

**SECTION 16720
FIRE ALARM SYSTEMS**

PART 1 – GENERAL INSTRUCTIONS

1.1 GENERAL REQUIREMENTS

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, and material as herein specified.
- B. This section requires the Contractor to furnish all materials required to install the fire alarm system. The Contractor shall be responsible for installing, testing, and start-up of a complete functioning fire alarm system, and each element thereof, as specified or indicated on the Drawings or reasonably inferred, including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's function as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation and utilities. Installation of devices shall be performed or supervised by a National Institute for Certification of Engineering Technologies (NICET) Level 3 or higher Fire Alarm Technician. Submit copies of the certification for employees through shop drawing submittals.
- C. All fire alarm system components shall include addressable field devices, and multiplexed, programmable, operator interface panels.
- D. The scope of work in this section includes:
 - 1. Fire alarm control panels.
 - 2. Remote annunciator panels.
 - 3. Manual fire alarm pull stations.
 - 4. Automatic smoke and heat detectors.
 - 5. Fire alarm notification appliances.
 - 6. Auxiliary fire alarm equipment.
 - 7. Sprinkler system water flow and valve tamper alarms.
 - 8. Air handling unit shutdown.
 - 9. Battery stand-by power.
- E. Provide an integrated fire alarm system, which meets the current versions of the codes and standards cited below and all local building and fire codes. All fire alarm equipment shall be Underwriters Laboratory (UL) or Factory Mutual (FM) approved for the type and class of service performed.
 - 1. NFPA 70 - National Electrical Code, 2014 Edition
 - 2. NFPA 72 - National Fire Alarm Code, 2013 Edition
 - 3. NFPA 90A - Installation of Air Conditioning and Ventilating Systems, 1999 Edition
 - 4. IBC 2009 Edition with local amendments
 - 5. IFC 2009 Edition with local amendments.
- F. The fire alarm system shall be a non-coded manual and automatic fire alarm system with connections to a remote supervising station. Control panel shall be micro-processor based, with fully addressable alarm devices.

1.2 SUBMITTAL REQUIREMENTS

- A. Submit a Description of Operation that explains in detail the specific methods the submitted fire alarm system functions. Pre-printed, generic material will not be accepted and will be rejected.
- B. Shop Drawings:
 - 1. The fire alarm system equipment vendor shall provide shop drawings showing fire alarm floor plans and a full building riser diagram. Fire alarm floor plans and riser diagram shall show fire alarm control panel, annunciator, all fire alarm initiating devices and notification appliances. Show typical wiring diagrams of control panel/s, annunciator and each device and wiring connections required. Show all interfaces to other systems, such as temperature control systems, and security systems.
 - 2. Shop drawing scale shall match the Engineer's drawings where possible. Scale shall not be less than 1/8" = 1'-0".
 - 3. The fire alarm floor plans and riser diagram shall show wiring to all fire alarm devices/appliances, indicating wire sizes and quantities as well as conduit/raceway sizes and locations of end-of-line (EOL) resistors. The fire alarm floor plans and riser diagram shall clearly show the routing of all fire alarm system wiring, including all horizontal routing and vertical routing (in chases). Routing of all fire alarm wiring shall comply with the "Survivability" requirements of NFPA 72.

4. The fire alarm floor plans shall also contain a Bill of Materials and a Sequence of Operations Matrix that explains how the submitted fire alarm system functions.
 5. Product Data: Provide electrical characteristics and connection requirements.
 6. Test Reports: Indicate satisfactory completion of required tests and inspections.
 7. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.
 8. The manufacturers listed in the sections below are Owner required. Alternatives will not be accepted under any circumstance without prior written approval from the Owner's Construction project manager. Without prior written approval from the owner, shop drawings with alternate equipment will be rejected.
- C. The manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum three years documented experience. The installer shall be a company specializing in installing the products specified in this section with minimum three years documented experience. Shall be bondable and licensed Contractor and Merchant of Electronic Automated Fire Alarm Systems and employ full-time factory-trained installers and technicians. The equipment manufacturer's service department shall be fully stocked in standard parts and components and engaged in the maintenance of fire alarm systems. On-the-premises service shall be available within 4 hours of notification, 7 days a week, 24 hours a day. Furnish service and maintenance of fire alarm system for one year from Date of Substantial Completion.
- D. The Engineer will review (2) separate shop drawing review submittals. If multiple reviews are made after the initial 2 reviews, the contractor will be required to pay the engineer's hourly rate for each additional review.

