

**OGDEN-WEBER APPLIED TECHNOLOGY CENTER – COSMETOLOGY BUILDING  
FIRE ALARM SYSTEM UPGRADE  
DFCM PROJECT # 08050240**

**SECTION 13851 - FIRE ALARM SYSTEM**

**PART I - GENERAL**

1.01 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. This section of the specifications includes the demolition of existing fire alarm system and furnishing, installation, connection and testing of new microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated fire alarm system to protect the Cosmetology Building of the Ogden Weber Applied Technology College in Ogden, UT. Fire alarm system shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices and relays, annunciators, conduit and wiring as shown on the drawings and specified herein.

1.03 QUALITY ASSURANCE:

- A. The fire alarm system shall comply with requirements of NFPA 72 (National Fire Alarm Code) for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
- B. Major system components (control panels, initiating devices, addressable modules or relays, power supplies, etc.) shall be manufactured by a State of Utah DFCM approved manufacturer.
- C. State of Utah DFCM Approved Manufacturers:
  - 1. Fire-Lite
  - 2. Silent Knight
- D. All initiating devices shall be listed compatible with the control equipment used.
- E. Materials, devices and equipment shall be Underwriters Laboratories (UL) listed or Factory Mutual approved for use in fire alarm systems and shall comply with all applicable requirements of the following UL standards:
  - 1. UL 38 Manually Actuated Signaling Boxes
  - 2. UL 50 Cabinets and Boxes
  - 3. UL 864 Control Units for Fire Protective Signaling Systems
  - 4. UL 268 Smoke Detectors for Fire Protective Signaling Systems
  - 5. UL 268A Smoke Detectors for Duct Applications
  - 6. UL 464 Audible Signaling Appliances
  - 7. UL 521 Heat Detectors for Fire Protective Signaling Systems
  - 8. UL 1971 Visual Notification Appliances.
- F. Shop drawings shall be prepared by an engineering technician or senior engineering technician (Level III or Level IV) NICET certified for fire alarm design. Include NICET certification number on the drawings. Drawings will be signed by the technician and submitted for approval under his name.

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- G. Contractor (and/or subcontractor) shall be licensed as both an electrical and a fire alarm contractor in the State of Utah. License shall be active throughout the duration of the project.

1.04 SUBMITTALS:

- A. Descriptive Data: Descriptive data shall be submitted on the following items of material and/or equipment. Such data shall consist of manufacturer's or supplier's catalog information in sufficient detail to allow verification that the material and/or equipment meets the specification requirements, or is equal to that specified. Descriptive data shall be included with the shop drawings submittal described in paragraph B below.
1. Fire alarm control panel.
  2. Annunciator panel.
  3. Initiating devices (smoke detectors, heat detectors, manual pull stations, monitor modules, etc.)
  4. Relay modules to control protected premise fire safety functions.
  5. Notification appliances.
- B. Shop Drawings: Prior to ordering or installing any equipment, contractor shall prepare shop drawings for submittal to Owner/Engineer. Shop drawings shall include sufficient information, clearly presented, to determine compliance with drawings and specifications. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts. Indicate type and gauge of wire to be used for each different circuit type. Show annunciator layout, configurations, and terminations.
- C. Submit four sets of drawings, descriptive data, battery calculations and voltage drop calculations to the Owner/Engineer for review. After review and acceptance by the Owner/Engineer, submit to State Fire Marshal for review. Any review comments, and associated drawing revisions, from state or local approving authorities that affect the system design shall be approved by the Owner/Engineer prior to installation.
- D. Testing Documentations/Certificates: Upon completion of installation and prior to final acceptance testing, complete and submit fire alarm system record of completion. Record of completion, along with all other material and test certificates shall be submitted to Project Engineer.
- E. As-Built Drawings: A complete set of "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system. As built drawings shall be furnished in printed (reproducible) format as well as electronic format.
- F. O&M Manuals: Operating and instruction manuals shall be submitted prior to testing of the system. Three (3) complete sets of operating and instruction manuals shall be delivered to the owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.
- G. Warranty Letter: Provide letter stating that contractor will warrant all equipment and wiring to be free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance. Provide information regarding any equipment warranty provided by the equipment manufacturer that exceeds 365 days.

1.05 SYSTEM DESCRIPTION:

- A. Remove existing fire alarm system including all control equipment, enclosures, power supplies,

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initiating circuits and devices, notification appliance circuits and devices, conduit, junction boxes and all wiring. Existing conduit and junction boxes may remain where they comply with the provisions of the specification and will be used to mount new devices.

