

## SECTION 28 31 11

### DIGITAL, ADDRESSABLE, FIRE ALARM SYSTEM

#### PART 1 GENERAL:

##### 1.01 INSTALLER QUALIFICATION/CERTIFICATION

- A. The Fire Detection Contractor shall have at least five (5) years experience in designing and installing fire alarm systems, with at least three (3) systems greater than two hundred thousand (200,000) square feet in the City and County of Denver within the last two (2) years.
- B. The Fire Detection Contractor shall directly employ NICET (minimum Level-II Fire Alarm Technology) technicians to guide the final checkout and to ensure system integrity.
- C. The Fire Detection Contractor shall employ a Journeyman Electrician for all electrical work. Electricians must have a Denver Fire Alarm Systems License.

##### 1.02 SUBMITTALS

- A. Certification: Submit certification from the major equipment manufacturer indicating that the distributor is an authorized Distributor and/or Installer for the equipment.
- B. Shop drawing submittal to AHJ(s): When the shop drawings are submitted to the AHJ(s) for review for a permit, the System Design Engineer shall be responsible to ensure that a third set of the fire alarm engineering drawings are submitted. The AHJ(s) will return this third set to the System Design Engineer, which shall be returned to DPS as the approved record submittal and must include the AHJ(s) comments.
- C. Shop Drawings:
  - 1. System Design Engineer shall submit shop drawings for review to the Architect, DPS, and DPS QA/QC before being submitted to the AHJ(s) for permit review. Shop drawings shall include the following:
    - a) Shop drawings shall be produced in AutoCAD or compatible version.
    - b) Architectural floor plans (scale as depicted on contract documents) showing location of FACP, annunciator, alarm initiating devices, alarm notification appliances, sources of electric power including electrical circuits used for FACP, interface, power supplies.
    - c) Architectural reflected ceiling plans showing ceiling height changes, soffits, coffers, supply and return air vents and light fixtures, etc.
    - d) Equipment layout and device arrangement.
    - e) Complete point-to-point wiring diagrams detailing internal and interconnecting wiring for power, signal and control that distinguishes between field installed and factory installed wiring.
    - f) Fire alarm symbols shall match the current International Fire Code Symbols and the City and County of Denver "Graphic Wall Map Symbols".
    - g) FACP cabinet layout.
    - h) Remote supervising station connection.
    - i) Graphic annunciator detail shall be submitted at actual size and depict the following:
      - i) Architectural floor plan (black).
      - ii) Room numbers (blue).
      - iii) Fire alarm initiating devices (red) with custom message number.
      - iv) FACP (red).
      - v) Graphic annunciator location with "YOU ARE HERE" arrow (red).
      - vi) North arrow (black).

- vii) Legend (black).
  - viii) Site plan with street names (black).
  - ix) Locations of hydrants, fire department connection and DFD transmitter (red).
  - x) Locations of main shutoffs for gas, water, electric, and fire sprinkler, etc. (red).
  - xi) No Fire Detection Contractor logo's allowed on graphic panels.
  - j) Standby battery calculations.
  - k) Voltage drop calculations for horn and visual devices.
  - l) Sequence of operation (Manufacturer's standard descriptions for generic systems are not acceptable).
  - m) Riser diagrams:
    - i) Typical riser diagrams are not acceptable.
    - ii) The riser diagram shall be specific to each building and include exact quantities of notification appliances.
    - iii) Show each circuit emanating from the control panel, auxiliary equipment such as printers, and every device on the system.
    - iv) Devices shall be shown located on the circuits they are connected to, in the same relation as shown on the floor plan.
  - n) Wire list including FACP manufacturer's recommended wire, size and color-coding.
  - o) 3:1 scaled elevation drawing of network graphical user interface station placement and layout of all equipment required therein.
  - p) Elevation drawings of walls on which control panels, interface panel, transmitter and annunciator panels are to be mounted. Elevations shall be fully dimensioned to show location of each piece of equipment.
- D. Product data: Specifications and highlighted cut sheets on each piece of equipment proposed. Include manufacturer's name(s), model numbers, ratings, power requirements.
- E. Record Drawings: Submit as-built shop drawings to the Architect (if applicable) or System Design Engineer for incorporation into the Project Record Drawings.
- F. Operation and Maintenance data:
1. List manufacturers.
  2. Include technical data sheets.
  3. Wiring diagrams indicating internal wiring for each device and the interconnections between items of equipment.
  4. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
- G. Tools for program modification, including addition and deletion of devices, circuits, zones and changes to system operation, and custom label changes for devices or zones:
1. Provide hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. If more than one installing company is qualified to install the equipment, make provisions that any company can modify the system.
  2. Provide software documentation that details procedures and precautions required for software modification.

## **PART 2 PRODUCTS**

### **2.01 MATERIAL AND EQUIPMENT, GENERAL**

- A. Materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

**2.02 APPROVED MANUFACTURERS AND FIRE DETECTION SYSTEMS**

- A. Simplex 4100ES
- B. Notifier NFS2-3030
- C. EST EST 3
- D. Siemens XLS

**2.03 FIRE ALARM CONTROL PANEL (FACP)**

- A. FACP shall be a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: Intelligent addressable photoelectric smoke and thermal (heat) detectors, addressable modules, temporal coded horn evacuation equipment, emergency voice evacuation equipment, annunciators, network graphic interface stations at the fire command center, and other system controlled devices.
- B. Meet UL Standard-864 (Control Units).
- C. Modular labeling: Meet the modular labeling requirements of Underwriters Laboratories, Inc. Each subassembly, including printed circuits, shall include the appropriate UL modular label. Systems which do not include modular labels are not acceptable.
- D. Include a full-featured operator interface control and annunciation panel with a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
- E. The FACP shall be capable of coding notification circuits in temporal pattern (NFPA-72 A-2-2.2.2), and California code.
- F. FACP functions:
  - 1. The actuation of any alarm initiating device shall automatically operate alarm notification appliances, including voice evacuation notices. The audible signals shall sound a temporal pattern until the system is silenced. The visual alarms shall continue to flash until the system is reset. The silencing of audible signals shall be a separate function from reset.
  - 2. Activation of any sprinkler or standpipe valve tamper switch shall activate the system supervisory alarm and illuminate the supervisory LED on the control panel. Acknowledgement of the supervisory or operation of the supervisory silence switch shall cause the audible alarm to silence. The supervisory condition shall remain on the system until the trouble is corrected. Once the trouble is corrected, the supervisory alarm shall self-restore.
  - 3. Activation of any carbon monoxide detector shall activate the system supervisory alarm and illuminate the supervisory LED on the control panel. Activation shall also initiate a carbon monoxide alarm condition at the AES system. Acknowledgement of the supervisory or operation of the supervisory silence switch shall cause the audible alarm to silence. The supervisory condition shall remain on the system until the carbon monoxide detector(s) are reset and condition is cleared.
  - 4. In the event of an open or ground in a circuit or an off-normal condition, a trouble alarm shall sound and the trouble LED on the control panel shall be illuminated. Acknowledgement of the trouble or operation of the trouble silence switch shall cause the audible alarm to silence. The trouble condition shall remain on the system until the trouble is corrected. Once the trouble is corrected, the trouble alarm shall self-restore.
  - 5. The system shall allow the programming of any input to activate any output or group of outputs. Systems, which have limited programming (such as general alarm) or have complicated programming (such as a diode matrix), are not considered suitable substitutes.
  - 6. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

