

26

DIVISION

ELECTRICAL

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SECTION 260513

MEDIUM VOLTAGE CABLES **601** to 35,000 VGENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for cables, related splices, and terminations.

1.2 QUALITY ASSURANCE

- A. IEEE C2
- B. NFPA 70 – National Electric Code
- C. Underwriter's Laboratory
- D. Trained and Certified Cable Splicer – by material manufacturer

1.3 CABLES

- A. UL Cable Type MV 90
- B. UL 1072, AEIC CS 8, **ICEA S-94-649**, ICEA s-97-682 compliant
- C. Conductor material shall be copper **or aluminum**
- D. Cross linked polyethylene 133 percent insulation
- E. **Bare** copper shielding wire

1.4 SPLICE KITS

- A. Comply with IEEE 404
- B. Type recommended by manufacturer

1.5 TERMINATIONS

- A. Comply with IEEE 48

1.6 INSTALLATION

- A. Install cables according to IEEE 576

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 260519****LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for building wire and cable for wiring systems of 600V or less
- B. Qualitative requirements for connectors, splices, terminations, and accessories for electrical distribution systems rated 600 volt or less.

1.2 QUALITY ASSURANCE – Copper Conductors

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory
- C. Copper Conductors NEMA WC 70.
- D. 600V Insulating Material NEMA WC 70.
- E. Armored Cable and Metal Clad Cable NEMA WC 70.
- F. Conductor Connection Torque Value UL 486A.

1.3 QUALITY ASSURANCE – Aluminum Conductors

- A. NFPA 70 – National Electrical Code
- B. Underwriter's Laboratory 1581 – table 10.1
- C. Aluminum Association 8000 series
- D. Conductor Connectors UL 486 B
- E. UL Standard 44
- F. ICEA S-95-658 NEMA WC 70

1.4 COPPER CABLE AND WIRING - 600V OR LESS

- A. Conductor material shall be copper.
- B. Wire and cable shall be rated 600V.
- C. Minimum conductor size shall be #12 AWG
- D. Type XHHW
- E. Type THHN/THWN

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- F. Type AC, 3 conductor, 75C insulation, copper conductor, armored cable.
- G. Type MC, 3 conductor, 75C insulation, copper conductor, metal clad cable.

1.5 ALUMINUM CABLE AND WIRING – 600v or less

- A. Conductor material shall be aluminum
- B. Minimum size conductor shall be No. 6 AWG
- C. Type XHHW-2
- D. 90 degree Celsius temperature rating
- E. Cable rated for 600 volts

1.6 MANUFACTURED WIRING SYSTEMS

- A. Premanufactured, relocatable, integrated electrical branch wiring system for lighting in accessible ceilings.
- B. Minimum No. 12 AWG copper wire with 600-volt, 90 degree insulation.
- C. Minimum No. 12 AWG insulated copper ground wire.
- D. Pin and socket contacts connected to branch circuit conductor.
- E. Metal constructed cable heads with corrosion-resistant heads.
- F. Designed so no interconnection can occur between different electrical voltages.
- G. System shall be completely modular in construction incorporating conversion modules, prefabricated receptacles located in top of light fixtures, modular selector cables for connecting to light fixtures, and cable extenders.
- H. System shall be capable of being manufactured to conforming to light switching arrangements required.

1.7 COPPER PERFORMANCES

- A. Type THHN/THWN or XHHW in raceway for service entrance wiring.
- B. Type THHN/THWN in raceway for feeders and branch circuits.
- C. Type THHN/THWN for exterior branch circuits.
- D. Minimum conductor size shall be #12 AWG for power circuits, #14 AWG for controls.
- E. Feeders and branch circuits shall be concealed above accessible ceilings, in walls, chases, and below slab-on-grade.

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- F. Manufactured wiring system installation shall be limited to wiring between light fixtures located in accessible acoustical tile ceilings and from junction box located above ceiling to fixtures. Conduit shall be provided from light fixture switch location to junction box located above ceiling.

1.8 ALUMINUM PERFORMANCES

- A. Type XHHW-2 in raceway for service entrance wiring, branch circuit feeders to panelboards, and distribution panels.
- B. Connectors shall be dual-rated (AL7CH or AL9CH).
- C. Aluminum conductor is not approved for branch circuits to receptacles, lighting fixtures, or mechanical/electrical motor circuits.
- D. Feeders and branch circuits shall be concealed above accessible ceilings, in walls, chases, and below slab-on-grade.
- E. Aluminum conductors shall be connected, terminated, and torque per manufacturer's recommendations.

END OF SECTION

SECTION 260526

GROUNDING and BONDING OF ELECTRICAL SYSTEMS

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for grounding for low and medium voltage systems and equipment
- B. Qualitative requirements for basic requirements for grounding for protection of life, equipment, circuits, and systems
- C. Qualitative requirements for grounding of underground distribution components.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. UL 467
- C. Bare solid copper conductors ASTM B3.
- D. Bare stranded copper conductors ASTM B8.
- E. Underground distribution components IEEE C2.

1.3 MATERIALS

- A. Minimum No. 12 AWG 600V insulated copper equipment grounding conductor insulated with green colored insulation.
- B. Stranded cable grounding electrode conductors.
- C. Bare copper conductors.
- D. Grounding bus consisting of bare annealed ¼ inch by 2 inch copper bars of rectangular cross section.
- E. Braided No. 30 AWG bare copper wire bonding jumpers.
- F. Copper clad steel 3/4 inch grounding rods.

1.4 PERFORMANCES

- A. Conduit is not an allowable grounding means.
- B. Continuous grounding conductor carried throughout the power system.
- C. Grounding of voice, video and data systems.
- D. Provide grounding of circuits, equipment, conduits and etc. as required by the NEC.
- E. Ground manholes and handholes with grounding electrode and No. 1/0 AWG bare copper conductor.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 260529****HANGERS AND SUPPORTING DEVICES****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Hangers and supporting devices for electrical components

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory

1.3 MATERIALS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel
 - 2. Concrete Inserts: Steel or malleable-iron
 - 3. Clamps for Attachments to Steel Structural Elements
 - 4. Through Bolts: Structural type, hex head, and high strength
 - 5. Toggle Bolts: All-steel springhead type
 - 6. Hanger Rods: Threaded steel

- 1.4** Hangars, supports, and fastening methods used shall be suitable for the weight of the components being supported.

END OF SECTION

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for raceways, boxes, wireways, raceway fittings, and technology raceways.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory
- C. Rigid Metal Conduit (RMC) ANSI C80.1.
- D. Intermediate Metal Conduit (IMC) ANSI C 80.6.
- E. Electrical Metallic Tubing (EMT) ANSI C 80.3.
- F. Liquidtight Flexible Metal Conduit (LFMC) UL 360.
- G. Underground Non-Metallic Conduit (RNC) NEMA TC 2, Type EPC-40-PVC.

1.3 RACEWAY MATERIALS

- A. Rigid Metal Conduit.
- B. Intermediate Metal Conduit.
- C. Electrical Metallic Tubing (EMT).
- D. Liquidtight Flexible Metal Conduit.
- E. Underground Non-Metallic Conduit.

1.4 TECHNOLOGY RACEWAY

- A. From technology outlet box provide two 1 inch conduits and extend the conduits to the associated telecommunications cable tray. Coordinate requirements with the Technology Designer.
- B. Utility Entrances
 - 1. Two 4 inch for telephone service from service pole to main technology equipment room.
 - 2. One 3 inch for cable television service from service pole to main technology equipment room.
 - 3. One 4 inch from service pole to main technology equipment room for wide area network (WAN).

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1.5 METAL WIREWAYS

- A. Sheet metal sized for conductors.
- B. NEMA 250 Type 1.
- C. Screw-on covers.
- D. NEMA 1 general purpose rating at interior of building.
- E. NEMA 3R raintight rating at exterior applications.

1.6 OUTLET C-D DEVICE BOXES

- A. Metal boxes NEMA OS 1 compliant.
- B. Cast metal, fully adjustable, rectangular floor box.
- C. Metal pull boxes NEMA OS 1 compliant.
- D. Exposed boxes cast type FS or FSA.
- E. Outlet boxes for technology shall be minimum 3 ½ inch deep.

1.7 FITTINGS

- A. NEMA FB 1 listed.
- B. Hazardous (classified) location UL 886 compliant.
- C. EMT Fittings: Metal compression or set screw type.

1.8 PERFORMANCES

- A. RNC conduit may be used under building slab on grade for branch feeder and branch circuits. Conduit shall be installed in drainage fill.
- B. RNC conduit may be used for exterior branch circuits. Encase PVC conduit in concrete when under drives and parking areas.
- C. Raceway installation shall comply with NECA 1.

ALLOWABLE CONDUIT USAGE

CIRCUIT IDENTIFICATION	ALLOWABLE TYPE CONDUIT						
	GRC	IMC	EMT**	RNC*	Flex	W.P.Flex	MC Cable
Underground secondary service entrance conduit	X			X			
Feeders to switchboards, panels, motors, transformers, exposed conduit	X	X	X				
Connections to interior light fixtures & transformers					X		
Connections to motors & motorized equipment, interior & exterior						X	
Underground interior feeder conduit	X	X		X			
Branch circuit wiring from light fixture to light fixture						X	X
Underground exterior branch conduit	X	X		X			
Exposed conduits	X	X	X				
Conduits in metal stud partitions			X				X
Conduits buried in block walls	X	X	X				
Conduits above suspended ceilings	X	X	X				
Misc. low voltage systems (fire alarm) up to 4" C size. (EMT not allowed underground or as otherwise limited above)	X	X	X				
Interior above ceiling conduits 3 1/2" and larger except as otherwise permitted	X	X	X				

* With 3 inch concrete envelope under drives and sidewalks.

** Not approved for exterior or exposed below 8 feet AFF.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS**

SECTION 260536**CABLE TRAY FOR ELECTRICAL SYSTEMS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for cable tray.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code.
- B. Underwriter's Laboratory.
- C. NEMA VE1 Cable Tray Systems.

1.3 MATERIALS

- A. Non-corrosive metal constructed center spine or wire baskets.
- B. Rungs at 9 inch on center.
- C. Wire mesh basket.
- D. Cold-rolled steel ventilated tray.
- E. Minimum size shall be 18 inches wide with 6 inch loading depth.
- F. Color coded rung caps.

1.4 PERFORMANCES

- A. Provide grounding per NFPA 70.
- B. Install per NEMA VE2.
- C. Install with ½ inch threaded rods.

END OF SECTION

SECTION 260543

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRIC SYSTEMS

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for conduits, ducts, handholes, and manholes.

1.2 QUALITY ASSURANCE

- A. NFPA 70 – National Electric Code.
- B. ANSI C2.

1.3 NON-METALLIC CONDUITS

- A. Rigid non-metallic conduit type EPC-40-PVC, NEMA TC2, UL 561.

1.4 NON-METALLIC DUCTS

- A. Rigid non-metallic Type EB-20-PVC, ASTM F 512, UL 651A.

1.5 HANDHOLES

- A. Reinforced – concrete complying with ASTM C 858.
- B. Cast-iron weatherproof frame.
- C. Cast-iron cover with “electric” or “communication” legend.

1.6 MANHOLES

- A. Reinforced concrete complying with ASTM C 858.
- B. Cast-iron weatherproof frame.
- C. Cast-iron cover with “electric” or “communication” legend.

1.7 PERFORMANCE

- A. Verify ductbank applications with local utility company.
- B. Verify loading requirements of manholes and handholes depending on locations.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 260923****LIGHTING CONTROL DEVICES****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for time switches, outdoor photoelectric switches, indoor occupancy sensors, and lighting contactors.

1.2 QUALITY ASSURANCE

- A. Underwriter's Laboratory
- B. NFPA 70 – National Electric Code

1.3 TIME SWITCHES

- A. Contact configuration: SPST, DPST, SPDT, or DPDT.
- B. Comply with UL 917.
- C. 40-amp contact rating.
- D. Electromechanical or fully electronic.
- E. Skip-a-Day mode.
- F. Astronomic time dial.

1.4 OUTDOOR PHOTOELECTRIC SWITCH

- A. Solid State with SPDT or DPST contacts required for application.
- B. 1800 VA tungsten or 1000 VA inductive load.
- C. Comply with UL 773 A.
- D. Illumination monitoring range from 1.5 to 10 foot candles with turn "on" and "off" adjustments.
- E. 15 second minimum time delay.

1.5 INDOOR OCCUPANCY SENSORS

- A. Contacts rated to operate connected relay complying with UL 773 A.
- B. Dry contacts rated for 20 amp ballast load ct 120 and 277 voH.
- C. Power supply to server shall be 24-Vdc or 150-mA.

- D. Recessed and concealed time delay and sensitivity adjustments.
- E. LED indicator to show motion is being detected.
- F. Equipped with bypass sensor override switch in case of sensor failure.
- G. Passive infrared type.
- H. Ultrasonic type.
- I. Dual technology combination of infrared and ultrasonic.

1.6 LIGHTING CONTACTORS

- A. Electrically or mechanically held type complying with NEMA ICS 2 and UL 508.
- B. Two through 12 poles field convertible contacts.
- C. 20-A tungsten lighting rating or 30-A fluorescent lighting rating.
- D. NEMA 250 type I indoor enclosure.

1.7 INSTALLATION

- A. Install and aim sensors to achieve 90 percent of area.
- B. Verify operation of each lighting control device and adjust time delays.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 261200****MEDIUM VOLTAGE TRANSFORMERS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for pad mounted, liquid filled transformers.

1.2 QUALITY ASSURANCE

- A. ANSI C57.12.26
- B. NFPA 70- National Electric Code
- C. IEEE C 57.12
- D. Underwriter's Laboratory
- E. ANSI C57.12.13.
- F. Mineral Oil ASTM D 3487

1.3 MATERIALS

- A. The mineral oil filled transformer shall be compartmental type, self-cooled and weather protected.
- B. Tap changing mechanism for accurate voltage adjustment without opening the tank.
- C. Compartments for medium and low voltage separated by a steel barrier.
- D. Surge arresters for each primary phases.
- E. Primary fuses complying with IEEE C 37.47.
- F. Arranged for radial or loop feed as required for application.
- G. Primary and secondary voltage as required.
- H. Mineral Oil tested according to ASTM D 117.
- I. Basic input level shall be standard value for primary equipment voltage per applicable IEEE standard.

END OF SECTION

SECTION 261300

MEDIUM VOLTAGE SWITCHGEAR

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for metal enclosed interruptor switchgear.

1.2 QUALITY ASSURANCE

- A. NFPA – National Electric Code
- B. Underwriter's Laboratory
- C. IEEE C2
- D. IEEE C37.20.3

1.3 METAL-ENCLOSED INTERRUPTOR SWITCHGEAR

- A. Suitable for application in 3-phase, 60 Hz, solidly grounded-neutral system.
- B. System Voltage: KV nominal to match utility voltage available.
- C. 600 amp main continuous bus rating.
- D. Power fuses to comply with NEMA SG-2.
- E. Outdoor enclosure of weatherproof steel construction.
- F. Surge arrestors to comply with NEMA LA1.
- G. Tin-plated copper or aluminum busing.

1.4 INSTALLATION

- A. Coordinate location and voltage with local electric utility and authority having jurisdiction.
- B. Provide arc flash hazard label on equipment per the National Electrical Code.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 262200****LOW VOLTAGE TRANSFORMERS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for dry type distribution transformers rated 600V or less, buck-boost transformers, and energy efficient dry type transformers.

1.2 QUALITY ASSURANCE

- A. Dry Type Distribution Transformers: NEMA TP-1.
- B. *High Efficiency Dry Type Distribution Transformers: Department of Energy CSL 3.***
- C. Buck-Boost Transformers NEMA ST 1, UL 506.
- D. Sound levels NEMA ST1-4 and ANSI C89.1.

1.3 DRY TYPE TRANSFORMERS (NEMA TP-1)

- A. Transformers shall be dry type gravity ventilated for wall or floor mounting.
- B. KVA rating shall be as denoted on the drawings.
- C. Transformers rated 7.5 kVA through 24 kVA shall have two -5 percent taps, below rated voltage.
- D. Transformers rated 25 kVA and larger shall have two 2-1/2 percent F.C.A.N. taps and four 2-1/2 percent F.C.B.N. taps, unless otherwise noted.
- E. Coils: continuous windings without splices except for taps.
- F. Insulation Class for Transformers 14 kVA and smaller: 180 degrees C, UL component recognized insulation system with a maximum of 115 degrees C rise above 25 degrees C ambient temperature.
- G. Insulation Class for Transformers 15 kVA and Larger: 220 degrees C, UL component recognized insulation system with a maximum of 150 degrees C rise above 40 degrees C ambient temperature.
- H. Cores shall be manufactured with non-ageing silicon steel.
- I. The core and coil assembly shall be mounted on vibration pads and bolted to the enclosure.
- J. Copper or aluminum windings to brace coil layers.

- K. Enclosure shall be heavy gauge steel.
- L. There shall be no metal to metal contact between the core, coil, and the enclosure.

1.4 DRY TYPE TRANSFORMER (**NEMA Premium**)

- A. Transformer shall be dry type gravity ventilated.
- B. KVA rating shall be as shown as drawings.
- C. Transformers rated 30 KVA–300 KVA shall have two 2-1/2% F.C.A.N. and two 2-1/2% F.C.B.S. taps. Transformers rated 15 KVA–500 KVA shall have one 5% F.C.A.N. and one 5% F.C.B.N. tap.
- D. Copper **or aluminum**-wound, 3-phase, common core insulation transformer built to NEMA ST20.
- E. 200% rated neutral, 60 Hz, 10kV BIL.
- F. Insulation class 220 degrees C.
- G. Labeled K Rating: K-7.
- H. Minimum efficiency shall comply with the following when tested per **10 C.F.R. Part 431 and TP-2 procedures**:

Three Phase Efficiencies	
KVA Size	Efficiency
15	97.90
30	98.25
45	98.39
75	98.60
112.5	98.74
150	98.81
225	98.95
300	99.02
500	99.09
750	98.16
1000	99.23

1.5 BUCK-BOOST TRANSFORMER

- A. Self-cooled dry type: continuous duty rating.
- B. Ventilated enclosure NEMA 250 Type 2.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 262413****SWITCHBOARDS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for switchboards and fusible bolted-pressure contact switch.

1.2 QUALITY ASSURANCE

- A. Switchboards 600 v or less: NEMA PB-2.
- B. NFPA 70 - National electrical Code
- C. Underwriter's Laboratory

1.3 SWITCHBOARDS

- A. Nominal system voltage, main bus continuous with uniform capacity for entire length of bus.
- B. Short circuit rating of 65K, 100K, or 200K to meet or exceed application.
- C. Low voltage circuit breakers to be continuous current, interrupting, and short-time current ratings for each circuit breaker suitable for use. Voltage and frequency ratings same as switchboard.
- D. Fusible switch branch units.
- E. Three-phase, four-wire configuration.
- F. Front connected, front accessible with fixed main device, panel-mounted branches and sections front and rear aligned.
- G. Tin plated copper or aluminum neutral and phase bussing.
- H. Minimum .25 by 2 inch full length ground buss.
- I. One hundred percent rated full length neutral buss.
- J. Utility Metering Compartment: Acceptable to local utility company.
- K. Integral fusible or circuit breaker type main switch.
- L. NEMA 1 enclosure.

