

SECTION 26 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 40 91 13 Gas Detection Device Requirements for Life Safety Systems.

1.2 REFERENCE CODES AND LISTINGS

- A. National Fire Protection Association (NFPA) – The latest adopted edition of the code referenced:
 - 1. NFPA 1 – National Fire Code
 - 2. NFPA 13 – Standard for the Installation of Sprinkler Systems
 - 3. NFPA 70 – National Electrical Code
 - 4. NFPA 72 – National Fire Alarm Code
 - 5. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems
 - 6. NFPA 101 – Life Safety Code
- B. Federal Guidelines for Accessibility for Americans with Disabilities
- C. Approval from the Office of the State Fire Marshall.
- D. The system as a whole and the individual system components shall comply with applicable listings of Underwriter’s Laboratories (UL), including but not limited to the following.
 - 1. UL864/UOJZ, APOU – Control Units for Fire Protective Signaling Systems
 - 2. UL 268A – Smoke Detectors for Fire Protective Signaling Systems
 - 3. UL268A – Smoke Detectors for Duct Applications
 - 4. UL 228 – Door Holders for Fire Protective Signaling Systems
 - 5. UL 464 – Audible Signaling Appliances
 - 6. UL 1638 – Visual Signaling Appliances
 - 7. UL 38 – Manually Activated Signaling Boxes
 - 8. UL 346 – Water flow Indicators for Fire Protective Signaling Systems
 - 9. UL 1971 – Standard for Signaling Devices for the Hearing Impaired
 - 10. UL 1481 – Power Supplies for Fire Protective Signaling Systems
 - 11. UL 521 – Heat Detectors for Fire Protective Systems

1.3 SUMMARY

- A. Fire alarm panel will provide standard fire alarm functionality. It will also provide monitoring, alarming, and transmitting “Point Annunciation” information to 3rd party monitoring for gas detection devices in the building associated with the Dangerous Gas Monitoring System (DGMS). See Specification 40 91 13.
- B. The new fire alarm panel shall maintain existing fire alarm functionalities. The fire alarm SLC and 24VDC circuits may be wired separately or combined with the SLC and 24VDC circuits for the gas detection devices.
- C. Existing conduits not reused shall be demolished back to the fire alarm panel.
- D. Fire alarm monitoring is required if building is occupied while construction is ongoing. Demolition of existing fire alarm system and installation of new shall be coordinated closely with the owner.
- E. The contractor is responsible for surveying existing facility and accounting for all field conditions. There shall be no cost addition to the contract for field conditions missed by contractor.
- F. A work permit for this contract shall not be issued until shop drawings have been approved.
- G. The contractor shall be responsible for installing and mounting the gas detection devices and their tubing.

- H. Section Includes:
 1. Fire-alarm control unit.
 2. Manual fire alarm pull stations.
 3. System smoke detectors.
 4. Intelligent addressable heat detectors.
 5. Notification devices.
 6. Firefighters' two-way telephone communication service.
 7. Air handling system shutdown relays
 8. Addressable interface devices
 9. Water flow detector pressure switches
 10. Sprinkler supervisory switches
 11. Digital alarm communicator transmitter.
 12. OnyxWorks server interface
- I. Related Sections include the following:
 1. Division 26 Section "Low-Voltage Electrical Power Conductors and Cables"
 2. Division 26 Section "Grounding and Bonding for Electrical Systems"
 3. Division 26 Section "Raceways and Boxes for Electrical Systems"
 4. Division 40 Section "Gas Detection Device Requirements for Life Safety Systems"

1.4 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.
- C. DGMS: Dangerous Gas Monitoring System

1.5 SYSTEM DESCRIPTION

- A. Furnish and install a complete UL certified, non-coded, point addressable, intelligent Fire Alarm System as described herein and as shown on the plans.
- B. System shall be dedicated to fire service and Dangerous Gas Monitoring System (DGMS) only.
- C. The fire alarm control unit shall have an operator interface to allow for loading or editing special instructions and system operating sequences as required. The system shall be capable of on-site programming to accommodate and facilitate expansion, building parameter changes and changes as required by local codes. All software operations are to be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the system programs stored in memory.
- D. The fire alarm control unit shall allow for operator to set detector sensitivity ratings for each device, within code allowed parameters.
- E. To accommodate and facilitate job site changes, initiation circuits shall be individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit.
- F. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.
- G. All control equipment shall have transient protection devices to comply with UL864 requirements.
- H. Fire alarm control unit shall accept addressable analog detectors and addressable monitor modules for dry contact devices.