- B. Furnish and install a new addressable FACP where indicated on drawings. FACP shall be Silent Knight model 5820XL or Fire-Lite MS-9600 with DACT-UD. FACP shall have integrated signaling line circuits (SLC) with sufficient capacity for all initiating devices and control modules required with an additional reserve of 20% unused addresses for future expansion.
- C. Furnish and install addressable initiating devices as indicated on the project drawings and as specified below:
  - 1. Smoke detectors: Provide smoke detectors as indicated on plans.
  - 2. Heat detectors: Provide heat detectors in mechanical areas.
  - 3. Duct smoke detectors: existing duct smoke detectors may remain but shall be connected to new FACP.
  - 4. Manual pull stations: Replace all existing manual pull stations with addressable devices. New pull stations may be mounted on existing junction boxes where height of existing junction box is between 48" and 52" aff.
- D. Provide addressable relay modules as indicated on the project drawings and specified below to provide the following protected premise fire safety functions:
  - 1. Fan shutdown
- E. Furnish and install notification appliances and notification appliance circuits as indicated on the drawings.

1.06 SYSTEM DESIGN:

- A. Basic Performance:
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 6 or 7 (Class A) Signaling Line Circuits (SLC).
  - 2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
  - 3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
  - 4. All circuits shall be power-limited, per 1995 UL864 requirements.
  - 5. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
  - 6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.
- B. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
  - 1. The system Alarm LED on the FACP shall flash.
  - 2. A local sounder with the control panel shall sound.
  - 3. LCD display on the FACP and all remote annunciators shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - 4. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm.
  - 5. Alarm signal shall be transmitted off-premise via the DACT to the central monitoring

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station selected by the owner.

- C. All wiring shall be free of opens, shorts and grounds. All wiring shall be installed in metallic conduit. In finished areas wire shall be installed in metal wire mold painted to match surrounding wall/ceiling. In unfinished areas wire shall be run in rigid conduit or EMT. All penetrations through rated partitions shall be fire stopped with a suitable caulking compound. All wiring (except new power distribution circuits) shall be fire power limited (FPL) with minimum 300V insulation or equivalent complying with NFPA 70 Article 760.
- D. Provide a ground fault detection circuit, to detect positive and negative grounds on all field wiring. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground fault will not interfere with the normal operation, such as alarm, or other trouble conditions.
- E. All low voltage circuits will be protected by microprocessor controlled power limiting or have self restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.
- F. Notification circuits shall be designed to limit the voltage drop to a maximum of 20% from the power supply to the most remote device on any notification circuit.
- G. All visible alarms within a single field of view shall flash in synchronization.
- H. Secondary power supply (battery backup) shall be sufficient to provide a minimum of 24 hours of standby power with an additional reserve to operate the system for 5 minutes in alarm.

1.07 WARRANTY:

- A. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance.

1.08 APPLICABLE CODES AND STANDARDS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with all applicable provisions of the latest issue of these standards.
  - 1. International Building Code – 2006 edition
  - 2. International Fire Code – 2006 edition
  - 3. International Mechanical Code – 2006 edition
  - 4. Utah State Fire Marshal Rule R710-4
  - 5. NFPA 70 - National Electrical Code – 2005 edition
  - 6. NFPA 72 - National Fire Alarm Code – 2007 edition
  - 7. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems - 2002 edition
  - 8. NFPA 101 Life Safety Code – 2006 edition

**PART II - PRODUCTS**

2.01 GENERAL:

- A. All equipment and components shall be new, and the manufacturer's current model. The installer shall be an authorized representative of the manufacturer of the major equipment, such as control panels and shall be responsible for the satisfactory installation of the complete system.

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- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

2.02 CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and DFCM requirements.
2. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the equipment manufacturer.
6. Conduit shall be 1/2 inch minimum.
7. Install conduit attached to structure by straps, staples, hangers or similar fittings designed and installed to support conduit. Installation shall conform to NFPA 70 Article 760 and 300.4.
8. Conduit shall be rigid or EMT. Flexible conduit may be used for a drop to a single device. Metal clad or armored cable may be used as an alternate to conduit where installed and supported in accordance with NFPA 70, DFCM requirements and NEMA RV1.
9. Conduit shall be concealed above ceilings or in walls where ceiling or walls are present. Where conduit is installed exposed, conduit and associated j-boxes and supports shall be painted to match the color of the surrounding building elements.
10. Conduit and junction boxes used for the fire alarm system shall be marked and labeled to indicate that they are part of the building fire alarm system. Conduits shall be periodically marked with red paint and labeled to indicate the circuit type and designation contained inside. Junction boxes shall be painted red.