1.4 FUSIBLE BOLTED-PRESSURE CONTACT SWITCH

- A. Labeled for use as service equipment.
- B. Manual handle operation for opening and closing.
- C. Contact interruption capability: twelve times switch rating.
- D. Ground fault relay: comply with UL 1053.
- E. Fused switch: NEMA KS 1 Type HD with clips to accommodate specified fuses.

1.5 INSTALLATION

- A. Provide arc flash hazard label on equipment per the National Electrical Code.

1.6 MULTI-FUNCTION DIGITAL METERING MONITOR

- A. Microprocessor-based unit.**
- B. Mounted flush or semi-flush in unit.**
- C. RS485 / RS232 and Modbus protocol digital communications output.**
- D. Monitoring functions including:**
 - 1. Phase currents each phase**
 - 2. Phase to phase voltages**
 - 3. Phase to neutral voltages**
 - 4. Megawatts – kilowatt hours**
 - 5. Megavars**
 - 6. Power factor**
 - 7. Power demand**
 - 8. Harmonics**

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 262416****PANELBOARDS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for lighting and appliance branch circuit panelboards and distribution panelboards.

1.2 QUALITY ASSURANCE

- A. Lighting and appliance branch circuit panelboards – NEMA PB 1.
- B. Distribution Panelboards: NEMA PB.1.
- C. NFPA 70 - National Electrical Code
- D. Underwriter's Laboratory

1.3 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS / DISTRIBUTION PANELBOARDS

- A. Tin plated copper or aluminum phase and neutral bussing.
- B. Integral ground bus.
- C. Lighting and appliance branch circuit panelboards to be provided with circuit breaker type overcurrent protective devices with short circuit current available at terminals.
- D. Distribution panelboards to be provided with fusible or circuit breaker type overcurrent protective devices with short circuit current rating available at terminals.
- E. Mechanical type main and neutral lugs.
- F. Feed-through lugs suitable for use with conductor material. Locate at opposite end of incoming lugs on main device.
- G. Bus bars in lighting and appliance branch circuit panelboards and distribution panel assemblies shall be adequately braced to withstand the maximum short circuit current at the point of application.

1.4 INSTALLATION

- A. Provide arc flash hazard label on equipment per the National Electrical Code.

END OF SECTION

SECTION 262419

MOTOR CONTROL CENTERS

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for motor control centers rated 600 V or less.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory

1.3 MOTOR CONTROL CENTER

- A. NEMA 250 Type 1 indoor enclosure.
- B. Modular construction with individual doors.
- C. Compartments constructed to allow for removal of units without opening adjacent doors.
- D. Copper or tin plated aluminum bus.
- E. Full size neutral bus.
- F. Non-insulated equipment ground bus.
- G. Phase, neutral, and ground buses to have same capacity the entire length.
- H. Unit to have short circuit withstand rating shall as rating of section.
- I. NEMA size 3 and smaller controllers shall be constructed with drawout mountings.
- J. Equipment unit with controller to meet application as specified in specification section 262913.

1.4 INSTALLATION

- A. Provide arc flash hazard label on equipment per the National Electrical Code.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 262726****WIRING DEVICES****GENERAL GUIDELINES****1.1 SECTION INCLUDES QUALITATIVE REQUIREMENTS FOR:**

- A. High Capacity Floor Boxes
- B. Duplex Receptacles and Integral GFCI Receptacles
- C. Tamper-Resistant Duplex Receptacles
- D. Wall Switches
- E. Wall Switch Occupancy Sensors
- F. Dimmer Switches
- G. Poke Through Assemblies
- H. Device Coverplates

1.2 QUALITY ASSURANCE

- A. High Capacity Floor Boxes: Underwriter's Laboratory Listed.
- B. Duplex Receptacles and Integral GFCI Receptacles: Underwriter's Laboratory 498, NEMA WD 1.
- C. Tamper-Resistant Duplex Receptacles: NEMA WD 1, UL 498..
- D. Wall Switches: NEMA WD 1, UL 20.
- E. Wall Switch Occupancy Sensors: Underwriter's Laboratory.
- F. Dimmer Switches: UL 1472.
- G. Poke Through Assemblies: Underwriter's Laboratory.

1.3 HIGH CAPACITY FLOOR BOXES

- A. Stamped steel 8 gang 2 compartments units.
- B. Fully adjustable.
- C. Rectangular steel with carpet flange and carpet insert.
- D. Blank aluminum plate where floor finish is not carpet.

1.4 DUPLEX RECEPTACLES AND INTEGRAL GFCI RECEPTACLES

- A. 1-pole, 3 wire, grounding.
- B. 20 amp, 125 volt rated.
- C. Heavy Duty Specification grade, Duplex, back and side wired.
- D. Ground fault protection where required shall be built into receptacle. Trippins values shall conform: UL 1436 and UL 943.

1.5 TAMPER-RESISTANT DUPLEX RECEPTACLES

- A. 1-pole, 3 wire, grounding.
- B. 20 amp, 125 volt rated.
- C. Hospital grade.

1.6 WALL SWITCHES

- A. 20 amp, 120/277 volt rated with ground screw.
- B. Specification grade.

1.7 WALL SWITCH OCCUPANY SENSORS

- A. Adaptive technology with adjustable time delay.
- B. 180 degree field of view.
- C. 1800 watts at 120-volt.
- D. 4155 watts at 277-volt.
- E. Passive infrared.
- F. Push “on”-“off” occupant switch

1.8 DIMMER SWITCHES

- A. Architectural grade, rotary knob series.
- B. 120 volt, wattage as required by fixture wattage.

1.9 POKE THROUGH ASSEMBLIES

- A. Factory fabricated.
- B. Fire rated or non-fire rated assemblies.
- C. Flush with floor type.

ELECTRICAL**CHAPTER 9: SPECIFICATIONS**

1.10 DEVICE COVERPLATES

- A. Stainless steel jumbo size with U.S. 32D finish.
- B. Configuration of plates to match devices.
- C. Weatherproof type stainless steel with U.S. 32D finish on exterior mounted duplex receptacles.

1.11 PERFORMANCES

- A. Provide receptacles on roof as required by National Electric Code.
- B. Toggle type in classrooms and key type in public areas.
- C. Provide tamper-resistant receptacles in pre-kindergarten and kindergarten classrooms.

END OF SECTION

SECTION 262813

FUSES AND FUSE HOLDERS

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for cartridge fuses rated 600 V and less and spare fuse cabinets.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory
- C. Cartridge Fuses: NEMA FU 1

1.3 CARTRIDGE FUSES

- A. Fuses shall be nonrenewable cartridge type, noninterchangeable type.
- B. Service entrance fuses shall be Class R or Class L rejection type, time delay, high interrupting, current limiting, dual element.
- C. Feeder fuses shall be Class L or J time delay.
- D. Motor branch circuit shall be NEMA Class "RK1" time delay.
- E. Other branch circuits Class J time delay.

1.4 SPARE FUSE CABINET

- A. Wall mounted steel constructed unit with hinged door and cam lock and pull.
- B. Three spare fuses for each type and size.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 262816****ENCLOSED SWITCHES AND CIRCUIT BREAKERS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for molded case circuit breakers, fusible and non-fusible switches, bolted-pressure contact switches, enclosures.

1.2 QUALITY ASSURANCE

- A. Molded Case Circuit Breakers: UL 489, NEMA AB 1.
- B. Fusible and Non-Fusible Switches, NEMA KS 1.
- C. Bolted-Pressure Contact Switches UL 977.
- D. Enclosures, NEMA AB 1 and NEMA KS 1.
- E. NFPA 70 - National Electrical Code

1.3 MOLDED CASE CIRCUIT BREAKER

- A. Interrupting capacity to meet available fault current at point of application.
- B. Magnetic trip elements.
- C. Lugs: Suitable for number, size, trip ratings, and conductor material.
- D. GFCI Circuit Breakers: Single and two pole with 5mA trip sensitivity.
- E. Type SWD for switching fluorescent lights.
- F. Type HACR for heating, air conditioning, and refrigerant equipment.
- G. Shunt trip: 120 v coil energized from separate circuit.

1.4 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Fusible Switches, 1200 amp and Smaller: NEMA KS 1, Type HD (heavy duty) with lockable handle.
- B. Non-fusible Switches: NEMA KS 1, Type HD (heavy duty) with lockable handle.

1.5 BOLTED-PRESSURE CONTACT SWITCHES

- A. Labeled for use as service equipment.
- B. Manual handle operation for opening and closing.
- C. Contact interruptions capability: twelve times switch rating.
- D. Ground fault relay comply with UL 1053.

1.6 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions.
 - 1. Outdoor locations: NEMA 250 Type 3R
 - 2. Kitchen areas: NEMA 250 Type 4X, stainless steel.

1.7 INSTALLATION

- A. Series rated circuit breaker not acceptable.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 262913****ENCLOSED CONTROLLERS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for across-the-line, manual, and magnetic controllers; and reduced-voltage controllers.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory

1.3 ACROSS-THE-LINE MANUAL CONTROLLERS

- A. Manual controller with quick make or quick break toggle switch or push button.
- B. General purpose Class A type.
- C. Equipped with heaters and sensors in each phase matched to nameplate full-load current of motor.

1.4 ACROSS-THE-LINE MAGNETIC CONTROLLERS

- A. Nonreversing across the line full voltage type.
- B. NEMA ICS 2 Class A full voltage.
- C. 120 volt control circuit obtained from integral control transformer.
- D. Heavy duty type, hand/off/auto selector switch with pilot light and test push button.
- E. Equipped with under voltage and phase-failure relays.

1.5 COMBINATION ACROSS-THE-LINE CONTROLLER / DISCONNECT

- A. Nonreversing across-the-line full voltage type.
- B. NEMA ICS 2 Class A full voltage.
- C. 120 volt control circuit obtained from integral control transformer.
- D. Heavy duty, fusible switch with rejection type fuses. NEMA KS 1.
- E. Heavy duty type, hand/off/auto selector switch with pilot light and test push button.
- F. Equipped with under voltage and phase-failure relays.

1.6 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

- A. Solid state controller suitable for use with polyphase induction motor.
- B. Adjustable acceleration rate and adjustable starting torque control.
- C. Surge suppressor in solid-state power circuit.
- D. LED indicators showing motor and control status.
- E. Heavy duty type, hand/off/auto selector switch with pilot light and test push button.
- F. Equipped with under voltage and phase-failure relays.

1.7 ENCLOSURES

- A. NEMA 250 Type 1 for indoor applications.
- B. NEMA 250 Type 3R for outdoor applications.
- C. NEMA 250 Type 1 for kitchen areas.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 263213****PACKAGE ENGINE GENERATORS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for packaged engine generator system

1.2 QUALITY ASSURANCE

- A. Compliance with NFPA 110
- B. Factory testing
- C. Field testing
- D. NFPA 70 - National Electrical Code
- E. UL 2200 – Stationary generators
UL 142 – Subbase fuel storage tanks
- F. Installation of stationary generator - NFPA 37

1.3 PACKAGED GENERATOR SYSTEM CHARACTERISTICS

- A. Type: Standby automatically started engine coupled to an AC generator unit.
- B. Ratings: Voltage, frequency, and power output ratings suitable for use.
- C. Maximum transfer time to assume full load: Per NEC.
- D. Fuel type: Diesel or natural gas dependent upon application and authorities having jurisdiction.
- E. Fuel supply: Minimum per NEC.

1.4 PACKAGED GENERATOR SYSTEM COMPONENTS

- A. Engine
- B. Cooling system: liquid-cooled unit mounted radiator.
- C. Subbase diesel double wall fuel storage tank with leak monitor or natural gas supply.
- D. For outdoor generator set provide weatherproof steel housing, louvers, and dampers.
- E. Provide vibration isolators.
- F. Critical type muffler/silencer.

END OF SECTION

SECTION 263600

TRANSFER SWITCHES

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for automatic transfer switch for packaged engine generators.

1.2 QUALITY ASSURANCE

- A. NFPA 70 – National Electric Code.
- B. NFPA 110 – Emergency and Standby Power Systems Level 1
- C. NEMA ICS 1

1.3 AUTOMATIC TRANSFER SWITCH

- A. Fault current and withstand ratings adequate for available fault currents.
- B. Solid state controls.
- C. Double-throw type, incapable of pauses or intermediate positions stops.
- D. 3 pole (phase) switching type.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 264313****TRANSIENT VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Transient Voltage Surge Suppressors

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code. Including article 285, NEC 2002.
- B. Underwriter's Laboratory
- C. Transient Voltage Surge Suppressors: UL 1449 2nd Edition and UL 1283, ANSI/IEEE C62.41 Category A, B, C, and C62.45 testing.
- D. NEMA LS-1

1.3 TRANSIENT VOLTAGE SURGE SUPPRESSORS

- A. Individually fused Metal oxide varistors (MOVs) or each mode of protection is to be protected with surge rated fuses and thermal disconnects.
- B. Line protection
 - 1. Line to line
 - 2. Line to neutral
 - 3. Line to ground
 - 4. Neutral to ground
- C. UL 1449 Edition suppressed voltage rating:

Voltage Configuration	L-N	L-G	N-G	L-L
120/208 Three Phase Wye	400v	400v	400v	800v
277/480 Three Phase Wye	800v	800v	800v	1200v

- D. One percent variation in metal oxide varistors.
- E. LED indicator light.
- F. Rated as a UL 1283 electromagnetic interference filter.
- G. NEMA 1 rated enclosure.

1.4 SERVICE ENTRANCE

- A. Integral or external mounting.
- B. Minimum single surge current rating of 120k per node.

1.5 BRANCH PANELBOARD

- A. Integral or external mounting.
- B. Minimum single surge current rating of 80k per node.

1.6 INSTALLATION

- A. Install transient voltage surge suppressors on the load side of the main disconnect at the main switchboard and each branch circuit panelboard serving duplex receptacles. Utilize a spare 30 to 60a two or three pole breaker for TVSS disconnect.

END OF SECTION

SECTION 265100

INTERIOR LIGHTING

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for interior lighting fixtures, lamps and ballast, emergency lighting units, exit sign, and lighting fixture support.

1.2 QUALITY ASSURANCE

- A. Underwriter's Laboratory
- B. NFPA 70 - National Electrical Code
- C. Fluorescent fixtures UL 1598.
- D. Explosionproof fixtures UL 844.**
- E. Track lighting UL 1574.**
- F. Exit signs UL 924.**
- G. Emergency lighting UL 924.**
- H. *Solid state lighting (LED) UL 1598.***

1.3 FLUORESCENT INTERIOR LIGHTING FIXTURES

- A. Fluorescent Troffers
 - 1. Static Recessed 2 by 4 foot, 2 by 2 foot, or 1 by 4 foot
 - 2. .125 inch Prismatic virgin acrylic A12 lens
 - 3. Flat steel door
 - 4. Number of lamps as required
 - 5. Steel construction
- B. Fluorescent Troffers – Specular Reflector
 - 1. Static recessed 2 foot by 4 foot, 2 foot by 2 foot, or 1 foot by 4 foot
 - 2. 0.125 inch prismatic virgin acrylic A12 lens
 - 3. Flat steel door
 - 4. 0.020 inch aluminum reflector, 92% specular, 3% diffuse
 - 5. Number of lamps as required
 - 6. Steel construction
- C. Fluorescent Wraparound Fixtures
 - 1. One piece acrylic prismatic
 - 2. Number of lamps as required
 - 3. Four foot length
 - 4. Steel construction
 - 5. Surface or suspended mounting

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- D. Fluorescent Strip Fixtures
 - 1. No lenses
 - 2. Four foot length
 - 3. Asymmetric or Symmetric reflectors as required.
 - 4. Steel construction

- E. Fluorescent Recessed Cans
 - 1. Minimum 6 inch diameter
 - 2. Clear alzak reflector
 - 3. Compact fluorescent
 - 4. Open lens unless required.

- F. ***Deleted***

- G. Fluorescent Recessed Indirect/Direct
 - 1. Static recessed by 2 by 4 foot, 2 by 2 foot
 - 2. Perforated metal round shield
 - 3. Number of lamps as required
 - 4. Matte white aluminum reflector
 - 5. Steel housing construction

- H. Fluorescent Pendant High-Bays
 - 1. 15 inch minimum round
 - 2. Steel stem or aircraft cable support
 - 3. Open or enclosed bottom
 - 4. UV stabilized prismatic acrylic reflector
 - 5. Die-cast aluminum ballast housing
 - 6. Compact fluorescent lamps
 - 7. Number of lamps as required
 - 8. Safety chain
 - 9. Wireguard

- I. Interior Track Lighting
 - 1. Track
 - a. Surface or recessed track
 - b. Two circuit minimum
 - c. Standard lengths with all fittings
 - 2. Fixtures
 - a. Shape per Design Professional
 - b. ***Dimmable LED***
 - c. Color selection by design professional

- J. High output Fluorescent High-Bay Industrial Fixtures
 - 1. Sizes
 - a. 16" x 4'
 - b. 2' x 4'
 - c. 16" x 8'
 - d. 2' x 8'
 - 2. Steel Construction
 - 3. No lens
 - 4. High output T5HO lamps

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- 5. 95% reflectance segmented specular aluminum reflector
- 6. Full wireguard
- K. Labels and Miscellaneous
 - 1. Wet and damp location labels as required.
 - 2. Provide wireguards on fixtures, exit signs, and emergency lighting in gymnasiums.
- L. Installation
 - 1. Chain hang troffer type fixtures from structural steel independent of grid or screw attach fixtures to grid and grid support at each corner of grid.

1.4 TRACK LIGHTING

- A. Types
 - 1. Open front type
 - 2. Round or flat back
 - 3. Porcelain socket

1.5 SOLID STATE LIGHTING (LED) LUMINAIRES

- A. Types
 - 1. Recessed or surface mount
 - 2. Comply with IES LM-79
 - 3. CRI 75 minimum
 - 4. Color consistency NEMA SSL 3
 - 5. B50 rating at least 50,000 hours per IES LM-80

1.6 EXPLOSIONPROOF FIXTURES

- A. Types
 - 1. Comply with hazardous classification for its location per the National Electrical Code
 - 2. Lamp type suitable for condition.

1.7 EMERGENCY LIGHTING UNITS

- A. Type
 - 1. Provide from fixtures above connected to emergency generator.

1.8 EXIT SIGNS

- A. Type
 - 1. Cast aluminum construction
 - 2. Color by design professional
 - 3. LED lamp type
 - 4. Wireguards as required
 - 5. Red lettering
 - 6. Directional arrows

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****1.9 LINEAR FLUORESCENT BALLAST**

- A. Electronic type with maximum 10 percent total harmonic distortion.
- B. Rapid start, instant start, or programmed start type.
- C. Suitable for T8, T5, or T5HO lamps.
- D. 95 percent minimum power factor.
- E. Class A sound rating.
- F. .71, .88, or 1.15 ballast factor.

1.10 DIMMABLE LINEAR FLUORESCENT BALLAST

- A. Electronic type.
- B. 100 percent to 5 percent dimming range.

1.11 COMPACT FLUORESCENT BALLAST

- A. Electronic type with maximum 20 percent total harmonic distortion.
- B. Programmed rapid start.
- C. 95 percent minimum power factor.
- D. 95 percent or higher ballast factor.
- E. Class A sound rating.

