronics Model MXL"
 - 2. Emergency Voice Communication panels
 - a. Panels as manufactured by Simplex, Notifier, Edwards Systems Technology, and Cerberus Pyrotronics.
 - 3. Vendor must be capable of providing local training and service support to SDPBC fire alarm personnel.
 - 4. The fire alarm control panel shall be of a type previously installed in SDPBC and operating satisfactorily for at least three-years, unless SDPBC grants in writing an exception.
- B. Installer
 - 1. A company specializing in smoke detection and fire alarm systems with 5-years experience, certified by the State of Florida's Licensing Board as fire alarm installing contractor.
 - 2. Proof of appropriate certification and registration is required.

1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide system wiring diagrams and conduit layout, complete battery load calculation, wiring and conduit sizes, wiring color codes, data sheets, and equipment ratings, layout, dimensions, and finishes.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- D. Submit manufacturer's certificate under provisions of Section 01 40 00 that system meets or exceeds specified requirements.
- E. On construction projects and renovations done in phases, Fire Alarm Shop (FAS) requires a Pre-Construction Agreement for each phase of the work prior to the contractor starting the project.
 - 1. The FAS requires (24) hour notice prior, to the start of each phase.
 - a. FAS will dispatch a technician to meet with the contractor on the job site and jointly establish the status of the F/A panel at the start of the project.

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- b. Problems which appear later that were not there at the start of the project, must be fixed by the contractor.
 - 2. If the contractor(s) start the work without a Pre-Construction Agreement, they are accountable for the F/A system function and repairs.
- 1.7 PROJECT RECORD DRAWINGS
 - A. Submit documents under the provisions of Section 01 77 00.
 - B. Provide accurately indicated locations of terminal boxes, junction boxes and all peripheral devices as well as the conduit run and point-to-point connection diagrams on disk in "AutoCAD" file format.
- 1.8 OPERATION AND MAINTENANCE DATA
 - A. Submit data under provision of Sections 01 77 00 and 01 78 23.
 - B. Include operating instructions, and maintenance and repair procedures.
 - C. Include manufacturer representative's letter stating that system has been inspected, tested and is certified as fully operational as specified by NFPA 72.
- 1.9 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver products to site under provisions of Section 01 60 00.
 - B. Store and protect products under provisions of Section 01 60 00.
- 1.10 EXTRA MATERIALS
 - A. Provide spare parts under provisions of Section 01 77 00.
 - B. Provide twelve keys of each type.
- 1.11 ALLOWANCES
 - A. Provide for ten (10) additional Alarm Lights (strobe lights) installed as directed in the field.
 - B. Provide for ten (10) additional Speaker/Strobe Lights installed as directed in the field
 - C. Provide for five (5) additional Manual Stations installed as directed in the field.
 - D. Provide for five (5) additional Ceiling Mounted Smoke or Heat Detectors installed as directed in the field.
 - E. Allowance includes purchase, delivery, and installation of box, fire alarm device, and 100 feet of conduit and cables for each device.
- 1.12 COMMISSIONING
 - A. Commissioning of a system or systems specified in this section is part of the construction process.
 - B. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative and the Commissioning Authority.
 - C. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure.
 - D. Refer to Section 01 77 00 - Contract Closeout, for substantial completion details.
 - E. Refer to Section 01 91 00 - Commissioning, for detailed commissioning requirements.

PART 2 PRODUCTS

- 2.1 ADDITIONS TO EXISTING SYSTEMS NOT REQUIRING A NEW CONTROL PANEL
 - A. All products shall match the existing system exactly.
 - B. In lieu of an exact match, products compatible to the existing system are acceptable only with documentation from the control system manufacturer's authorized representative, stating compatibility as well as the UL cross-listing.
 - C. In additions and renovations where fire alarm system is up-graded (new fire alarm panel is provided), all the fire alarm devices including the fire alarm devices in the relocatables shall be compatible with the up-graded fire alarm system.
 - D. Bidder shall visit the site and verify all existing conditions, and shall include in his bid all the work necessary for a fully functional fire alarm system.