1.3 SERVICE AND GUARANTEE

- A. Furnish service and maintenance of fire alarm system including wiring and raceways for one year from date of substantial completion.
- B. All components, system software, parts and assemblies shall be guaranteed against defects in materials and workmanship for the one-year period stated above.
- C. Labor (including travel expenses) to trouble-shoot, repair, reprogram, or replace components shall be furnished by this contractor at no charge during the warranty period.
- D. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks.
- E. Contractor shall be responsible for contacting the local Authority Having Jurisdiction and confirm whether they will require a 2 year or a 5 year certification on the Fire Alarm system. This shall be done by the installing contractor prior to bid submittal.
- F. Any equipment listed in these specifications or located on the drawings determined by the manufacturer to be obsolete or unavailable at the time of construction shall be presented to the Engineer and Architect along with manufacturer's alternate equipment selections for approval prior to bid. The owner shall not be responsible for any additional compensation due to notification of obsolete products after the original bid date, if that product is determined to have been obsolete prior to the schedule bid date.

PART 2 – PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. The supervising system agency shall be: Guardian Home Technologies.

- B. Equipment list shall be as follows:
 - 1. Fire Alarm Control Panel Bosch FPD 7024
 - 2. Bell Supervision Module Bosch D192C
 - 3. Annunciator Panel Bosch FMR-7033
 - 4. Popit Interface Module Bosch D8125
 - 5. Poweronic 12v 7ah Battery PS-1270F2
 - 6. Addressable Single Point Expander Module D9127U
 - 7. Multiplex Expansion Module Bosch D7039 (ADDED)
 - 8. Multiplex Single-Input Module Bosch D7044M (ADDED)
 - 9. Multiplex Input-Output Module Bosch D7053 (ADDED)
 - 10. Weatherproof Back-Box System Sensor WPBB-R
 - 11. Outdoor Horn/Strobe System Sensor P2RK
 - 12. Exterior Alarm Bell System Sensor SSM24-10
 - 13. Indoor Horn/Strobe System Sensor P2W
 - 14. Ceiling Mount Horn/Strobe System Sensor PC2W
 - 15. Indoor Strobe System Sensor SW
 - 16. Manual Pullstation Bosch FMM 7045-D
 - 17. Smoke Detector Bosch D7050
 - 18. Duct Smoke Detector* Bosch D7050-DH
 - 19. Duct Smoke Detector Enclosure* Bosch D341
 - 20. Remote Test Station* Bosch D344-RT
 - 21. Power Booster Bosch FPP-RNAC-8A-4C
 - 22. NAC Power Extender AL802
 - 23. Waterflow Alarm Switch System Sensor WFD
 - 24. Control Valve Tamper Switch System Sensor

* If not factory provided

2.2 FIRE ALARM SYSTEM CONTROL PANEL

- A. The Fire Alarm System shall be a microprocessor-based system designed specifically for Fire applications. The System shall be UL listed under Standards 864 (Control Units for Fire-Protective Signaling Systems). Modular construction with a surface mounted enclosure.

- B. Remote Annunciator: Provide supervised remote annunciator(s) where shown on the plans, including audible and visible indication of fire alarm by address, and audible and visible indication of system trouble and supervisory. Install in flush mounted enclosure.

- C. Power supply: Provide two separate and reliable power supplies. The control panel shall receive 120 VAC power via a dedicated fused disconnect circuit of the building's electrical system. Each shall have adequate capacity for the system. The fire alarm contractor shall submit battery calculations for review and approval. The calculations shall indicate each device and the load required in stand-by and alarm mode. The secondary power system shall be a battery-operated emergency power supply and charger with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

- D. System Supervision: Automatically detects and reports open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification appliance circuits. Alarm, supervisory and trouble signals shall be monitored by the supervising station over a Digital Alarm Communicator Transmitter (DACT), or other approved method.

- E. Initiating Device Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Initiating device circuits shall be Class B.

- F. Notification Appliance Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Notification appliance circuits shall be Class B.

- G. Signaling Line Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Signaling line circuitry shall be Class B.
- H. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
- I. Digital Alarm Communicator Transmitter: Electrically supervised, capable of transmitting alarm, supervisory and trouble signals over telephone lines to remote station receiver.
- J. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- K. Control Panel: The control panel and remote annunciator panel shall have dedicated alarm, supervisory and trouble LED's and dedicated alarm, supervisory and trouble acknowledge switches.
- L. Lamp Test: Manual lamp test function causes each LED to function at fire alarm control panel.
- M. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- N. Addressable systems shall have Silent Walk Test, History logging for a minimum of 400 events, 80 character LCD display.