7. Detector sensitivity test, meeting requirements of NFPA-72, Chapter-7.
8. Maintenance alert to warn of excessive smoke detector dirt or dust accumulation.
9. Automatically compensate the sensitivity level of smoke sensors for dusty or dirty conditions.
10. A minimum of seven sensitivity levels for alarm, selected by detector. Range of 1 to 2.35% per foot for photoelectric detectors.
11. Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
12. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification twenty (20) times. (Alarm verification shall be enabled or disabled for initial installation per Denver Fire Department instructions.)
13. PAS presignal, meeting NFPA-72 3-8.3 requirements.
14. Non-alarm points for general (non-fire) control.
15. Periodic detector test, conducted automatically by the software.
16. Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
17. Cross zoning with the capability of counting: two (2) detectors in alarm, two (2) software zones in alarm, or one (1) smoke detector and one (1) thermal detector.
18. Walk test, with a check for two detectors set to same address.
19. Control-by-time for non-fire operations, with holiday schedules.
20. Day/night automatic adjustment of detector sensitivity.
21. UL-1076 security monitor points.
22. Provide 25% spare capacity on each card(s).
23. Provide 25% capacity on each circuit(s) and for panel points, considering both circuit and panel limitation. This includes device count, circuit length, voltage drop, and panel capacity.
24. Balance circuits for equal loading and spare capacity.
25. Provide an eight (8) point relay card in the FACP and program the FACP to send discrete signals to the DFD transmitter.
26. Capability to cancel, through software modification, the detector polling light during normal operation of the system.
27. Provide the ability to log, display and print system reports:
  - a) Real time and date shall accompany history event recording.
  - b) Provide an integrated printer that prints out a hard copy indicating each device in alarm and/or in "trouble" state. If the printer is not integrated, the Contractor shall provide and install a shelf with an enclosure for the printer and paper rack.
  - c) The descriptor at the FACP and printer shall clearly indicate the location of each alarm-initiating device. The descriptor shall contain the general area, the specific area, the room, the room number, and the device. Example - CLASSROOM 301, SMOKE DETECTOR, DEVICE NUMBER L1-D102.
28. Allow for loading and editing of special instructions and operating sequences.
29. Provide capability for on-site programming.
30. Provide means of minor programming changes by DPS personnel.
31. The backup software programming shall be stored on a DPS - 2GB USB Smart Stick. Prior to completing any Fire Detection System Updates, Upgrades, Modifications, or Additions, the Contractor must complete the following:

- a) The Contractor must checkout the current Fire Detection System Backup Software Program Smart Stick from the DPS Electrical Shop Supervisor, located at 2800 W. 7<sup>th</sup> Avenue, Denver, CO. The DPS – 2GB USB Smart Stick will only contain the current AHJ/DPS approved program.
  - b) After completing the Contract Scope of Work, the Contractor must backup the updated Fire Detection Software Programming to the 2 GB USB Smart Stick. The DPS – 2GB USB Smart Stick will only contain the updated program.
  - c) The Contractor must return the updated Fire Detection System Backup Software Program Smart Stick to the DPS Electric Shop Supervisor (located at 2800 W. 7<sup>th</sup> Avenue, Denver, CO) two (2) days after the AHJ Acceptance Testing.
32. The system structure and software shall place no limit on the type or extent of software modifications on-site.
33. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
34. If allowed by the Authorities Having Jurisdiction (AHJ), the system shall have an alarm verification feature that can be set by individual sensor or for a group of sensors:
- a) Verification time adjustable from zero (0) to sixty (60) SECONDS.
  - b) Alarm verification set at thirty (30) seconds.
  - c) Special conditions may dictate that specific detectors have a different verification period.
35. Smoke density sensors and heat (temperature) sensors:
- a) The control panel shall determine if an alarm condition exists by comparing the sensor value to stored values.
  - b) If allowed by the AHJ, the alarm point shall be adjustable manually or automatically from the control panel.
  - c) Program to set the sensitivity to the lowest level during school hours and then reset to a higher sensitivity when the building is unoccupied.
- G. Signals and transmission:
1. Automatically transmit a coded signal to the Denver Fire Alarm Headquarters through an AES radio transmitter box:
    - a) Trouble and supervisory alarms are to be transmitted to the Denver Fire Alarm Headquarters. When activated, they shall sound and the yellow trouble LED on the FACP shall be illuminated.
    - b) It shall not be possible to disable the radio transmitter (AES) for testing and maintenance purposes.
    - c) The system shall transmit to the radio transmitter (AES) those alarms, troubles and supervisory as required by the AHJ.
    - d) For schools with a swimming pool, an additional "drowning alarm," activated by a separate manual box in the pool area, shall be transmitted:
      - i) The drowning alarm shall transmit a different sound (not temporal pattern) in the pool area only, not as a general alarm throughout the building.
      - ii) The pull station shall be yellow and be labeled as "Drown Alarm".
    - e) Special systems such as kitchen hoods, fire pump running, etc. shall be transmitted as separate alarms.
    - f) The radio transmitter (AES) is limited to eight (8) zones. If more than eight (8) zones are required, additional transmitters shall also be provided.
  2. Each device will be programmed to report to one (1) of the transmitter zones. Duct Detector, Supervisory, and Trouble alarms shall be transmitted to Denver Fire Department Dispatch.

3. The outside horn/strobe at the Fire Department Connection (FDC) shall be activated by a water flow alarm only.
- H. Operator control:
1. Acknowledge Switch: Activation of the FACP ‘Acknowledge Switch’ in response to new alarms and/or troubles/supervisories shall silence the FACP signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble or supervisory conditions exist, depression of this switch shall advance the eighty (80) character LCD display to the next alarm, trouble or supervisory condition. Depression of the Acknowledge switch shall also silence all remote annunciator sounders.
  2. Alarm Silence Switch: Activation of the “Alarm Silence” switch shall cause all programmed alarm notification appliances (horns) and relays to return to the normal condition during an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
  3. System Reset Switch: Activation of the “System Reset” switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
  4. Lamp Test Switch: The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.
- I. Central microprocessor:
1. The microprocessor shall be a state-of-the-art, high speed, device and it shall communicate with, monitor and control all external interfaces.
  2. Include an EPROM for system program storage, non-volatile memory for building-specific program storage, and a watchdog timer circuit to detect and report microprocessor failure.
  3. Contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
  4. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
  5. A special program check function shall be provided to detect common operator errors.
- J. Display:
1. Provide the controls and indicators used by the system operator and also be used to program system operational parameters.
  2. Include status information and custom alphanumeric labels for intelligent detectors, addressable modules, internal panel circuits, and software zones.
  3. Include an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eight (8) Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PRE-ALARM WARNING, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS and ALARM SILENCED.
  4. Include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, SYSTEM RESET and LAMP TEST.
  5. The system shall support an optional battery ammeter/voltmeter display.
- K. Signaling Line Circuits (SLC):
1. Each Signaling Line Circuits (SLC) interface shall provide power to, and communicate with, intelligent detectors (flame, photoelectric or thermal) and intelligent modules (monitor or control).

- L. The Loop Interface Board (LIB):
  - 1. The Loop Interface Board (LIB) shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, supervisory or trouble conditions exist for each detector. The software shall 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 shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements:
    - a) The detector software shall meet NFPA-72, Chapter-7 requirements and be certified by UL as a calibrated sensitivity test instrument.
    - b) The detector software shall allow manual or automatic sensitivity adjustment.
- M. Serial Interfaces:
  - 1. Include serial EIA-232 interfaces. Each interface shall be a means of connecting UL listed Electronic Data Processing (EDP) peripherals.
- N. Notification Appliance Circuit (NAC) Module:
  - 1. The NAC module shall provide fully supervised Class B (NFPA Style Y) notification circuits.
  - 2. An expansion circuit board shall allow expansion to 8-circuits per module.
  - 3. The module shall not affect other module circuits in any way during a short circuit condition.
  - 4. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
  - 5. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or word processor or computer printer.
  - 6. Provide with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 14-AWG wire.
  - 7. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.
- O. Control Relay Module:
  - 1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 2-amps, 28-VDC.
  - 2. An expansion circuit board shall allow expansion to eight (8) Form-C relays per module.
  - 3. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
  - 4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
  - 5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor or computer printer. The Contractor shall provide all labels.
  - 6. Provide with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 14-AWG wire.
- P. FACP Enclosures:
  - 1. The FACP shall be housed in an UL-listed cabinet for surface or semi-flush mounting.
  - 2. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The Owner will select the color of the cabinet from choices provided by the equipment supplier.
  - 3. The back box and door shall be constructed of 0.060-steel with provisions for electrical conduit connections into the sides and top.

4. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- Q. Voice Command Center (VCC):
1. The Voice Command Center (VCC) shall contain equipment required for all audio control, telephone system control, signaling and supervisory functions.
  2. Include amplifiers, tone generators, digital voice units, a microphone and a main telephone handset. Provide a hand held microphone with priority push-to-talk switch.
  3. The voice command center shall be an integral part of the fire alarm system. Systems which require separate, non-integrated voice systems, are not considered suitable substitutes.
  4. Function:
    - a) Operate as a supervised dual channel emergency voice communication system.
    - b) Provide automatic custom digital recorded voice message and tone generation.
    - c) Provide an all-call switch and indicator to quickly activate all speaker circuits.
- R. Power Supply:
1. The main power supply shall operate on 120-VAC, 60-Hz, and shall provide all necessary power for the FACP. The FACP shall be connected to a separate dedicated branch circuit, maximum 20-amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. The branch circuit number, panel number and location shall be indicated inside the FACP panel.
  2. UL-listed with secondary power capable of operating the system, including the printer, as required by code.
  3. Provide minimum 6.0-amps of available power for the control panel and peripheral devices.
  4. Provide the ability to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies. The branch circuit number, panel number and location shall be indicated inside the FACP panel.
  5. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on power outputs.
  6. LED indicators:
    - a) Ground Fault LED.
    - b) Battery Fail LED.
    - c) AC Power Fail LED.
  7. Circuits shall be power-limited, per UL-864 requirements, latest edition.
  8. Provide a battery charger for 24-hours of standby using dual-rate charging techniques for fast battery recharge. If necessary to meet standby requirements, external battery and charger systems may be used.
- S. Batteries:
1. Sealed Gel Cell type, 12-Volt.
  2. Sufficient capacity to power the fire alarm system for not less than twenty four (24) hours plus five (5) minutes of alarm upon a normal AC power failure.
  3. Completely maintenance free. No liquids required. Fluid level checks for refilling, spills, and leakage shall not be required.
  4. In existing systems, where batteries can be re-used, replace all batteries where production dates are older than 2-years from completion date.
- T. Field Charging Power Supply (FCPS):



1. The FCPS is a device designed for use as either a remote 24-Volt power supply or used to power Notification Appliances.
2. The FCPS shall offer up to 6.0-amps (4.0-amps continuous) of regulated 24-Volt power. It shall include an integral charger designed to charge two (2) 7.0-amp hour batteries and to support 60-hour standby.
3. The FCPS shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the FACP) or a relay. Four outputs (two style-Y or Z and two style-Y) shall be available for connection to the Notification devices.
4. The FCPS shall include an attractive surface mount back box with key lockable door.
5. The FCPS shall include the ability to delay the AC fail delay per NFPA requirements, latest edition.
6. The FCPS include power limited circuitry, per latest UL standards.

U. System Circuit Supervision:

1. Each FACP node shall supervise all circuits to intelligent devices, annunciators and peripheral equipment and annunciate loss of communications with these devices. The FACP CPU shall continuously scan the above devices for proper system operation and upon loss of response from a device shall flash a LED, sound an audible trouble, indicate which device or devices are not responding and print the information on the printer.
2. Sprinkler system valves, standpipe control valves, Post Indicating Valve (PIV), and main gate valves shall be supervised for off-normal position.
3. All notification circuits shall be supervised for open and short circuits.

V. Audio Amplifiers:

1. The audio amplifiers will provide audio power for distribution to the speaker circuits.
2. Multiple audio amplifiers may be mounted in the FACP using additional cabinets if necessary. Each FACP shall have a primary and a back-up amplifier.
3. The audio amplifiers shall include an integral power supply, and shall provide the following controls and indicators:
  - a) Normal Audio Level LED.
  - b) Incorrect Audio Level LED.
  - c) Brownout LED.
  - d) Battery Trouble LED.
  - e) Amplifier Trouble LED.
  - f) Audio Amplifier Gain Adjust.
4. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
5. Terminal blocks for the connection of field wiring shall have a removable plug-in and be hardwired to allow for ease of field wire installation in a cabinet or at a remote location.
6. The amplifier shall include audio input and amplified output supervision, backup input, and automatic switchover to back up (if primary amplifier should fail).

W. Specific System Operations:

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of seven (7) levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
  4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
    - a) Device status.
    - b) Device type.
    - c) Custom device label.
    - d) View analog detector values.
    - e) Device zone assignments.
    - f) All program parameters.
  5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
  6. System History Recording and Reporting: The FACP shall contain a history buffer that will be capable of storing up to one thousand (1000) events. Up to two hundred (200) events shall be dedicated to alarm and the remaining events are general purpose. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
  7. Automatic Detector Maintenance Alert: The FACP shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
  8. The FACP shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
    - a) Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for three (3) seconds.
    - b) Introducing a trouble into the initiating device shall activate the programmed outputs for 8-seconds.
    - c) Walk test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for walk test shall continue to provide fire protection and if an alarm is detected, will exit walk test and activate all programmed alarm functions.
    - d) All devices tested in walk test shall be recorded in the history buffer.
- X. Waterflow Operation:
1. An alarm from a water flow device shall activate the appropriate alarm message on the eighty (80) character display, turn on all programmed notification appliance circuits.
  2. An alarm from the "Main Water Flow" device(s) shall activate the exterior horn/strobe(s). The exterior horn/strobe shall be electrically supervised. The silence button on the FACP shall have no affect on the exterior horn/strobe(s).
- Y. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the eighty (80) character display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
- Z. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc.) to deactivate upon depression of the signal silence switch.

- AA. Non-Alarm Input Operation: Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
- BB. The Fire Alarm Control Panel shall be equipped with a minimum of four (4) programmable buttons which will perform the following functions:
  - 1. Disable devices such as motorized fire dampers and certain fire door hold open devices. The DPS will provide details for the specific installation.
  - 2. Signal bypass.
  - 3. Elevator bypass
  - 4. Almost dirty for detection.

## 2.04 CONDUIT/WIREMOLD AND WIRE

- A. Circuits and raceway:
  - 1. Fire alarm system wire and cable shall be installed in metal conduit regardless of code exceptions. EMT/Conduit is required in concealed areas, including but not limited to mechanical rooms, above ceilings, pipe chases, attics, etc.
  - 2. Wiremold-700 is required in all exposed areas, including but not limited to corridors, hallways, classrooms, offices, restrooms, etc. Acceptable colors include Ivory or White, pending wall color.
  - 3. The system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
  - 4. Raceway fill shall be less than 40% per NEC:
    - a) Raceway capacity between control panels and terminal cabinets shall be sufficiently sized to accept additional circuits in the future.
  - 5. Lay out circuits to serve a specific geographical area (zone) per floor.
  - 6. Field location of transponders and power supply panels may be allowed. Good access must be provided for testing and maintenance requirements.
  - 7. Cable must be separated from open conductors of power, or Class-1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per the NEC.
  - 8. Wiring for 24-VDC control as related to the fire alarm system, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. 120 V.A.C. must be in separate conduit.
  - 9. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
  - 10. Conduit shall not enter the FACP, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the manufacturer.
  - 11. Field wiring shall be electrically supervised for open circuit and ground fault.
  - 12. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry is not permitted except on signaling line circuits connected to intelligent reporting devices.
- B. EMT / Conduit:
  - 1. Existing conduit may be reused; however, any extension thereof shall be in wiremold 700.
  - 2. Minimum 3/4-inch EMT.
    - a) Exception: Conduit runs to single device locations may be minimum 1/2-inch EMT.
  - 3. Existing conduit meeting specified requirements may be reused provided the Architect and/or the System Design Engineer confirms existing raceways meet current codes and have adequate capacity to support the new devices. In areas where raceways have not been installed, the Fire Detection Contractor shall install

new raceways in accordance with the DPS Design and Construction Standards 26 05 33 Raceways and Boxes for Electrical Systems.

