
SECTION 28 31 00 – FIRE ALARM AND MASS NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Control panel.
 - 2. Initiating devices.
 - a. Manual station.
 - b. Photoelectric smoke detectors.
 - c. Thermal detectors.
 - 3. Signaling appliances.
 - 4. Auxiliary devices.
 - 5. Voice evacuation/Mass Notification.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 26 05 19 "Low Voltage Electrical Power Conductors"
 - 3. Section 26 05 33.13 "Conduits for Electrical Sysetms"
 - 4. Section 26 05 33.16 "Boxes and Covers For Electrical Systems"
 - 5. Section 26 05 33.23 "Surface Raceways for Electrical Systems"

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - National Fire Alarm Code.
- C. NFPA 101 - Life Safety Code.
- D. State of Texas Accessibility Standards.
- E. Federal Americans with Disabilities Act.
- F. ASME 17.1 - Elevator Code.

1.3 SYSTEM DESCRIPTION

- A. Fire Alarm System: System is comprised of a new intelligent manual and automatic local fire alarm system with integrated voice evacuation/Mass Notification and connections for off-sitereporting. The system shall be non-proprietary.
- B. The system shall have capacity to support all required devices. Interface devices and connections shall be provided to communicate with intelligent detectors, addressable modules, annunciators, and other required system controlled devices. Provide for panel expansion as required to accommodate the number of devices required. All associated wiring shall be new.

The complete system will be comprised of the intelligent fire alarm control panel, integrated emergency voice communications/Mass Notification system, and connections for off-site reporting.

1.4 SUBMITTALS FOR REVIEW

- A. Product Data: Provide electrical characteristics and connection requirements. Shop Drawings: Provide a system layout and wiring diagram showing each device and the wiring connections that are required.
- B. Test Reports: Provide testing reports for certification that the system has been tested and inspected.
- C. Manufacturer's Installation Instructions: Indicate the application conditions and limitations of use stipulated by the product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.
- D. Wiring Diagrams: Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams must show connections from field devices to the FMCU and remote FMCU, initiating circuits, switches, relays and terminals, including pathway diagrams between the control unit and shared communications equipment within the protected premises. Point-to-point wiring diagrams must be job specific and must not indicate connections or circuits not being utilized. Provide complete riser diagrams indicating the wiring sequence of all devices and their connections to the control equipment. Include a color-code schedule for the wiring.
- E. System Layout: Plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, conduit sizes, wire counts, conduit fill calculations, wire color-coding, circuit identification in each conduit, and circuit layouts for all floors. Indicate candela rating of each visual notification appliance. Indicate the wattage of each speaker. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, and similar. Show/identify all acoustically similar spaces. Indicate if the environment for the FMCU is within its environmental listing (e.g. temperature/humidity). Provide a complete description of the system operation in matrix format similar to the "Typical Input/Output Matrix" included in the Annex of NFPA 72.
- F. Data Sheets for Notification and Initiating devices.
- G. Product Data: Descriptive data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, and options that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal. Provide an equipment list identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. The equipment list must include the type, quantity, make and model of spare equipment. Types and quantities of equipment submitted must coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings.

