

ELECTRICAL DESIGN CRITERIA

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ELECTRICAL DESIGN CRITERIA

I GENERAL

- A. The Design Professional shall use this document in conjunction with the Educational Specifications, and District Master Specifications (DMS) to develop the design and contract documents
- B. Goals:
 - 1. Design the project to USGBC LEED for Schools Silver requirements see USGBC LEED for Schools Recommendation List in the Architectural Criteria for point recommendations.
 - a. Coordinate with Architect – see Architectural Design Criteria for additional goals and documentation requirements.
 - 2. Provide safe and secure life safety system for the structures.
 - 3. Provide safe useable electrical system for end users.
- C. This division contains requirements for the following elements:
 - 1. Power Distribution Systems
 - 2. Lighting
 - 3. Switching
 - 4. Electrical receptacles
 - 5. Electrical Systems
 - 6. General requirements
- D. In this document, the term Engineer represents the professionally qualified Design Engineer of Record or Engineering Consultant, duly licensed in the State of Florida, that signs and seals project construction documents.
- E. The Engineer is the person responsible for the design and development of all project documents.
- F. Design shall incorporate the latest design or code requirements.
 - 1. National Electric Code, NEC
 - 2. Illuminating Engineering Society of North America, IES
 - 3. Florida Building Code, FBC
 - 4. Educational Specification
 - 5. National Fire Prevention Code, NFPA
 - 6. Add other references
- G. Submittal requirements as listed in procedure BD-001 – Submission for Project Documents
- H. The Criteria shall not limit or restrain the performance and liability of the Professional or Professionals responsible for the integrity and performance of the structure.
- I. The Criteria is applicable to new construction and to the remodeling and renovation of existing facilities.
- J. The use of the Criteria in this document does not exempt the Design Professionals from any federal or state code or standards controlling the design and construction of any Facility.
- K. Do not put electrical systems on the same drawings with electrical power system.
 - 1. Provide separate electrical systems drawings.

II CRITERIA

A. POWER DISTRIBUTION SYSTEMS

- 1. Normal Power:
 - a. Electrical service for new facilities shall be 277/480 volts, 3-phase, and 4-wire.
 - b. Main distribution panel (MDP, SDP switchgear) shall have a minimum 10% spare capacity (this means 10% spare ampacity and 10% spare circuit breakers).
 - c. Distribution and Branch Circuit panels shall have a minimum of 20% spare capacity (this means 20% spare ampacity and 20% spare circuit breakers).
 - d. Each school facility shall have only one electrical service as defined by NEC Article 230.
 - e. Provide only one electric meter for each school facility.
 - 1) Exception: Sports lighting installed and maintained by local municipalities (county or cities) on School District owned facilities shall have a separate electrical service and meter.

- f. Size feeder conductors to meet the maximum voltage drop of 2%.
 - g. Remodeling, renovation or addition to the existing facilities: the Engineer shall determine the adequacy of the existing service, and if necessary replace with a larger service.
 - h. The Engineer shall obtain at least the following information from the local utility company, available fault current, existing buildings maximum demand for the past 12 months, service entrance requirements including voltage load, and the location of power company transformer and primary power lines.
 - i. Main switchboard (Main Distribution Panel) shall be in a dedicated room with two (2) entry/exit doors (one door at each end of the room). One set of door(s), double if needed, must be opening to the exterior, and second door may be opening to the interior or exterior of the building.
 - 1) Doors shall open in direction of exit and shall be equipped with panic hardware.
 - j. Locate all electrical distribution panels in dedicated electrical rooms. Panels cannot be located in the storage rooms.
 - k. Step down transformers shall not be located above ceiling spaces.
 - l. Provide non-linear electrical panels to supply receptacle outlets dedicated for computers/data equipment.
 - 1) These non-linear panels shall not feed any other loads.
 - 2) Have 200% rated neutral bus bars, with the neutral feeder conductor rated at 200% of phase conductors
 - 3) Dry-type step down transformers (480 volts/ 208-120 volts) feeding non-linear panels shall be K-13 type.
2. Emergency Power
- a. The initial source of life safety branch of emergency power shall be a separate service lateral.
 - 1) Connect the emergency service feeders directly from power company transformer to an emergency power panel-board or disconnect switch.
 - b. Provide new facilities with an emergency generator.
 - c. Total load on new generator shall not exceed 80% of the generator rated capacity.
 - d. In existing schools, with major remodeling, renovations, or additions back-up emergency power source shall be from an emergency generator.
 - 1) When adding a new generator to an existing facility, make provisions to allow for future connection of entire campus to the generator system, this means sizing the new emergency generator, transfer switches, feeders, and panel-boards to supply the entire facility.
 - 2) The load on the existing generator shall not exceed 90% of the generator rated capacity.
 - e. Emergency Generators for Non-EHPA facilities:
 - 1) Emergency generator shall be LP gas or natural gas.
 - a) **DESIEL GENERTORS ARE NOT ALLOWED.**
 - b) When natural gas is available on the site, emergency generator shall be natural gas type.
 - c) When natural gas is not available on the site, emergency generator shall be LP gas with a separate and dedicated on-site storage LP gas tank for minimum of 4-hours full demand operation.
 - 2) Emergency Generators for EHPA facilities:
 - a) When natural gas is available on the site, emergency generator shall be dual type natural gas / LP gas type.
 - (1) Natural gas shall be primary and LP gas shall be back-up.
 - b) When natural gas is not available on the site, emergency generator shall be LP gas type but must have capabilities for future connection to natural gas.
 - c) All generators for EHPA facilities shall have separate and dedicated on-site storage LP gas tanks for minimum of 24-hours full demand operation.
 - 3) Provide the emergency generator system with two separate branches of power:
 - a) Life Safety and Optional Standby Loads.
 - b) Provide separate automatic transfer switches and disconnect switches for each branch.
 - 4) The following are systems that shall be connected to emergency generator:

- a) Through Life Safety Transfer Switch
 - (1) Emergency Lighting
 - (2) Exit Signs
 - (3) Elevator car Lights
 - (4) Fire Alarm
 - (5) Intercom System
 - (6)
 - (7) Fire Pump
- b) Through Optional Standby Loads Transfer Switch
 - (1) Security System
 - (2) Main Telephone Board
 - (3) Card Access System
 - (4) Video Surveillance System
 - (5) Receptacles for the EHPA
 - (6) EMS' Control Panels
 - (7) All Mechanical equipment required for EHPA
 - (8) Cooler/Freezer
 - (9) School District owned and operated lift station
 - (10) One (1) 125 volts, 20 amps receptacle in the Clinic for the refrigerator
 - (11) One (1) 125 volts, 20 amps receptacle in each School Police Office(s)
 - (12) One (1) 125 volts, 20 amps receptacle in the Media Center
 - (13) One (1) 125 volts, 20 amps receptacle in Principal's Office
 - (14) One (1) 125 volts, 20 amps receptacle in the Dinning room
 - (15) One (1) 125 volts, 20 amps receptacle in the Gymnasium
 - (16)
- 5) Transfer life safety loads to generator within 10-seconds of normal power loss, transfer optional standby loads to emergency generator within 30 to 60 seconds of normal power loss.
- 6) Locate the emergency generator and automatic transfer switches in a dedicated, two hour fire rated room with doors opening directly to the outside.
 - a) Provide generator room with emergency lighting connected to the generator and a wall pack battery light connected to room emergency circuit ahead of room lighting switch.
- 7) Generators for the facilities designated as an EHPA shall have two remote annunciator panels; one in the EHPA managers' office and second in the main administrative office area.
- 8) Emergency system overcurrent devices shall be selectively coordinated with 0.1 second response time.
 - a) Project Electrical Engineer (Engineer of Record) must submit a signed and sealed letter to the Building Department certifying that installed emergency power system is a selectively coordinated system and meets the requirements of NEC Article 700 and District Design Criteria.
- 9) Spaces with unit equipment emergency lights shall utilize wall pack battery lights connected to local lighting circuit ahead of any switching.
- 10) Connect self-powered exit signs to local lighting circuit ahead of any switching.
 - a) Provide self-powered exit signs in facilities without a generator.
- 11) Provide battery back up for the fire alarm panel.
- 3. Provide Surge Suppression Devices for Power Distribution Equipment as noted below:
 - a. Normal and Emergency main service entrances equipment (panels).
 - b. All distribution and branch circuit panels for computer loads and electronic lighting.

B. LIGHTING

- 1. General
 - a. Pole mounted lighting fixtures shall have fuses in the base of the pole, not at the top or in the light fixture.

- b. When possible use remote ballast light fixtures for pole mounted lighting fixtures.
 - c. Provide illumination computations for all non-standard layouts
 - d. DO NOT use Coffered type light fixtures in any SDPBC school or ancillary facilities.
 - e. Avoid placing light fixtures directly above projection screens; if necessary provide switching of the fixture allowing teacher control of fixture.
2. Average Maintained Light levels
- a. Classroom Lighting 50-55 FC
 - b. Laboratories & Shops 55-60 FC
 - c. Computer Laboratories 50-55 FC
 - d. Media Center 50-55 FC
 - e. Cafeteria 45-50 FC
 - f. Kitchen 60-65 FC
 - g. Administrative Offices 50-55 FC
 - h. Teacher Planning Spaces 50-55 FC
 - i. Corridors and Stairs 20-25 FC
 - j. Gymnasiums 50 -60 FC
 - k. All Other Interior Areas (refer to IES recommendations)
3. Exterior Lighting
- a. The LEED Team shall evaluate using lighting complying with the requirements of SS Credit 8 Light Pollution Reduction and provide recommendation to SDPBC PM.
 - b. Minimum of two foot-candle for walkway covers and canopies.
 - c. Provide an average of one foot-candle for building perimeter lighting.
 - 1) Provide wall packs around the perimeter of the buildings and adjacent to all entrances to the building.
 - d. Provide an average of five foot-candle at building entrances.
 - e. Provide a minimum of one (1) foot-candle for the courtyards.
 - f. All fixtures shall be high-pressure sodium or metal halide, or fluorescent or LED type.
 - 1) HID fixtures on emergency circuit shall have quartz re-strike.
 - g. Locate lighting fixtures for the aluminum (metal) canopies and walkway covers on the columns with branch circuit conduits extended underground to the base of each column.
 - h. Minimum of five (5) foot-candle lighting in open chiller plants controlled by four hour timer switch.
 - i. Parking Lot and Bus Loop areas
 - 1) Minimum maintained of one (1) foot-candle with maximum to minimum ratio of 10 to 1.
 - 2) Coordinate location of light poles with the architectural and landscape site plans to avoid conflict with trees.
 - 3) All luminaries shall be HPS, or metal halide, or LED..
 - 4) Maximum wattage of luminaries shall be 400 watts.
 - 5) Maximum mounting height for light poles shall be 25 feet.
 - j. Lighting spillage and glare into residential properties at a minimum shall meet the Palm Beach County Lighting Ordinance.
 - k. All light fixtures installed on exterior buildings walls and walkway covers shall be of type with shields to provide full cutoff light distribution.
4. Sport fields
- a. Discuss the design criteria with SDPBC Electrical Engineer prior to designing.
 - 1) Provide lighting for all high school sports fields unless waved by School District.
 - 2) Sports fields lighting shall meet recommendations of IES and School District requirements.
 - 3) Lighting to cover all bleacher areas of the High School stadium, both above and below seating area.
 - 4) Provide stadium bleachers with minimum of 10-foot-candle lighting.