- I. Fire alarm control unit shall interface to ONYXWorks™ graphical workstation through Georgia Tech internal network (GTLAN).
- J. Bypass switches shall be included for system testing to prevent audible/visual signal operation, HVAC control activation, and remote fire department notification. Bypass switches for fire alarm system testing shall be located in main fire alarm control unit. Activation of bypass switches shall cause system trouble alarm.
- K. The fire alarm control unit shall perform all existing functions that may not have been listed above but are part of the existing fire alarm system.
- L. Qualified contractors interested in bidding on the project must attend mandatory pre bid meeting and pre construction meeting on project scope of work. No submittals will be accepted without attendance.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include 50% spare capacity on each signal circuit so that additional devices can be added.
 - 4. Include substantiating emergency (battery) and normal power supply calculations for supervisory, alarm power requirements and gas detection devices power requirements.
 - 5. Include calculations of notification device circuit loading (end of circuit voltage drop) to ensure proper operation of all devices.
 - 6. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits. Drawing scale shall match engineers design drawings.
 - 8. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 - 9. Include complete schematic circuit diagrams for system, including all equipment. Wiring diagram shall show point to point connections between all system components
 - 10. Include descriptions of system operation, annunciator schedule showing titles for each zone, and manufacturer's literature marked to show model and catalog number for all equipment.
 - 11. Include complete riser diagrams for system indicating wiring sequence of all alarm devices and control equipment shall be included with submittal data.
- C. General Submittal Requirements:
 - 1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - 2. Where fire protection system plan approval is required, the contractor shall assist the Engineer in the preparation of the submittal. Refer to State Register April 2003, Department of Commerce Code, Chapter 61, paragraph 61.30(3) and table 61.30-3 for buildings where fire protection system plan approval is required. Submittal requirements and areas of responsibility are as follows:
 - a. Fire Alarm System Floor Plans dimensioned and drawn to scale with appropriate symbols, system wiring requirements, and other information required by the Department of Commerce. Four sets required to be furnished to the Engineer by the electrical contractor.
 - b. Copy of the fire alarm system control unit and device shop drawings. Four sets required to be furnished to the Engineer by the electrical contractor.
 - c. Fire alarm system voltage drop calculations and standby battery calculations. Four sets required to be furnished to the Engineer by the electrical contractor.
 - d. One set of fire alarm system specifications. Provided by the electrical engineer.

- e. Additional information required by the Department of Commerce relating to the specific system to be installed, system wiring requirements, calculations, or other components shall be furnished to the engineer by the electrical contractor. Costs associated with this shall be included in the contractor's bid.
 - f. Application for Approval to be completed and submitted by the Engineer.
 - g. Permit approval fees. Paid for by the Engineer.
3. Contractor shall note that fire alarm system shall be submitted and approved prior to the installation of the system.
- D. Permit Drawings:
- 1. The System's Contractor furnishing and installing the fire alarm system is responsible for preparation of these drawings and getting drawings approved by the Authority Having Jurisdiction (AHJ).
- E. Systems Contractor Qualifications.
- 1. The contractor directly responsible for this work shall be a Notifier 'Premier' Distributor who has been regularly engaged in installation of industrial fire alarm systems for at least the immediate past 5 years. All equipment shall be installed by a technician trained by the equipment manufacturer or a recognized training school or course for the installations of this type system. The contractor shall, if requested by the engineer, show proof of a specific individual's training. The system's contractor shall directly employ a suitable number of skilled systems installers whose normal work is systems installation and who shall install and make the wire and cable connections thereto.
 - 2. As part of the project submittal, it shall be demonstrated to the satisfaction of the engineer that the systems contractor has adequate plan and equipment to do the work properly and expeditiously, adequate staff and technical experience.
 - 3. Qualified contractors must attend mandatory pre bid meeting and pre construction meeting on the project scope of work. No submittals will be accepted without attendance

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Seismic Qualification: Manufacturer's certification of seismic qualification according to ASCE 7-05. Submit ASCE 7-05 special seismic certification as required. Include method used to determine compliance with requirements.
 - 1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- C. Detailed description of equipment anchorage Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - 3. Record copy of site-specific software.
 - 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 - 5. Manufacturer's required maintenance related to system warranty requirements.
 - 6. Abbreviated operating instructions for mounting at fire-alarm control unit.

- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
- C. The Contractor shall provide three bound copies of the following, to be forwarded to the Owner at completion of project:
 1. As-built wiring and conduit layout diagrams showing all fire alarm devices and DGMS on floor plans, including wire color code and terminal numbers, and showing all interconnections in the system.
 2. Electronic circuit diagrams of all FACP modules, power supplies, annunciator, data gathering panels, addressable interface modules, etc.
 3. Technical literature on all major parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.
 4. As-built point I/O list for installed modules and a floor plan showing locations of modules.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 3. Keys and Tools: One extra set for access to locked and tamper proofed components.
 4. Fuses: Two of each type installed in the system.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. The installing contractor must be a Notifier Premier Distributor.
- C. The Systems Contractor shall be a Certified Alarm System Contractor I or Certified Unlimited Electrical Contractor.
- D. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- E. The addressable fire alarm system shall be connected, programmed, and tested only by the manufacturer or by an authorized distributor who stocks a full complement of spare parts for the system. Technicians performing this service shall be trained and individually certified by the manufacturer for the model of system being installed. Copies of their certifications must be included with the contractor's submittal to the engineer, prior to installation. The submittal cannot be approved without this information.
- F. System equipment shall be from a single manufacturer and shall be supported by a manufacturer authorized, established service organization that shall stock parts for the equipment supplied.
- G. Equipment shall be manufactured by a firm that has been actively manufacturing fire alarm systems for a minimum of 7 years and that offers a 3-year warranty on all control equipment.
- H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.11 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Receive equipment at jobsite; verify applicable components and quantity delivered per invoice.
- B. Handle equipment to prevent internal components damage, breakage, denting, and scoring enclosure and finish.

- C. Do not install damaged equipment.
- D. Store equipment in a clean, dry space and protect from dirt, fumes, water, construction debris, and physical damage.
- E. After installation, protect from damage by work of other trades.

1.12 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service:
 1. Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 2. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.13 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of system and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Manufacturer's standard warranty period (minimum one year) from date of start-up.
 2. Labor and travel time for necessary repairs at the job site shall be included.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Onyx Series NFS2-3030 by Honeywell Notifier with NCA card. No alternates shall be acceptable.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Refer to Division 40, Gas Detection Device Requirement for Life Safety Systems. This specification covers signal initiation and actions from the gas detection devices by the fire alarm panel.
- B. Fire-alarm signal initiation shall be by one or more of the following devices:
 1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Gas Sensors
 6. Emergency pushbutton
 7. Automatic sprinkler system water flow.
 8. Fire-extinguishing system operation.
 9. Fire standpipe system.
- C. Fire-alarm signal shall initiate the following actions:
 1. Continuously operate alarm notification appliances.
 2. Identify alarm at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Activate voice/alarm communication system.
 7. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.

8. Activate emergency lighting control.
 9. Activate emergency shutoffs for gas and fuel supplies.
 10. Record events in the system memory.
 11. If fire alarm activation is caused by any smoke detector, duct detector, sprinkler flow alarm switch, or other automatic detection device located on a serving a floor, the following actions shall be initiated:
 - a. Shut down all air handling systems and exhaust fans serving that floor.
 - b. Close all smoke dampers in ducts associated with the air handling unit along with exhaust fans that are shut down.
- D. Supervisory signal initiation shall be by one or more of the following devices and actions that are existing:
1. Valve supervisory switch.
 2. Sprinkler tamper switches.
 3. Low-air-pressure switch of a dry-pipe sprinkler system.
 4. Provide monitoring of the following fire pump alarms:
 - a. Pump running.
 - b. Controller connected to alternate power source.
- E. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Fire-pump isolated switch opening.
 11. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
 12. Fault signal from the gas detector.
- F. System installation shall allow remote restarting of all air handling systems after having been shut down by the Fire Alarm System. Air handling systems shall automatically restart after fire alarm system has been reset.
- G. Smoke dampers in ducts shall close whenever associated air handling system is shut down either by fire alarm system activation or otherwise.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 2 line(s) of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
 3. See Messaging section of this specification for details on message content/format.
- C. Loop (Signaling Line Circuit) Control Module
1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.
 2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
 3. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.
- D. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style B.
 - b. Notification Appliance Circuits: Class A
 - c. Signaling Line Circuits: Class A
 - d. Provide 50% spare capacity on circuits for additional devices.
 2. DGMS: NFPA 72, Circuits Class A. SLC Loop will be the same loop used for fire alarm devices.
 3. Serial Interfaces: Two RS-232 ports for printers.
- E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located at the fire alarm control panel.
1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

4. Provide sufficient amplification to operate all system speakers simultaneously plus thirty (30) percent spare capacity. Calculation shall assume each speaker is connected at the one (1) watt tap.
5. A minimum of two (2) microphones shall be located in the building remote from the fire alarm control panel.