- H. Amplifiers: Calculations and supporting data to indicate that amplifiers have sufficient capacity to simultaneously drive all notification speakers at tapped settings plus 25 percent spare capacity. Annotate data for each circuit on the drawings.
- I. Voltage Drop Calculations: Voltage drop calculations for each notification circuit indicating that sufficient voltage is available for proper operation of the system and all components, at a minimum rated voltage of the system operating on batteries. Include the calculations on the system layout drawings.
- J. Operation and Maintenance (O&M) Instructions: Operation and Maintenance Instructions. The O&M Instructions must be prepared in a single volume or in multiple volumes, with each volume indexed, and may be submitted as a Technical Data Package. Manuals must be approved prior to training. The Interior Fire Alarm and Mass Notification System Operation and Maintenance Instructions must include the following:
 - 1. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual must include the manufacturer's name, model number, service manual, parts list, and preliminary equipment list complete with description of equipment and their basic operating features.
 - 2. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals must include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
 - 3. Complete procedures for system revision and expansion, detailing both equipment and software requirements.
 - 4. Software submitted for this project on CD/DVD media utilized.
 - 5. Routine maintenance checklist. The routine maintenance checklist must be arranged in a columnar format. The first column must list all installed devices, the second column must state the maintenance activity or state no maintenance required, the third column must state the frequency of the maintenance activity, and the fourth column provided for additional comments or reference. All data (devices, testing frequencies, and similar) must comply with UFC 3-601-02.
 - 6. A final Equipment List must be submitted with the Operating and Maintenance (O&M) manual.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- C. Installer Qualifications: Company and/or installer specializing in installing the products specified in this Section with minimum three years' documented experience, and certified by State of Texas as Fire Alarm Installer.
- D. Products: Listed and classified by UL testing firm as acceptable to the authority having jurisdiction and suitable for the purpose specified and indicated.
- E. At the completion at the Project, Contractor shall provide certification tests and completion documentation in accordance with NFPA 72.

- F. Provide to Owner an electronic file with all fire alarm control panel software settings.

1.6 MAINTENANCE

- A. Provide service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.
- B. During the warranty period, the service technician must be on-site within 24 hours after notification. All repairs must be completed within 24 hours of arrival on-site.
- C. During the warranty period, the installing fire alarm contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72 and the system manufacturers. Installing fire alarm contractor is NOT responsible for any damage resulting from abuse, misuse, or neglect of equipment by the end user.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Silent Knight, or any Honeywell product that is non-proprietary.
- B. Gangwell
- C. Potter

2.2 CONTROL PANEL

- A. The fire alarm/mass notification system shall be, non-proprietary, addressable control panel with integrated Emergency Voice Evacuation/Mass Notification equal to Silent Knight #6820-EVS. Provide for panel expansion as required to accommodate the number of devices required.
- B. The system shall include alarm and trouble relays.
- C. The signal line circuit (SLC) shall provide power to and communicate with the number of detectors and modules as required to serve all devices. The detector software shall allow manual or automatic sensitivity adjustment.
- D. The system power supply and battery charger shall operate on 120 volts, 60 Hz, and shall provide for all of the power needs of the existing and new system devices. Provide circuit breaker, wire, and conduit as required.
- E. Any proposed control panel substitutions shall also comply with all other system features that are included with the system specified by manufacturer name and number indicated as a part of this Specification.

2.3 INITIATING DEVICES – SYSTEM SENSOR OR APPROVAL EQUAL

- A. Manual Station: Semi-Flush mounted, addressable type, double action manual station with key operated test-reset lock and shall be so designed so they cannot be restored to normal position except by the use of a key. Station shall have the word "FIRE" on the front of the unit in raised letters. Stations shall be red in color. Provide semi-recessed single gang back box which can accept surface mounted raceway. Refer to Section 26 05 33 "Raceways and Boxes for Electrical Systems" for additional box restrictions.
- B. General Area Intelligent Photoelectric Smoke Detectors: Smoke detectors shall be provided in Mechanical Rooms, Electrical Rooms, and TER's/IT Equipment rooms. Provide quantity of detectors required to provide complete coverage and detectors that are suitable for the area application. Provide smoke detectors required for coverage of the fire alarm control panel location as required by the NFPA 72. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. Detectors shall include a twist-lock base with a tamper proof feature. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated by the detector itself (by activating a magnetic switch).
- C. Intelligent Thermal Detectors: Provide addressable, fixed temperature 135 degrees F detectors where indicated.
- D. Modules: Monitor and control modules shall be provided for the system as required for the operations as indicated. Control modules for notification appliance circuits shall supervise the circuits and shall be wired as Style Z in accordance with NFPA.