B. Wire:

1. All fire alarm system wiring must be new, unless specified herein.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as indicated on project drawings and as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for any type of fire alarm circuit.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use

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- with a protective signaling system.
4. All wiring shall be installed inside permanent conduit or raceway or contained inside approved junction boxes or enclosures.
  5. The system shall permit the use of IDC and NAC wiring in the same conduit or raceway with the multiplex communication loop.
  6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
  7. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.
  8. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel (UPS/generator distribution panel) as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.03 FIRE ALARM CONTROL PANEL:

- A. FACP shall be either Silent Knight model 5820 XL or Fire-Lite MS-9600 with DACT-UD.
- B. Install all required expansion modules to ensure adequate SLC loop capacity for all initiating devices and control relays shown on panel with a additional reserve or a least 20% for future expansion.
- C. The FACP must have an integrated UL approved digital communicator. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.
- D. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. Maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core operating software on site or over the telephone.
- E. The main communication bus shall be capable of class A or class B configuration with a total Bus length of not less than 6,000 feet.
- F. The main control must have a built in annunciator with a minimum 80 character LCD display and feature LED's for General alarm, Supervisory, System trouble, System silence and Power. When in the normal condition the LCD shall display time and date which is capable of automatic daylight savings time adjustments. The annunciator must be able to silence and reset alarms through the use of a keypad-entered code, or by using a firefighter key. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.
- G. Provide all necessary system expansion module required to provide a complete and functional fire alarm system as described on the project drawings and specified herein.

2.04 NOT USED:

2.05 ANNUNCIATOR PANELS:

- A. The fire system shall be capable of supporting up to eight remote annunciators. LCD Remote

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annunciators shall have the same control and display layout so that they match identically the built in annunciator on the FACP. LED Remote annunciators shall have individually mapped LED's and reset and silence inputs. Remote annunciators shall be capable of operating at a distance of 6000 feet from the main control panel on unshielded non-twisted cable.

2.06 DACT:

- A. The digital communicator shall be capable of reporting all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct messages to a central station or remote station. The communicator must also be capable of up/downloading of all system programming options, Event history and Sensitivity compliance information to a PC on site or at a remote location. The communicator shall have an answering machine bypass feature that will allow the panel to respond to communication even on phone lines that have other communication equipment present. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage. DACT shall be integrated into the FACP circuitry or may be a separate card or panel connected to FACP and installed in FACP or adjacent enclosure.

2.07 SLC CIRCUITS:

- A. Each SLC shall be capable of a wiring distance of 10,000 feet from the SLC driver module and be capable of supporting at least 127 devices per loop. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 3 seconds. The SLC shall be capable of functioning in a class A configuration.

2.08 SLC LOOP DEVICES:

- A. Devices supported must include analog photoelectric, ionization smoke detectors, analog heat detectors, manual pull stations, contact monitoring modules and relay output modules. There is to be no limit to the number of any particular device type that can be connected to the SLC.

2.09 ADDRESSABLE SYSTEM DEVICES - GENERAL:

- A. Addressable devices shall provide an address-setting means using rotary decimal switches.
  - 1. Addressable devices shall use simple to install and maintain address switches.
  - 2. Detectors shall be Analog and Addressable, and shall connect to the fire alarm control panel's Signaling Line Circuits.
  - 3. Addressable smoke and thermal detectors shall provide dual (2)status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
  - 4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
  - 5. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature.
  - 6. The detectors shall provide a test means whereby they will simulate an alarm condition

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and report that condition to the control panel.

7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

2.10 INTELLIGENT PHOTOELECTRIC SMOKE DETECTOR:

- A. 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.

2.11 INTELLIGENT THERMAL DETECTORS:

- A. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) fixed temperature element and rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. Both shall mount to a base that is connected via two wires to the fire alarm control panel signaling line circuit.

2.12 NOT USED:

2.13 NOT USED:

2.14 ADDRESSABLE CONTROL MODULE:

- A. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.
- B. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
- C. The control module NAC may be wired for Style Z (Class A) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
- D. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
- E. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

2.15 MANUAL PULL STATIONS:

- A. Manual Fire Alarm Stations shall be non-coded, double action type, with a key operated test reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset the manual Pull Station and open the FACP cabinet without use of another key. An operated station shall automatically condition itself so as to visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed of die cast metal with clearly visible operating instructions on the front of the station in raised letters. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting on a standard single

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gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on Manual Station accessibility or per local requirements.