H. Power Supplies:

1. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory, and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - a. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
2. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - a. Batteries: Sealed lead calcium.
3. Provide battery backed up 24-V dc supply to power the gas sensors/transmitters, SLC modules, tree lights and any other equipment connected to the DGMS SLC loop.
4. After 24 hours, the battery backup supply shall be capable of energizing all signal devices for a period of at least fifteen minutes. In addition, the low battery backup supply monitor shall supervise and automatically sound System Trouble in the event that a trouble occurs in the system (i.e., the batteries being disconnected or discharging to 85% of full charge). Battery and power supply capacity shall provide an additional 50% spare capacity for additional alarm signal devices that may be added to the system.
5. Provide power supply and battery capacity for system operation. Power supply and battery capacity shall be sized to allow an additional 50% spare capacity for future growth. The power supply shall be able to perform an automatic load test of batteries and indicate a trouble condition if the batteries fall outside a predetermined range. Power supplies shall incorporate the ability to adjust the charge rate of batteries based on ambient temperatures. Exact locations and quantities of power supplies shall be as determined by the contractor.

I. Surge Protection Devices

- a. The system shall be provided with the following protective devices to prevent damage of nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. They are to be provided by the fire alarm equipment supplier:
 - 1) On AC Input: Ditek DTK-120HW or DTK-120/240 CM, EFI HWM-120, Leviton OEM-120EFI, Transtector ACO100BWN3, or equal UL Listed device approved by NCDOL. Installed at the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns of about 1" diameter, and tie-wrapped.
 - 2) On DC circuits Extending Outside Building: Adjacent to the FACP, and near the point of entry to the outlying building, provide a "pi" filter on each leg. This consists of a primary arrestor, a series impedance of 1 millihenry or more, and a fast acting secondary arrestor which clamps between 30 and 40 volts. Acceptable models with these or equivalent features include Simplex 2081-9027 and 2081-9028, Transtector TSP8601, Ditek DTKxLVL series, Citel American B280 -24V, Edco P264 and P642, or equal. Submit specification on other candidate suppressors for approval.

J. Networking

1. Provide required fiber network modules and equipment to network multiple Fire Alarm Control Panels in remote buildings.
2. All cable between buildings Fire Alarm Control Panels shall be multimode optical fiber cable. All fire alarm "backbone cable" shall be 50/125 laser optimized multimode optical fiber suitable for in-ground applications (indoor/outdoor rated).

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.
 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
 5. Boxes shall be addressable and on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 4. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 5. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Provide remote indicator alarm for each duct detector. Mount on ceiling in corridor nearest to duct detector location.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 3. Auxiliary contacts rated for 120 volts AC for control of elevator shunt trip breaker.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.
 1. Device Color: Factory finished, white
 2. Devices shall be flush mounted with surface.
 3. Strobes shall be set at 75 candela, unless otherwise noted on drawings.
 4. Exterior mounted devices shall be provided with flush mounted weatherproof backbox.
 5. Audible signals shall be ANSI Temporal 3
 6. Audible and visual devices shall be NFPA 72 compliant and shall comply with ADA requirements.
 7. A weatherproof strobe shall be mounted at the designated building entrance.
- B. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "ALERT" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 1. Rated Light Output:
 - a. 15/30/75/110 cd, field selectable and synchronized.
 2. Mounting: Wall mounted unless otherwise indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 4. Flashing shall be in a temporal pattern, synchronized with other units.
 5. Strobe Leads: Factory connected to screw terminals.
- C. Speaker Strobes
 1. The Speaker Strobe appliance shall be System Sensor SpectrAlert Advance. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
 2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
 3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
 4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with

associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.

5. All notification appliances shall be backward compatible.
6. Strobes shall have an "ALERT" label to be used for fire alarm and gas detection notifications.
7. See Messaging section of this specification for details on message content/format.

D. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. Speakers shall provide power taps at 1/4w, 1/2w, and 2w. Speakers shall provide UL confirmed 90 dBA sound output at 2w. Speaker tap settings shall be as follows:
 - a. Corridors – 1.0 watt
 - b. Rooms smaller than 100 sq. ft.- (10 sq. m-) – 0.5 watts
 - c. Rooms from 100 to 400 sq. ft.- (10 to 37-sq. m-) – 1.0 watt
 - d. Rooms larger than 400 sq. ft.- (37-sq. m-) – 2.0 watts

E. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

1. The word "ALERT" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

F. Operation: Strobes/voice notification shall be activated in the event of Level 2 gas detection alarm. See gas detector specification for more details and coordinate details with Ga Tech.

2.8 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

2.9 LED DISPLAY

A. High visibility multi-color LED text message board that provides visible textual alarm notification from the fire alarm control panel.

1. UL 1638 listed.
2. Wall and/or ceiling mounted (see drawings).
3. Fire alarm notification including room number/label where action is activated shall be displayed on the message board.
4. Gas type, ppm level of gas and room number/label where gas is detected shall be displayed on the message board.
5. See Messaging section of this specification for details on message content/format.

2.10 GAS MONITORING DEVICES

A. See Division 40, Gas Detection Device Requirements for Life Safety Systems specification for gas devices that shall be furnished as part of this contract.

B. Contractor is responsible for furnishing, mounting and installation of these devices per manufacturer's recommendations.

2.11 ADDRESSABLE INTERFACE DEVICE

A. Description: Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.

B. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.

- C. Addressable 4-20 mA module shall be available to monitor Midas Gas detectors 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display. Programming of detector threshold levels and sequence of events for each level will be detailed by Georgia Tech.
- D. Air Handling System Shutdown Relays: Provide and install a supervised addressable output relay at each Air Handling System for shutdown on alarm from fire alarm system as per system operation description. The unit shall be normally closed with a coil to match voltage of Fire Alarm Control Panel and interrupt starting circuit of Air Handling System unit fan(s). Provide and install a supervised addressable output relay at each exhaust fan for shutdown on alarm from fire alarm system as per system operation description, unless exhaust fan is interlocked with AHU.
- E. Waterflow Detector/Pressure Switches: Existing Waterflow or pressure switches shall be wired to the Fire Alarm System by this Contractor. Provide addressable water flow/tamper module for each switch so that each switch can be individually monitored.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 1. Address of the alarm-initiating device.
 2. Address and/or Zone of the supervisory signal.
 3. Address and/or Zone of the trouble-initiating device.
 4. Loss of ac supply or loss of power.
 5. Low battery.
 6. Abnormal test signal.
 7. Communication bus failure.
- E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 WORK STATION