- E. New fire alarm system devices may be connected to existing loop, circuit or wiring.
 - 1. However, existing loop, circuit, or wiring shall be upgraded to fully meet the requirements of the fire alarm system and these specifications.
 - 2. In lieu of upgrading existing loop, circuit or wiring contractor may choose to provide new loop, circuit and wiring for new devices.
- F. Additions and renovations of fire alarm system up-grades (new fire alarm panel); submittals to Building Department shall include circuit capacity of all existing fire alarm system circuits.
 - 1. Successful bidder must visit the site and fully survey and analyze the existing system in preparation of required submittals.

2.2 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

- A. Control Panel: The control panel shall provide power, annunciation, supervision, and control for the detection and alarm system and shall be modular in construction, and contain all modules necessary to operate according with this section.
 - 1. The detection system shall remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode.
 - a. The system shall be capable of having the entire total number of detection devices in alarm at the same time, without any loss of function.
 - b. The control panel shall be capable of supporting non-addressable as well as addressable detection devices.
 - c. The panel annunciator shall be a minimum, 32-character alphanumeric display, providing an optional user definable message associated with each detection device or zone.
 - 2. The control system shall provide the supervision of system electronics, wiring, devices, and software.
 - a. Monitor for the failure of system hardware or wiring with an independent hardware watchdog, which will indicate their failure.
 - b. The system shall provide failsafe operation, i.e. incoming alarms shall automatically override all other modes of operation, and the panel shall automatically return to normal operating mode from any operator initiated mode.
 - c. Provide ground fault detection for all initiating and audible circuits.
 - 3. Provide lamp test capability to test all visual panel indicators and associated software.
 - a. Make provisions for remote trouble and remote alarm silencing switches.
 - b. The control panel shall be equipped with a silence before reset feature, designed to prevent accidental system reset during an alarm condition.
 - 4. The system alarm lamp shall flash upon receipt of any alarm condition.
 - a. Acknowledgement of the alarm by operation of the silence switch shall silence the audible alarm and cause the alarm lamp to light steadily.
 - b. Receipt of subsequent alarms shall cause the audible devices to resound and the alarm lamp to flash.
 - 5. The system trouble lamp shall flash and an integral trouble buzzer shall sound upon the occurrence of any trouble condition.
 - a. Acknowledgement of the trouble condition by operation of the silence switch shall silence the audible alarm and cause the trouble lamp to light steadily.
 - b. Receipt of subsequent troubles shall cause the trouble buzzer to resound and the trouble lamp to flash.
 - 6. Use the same pair of wires to perform the individual input and output device addressability.
 - a. The system shall be capable of having all addressable devices in alarm simultaneously.
 - 7. The service mode shall permit the arming and disarming of individual input or output devices as well as manually operating output devices.