2.16 BATTERIES AND EXTERNAL CHARGER:

A. Battery:

1. Shall be 12 volt, Gell-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

B. External Battery Charger:

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt 60 hertz source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.

2.17 ENCLOSURES:

- A. The control panels shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
- B. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
- C. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- D. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

2.18 NOTIFICATION APPLIANCES:

- A. The visible and audible/visible signals shall be listed by Underwriters Laboratories Inc. per UL 1971 and/or 1638.
- B. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.
- C. The notification appliance (combination audible/visible units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The visible signaling appliance shall maintain a minimum flash rate of 1Hz or greater regardless of power input voltage. The appliance shall also be capable of meeting the candela requirements of the blueprints presented by

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the Engineer and ADA. The appliance shall be capable of synchronization with all other appliances in the same field of view.

- D. The appliance shall be polarized to allow for electrical supervision of the system wiring.
- E. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate.
- F. The unit shall have an input voltage range of 20-30 volts with either direct current or full wave rectified power.

2.19 SPARE DEVICES:

- A. Furnish the owner with a stock of spare initiating devices and notification appliances to allow for future addition/relocation of devices or replacement of equipment that fails after expiration of the warranty period. Manufacturer and model number of spare devices shall match those of devices used for the system installation. Minimum number and type of devices per building shall be as indicated below:
  - 1. Four addressable smoke detectors.
  - 2. One addressable smoke detectors.
  - 3. One addressable manual pull station.
  - 4. Six notification appliances corresponding to the type and proportion of notification appliances installed.

**PART III - EXECUTION**

3.01 INSPECTION:

- A. Contractor shall be responsible to attend a mandatory pre-bid walk through of the building. If required, an additional pre-bid inspection can be arranged. The contractor shall be responsible to examine all areas and conditions under which fire alarm systems are to be installed and identify conditions detrimental to proper completion of the work. All unsatisfactory conditions shall be specifically identified in the bid.

3.02 INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. Smoke detectors shall not be installed prior to the system programming and test period.
- C. Contractor is responsible for making his own job check and any necessary adjustments in the design prior to installation. Make final coordination with existing building elements and adjust design as necessary. Major conflicts shall be brought to the attention of the Project Engineer for resolution.
- D. Work shall be performed in a manner to minimize interruptions in service of the existing fire alarm system. Contractor shall be responsible to provide a fire watch throughout all times that the automatic fire alarm and detection service is interrupted.
- E. Work only in one area of a building at a time. Complete all required work in that area before proceeding to the next area.

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- F. Contractor shall prepare a schedule of work to be performed and submit the schedule to the building coordinator for review/approval.
- G. Work during normal business hours will be allowed but must be scheduled in advance with building coordinator. Operations involving the creation of dust, debris or distracting noise shall be scheduled in advance with the building coordinator and shall be performed early in the morning or near the end of the work day.

3.03 FIELD QUALITY CONTROL:

- A. Obtain permits and post bonds as required by state and local AHJ's (Authorities Having Jurisdiction).
- B. Inform AHJ's of job progress. Request presence of AHJ's, perform tests, and document results using Contractor's Material and Test Certificates.

3.04 TESTING/TRAINING:

- A. Make and pay for all tests required by applicable codes during and after completion of the work and correct and defects in the systems indicated by the tests.
- B. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system.
- C. Testing shall include but not be limited to the following:
  - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  - 2. Open initiating device circuits and verify that the trouble signal actuates.
  - 3. Open signaling line circuits and verify that the trouble signal actuates.
  - 4. Open and short notification appliance circuits and verify that trouble signal actuates.
  - 5. Ground initiating device circuits and verify response of trouble signals.
  - 6. Ground signaling line circuits and verify response of trouble signals.
  - 7. Ground notification appliance circuits and verify response of trouble signals.
  - 8. Check alert tone and prerecorded voice message to all alarm notification devices.
  - 9. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
  - 10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
  - 11. Test system batteries to verify that secondary power supply is sufficient to provide specified standby and alarm power.
- D. Train the Owner's maintenance personnel in the proper operation, testing and maintenance of all installed equipment. Training shall be sufficient to enable owner to service equipment, add or remove devices and make programming changes.