4. Where EMT / Conduit are used, all steel fittings must be steel and set screw type, zinc die cast fittings are not allowed. Exception: All EMT/ Conduit mounted on the exterior of the building or in a wet environment must be water tight.
  5. Fire alarm conduit shall be identified by spraying with red paint or applying red self-adhesive tape at least every three (3) feet at all changes in direction.
  6. Also refer to other DPS Design and Construction Standards 26 05 33 Raceways and Boxes for Electrical Systems, for conduit.
  7. Any Architectural metallic conduit system, must be UL listed and pre-approved by DPS and DFD.
- C. Wiremold:
1. Existing Wiremold 500 shall not be re-used. Fire Detection Contractor will remove Wiremold 500 and replace with specified raceway in DPS Design and Construction Standards 26 05 33 Raceways and Boxes for Electrical Systems.
  2. Use Wiremold 700 in new raceways throughout in all exposed areas. EMT may be used in mechanical rooms and custodial areas. Wiremold color shall be ivory; scratches shall be touched up with Wiremold 700 ivory touchup paint. Any other painted Wiremold shall be painted only with Wiremold 700 ivory touchup paint. In areas where access is impossible, the use steel flexible conduit rated as fire alarm cable may be used.
  3. All Wiremold 700 raceway shall be cut only by a Wiremold 700 cutter; any Wiremold raceway cut by a hacksaw or other unapproved means shall be removed and replaced at the Contractor's expense.
  4. All Wiremold 700 raceway shall be bent only by a Wiremold 700 bender; any Wiremold 700 raceway bent by non pre-approved means shall be removed and replaced at the Contractor's expense.
- D. Wire:
1. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16-AWG or Initiating Device Circuits and Signaling Line Circuits, and 14-AWG for Notification Appliance Circuits.
  2. 12-AWG is not allowed to be directly connected to notification appliances.
  3. Wire shall be solid copper.
  4. FACP primary power wiring shall be 12-AWG.
  5. Field Wiring Terminal Blocks: For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for 18 to 14-AWG wire. Terminal blocks, which are permanently fixed, are not acceptable.

## **2.05 TERMINAL BOXES, JUNCTION BOXES AND CABINETS**

- A. Also refer to other Division 26 standards for boxes and cabinets.
- B. Fire alarm junction and back boxes shall be identified by spraying at least one surface with red paint or applying red self-adhesive tape to the surface. Mask adjacent surfaces when spray-painting to avoid overspray.

## **2.06 ANCHORS**

- A. Plastic anchors and percussion driven anchors are prohibited for any anchoring of the fire alarm system, guards, door holders, or door stops.
- B. Wall Anchors – Contractor shall install only drilled lead anchors. Alternate anchors must be submitted and approved by DPS.

## **2.07 INITIATING DEVICES**

- A. Detector indicator lights shall illuminate a solid red signal upon alarm and can be seen from the floor.

- B. All detectors shall have locking bases.
- C. Detectors and other fire alarm devices shall be mounted as flush as possible to the surface to minimize vandalism.
- D. Smoke Detection:
  - 1. Intelligent Photoelectric Smoke Detector:
    - a) The detectors shall use the photoelectric (light-scattering) principle to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. It shall connect via two wires to the FACP signaling line circuit.
    - b) All photoelectric smoke detectors shall be low profile.
    - c) Detectors shall have locking bases.
  - 2. Intelligent Duct Smoke Detector:
    - a) The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel.
    - b) When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
    - c) Photoelectric duct smoke sensors shall be located in the supply and return ductwork of all HVAC units rated in excess of two thousand (2,000) CFM. The remote test switch for the duct detection shall be in a readily accessible area.
    - d) All duct detection shall have a remote test switch readily accessible to the unit.
      - **EXCEPTION:** With approval of AHJ, duct detectors may be eliminated if all HVAC units shut down upon activation of any general fire alarm.
    - e) Auxiliary SPDT relay contact.
    - f) Key-operated normal-reset-test switch.
    - g) Duct Sampling tubes extending width of duct.
    - h) Visual indication of detector actuation.
    - i) Duct-mounted housing.
- E. Heat Detection:
  - 1. Automatic Conventional Heat Detectors: Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 194-degrees Fahrenheit for areas where ambient temperatures do not exceed 100-degrees F, and 200-degrees F for areas where the temperature does not exceed 150-degrees F.
  - 2. Mechanical room heat detectors shall be rate anticipation heat detectors rated at 194-degrees Fahrenheit in rooms where the ambient temperature can rise above 100-degrees F, but does not exceed 150-degrees F.
  - 3. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15-degrees Fahrenheit per minute. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
  - 4. Intelligent Thermal Detectors:
    - a) Thermal detectors shall be intelligent addressable devices rated at 135-degrees Fahrenheit and have a rate-of-rise element rated at 15-degrees Fahrenheit per minute. It shall connect via 2-wires to the FACP signaling line circuit.
- F. Explosion proof heat sensors shall be used in gasoline storage areas and other areas as required by the AHJ.
- G. Carbon Monoxide Detectors:

1. General: Carbon monoxide detector listed for connection to fire-alarm system.
2. Mounting: Adapter plate for outlet box mounting.
3. Testable by introducing test carbon monoxide into the sensing cell.
4. Detector shall provide alarm contacts and trouble contacts.
5. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
6. Comply with UL 2075.
7. Locate, mount, and wire according to manufacturer's written instructions.
8. Provide means for addressable connection to fire-alarm system.
9. Test button simulates an alarm condition.

H. Addressable Pull Station:

1. Addressable pull station(s) shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Conventional manual stations with a mini-monitor located within the back box will be acceptable.
4. A double-contact pull station shall be located adjacent to FACP:
  - a) One (1) contact shall provide alarm directly through the transmitter.
  - b) Override all disabled points on the FACP including horn/strobes.

I. Projected Beam Smoke Detector:

1. Projected beam smoke detector shall consist of an infrared transmitter and receiver. Units shall be mounted on opposite walls or on ceiling across from each other. Beam smoke detector shall be designed in accordance with the NFPA and the AHJ.
2. Detector shall contain a built-in automatic gain control to compensate for gradual deterioration of signal due to dust accumulation, component aging and temperature fluctuation. Receiver and transmitter may be powered separately or together for maximum flexibility. Unit shall have selectable sensitivity at 30% or 55% total obscuration.
3. Provide remote test station and remote annunciator LED located in central location for each detector and label.

J. Sprinkler Systems:

1. Provide modules for flow and tamper switches.
  - a) If the building currently has a partial sprinkler system, provide modules for that system and modules for flow and tamper switches for each floor and a set of modules for the main flow and tamper switches.
  - b) If the building currently has a full sprinkler system, connect all existing flow and tamper switches to the new system.
2. Waterflow Indicator:
  - a) Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
  - b) Waterflow Switches shall have an alarm transmission delay time, which is conveniently adjustable from 0 to 60-seconds. Initial settings shall be thirty (30) to forty five (45) seconds.
  - c) All waterflow switches shall come from a single manufacturer and series.
  - d) Waterflow switches shall be provided under a separate bid package by Division 21 and connected under this section.

3. Sprinkler and Standpipe Valve Supervisory Switches:
  - a) Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
- K. Valve supervisory switches shall be provided and installed.
  - a) Post Indicator Valve (PIV) or main gate valves shall be equipped with a supervisory switch.
  - b) The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one fifth of the distance from its normal position.
  - c) The supervisory switch shall be contained in a weatherproofed aluminum housing, which shall provide a 3/4-inch conduit entrance and incorporate the necessary facilities for attachment to the valves.
  - d) The switch housing shall be finished in red baked enamel.
  - e) The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

## 2.08 NOTIFICATION DEVICES

- A. Provide required annunciation including: horns, strobes and voice for all areas including classrooms, gymnasiums auditoriums, and other spaces greater than one hundred (100) square feet (exceeding current code requirements).
- B. Visual alarm strobes shall be mounted eighty (80") to ninety-six (96") inches (to center) above the floor level within a space or six (6") inches (to center) below the ceiling, whichever is lower or as required by current ADA requirements. In general, visual alarm strobes shall be no more than fifty (50') feet from any point in a room or corridor. Do not install strobes in small toilets in kindergarten classrooms. Strobes shall be UL listed in accordance with the AHJ.
- C. Provide speaker/strobes in each classroom, office, and other spaces greater than one hundred (100) square feet (exceeding the current code requirements). Provide UL listed Lexan guards for all horn/strobes excluding ceiling mount horn/strobes above 10'-0". Guards must be pre-approved by the DPS.
- D. Strobe Lights:
  1. Strobe lights shall meet the requirements of the ADA, UL Standard (latest edition), and shall meet the following criteria:
    - a) The maximum pulse duration shall be 2/10-second.
    - b) The flash rate shall not exceed two flashes per second (2-Hz) nor be less than one flash every second (1-Hz) throughout the listed voltage range of the appliance.
    - c) Strobe intensity shall meet the requirements of NFPA 72. Strobes shall be synchronized.
    - d) The flash rate shall meet the requirements of UL, latest edition.
    - e) The light source color shall be clear.
    - f) For wall installation the appliance shall be placed eighty (80) to ninety-six (96) inches above floor level or 6-inches below the ceiling, whichever is lower. Ceiling mount is encouraged.
- E. Horn: Horn shall be capable of operating at 24-Volts. Horn shall be UL listed in accordance with the AHJ for fire protective signaling systems. The horn shall have a minimum of two (2) audibility options and shall produce a temporal-3 pattern.
- F. Speaker/Strobe Combination:
  1. Speaker/strobe shall be listed to UL and UL-464 (latest edition) and shall be approved for fire protective service. Horn/Strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances.
  2. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