- 5) Provide below the stadium bleachers and exit pathways from bleachers with minimum of 2-foot-candle lighting.
 - b. Install sports lighting on the same electric meter main buildings, unless another municipality (county or city) is maintaining and paying for the lighting.
 - c. Provide one - 1000 watt incandescent or quartz light fixture on each pole and supplied by building emergency power for re-strike purposes.
 - d. Sports fields lighting fixtures shall be metal halide.
 - e. Provide provisions (conduits and wiring for power and controls) for sports-fields scoreboards.
 - f. Provide provisions for football field pole mounted speaker systems, verify requirements with School District.
 - g. Provide non-lighted sports fields (baseball, softball, and multi-purpose fields) with spare conduits for future lighting.
 - 1) Each field shall have 1-4" conduit extended from main electrical room to an underground pull box near the fields.
 - h. Provide normal and emergency illuminations at all means of egress from stadium bleachers.
5. Emergency lighting
- a. Requirements refer to FBC and NFPA requirements.
 - b. Provide two luminaries connected to emergency power in each area where emergency lighting is required by FBC or NFPA.
 - c. Provide additional emergency lighting in all electrical rooms, elevator equipment room, elevator cab, mechanical rooms, central receiving, and teacher dining area/lounge.
 - d. Provide switches for all emergency lights.
 - e. Use relays for automatic switching of emergency lighting (where emergency lighting is required by FBC or NFPA).
 - f. Provide relay interlocks and on/off switches for emergency lights installed in classroom, corridors, group toilets, stairs and office areas to prevent 24 hours per day operation
 - g. Each light fixture on emergency branch circuit in the stairs shall have minimum two ballasts and two lamps.
 - h. Provide one light fixture un-switched and connected to emergency branch circuit in each elevator lobby.
6. Incandescent light fixtures
- a. Avoid using incandescent light fixtures unless it is absolutely necessary in such areas as stage and theatrical lighting.
 - b. Provide down light fluorescent PL and general purpose fluorescent fixtures for non-performance hours.
 - c. Extensive use of compact fluorescent is highly recommended.
 - d. Designer may also consider LED lighting, especially in high locations, which require special equipment to change the lamp.
7. Fluorescent lighting fixtures
- a. In all facilities shall be electronic lighting using electronic type ballast's T-8 lamps (4100°K).
 - b. Fluorescent fixtures may have one, two, three or four lamps as needed.
 - 1) Fixtures with three and four lamps shall have single ballast to support all lamps.
8. Stair Ways and Ramps
- a. Locate fixtures over landing, not stairs.
 - b. Locate fixtures a maximum of 10' above the landing level.
- C. SWITCHING
1. The LEED Team
- a. Shall evaluate using available daylight and follow the Collaborative for High Performance Schools (CHPS) High Performance Classroom design then provide recommendation to SDPBC.
 - 1) Circuits parallel to window walls shall enable those fixtures be dimmed or off in response to sufficient daylight.

2. Instructional technology equipment and the teaching wall
 - a. Shall have supplemental electric lighting and switching to enable the use of that equipment without the use of the general illumination in the classroom
3. Classrooms and all instructional spaces:
 - a. Double switching for fixtures on normal branch circuits (two level lighting) if lighting controls indicated in item C. 1 above are not used.
 - b. Control light fixtures on emergency branch circuits in all interior spaces with a separate red toggle switches via override emergency relays except as noted below.
4. Corridors and Group Restrooms:
 - a. Controlled by EMS. See section for Automatic Control of Interior lights.
5. Gymnasium, Dining, Media Center and Similar Assembly Spaces:
 - a. Locate gymnasium light switches (one set only) in a lockable cabinet near the main exit doors.
 - b. Provide multiple sets of lights switches (3 and 4 way light switches) at each main entrance to the dining room, media center, and other assembly spaces.
 - c. Control emergency lights by separate red switches via override emergency relays.
6. Rooms with multiple entrances
 - a. Provide spaces and rooms with multiple entrances with 3 and 4 way light switches located at each entrance door, but do NOT use three way automatic switches.
7. Clinics
 - a. See prototype clinic in Ed Specs.
 - b. Provide separate switches for each of the cot areas.
 - c. Each area shall have separate automatic lighting switch (switch with integral motion sensor.)
8. Automatic Control of Interior and Outdoor Lighting:
 - a. The LEED Team shall evaluate switching and dimming that responds to available daylight as recommended by the ASHRAE Standard 129 for K12 Schools and the Collaborative for High Performance Schools (CHPS) High Performance Classroom design and provides recommendation to SDPBC PM.
 - b. Interior lights supplied from normal and emergency power:
 - c. Provide an occupancy sensor in every classroom, computer lab, home economic, skill lab, art lab, resource room, and press box, concession building rooms, large storage rooms, large office, weight room and all other similar spaces.
 - 1) Occupancy sensors shall control the light fixtures in each space when the wall light switch is in "on" position.
 - d. Provide automatic light switches to control the lights in the small non-instructional spaces of less than 300 square feet such as teacher planning rooms, small offices, small storage rooms, single group toilets, custodial rooms, and other similar rooms.
 - 1) Three way automatic switches not allowed.
 - e. Occupancy sensors shall be ceiling mounted and located in the room for best results.
 - f. Control light fixtures in the corridors, stairs and group restrooms by (EMS).
 - 1) Provide each floor of every building with one separate control point.
 - g. Control light fixtures in the gymnasium, gymnasium lobby, locker rooms, shower areas, and its restrooms by (EMS).
 - h. Control light fixtures in every large assembly area (dinning room and associated stage and kitchen, media center, auditorium) by (EMS).
 - 1) Provide each space with one separate control point.
 - i. Provide a switch for each space to override the EMS control of the lights during scheduled off hours/days.
 - 1) Override switches shall provide maximum of four (4) hours lighting.
 - 2) Override switches shall be capable of turning the lights on and off only during scheduled off hours/days.