- a. Provide one-step function switches to allow the disarming & arming of groups of inputs or outputs, according to the grouping requirements of the School District.
 - b. The control panel shall display the status of these devices upon command.
 - c. The panel shall automatically return to normal mode in the event the panel remains unattended in the service mode for more than 4-hours.
 - d. The panel shall be capable of receiving and processing alarms even when in the service mode.
8. The control shall operate from a three-wire 120 VA supply and internal 24V back-up battery.
- a. Separately fuse all power connections whether AC or DC within the control unit.
 - b. Include light emitting diodes (LED's) to indicate (green) system power, (yellow) trouble, and (red) alarm; with trouble and alarm annunciated on an alphanumeric display, giving device number and location plus diagnosis of trouble.
 - c. Momentary contact switches shall provide for Locate, Next Alarm, Next Trouble, Acknowledge/Silence, and Reset.
 - d. An audible device shall sound within the control for alarm or trouble.
 - e. This device shall have two distinct sounds, and shall be silenceable by the acknowledge/silence switch.
 - f. Alarms shall override any trouble condition.
9. The control CPU and power supply shall be capable of powering up to 960 addressable early warning detectors and up to 960 addressable auxiliary relays.
- a. All system expansion modules shall interconnect through a card edge connector and shall require no inter-module wiring.
 - b. The control shall be capable of measuring and adjusting the sensitivity of detectors.
 - c. Provide an alphanumeric display, to display custom messages and give readings of detector sensitivity, detector by detector.
 - d. The system shall check each device on an addressable initiating circuit continuously for the following: sensitivity, response, open shorts, ground faults, functionality, and status.
 - e. The control CPU shall report the failure of a device's transmitting component(s) for open or shorts on an addressable initiating circuit.
 - f. Recognize and identify the device by location with the circuit to the specific device, and all other devices shall continue to function properly.
10. The control shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.
11. The control shall allow changing the status of configured circuits (arming or disarming and changing status of relays).
- a. If any change in status degrades system operation as configured, a trouble condition shall be reported and remain until system operation again meets configured status.
12. FACP shall include the necessary hardware to provide remote access via an Internet/Intranet Interface.
- a. The Internet Interface shall provide an alternative access to system information using the familiar interface of a standard Internet browser.
 - b. Remotely located authorized personnel can use this access to analyze control panel status during non-alarm conditions and to assist responder during alarm conditions.
 - c. The Internet Interface shall provide single user access for multi-user accounts each with separate password.
 - i) Provide programmable lockout to prevent excessive login attempts by unauthorized users.

- ii) Provide a built-in email feature that will automatically notify user accounts of individually selected status changes
 - iii) (i.e.: Alarm, Trouble, Supervisory, Sensor Sensitivity Status, and Historical Logs, for the same, on demand or via a selectable schedule-weekly, bi-weekly, or monthly).
- 13. The control shall allow for expansion and shall be configurable without system inter-wiring.
 - a. Leave 20% of points or addresses on each mapnet loop available for future additions on fire alarm system.
 - b. Leave capacity for one additional NAC panel per loop for future expansion.
 - i) For example if one loop can support five NAC panels, use no more than four and leave one NAC panel capacity for future use.
- 14. The manufacturer shall provide all system software, configuration software, training, licensing and required certification that is necessary in order to allow the SDPBC Fire Alarm Shop to perform their own modifications, additions, and deletions to the fire alarm system.
- 15. The system shall have capability to provide a level III access to view all past trouble and alarm events on site.
- 16. The system shall be capable of providing a hardcopy written record of all alarms, troubles, and system activity by means of full carriage width terminal to print detection device designations and location messages on a single line of up to 128 characters wherein 32 are reserved for device or zone custom identification. Printer is not required.
- 17. New unacknowledged alarms and troubles shall be distinctively displayed on the visual display and differentiated from previous alarm and troubles.
- 18. The system shall automatically indicate the total quantity of alarms and of troubles, which have occurred prior to reset at the control unit.
- 19. No alarm or trouble indication shall be re-settable until acknowledged.
- 20. It shall not be possible to reset the system without acknowledging all alarms, it shall be possible to display up to 250 alarms and up to 250 trouble indications one at a time on the digital annunciator, which shall be capable of listing, upon request:
 - a. Alarms with time, date, and location
 - b. Troubles with time, date, and location
 - c. Status of output functions, "on" or "off"
 - d. Sensitivity of addressable smoke detectors
 - e. Device number, type and location
 - f. Status of remote relays, "on" or "off"
- 21. The fire alarm system's programmed database of initiation devices shall be "hard burned" (stored in permanent memory) not reliant on a power source of any form.
- B. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciator(s), door holders, smoke dampers, relays, and alarm signaling devices and 20% spare capacity.
- C. Connect the system to the life safety branch of emergency generator.
 - 1. The system shall have battery back up.
 - 2. Size the batteries to provide 24-hours of standby operation followed by five-minutes of alarm.
 - 3. Provide a dual rate battery charger, which is capable of recharging the batteries to 80% capacity in 12-hours.
 - 4. Loss of commercial power shall annunciate as a system trouble.
 - 5. System trouble shall indicate for over or under voltage conditions, blown fuse or disconnected batteries.
 - 6. The system shall indicate visually and audibly when operating from standby power.
 - 7. The system shall automatically restart upon the return of power.
- D. Detection Circuits:

1. Addressable device input supervisory modules capable of Class A or Class B supervision, Class B is allowed with the following conditions:
 - a. Total number of devices on any circuit shall not exceed 80% of manufacturer's recommended capacity.
 - b. The end line resistors shall be located in the fire alarm terminal cabinets.
 - c. Any construction on an active campus requires hand excavation in locations within 10' of any known or suspected location of utility or wiring.
 2. For Class A fire alarm system the minimum separation between the outgoing and return conduits shall be 18" where the conduits are horizontal and 6" where the conduits are vertical.
 3. Addressable devices shall be monitored, each device uniquely identifiable.
 4. Capable of supporting non-addressable initiating devices through installation of additional modules.
 5. Sized and programmed, suitable for all initiating devices connected to the system and an additional 100 possible future expansion devices.
- E. Signal Circuits
1. Supervised march time signal modules, sufficient for signal devices connected to system and two additional unused circuits, tested, installed and programmed for future expansion.
 - a. All shall be designed for use with audible circuit operation with Class A or Class B supervision, Class B is allowed with the following conditions:
 - i) Total number of devices on any circuit shall not exceed 80% of manufacturer's recommended capacity.
 - ii) The end line resistors shall be located in the fire alarm terminal cabinets.
 - iii) Any construction on an active campus requires hand excavation in locations within 10' of any known or suspected location of utility or wiring.
 - b. For Class A fire alarm system the minimum separation between the outgoing and return conduits shall be 18" where the conduits are horizontal and 6" where the conduits are vertical.
- F. Remote Station Outputs: Provide a self-restoring relay to output common trouble conditions and a re-settable relay to output common alarm conditions to the Owner's security interface equipment.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified. Relays shall be wired fail-safe. Failure of the relay or circuit shall cause the controlled device to go into a safe condition.
- H. Provide one-step, panel mounted RECALL switch.
- I. Do not provide panel with DRILL switches.
- J. Supervised booster panels, or remote power supplies may be used to power and supervise the notification appliance circuits.
 1. Install Manufacturer recommended transient absorption devices at booster panels.
 2. Install remote booster panels or remote power supplies in electrical or mechanical rooms.
 3. Do not install fire alarm system equipment in locations that are not readily accessible.
 4. Connect booster panels and remote power supplies to the life safety branch of generator.
- ### 2.3 INITIATING DEVICES
- A. Manual Station
1. Semi-flush mounted, double action manual station equipped with an addressable interface module that interfaces the manual station and the addressable initiating circuit.
 2. It shall be field programmable.
 3. The double action product shall not be of the type, which uses disposable components, (i.e.: break glass).
- B. Heat Detectors

1. Combination rate-of-rise and fixed temperature, rated 135°F and temperature rate of rise of 15°F or 190°F (fixed only), as specified.
 2. Addressable and controlled by the system control panel.
 3. Each detector to be uniquely identifiable and be field programmed.
 4. Calibration and device identification monitored by the system control panel.
 5. Heat detectors shall be self-restoring type.
- C. Ceiling Mounted Smoke Detector
1. Addressable detector controlled by the system control panel.
 2. Photoelectric type with adjustable sensitivity, removable from base, auxiliary relay contact, and visual indication of detector actuation, suitable for mounting on 4" (100 mm) outlet box, and each detector shall be uniquely identifiable and field programmable.
 3. The system control panel shall monitor calibration, device identification, and sensitivity.
 4. The sensitivity controlled by and reading received by the system control panel upon request.
 5. Exceptions
 - a. In Additions to Existing Systems, where the control panel is a non-addressable type:
 - i) The ceiling mounted smoke detectors shall be compatible to the existing system and the smoke detector shall be removable from its base.
 - ii) The base shall accommodate both ionization and photoelectric type area smoke detectors.
- D. Duct Mounted Smoke Detector
1. Photoelectric type with auxiliary SPDT relay contact duct-sampling tubes extending width of duct and visual indication of detector actuation in duct-mounted housing.
 2. Provide remote test station with key switch and red LED status indicator.
 - a. Wire the remote test station to the duct smoke detector via remote relay.
 - b. Mount the remote test stations 48" AFF.
 - c. Group all remote test stations at one place inside the mechanical room.
- E. The sensitivity controlled by and reading received by the system control panel upon request.
- F. In Additions to Existing Systems where the control panel is a non-addressable type, the duct detector must be compatible with the existing system and the housing shall be molded plastic.
1. An integral filter system shall be included to reduce dust and residue effects on the detector and housing.
 2. Sampling tubes shall be easy to install after the mounting the housing to the duct, by passing through the duct housing.
 3. The smoke detector shall be removable from the base and the base shall accommodate either ionization or photoelectric smoke detectors.
 4. The unit shall also accommodate a remote key operated test switch with visual remote indicator.