1.12 DIMMABLE COMPACT FLUORESCENT BALLAST

- A. Electronic type.
- B. 100 percent to 5 percent dimming range.

1.13 DIGITAL ELECTRONIC DIMMING BALLAST

- A. Provides a continuous 2-wire dimming signal.
- B. Internal circuitry to limit inrush current.
- C. Operating voltages of 120/240/277 volts at 50 or 60 Hz.
- D. Continuous flicker free dimming range from 100% to 10%.
- E. Capable of connecting one or multiple sensors.
- F. Capable of generating digital communication commands to digital bus.
- G. Capable of monitoring lamp and ballast conditions.
- H. Total harmonic distortion (THD) less than 20%.
- I. Power factor greater than 95%.
- J. Ballast factor greater than 85% for T8 lamps and equal to 1.0 for T5 and T5HO lamps.

1.14 FLUORESCENT LAMPS

- A. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2950 initial lumens (minimum), CRI 85 (minimum), color temperature **range of 4100K-5000K**, and average rated life 30,000 hours, unless otherwise indicated.
- B. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches, 1350 initial lumens (minimum), CRI 85 (minimum), color temperature **range of 4100K-5000K**, and average rated life 20,000 hours, unless otherwise indicated.
- C. T8 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 18 inches, 2725 initial lumens (minimum), CRI 85, color temperature **range of 4100K-5000K**, and average rated life 36,000 hours, unless noted otherwise.

- D. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 3100 initial lumens (minimum), CRI 85, color temperature **range of 4100K-5000K**, and average rated life of 36,000 hours, unless rated otherwise.
- E. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature **range of 3500K-5000K**, and average rated life 20,000 hours, unless otherwise indicated.
- F. T5HO rapid-start high output low-mercury lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature **range of 3500K-5000K**, and average rated life 20,000 hours, unless otherwise indicated.
- G. Compact Fluorescent Lamps: 4-pin, low mercury, CRI 80 (minimum), color temperature **range of 3500K-5000K**, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

1.15 LIGHT FIXTURES SUPPORT COMPONENTS

- A. 1/4 inch minimum diameter thread steel rod hangers
- B. ½ inch steel tubing with swivel ball fittings and ceiling canopy.

END OF SECTION

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SECTION 265561

THEATRICAL DIMMING SYSTEM

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Stage dimming and control.
- B. Stage lighting.

1.2 QUALITY ASSURANCE

- A. NFPA - National Electrical Code.
- B. Underwriter's Laboratory.
- C. Light Fixtures UL 1573.
- D. Main Control Console UL 508.

1.3 MAIN CONTROL CONSOLE

- A. Minimum 48 channel single scene microprocessor based.
- B. Non-volatile memory disk backup.
- C. Minimum 12 scene masters.
- D. Console receptacles located at stage managers panel, at rear of cafetorium and in booth (if one is provided).
- E. Minimum 10 foot cables for power and signal.
- F. Tabletop unit.

1.4 DIMMER RACK

- A. Dual 2400 watt dimmers.
- B. Free standing rack mounted with cooling fan(s).
- C. Primary circuit breaker with fault current rating for point of service.
- D. Capable of data transmission with USITT DMX 512.

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****1.5 LIGHTING UNITS****A. Front Lighting (cafetorium ceiling)**

1. Connector Strips: Approximately 4 inch by 4 inch with flush receptacles, hangers, interior terminal strip.

For School	Overall Dimmed Length Circuits	Number of Receptacles	Minimum Quantity
Middle 10'	Six each	Six each	Two
High 10'	Six each	Six each	Three

Locate at minimum the distance equal to proscenium height from the stage out onto the ceiling, centered on proscenium edges plus at proscenium center line for high school.

2. Lighting Instruments: Ellipsoidal spotlights, 6 inch by 20 degrees, 575 watt lamp, 36 inch leads, connector, color frame, safety cable, "C" Clamp.

For School	Minimum Quantity	Initial Location
Middle	Six	Three each connector strip
High	Nine	Three each connector strip

E. Overstage Lighting (Electrics): Should appear approximately 3 feet back, then at intervals of approximately eight feet.

1. Connector strips approximately 4 inch by 4 inch plus junction box, with receptacles on 18 inch pigtailed, double pipe hangers. Provide additional (*) three receptacles at ends and center on a circuit switched at stage managers panel for worklights.

For School	Minimum overall Length	Dimmed Circuits	Number of Receptacles	Minimum Quantity
Middle	3/4 proscenium width	Twelve	Fifteen*	Two
High	3/4 proscenium width	Eighteen	Twenty-one*	Two

2. Additional Overstage: Third Electric (fourth electric if stage is more than 25 foot deep). Four, 4 circuit/receptacle plug boxes on flexible cables capable of reaching a point 5 feet above the stage floor.

3. Spotlights: Fresnel Spotlights: 6 inches, 750 watt lamp, 36 inch leads, connector, color frame, safety cable, "C" Clamp.

For School	Minimum Quantity	Initial Location
Middle	Twelve	Six each connector strip
High	Eighteen	Nine each connector strip

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4. Striplights: 7'-6" x 4 circuit, with red, green, blue, and clear roundels, 200 watt lamps, 36 inch leads at each end with appropriate connectors.

For School	Minimum Quantity	Initial Location
Middle	Six	Three each connector strip
High	Six	Three each connector strip

5. Stage Worklights: Scoops: 10 inches, 150 watt lamp 36 inch leads, connector, color frame, safety cable, "C" Clamp.

For School	Minimum Quantity	Initial Location
Middle	Six	Three each connector strip
High	Six	Three each connector strip

- C. Backstage Worklights:

1. **2700 Lumen Fluorescent or LED** in industrial reflectors to limit spill onto the stage.
2. Minimum two each side of either type stage.

1.6 MISCELLANEOUS

- A. Provide stage managers panel to allow control of area lighting functions.
- B. Provide a minimum of two floor pockets, one each side of the stage, each with three dimmed circuits/receptacles and one constant duplex receptacle.

1.7 INSTALLATION

- A. Neutrals from system feed to be 130 percent of hot line size.
- B. All branch circuits are to be two wire no common neutrals.
- C. All strips and floor pockets shall be grounded per NEC.

END OF SECTION

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****SECTION 265600****EXTERIOR LIGHTING****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for exterior luminaires with lamps and ballast; and poles.

1.2 QUALITY ASSURANCE

- A. Underwriter's Laboratory
- B. NFPA 70 - National Electrical Code
- C. Luminaires UL 1598.
- D. High intensity discharge (HID) ballast UL 1029.

- E. *Solid state lighting (LED) UL 1598***

1.3 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead load weight of luminaire, supports, lowering devices as stated in AASHTO LTS-4.
- B. Fixtures and poles shall be designed for wind load pressures conforming to the Ohio Basic Code.

1.4 LUMINAIRES

- A. Listed and labeled for installation in wet location.
- B. Metal parts free of burrs, sharp corners, and edges.
- C. Constructed of corrosion-resistant aluminum.
- D. Rigidly formed housings that provide weathertight and lighttight enclosures.
- E. Stainless steel exposed hardware.
- F. Doors and frames shall prevent accidental falling during relamping or ballast replacement.
- G. Heat and aging-resistant resilient gasket to seal lenses to luminaire door.

1.5 FLUORESCENT BALLAST AND LAMPS

- A. Low temperature ballast for reliable starting and operation of lamps to minus 20 degrees Fahrenheit.
- B. Ballast to have less than 10 percent total harmonic distortion.

- C. Electromagnetic ballast to be high power factor Class P.
- D. Fluorescent lamps shall be low-mercury type and reliable starting and operation to minus 20 degrees Fahrenheit.

1.6 BALLAST FOR HID LAMPS

- A. Constant wattage autotransformer or high power factor type.
- B. Minimum starting temperature of minus 22 degrees Fahrenheit.
- C. High pressure sodium ballast shall be electro magnetic type with solid state igniter/starter and minimum starting temperature of minus 40 degrees Fahrenheit.

1.7 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

1.8 **SOLID STATE LIGHTING (LED) LUMINAIRES**

- A. **Wall or pole mounted**
- B. **Comply with IES LM-79**
- C. **CRI 75 minimum**
- D. **Color consistency NEMA SSL 3**
- E. **B50 rating at least 50,000 hours per IES LM-80**

1.9 **DRIVERS FOR SOLID STATE LIGHTING (LED) LUMINAIRES**

- A. **Comply with ANSI 82.11**
- B. **UL 935 approved**
- C. **100 to 277-volt input rating**
- D. **24v DC output rating**
- E. **Power Factor: .90 or higher**

ELECTRICAL**CHAPTER 9: SPECIFICATIONS****1.10 POLES**

- A. *Structural Characteristics: Comply with AASHTO LTS-5.***

1.11 STEEL POLES

- A. Poles complying with ASTM A 500 Grade B carbon steel with minimum yield of 46,000 psig.
- B. One piece construction.
- C. Weld ½ inch threaded lug for grounding conductor connections.
- D. Vibration dampeners for Mode 1 and Mode 2
- E. Factory-painted finish.

1.12 ALUMINUM POLES

- A. Poles complying with ASTM B429 / B429M constructed with extruded seamless 6063 alloy.
- B. Heat treated full length shaft to produce a T6 temper.
- C. 1/2" threaded lug for grounding conductor connections.
- D. A356 aluminum anchor base welded to shaft.
- E. Vibration dampeners for Mode 1 and Mode 2.
- F. Integrally-colored or electrolytically deposited color coating complying with AAMA 611.

1.13 FIBERGLASS POLES

- A. 65% fiberglass with resin.
- B. Resin color uniform throughout entire wall thickness UV inhibited.
- C. Direct embedded along pedestrian walkways.
- D. Concrete base mounted in vehicular traffic areas.

1.14 CONCRETE POLES

- A. *Poles: Manufactured by centrifugal spin-casting process or of cast concrete.***
- B. *Cure with wet steam and age for a minimum of 15 days before installation.***
- C. *Fabricate poles with a hard, non-porous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.***

END OF SECTION

27

DIVISION

COMMUNICATIONS

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SECTION 270526

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

GENERAL GUIDELINES

1.1 SUMMARY

- A. This Section defines the general design requirements for a uniform Telecommunications Grounding and Bonding infrastructure that shall be followed for all OSFC Technology construction projects.
 - 1. Figure 1 describes the Telecommunications Bonding System
 - 2. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. Telecommunications Main Grounding Busbar (TMGB)
- B. Telecommunications Grounding Busbar (TGB)
- C. Telecommunications Bonding Backbone (TBB) – **optional**.

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment Installation Practices shall comply with the latest ANSI/TIA/EIA-758 Customer Owned Outside Plant Standard.
- E. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- F. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manual (TDMM).

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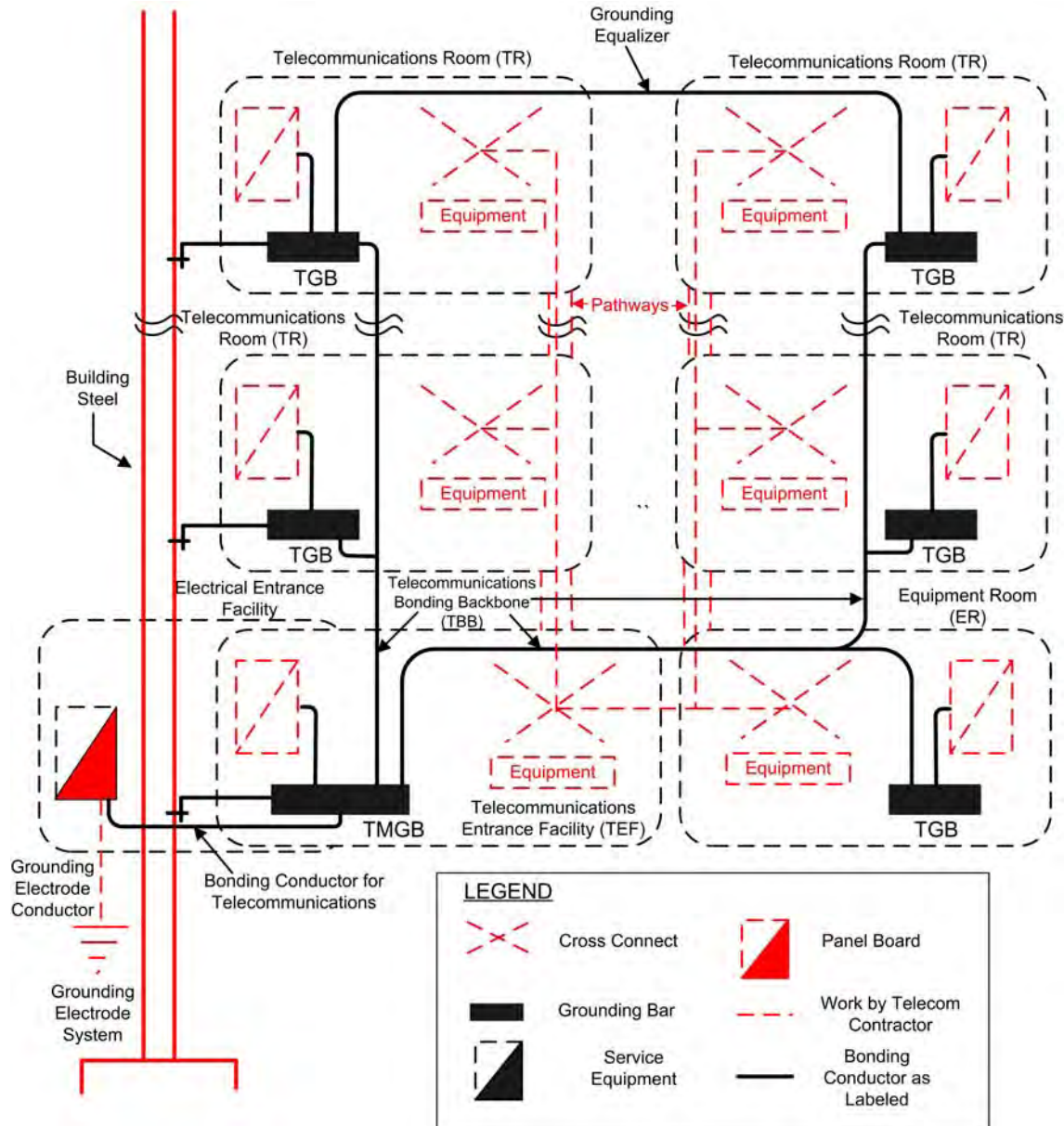


Figure 1 – Telecommunications Bonding System

1.4 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- A. Provide Telecommunications Main Grounding Busbar (TMGB) in Main Equipment Room (ER) and Telecommunications Room (TR).
- B. All TMGB Connections to be made with double-bolted, Compression style, Grounding Lugs.

1.5 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- A. Provide Telecommunications Grounding Busbar (TGB) in all Telecommunications Rooms (TRs) and AV Equipment Cabinets.
- B. All TGB Connections to be made with double-bolted, Compression style, Grounding Lugs.

1.6 TELECOMMUNICATIONS BONDING BACKBONE (TBB) - OPTIONAL

- A. Provide Telecommunications Bonding Backbone (TBB) between all TGBs and the TMGB.
- B. All TBB Connections to be made with double-bolted, Compression style, Grounding Lugs.
- C. ***Where a TBB is provided, install in accordance with BICSI Telecommunications Design Method Manual chapter 9 (Bonding and Grounding).***

1.7 GROUNDING/BONDING CONDUCTORS

- A. All Grounding and bonding conductors shall be copper and may be insulated. When Conductors are insulated, they shall be listed for the application. The minimum bonding conductor shall be No. 6 AWG.

1.8 INSTALLATION

- A. As a minimum, Bond TMGB to following:
 - 1. Building Steel, (minimum No. 2 AWG insulated copper bonding conductor). CAD Weld Bonding Conductors to Building Steel.
 - 2. Main Electrical Service Grounding Electrode System (minimum No. 2 AWG insulated copper bonding conductor).
 - 3. Local Service Panel Ground (minimum No. 6 AWG insulated copper bonding conductor).
 - 4. Telecommunications Bonding Backbone (TBB) that connects TMGB to other TGBs (***size per BICSI TDMM***) – optional.
 - 5. Associated Telecommunications Cable Tray(s) (continuous No. 6 AWG bare copper bonding conductor connecting all Cable Tray Sections).
 - 6. Telecommunications Conduit(s) Entering TR (minimum No. 6 AWG insulated copper bonding conductor).

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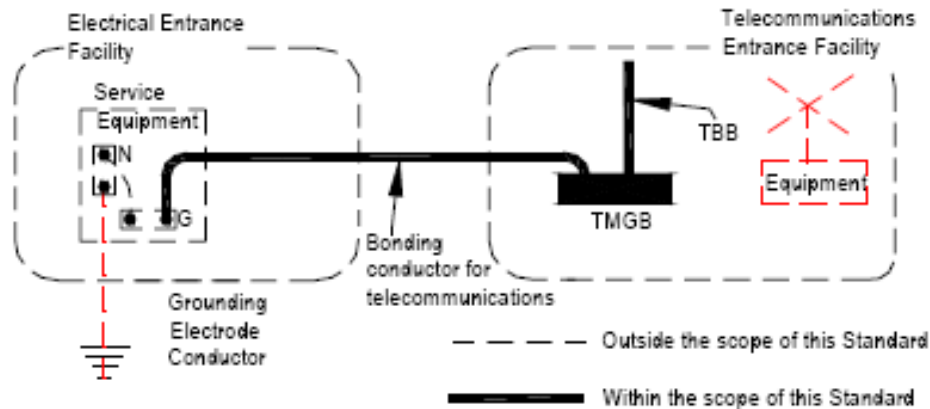


Figure 3 – Connection to Grounding Electrode

- B. As a minimum, Bond TGB to following:
1. Building Steel, (minimum No. 2 AWG insulated copper bonding conductor).
CAD Weld Bonding Conductors to Building Steel.
 2. Local Service Panel Ground (minimum No. 6 AWG insulated copper bonding conductor).
 3. Telecommunications Bonding Backbone (TBB) that connects TGB to other TGBs and TMGB (*size per BICSI TDMM*) - Optional.
 4. Associated Telecommunications Cable Tray(s) (continuous No. 6 AWG bare copper bonding conductor connecting all Cable Tray Sections).
 5. Telecommunications Conduit(s) Entering TR (minimum No. 6 AWG insulated copper bonding conductor).
- C. As a minimum, the Technology Contractor shall bond the following devices to the associated TMGB and TGBs using a minimum No. 6 AWG insulated copper bonding conductor using compression style lugs:
1. Antenna Cable Shields
 2. Backbone Cable Shields
 3. CATV Equipment
 4. Coupled Bonding Conductors (CBCs)
 5. Equipment Racks and Cabinets
 6. Lightning and Surge Protectors
 7. PABX Equipment
 8. Raised Floors
 9. Telecommunication and Fiber Cable Shields
 10. Telecommunications Devices
 11. TR Cable Ladder and Tray

END OF SECTION

SECTION 271100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

GENERAL GUIDELINES**1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Communications Room Infrastructure that shall be followed for all OSFC Technology construction projects.
 - 1. Communications Rooms consist of:
 - a. Main Equipment Room (ER)
 - b. Telecommunication Rooms (TR)
 - 2. Figure 1 describes a typical Communications Room
 - 3. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. Equipment Room (ER)
- B. Telecommunication Rooms (TR)
- C. Equipment Backboards
- D. Equipment Racks and Cabinets
- E. Cable Ladder and Cable Tray

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manual (TDMM).
- F. All equipment Racks and Cabinets shall comply with the latest ANSI/EIA-310 Cabinets, Racks, Panels and Associated Equipment Standard.