- 3) Locate the override switches next to the wall mounted light switches for each space.
Exception: for the corridors locate an override switch adjacent to each entry door.
- j. Provide required lighting contactors for EMS control.
 - 1) Locate contactors in the electrical rooms next to the lighting panels.
- 9. Additional requirements for the interior emergency lights:
 - a. EMS shall control emergency lights in the corridors, and group restrooms.
 - 1) No manual wall mounted switches are required.
 - b. EMS shall control emergency lights in the main lobbies (administration building, gymnasium building, media building, and similar spaces).
 - 1) No manual wall mounted switches are required.
 - 2) Locate occupancy sensors as needed for maximum reliability.
 - c. EMS shall control emergency lights in the student locker rooms.
 - 3) No manual wall mounted switches are required.
 - 4) Locate occupancy sensors as needed for maximum reliability
 - d. Provide override relays that bypass occupancy sensors and EMS control upon loss of normal power.
 - 1) Emergency lights must automatically turn “on” within ten (10) seconds of the loss of normal power in the area.
 - e. Control emergency lights in all other spaces only by wall lights switches (red) via override relays.
- 10. Outdoor lights supplied from normal power:
 - a. The LEED Team shall provide evidence to SDPBC PM that the exterior lighting and associated controls have been accurately represented in the energy modeling required to comply with SS credit 8 Light Pollution Reduction and Energy and Atmosphere Credit I Optimize Energy Performance.
 - b. Energy management system
 - c. Time clocks for schools without energy management system
 - d. Divide outdoor lighting into three categories, and provide separate branch circuits and EMS controls points as stated below:
 - 1) Parking lot, service area, and bus loop area lighting.
 - a) Provide multiple branch-circuits and EMS controls points for sectional control of each area.
 - 2) Walkway and canopy lighting
 - a) Provide separate EMS control point for control of lights for each building.
 - 3) Security lighting including lights at building entrances and in the path of egress from enclosed court yards and corridors.
 - a) Connect to emergency branch circuits
 - b) Provide override relays to bypass EMS control upon loss of normal power.
 - c) Emergency lights must be automatically be turned “on” within ten second of the loss of normal power.
 - e. Sports fields' lights shall have manual controls with time clocks to override manual controls.
 - 1) Locate controls near the sports fields.
 - f. Lighting contactors shall be provided for EMS control, locate in the electrical room next to the lighting panels.

D. ELECTRICAL RECEPTACLES

- 1. Floor boxes
 - a. Do not use Floor Boxes, unless you have written permission from the District.
- 2. Location for general 20A-120 volt duplex receptacles
 - a. In Pre-K through 1st grade classrooms, provide child safety receptacles within the students reach.
 - b. Provide GFI receptacles in all elementary special needs classrooms.

- c. Classrooms: Instructional wall to have minimum of three, all other walls two plus specific requirements such as receptacles for computers, media cabinet, teacher desk station, and other equipment.
 - 1) One receptacle shall be located in the center of instructional wall.
 - 2) Location and number of receptacle outlets shall meet the requirements of the Educational Specifications' prototype classroom layouts.
 - 3) Refer to prototype classroom, music suites, and science rooms in Ed Specs for additional receptacles locations.
 - d. Corridors: Every 100 feet and maximum 25' to end of corridors
 - e. Storage and other closets: Minimum of one in each space, except as indicated on prototype classroom in Ed Specs, no receptacle in the storage room.
 - f. Multi-Purpose Spaces such as media center, cafeteria, etc.:
 - 1) Every 20 feet, maximum 15 feet to end of each wall plus requirements per Educational Specifications
 - 2) Provide outlets on each side of columns located in the media center and cafeteria
 - 3) Refer to prototype media center in Ed Specs for additional receptacles locations
 - g. Other instructional areas: Same as classrooms plus requirements per Educational Specifications
 - h. Mechanical Rooms: Minimum of two GFI.
 - i. Gymnasiums: Minimum of three per wall.
 - j. Teachers' Lounge: Minimum of eight, on four dedicated branch circuits.
 - k. Offices and teacher planning rooms: Minimum of one per wall.
 - 1) Additionally, teacher planning rooms shall have two 20 amps, 125 volts receptacles on dedicated branch circuits for future vending machines.
 - l. Secretarial Areas: Minimum of two in each wall plus requirements per Educational Specifications.
 - m. Electrical Rooms: Minimum of one GFI.
 - n. Provide a single receptacle outlet located directly under EWC cabinet unless the EWC's manufacturer requires otherwise.
 - o. Custodial Closets: Minimum of one GFI each closet.
 - p. Custodial/Central Receiving: Provide two receptacles each wall at 4' AFF, plus receptacles for washer/dryer, refrigerator, and vending machines.
 - q. Exterior: Every 250', maximum 50' to end of building, weather proof GFI.
 - r. Provide service outlets at 125 volts, 20 amps within 25' of HVAC equipment on the roofs and grounds.
 - s. Chiller plants: four 125 volts, 20 amps, outlets (one on each wall), on two separate branch circuits.
3. Specific location special requirements for electrical outlets
- a. Cart Storage/Charging room provide charging capacities for:
 - 1) Elementary: 2 golf carts
 - 2) Middle: 3-4 golf carts
 - 3) High: 5-6 golf carts
 - b. Special safety provisions refer to FBC.
 - c. Provide special outlets for equipment required by Educational Specifications.
 - d. Kiln Rooms: Two 50-amp, 208-volt kiln outlets and one GFI 20-amp, 125-volt general receptacle.
 - 1) Control kiln outlets with a programmable time clock located in the kiln room.
 - e. Skills and Computer Labs: Provide branch circuits required for the modular furniture (furnished by School District) for minimum of 30 computers in each lab.
 - 1) Coordinate with Interior Design Coordinator for exact modular furniture power requirements.
 - 2) Provide setup for typical classroom in addition to above.
4. Color or receptacles
- a. All receptacle outlets connected to generator backed-up panels shall be red in color.

- b. All receptacle outlets for communication/data outlets shall be gray in color.
- 5. General requirements
 - a. Refer to educational specification and NEC for specific requirements and outlets for all equipment.
 - b. Maximum of six duplex convenience receptacles on any branch circuit.
 - c. Provide a dedicated receptacle at each appliance rated for 120 volts, 750 watts and more (EWC, refrigerator, microwave, toaster, coffeemaker, washer, etc) supplied from a dedicated branch circuit.
 - d. Drawings shall be coordinated so those receptacle outlets are not located behind cubbies, shelving, and cabinets.