2.4 NOTIFICATION DEVICES

- A. Alarm Lights: Strobe lamp and flasher with red lettered FIRE on white lens.
- B. Alarm Horn
1. Flush type with wall trim plate (interior), surface type (exterior), and fire alarm horn.
 2. Provide additional integral strobe lamp and flasher with red lettered FIRE on white lens.
- C. Speaker/Alarm Lights
1. Flush type with wall trim plate (interior), surface type (exterior), and fire alarm speaker.
 2. Provide additional integral strobe lamp and flasher with red lettered FIRE on white lens.
- D. Remote smoke detector alarm lamp assembly: flush mounted with red LED to indicate remote (above ceiling or obscured from normal view) detectors alarm status.

- E. Voice Alarm Panel: Provide and install a new voice alarm panel. System shall be capable of distributing voice messages throughout the building via an audio amplifier and fire alarm speakers. Provide the following features:
 - 1. Multiplexed audio wiring.
 - 2. Distributed audio.
 - 3. Pre-recorded evacuation message using solid-state electronics. May provide different message or tones on events.
 - 4. Remote All-Call page option.
 - 5. Medium system capacity.
 - 6. Multiple channel capability for up to 4 audio channels.
 - 7. Style Y or Style Z speaker circuit operation.
 - 8. Speaker and telephone on/off manual switches with custom labels.
 - 9. 30 watt and 120 watt audio amplifiers with switch-mode power supplies.
 - 10. All-call switch and indicator.
 - 11. Field recorded message option.
 - 12. Zone-coded voice options.
- F. Audio Amplifier: provides up to 120 watts of 25 VRMS audio power, low-power standby mode for low battery drain, high-efficiency switched regulation, plug-in terminal strips and cable connectors, and 10-position level adjust and indicator LED's, and includes a built –in automatic tone generator (slow whoop on high/low).

2.5 AUXILIARY DEVICES

- A. Door Release: Door closer as specified in Section 08 71-00
- B. Provide magnetic door holder with integral diodes to reduce buzzing 24 VAC coil voltage.
- C. Mount the armature with bolts extending through the entire depth of the door, (through bolted).
- D. Devices shall be wired failsafe. Failure of the device or circuit shall cause the controlled device to go to a safe condition.