3.05 FINAL INSPECTION:

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

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3.06 INSTRUCTION:

- A. Instruction shall be required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation"

3.07 CLEANING:

- A. Remove dust, scale, debris, and foreign substances from interior and exterior of devices, equipment, and materials prior to installation.
- B. Upon job completion, remove tools, surplus materials and equipment, leaving all areas broom clean.

3.07 AUTHORITIES HAVING JURISDICTION:

- A. Acceptance of installation is subject to final inspection and approval by:
  - 1. State of Utah Fire Marshal's Office
  - 2. State of Utah Division of Facilities and Construction Management
  - 3. Building Maintenance Personnel
  - 5. Project Engineer

END OF SECTION 13851

# BATTERY CALCULATIONS

SILENT KNIGHT 5820XL FIRE PANEL CALCULATIONS			REQUIRED CURRENT (STANDBY)		REQUIRED CURRENT (ALARM)	
PART	DESCRIPTION	QTY	EACH (A)	TOTAL (A)	EACH (A)	TOTAL (A)
5820XL	CONTROL PANEL	1	0.2150	0.2150	0.3850	0.3850
5860	ANNUNCIATOR	1	0.0200	0.0200	0.0250	0.0250
SD500-PSDATK	PULL STATION	2	0.0006	0.0012	0.0006	0.0012
SD505-APS	SMOKE DETECTOR	12	0.0006	0.0072	0.0006	0.0072
SD505-ADHR	DUCT SMOKE DETECTOR	1	0.0006	0.0006	0.0006	0.0006
SD500-ARM	RELAY CONROL MODULE	2	0.0006	0.0012	0.0006	0.0012
RIXSON 996	DOOR HOLD-OPEN DEVICE	23	0.0200	0.4600	0.0000	0.0000
SD505-AHS	HEAT DETECTOR	42	0.0006	0.0252	0.0006	0.0252
TOTAL				0.7304		0.4454
SECONDARY STANDBY BATTERY CALCULATIONS: HOUR + (ALARM) X 5 MINUTES + 10% =				(STANDBY) X 24		19.3

# BATTERY CALCULATIONS

REMOTE POWER SUPPLY CALCULATIONS			REQUIRED CURRENT (STANDBY)		REQUIRED CURRENT (ALARM)	
PART	DESCRIPTION	QTY	EACH (A)	TOTAL (A)	EACH (A)	TOTAL (A)
5895XL	POWER SUPPLY	1	0.040	0.040	0.160	0.160
	NAC CIRCUIT	3	0.000	0.000	2.000	6.000
TOTAL				0.0400		6.1600
SECONDARY STANDBY BATTERY CALCULATIONS:					(STANDBY) X 24	
HOUR + (ALARM) X 5 MINUTES + 10%=					1.6	

# BATTERY CALCULATIONS

REMOTE POWER SUPPLY CALCULATIONS			REQUIRED CURRENT (STANDBY)		REQUIRED CURRENT (ALARM)	
PART	DESCRIPTION	QTY	EACH (A)	TOTAL (A)	EACH (A)	TOTAL (A)
FIREFORCE 6	POWER SUPPLY	1	0.090	0.090	0.175	0.175
SW	15 Cd STROBE	2	0.000	0.000	0.066	0.132
P2W	15/75 Cd HORN/STROBE	11	0.000	0.000	0.090	0.990
P2W	30 Cd HORN/STROBE	2	0.000	0.000	0.107	0.214
P2W	15 Cd HORN/STROBE	3	0.000	0.000	0.079	0.237
TOTAL				0.0900		1.7480
SECONDARY STANDBY BATTERY CALCULATIONS:					(STANDBY) X 24	
HOUR + (ALARM) X 5 MINUTES + 10%=					2.5	

# BATTERY CALCULATIONS

REMOTE POWER SUPPLY CALCULATIONS			REQUIRED CURRENT (STANDBY)		REQUIRED CURRENT (ALARM)	
PART	DESCRIPTION	QTY	EACH (A)	TOTAL (A)	EACH (A)	TOTAL (A)
5895XL	POWER SUPPLY	1	0.0400	0.0400	0.1600	0.1600
	NAC CIRCUIT	2	0.0000	0.0000	2.0000	4.0000
5815XL	SLC EXPANDER	1	0.1250	0.1250	0.1250	0.1250
SD505-APS	SMOKE DETECTOR	9	0.0006	0.0054	0.0006	0.0054
SD500-PS	PULL STATION	7	0.0006	0.0042	0.0006	0.0042
SD505-AHS	HEAT DETECTOR	73	0.0006	0.0438	0.0006	0.0438
SD500-ARM	RELAY MODULE	1	0.0006	0.0006	0.0006	0.0006
SD505-ADH	DUCT SMOKE DETECTOR	1	0.0006	0.0006	0.0006	0.0006
				0.0000		0.0000
TOTAL				0.2196		4.3396
SECONDARY STANDBY BATTERY CALCULATIONS: HOUR + (ALARM) X 5 MINUTES + 10% =					(STANDBY) X 24	6.2