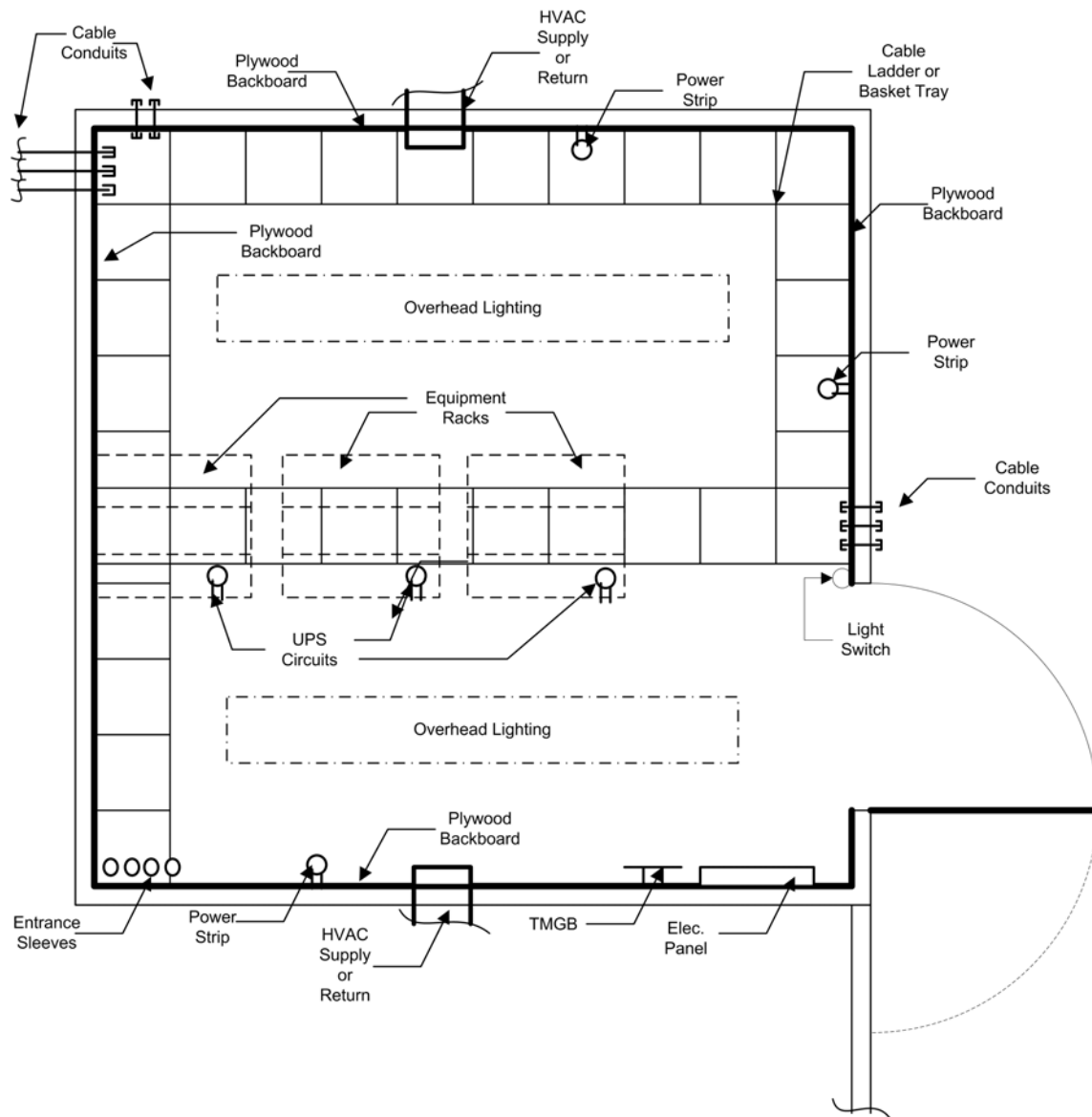
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Figure 1 - Typical 10 ft x 10 ft Communications Room

1.4 EQUIPMENT ROOM (ER) GENERAL

- A. Each Building shall be equipped with at least 1 ER
- B. Locate the ER in a Central area of the Building.
- C. For multiple story buildings, consider centrally locating the ER so it can serve multiple floors.
- D. Extend Service Entrance Conduits to the ER
- E. The ER typically contains the following equipment:

1. ACTIVE EQUIPMENT
 - a. Access Control Systems
 - b. CATV Systems
 - c. CCTV Systems
 - d. Clock Systems
 - e. Intercom Systems
 - f. Network Electronics
 - g. Paging Systems
 - h. PBX Equipment
 - i. Security Electronics
 - j. UPS Systems
 - k. Video Systems
 - l. Voice Mail Systems
 - m. Wireless Electronics
2. CROSS-CONNECT EQUIPMENT
 - a. Racks
 - b. Cabinets
 - c. Patch Panels
 - d. Backboards
 - e. 110 Blocks
3. BUILDING FACILITIES EQUIPMENT
 - a. Associated HVAC Equipment
 - b. Associated Electrical Equipment

1.5 TELECOMMUNICATION ROOM (TR) GENERAL

- A. When more than one Equipment Room (ER) is required, additional satellite Telecommunications Rooms (TRs) shall be provided.
- B. Centrally locate the TRs in the areas being served.
- C. For multiple story buildings, consider centrally locating the TRs so they can serve multiple floors.
- D. The TR typically contains the following equipment:
 1. ACTIVE EQUIPMENT
 - a. CATV Systems
 - b. Network Electronics
 - c. UPS Systems
 2. CROSS-CONNECT EQUIPMENT
 - a. Racks
 - b. Cabinets
 - c. Patch Panels
 - d. Backboards
 - e. 110 Blocks
 3. BUILDING FACILITIES EQUIPMENT
 - a. Associated HVAC Equipment
 - b. Associated Electrical Equipment
- E. Fiber and Copper Backbone cables shall be provided to interconnect the TR(s) with the ER.

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****1.6 ER AND TR REQUIREMENTS**

- A.** *Verify and coordinate ER/TR quantity, size and location with the Design Professional during the programming phase.*
 - 1.** *Refer to the OSDM space plates for minimum SF requirements.*
 - 2.** *Consider additional space requirements if district is considering thin client or N.O.C. applications.*
- B.** The minimum ER and TR minimum ceiling heights shall be 8 feet (2.4 m) above finished floor (AFF). Consideration should be given to 10 ft (3 m) ceilings.
- C.** The ER and TR shall be rectangular in shape.
- D.** Consolidate multiple floors and serving areas into a single TR whenever possible. For example, a centrally located TR on the 2nd floor could also serve the 1st and 3rd floor.
- E.** The ER and TR shall have tiled floors.
- F.** The ER and TR shall have at least one lockable door that opens outward and has minimum dimensions of 3 feet (0.91 m) wide by 6.7 feet (2.0 m) tall.
- G.** Provide each ER and TR with an HVAC system that maintains continuous environmental control 24 hours per day, 365 days per year.
- H.** Maintain temperature between 64° F (18° C) to 75° F (24° C).
- I.** Maintain relative humidity between 30% and 55% -- non-condensing.
- J.** Provide Telecommunications Grounding Systems
- K.** Provide the following minimum clearances:
 - 1.** Minimum of 40 in. (1 m) between equipment racks and the front of cross-connect fields.
 - 2.** Allow a minimum of 6 in. (150 mm) from the wall for wall-mounted equipment.
 - 3.** Minimum of a 40 in. (1 m) aisle in front of and behind all equipment racks and cabinets.
 - 4.** Minimum of 36 in. (0.91 m) floor area depth for equipment racks and cabinets.
- L.** Provide sufficient Generator Electrical circuits to service the associated UPS units.
- M.** Power all active devices from UPS units, which are connected to the Building generator.
- N.** Provide a minimum of 500 lux (50-foot candles of uniform lighting when measured at 3 feet AFF.
- O.** Use light colored walls to enhance lighting.

1.7 EQUIPMENT BACKBOARDS

- A.** Cover at least two (2) walls with AC grade or better, void free ¾ in. (19 mm) plywood at least 8 feet (2.4 m) high.
- B.** Place the grade C surface towards the wall and coat the plywood with two coats of fire-retardant white paint.

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1.8 EQUIPMENT RACKS

- A. Place equipment racks or cabinets in a continuous row.
- B. Equipment racks shall be black, 84 inches high, have 19 inch EIA, pre-tapped, mounting rails and shall have integral, 5 inch minimum, vertical cable organizers on both the left and right of the rack.
- C. Equipment racks shall be provided with rear vertical cable organizers on both the left and right side of the rack.
- D. Provide at least one 4-posted rack or equipment cabinet in the ER for placing file servers and other equipment requiring four-corner mounting.
- E. Equipment racks are the preferred equipment-mounting device.
- F. When equipment cabinets are furnished, they shall be black, have vented side panels and lockable front and back doors. **Provide ventilation fans as required for active equipment.** Cabinets shall be a minimum of 24 inches (610 mm) wide by a minimum of 42 in. (1.07 m) deep and 84 in. (2.15 m) high.
- G. All equipment racks and cabinets shall be of the same manufacturer and model type.

1.9 CABLE LADDER AND CABLE TRAY

- A. Line the walls of the ER and TR with a minimum of 12 in (305 mm) wide cable ladder or wire basket cable tray for cable management.
- B. Provide a minimum of 12 in (305 mm) wide cable ladder or wire basket cable tray over the tops of racks and cabinets for cable management.
- C. **Provide waterfall support structure to assure proper cable bend radius.**



Figure 2 -- Typical Communications Room Cable Conduits



Figure 3 -- Typical Communications Room Overhead Cable Ladder and Backboard

1.10 GENERAL

- A. All racks, patch panels, cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/architect.
- B. Coordinate the location of lighting equipment so that fully loaded cable trays and ladder do not impede or obstruct the lighting.

END OF SECTION

SECTION 271313

COMMUNICATIONS COPPER BACKBONE CABLING

GENERAL GUIDELINES**1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Intra and Inter-Building Communications Copper Backbone Cabling Infrastructure that shall be followed for all OSFC Technology construction projects.
 - 1. Figures 1, 2 and 3 describe a typical Intra-Building Communications Copper Backbone Cabling Systems
 - 2. Figure 4 describes a typical Inter-Building Communications Copper Backbone Cabling System
 - 3. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. INTRA-BUILDING COPPER BACKBONE CABLE SYSTEMS
 - 1. Main Equipment Room (ER) to Telecommunication Rooms (TR) Voice Backbone Cable System.
 - 2. Main Equipment Room (ER) to Telecommunication Rooms (TR) Data Backbone Cable System.
 - 3. Entrance Facility (EF) to Main Equipment Room (ER) Voice Backbone Cable System.
 - 4. Entrance Facility (EF) to Main Equipment Room (ER) Data Circuit Backbone Cable System.
- B. INTER-BUILDING COPPER BACKBONE CABLE SYSTEMS
 - 1. Main Equipment Room (ER) to Main Equipment Room (ER) Voice Backbone Cable System.

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.

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- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM) and BICSI[®] Customer-Owned Outside Plant Design Manual.
- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, Standards.
- G. All Inter-Building cabling shall comply with the latest ANSI/TIA/EIA-758. Customer-Owned Outside Plant Telecommunications Cabling, Standard, as applicable.
- H. All Inter-Building cabling shall comply with the latest ANSI/ICEA S-98-688. Broadband Twisted-Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors, Standard, as applicable.
- I. All Inter-Building cabling shall comply with the latest ANSI/ICEA S-99-689. Broadband Twisted-Pair, Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors, Standard, as applicable.



Figure 1 – Main Equipment Room (ER) to Telecommunication Rooms (TRs) Data and Voice Backbone Cable System, Option - 1

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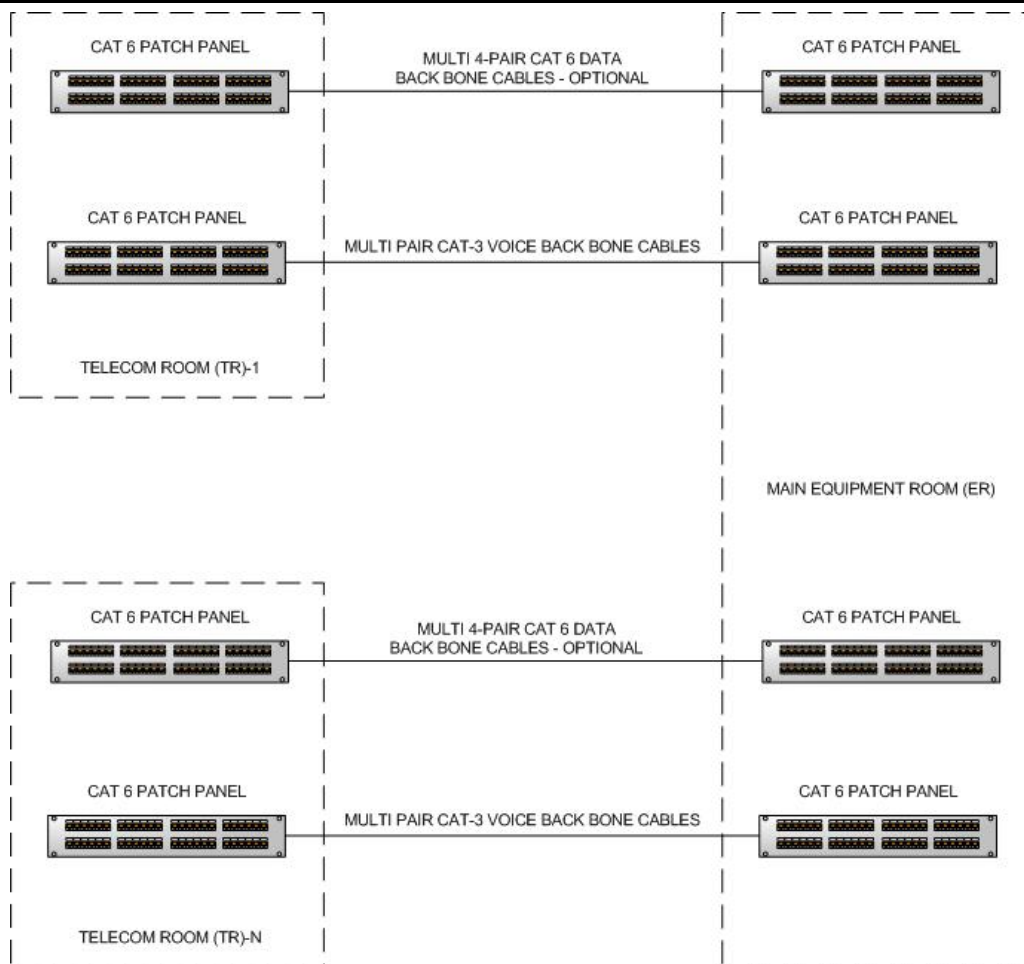


Figure 2 – Main Equipment Room (ER) to Telecommunication Rooms (TRs) Data and Voice Backbone Cable System, Option – 2

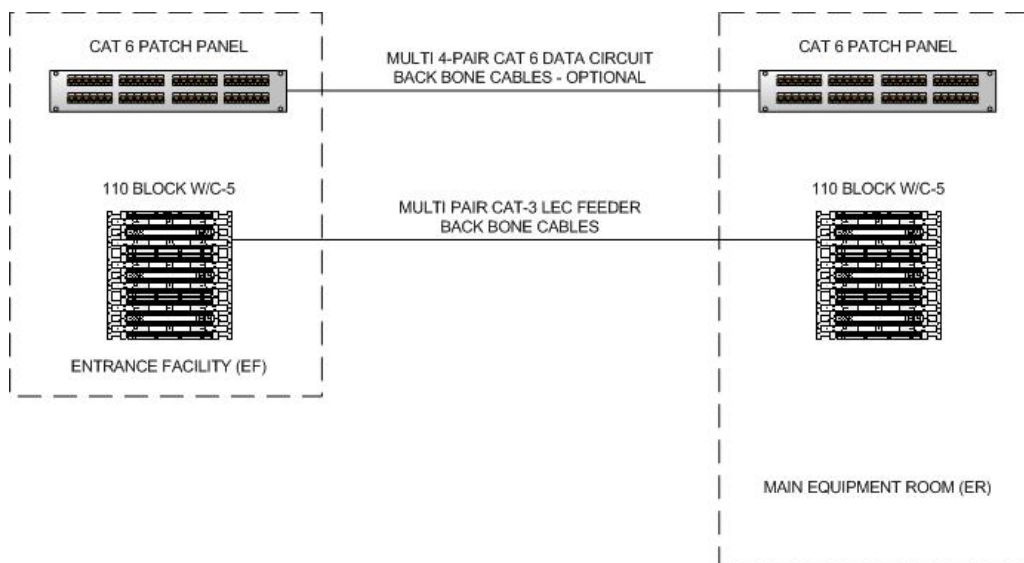


Figure 3 – Entrance Facility (EF) to Main Equipment Room (ER) Data Circuit and Voice Backbone Cable System

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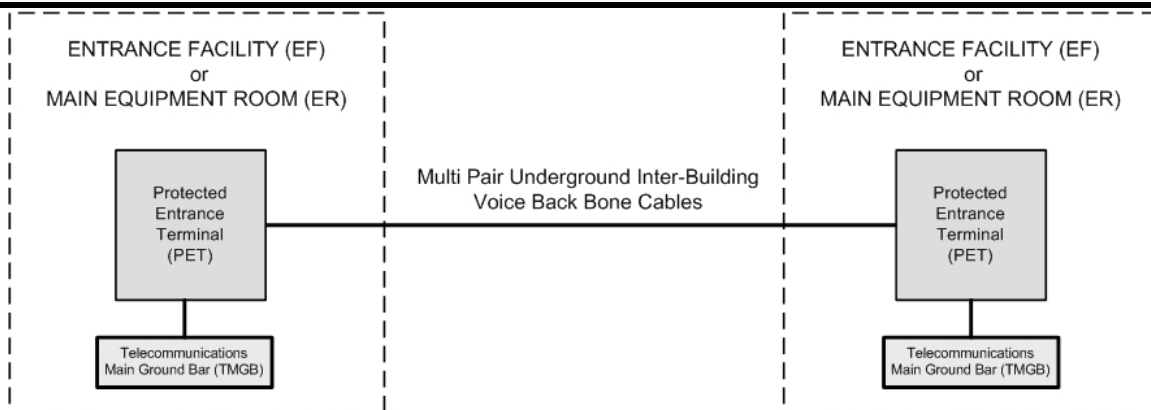


Figure 4 – Main Equipment Room (ER) to Main Equipment Room (ER) Inter-Building Voice Backbone Cable System

1.4 WARRANTY

- A. *System shall carry an industry standard, performance based warranty, by the manufacturer and contractor, for a period of at least 20 years on the complete cabling system; including patch panels, patch cables, terminations and labor. The remaining portions of the system shall be warranted for a period of three (3) years from date of substantial completion.*

1.5 INTRA-BUILDING COPPER BACKBONE CABLE SYSTEMS

A. MAIN EQUIPMENT ROOM (ER) TO TELECOMMUNICATION ROOMS (TR) VOICE BACKBONE CABLE SYSTEM

1. When the School has a Traditional IP-Enabled PBX Phone System, provide a multi-pair CAT-3 Voice Backbone system between the ER and the associated TRs, sufficient to serve all voice stations with 2 pairs in the backbone.
2. When the School has an all-IP Phone System, a minimal 25-pair CAT-3 Voice Backbone is recommended **but** not required.
3. Provide a minimum of one (1) 100-pair cable between the ER and each associated TR. Equip cables in increments of 100 pairs. For TE/TR serving less than 24 users, provide a minimum 50 pair cable.
4. Provide a minimum of one (1) pair per associated TR telephone outlet with 50% spare capacity.
5. Terminate 100-pair cables on 110 Blocks using C-4 Clips or **Cat-6**, rack-mounted, patch panels as minimum 2-pair circuits – See figures 1 and 2 above.