2.6 SYSTEM RACEWAY

- A. Install all raceway necessary to provide specified equipment function and per print sheets as under the provisions of Sections 26-05-33, 26-27-16 and 26-05-53.
- B. Install flexible conduit to duct detectors.
- C. Install an 24" x 24" x 6" minimum size cabinet with hinged and lockable cover and with internal wood backboard and screw type terminals in point of entry room to each building.
 - 1. All wiring shall terminate through the terminal strips, one wire per connector screw.
 - 2. Mount all ends of line devices (resistors) in these cabinets.
- D. Install a 36" x 36" x 6" minimum size cabinet with hinged, lockable cover, wood backboard and terminal strips. Locate cabinet within 25' of fire alarm control panel but not in the main administration reception area.
 - 1. All system field wiring shall terminate through terminal connections in this cabinet.
 - 2. Use one wire per connector screw.
- E. Label conduit at each terminal cabinet as to its destination, building number, direction interior or exterior.
- F. Provide a grounding bar in every terminal cabinet and bond to the main building grounding system with a #8 AWG.
- G. Permanently label all fire alarm terminal boxes, panels and relay enclosures (Fire Alarm).
- H. Paint all fire alarm junction box covers orange and install an orange round dot on the ceiling tile grid below all fire alarm junction boxes and equipment located above the ceiling.
- I. All conduit connections to terminal cabinets and control cabinet shall have bushings installed.
- J. Raceway shall not exceed 400' without a pull box.
- K. Maximum Number of conductors in a conduit shall not exceed 40% conduit fill.

2.7 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire as specified in Section 26 05 13.
- B. Initiating Circuits and Auxiliary Control
 - 1. Building wire as specified in Section 26-05 13.
 - 2. Non-power limited fire-protective signaling cable, copper conductor, Class 1, 600-volt insulation and Article 760 of NEC Power limited circuits.
 - 3. Constructed shall be in accordance with articles 318, 340, 500 & 501 of NEC.
 - 4. Passing VW-1 Vertical Flame Test
 - 5. If stranded annunciator point wiring, maximum of seven strands
- C. Signal Circuits, Door Holder and Annunciator point wiring: Building wire as specified in section 26-05 13, 600 volt insulation, Type THWN stranded (maximum of 19 strands), and in accordance with NEC 310.
- D. Each separate circuit, initiation, signal and auxiliary shall have a specific number.
 - 1. Label each conductor by this circuit number at the control connections and at each terminal connection in the terminal boxes.
- E. Install a grounding conductor through the entire conduit system and bonded to each device, junction box, terminal box, and control panel.
- F. Use cables listed for wet locations below grade.

2.8 SURGE SUPPRESSION

- A. Provide surge protection devices on all wires that enter and leave the fire alarm control panels and the fire alarm booster panels.
 - 1. Provide surge protection devices on all 120-volt power circuits serving the fire alarm control panels and the fire alarm booster panels.
 - 2. Provide a dedicated cabinet to house the surge protection devices. Locate cabinet within 5' to 25' of the fire alarm panel or booster panels.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. All terminal connections in terminal cabinets and in equipment shall be made using solder less block spade connectors suitable for use with the wire gauge and screw terminal applied to.
- C. Mount end-of-line devices (resistors) in the building terminal cabinet nearest the circuit.
- D. Mount outlet box for electric door holder to withstand 80 pounds (36.3 kg) pulling force.
 - 1. Wall magnet mounting boxes shall have solid backing support behind.
- E. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire-suppression system control panels, duct smoke detectors, and all other specified peripherals.
- F. Install duct access panels at all locations of sampling tubes locations.
- G. Install all exterior equipment, mounting boxes and junction boxes with all precautions necessary to insure the wiring and equipment is "weatherproof".
- H. In additions to existing systems, the contractor shall phase the contract with the concurrence of the Owner; to assure that the minimum amount of manipulation events occur to the existing fire alarm system.
 - 1. Schedule all modifications and additions to the existing fire alarm panel or circuits in advance with the concurrence of the Owner, to allow them to observe the code required re-acceptance inspection.
- I. Install duct smoke detectors within mechanical rooms at heights accessible for service, usually no more than 20' AFF.
- J. Clean the inside of the terminal cabinets and other enclosures from wire cuts and other installation debris.
- K. Fire alarm visual alarm signal devices (strobe lights) shall be set at 80" to 96" to the bottom of the devices' above finished floor.