# BATTERY CALCULATIONS

REMOTE POWER SUPPLY CALCULATIONS			REQUIRED CURRENT (STANDBY)		REQUIRED CURRENT (ALARM)	
PART	DESCRIPTION	QTY	EACH (A)	TOTAL (A)	EACH (A)	TOTAL (A)
FIREFORCE 6	POWER SUPPLY	1	0.090	0.090	0.175	0.175
SW	15 Cd STROBE	2	0.000	0.000	0.066	0.132
P2W	15/75 Cd HORN/STROBE	11	0.000	0.000	0.090	0.990
P2W	30 Cd HORN/STROBE	2	0.000	0.000	0.107	0.214
P2W	15 Cd HORN/STROBE	3	0.000	0.000	0.079	0.237
TOTAL				0.0900		1.7480
SECONDARY STANDBY BATTERY CALCULATIONS:					(STANDBY) X 24	
HOUR + (ALARM) X 5 MINUTES + 10%=					2.5	

**Voltage Drop Circuit #1 (1st Floor)**

Wire Gauge	Cmil	Resistivity
12 AWG	6530	13
14 AWG	4110	13
16 AWG	2580	13
18 AWG	1620	13

**Physical Parameters**

Source Voltage	20.4 V
Wire Gauge	16 AWG
Wire Resistivity	2580 cmil 13 Ohm-cmil/ft

Ref. Start No.	Device/device Distance (feet)	Cumulative Distance (feet)	Light Intensity (Cd/dBA)	Device Current (Amps)	Circuit Current (Amps)	Device Voltage (Vdc)	% Voltage Drop	Ref. End No.
FCPS	20	20	15	0.079	1.283	20.141	1.268	1
1	20	40	15	0.066	1.204	19.899	1.205	2
2	20	60	15	0.066	1.138	19.669	1.153	3
3	20	80	15	0.066	1.072	19.453	1.098	4
4	30	110	15	0.066	1.006	19.149	1.563	5
5	45	155	115	0.218	0.94	18.723	2.226	6
6	30	185	15	0.066	0.722	18.505	1.166	7
7	20	205	15	0.066	0.656	18.372	0.715	8
8	30	235	115	0.218	0.59	18.194	0.971	9
9	50	285	15	0.079	0.372	18.007	1.030	10
10	40	325	15	0.079	0.293	17.888	0.656	11
11	35	360	30	0.107	0.214	17.813	0.422	12
12	50	410	30	0.107	0.107	17.759	0.303	13

Total Circuit Length

**410**

Total Circuit Current

**1.283**

Total Circuit Voltage Drop %

**13.78**

**Voltage Drop Circuit #2 (1st Floor)**

Wire Gauge	Cmil	Resistivity
12 AWG	6530	13
14 AWG	4110	13
16 AWG	2580	13
18 AWG	1620	13

**Physical Parameters**

Source Voltage	20.4 V
Wire Gauge	16 AWG
Wire Resistivity	2580 cmil 13 Ohm-cmil/ft

Ref.Start No.	Device/device Distance (feet)	Cumulative Distance (feet)	Light Intensity (Cd/dBA)	Device Current (Amps)	Circuit Current (Amps)	Device Voltage (Vdc)	% Voltage Drop	Ref. End No.
FCPS	25	25	15	0.066	1.198	20.098	1.480	1
1	30	55	15	0.066	1.132	19.756	1.703	2
2	25	80	115	0.218	1.066	19.487	1.359	3
3	45	125	15	0.066	0.848	19.103	1.973	4
4	30	155	15	0.066	0.782	18.866	1.238	5
5	20	175	15	0.066	0.716	18.722	0.765	6
6	30	205	115	0.218	0.65	18.526	1.050	7
7	40	245	115	0.218	0.432	18.351	0.940	8
8	45	290	30	0.107	0.214	18.254	0.529	9
9	55	345	30	0.107	0.107	18.195	0.325	10

Total Circuit Length

**345**

Total Circuit Current

**1.198**

Total Circuit Voltage Drop %

**11.36**