B. MAIN EQUIPMENT ROOM (ER) TO TELECOMMUNICATION ROOMS (TR) DATA CIRCUIT BACKBONE CABLE SYSTEM - OPTIONAL

1. Provide a minimum of six (6) four-pair, **Cat-6** cables to match category rating of data cables between the ER and each associated TR.
2. Terminate the cables on **Cat-6**, rack-mounted, Patch panels at each end. – See figures 1 and 2 above.

C. ENTRANCE FACILITY (EF) TO MAIN EQUIPMENT ROOM (ER) VOICE BACKBONE CABLE SYSTEM

1. Separate Entrance Facilities (EF) are generally encountered during renovations to existing buildings and are not recommended for new construction. For new construction, co-locate the Entrance Facility (EF) in the Main Equipment Room (ER).
2. When the Entrance Facility is not co-located in the Main Equipment Room (ER), provide a multi-pair CAT-3 Voice Backbone system between the EF and the ER, for the extension of voice, FAX and alarm circuits provided by the Service Provider (SP).
3. Provide a minimum of one (1) 100-pair cable between the EF and each associated ER. Equip cables in increments of 100 pairs.
4. Terminate LEC Feeder, 100-pair cables on 110 Blocks using C-5 Clips at both ends. – See figure 3 above.

D. ENTRANCE FACILITY (EF) TO MAIN EQUIPMENT ROOM (ER) DATA CIRCUIT BACKBONE CABLE SYSTEM

1. When the Entrance Facility is not co-located in the Main Equipment Room (ER) provide a minimum of six (6) four-pair, **Cat-6** cables between the EF and the ER for the extension of special circuits (T-1, PRI, etc.) provided by the Service Provider (SP) - Optional.
2. Terminate the cables on a **Cat-6**, wall-mounted, Patch panel at the EF end and on a **Cat-6**, wall-mounted or rack-mounted patch panel at the ER end. – See figure 3 above.
3. Terminate LEC Feeder, 100-pair cables on 110 Blocks using C-5 Clips at both ends. – See figure 4 above.

1.6 INTER-BUILDING COPPER BACKBONE CABLE SYSTEMS**A. MAIN EQUIPMENT ROOM (ER) TO MAIN EQUIPMENT ROOM (ER) VOICE BACKBONE CABLE SYSTEM**

1. When multiple School Buildings are located on the same campus, and served by a common IP-Enabled Phone System, provide a multi-pair, underground or aerial telecommunications cable between the ER or EF of the building containing the common Phone System and the ER or EF of each of the associated satellite buildings.
2. Provide a minimum of 25 pairs.
3. Provide a minimum of one pair for each active telephone outlet in the associated satellite building.
4. Provide a minimum of 25 % spare pairs for growth.

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5. When the School has an all-IP Phone System, the multi-pair inter-building Voice Backbone is optional. In cases where only one Service Provider DEMARC is provided per campus, provide an inter-building Voice Backbone cable for 911 backup and alarm circuits.
6. Terminate the inter-building cables on Protected Entrance Terminals (PETs) at both ends. – See figure 4 above.
7. Provide Gas-Tube Protector Modules for all pairs at both ends.
8. Ground the Cable sheath and the PET to the associated Telecommunications Main Grounding Bus (TMGB) at both ends.
9. Depending on the application, provide metal protective sheaths and appropriate rodent protection devices for aerially installed Telecommunications cables.

1.7 INSTALLATION

- A. All cabling shall be installed according to ANSI/EIA/TIA specifications and BISC standards.
- B. All **Cat-6** cabling shall be terminated on **Cat-6** (minimum) patch panels and jacks as noted above.
- C. All system multi-pair voice backbone cabling shall be terminated on **Cat-6** (minimum) patch panels or 110 style punch blocks as noted above.
- D. Provide designated space on Telecommunications Backboard for location of Access Provider's (AP's) Service Entrance Cable Termination and Protection Point.

1.8 LABELING

- A. All racks, patch panels, cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/architect.
- B. All cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.
- C. All Patch Panels shall be equipped with pre-printed, cable identification designation strips installed behind clear plastic label holders on the front of the patch panel.

1.9 TESTING

- A. All **Cat-6** backbone cables shall be tested to **Cat-6** performance levels in accordance with ANSI/TIA/EIA-568-B.2 (or latest) specifications, using a Level III compliant tester.
- B. All multi-pair, backbone cables shall be tested to Cat-3 (minimum) performance levels in accordance with ANSI/TIA/EIA-568-B.2 (or latest) specifications, using a Level III compliant tester.

- C. All multi-pair, inter-building backbone cables shall be tested to Cat-3 (minimum) performance levels in accordance with ANSI/TIA/EIA-568-B.2 (or latest) specifications, using a Level III compliant tester.
- D. All Cable test results shall be stored and presented to the Architect in both hard copy and electronic format for approval.
- E. All Cable Tester record designations shall match the associated cable label, and associated patch panel or 110-block label designation.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 271323****COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Intra and Inter-Building Communications Optical Fiber Backbone Cabling Infrastructure that shall be followed for all OSFC Technology construction projects.
 - 1. Figure 1 describes a typical Intra-Building Communications Optical Fiber Backbone Cabling System
 - 2. Figure 2 describes a typical Inter-Building Communications **Optical Fiber** Backbone Cabling System
 - 3. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. INTRA-BUILDING OPTICAL FIBER BACKBONE CABLE SYSTEMS
 - 1. Main Equipment Room (ER) to Telecommunication Rooms (TR) Fiber Optic Backbone Cable System
- B. INTER-BUILDING OPTICAL FIBER BACKBONE CABLE SYSTEMS
 - 1. Main Equipment Room (ER) to Main Equipment Room (ER) Fiber-Optic Backbone Cable System
- C. OPTICAL FIBER PATCH PANEL SYSTEMS
 - 1. Fiber-Optic Patch Panels
 - 2. Fiber-Optic Connectors
 - 3. Fiber-Optic Splice Trays

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment installation practices shall comply with the local electric code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM) and BICSI[®] Customer-Owned Outside Plant Design Manual.

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- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, standards.
- G. All 62.5 micron, multi-mode fiber equipment shall comply with the latest American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance Specification ANSI/TIA/EIA-492AAAA. Detail Specification for 62.5- μ m Core Diameter/125- μ m Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers. Note: 62.5 micron is only for legacy systems.
- H. All 50 micron, multi-mode equipment shall comply with the latest American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance Specification ANSI/TIA/EIA-492AAAB. Detail Specification for 50- μ m Core Diameter/ 125- μ m Cladding Diameter Class 1a Multimode Graded-Index Optical Waveguide Fibers. 50 micron fiber shall be OM4 laser optimized with support for 10 GB serial at 500m.
- I. All single-mode equipment shall comply with the latest American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance Specification ANSI/TIA/EIA-492CAAA. Detail Specification for Class IVa Dispersion—Unshifted Single-Mode Optical Fibers.

1.4 SYSTEM WARRANTY

- A. System shall carry an industry standard, performance based warranty, by the manufacturer and contractor, for a period of at least 20 years on the fiber-optic cabling; including patch panels, patch cables, terminations and labor. The remaining portions of the system shall be warranted for a period of **three (3) years** from date of substantial completion.

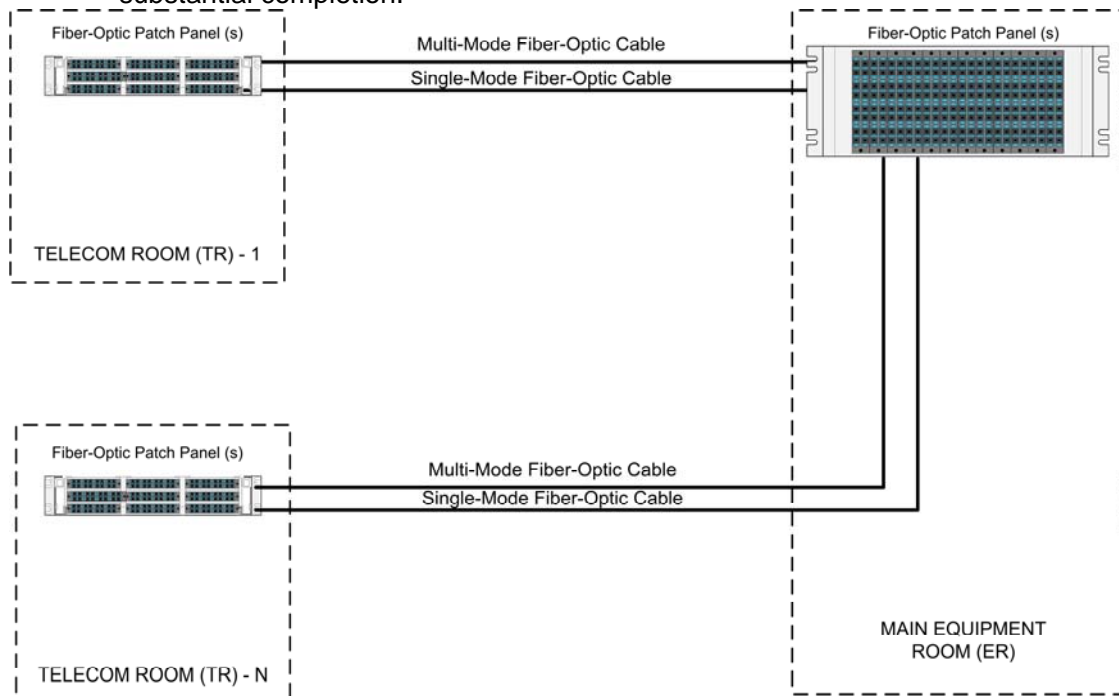


Figure 1 – Main Equipment Room (ER) to Telecommunication Rooms (TRs) Fiber-Optic Backbone Cable System

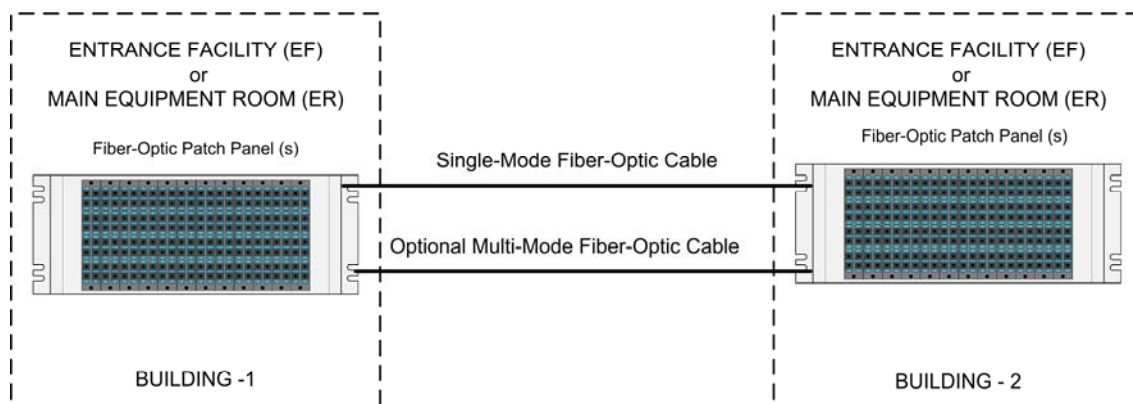
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Figure 2 – Main Equipment Room (ER) to Main Equipment Room (ER) Inter-Building Fiber-Optic Backbone Cable System

1.5 INTRA-BUILDING OPTICAL FIBER BACKBONE CABLE SYSTEMS

A. MAIN EQUIPMENT ROOM (ER) TO TELECOMMUNICATION ROOMS (TR) FIBER-OPTIC BACKBONE CABLE SYSTEM

1. GENERAL

- a. Provide a multi-mode and single-mode Optical Fiber Backbone System for all new and renovated Buildings when the building contains more than one (1) Telecommunications Closet.
- b. Upgrade existing Optical Fiber Backbone Systems to the following requirements.
- c. Ground the Cable sheath of aerial fiber-optic cables to the associated Telecommunications Main Grounding Bus (TMGB) at both ends.
- d. Depending on the application, provide metal protective sheaths and appropriate rodent protection devices for aerially installed fiber-optic cables.

2. MULTI-MODE FIBER-OPTIC CABLE

- a. Provide a Multi-Mode, Fiber-Optic Cable between the Main Equipment Room and each associated Telecommunications Room (TR).
- b. The Multi-Mode, Fiber-Optic cable shall be 50/125, OM4 micron laser optimized fiber.
- c. The Multi-Mode, Fiber Optic cable shall be OFNP rated, tight-buffered and installed in plenum rated inner-duct.
- d. The Multi-Mode, Fiber-Optic cable shall be sized per the following formula; # strands: 6 strands per 48 ports. TR serving less than 96 users shall be minimum 12 strands.
- e. Provide spare fibers after initial Network Configuration Design.
- f. The Multi-Mode fibers shall be terminated with fusion-spliced, factory-polished, SC or LC Pigtails or pre-terminated backbone fiber with associated fiber cassettes.

- g. Classroom fibers are not supplied for new construction; however, for existing construction (renovations), the fibers may be terminated with epoxy cured, field-terminated, SC or LC Connectors.

3. SINGLE-MODE FIBER-OPTIC CABLE

- a. Provide a Single-Mode, Fiber-optic Cable between the Main Equipment Room (ER) and each associated Telecommunications Room (TR).
- b. The Single-Mode, Fiber Optic cable shall be **OS2** 8.7/125 micron fiber.
- c. The Single-Mode, Fiber Optic cable shall be OFNP rated, tight-buffered and installed in plenum rated inner-duct.
- d. The Single-Mode, Fiber Optic cable shall be a minimum **12 strands** per TR to ER.
- e. The Single-mode fibers shall be terminated with fusion-spliced, factory-polished, SC or LC Pigtails or pre-terminated backbone fiber with associated fiber cassettes capable of 10 Gbps operation.
- f. Angle-Polished Connectors (APC) shall be utilized on all Single-mode fibers used to support AM Video (CATV, etc.) applications.

1.6 INTER-BUILDING OPTICAL FIBER BACKBONE CABLE SYSTEMS

A. MAIN EQUIPMENT ROOM (ER) TO MAIN EQUIPMENT ROOM (ER) INTER-BUILDING FIBER-OPTIC BACKBONE CABLE SYSTEM

1. GENERAL

- a. Provide a single-mode Optical Fiber Backbone System between all buildings on the same campus.
- b. Provide an optional, multi-mode Optical Fiber Backbone System between all buildings on the same campus that are less than 250 meters between building ERs.
- c. Upgrade existing Optical Fiber Backbone Systems to the following requirements.

2. MULTI-MODE FIBER-OPTIC CABLE - OPTIONAL

- a. Provide an optional Multi-Mode, Fiber-Optic Cable between the Main Equipment Room (ER) of the Network Center and each associated Building's Main Equipment Room (ER).
- b. The Multi-Mode, Fiber-Optic cable shall be 50/125, OM4 micron laser optimized fiber.
- c. The Multi-Mode, Fiber Optic cable shall be gel-filled or indoor/outdoor rated, tight-buffered cable installed in underground duct banks or aerially between buildings.
- d. If the fiber-optic cable shares the duct bank with other cables, install an inner-duct.
- e. The Multi-Mode, Fiber-Optic cable shall be a minimum 12 strands between buildings -- ER to ER.
- f. Provide a minimum of 25% spare fibers after initial Network Configuration Design.

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- g. The Multi-Mode fibers shall be terminated with fusion-spliced, factory-polished, SC or LC Pigtails or pre-terminated backbone fiber with associated fiber cassettes.
- 3. SINGLE-MODE FIBER-OPTIC CABLE
 - a. Provide a Single-Mode, Fiber-optic Cable between the Main Equipment Room (ER) of the Network Center and each associated Building's Main Equipment Room (ER).
 - b. The Single-Mode, Fiber Optic cable shall be an **OS2** 8.7/125 micron fiber.
 - c. The Single-Mode, Fiber Optic cable shall be gel-filled or indoor/outdoor rated, tight-buffered cable installed in underground duct banks or aerially between buildings.
 - d. If the fiber-optic cable shares the duct bank with other cables, install an inner-duct.
 - e. The Single-Mode, Fiber-Optic cable shall be a minimum 12 strands between buildings -- ER to ER.
 - f. The Single-mode fibers shall be terminated with fusion-spliced, factory-polished, SC or LC Pigtails or pre-terminated backbone fiber with associated fiber cassettes capable of 10 Gbps operation.
 - g. Angle-Polished Connectors (APC) shall be utilized on all Single-mode fibers used to support AM Video (CATV, etc.) applications.

1.7 OPTICAL FIBER PATCH PANEL SYSTEMS

- A. FIBER-OPTIC PATCH PANELS
 - 1. Fiber-Optic patch panels shall be mounted in equipment racks.
 - 2. Fiber-Optic patch panels shall be rack-mounted and shall be 24/48/72/144 port, or as required.
 - 3. Provide "Dual SC or LC" type couplers for multi-mode and single-mode cables.
- B. FIBER-OPTIC CONNECTORS
 - 3. Terminate Multi-Mode fibers with factory-terminated SC or LC multi-mode pigtails. Match fiber cable type provided.
 - 4. Terminate Single-Mode fibers with factory-terminated SC or LC single-mode pigtails. Match fiber cable type provided.
- C. FIBER-OPTIC SPLICE TRAYS (Fusion Splice Pigtails)
 - 3. Provide Fiber-Optic Fusion Splice Trays for connecting the factory-terminated, SC or LC pigtails to the associated Multi-Mode and Single-Mode fibers.

1.8 INSTALLATION

- A. All cabling shall be installed according to ANSI/EIA/TIA specifications and BISC standards.
- B. All fiber-optic cabling shall be terminated on rack-mounted patch panels using fusion-spliced, pigtails, as noted above, or pre-terminated connector panel assembly.

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- C. Provide space in rack (min 3 units) for possible District or DA-Site-provided, inter-building Fiber-Optic Cable Patch Panel.

1.9 LABELING

- A. All racks, patch panels, cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/architect.
- B. All Fiber-Optic cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.
- C. All Fiber-Optic Patch Panels shall be equipped with pre-printed, cable identification designation strips installed behind clear plastic label holders on the front of the patch panel.