E. ELECTRICAL SYSTEMS

- 1. General
 - a. Do not put electrical systems on the same drawings with electrical power system, provide separate electrical systems drawings.
- 2. Energy Management System (EMS)
 - a. New facilities shall have an energy management system in accordance with DMS.
 - b. The LEED Team shall provide evidence to SDPBC PM that the control logic in the EMS and the building energy systems modeling required for EA Credit 1 Optimize Energy Performance are consistent no later than the completion of Design Development.
 - c. The EMS shall control the irrigation pump.
 - 1) In addition, the control shall be in accordance with credit requirements for Water Efficiency Credits 1.1 and 1.2 Water Efficient Landscaping.
 - 2) The LEED Team shall coordinate the information for programming the irrigation system control logic between the civil engineer, landscape architect, design architect, and the mechanical, electrical, and plumbing engineers.
 - d. Connect the power metering device(s) at main switchboard(s) to EMS.
 - e. In a hurricane shelter facility, connect all EMS panels controlling shelter equipment to the optional branch of the generator.
 - f. Provide riser diagram for energy management system.
 - 1) Rooms housing main equipment and building boundaries and levels shall be identified on the riser diagram.
 - g. For stadium elevators and elevators that open to the exterior of a building, provide a float switch in the elevator pit connected to the Energy Management Control System (EMCS) to send an alarm signal to the EMCS monitoring station when the water level in the pit reaches above the steel grate of the dry sump.
 - 1) General contractor shall coordinate the installation of the raceway system for the float switch.
 - 2) General contractor shall coordinate with the elevator inspector.
 - h. Underground EMCS conduits shall be minimum 2 inches.
- 3. Lightning Protection System
 - a. Evaluate new facilities using the Risk Assessment Guide in NFPA 780, and provide protection accordingly.
 - b. Installation of the lightning protection system shall be in accordance with DMS.
 - c. DO NOT install copper lightning protection materials on aluminum surfaces.
 - d. DO NOT install aluminum lightning protection materials on copper surfaces.
 - e. Provide lightning protection for buildings, covered walkways, press boxes, scoreboards, and all other structures required and/or recommended by NFPA 780.
- 4. Fire Alarm System
 - a. New facilities shall have a fire alarm system in accordance with DMS.
 - b. Where codes allow smoke detector or heat detector, provide heat detector to minimize false alarms.

- c. In non-sprinklered facilities, provide ceiling mounted smoke detectors in media center reading room/stacks, student records room, and stage.
- d. In non-sprinklered facilities/buildings, provide heat detector in group restrooms.
- e. Provide weatherproof horns/strobes near every main exit door (exit from the building, not exit from a single space) on the exterior of the buildings.
- f. Provide strobe lights in corridors, classrooms, all restrooms, instructional spaces, media center, cafeteria, kitchen, locker room, conference room, lobby, and any other common use area.
- g. A fire alarm strobe light is not required in an employee only work area space such as an office.
- h. Provide horns in accordance with NFPA 72.
- i. Synchronize all strobe lights in the same room or adjacent spaces visually open to each other.
- j. Fire alarm control panel shall not have a drill switch.
- k. Electrical systems drawings shall show fire alarm shut down relays adjacent to the equipment it controls.
- l. In EHPA facilities locate the fire alarm control panel in EHPA manager's office.
 - 1) Remote fire alarm annunciator panel shall be located in the main office.
- m. Provide a wire guard for fire alarm horns/strobes in gym.
- n. Fire alarm circuits and devices may be Class A or Class B, Class B is allowed with the following conditions:
 - 1. No more than devices on one circuit than 80% of the manufacturer's design capacity.
 - 2. The end line resistors shall be located in the fire alarm terminal cabinets.
 - 3. Any construction on an active campus requires hand excavation in locations within 10 feet of any known or suspected location of utility or wiring.
For Class A fire alarm system the minimum separation between the outgoing and return conduits shall be 4 feet where the conduits are installed horizontally and one foot where the conduits are installed vertically.
 - 4. Additions/renovations to the existing facilities shall continue utilizing the same wiring method (class A/B) as the existing fire alarm system.
- o. Provide fire alarm pull station at the exit door from the administration reception area.
- p. If there is no door between an interior group toilet room and the corridor and the sound level of the horns in the room meets the code requirements, provide strobe light only and no horn.
 - 1) Provide horn/strobe if the toilet room has door.
- q. Initiation of elevator lobby, top of shaft, or machine room smoke detectors shall recall the elevator to the designated or alternate level.
- r. Heat and smoke detectors shall not be located in a direct air-flow or closer than 3' from a supply air or return air diffuser.
- s. Provide an emergency voice evacuation system in auditorium, gym, and cafeteria per NFPA 101.
- t. The activation of the facility's fire alarm system shall not activate the NFPA 96 exhaust hood fire suppression system; however the activation of the hood's system shall activate the facility's fire alarm system.
- u. Provide surge protection devices on all wires that enter and leave the fire alarm control panels and booster panels.
 - 1) Provide surge protection devices on all wires that enter and leave the buildings.
 - 2) Provide surge protection devices on all 120-volt power circuits serving the fire alarm control panels and booster panels.
- v. Show all fire alarm devices on the fire alarm riser diagram.
- w. Fire alarm system shall comply with the State Fire Marshal Rule 69A-58.
- x. In all School District Owned Buildings with a fire alarm system, provide heat detectors in all unoccupied or unsupervised spaces, if the buildings are not sprinklered.
 - 1) Heat detectors are not required, in spaces protected by automatic sprinkler head.
- y. There shall be fire alarm relay(s) in each mechanical room to shut down the required fans.
 - 1) EMCS shut down of the fans for fire alarm shut down is not acceptable.
- z. Fire alarm control panel shall monitor fire pump fail, fire pump run, and fire pump phase reversal.