3. The speaker shall meet requirements for Voice/Tone Notification Appliances.
  4. Strobes shall be powered independently of the sounder with the removal of factory installed jumper wires.
  5. The speaker/strobe shall operate on a coded or non-coded power supply.
- G. Synchronization Module:
1. The synchronization module shall be listed to UL-464 and shall be approved for fire protective service.
  2. The module shall synchronize strobes at 1-Hz and horns at temporal-3. The module shall be capable to silence the horns on horn/strobe models, while still operating the strobes, over a single pair of wires.
  3. The module shall be capable of multiple zone synchronization by daisy chaining multiple modules together and re-synchronizing each other along the chain.
  4. The module shall not operate on a coded power supply.
- H. Voice/Tone Notification Appliances:
1. Comply with UL 1480.
  2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
  3. High-Range Units: Rated 2 to 15 W.
  4. Low-Range Units: Rated 1 to 2 W.
  5. Mounting: Flush in ceiling is preferred, with semi-flush in wall where necessary.
  6. Matching Transformers: Tap range matched to acoustical environment of speaker location.
- I. Remote Indicating Light:
1. Visual LED annunciation with active current regulator.

## **2.09 MODULES**

- A. Addressable Dry Contact Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices to one of the FACP SLCs. It shall connect via two (2) wires to the FACP signaling line circuit.
  2. The monitor module shall mount in a 4-inch square, 2-1/8-inch deep electrical box.
  3. The IDC zone shall be suitable for Style-D or Style-B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
  4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4-inch x 1-1/4-inch x 1/2-inch. This version need not include Style-D or an LED.
- B. Two Wire Detector Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional two (2) wire smoke detectors or alarm initiating devices.
  2. The IDC zone may be wired for Class-A or B (Style-D or Style-B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- C. Addressable Control Module:
1. 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.



2. The control module NAC may be wired for Style-Z or Style-Y (Class-A/B) 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.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main FACP or from a supervised UL listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6-amps at 30-VDC.

## **2.10 GUARDS**

- A. Stopper-II (STI-1100 with horn) for all existing and proposed manual pull station(s) .
- B. STI Damage Stopper model or equivalent guard for horn/strobes. Specify UL-listed metal guards on detector heads and Lexan guards on horn/strobes in corridors, staircases, gymnasiums, locker rooms, and any other areas with device mounted at less than 10-feet above finish floor.
- C. Mount all speaker/strobes per ADA and provide UL listed, for the system provided, wire guards on detector heads and Lexan guards on speaker/strobes in corridors, staircases, gymnasiums, locker rooms, and any other areas with device mounted at less than 10' above finish floor. Guards shall pre-approved by the DPS.

## **2.11 GRAPHIC ANNUNCIATOR**

- A. Follow current version of Denver Fire Department “Guideline for Graphic Wall Maps”.
- B. Annunciator shall clearly indicate the location of each alarm-initiating device.
- C. Each high output LED lamp shall light when that device is in alarm.
- D. Provide a legend for each type of device.
- E. Location of the FACP and annunciator shall be shown with “You Are Here”.
- F. Initiating devices, locations of special systems, room numbers, site map, street names and the locations of hydrants, FDC(‘s), main gas shutoff, main water shutoff, fire sprinkler shutoff, main electrical shutoff, etc. shall be shown as required by Denver Amendments Sections-509.1 Item #12 and 907.2.12.1.1.
- G. Annunciator and Map(s) shall have the correct orientation and layout of the building, including a North directional arrow.
- H. Graphic Annunciators shall be located by DFD and the AHJ.
- I. Alarms shall be annunciated in the following way:
  1. A backlit point graphic annunciator shall be provided. Each fire alarm initiating device shall be identified by a symbol and illuminated. The graphic representation of the building shall be divided into logical zones as described in 12 above and as required by the AHJ. Each device shall light when that device is in alarm. A LEGEND shall be provided for each type of device used. Provide a printer integral with the fire alarm panel.
- J. The annunciator shall be located at the first responder point of entry into the building in a location approved by the AHJ. With approval of the DPS Engineering Department and the AHJ, the annunciator may be located in the main office of the school. Whenever this is done, a graphic zone map, laid out in the same format as the main graphic zone map located at the first responder point of entry, shall be provided at the locations of the other LCD annunciators and the Fire Alarm Control Panel.
- K. An additional LCD annunciator and map shall be provided in the Maintenance Office.

## **2.12 GRAPHIC MAP(s)**

- A. Mount wall map(s) in a permanent metal frame, behind Lexan. Permanently attach the framed map to the wall by the FACP.
- B. Follow current version of Denver Fire Department “Guideline for Graphic Wall Maps”.
- C. Graphic Map(s) shall be installed at Stair(s) and on each Level.

- D. Location of the Graphic Map shall be shown with “You Are Here”.
- E. Provide additional graphic zone maps in multilevel buildings. The additional zone maps shall be located on the other levels from where the main zone map is located. These zone maps shall represent only the level on which they are located.

### **2.13 ELEVATOR**

- A. As required by AHJ, add elevator recall including necessary elevator modifications per latest Denver Codes. Upgrade the elevator to be capable of Phase II operation.
- B. Contractors shall include all components for the tie-in of the existing Elevator.
- C. If the existing building elevator(s) is missing or does not have recall functions and/or Fire Hat Operation in accordance with the AHJ and Denver Fire Department; the Contractor shall be responsible for all necessary components (including electrical equipment, elevator equipment and circuitry upgrades) for the complete upgrade of the elevator in accordance with the AHJ(s) and Denver Fire Department.
- D. Shunt Trip shall be designed and installation completed in accordance with the DPS Design and Construction Standards Section 21 13 13 Wet Pipe Sprinkler Systems.
- E. Contractor is responsible to contract directly with the DPS Elevator Maintenance Contractor to gain access to or complete work associated with all Elevator Shaft(s). Contractor shall be responsible (financially and to coordinate) for all 3<sup>rd</sup> Inspections for the elevator(s).

### **2.14 LOCATIONS**

- A. Smoke sensors shall be located by the Engineer in accordance the latest adopted Edition of NFPA 72, IFC, Denver Amendments to the IFC, and the manufacturer's instructions. Even though NFPA 72 may be referenced in the specifications, it is required that the sensors not be located closer than 3'-0" to supply air diffusers or the transfer grill to the corridor and within 1'-6" of light fixtures.
- B. Smoke sensors may be omitted from closets where the area does not exceed twenty four (24) square feet and the least dimension does not exceed three (3') feet with approval of AHJ.
- C. Manual fire alarm boxes shall be located as required by the AHJ, also at all exits from Kitchens, Gyms, Boiler Rooms and Auditoriums/Stages. Pull stations shall be installed per ADA.
- D. Manual fire alarm boxes shall not be installed in chemistry labs, home economics labs, or wood and metal shops.
- E. Photoelectric smoke sensors shall be located in the following areas:
  - 1. Classrooms
  - 2. Offices
  - 3. Cafeterias
  - 4. Corridors
  - 5. Toilets
  - 6. Stairs
  - 7. Lobbies
  - 8. Vestibules
  - 9. Gymnasiums
  - 10. Electrical Rooms
  - 11. Custodial Closets, if water vapors and dust do not present a potential false alarm
  - 12. Locker Rooms, if vapors from showers do not present a potential false alarm

13. Per the Denver Fire Department, for rooms more than nine hundred (900) square feet, DPS no longer has an Administrative Modification allowing undetected corners. As a result, Contractor might need to add an additional device
- F. Rate-of-rise heat sensors shall be located in the following areas:
    1. Shower rooms
    2. Attics
    3. Crawl spaces
    4. Custodial closets with sinks
  - G. Fixed temperature heat sensors shall be located in:
    1. Boiler rooms
    2. Kitchens
    3. Kiln rooms
    4. Exterior installations
  - H. Heat sensors located in attics and crawl spaces shall be spaced in accordance with their listing with the following exceptions:
    1. The sensors must be accessible from catwalks or access doors. In existing buildings, the sensors should be located over existing catwalks. It is not required to add catwalks simply to meet spacing requirements unless directed by the AHJ to do so.
    2. Spacing may be modified in order to locate sensors where they will be accessible as acceptable by the AHJ.
    3. In crawl spaces or attics with limited access, heat sensors are to be located at the access to the space and at any equipment located in the space if acceptable to the AHJ.
  - I. Carbon monoxide sensors shall be provided in areas served by fuel fired air handling system, or in space with or adjacent to fuel fired equipment per IFC requirements.