2.3 SEQUENCE OF OPERATIONS

- A. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 - 1. Visible and audible trouble alarm indicated at fire alarm control panel.
 - 2. Visible and audible trouble alarm indicated at remote annunciator panel.
 - 3. Trouble signal transmitted to supervising station.
 - 4. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visible alarm is displayed until initiating failure or circuit trouble is cleared.
- B. Supervisory Sequence of Operation: The activation of any sprinkler valve tamper switch or duct-mounted smoke detector places system in supervisory mode, which causes the following system operations:
 - 1. Visible and audible supervisory alarm indicated by address at fire alarm control panel.
 - 2. Visible and audible supervisory alarm indicated by address at remote annunciator panel.
 - 3. Supervisory signal transmitted to supervising station.
 - 4. Duct-mounted smoke detectors shall shutdown their respective unit upon detection of smoke and remain down until manually reset.
 - 5. Manual acknowledge function at fire alarm control panel and remote annunciator panel silences audible supervisory alarm; visible alarm is displayed until device is returned to its normal position/supervisory condition is cleared.
- C. Alarm Sequence of Operation: Actuation of an alarm initiating device places circuit in alarm mode, which causes the following system operations.
 - 1. Audible notification appliances shall sound until silenced by the alarm silence switch at the control panel.
 - 2. All visible alarm notification appliances shall display a continuous synchronized pattern until reset by the Alarm Reset Switch.
 - 3. Alarm signal transmitted to supervising station.
 - 4. All air-handling systems that are monitored shall shutdown and remain down until the fire alarm control panel is reset.
 - 5. The alarm LED shall flash on the control panel and remote annunciator panel until the alarm has been acknowledged at the control panel/remote annunciator panel. Once acknowledged, this same LED shall latch on and the custom label for the address in alarm shall be displayed on the alphanumeric LCD readout. A subsequent alarm received from another address after acknowledged shall flash the alarm LED on the control panel showing the new alarm information.
 - 6. A pulsing alarm tone shall occur within the control panel until acknowledged.

2.4 INITIATING DEVICES

- A. Manual Pull Station: Provide semi-flush, non-coded type, double action manual pull station.

- B. Spot Smoke Detector (Photoelectric type): Device shall have visible indication of detector actuation, self-restoring, plug-in with an integral addressable module indicating the detector status. Photoelectric detectors shall have sensitivity between 0.5 and 3.5 percent/foot smoke obscuration.
- C. Duct Mounted Smoke Detector: Photoelectric detector along with a standard, relay or isolator detector mounting base. Provide for variations in duct air velocity between 100 and 4000 feet per minute. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Provide remote alarm LEDs and remote test stations as shown on the plans.
- D. Waterflow Alarm Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer. Switch shall have an adjustable delay to minimize false alarms due to fluctuations in water pressure.
- E. Gate Valve (Tamper) Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer.
- F. Control Relay Module: Provide intelligent control relay modules. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

2.5 NOTIFICATION APPLIANCES

- A. Exterior Alarm Bells: Electric vibrating, 10" bell with operating mechanism behind dome and weatherproof bell kit. Sound Rating: 80 dB at 10'-0".
- B. Alarm Horn: Surface type fire alarm horn. Sound rating: 90 dB at 10'-0".
- C. Visible Alarm Notification Appliances (Strobes): Strobes shall be xenon or equivalent, unfiltered or clear filtered white light, a minimum intensity candela as indicated on drawings, flash rate range from 1 to 3 Hz, a maximum pulse duration of 0.2 sec with a maximum duty cycle of 40%. Strobe shall meet all requirements of the Americans with Disabilities Act (minimum 75 cd as tested per UL 1971). Strobes shall be white.
- D. Audible/Visible Alarm Notification Appliances (Horn/Strobes): Combination units shall provide a common enclosure for the fire alarm audible and visible alarm appliances and be UL listed for its purpose. Minimum audible level and strobe intensity shall meet all requirements for separate appliances. Horn/strobes shall be white.
- E. Provide flush or recessed mounted devices unless otherwise noted.

2.6 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire as specified in Division 16.
- B. Signaling Line, Initiating Device and Notification Appliance Circuits: Power limited fire-protective signaling cable, solid copper conductor, 300 volts insulation, suitable for temperature, conditions and location installed. Minimum wire size for initiating device circuits, control circuits and notification appliance circuits shall be determined by calculations and manufacturer's requirements or recommendations. Wire and cable shall be twisted and shielded if recommended by the system manufacturer. Initiating, notification, and control circuits shall be sized based on 20% additional power consuming devices. The conductors shall meet the requirements of NEC article 760.
- C. The type of cable chosen should be based on fire alarm system requirements, specification requirements and applicable code requirements. Consideration should also be given to the length of cable runs and potential interference.
- D. All wiring provided on this project shall be UL listed for the intended use. All wiring including wiring to existing modified devices and appliances shall be new.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall install, program and test all new equipment identified in this contract and revise existing equipment as noted.