2.4 SIGNALING APPIANCES

- A. Audible/Visual Devices: The devices shall be combination speaker/light units. The audible portion of the device shall have a sound output level of at least 85 dBA measured at 10 feet from the device. This visual portion of the devices shall meet the requirements of the Americans with Disabilities Act and the Texas Accessibility Standards and the NFPA. Strobes for the Mass Notification system shall be amber and strobes for the fire alarm system shall be clear. Minimum candela level for the strobe light intensity shall be 75 and the flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz. The maximum flash duration shall be two-tenths of one second. All visual devices shall be synchronized. Contractor is responsible to provide sound level of voice announcements and fire alarm chimes meeting requirements of NFPA. Contractor shall provide additional speaker/light units, amplifier, 120 V wiring, fire alarm wiring, and conduit as required.
- B. All NAC shall be installed in accordance with NFPA 72, Class B wiring.
- C. Refer to the Drawings for device locations. Where devices are shown as ceiling mounted, provide equivalent intensity devices per NFPA 72.
- D. Contractor shall provide additional signaling appliances where required for full coverage.
- E. Visual appliances shall have capability of output level selections 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, or 189 Candelas by way of rear mounted slide switch and from viewing window.

- F. Visual appliances shall be synchronized in accordance with NFPA 72.
- G. Horn tones and volume by way of rotary switch.

2.5 AUXILIARY DEVICES

- A. Connection to shut down all mechanical equipment provided with duct-mounted smoke detectors and all mechanical equipment that has associated smoke dampers upon initiation of general alarm. Refer to Mechanical Drawing for the location of dampers.
- B. Provide monitor modules and connections required to flow and tamper switches associated with the fire suppression system.
- C. Provide 120 V power, control transformers, and control wiring as required for connection to any equipment associated with the shutdown and control of mechanical equipment.
- D. Provide for all control wiring and connections for interface with tamper and flow switches associated with the suppression system. Coordinate with Fire Protection Suppression Contractor for all locations. Any modules for the outdoor shut-off valve shall be mounted inside the building as directed. No modules shall be located below grade. This will include connection to the tamper switch at the post indicator valve on the site.
- E. Provide remote fire alarm annunciator panel (FAAP), including audible and visual indication of fire alarm condition device description. Indications shall be provided on an alpha-numeric display. Provide FAAP with in-factory mounted flush wall enclosure.
- F. Provide a UDACT and digital communicators with required connectors for capabilities of dialing / reporting to a central receiving station with or without a phone line connection.

2.6 FIRE ALARM WIRE AND CABLE

- A. All fire alarm and associated mass notification system wiring shall be new and shall be installed in conduit.
- B. Fire Alarm Power Branch Circuits: Building wire as specified in Section 26 05 19 "Low Voltage Electrical Power Conductors."
- C. Fire alarm circuit conductors have insulation color or coded as follows:
 - 1. Power Branch Circuit Conductors: Black, red, white.
 - 2. Initiating Device Circuit: Black, red.
 - 3. Signal Device Circuit: Blue (positive), white (negative).
 - 4. Door Release: Gray, gray.
 - 5. All fire alarm wiring.
- D. All fire alarm wiring shall be UL listed for use as a fire protective signaling system.
- E. All wiring shall be complying with the recommendations by the fire alarm equipment manufacturer.