1.10 TESTING

- A. All Cable test results shall be stored and presented to the Architect in both hard copy and electronic format for approval.
- B. All Cable Tester, Record designations shall match the associated cable label, and associated patch panel label designation.
- C. All Fiber-Optic Cables shall be tested with both a power meter and an OTDR.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 271513****COMMUNICATIONS COPPER HORIZONTAL CABLING****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Communications Copper Horizontal Cabling System Infrastructure that shall be followed for all OSFC Technology construction projects.
 - 1. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. COMMUNICATIONS COPPER HORIZONTAL CABLING SYSTEM SYSTEMS
 - 1. Modular Jacks
 - 2. Modular Cover Plates
 - 3. Horizontal Cable
 - 4. Modular Patch Panels

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM).
- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.
- G. All connecting equipment shall be from the same manufacturer.

1.4 SYSTEM WARRANTY

- A. System shall carry an industry standard, performance based warranty, by the manufacturer and contractor, for a period of at least 20 years on the horizontal cabling; including patch panels, patch cables, terminations and labor. The remaining portions of the system shall be warranted for a period of **three (3) years** from date of substantial completion.

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1.5 MODULAR JACKS

- A. Each 4-pair 100-ohm UTP data cable shall be terminated in an eight position, modular jack at the Work Area (WA).
- B. The data cable shall be terminated directly to the modular jack with insulation displacement connectors.
- C. The modular jack shall be a minimum of **Category 6** compliant and 6a compliant for wireless solution.
- D. The modular jack pair/pin assignments shall be T568B.

1.6 COVER PLATES

- A. Plates shall be modular, front-loading and colored to match the video/data wall plates.
- B. All plate colors shall be coordinated with the architect to match furnishings and fixtures.
- C. Wall mounted phones shall utilize 630 style faceplates.

1.7 HORIZONTAL CABLE

- A. In accordance with ANSI/EIA/TIA 568B.2 all horizontal data cable shall be:
 - 1. UL listed, 4-pair 100 ohm, UTP, **Category 6 / Category 6a (wireless)** compliant
 - 2. Conductors shall be 24 AWG, solid bare annealed copper.
 - 3. Cable shall be insulated with FEP material.
 - 4. Cable shall be NEC CMP rated.
- B. Cable shall be sequentially marked at 2-foot intervals.
- C. Cable pairs shall be color coded:
 - 1. Pair 1- White/Blue and Blue.
 - 2. Pair 2- White/Orange and Orange
 - 3. Pair 3- White/Green and Green
 - 4. Pair 4- White/Brown and Brown
- D. Provide horizontal voice / data cable drops for:
 - 1. Administrative Computers
 - 2. Bulletin Board System
 - 3. CCTV Cameras (as required)
 - 4. Classroom and Lab Computers
 - 5. Desk top phones
 - 6. Distance Learning Systems
 - 7. Door Phones (as required)
 - 8. Electrical Closets
 - 9. Elevator Phones
 - 10. Energy Management Systems (EMS)
 - 11. Fax Machines
 - 12. Fire Alarm Systems
 - 13. HVAC Equipment

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14. LCD TVs
15. Master Clock System (as required)
16. Mechanical Closets
17. Miscellaneous Network Attached Devices
18. Pay Station Phones (as required)
19. Point of Sale Terminals (as required)
20. Printers
21. Projectors
22. Security and Access Control Systems
23. Set Top Boxes (as required)
24. Teacher Technology Centers
25. Video Conference Units
26. Wall mounted phones

- E. Provide horizontal Category 6a cable drops for wireless access points.
- F. Telecommunication outlet/connectors that serve an individual work area may be located in multiple faceplates.

1.8 MODULAR PATCH PANELS

- A. All patch panels shall be in accordance with ANSI/EIA/TIA 568B.2 (or latest) and shall be equipped with eight position, modular jacks with insulation displacement connectors, rear cable-management bars/standoffs and front label designation strips.
- B. Provide 24 or 48 port, **Category 6** rated patch panels for termination of horizontal cabling. When the Equipment Room (ER) or Telecommunications Room (TR) serves more than one floor, sequentially group the cables by floor on separate patch panels.
- C. Provide 24 or 48 port, Category 6a rated patch panels for termination of all wireless horizontal cabling. When the Equipment Room (ER) or Telecommunications Rooms (TR) serves more than one floor, sequentially group the cables by floor on separate patch panels.
- D. Provide color-coded, **Category 6 / Category 6a** (wireless) rated patch cords for all connections (plus 10% spare).

1.9 INSTALLATION

- A. All cabling shall be installed according to ANSI/EIA/TIA specifications and BISC standards.
- B. All horizontal voice / data cabling shall be terminated on patch panels and jacks as noted above.
- C. Consider providing cable slack at both ends of the horizontal cables to accommodate future cabling system changes.

1.10 LABELING

- A. All patch panels, cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the owner/architect.
- B. All horizontal cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.
- C. All Patch Panels shall be equipped with pre-printed, cable identification designation strips installed behind clear plastic label holders on the front of the patch panel.
- D. All Modular Plates shall be equipped with a pre-printed, cable identification strip, installed behind a clear plastic label holder.

1.11 TESTING

- A. All horizontal cabling shall be tested to **Category 6 / Category 6a (for wireless solution)** performance levels in accordance with ANSI TIA/EIA-568-B.2 (or latest) specifications, using a Level III compliant tester.
- B. All Cable test results shall be stored and presented to the Architect in both hard copy and electronic format for approval.
- C. All Cable Tester Record designations shall match the associated cable label, patch panel label and faceplate label.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 271543****AUDIO-VIDEO COMMUNICATIONS HORIZONTAL TRANSPORT SYSTEM****GENERAL GUIDELINES****1.1 GENERAL**

- A. The baseline A/V system shall utilize digital sources and digital transport medium, to all display devices. The Technology Designer shall provide active electronics where required due to cable distance limitations. Coordinate infrastructure sizes and routing with the Electrical Designer.
- B. The use of analog sources and transport medium shall be ***legacy only***.
- C. ***All new work shall be digital systems.*** This Section defines the general design requirements for a uniform Audio-Video Horizontal Transport System Infrastructure that shall be followed for all OSFC Technology construction projects.
- D. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.
- E. ***Refer to Figure 1 – Typical classroom audio-visual system components for general overview of equipment and interconnectivity***

1.2 SECTION INCLUDES

- A. AUDIO-VIDEO COMMUNICATIONS HORIZONTAL TRANSPORT SYSTEM
 - 1. ***Instructor AV interface outlet.***
 - 2. ***Guest AV Interface Outlet (optional)***
 - 3. ***Wardrobe AV equipment interface outlet***
 - 4. ***Instructor AV equipment interface outlet***
 - 5. ***Classroom Interactive Projector AV interface outlet***
 - 6. ***Public Monitor/TV AV Interface Outlet***

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM).

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- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.

1.4 SYSTEM WARRANTY

- A. System shall carry an industry standard, performance based warranty, by the contractor, for a period of at least 20 years on the cabling; including patch panels, patch cables, terminations and labor. The remaining portions of the system shall be warranted for a period of **three (3)** years from date of substantial completion.

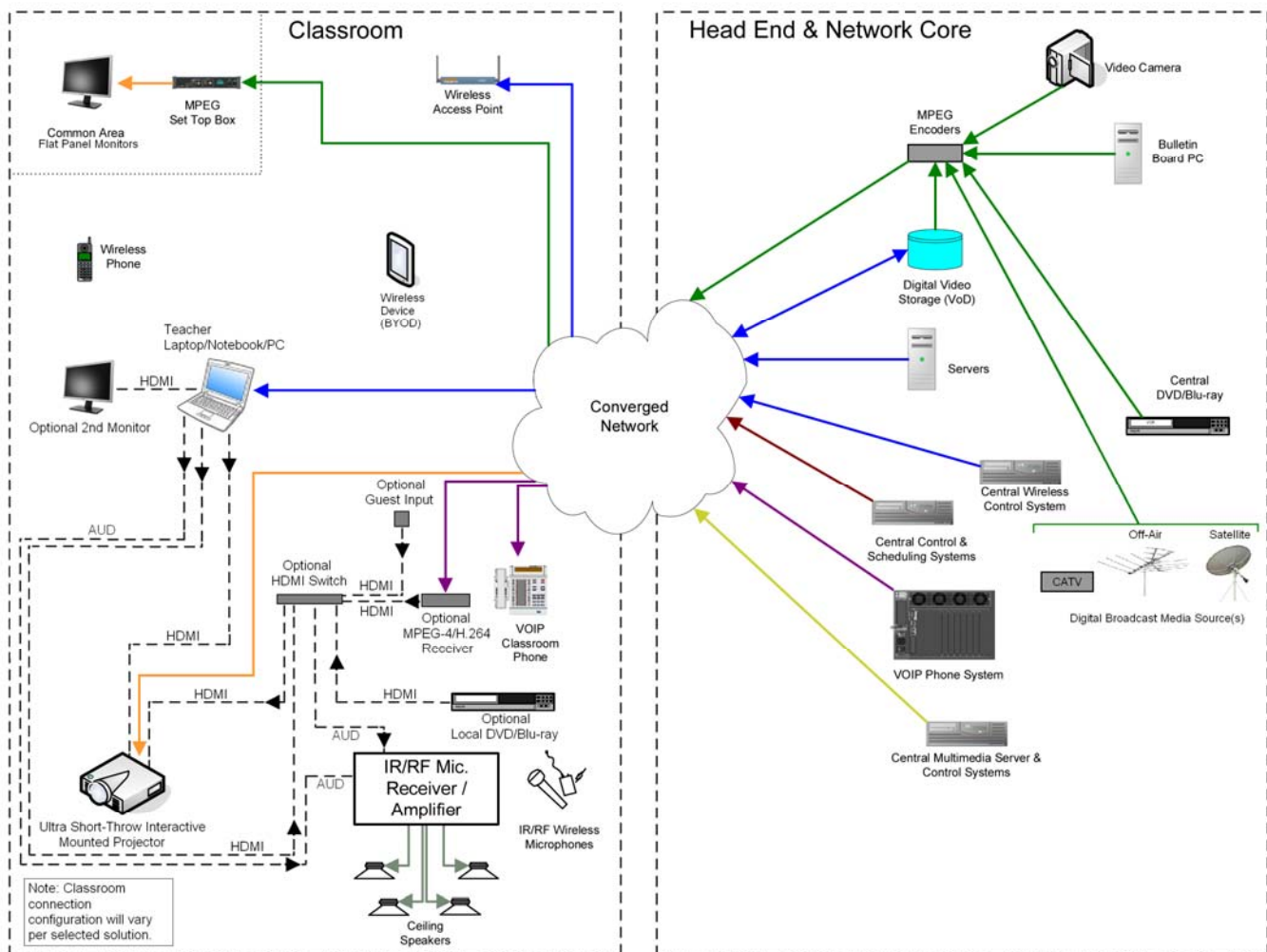


Figure 1 - Typical Classroom Audio-Visual System Components

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1.5 AV INTERFACE OUTLETS

- A. Each classroom/lab shall be provided with AV system interface outlets to transport digital media from and to the required AV equipment.
- B. The video cabling shall utilize the appropriate media to transport digital signals including HDMI, DVI and USB. In addition, where required the cabling shall be provided to transport analog audio media, RS-232 controls and IR controls.
- C. Instructor AV Interface Outlet
 - 1. Provide Digital AV interface of HDMI or DVI for connection to the room projector or room HDMI/DVI switch. Utilize either HDMI/DVI cables, shared sheath cabling systems, or an active UTP based solution with appropriate transmitters/receivers based upon cabling distance limitations.
 - 2. Where the room sound enhancement system is not co-located at the Instructor location, provide additional analog audio cabling to the sound enhancement system.
 - 3. Provide interface for USB cabling to local interactive projector.
- D. Guest AV Interface Outlet (*Optional*)
 - 1. Provide Digital AV interface of HDMI or DVI for connection to the room projector or room HDMI/DVI switch. Utilize either HDMI/DVI cables, shared sheath cabling systems, or an active UTP based solution with appropriate transmitters/receivers based upon cabling distance limitations.
- E. Wardrobe AV Equipment Interface Outlet – Provide the following cables as required by room interconnectivity design
 - 1. HDMI/DVI switch
 - a. Provide Digital AV interface of HDMI or DVI for connection from the Instructor AV Interface, Guest AV Interface, local AV device (BluRay player, Set-top box) and the room projector. Utilize either HDMI/DVI cables, shared sheath cabling systems, or an active UTP based solution with appropriate transmitters/receivers based upon cabling distance limitations
 - 2. Sound Enhancement System
 - a. Provide speaker, line level audio (from Instructor AV Interface Outlet, HDMI/DVI switch) and IR sensor cabling.
 - 3. Provide RS-232 cabling (optional) to projector for remote RS-232 to IP interface device.
- F. Instructor AV Equipment Interface Outlet - Provide the following cables as required by room interconnectivity design.

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1. Provide Digital AV interface of HDMI or DVI for connection from the Guest AV Interface, local AV device (BluRay player, Set-top box) and the room projector. Utilize either HDMI/DVI cables, shared sheath cabling systems, or an active UTP based solution with appropriate transmitters/receivers based upon cabling distance limitations.
 2. Sound Enhancement System
 - a. Provide speaker, line level audio (from Instructor AV Interface Outlet, HDMI/DVI switch) and IR sensor cabling.
 3. Provide RS-232 cabling (optional) to projector for remote RS-232 to IP interface device.
- G. Classroom Projector Display AV Interface Outlet
1. Provide Digital AV interface of HDMI or DVI for connection to the Instructor AV Interface Outlet, the Wardrobe AV Equipment Interface Outlet and/or the Instructor AV Equipment Interface Outlet. Utilize either HDMI/DVI cables, shared sheath cabling systems, or an active UTP based solution with appropriate transmitters/receivers based upon cabling distance limitations.
 2. Provide interface for USB cabling to Instructor AV Interface Outlet
 3. Provide RS-232 cabling (optional) to projector for remote RS-232 to IP interface device.
- H. Public Monitor/TV AV Interface Outlet
1. Provide **CAT 6** network connectivity as a dual data drop.
 2. Where required to have local input - Provide Digital AV interface of HDMI or DVI for connection to the Guest AV Interface Outlet, the Wardrobe AV Equipment Interface Outlet and/or the Instructor AV Equipment Interface Outlet. Utilize either HDMI/DVI cables, shared sheath cabling systems, or an active UTP based solution with appropriate transmitters/receivers based upon cabling distance limitations.

1.6 AV INTERFACE CABLES

A. Digital Video Cables

1. Provide listed cabling to support digital format such as DVI, HDMI, etc. Provide active electronics where required for selected cable distance limitations or for UTP based solutions.
2. The use of HDMI cables may present specific challenges due to the limited bending radius of the cables, the depth of the outlet boxes, and the conduit installation requirements to pull the pre-terminated cables through.

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****B. Line Level Audio Cable**

1. Provide shielded twisted pair cable connected to Female RCA connectors (White/Red).

C. Projector Network Cable

1. Option 1 – Provide one (1) **Category-6** UTP cable connected to **Category-6** patch panel in associated Telecommunications room.
2. Option 2 – Provide one (1) RS-232 cable connected to RS-232 to IP Interface.

D. Set-Top-Box Network Cable

1. Provide one (1) **Category-6** UTP cable connected to **Category-6** patch panel in associated Telecommunications room.

E. Instructor Technology Center Network Cable

1. Provide two (2) **Category-6** UTP cables connected to the **Category- 6** patch panel in associated Telecommunications room.

F. USB Cable

1. Provide one (1) UTP to USB converter on each end with corresponding cabling to connect interactive projector and Teacher Workstation together through UTP based cabling.

1.7 VIDEO COVER PLATES

- A. Plates shall be modular to fit all video jack components and shall match the associated voice/data plates.

1.8 INSTALLATION

- A. Contractor shall provide and install AV Interface Wiring System.
- B. Cables and associated connectors shall be terminated in accordance with industry standards.
- C. Route the classroom Sound Reinforcement Amplifier IR sensor coax and associated speaker cables through faceplate to the Amplifier.

1.9 LABELING

- A. Cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/architect.
- B. All Audio-Video Cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.

1.10 TESTING

- A. **Audio-video** Wiring system and associated systems shall be tested end-to-end complete.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 272100****DATA COMMUNICATIONS NETWORK EQUIPMENT****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Data Communications Network Infrastructure that shall be followed for all OSFC Technology construction projects.
 - 1. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. DATA COMMUNICATIONS NETWORK EQUIPMENT
 - 1. File/Building Server – optional.
 - 2. Network Switches.
 - 3. Network Core Switch.
 - 4. Network Security Equipment.
 - 5. Uninterruptible Power Supplies (UPSs).

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM).

1.4 SYSTEM WARRANTY

- A. ***The Local Area Network Electronics and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.***

1.5 GENERAL

- A. Each Building shall be provided with a Local Area Network (LAN) System.
- B. Existing Facilities that are being remodeled shall be upgraded to the current requirements stated herein.
- C. Single Building projects shall be compatible with the existing District Network infrastructure.