**2.15 MAGNETIC DOOR HOLD OPEN**

- A. Magnetic door hold open release shall occur upon any alarm.
- B. Provide and install magnetic door hold open on all LMC/IMC (library) doors, gymnasium doors, auditorium doors, cafeteria / all-purpose doors, classroom doors, office doors, area separation doors and rooms greater than 100 square feet with access to the building corridors and hallway's (excluding Custodian closets, restrooms, and IDF/MDF rooms).
- C. Manual Door Hold Open Release Button:
  1. Provide manual door hold open release button in each classroom, located by the room light switch.
  2. Provide manual door hold open release button, Carling switch model #170, normally closed, SPST.
  3. Manual door hold open release button cover shall be stainless steel faceplate.
- D. Magnetic Door Hold Opens:
  1. Magnetic door holders shall be mounted in such a manner that they do not interfere with the ADA requirement of a 32" opening perpendicular to the door frame.
  2. The magnetic door holder shall be securely mounted and be vandal resistant.
  3. Some conditions may require a floor mounted magnetic door holder mounted on the wall to meet the ADA clearance and the secure mounting requirement while others may require the release mechanism in the door closer (provided by the Contractor).
  4. Coordinate mounting requirements to assure adequate support structure exists for mounting of door holders.

5. For remodel projects only, provide 10-gauge metal plate, 10-inch x 10-inch to mount magnetic door holder unless door holder is flush mounted. If mounted on a corner, make the plate 10-inch x 20-inch bent at a 90-degree angle to go around the corner. All mounting plates shall match the existing wall color.
  6. All hardware on the magnetic door holders shall be reassembled with Loctite or equal after all adjustments have been made.
- E. Power Requirements:
1. Magnetic door hold-opens and door closers with an electric hold-open feature shall be connected to a dedicated circuit from the building electrical system (120 volt AC) and shall not obtain their power from the fire alarm system or convenience outlets.
  2. The maximum number of magnetic door hold opens allowed per control relay is twenty (20).
- F. Adjust all door closers as required to function with the door holders and to provide an over travel stop by increasing resistance to protect the magnetic holders. Adjust all doors to latch from the magnetic door holder release.

## 2.16 SIGNAGE

- A. Identification signage must be installed for all equipment and modules installed above ceilings, behind access doors, or not readily accessible (identifying concealed equipment).
- B. All detectors bases, pull stations, duct detectors, control modules, etc. shall have addresses labeled with black lettering a minimum of 3/8" in height.
- C. Door Labels:
1. The Fire Detection Contractor shall provide a 1½" phonetic label, white letter on black background sign above each door indicating the room number where the detectors are located. Contractor shall use 3M double sided tape (3M 4408) on all phonetic labels. Where room numbers are permanently affixed, these signs may be deleted.
  2. Room numbers shall be installed above each door, centered on the door frame.

## 2.17 IBAS

- A. Include connection to Integrated Building Automation System (IBAS). Connect the trouble and supervisory alarms to the building Integrated Building Automation System (IBAS). Include any modifications to the IBAS to monitor these points via BAC Net or provide a module to broadcast on BAC Net. Trouble and supervisory alarms will also be transmitted to the Denver Fire Alarm Headquarters through the DFD transmitter.

## 2.18 DENVER FIRE DEPARTMENT RADIO TRANSMITTER

### A. AES SUBSCRIBER INSTALLATION

1. Installers shall obtain permit from Denver Fire Prevention Bureau. The Denver Fire Department Lineshop shall determine the location for installation of the AES subscriber unit, A.C. outlet and external antenna if required.
2. Installation requirements include:
  - a) Mount subscriber unit in accordance with Denver Fire Department Lineshop standards.
  - b) Installation of electrical outlet on circuit dedicated for fire (if surface mounting outlet then 4" square box minimum size). Installation shall be completed in accordance with the current National Electrical Code (NEC).
  - c) Install ½" E.M.T. from transformer enclosure to subscriber.
  - d) Install ½" E.M.T. from subscriber to F.A.C.P.
  - e) Pull in #12 ground wire from outlet to subscriber unit.
  - f) Install shielded solid wire (max. 18ga.) from F.A.C.P. to subscriber one (1) pair per zone. (shield will be connected only in the subscriber)
  - g) Install E.O.L. resistors in F.A.C.P. across N.O. contacts.(resistors come with subscriber)
  - h) F.A.C.P. will have NO city disconnects if currently installed they shall be removed.
  - i) F.A.C.P. output will include a minimum of Alarm, Trouble, and Supervisory (if required). Inform the Lineshop of any special alarm requests.

- j) If external antenna is required 3/4" E.M.T inside to 3/4" rigid outside. No use of L.B's or pulling L's are allowed. The minimum bend radius is 1". Rigid conduit will be grounded per N.E.C. Typical installation will require 2 weatherproof gutters. Install per figures B and C. Pull in a pull string, the LMR-400 coax cable will be pulled in at the time of antenna installation (long pulls may be done prior to antenna install coordinate with Lineshop). Lineshop will terminate coax and install antenna.
  - k) Lineshop will program and terminate wires in subscriber unit.
3. The following parts will be required to be purchased: AES subscriber, the appropriate battery, and transformer for this subscriber. The subscriber unit shall be sent directly to the Lineshop from AES. An external antenna with poly phaser and coax cable may also need to be purchased and will require a survey by the lineshop to determine the need. The Denver Fire Department will own all of the equipment and will be responsible for maintenance on the equipment.
- a) AES subscriber model 7788F on DFD frequency 460.325 MHZ (for options the color is RED and 8 E.O.L. inputs)
  - b) Battery 12V 7.5 AH sealed lead acid (up to 9AH acceptable case dimensions approx. 6"Lx 2.5"Wx3.75"H prefer F1 terminals)
  - c) Transformer Amesco 16.5VAC 40 VA, AS-XF-1640Y (possible source approved dealers or ADI 303-777-1660)
  - d) Antenna AES # 7210-6-UC (if needed)
  - e) Poly phaser # IS-50NX-C2 ( if needed) (possible source Hutton 303-371-8182) the poly phaser from AES is also acceptable #7230
  - f) LMR-400 coax cable (if needed) (possible source All Cable 303-295-0106)
4. Note items a) and d) need to be ordered through approved vendors. Use your own suppliers for the remaining items.
5. Contact the Denver Fire Department Lineshop with questions 720-913-1820

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. The Fire Alarm Control Panel (FACP) cabinet, AEC cabinets, interface cabinets and any N.A.C. cabinets shall be grounded to either a cold water pipe or grounding rod.
- B. Plastic anchors and percussion driven fasteners are prohibited.
- C. Synchronize visual notification devices when multiple devices are in a line of sight. Synchronize the circuit at the individual floor terminal cabinet.
- D. The Fire Detection Contractor shall not place N.A.C.'s and relays above ceilings or in MDF/IDF/DATA rooms.
- E. Smoke detectors shall not be located less than eighteen (18") inch from any light fixture and not less than three (3') feet from any HVAC ceiling mounted diffuser or fan.
- F. Relays shall be identified of their location inside the FACP on a directory card.
- G. Auxillary controls shall have bypass buttons programmed for dampers, door mags (MHO's), elevators and when initiated will give an audible and visual trouble.
- H. The Fire Detection Contractor shall have an employee with Nicet-II (in fire alarm technology) on the project premises at all times that work is being performed through final acceptance by DPS.
- I. Initiating Devices (smoke and heat detectors) shall not be installed until after all drywall work and painting have been completed by the Contractor. Initiating Devices installed prior to the completion of all drywall work and painting shall be removed and replaced with new (un-cleaned) Initiating Devices (Used/re-manufactured equipment will not be allowed).
- J. During the installation, the Fire Detection Contractor shall provide emergency repair service for the fire detection system within four (4) hours of a request by the District. Service shall be available twenty four (24) hours per day, seven (7) days per week.