2.7 VOICE EVACUATION (MASS NOTIFICATION SYSTEM)

- A. The voice evacuation system shall be integral to the fire alarm control panel (Silent Knight #56820XL-EVS), or approved equal, as indicated above.
- B. UL listed to UL 2572 Communication (Control Units Mass Notification Systems) and UL 864 (emergency voice evacuation for fire).
- C. Provide an integral audio amplifier cable of operating speaker circuits wired in a Class A configuration.
- D. Provide required power supplies and amplifiers necessary to support all required devices.
- E. Provide a digital message generator capable of primary and secondary messages (60 seconds each). These messages shall be field programmable without special equipment.
- F. Supports up to 14 pre-recorded messages that are field programmable.
- G. 8 Command input circuits that can be used to activate messages 1 to 8.
- H. Built-in, programmable alert tones with steady, slow, whoop, high/low, and chime tones.
- I. The voice control panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generators.
- J. Speakers shall operate at 25 VRMS and have field selectable taps from 0.5 to 2 watts. Speakers shall have a minimum frequency response between 400 Hz and 4,000 Hz. Units shall produce a nominal sound output of 84 dBA at 10 feet. Refer to Section 2.4.A for additional requirements.
- K. Speakers shall meet the listing requirements of UL Standard 1480.
- L. Provide speakers with field-adjustable tap settings to allow adjustment after installation to meet intelligibility requirements.
- M. Speakers shall be suitable for the intended climatic and environmental conditions and shall be suitable for the space/area application.
- N. Provide quantity of speakers to meet the intelligibility requirements defined in the NFPA.
- O. The system shall be capable of making general paging or other non-emergency messages available without the activation of strobes.
- P. The system must have the ability to interrupt PA system announcements and to silence building background music while delivering voice messages.
- Q. The system shall be able to accept voice messages from the Government's installation telephone system.
- R. The system shall have conductor integrity monitoring for strobes, speaker wiring, power supplies, and connections to the LOCs.

- S. The system shall be capable of switching between the Mass Notification system and the fire alarm notification functions without generating trouble alarms in either system.
- T. For pre-recorded messages, the messages shall at least address the following subjects:
 - 1. Bomb threat or actual bomb within/around the building.
 - 2. Intruder/hostile person sighted within/around the building.
 - 3. Directions to occupants to take cover within the building.
 - 4. Evacuation of the building using exits other than the normal main entrance/exit (since the front entrance/exit is often a location targeted by terrorists).
 - 5. Emergency weather conditions appropriate for the local area.
 - 6. "All Clear" message.
 - 7. A test message intended for verifying functionality of the system.
 - 8. Coordinate final wording of pre-recorded messages with Owner (Texas Military Department personnel.)
- U. Provide Local Operator Consoles near building entries and at location required so occupants do not need to travel more than 200 ft horizontally or to travel to other floors to access a LOC. Single story locations will only need 2 LOC's. Two or more stories will require one on each floor in addition to the 2 on the main floor. If the building requires an outside entrance to the main fire riser or fire pump room, then 1-LOC will be installed at that location. Voice must be female per UFC.
 - 1. Honeywell ECC-LOC or approved equal.
 - 2. Provides complete control and has interface similar to the ECC.
 - 3. Includes built-in microphone for ALL CALL paging along with message and zone control.
 - 4. Provide signage at the LOCs to allow rapid recognition of the means of initiating the pre-recorded messages.
 - 5. Provide signage on the outside of the enclosure to indicate "Mass Notification".
 - 6. Activation of a LOC pushbutton must activate the audible and visual alarms in the facility. The audible message must be the one associated with the pushbutton activated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide for the service of a competent, factory-trained engineer or technician authorized by manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All software modifications shall be supervised by this technician. All testing shall comply with NFPA.
- B. Before energizing the wiring, check for correct connections and tests for shorts and grounds.
- C. Install manual station with operating handle 48 inches above floor measure to the operating handle.
- D. Install audible and visual signal devices on the ceiling or wall as indicated. If wall mounted, mount at 90", or 6" below ceiling whichever is lower to comply with the requirements of the NFPA 72. If ceiling mounted in acoustical tiles the device must be centered in the tiles plus or minus 2 inches.