- aa. Provide high temperature heat detector in press box.
 - bb. If there are two strobe lights in one room, they are required to be on opposite walls.
 - cc. All fire alarm devices in open-air areas exposed to exterior elements shall be weatherproof.
 - dd. Provide fire alarm pull station at the doors to stairs on upper levels.
 - ee. Provide riser diagram for fire alarm system indicating any rooms housing main equipment, and show all building boundaries and levels on the riser diagram.
 - ff. Provide battery back up for the fire alarm system.
 - gg. Fire alarm control panel or a fully functional remote annunciator panel shall be located in Administration Reception Area.
 - hh. If the main fire alarm control panel does not have voice evacuation capability, the voice evacuation sub-panels for auditorium, gym, and cafeteria should be located in auditorium lobby, gym lobby, and cafeteria stage.
 - ii. In a high school facility or middle school facility with many buildings, the fire alarm system shall be configured in a network / node configuration utilizing fiber optic backbone wiring between building's control panels and the campus control panel.
 - jj. Duct smoke detector is not required in the return air duct of the air conditioning unit, if the return air volume is not greater than 15000 cfm.
 - kk. In order to avoid the nuisance pulls of the fire alarm pull stations in fully sprinklered campus, the designers should take advantage of the exceptions provided in the NFPA 101-2005: 14-3.4.2.3.2 and in the FBC 2007: 907.3.1 to reduce the quantity of the pull stations.
5. Security System
- a. New facilities shall have a security system in accordance with DMS.
 - b. The designer of the security systems shall coordinate the design with the School Police Department.
 - c. Locate the security system main terminal cabinet within 95' of the security system antenna.
 - d. Provide conduit from the nearest security cabinet to the fire alarm main terminal cabinet.
 - e. Provide conduit from the main security cabinet to the main telephone room.
 - f. Provide 120V receptacle fed from normal power and 120V receptacle fed from optional branch of the generator at main security terminal cabinet.
 - g. Obtain installation details from the School Police Department.
 - h. Contractor shall provide a complete security system per DMS Section 28 16 00 (16722), except the owner pulls security wiring and installs security devices.
 - 1) Contractor shall provide pull wires in conduits.
 - i. Provide riser diagram for security system indicating any rooms housing main equipment and show all building boundaries and levels on the riser diagram.
 - j. Designer shall meet with the School Police Department at the beginning of the design to discuss the scope of the project.
6. Video Surveillance System
- a. New facilities shall have a video surveillance system in accordance with DMS.
 - b. The designer of the video surveillance systems shall coordinate the design with the School Police Department.
 - c. Provide conduit from main video surveillance cabinet to main security cabinet.
 - d. Provide conduit from main video surveillance cabinet to main card access cabinet.
 - e. Provide 120V receptacle fed from normal power and 120V receptacle fed from optional branch of the generator at main video surveillance cabinet.
 - f. Video surveillance monitoring room shall have no windows with supplemental A/C unit, and the door lock keyed separately from the other doors.
 - g. Obtain installation details from the School Police Department.
 - h. Contractor shall provide a complete video surveillance system per DMS Section 27 33 00 (16723), except the owner pulls wiring and installs devices.
 - 1) Contractor shall provide pull wires in conduits. School District Police Department determines the locations of the video cameras.

- i. Provide riser diagram for video surveillance system indicating any rooms housing main equipment and show all building boundaries and levels on the riser diagram.
 - j. Designer shall meet with the School Police Department at the beginning of the design to discuss the scope of the project.
7. Card Access System
- a. New facilities shall have a card access system in accordance with DMS.
 - b. The designer of the card access systems shall coordinate the design with the School Police Department.
 - c. Provide conduit from main card access cabinet to main telephone room.
 - d. Provide conduit from main card access cabinet to elevator machine room.
 - e. Provide conduit from main card access cabinet to gate.
 - f. Provide 120V receptacle next to each card access terminal cabinet fed from optional branch of the generator.
 - g. At each controlled door, provide 120V to electric hardware's power supply fed from optional branch of the generator.
 - h. Obtain installation details from the School Police Department.
 - i. Provide riser diagram for card access system indicating any rooms housing main equipment and showing all building boundaries and levels shall the riser diagram.
 - 1) Show power receptacles required for cabinets on the riser diagram.
 - j. Designer shall meet with the School Police Department at the beginning of the design to discuss the scope of the project.
8. Intercom System
- a. New facilities shall have an intercom system in accordance with DMS.
 - b. Provide two-way intercom for classrooms, instructional spaces, offices, teacher planning areas, kitchen, dining, stage, gym, media center, and custodial receiving area.
 - c. Provide ceiling mounted intercom speakers in corridors and areas with ceiling tiles.
 - d. Locate the speakers within 15' of the end of the corridor.
 - e. If intercom speakers mounted on the buildings do not provide adequate coverage to bus loop area, provide additional speakers at bus loop area.
 - f. Install combination call buttons and volume controls in all administrative offices, teacher planning areas, conference rooms, clinic, media center, CCTV studio, and CCTV control room.
 - 1) Expansion on existing systems:
 - a) If the intercom consol lacks enough call button stations, the intercom call button in offices with telephones may be omitted; the telephone may be a substitute for the call button.
 - b) This substitution shall be authorized in writing by the school principal.
 - 2) Office shall have intercom speaker.
 - g. Areas primarily used by the students shall have intercom call button.
 - 1) Volume control is not allowed in student occupied areas.
 - h. Do not provide intercom call button in dining area.
 - i. The intercom system shall permit 4 and 5-digit dialing.
 - j. Provide four Administrative Display Telephones for elementary schools and seven for middle schools and high schools.
 - k. Provide a protective wire cage around intercom speakers in gym.
 - l. Do not locate the intercom console in the general reception area; locate it in a space such as production/workroom.
 - m. Class change bell system shall be a tone generator through intercom system.
 - n. Provide Administrative Display Telephone outlet in EHPA manager's office.
 - o. In elementary schools, provide intercom administrative display telephones in principal's office, principal's secretary's office, one assistant principal's office, and admin reception area (total of four devices).