### **3.02 FIRE WATCH**

- A. If at any time during construction of this project, the AHJ determines that a fire watch is required due to Contractor delays, methods, or sequencing of construction, the Contractor shall be responsible for the cost of such watch and obtain all permits required and pay for all project delays and fees as a result of Fire Watch.
- B. **Where a Fire Detection System is being installed to replace an existing Fire Detection System, or an existing Fire Detection System is being modified, or a building is under construction (partial or full), the existing Fire Detection System or Temporary System shall remain fully operational at all times. Denver Fire Department (DFD) requires a Fire Watch for the following conditions:**
1. Procedures While School is in Session, including all After School Activities:
    - If the Fire Detection System must be taken off-line, disabled for any reason, or becomes inoperable, a Uniformed Denver Fire Department Fire Watch is mandatory.
    - The Contractor must coordinate any Uniformed Denver Fire Department Fire Watch through the DPS and Denver Fire Department. Upon receiving notification, the DPS must notify Andy Raicevich, DPS Supervisor Community Use and Service Coordination Center (SCC) at (720) 423-4152.
    - The Contractor must obtain a Fire Watch Permit and is responsible for all permitting fees.
    - The Contractor shall pay for the Denver Fire Department Uniformed Fire Watch.
    - Contact Denver Fire Department for the current hourly Fire Watch rates.
  2. Procedure While School is not in Session, and the Contractor would like to disable the Denver Fire Department Bronco Box or the Denver Fire Department AES Transmitter:
    - The Contractor must obtain a Denver Fire Department Fire Watch Permit and is responsible for all permitting fees and Fire Watch costs. Denver Fire Department will review each Fire Watch Permit request and determine which of the following types of Fire Watch will apply:
      - a) Denver Fire Department – Uniformed Fire Watch
      - b) DPS Security or a Bonded Company Identified by DPS Security
      - c) Contractor Fire Watch
    - If Denver Fire Department allows a DPS Security, or a Bonded Company identified by DPS Security, or a Contractor Fire Watch; the Fire Watch shall be in accordance with all Denver Fire Department requirements and the following Denver Public Schools requirements, including but not limited to:
      - a) DPS Security, or a Bonded Company identified by DPS Security, or the Contractor; shall be designated the Responsible Party(s). The Contractor shall be solely responsible for all fees associated with the Fire Watch.
      - b) The Responsible Party(s) must provide a copy of the Emergency Reaction Plan to Fire Watch personnel and the DPS.
      - c) The Fire Watch is in effect during all construction hours and afterhours (if required by DFD). Only the Responsible Party(s) shall conduct the Fire Watch.
      - d) **THE RESPONSIBLE PARTY(S) CONDUCTING THE FIRE WATCH MUST HAVE NO OTHER DUTIES.**
      - e) The Contractor must provide specific work days and times the system is scheduled to be off-line. The Responsible Party(s) must call the DFD Systems Off-Line in accordance with DFD Fire Watch Permit requirements at (720) 913-3430 prior to taking any system off-line from the monitoring agency. The same number shall be used to inform the DFD Duty Officer that the system has been returned to normal operation. This will be a daily occurrence during the Fire Watch.
      - f) **AT THE END OF EACH WORK SHIFT, THE SYSTEM MUST BE BACK ON-LINE AND ALL DETECTORS MUST BE UNCOVERED.** (Based upon the Construction Activities, DFD may amend these requirements on the Fire Watch Permit)
      - g) The Responsible Party(s) doing Fire Watch **MUST HAVE MEANS OF 911 NOTIFICATION.**
      - h) The Responsible Party(s) **MUST WALK THE FLOOR(S)** in the affected area a minimum of every 30 minutes.

- i) The Responsible Party(s) **MUST MAINTAIN AND COMPLETE THE DFD DAILY LOG** and track all issues and concerns during the Fire Watch. **THE DFD LOG MUST BE FAXED** by 10:00 pm daily to (720) 913-3596 and forwarded to the DPS.
- j) If for any reason the Fire Detection System becomes disabled/ damaged during the Contractor Fire Watch, the Responsible Party(s) must immediately contact Denver Fire Department Dispatch at (720) 913-2400 (notifying the Duty Officer). Additionally, the Responsible Party(s) will complete the following:
  - Contact the DPS.
  - Hire an Approved DPS Fire Detection Contractor to complete the necessary repairs.
  - The Approved DPS Fire Detection Contractor must obtain a City and County of Denver 3A Permit to complete the repairs.
  - The Building will remain on Fire Watch until the system has been repaired; inspected, tested, and all applicable permits have been signed off by the AHJ (City and County of Denver and Denver Fire Department) and DPS QA/QC and the DPS.
- k) Fire Watch procedures are to remain in effect until the Fire Detection System is repaired, operable, and tested. Please contact the DFD Testing Section at (720) 913-3480 to schedule the system test.
- l) The Responsible Party(s) must notify the DFD Assistant Chief at (720) 913-3466 and/or the DFD Administrative Captain at (720) 913-3460 when the system is on-line and functioning.

**3. Additional Contractor Responsibilities:**

- It will be the responsibility of the Contractor to manage and preserve the functioning ability of the Fire Detection System during construction. The Contractor must properly protect all components of the Fire Detection System throughout the construction area to ensure the functionality and cleanliness of the system. If the Fire Detection System is compromised, the Contractor will be responsible for any and all repairs to the system.

**3.03 TESTING**

**A. Fire Detection and Fire Suppression Onsite Construction Inspections:**

- 1. The System Design Engineer, Architect (if applicable), and DPS shall confirm the following items prior to completing the Contractor Pre-Test:
  - a) Spacing and coverage requirements for each type of detector installed.
  - b) Detectors shall not be installed within three (3') feet of any mechanical fans, heaters, grilles, registers or diffusers.
  - c) Detectors shall not be installed within eighteen (18") inches of any lighting.
  - d) Devices and suppression piping are not to be installed within four (4') foot of any equipment, includes but not limited to climbing ropes or wall, gymnasium equipment, etc.

**B. Procedures Prior to any Contractor Pre-Test or Denver Fire Department Test:**

- 1. Contractor must submit the Proposed Graphic Panel Map for approval a minimum of four (4) weeks prior to any Contractor Pre-Test and/or Denver Fire Department Test. This will allow both DPS and the Contractor adequate time to review, build a new or modify the existing Graphic Map, complete the installation or modifications, and time for the Contractor to test the Graphic Map prior to any Denver Fire Department Test.
- 2. For all projects involving testing of any Flow or Tamper Switches for the Fire Suppression System or new Fire Alarm Control Panel installations, the Contractor must make provisions to have a Certified Fire Suppression Inspector/Tester attend the DFD Fire Department Test.
- 3. For all projects involving testing of any Elevator(s), the Contractor must make provisions to have the Certified DPS Contracted Elevator Technician attend the Contractor Pre-Test and DFD Fire Department Test. The Contractor is responsible for all associated costs for the Certified DPS Contracted Elevator Technician.