- A. Description: Provide a high performance industrial computer capable of networking to the fire alarm panel for remote monitoring.
 1. The ONYXWorks workstation(s) provide centralized control and monitoring of the fire alarm and gas detection systems.
 2. If requested by Georgia Tech, provide an ONYXWorks workstation and associated network connection to connect the workstation to the GTLAN. Coordinate access to GTLAN and location for the ONYXWorks workstation with the Georgia Tech Facilities Engineering organization.
 3. Provide support for the update to any graphic screens needed to monitor new fire alarm and/or gas detection devices.
 4. Provide support for programming to allow the unit to send email and text messages in response to any system event.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. All wiring shall be installed in conduit. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduit, mounting boxes, junction boxes and panels shall be securely hung and fastened with appropriate fittings to ensure positive grounding throughout the entire system.
- C. No wiring other than that directly associated with fire alarm or auxiliary fire protection functions shall be permitted in fire alarm conduits. There shall be NO splices in the system other than at terminal blocks. "Wire nuts" and crimp splices are NOT permitted. Permanent wire markers shall be used to identify all terminations for each circuit. For splices, use markers or other means to indicate which conductor leads to the FACP. All connections shall be made on terminal strips. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. No more than two conductors under one connection. Wire on these terminals shall be labeled. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end with "E-Z markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.
- D. Wire shall be 14 AWG minimum, stranded or solid copper, type THHN or THWN except for addressable loop controller circuits. Addressable loop controller circuits are to be wired with type FPL/FPLR/FPLP fire alarm cable, solid copper, AWG 18 minimum, twisted pair, installed in conduit, instead of AWG 14 THHN/THWN stranded conductors. Provide shielded cable if required by manufacturer. If shielded cable is required by manufacturer, cable shield drain wires are to be connected at each device on the loop to maintain continuity, and taped to insulate from ground. Terminate the shield at the FACP in accordance with the manufacturer's instructions. The cable shall have red jacket, with yellow (+) and brown (-) conductors.
- E. Riser cable (where required) for alarm signaling circuits shall be a 2-hour rated cable (Type CI cable).
- F. All addressable loop controller circuits shall have a minimum of 50% spare addresses for future use.
- G. Initiating device or indicating appliance circuits must not be included in raceways containing AC power or AC control wiring. Within the FACP panel, any AC control wiring must be properly separated from other circuits. The enclosure must have an appropriate warning label to alert service personnel to the hazard.
- H. A unique identification number shall be assigned to each detector. (Identification shall be by zone number and device number within the zone.) This number shall be noted on the submittals and as-built plans, and also be permanently mounted adjacent to the detector or affixed to its base.
- I. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- J. Comply with mounting and anchoring requirements for seismic installations.
- K. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Provide weatherproof enclosures for any duct smoke detector installed outdoors.
- L. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 3. Smoke dampers in air ducts of designated air-conditioning duct systems.
 4. Alarm-initiating connection to elevator recall system and components.
 5. Alarm-initiating connection to activate emergency lighting control.
 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 7. Supervisory connections at valve supervisory switches.
 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 9. Supervisory connections at elevator shunt trip breaker.
 10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 11. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 POWER CONNECTIONS

- A. Provide 120 volt, 20 amp circuit to all fire alarm panels, remote panels, terminal cabinets, etc (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest [emergency] 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker and color breaker red.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 MESSAGING AND PROGRAMMING

- A. General
 1. Messages will be displayed and transmitted from the Fire Alarm/DGMS to provide information to building occupants, 3rd party monitoring company, Georgia Tech staff, and emergency responders.
 2. Messages will be for both the fire alarm and DGMS, including other safety devices such as e-stops.
 3. DGMS messages will be categorized into four hazard categories:
 - a. Flammable
 - b. Toxic/Highly Toxic
 - c. Asphyxiant
 - d. Pyrophoric
 4. Any hazardous gas not in these categories shall be evaluated by the Georgia Tech EH&S department and a determination made of the hazards category to be applied.
 5. Messaging may be alphanumeric displays or may be audible.
- B. Message Format for Alphanumeric Displays
 1. Displays consist of
 - a. LED screens
 - b. FACP screen
 - c. ONYXWorks graphics

- d. Texts
 - e. Emails
 - f. 3rd party monitoring
2. Message format: SIGNAL TYPE/Building/Room No OR Zone/Gas Type OR FA Type/Level (1 or 2) where:
 - a. SIGNAL TYPE = ALARM, SUPERVISORY, OR TROUBLE (IN CAPITALS)
 - b. Building = Zinn, Bunger Henry, Pettit, etc.
 - c. Room = where applicable the room number of the signal
 - d. Zone = fire alarm zone or address of device
 - e. Gas Type = Flammable, Corrosive, Toxic, Pyrophoric, Asphyxiant, Oxidizer, Reactive
 - f. Level = for gas detection, would be Level 1 or Level 2
 3. For gases that are classified by multiple hazards, the highest NFPA 704 rating shall be used.
 4. For trouble alarms, local beep at FACP. There shall be no display on LED.
 5. To indicate trouble with the DGMS for a room, the stack light status is "all lights off". There shall be a message displayed on the FACP and an email from ONYXWorks.
 6. Texts and emails from ONYXWorks shall be the consistent with the message format.
 7. 3rd party monitoring will receive "trouble" signals and notify as directed by Georgia Tech.

C. Output and Messaging Matrix

1. The matrix below summarizes the system outputs and messaging requirements for the Fire Alarm and DGMS system.
2. Messaging assigned to each output is given in Table 1.
3. Message information is given in Table 2.