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- D. Wide Area Network (WAN) Interfaces shall be provided to interface the District's WAN provider. Coordinate WAN requirement with the District's fiber provider or DA-Site as applicable.
 - E. Buildings shall be designed as to minimize the quantity of Telecommunications Rooms and to centralize as much of the Data Network Equipment as possible.
 - F. Multiple buildings on the same campus should be designed to share common Data Network Electronics and equipment wherever possible.
 - G. Districts should design their Data Networks to take advantage of Centralization of Common Network Equipment at a Network Operations Center(s).
 - H. Items that should be centralized include:
 - 1. File/Building Servers.
 - 2. L-3 Routing Devices.
 - 3. Network Management Equipment.
 - 4. Security Devices, Radius Servers, etc.
 - 5. WAN access equipment.
 - 6. Wireless Management Equipment.
 - I. As a minimum, the Network may be used to support the following applications on a Local and Wide Area basis:
 - 1. Automation Systems.
 - 2. Clock Systems.
 - 3. Control Systems.
 - 4. Data Networking
 - 5. Security Systems.
 - 6. Video Conferencing.
 - 7. Video Streaming/Media Retrieval.
 - 8. VoIP Telecommunications.
 - 9. Wireless Access Points.
- 1.6 FILE/BUILDING SERVER – Optional (Coordinate need with district)
- A. Provide Network File/Building Server for the central administration and storage of computer files and information. The Networked Server shall be of a current design criteria, utilizing **SAS 10k-15k rpm RAID level 5 hard drive storage (minimum 2TB)--Quad core processor. Coordinate OS with District. Min. 64-bit Windows Server 2008 if Windows based. Minimum 16 GB of RAM, 2 x 10Gig NIC. Attach to Core via 10 Gig DAC. 22" LED monitor, rack mounted.**
 - B. Provide Operating System based on District requirements.
- 1.7 NETWORK SWITCHES
- A. Provide 100/1000 Base T Layer 2 Manageable Ethernet Switches with ports in a quantity to support all initially planned devices with 15% spare.
 - B. Provide 100/1000 Base T Layer 2 Manageable Ethernet switch with ports in quantity to support all wireless access point devices with 15% spare.
 - C. Provide a configuration of switch ports utilizing either stackable edge switches or a modular chassis with single engine and dual PS.
 - 1. Provide dual 10GB uplinks to each switch stack or modular chassis.
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- D. The 100/1000 switches shall be “non-blocking” and support a minimum forwarding bandwidth equal to the number of switch ports x 1 Gbps.
- E. Utilize 10GB uplinks for all uplinks. Switches may be stacked, but provide each stack with a minimum of two uplinks for redundancy.
- F. Chassis mounted units are acceptable for Edge Switches, provided that dual power supplies and equivalent uplink bandwidth is supplied.
- G. The Network switches shall support advanced services such as:
 - 1. IP Telephony.
 - 2. Wireless Access Points.
 - 3. Building Management Systems.
 - 4. Video Streaming.
 - 5. **IP CCTV/Access Control**
- H. POE+ switches shall be rated to provide POE+ class 3 on all ports simultaneously. **Standard 30 watts per port.**
- I. The 100/1000 switches shall support the following features and specifications:
 - 1. 1000BASE-LX/LH.
 - 2. 1000BASE-SX.
 - 3. 1000BASE-X (SFP).
 - 4. 1000BASE-ZX.
 - 5. Access Control Lists (ACL).
 - 6. Advanced QoS.
 - 7. IEEE 802.1s.
 - 8. IEEE 802.1D Spanning Tree Protocol.
 - 9. IEEE 802.1p CoS Prioritization.
 - 10. IEEE 802.1Q VLAN.
 - 11. IEEE 802.1s.
 - 12. IEEE 802.1w.
 - 13. IEEE 802.1x.
 - 14. IEEE 802.3 10BASE-T specification.
 - 15. IEEE 802.3ab 1000BASE-T specification.
 - 16. IEEE 802.3ad.
 - 17. IEEE 802.3af and 802.11at POE.
 - 18. IEEE 802.3u 100BASE-TX specification.
 - 19. IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports.
 - 20. IEEE 802.3z 1000BASE-X specification.
 - 21. IPv6.
 - 22. Rapid Spanning Tree.
 - 23. Rate Limiting.
 - 24. RMON I and II standards.
 - 25. SNMPv1, SNMPv2c, and SNMPv3.
- J. Provide sufficient 100/1000 ports to accommodate, as a minimum, the following devices as required:
 - 1. Access Control System.

2. Admin PCs.
 3. Classroom PC Devices.
 4. Clock Systems.
 5. Distant Learning Systems.
 6. Instructor PCs.
 7. Monitor/TVs, as required.
 8. MPEG Encoders.
 9. PABX System.
 10. Printers.
 11. Projectors.
 12. Set Top Boxes, as required.
 13. UPS Units.
- K. Provide sufficient 100/1000 POE+ ports to accommodate, as a minimum, the following devices as required:
1. IP Phones
 2. IP CCTV Cameras
 3. **WLAN access points.**

1.8 NETWORK CORE SWITCH

- A. Provide a modular chassis-based central Layer-3 ethernet routing switch with advanced QoS to serve the entire building or campus. The Core switch shall be provided with backplane capacity to provide full non-blocking support of all installed line cards plus 15% growth.
- B. Equip the Central Layer-3 switch with a minimum of two (2) Power Supplies and two (2) Redundant Central Control/Supervisor Units.
- C. All Core switch Blades must support full line speed and shall not be over-subscribed.
- D. Provide sufficient Ports on the Layer-3 Core Switch, as a minimum, for the following devices:
1. Provide Network Switch uplink ports to support all edge switches plus 15% spare. The switch shall have at least one spare uplink card for redundancy.
 2. Building Automation Systems, as required (typically TX).
 3. CCTV DVR System (typically TX).
 4. File Servers (typically TX, **10GB**).
 5. Firewall, as required (typically TX).
 6. Media Distribution Servers & Controllers (typically TX).
 7. Radius Authentication Server, as required, (typically TX).
 8. WAN Connectivity (typically LX or CWDM).
 9. Wireless Controllers (typically TX, **10GB**).
 10. Wireless Phone Controller (typically TX).
 11. Wireless Control Console (typically TX).
- E. In addition to the above listed features and specifications for the Network Switches, the Network Core Switch shall support the following Features and Specifications:
1. 10 Gbps Support capabilities.
 2. BGP4 and Multicast Border Gateway Protocol (MBGP).
 3. Full Internet Control Message Protocol (ICMP) support.
 4. Hot Standby Router Protocol (HSRP).

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5. ICMP Router Discovery Protocol.
6. IGMP filtering.
7. IGMP v1, v2, and v3.
8. IP Multicast routing protocols.
9. IP routing protocols: EIGRP, OSPF, Routing Information Protocol (RIP), and RIP2.
10. Non-Blocking GBE Ports.
11. NSF awareness.
12. Policy-based routing (PBR).
13. Virtual Router Redundancy Protocol (VRRP).

1.9 NETWORK SECURITY EQUIPMENT**A. RADIUS SERVER**

1. If the District does not have a Central Radius Server, provide a Radius Server for Network Authentication, VLAN Assignment and Policy Assignment for IP Network Attached Devices.

B. FIRE WALL

1. If the District does not have a Central Firewall and Intrusion Detection Device for connection to the Wide Area Network and Internet, provide a Firewall and Intrusion Detection Device for Protection and Security. Establish all Internet Connections via a Firewall.
2. Size the Firewall based on planned Network throughput, available WAN bandwidth and attached IP Devices.
3. Provide VPN services in the Firewall for remote access and network maintenance services.
4. Coordinate requirements with District Technology Department.

1.10 UNINTERRUPTIBLE POWER SUPPLIES (UPSs)

- A. Provide Dual Conversion UPS units for ER and TR Local area Network Electronics and File Server, providing sufficient protection from power anomalies.
- B. Provide Power strips, connected to the UPS Unit via twist-lock plugs. Locate the power strips in the equipment racks and on the equipment backboards for powering all electronics systems in the ER and TRs.
- C. Provide multiple UPS Units based on expected power load or a single large UPS Unit. Locate the multiple UPS units in the associated equipment racks or locate a larger central UPS unit in the Room.
- D. Connect the UPS Units to Building Emergency Generator when available.
- E. For buildings without a Generator, supply a two-hour (2) standby.
- F. Provide shutdown connections from the UPS to servers for graceful power down in the event of a power failure.
- G. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.
- H. Connect the UPS SNMP Management to the Management VLAN.

- I. Coordinate UPS voltage, circuit size, and connection requirements with the Electrical Design Professional.

1.11 INSTALLATION

- A. Install File Server (optional) and setup basic user accounts and network configuration.
- B. Install Data Network Ethernet Switches and validate connectivity throughout. Establish all VLANs, QoS, IP Routing and IP Subnets.
- C. Consult with the District and consider providing the following VLANs as a minimum:
 - 1. Administration.
 - 2. HVAC.
 - 3. Management.
 - 4. Point of Sale.
 - 5. Student.
 - 6. Video.
 - 7. Voice.
 - 8. Wireless.
 - 9. **Security, CCTV**
- D. Coordinate network installation and integration with other systems connected to the network with District's and applicable DA-Site's technical and operational requirements.
- E. Install and setup UPS units and establish power down procedures.
- F. Connect System to DA-Site WAN Links and configure as per DA-Site requirements, when applicable.
- G. Program and configure any State of Ohio Educational Network ATM switches required to access the DA-Site or the State of Ohio IVDL Network.

1.12 LABELING AND MARKING

- A. Provide a typed schedule of all data ports according to each related room jack designation for all TRs, and ER, in accordance with District's requirements.

1.13 TESTING

- A. Test the system "end-to-end" (from TR to ER, and from TR to station jack) at the direction of the Design Professional and verify, in writing, that the data network system is in proper working condition.
- B. Verify and demonstrate proper operation of all switches, Access Points, VLANs, Routing, WAN Connectivity and possible ATM Connectivity with District and DA-Site representative, if applicable.

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1.14 TRAINING

- A. Provide a minimum of **forty (40)** hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:
 - 1. System Equipment Connectivity
 - 2. Device Configurations
 - 3. Operation, maintenance, and upgrade procedures.
- B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***
- C. ***Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
- D. ***Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
- E. ***Training shall be by certified manufacturer instructor.***
- F. ***Training schedule shall be coordinated with District personnel and their needs.***
- G. ***Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
- H. ***Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
- I. ***Provide a digital video copy of the training sessions.***

END OF SECTION

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COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 272133****DATA COMMUNICATIONS WIRELESS ACCESS POINTS****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Data Communications Wireless Network Infrastructure that shall be followed for all OSFC Technology construction projects.
- B. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. DATA COMMUNICATIONS WIRELESS ACCESS POINTS
 - 1. Wireless Controllers
 - 2. Wireless Software Management
 - 3. Network Tracking
 - 4. Wireless Access Points
 - 5. **Mobile Device Management**
 - 6. **Application Management**

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM).
- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.
- G. All equipment shall provide protection and containment of unwanted wireless signals and prevent student access to unwanted networks and content, in accordance with CIPA requirements.
- H. All equipment shall meet or exceed 802.11n requirements **and have an upgrade path to 802.11ac standard.**

1.4 SYSTEM WARRANTY

- A. *The Wireless Network Electronics and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.*

1.5 WIRELESS NETWORKING

A. GENERAL

1. Design Wireless System for full building coverage and to assure coverage for **ubiquitous high density coverage for an average of 15-20 users per AP in educational areas and standard high density coverage throughout the remainder of the building, as per parameters in this specification.**
2. Design Wireless System with 30% growth factored.
3. Design shall allow for additional bandwidth growth and shall be capable of limiting the bandwidth used by each device
4. Design shall provide for multi-state radios that can be switched from 2.4GHz to 5GHz
5. System shall allow bandwidth limits and time of day restrictions to be placed on particular users or particular device types
6. System shall allow network administrators to set QoS parameters for different traffic types
7. Provide 802.11n Wireless Access Points, management software and associated Wireless Network Controller(s), to support wireless Network Devices and Phones throughout the building and the associated campus. **Provide upgrade path to 802.11ac.**
8. Provide a CAT 6A horizontal data cable drop for each AP. Terminate the AP Cable drop on a Patch Panel at the associated Telecommunication Room (TR).
9. Connect the AP to the IP Network via an IEEE 802.3af Power Over Ethernet (POE) 1 Gbps Switch Port.
10. Coordinate 802.31x, VLAN and Security Settings/Requirements with the District.
11. Shall provide proper network authentication and authorization
12. Security shall have the ability to check antivirus software
13. Wireless network management shall utilize the same firewall, NAC, and RADIUS as the LAN
14. System shall allow different user groups to be created with each group mapped to specific VLANS, access control list, and QoS parameters
15. System shall provide device fingerprinting identifying devices operating systems such as iOS, Microsoft Windows, Blackberry, or Android and shall classify the device type such as tablet, laptop, or smartphone.
16. Once the system has identified the device, a policy can be applied to control a device's reach and behavior
17. The device ID along with the user ID shall be used together to map that instance to a specific user group
18. Provide Wireless coverage for the entire building and associated perimeter area.
19. Provide minimum of -65 dB signal level at all locations in building for 802.11n coverage.
20. Provide a minimum of 7 Mbps throughput per user.
21. Technology Designer shall verify quantity of users with the District.

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22. Supply sufficient Access Points to provide for expected throughput and load sharing.
23. Users can “see” at least 3 Access points to provide for load sharing and balancing.
24. Wireless system shall have full multi-media capabilities by integrating:
 - a. 802.11e
 - b. WMM
 - c. QoS
 - d. Stateful Firewall
 - e. Wired to wireless mapping and traffic management services based on device, user and/or traffic types. This includes priority queuing for multiple traffic types as well as multicast snooping and pruning.
 - f. All APS/Arrays shall provide the ability to optimize multicast traffic by converting to unicast and/or optimize multicast traffic transmit rates to better match speeds of connected users.
25. Wireless system shall provide the following security functions:
 - a. Dedicated 24/7 threat sensor radio
 - b. Stateful firewall
 - c. Integrated RADIUS
 - d. Integrated ACLs, 802.11i, 802.1
 - e. Line rate encryption, no matter the traffic volume of encryption protocol in use.
26. Wireless Design Validation
 - a. During Design Phase, the Technology Designer shall utilize WLAN modeling software to plan the wireless access point deployment in a building and/or campus.
 - b. The Technology Designer shall submit a predictive analysis survey via use of WLAN modeling software, along with the OSFC DD and CD technology phase submissions for review.
 - c. As a minimum, this analysis shall indicate protocol, through-put and client density.
 - d. The WAP quantity and layout shall be based on this modeling.
 - e. **Predictive analysis survey modeling shall be performed for 2.4 Ghz and 5 Ghz. Include both results in the submittal.**
27. Wireless Installation Validation
 - a. Prior to installation of cabling for Access Points, the contractor shall perform an on-site Validation Survey. This survey shall be utilized to obtain actual site conditions including RF environment and RF properties of the construction. Prepare an AP placement plan utilizing the Validation Survey information and using the AP controllers “planning” tools. Provide a report to the Owner and Technology Designer for review and approval.
 - b. After complete install of all AP’s, perform a final survey and tune/optimize the system, **while the building is occupied**, to verify coverage. Move any AP’s required to guarantee that coverage and performance requirements are met. Provide final report to the Owner and Technology Designer for review and approval.
28. Coordinate with local Law Enforcement and Safety Forces regarding their requirements for remote and wireless access into building Security and Energy Management Systems.
29. Law Enforcement and Safety Forces shall be responsible for providing their own remote access equipment.

-
- B. CABLING INFRASTRUCTURE FOR WIRELESS LOCAL AREA NETWORK**
1. *Shall consist of single mode fiber for the backbone to enable 10Gig backbone and provide upgradability for future.*
 2. *Shall utilize CAT 6A horizontal cable solution.*
 3. *Baseline includes CAT6A cable to each classroom. Wireless design will determine quantity and placement of WAP's.*
 4. *Shall utilize 1 Gig uplink to the switch and a 10 Gig uplink to the headend equipment.*
- C. WIRELESS SYSTEM SPECIFICATIONS**
1. *RF Management*
 2. *In-band per IAP Spectrum Analysis*
 3. *Dynamic Channel Configuration*
 4. *Dynamic Cell Size Configuration*
 5. *Monitor radio for threat assessment and mitigation*
 6. *Wired and Wireless Packet Captures (including all 802.11 headers)*
 7. *Radio Assurance for radio self test and healing*
 8. *RF Monitor*
 9. *High Availability Supports Hot Stand-By for mission critical areas*
 10. *Supports ability to turn off radios based on schedule configuration*
- D. WIRELESS PROTOCOLS**
1. *IEEE 802.11*
 2. *IEEE 802.11 a*
 3. *IEEE 802.11 b*
 4. *IEEE 802.11 d*
 5. *IEEE 802.11 e*
 6. *IEEE 802.11 g*
 7. *IEEE 802.11 h*
 8. *IEEE 802.11 i*
 9. *IEEE 802.11 j*
 10. *IEEE 802.11 n*
- E. WIRED PROTOCOLS**
1. *IEEE 802.1p – Layer 2 Traffic Prioritization*
 2. *IEEE 802.1q – VLAN Tagging*
 3. *RFC Support*
 4. *RFC 768 UDP*
 5. *RFC 791 IP*
 6. *RFC 2460 IPV6 (Bridging only)*
 7. *RFC 792 ICMP*
 8. *RFC 793 TCP*
 9. *RFC 1122 Requirements for Internet Hosts – Communication Layers*
 10. *RFC 1542 BOOTP*
 11. *RFC 2131 DHCP*
- F. SECURITY**
1. *IEEE 802.11iWPA2, RSN*
 2. *RFC 1321 MD5 Message-Digest Algorithm*
 3. *RFC 2246 TLS Protocol Version 1.0*
 4. *RFC 3280 Internet X.509 PKI Certificate and CRL Profile*
 5. *RFC 4347 Datagram Transport Layer Security*

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6. *RFC 4346 TLS Protocol Version 1.1*
7. *WEP*
8. *WPA™ – Personal*
9. *WPA™ – Enterprise*
10. *WPA2™ – Personal*
11. *WPA2™ – Enterprise*
12. *EAP Type(s)*
13. *EAP-TLS*
14. *EAP-TTLS/MSCHAPv2*
15. *PEAPv0/EAP-MSCHAPv2*
16. *PEAPv1/EAP-GTC*
17. *Encryption Type*
18. *Open*
19. *WEP*
20. *TKIP-MIC: RC4 40, 104 and 128 bits*
21. *SSL and TLS: RC4 128-bit and RDA 1024 and 2048 bit*

G. AUTHENTICATION

1. *IEEE 802.1x*
2. *RFC 2548 Microsoft Vendor-Specific RADIUS Attributes*
3. *RFC 2716 PPP EAP-TLS*
4. *RFC 2865 RADIUS Authentication*
5. *RFC 2866 RADIUS Accounting*
6. *RFC 2867 Tunnel Accounting*
7. *RFC 2869 RADIUS Extensions*
8. *RFC 3576 Dynamic Authorizations Extensions to RADIUS RFC 3579 RADIUS Support for EAP*
9. *RFC 3748 Extensible Authentication Protocol*
10. *Web Page Authentication*
11. *WPR, Landing Page, Redirect*
12. *Support for Internal WPR Landing Page and Authentication*
13. *Support for External WPR, Landing Page, and Authentication*

H. CHANNEL SUPPORT 2.4GHz

1. *1 2 3 4 5 6 7 8 9 10 11 12 13 14*

I. CHANNEL SUPPORT 5GHz

1. *Uni 1 – Non-DFS Channels*
2. *36 40 44 48*
3. *UNI I DFS Channels*
4. *52 56 60 64*
5. *UNI II DFS Channels*
6. *100 104 108 112 116 120 124 128 132 136 140*
7. *UNI III Non-DFS Channels*
8. *149 153 157 161 165*

J. MANAGEMENT INTERFACES

1. *Command Line Interface via serial console, SSHv2, Telnet*
2. *Web interface (http / https)*

K. MANAGEMENT

1. *SNMP v1, v2c, v3*

2. *RFC 854 Telnet*
3. *RFC 1155 Management Information for TCP/IP Based Internets*
4. *RFC 1156 MIB*
5. *RFC 1157 SNMP*
6. *RFC 1213 SNMP MIB II*
7. *RFC 1350 TFTP*
8. *RFC 1643 Ethernet MIB*
9. *RFC 2030 Simple Network Time Protocol SNTP*
10. *RFC 2616 HTTP 1.1*
11. *RFC 3636 Definitions of Managed Objects for IEEE*
12. *RFC 2674 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and Virtual LAN Extensions*
13. *RFC 2819 Remote Network Monitoring Management Information Base*
14. *RFC 2863 The Interface Group MIB*
15. *RFC 3164 BSD Syslog Protocol*
16. *RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*
17. *RFC 3418 Management Information Base (MIB) for the Simple Network Management protocol (SNMP)*