**C. Procedure for Fire Alarm Test:**

1. Testing shall be in accordance with NFPA 72, Chapter 7, as amended in Part I, UFC Standard 10-2.
2. The Contractor must have all applicable Permits signed off by the AHJ prior to completing the Contractor Pre-Test and DFD Test (*this includes the Rough-in signoff for the City and County of Denver #3A Permit*).
3. The Contractor must notify the DPS and DPS QA/QC at least ten (10) working days prior to any Contractor Pretest date and at least ten (10) working days prior to any DFD Test date.
4. The Contractor must pretest 100% of the system for their scope of work and verify all the requirements (listed below) have been completed before calling for the DFD Test of the system.
5. The System Design Engineer, Architect (if applicable), DPS, and the Fire Detection & Fire Suppression Team must be present for all Contractor Pretest's and acceptance testing by the Denver Fire Department and subsequent Denver Fire Department testing of the completed system.
6. The Contractor is responsible for providing five (5) two-way radio's for all Contractor Pretest(s) and DFD Testing. THE CONTRACTOR IS NOT ALLOWED TO USE DPS FACILITY RADIOS FOR ANY TESTING.
7. The System Design Engineer, Architect (if applicable), DPS, and the Fire Detection & Fire Suppression Team and QA/QC must be present during all DFD acceptance testing, without exception.
8. The service of a competent, factory-trained engineer or technician (minimum NICET level 2) authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during the adjustments and tests for the system.
9. The Contractor must furnish appliances, equipment, instruments, connecting devices, two-way radios, ladders, lifts, and all personnel for the tests.
10. The Contractor must temporarily take offline the AES Transmitter prior to the start of any Pretest or Final Test. Upon completion of the Pretest or Final Test, the Contractor must place the AES Transmitter online. If the system has an existing DFD Radio Box, only the Facility Manager or Custodial Staff can temporarily take the system offline and put the system back online.
11. The DPS must confirm the Contractor and/or the Facility Manager/ Custodial Staff have taken the system offline prior to the start of any testing and must confirm the system is back online at the conclusion of each test.
12. The DPS and Contractor must verify the following fire detection systems are bypassed prior to the start of any test:
  - a) Horn/Strobes (if applicable)
  - b) Elevators (if applicable)
  - c) Magnetic Door Hold Opens (if applicable)
  - d) Mechanical Equipment (if applicable)
13. The System Design Engineer, Architect (if applicable), and the Contractor shall provide a written report of each test to the DPS.
14. At the DFD inspection, a factory-trained Project Manager of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.
15. General testing process:
  - a) Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  - b) Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
  - c) Verify activation of water flow switches.
  - d) Open initiating device circuits and verify that the trouble signal actuates.
  - e) Open and short signaling line circuits and verify that the trouble signal actuates.



- f) Open and short notification appliance circuits and verify that trouble signal actuates.
- g) Ground circuits and verify response of trouble signals.
- h) Check presence and audibility of tone at alarm notification devices.
- i) Verify the installation of all maps, signage, and that the point lit graphic is functional
- j) Check & verify the system is free of all alarms, supervisories, and troubles prior to testing.
- k) The Contractor shall provide DPS with a complete printed summary verifying that every device has been tested with a trouble and an alarm prior to final inspection authorization.
- l) All punchlists from the System Design Engineer, Architect (if applicable), DPS, and DFD shall be completed prior to final inspection authorization and "Final Acceptance" as defined in the contract documents.
- m) All relays and other power sources (door magnets, Dampers, FACP, N.A.C.'s, Remote Test Switches, etc.) shall be labeled with Electric Panel Circuit numbers and the location of the device. A card shall be installed inside the panel typewritten with the FACP electrical panel circuit number and field location followed by N.A.C.'s Point Lit Annunciator and relays.
- n) The system shall operate for three (3) days without an alarm, supervisory or trouble then the Contractor shall be authorized to proceed with final testing.
- o) Check installation, supervision, and operation of all intelligent smoke detectors using the walk test. Canned smoke (provided by Contractor and acceptable to the fire alarm equipment manufacturer) shall be used at the final inspection with Denver Fire Department to verify actuation of smoke detectors.
- p) 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.
- q) When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

### **3.04 RECORD OF COMPLIANCE**

- A. A record of compliance, Section-1-7.2 and Figure-1-7.2.1 in NFPA-72 shall be prepared for each system. Parts 1, 2 and 4 through 10 shall be completed after the system is installed and the installation wiring has been checked. Part 3 shall be completed after the operational acceptance tests have been completed. A preliminary copy of the record of compliance shall be given to the DPS and to the Architect (if applicable) prior to scheduling an acceptance test. A final copy shall be provided after completion of the operational acceptance tests.

### **3.05 FINAL INSPECTION INSTRUCTIONS**

- A. The system manufacturer shall include hands-on, on-site factory training seminars for DPS Maintenance and Operations personnel. Training shall address programming, testing and maintenance of the fire alarm system network and building control panels.
- B. The Fire Detection Contractor shall provide a typewritten "Sequence of Operation".
- C. Provide a minimum of thirty-two (32) training hours for maintenance and operator training in two (2) separate sessions.
- D. System manufacturer shall provide certificate of training to attending DPS personnel.
- E. The system manufacturer shall provide training and training manuals for up to six DPS maintenance personnel to a level equal to a "Factory-Certified Programmer." The training shall be conducted at the vendor's local office or the factory. The Contractor may elect to provide out of Denver training, however, all costs, including transportation lodging and meals will be the Contractor's responsibility.

**3.06 SOFTWARE MODIFICATIONS**

- A. For all testing, the Fire Detection Contractor shall provide the services of a factory trained and authorized technician to perform system software modifications, upgrades and changes.
- B. If another qualified Fire Detection Contractor needs to make modifications to the Fire Alarm System, installing Fire Detection Contractor shall comply with all needs of the 2<sup>nd</sup> Fire Detection Contractor.

**3.07 SPARE PARTS AND TOOLS**

- A. Provide a quantity of 5% spare bases, smoke detectors, heat detectors, duct detectors, pull stations, horn/strobes, strobes only, power supplies, relays and modules with a minimum of five (5) smoke detectors; and a minimum of one (1) device for heat detector, duct detector, pull station, horn/strobe, strobe only, relays and modules.

**3.08 WARRANTY**

- A. In addition to the DPS Design and Construction Standards Warranty requirements, the Contractor shall complete the following:
  - 1. During the warranty period, the Fire Detection Contractor shall provide emergency repair service for the fire detection system within four (4) hours of a request by the District. Service shall be available twenty four (24) hours per day, seven (7) days per week.
  - 2. Twenty-three (23) months from the date of Substantial Completion, the Contractor shall repeat the system test demonstrating the system is operational without deficiencies. All deficiencies and defective parts shall be repaired and/or replaced in accordance with DPS Design and Construction Standards.

**3.09 FIRE ALARM CONTROL PANEL (FACP) STATUS & ACCEPTANCE REPORT**

**DENVER PUBLIC SCHOOLS  
FIRE ALARM CONTROL PANEL (FACP) STATUS & ACCEPTANCE REPORT  
(To Be Completed Prior to the Start of Construction)**

<b>This FACP Status &amp; Acceptance Report will document the condition of the Fire Alarm Control Panel and Components prior to the start of any construction within the building.</b>			
<b>School:</b>			
<b>FACP Manufacturer:</b>		<b>FACP Model:</b>	
<b>Project Number:</b>		<b>GB Number:</b>	
<b>Project Scope of Work:</b>			
<b>DENVER PUBLIC SCHOOLS</b>		<b>CONTRACTOR</b>	
<b>DPS:</b>		<b>Company Name:</b>	
<b>Phone Number:</b>		<b>Responsible Person:</b>	
<b>Cell Number:</b>		<b>Address:</b>	
<b>Email:</b>		<b>Phone Number:</b>	
<b>Construction Start Date:</b>		<b>Cell Number:</b>	
		<b>Email:</b>	
<b>During construction, the Contractor must properly protect all components of the FACP System throughout the construction area to ensure the functionality and cleanliness of the system! If the FACP System is compromised, the Contractor will be responsible for any and all repairs to the system.</b>			
<b>Current Fire Detection System Status: Circle all that apply (Normal, Disables, Troubles, Supervisory, or Ground Faults). List all deficiencies on Page 2.</b>			<b>NORMAL</b>
<b>DISABLES</b>	<b>TROUBLES</b>	<b>SUPERVISORY</b>	<b>GROUND FAULTS</b>

**LIST OF DEFICIENCIES**

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

**The DPS will forward this document to QA/QC. QA/QC will forward this document to the affected DPS Maintenance Department to remedy the deficiencies prior to Estimated Contractor Start Date.**

**Contractor Signature and Date:**

**DPS Signature and Date:**

**DPS QA/QC or DPS FA/FS Department Signature and Date:**

**DPS Maintenance Department Signature:**

**DATE OF CORRECTION BY DPS MAINTENANCE DEPARTMENT**

**DPS Maintenance Department Signature & Completion Date  
(UPON COMPLETION, FORWARD COPY TO QA/QC):**

**END OF SECTION 28 31 11**