- p. In middle and high schools, provide intercom administrative display telephones in principal's office, principal's secretary's office, admin reception, student services reception, dean's reception, guidance reception, and grade level student services offices (total of seven devices).
 - 1) If the above-mentioned areas are more than seven, the principal will decide which seven spaces get intercom administrative telephones.
 - q. Intercom call button in classrooms shall be located at the teacher station. Location of the call button shall comply with the ADA.
 - r. Provide complete intercom rack with all card cages/power supply for full capacity of the system specified (xxx room's capacity).
 - 1) Provide required station and analog cards needed now plus 20% spares.
 - s. Provide intercom speaker(s) in-group toilets.
 - t. Provide weatherproof exterior intercom speaker near every main exit door and one every 100 feet.
 - u. Provide riser diagram for intercom system indicating any rooms housing main equipment and indicating all building boundaries and levels on the riser diagram.
 - 1) Show power receptacles required for cabinets on the riser diagram.
 - v. Do not provide administrative display telephone in media center reading room.
 - w. Intercom equipment shall have a capacity of no less than 350 room stations for high school.
 - x. Intercom equipment shall have a capacity of no less than 240 room stations for middle school and elementary school.
 - y. 1. Contractor shall provide separate intercom system (AIPHONE, not part of campus intercom system) from main office entrance door to the reception counter, principal's office, and principal's secretary's office.
 - z. Intercom speakers shall produce sound level 10 decibels above the space noise at full occupancy.
9. Public Address System
- a. New facilities shall have a public address system in accordance with DMS.
 - b. Provide public address system in media center, courtyard, cafeteria, gym, and stadium.
 - c. Provide 1" conduit for owner supplied system in the parent drop-off area.
 - d. Provide microphone outlet at satellite control system.
 - e. Provide surge protection devices on all wires that enter and leave the stadium public address consol. Provide surge protection device on 120-volt power circuit serving the stadium public address consol.
 - f. Provide riser diagram for public address system indicating any rooms housing main equipment and show all building boundaries and levels on the riser diagram.
 - 1) Show power receptacles required for cabinets on the riser diagram.
 - g. Public address speakers shall produce sound level 10 decibels above the space noise at full occupancy.
 - h. Provide three microphone outlets at stage ceiling.
10. Instructional Television System (ITV)
- a. New facilities shall have an ITV system in accordance with DMS.
 - b. Provide receiving ITV outlet in School Police Office.
 - c. Provide receiving ITV outlet in classrooms, instructional spaces, administrative spaces, conference rooms, teacher planning areas, cafeteria, gym, media center, areas with ceiling projector, covered play area, and as required by educational specifications.
 - d. Provide origination ITV outlets in cafeteria (if there is no auditorium), gym, media center, CCTV control room, auditorium control booth, press box, and as required by educational specifications.
 - e. Supporting structures for ITV antennas shall have a certified grounding system installed in accordance with NFPA 780, and certified by a contractor licensed in this field.
 - 1) Provide written certification to the District Project Manager.
 - f. Base the ITV tower wind load design on ASCE 7.
 - 1) Embedment of the ITV tower shall be in accordance with actual soil condition, and not a generic design.

- g. Coordinate location of ITV outlets with the school district's interior designer and the furniture layout.
 - h. Provide a 3" conduit with pull wire from ITV head-end to property line for cable TV connection.
 - 1) Verify the location of the conduit with local cable TV provider.
 - i. In rooms with multimedia cabinets, provide ITV outlet on the wall behind the multimedia cabinet.
 - j. Locate ITV head-end equipment in the production room in the media center/AV Storage, see prototype media center in Ed Specs for location.
 - k. Provide a quad power receptacle inside the 20"x20"x6" junction box at the base of the ITV tower.
 - l. Provide power receptacle at ITV head-end equipment.
 - m. Provide two WAN/LAN connections at ITV head-end, typically at Media Center CCTV rack.
 - n. Wire minimum of RG-6 to all "out" buildings, starting at Media Center CCTV rack and runs to out buildings, cafeterias, press boxes, gyms, to allow future ITV Productions at each facility.
 - o. Provide WAN/LAN connection at all areas with projectors.
 - p. Provide riser diagram for instructional television system indicating any rooms housing main equipment and show all building boundaries and levels on the riser diagram.
 - 1) Show power receptacles required for cabinets on the riser diagram.
 - q. Provide ITV tower installation detail and ITV tower grounding system detail on the drawings.
 - r. Architect to include in the bid documents that the ITV system installations to be performed by a licensed Communications Cabling Contractor with a minimum of five years successful experience in this field.
 - s. Use compression fittings, with the tools recommended by the manufacturer.
 - t. Provide power receptacle within 12 inches of every ITV outlet.
11. Communication System (Voice and Data)
- a. New facilities shall have a communication system in accordance with DMS.
 - b. Provide two communication outlets in the Clinic, one in Counter Area and one in Reception Area
 - c. Provide four communication outlets in classrooms one of which shall be located at teacher station.
 - d. Provide three communication outlets in resource rooms.
 - e. Provide four communication outlets in all other instructional spaces.
 - f. Provide two communication outlets in offices.
 - g. Provide minimum two communication outlets in teacher planning areas, if more than two stations, one per station.
 - h. Provide one communication outlets in stage.
 - i. Provide one communication outlet in kitchen manager's office.
 - j. Media Center: See prototype layout for locations and exact amounts, at minimum:
 - 1) Provide 8 communication outlets in media center reading area for elementary schools.
 - 2) Provide 12 communication outlets in media center reading area for middle schools.
 - 3) Provide 16 communication outlets in media center reading area for high schools.
 - k. Communication outlets requirements for computer labs and skill labs shall be in accordance with educational specifications.
 - l. Provide communication outlet in ceiling at each projector location.
 - m. Allow minimum of 5' wall space for each outlet.
 - 1) Provide quad receptacle outlet within 12" of the communication outlet.
 - n. Communication Service Room shall be the entry point for communication cables coming to the facility.
 - 1) Room size shall be minimum 320 (16 x 20) SF for middle schools/high schools.
 - 2) Room size shall be minimum 168 (12 x 14) SF for elementary schools.
 - o. Provide communication closets on each floor in each building.
 - 1) Communication closet shall be minimum 8' wide x 6' deep, with no other electrical systems in this closet.
 - p. Obtain installation details from the Network Services Department.