- E. At a minimum, provide the following systems tests:
 - 1. Open and short signal line circuits and verify that a trouble signal actuates and alarm receipt is present.
 - 2. Open and short notification appliance circuits and verify that trouble signal actuates and alarm receipt is present.
 - 3. Ground all circuits and verify response of trouble signals and alarm receipt is present.
 - 4. Check presence and audibility of tone at all notification devices.
 - 5. Check the installation, supervision, and operation of all initiating devices.
 - 6. Check proper operation of door release, damper operation, and mechanical unit shutdown.
 - 7. All alarm inputs and optional features shall be verified.
- F. All smoke detectors shall be firmly supported to the ceiling. On lay-in ceiling, secure detectors with suitable ceiling grid bridges that fasten securely to two grid runners. Locate detectors as required by NFPA 72 and their listing on a 4-inch mounting box. Smoke detectors are permitted to be on the wall no lower than 12 inches from the ceiling with no minimum distance from the ceiling. Install smoke detectors no closer than 3 feet from air handling supply diffusers. Detectors installed in acoustical ceiling tiles must be centered in the tiles plus or minus 2 inches.
- G. Remote Graphic Annunciator: Locate the graphic annunciator as shown on the drawings. Mount the annunciator, with the top 6 feet above the finished floor or center the annunciator at 5 feet, whichever is lower.
- H. Local Operator Console (LOC): Locate the LOC(s) as required by NFPA 72 and as indicated. Mount the console so that the top message button and microphone is no higher than 4 feet above the floor and the bottom (lowest) message button and microphone is at least 3 feet above the finished floor.
- I. Fire alarm reporting will include all modules, fiber, etc., to extend and connect through the building's system to report trouble and alarm.

3.2 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72 and local fire department requirements. All test procedures and requirements shall also meet the requirements as set by the Authority having jurisdiction.
- B. Minimum System Tests:
 - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
 - 2. Test each initiating device and notification appliance and circuit for proper operation and response at the control unit. Smoke detectors must be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors must comply with the requirements of NFPA 72 except disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision must be tested at each device.
 - 3. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
 - 4. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
 - 5. Visually inspect wiring.

6. Verify that software control and data files have been entered or programmed into the Fire alarm control panel. Verify all programming with the Texas Military Fire Marshal. Hard copy records of the software must be provided to the Texas Military Department.
 7. Verify that red-line drawings are accurate. All documents will go into a red fire document box mounted near the main fire alarm panel. A flash drive of the systems programming will also be left in this box.
 8. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
 9. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
 10. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke detectors must be conducted using real smoke or the use of canned smoke which is permitted.
 11. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.
 12. Audibility Tests: Sound pressure levels from audible notification appliances must be a minimum of 15 dBa over ambient with a maximum of 110 dBa in any occupiable area. The provisions for audible notification (audibility and intelligibility) must be met with doors, fire shutters, movable partitions, and similar devices closed.
- C. Intelligibility Tests: Intelligibility testing of the System must be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, and ASA S3.2. Use commercially available test instrumentation to measure intelligibility as specified by NFPA 72 as applicable. Use the mean value of at least three readings to compute the intelligibility score at each test location.
- D. Following are the specific requirements for intelligibility tests:
1. Intelligibility Requirements: Verify intelligibility by measurement after installation.
 2. Ensure that a CIS value greater than the required minimum value is provided in each area where building occupants typically could be found. The minimum required value for CIS is .8. Rounding of values is permitted.
 3. Areas of the building provided with hard wall and ceiling surfaces (such as metal or concrete) that are found to cause excessive sound reflections may be permitted to have a CIS score less than the minimum required value if approved, and if building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 33 feet to find a location with at least the minimum required CIS value within the same area.
 4. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than the minimum required value if personnel can determine that a voice signal is being broadcast and they must walk no more than 50 feet to a location with at least the minimum required CIS value within the same area.
 5. Take measurements near the head level applicable for most personnel in the space under normal conditions (e.g., standing, sitting, sleeping, as appropriate).
 6. The distance the occupant must walk to the location meeting the minimum required CIS value must be measured on the floor or other walking surface as follows:
 - a. Along the centerline of the natural path of travel, starting from any point subject to occupancy with less than the minimum required CIS value.
 - b. Curving around any corners or obstructions, with a 12 inches clearance there from.
 - c. Terminating directly below the location where the minimum required CIS value has been obtained.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.4 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate normal and abnormal modes of operation and required responses to each.
- B. Contractor shall provide for a minimum of eight hours of training for Owner's personnel.
- C. Technical Training Manual: Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training must familiarize designated government personnel with proper operation of the installed system. The maintenance training course must provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

END OF SECTION 28 31 00

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