3.2 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 01 40 00.
- B. Test in accordance with NFPA 72 and additional owner requirements.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Section 01 40 00.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing and field service certification per NFPA 72.
- C. The equipment installer and/or manufacturer as required by NFPA 72 shall prepare a certificate of completion.
 - 1. Complete parts 1, 2, and 4 through 10 after installing the system and checking installation wiring.
 - 2. Complete part 3 after completing the operational acceptance tests.
 - 3. Provide a filled-out preliminary copy of the certificate to the Owner after the completion of the installation wiring tests.
 - 4. Submit a final copy to the Owner, after completion of the operational acceptance tests.
- D. After each re-acceptance test and after final acceptance testing, the Contractor shall provide the Owner with completed NFPA 72 inspection and test forms, verifying that the system passes the testing requirements of NFPA 72 and is thereby "operational".
- E. Upon final acceptance of the systems, the Contractor shall provide the Owner with an operator's manual.

1. Installation instructions covering all new system equipment with PDF files and an AutoCAD computer disk of the fire alarm system "As-Built".
 2. Depicting architectural room along with fire alarm device layout, fire alarm riser diagrams depicting point to point conduit runs with wiring counts, wire gauge, wire color, and function noted on each conduit run
 3. Provide a second copy of the as-build (fire alarm) to the Fire Alarm shop.
- 3.4 FIRE ALARM WIRE AND CABLE COLOR CODE
- A. Provide fire alarm circuit conductors with color-coded insulation as follows:
1. Additions to Existing Systems
 - a. Match existing gauges and color code, except for signal circuits that shall be as for new systems.
 - b. If non-addressable devices are used, use Purple and Blue for initiation devices and Pink (positive) and Grey (negative) for A/C shut down and gas shut down.
 2. New Systems
 - a. Initiating Device Circuit and field relay controls: 1-pair #18 gauge shielded Cable, Red casing.
 - b. SDPBC requires the initiating device circuits wiring for the underground installations to be twisted/shielded cable.
 - c. Initiating device circuits wiring for the above ground installations shall be twisted/shielded cable, if required by the equipment manufacturer.
 - i) Horn Circuit: #12 AWG Orange (positive), #12 AWG Brown (negative).
 - a) For longer than 200' wire run, increase wire gauge to comply with manufacturer's requirements.
 - ii) Strobe Circuit: #12 AWG Yellow (positive), #12 AWG Gray (negative).
 - a) For longer than 200' wire run, increase wire gauge to comply with manufacturer's requirements.
 - iii) Door Release: #12 AWG Yellow (positive), #12 AWG blue (negative).
 - iv) Speaker Circuit: 1-pair #18 gauge shielded Cable, Green casing
 - v) Annunciator Point Wiring Power use #14 AWG Orange, positive and #14 AWG brown, negative.
 - a) Processor connection #18 AWG shielded pair.
 - vi) Equipment Grounding Conductor: #12 AWG Green.
 - vii) Spares: Provide 4 #10 AWG, White spare wires and one spare data cable in each fire alarm system terminal cabinet.

3.5 DEMONSTRATION

- A. Provide systems demonstration and instructions under provisions of Section 01 75 00.
- B. Employ manufacturer's field representative to demonstrate system operation to Owner's personnel.
- C. Conduct walking tour of Project; describe function, operation, and maintenance of each component.
- D. Use submitted operation and maintenance manual as reference during demonstration and training.

3.6 FUNCTIONAL PERFORMANCE TESTING

- A. System Functional Performance Testing is part of the Commissioning Process.
 1. The Contractor shall perform the Functional Performance Testing and the Commissioning Authority shall witness and document the test.
 2. Refer to Section 01 91 00, Commissioning, for functional performance tests and commissioning requirements.
- B. Systems Readiness Checklists shall be completed and submitted for each piece of equipment included in this section.

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- C. Perform the functional performance testing of Panelboards as part of the Fire Alarm System Functional Performance testing.

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3.7 DEMONSTRATION AND TRAINING

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative.
 - 1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.
 - 2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.
 - 3. Refer to Section 01 91 00, Commissioning, for further contractor training requirements.
- B. Provide demonstration and training for all types of fire alarm installed in this project.

END OF SECTION