- q. The designer of the communication system shall coordinate the design with the Network Services Department.
 - r. Communication equipment rooms shall have dedicated secondary source of air conditioning for evenings, weekends and holidays when the chiller is shutdown.
 - s. Do not use floor outlets.
 - t. Provide one communication outlet in main security cabinet, main card access cabinet, and main video surveillance cabinet.
 - u. Provide two communication outlets in principal's conference room.
 - v. Provide communication outlet in EHPA manager's office.
 - w. Provide conduit from cash registers to kitchen manager's office.
 - 1) Locate junction box next to telephone outlet.
 - x. In media center reading room, with columns within the space, provide communication outlet and electrical receptacle on all faces of the columns facing the student sitting areas, also see prototype media center in Ed Specs.
 - y. Provide riser diagram for communication system indicating any rooms housing main equipment and show all building boundaries and levels on the riser diagram.
 - 1) Show power receptacles required for cabinets and equipment on the riser diagram.
 - z. Provide and install a mule tape 2500 pound test pull string in each of the service conduits for AT&T (Bellsouth).
 - aa. Floor outlets are not allowed.
 - bb. Cable trays are not allowed.
 - cc. Install vinyl flooring in the Communications Service Room.
12. Ceiling Projector System
- a. New facilities shall have a ceiling projector system in accordance with DMS.
 - b. The designer of the security systems shall coordinate the design with the Educational Technology Department.
 - c. Obtain detail of installation from the Educational Technology Department.
 - d. Ceiling projector system shall include complete system including junction boxes, outlets, cables, connectors, and receptacles.
 - e. Provide ceiling projector system in classrooms, instructional spaces, resource rooms, laboratories, media center reading room, cafeteria, and in any other space where projection screens are required by the educational specifications.
 - 1) Refer to Section 11 52 13 (11131) of DMS for projection screen specifications.
 - f. Group ceiling projector outlet together with power outlets and communication outlet, near the teacher station.
 - 1) Refer to projector wiring detail.
 - g. Position the security sensor junction box and the intercom speaker on the teaching wall to the left or right of the projection screen to clear the screen.
 - h. In rooms with multimedia cabinet provide outlets on the wall behind the multimedia cabinet to serve the equipment housed inside the multimedia cabinet.
 - i. Group ceiling projector outlets together with power outlets, and ITV outlet on the wall behind the multimedia cabinet. Refer to projector wiring detail.
 - j. At the start of each project, the electrical designer shall obtain the scope of technology wiring in classrooms for that project from the Educational Technology Department and design accordingly.
 - k. Provide classroom technology wiring detail on the drawings.
 - 1. Provide specific detail for every space such as classroom, cafeteria, and conference room, one typical detail covering all the spaces is not acceptable.

F. GENERAL REQUIREMENTS

- 1. Install all wiring and cable in conduit including but not limited to wiring and cable to power, fire alarm, intercom, MTAS, telephone, instructional technology, energy management, etc.

2. Open wiring for non-lifesafety systems shall be allowed in existing buildings that are being renovated or remodeled, see DMS section for open wiring for details.
3. Provide a pull wire in all empty conduits.
4. Minimum size conduit is 3/4" except as noted for specific systems, see DMS for detail requirements.
5. All wiring shall be copper.
6. Provide a grounding conductor in all conduits and raceways, size per NEC table 250-94 or 250-95, whether the grounding conductor is required by code or not except for service entrance conduits.
7. Provide installation details to facilitate a quality and well thought out installation.
8. Provide power and lighting equipment schedules and panel-board schedules on the plans and not in the specifications.
9. Generally all conduits shall be installed concealed to view, except, exposed conduits may be installed on existing block walls.
10. Give special consideration to the resulting aesthetics of electrical equipment and conduit installed exposed to view outside of equipment or storage rooms.
 - a. Give consideration to soffits and/or placement (such as in the wall/ceiling corner) so as to minimize the negative impact on the aesthetics of the facility.
 - b. This may require the addition of special notes and/or showing conduit on the plans all the way back to the panel it originates from in lieu of the traditional home run arrow.
 - c. Electrical equipment and conduit shall be painted to match the adjacent surface where exposed in finished spaces.
 - d. Exposed conduits within classrooms, offices, and corridors (existing block walls) shall be surface raceways.
11. All systems and equipment shall meet the requirements of DMS.
 - a. Provide all required systems and equipment design including special systems such as gymnasium sound system, auditorium stage lighting and sound system, CCTV, security system, telephone system, instructional technology for data, voice and video, etc. for a complete project as per requirements.
12. Fully coordinates design with other consultants such as mechanical, structural, civil, kitchen equipment, etc.
- 13.
14. Provide empty conduits and pull-boxes for future portables in all new facilities. Provide two 4" conduits for power and eight-2" conduits for systems (two 2" conduits for intercom and two 2" conduits for fire alarm).
15. DO NOT use floor outlets in classrooms, labs, or at any other location use of floor outlets (power and data) are not permitted.
16. Locate dry type transformers in the electrical rooms.
17. Do not locate manholes or pull boxes in sport fields and play ground areas.
18. Light fixtures in the stairwell shall be wall mounted at each landing/level areas with bottom at 10'-0" above finished floor or 12" below the ceiling whichever is less.
 - a. DO NOT locate light fixtures directly above the tread and risers.
19. Provide each facility with a lightning detection system.
20. Provide notes on plans indicating the following:
 - a. Prior to any trenching or excavation the Contractor shall locate all existing underground utilities.
 - b. Contractor is responsible for restoring any damage to underground utilities caused by trenching or excavating.

END OF SECTION