- B. The installation supervisor shall be on the job site during the entire installation. The installation supervisor shall maintain marked up copies of the drawings at the job site showing as-built conditions. These drawings shall be updated daily and available for Owner review.
- C. The Contractor shall provide all required conduit and all associated hardware, and shall install (pull), connect, and test all cable for a complete fire alarm system. All wiring shall be installed in accordance with the guidelines of these specifications and documents as well as the NFPA codes and standards listed in these specifications.

3.2 INSTALLATION

- A. All wiring shall be installed in conduit. Minimum allowable conduit size shall be 3/4". The conduit shall be sized so that conduit fill does not exceed 75% of NFPA 70 maximum fill requirements. Cables in vertical risers shall not exceed 50% of NFPA 70 maximum fill requirements. Conduit installation shall be as required by the Contractor's layout and as described in these specifications. All conduit field routing shall be acceptable to the Owner. Routing not acceptable shall be rerouted and replaced without expense to the Owner.
- B. All wire, cable, conduit and raceways shall be concealed in walls, ceiling spaces, electrical shafts or closets in finished areas except as specifically noted otherwise. Conduit and raceways may be exposed in unfinished areas or where specifically approved by the Owner.
- C. Except as otherwise specified or indicated on the drawings, all conduit shall be installed parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.
- D. Conduit shall be located at least 6" from hot water or steam pipes, and from other hot surfaces. Conduit shall not block access to any existing equipment or fixtures.
- E. All conduits and junction boxes shall be labeled as specified in Division 16 (red).
- F. All wiring shall be terminated at devices or panels using terminal connectors for screw type terminals. All terminal connectors for conductors shall be pre-insulated ring type or pre-insulated spade type. Pre-insulated terminal connectors shall include a vinyl sleeve, color coded to indicate conductor size. Pre-insulated terminal connectors shall include a metallic support sleeve bonded to the vinyl-insulating sleeve and designed to grip the conductor insulation.
- G. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit for conventional hardwired class B initiating and notification appliance circuits.
- H. Conduit shall be securely fastened to all boxes and cabinets. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit. The locknuts both inside and outside shall then be tightened sufficiently to bond the conduit securely to the box. Conduit shall enter cabinets from the bottom and sides only.
- I. Install manual station with operating handle 48" above floor unless noted otherwise on drawings.
- J. Install ceiling mounted initiating devices in areas with exposed structure tight to underside of floor/roof deck.
- K. Install ceiling mounted visible and audible/visible notification appliances in areas with exposed structure to bottom of floor/roof structure or at 30'-0" AFF, whichever is lower.
- L. Install ceiling mounted visible and audible/visible notification appliances in areas with finished ceilings flush with bottom of ceiling or at 30'-0" AFF, whichever is lower.
- M. Install wall mounted visible and audible/visible notification appliances with visible element (strobe) between 80" and 96" above finished floor unless noted otherwise on drawings.
- N. Install wall mounted audible devices with the top of the device at least 90" above finished floor or 6" below the ceiling, whichever is lower, unless noted otherwise on Drawings. If combination devices are installed, they shall be installed per the visible signal device requirements.

- O. Make conduit and wiring connections to equipment provided by others.
- P. Provide strobe synchronization as required per NFPA 72.

3.3 FIELD QUALITY CONTROL

- A. Systems shall be checked and tested in accordance with the instructions provided by the manufacturer to insure that the system functions as required and is free of grounds, opens, and shorts. Each device shall be tested. Smoke detectors shall be tested with products of combustion.
- B. Upon completion of the system installation and before the Date of Final Acceptance, a factory-trained technician shall perform all necessary tests and adjustments and shall then file a Letter of Certification and a Certificate of Completion (NFPA 72) with the Owner indicating that the system functions and conforms to the Fire Alarm System Specifications.
- C. Test in accordance with NFPA 72 and local fire department requirements.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Include services of factory trained and certified technician to supervise installation, adjustments, final connections, and system testing as performed by the fire alarm contractor's factory-trained technicians.

3.5 ACCEPTANCE TESTING

- A. Upon completion of the system installation, a factory-trained technician shall perform all necessary tests and adjustments in the presence of the Owner's designated personnel.

END OF SECTION 16720