		SYSTEM OUTPUTS																	
		FACP ANNUNCIATION				NOTIFICATION				OTHER									
SYSTEM INPUTS		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	SMOKE DETECTOR (AREA DETECTORS)	•	•					•	•	•				•	•				
2	DUCT SMOKE DETECTOR																		
3	HEAT DETECTOR (AREA DETECTORS)	•	•					•	•	•				•	•				
4	MANUAL PULL STATION	•	•					•	•	•				•	•				
5	SPRINKLER WATER FLOW SWITCH	•	•					•	•	•				•	•				
6	SPRINKLER VALVE TAMPER SWITCH			•	•														
7	OPEN LARJET																		
8	WIRE TO WIRE SHORT					•	•	•	•	•									
9	WIRE TO WIRE SHORT					•	•	•	•	•									
10	REMOVAL OF DEVICE					•	•	•	•	•									
11	FACP TROUBLE					•	•	•	•	•									
12	ANY OTHER TROUBLES					•	•	•	•	•									
13	LEVEL 1 GAS LEAK DETECTION			•	•														
14	LEVEL 2 GAS LEAK DETECTION			•	•														
15	SMOKE DETECTOR FAULT / BURNED OFF					•	•	•	•	•									
16	SMOKE DETECTOR NORMAL CONDITION																		

Table 1: Message Assignment

Number	Inputs (from matrix)	Audible An- nouncement	LED/FACP/ ONYXWorks	3 rd party monitoring
1	Smoke Detector (Area Detectors)	A	B	C
2	Duct Smoke Detector	A	B	C
3	Heat detector (Area Detectors)	A	B	C
4	Manual Pull Station	A	B	C
5	Sprinkler Water Flow Switch	A	B	C

Number	Inputs (from matrix)	Audible Announcement	LED/FACP/ ONYXWorks	3 rd party monitoring
6	Sprinkler Valve Tamper Switch	D	E	F
7	Open Circuit	G	H	I
8	Ground Fault	G	H	I
9	Wire to Wire Short	G	H	I
10	Removal of Device	G	H	I
11	FACP Trouble	G	H	I
12	Any other trouble (FA)	G	H	I
13	Level 1 Gas Leak Detection	J	K	L
14	Level 2 Gas Leak Detection	M	N	O
15	Gas Detector Fault/Switched Off	P	Q	R
16	Gas Detection Normal Condition	None	None	None

Table 2: Message Information

Designation	Display/Announcement	Designation	Display/Announcement
A	Fire detected - evacuate building	J	Gas Detection Alert
B	ALARM/Zone/FA Type	K	SUPERVISORY/Room/Gas Type/Level 1
C	ALARM/Bldg/Zone/FA Type	L	SUPERVISORY/Bldg/Room/Gas Type/Level 1
D	Sprinkler Valve Tamper	M	DANGEROUS GAS - EVACUATE BUILDING
E	SUPERVISORY/Zone/Sprinkler Valve Tamper	N	ALARM/Room/Gas Type
F	SUPERVISORY/Bldg/Zone/Sprinkler Valve Tamper	O	ALARM/Bldg/Room/Gas Type
G	none	P	none
H	none	Q	none
I	TROUBLE/Bldg/Zone/FA Type	R	TROUBLE/Bldg/Room/Gas Type/Fault

3.7 FIELD QUALITY CONTROL

- A. Programming
 - 1. Fire alarm control panel shall be programmed offsite prior to project completion.
 - 2. Owner and engineer shall be notified when programming is complete and a time set up for testing demonstration. Tests shall be performed to demonstrate compliance with project.
 - 3. Owner and engineer must approve fire alarm operation compliance before the fire alarm panel can be installed on site.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- D. Re-acceptance Testing: Perform re-acceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.8 COMMISSIONING

- A. Fire Alarm Systems combined with gas monitoring will have a formal commissioning performed on all systems.
- B. Commissioning may be conducted by the 3rd party commissioning agent or by Georgia Tech. It shall include completion of the NFPA 72 Inspections and Testing form and shall be witnessed by the Georgia Tech Fire Marshal.
- C. The Installer is responsible for completing pre-testing using the commissioning document on 100% of the fire alarm and gas detection devices.
- D. Commissioning may choose to perform 100% testing or may using a sampling method to confirm the Installer testing data is accurate. The recommended sample size will be no less than 10% of the installed devices.
- E. If functional errors are found in the commissioning sample, Georgia Tech may request a 100% re-testing of all devices.
- F. All commissioning shall be documented using Good Documentation Practices and these documents turned over to Georgia Tech as part of the turnover package for the system.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.
- B. As an alternate cost, provide 40-hours training for owner's employee.

END OF SECTION