L. RADIO OPTIMIZATION MANAGEMENT

1. *Shall individually control band selection (2.4GHz or 5GHz), transmit power, and channel allocation.*
2. *Shall have option of controlling band selection either automatically or manually.*
3. *Shall support Auto Channel which provides an automatic means of allocating Wi-Fi channels between radios in a deployment.*
4. *Shall provide Auto Channel. System scans the RF environment on a radio-by-radio basis, coordinated among all AP's/Arrays in the network, to determine the best channel of operation per radio.*
5. *Auto Channel function shall be scheduled periodically to tune the design in response to potential environmental changes.*
6. *Shall support Auto Cell – an automatic, self-tuning mechanism that balances cell size between AP's/Arrays. Shall ensure sufficient coverage while limiting the RF energy that would extend beyond the organizational boundary between AP's/Arrays.*

M. RESOURCE ASSURANCE MANAGEMENT

1. *Shall continuously monitor wireless client behavior for potential issues.*
2. *If a client is detected encountering connectivity or performance issues, a notification is logged.*
3. *Elements to be monitored:*
 - a. *Authentication failures*
 - b. *Packet error rates*
 - c. *Packet retry rates*
 - d. *Data rates*
 - e. *Signal strength*
 - f. *Signal-to-noise ratio*
4. *Shall execute local testing of radio resources and self-healing to ensure wireless service availability.*

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5. *The monitor radio shall periodically function as a wireless client and connect to each of the user servicing radios. If a problem is detected, multiple options for action may be taken, including logging a notification or resetting the radio itself.*
6. *Network Assurance shall actively monitor the status of key network elements, including the Gateway, RADIUS servers, NTP servers, SNMP trap hosts, and DNS servers. If any of these are unreachable, a notification is logged.*
7. *The System shall be optionally configured to disassociate users proactively if network resources are not available so that clients do not remain connected wirelessly with no network service.*

N. DEVICE OPTIMIZATION MANAGEMENT

1. *Wi-Fi devices shall be identified by type upon connecting to the network, e.g. laptop, tablet, smartphone, gaming device, etc.*
2. *This information is then used to map the device to specific resources as desired. Dedicated radios and wireless networks (SSIDs) can be assigned to devices that need high bandwidth or are operating in a specific mode.*
3. *Shall provide Station Load Balancing.*

O. SECURE WIRELESS NETWORK

1. *Shall perform packet encryption and decryption. All encryption processes are performed at line-rate in hardware.*
2. *Wireless encryption supported shall include the standard three encryption options:*
 - a. *Wi-Fi Protected Access with AES*
 - b. *Wi-Fi Protected Access (WPA & WPA2)*
 - c. *WEP-40 bit or WEP-128bit – only use this for legacy devices that cannot support a stronger encryption type*
3. *Should also support TKIP and AES protocols simultaneously on the same SSID to support mixed and dynamic client environments.*
4. *Shall include PCI and FIPS140-2 audit modes of operation to monitor for compliance.*
5. *Shall monitor, detect, mitigate and report on active or potential wireless threats to your network. These include:*
 - a. *Dedicated threat sensor radio, depending on network design, for complete 24x7 IDS/IPS coverage of the RF environment.*
 - b. *Continuous 24x7 monitoring of the wireless RF environment.*
 - c. *Detection of potential rogue or malicious APs, ad hoc, and stations.*
 - d. *Rogue device classification*
 - e. *Automatic alerts, alarms, and logging of rogue devices.*
 - f. *Key rogue device information such as first seen, last seen, manufacturer, SSID, and channel.*
 - g. *Automatic shielding of rogue devices by Array radios to contain threatening devices when detected, while still scanning for new threats.*
6. *Ensures compliance with wireless security policies and regulations through automated reporting.*
7. *Continuously monitor all 802.11 channels for throughput, signal, noise, errors, and interference levels continually per channel.*

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8. *Administrators centrally collect data from their desk and monitor the entire network at one time.*
9. *Monitor all 802.11 channels, not just the ones that are currently being used for data traffic.*
10. *Provides device locating via analysis of Received Signal Strength Indication (RSSI) data collected by radios. This capability is available via the CLI, WMI, and XMS interfaces/applications at different levels of functionality.*
11. *Use integrated directional antennas on each radio, providing angle of orientation information about device location in addition to estimated distance based on RSSI level.*
12. *Both associated and unassociated stations can be located in this fashion.*
13. *Aggregate data from multiple AP's/Arrays to determine device positioning. Multi-AP/Array design provides for even greater accuracy than single AP/Array methods.*
14. *Locating in normal conditions shall provide accuracy within a 5-meter radius or better.*
15. *User access control protocols and features designed to classify, assign, and monitor associated and unassociated clients. These include:*
 - a. *RADIUS 802.1x*
 - b. *Fully support 802.1x authentication servers*
 - c. *MAC Access Control Lists (ACLs) supports 512 ACL entries*
 - d. *Web Page Redirect (Captive Portal) capabilities*
 - e. *Web-based authentication against internal or external RADIUS server*
 - f. *Local host or remotely hosted web page redirect (log-in/splash screen)*
 - g. *Configure splash screen time-out*
16. *Failover capability by allowing the specification of primary and secondary RADIUS servers and timeout values.*
17. *Each SSID can specify a unique RADIUS server set enabling each SSID independent authentication control.*
18. *Each SSID can define limits for users based on time of day, day of week, and traffic volume.*
19. *Identify devices by operating systems, such as iOS®, Microsoft®, BlackBerry®, or Android™*
20. *Identify devices by type, such as tablet, laptop or smartphone.*
21. *The device ID, along with the user ID, can be used together to map the device to a policy to control a user's reach and behavior.*

P. LOCATION SERVICES

1. *Provide Wi-Fi client location services across the entire wireless network using a Management System. Each AP provides a signal reading for each client, and the direction of the antenna provides information about the direction of the client relative to the AP/Array.*
2. *Mapping – Based on RF settings and properties of the environment, the management software shall generate heat maps showing RF coverage patterns across the environment.*

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3. ***Asset Tracking – Can have the ability to track assets across a wide variety of devices and use cases. Devices can be tracked to within 3-5 feet accuracy.***

Q. GUEST SERVICES

1. ***Web Page Redirect (WPR) allows a guest to be presented with a web browser welcome screen before gaining access to the wireless network.***
2. ***Directory Integration – Shall integrate with the same systems used for the wired network.***
3. ***Policy Management – Bandwidth limits can be configured to ensure guest users do not overrun educational staff and student traffic usage. Restrictions can be placed on time of day access and day of the week access. Policies can be set to enforce use policies for different device types. Policies can be set and enforced on a user, role, device, and time basis.***

R. VOICE AND MULTI-MEDIA SUPPORT (QoS)

1. ***Optimize application support so all standard QoS (802.11e) and Wireless Multi-Media (WMM) features including multiple traffic queues (4) and packet level identification of voice traffic. Wired to wireless QoS mapping (802.11p/q) support. Separate protocol support for the leading providers of 802.11 handsets.***
2. ***Enable end-to-end QoS support and tag 802.1P packets.***
3. ***Shall have multicast-to-unicast conversion and IGMP snooping to optimize the performance of multicast in a Wi-Fi environment. IGMP (Internet Group Management Protocol) is used to establish and manage the membership of multicast groups. The following configuration options are available:***
 - a. ***Send multicasts unmodified***
 - b. ***Convert to unicast and send unicast packets to all stations***
 - c. ***Convert to unicast, snoop IGMP, and only send to stations subscribed (send as multicast if no subscription).***
 - d. ***Convert to unicast, snoop IGMP, and only send to stations subscribed (don't send packet if no subscription).***
4. ***Each SSID can define separate traffic controls based on business requirements, including QoS (VoIP) and QoS tags can also be updated based on policy rules via the integrated Stateful firewall.***

S. MOBILE DEVICE MANAGEMENT

1. ***Provide a high level of flexibility in allocating Wi-Fi users and devices among system resources to optimize overall performance.***
2. ***Wi-Fi devices shall be identified by type upon connecting to the network (e.g. laptop, tablet, smartphone, gaming device).***
3. ***Dedicated radios and wireless networks (SSIDs) can be assigned to devices that need high bandwidth or are operating in a specific mode. Coordinate with Owner.***
4. ***Based on device type, specific policies can be applied such as bandwidth restrictions, application types, and time restrictions. Coordinate with Owner.***

5. *Resources can also be allocated based on device performance ensuring the performance of faster device types (e.g. 802.11n) are not negatively impacted by slower device types (e.g. 802.11b). Coordinate with Owner.*
6. *Users can be assigned to specific resources based on not just login information, but also client type and class. Identify the devices' operating systems such as iOS®, Microsoft® Windows®, BlackBerry®, or Android™ and can then classify the device type such as tablet, laptop, or smartphone. Once the device has been identified, a policy can then be applied to control a user's reach and behavior. The device ID, along with the user ID, can be used together to map that instance to a specific user group.*
7. *Allow different user groups to be created with each group being mapped to specific VLANs, access control list, and QoS parameters.*

T. WIRELESS CONTROLLERS AND LOCATION TRACKING

1. Equip each building with a Wireless Controller(s). Provide Location Tracking as an option. This may be a separate appliance or software upgrade to wireless controller(s).
2. These devices shall be directly attached to the associated L-3 Network Core Switch via **10 Gigabit** interfaces as required.
3. ***Shall adhere to all requirements in the aforementioned sections.***
4. Hosted Control Systems can be utilized as long as all required features are provided as well as a minimum 5 years of licensing.

U. WIRELESS ACCESS POINTS

1. Provide centrally powered IEEE 802.11n Wireless Access Points (APs) for each new and remodeled building.
2. Each Access Point shall support a minimum of 14 VoWLAN Phones and dynamically throttle back non-VoIP traffic.
3. Place and dimension the number of Access Points based on required throughput, load balancing and location tracking.
4. ***Shall adhere to all requirements in the aforementioned sections.***

1.6 INSTALLATION

- A.** Contractor shall provide and install Wireless System and associated cabling, POE devices, Central Controllers and Console.
- B.** The Building Floor Plans and Site Plans shall be entered into the Central Wireless Control Console.
- C.** The Central Wireless Control Console floor and site plans shall be calibrated after the installation has been performed.
- D.** Access Point cables and associated connectors shall be terminated in accordance with industry standards.
- E.** Balance Wireless Access Points to insure complete coverage with minimal service degradation.
- F.** Setup Wireless Access Security and provide for CIPA Compliance.

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- G. Determine the optimum location of all devices in the wireless LAN coverage areas and consider the access point density and location.
- H. Locate all internal Access Points above the ceiling tile grid wherever possible.
- I. Provide Antennas mounted external to the building for coverage of areas surrounding the building such as: playgrounds, parking lots, athletic fields, etc.
- J. Connect the external antennas to APs mounted inside of the building.

1.7 LABELING

- A. Cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District requirements.
- B. All AP Cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.

1.8 TESTING

- A. Perform complete site survey after system placement and verify coverage and throughput to comply with the specifications and to optimize the system.

1.9 TRAINING

- A. Provide a minimum of **forty (40)** hours of training to the District's personnel and/or designated representative. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:
 - 1. System Equipment Connectivity
 - 2. Device Configurations
 - 3. Operation, maintenance, and upgrade procedures.
- B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***
- C. ***Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
- D. ***Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
- E. ***Training shall be by certified manufacturer instructor.***
- F. ***Training schedule shall be coordinated with District personnel and their needs.***
- G. ***Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
- H. ***Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
- I. ***Provide a digital video copy of the training session.***

END OF SECTION

SECTION 273113

IP-ENABLED PABX SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for a uniform IP-Enabled PABX System that shall be followed for all OSFC Technology construction projects.
- B. Refer to Section 8500, Technology Systems for additional information.
- C. An IP-Enabled PBX shall only be specified for projects that are expanding or extending existing systems.

1.2 SECTION INCLUDES

- A. Central IP-Enabled PABX.
- B. Attendant Console Terminal.
- C. Executive Display Digital Voice Terminal.
- D. Standard Display Digital Voice Terminal.
- E. Single Line Voice Terminal.
- F. Voice Mail with Automated Attendant.
- G. E-911 Console.
- H. Uninterruptible Power Supply (UPS)

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. Compliance with the National Electric Code.
- C. Compliance with FCC rules.
- D. Comply with latest NENA E-911 requirements.

1.4 SYSTEM WARRANTY

- A. ***The IP Enabled PABX System and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.***

1.5 GENERAL REQUIREMENTS

- A. Each Building's telephone system must provide the following minimum requirements:
 - 1) Support for E-911.
 - a. ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***
 - 2) Support for the following carrier and Inter-switch interfaces:
 - a. Digital (T-1, PRI).
 - b. Session Initiation Protocol (SIP).
 - c. Analog (POTS) lines.

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- d. Provide carrier circuit interfaces adequate to handle ALL incoming and outgoing calls.
 - 3) Support for Direct inward Dialing (DID).
 - 4) Support for the following endpoints (phones/devices):
 - a) Digital (TDM)
 - b) IP (must support non proprietary H.323 and SIP compliant devices).
 - c) Analog (phones/faxes etc.)
 - d) Endpoints that provide “full duplex speakerphone” capability must be provided in specific rooms.
 - e) Provide system with capacity for all endpoints required plus 10% spare.
 - 5) Provide support for a minimum of two (2) fax stations per building.
 - 6) Provide UPS.
 - B. System to have maintenance and administration terminal and remote access capabilities.
 - C. A common Telephone Switching Platform shall be used across the District to insure inter-operability. In the event that the District already has an established Telephone System that meets OSFC requirements, additional buildings may be added to the District, specifying existing Vendor’s system.
 - D. In the event that no standard system exists for the District, then the OSFC PA shall decide if the first systems bid establish a critical mass and if the multiple vendor requirement can be waived.
- 1.6 WORK BY LOCAL UTILITIES
- A. Coordinate all work with the local and long-distance Service Providers (SPs).
- 1.7 IP-ENABLED PABX
- A. The Central Switching Exchange shall be a fully-digital, IP-Enabled (minimum) PBX Telephone Switch. Key Systems and hybrid intercom/telephone systems will NOT be acceptable.
 - B. The IP-ENABLED PABX must be modular in design.
 - C. The IP-ENABLED PABX shall be sized according to student population and traffic requirements and shall be equipped with carrier circuit interfaces for incoming/outgoing call lines. The minimum circuits shall be as follows:
 - 1. One PRI or equivalent SIP trunk for up to 100 stations.
 - 2. Two PRIs or equivalent SIP trunks for greater than 100 stations.
 - 3. Additional PRIs or equivalent SIP trunks based on traffic requirements.
 - 4. The use of analog central office (CO) line interface is acceptable if system is supporting existing analog phone service and as long as adequate line capacity is provided to support call traffic. System must still include digital carrier interface for future growth.
 - D. The IP-ENABLED PABX shall be equipped with full Name and Number Caller ID functions for incoming and outgoing calls.
 - E. The IP-ENABLED PABX must be equipped with a minimum of three (3) analog lines to the local Service Provider for E-911 services and PRI backup.
 - 1. ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***
 - F. Connect the Analog Lines to a Power Failure Transfer (PFT) Unit and supply a minimum of three (3) analog phones, located in the Central Office Area for emergency operation.

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- G. The telephone system must have the following minimum features:
- 1) Access Codes.
 - 2) Attendant's Console.
 - 3) Automatic Location Identifier (ALI).
 - 4) Automatic Number Identification Support (ANI).
 - 5) Call Accounting Software and Hardware.
 - 6) Call Conferencing.
 - 7) Call Forwarding on Busy.
 - 8) Call Forwarding External Calls
 - 9) Call Forwarding Internal Calls.
 - 10) Call Hold.
 - 11) Call Pickup.
 - 12) Call Screening.
 - 13) Dialed Number Identification Service (DNIS).
 - 14) Direct Inward Dialing (DID).
 - 15) Distinctive ring tones.
 - 16) Do Not Disturb
 - 17) E-911 and latest NENA support.
 - 18) E-911 Call Recording and Bridging to E-911 Central Console.
 - 19) FCC Registration.
 - 20) Full Caller ID – Incoming/Outgoing.
 - 21) Full duplex, Digital Display, Speaker Phones.
 - 22) Hands Free Intercom – Phone-to-Phone.
 - 23) IEEE 802.3af compliant VoIP Power
 - 24) Least Cost Routing.
 - 25) Maintenance and Administration Terminal.
 - 26) Malicious Call Trace/Hold.
 - 27) Message Waiting Lamp.
 - 28) Paging Interface (minimum 6 zones).
 - 29) Minimum of eight (8) Pre-program buttons.
 - 30) PRI/T-1 Trunking.
 - 31) Remote diagnostics.
 - 32) SIP Signaling Protocol
 - 33) Standards Based, VoIP Phone Support.
 - 34) Support wireless 802.11 VoWLAN phones
 - 35) System Speed Dial.
 - 36) Unified Messaging.
 - 37) VoIP Trunking – H.323 and SIP.
- H. Inter-Building Trunks (Links) between Systems shall be designed using T-1 Lines, PRI Lines or VoIP Trunking. A minimum capacity of 23 inter-building links shall be provided. Dimension all Trunks based on a minimum of P=0.01 Grade of Service.
- I. When a high-speed WAN connection exists, use a VoIP connection between buildings.
- J. Design the District-Wide system to provide for Least-Cost Routing and Toll-Bypass when applicable. Supply additional PRI circuits as required.
- K. Provide IEEE 802.3af compliant Power Injectors/switches for all VoIP Phone instruments.

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- L. Each District Building's IP-ENABLED PABX shall be capable of complete stand-alone operation (with the exception of centralized voicemail) in the event that the Inter-Building Trunks (Links) are not operational.
- M. District-Wide Systems shall function as a single system with Common Features, Centralized Voice Mail, and Centralized Call Detail Recording with a single record per call and the ability for Centralized Attendant Service for the entire District.
- N. When more than one building per District is involved, all incoming and outgoing calls may be routed over carrier circuits connected to a Central IP-Enabled PABX. The Central IP-ENABLED PABX capacity shall be dimensioned to handle all current and planned District buildings.
- O. IP-ENABLED PABX units shall employ a hardened Operating System that is not susceptible to Internet Computer Viruses.
- P. IP-ENABLED PABX units shall be provided with a minimum of 10% spare line/station capacity at initial installation.
- Q. The PABX shall be an IP-Enabled PABX or an IP Based PABX. The all IP Based system shall maintain the same high level of functionality, redundancy and programmable features as originally specified. Any all-IP system shall employ standards based signaling, instrument powering and redundant call servers in each District Building served by the system. See Section 273123 for additional details.
- R. Provide centralized PABX and phone instrument power with a minimum of two (2) Busy-Hour standby capabilities for all PABX equipment. IP Based systems shall also be provided with two (2) Busy-Hour standby capabilities for all powered Switches or Patch Panels located in each Telecommunications Room (TR). Connect the Central Power Supplies to Building Emergency Power when available.
- S. All IP Instruments and power sources shall be IEEE 802.3af compliant.
- T. All PABX systems shall support IP Inter-building trunking (H.323 or SIP) and the attachment of IP Instruments such as IP Phones, PDAs, Soft Phones and 802.11 Phones.
- U. As a minimum, the Call Accounting shall include date, time, duration of call, extension number, account code (if applicable) and number dialed along with software export features to standard spread sheets.

1.8 ATTENDANT CONSOLE TERMINAL

- A. Minimum of 32 Character LCD Display.
- B. Display day, date and time.
- C. Display call durations.
- D. Display caller name and extension/telephone number and incoming caller-ID information.
- E. Hands free, Full-Duplex, Speakerphone.
- F. Shall have a system display panel capable of showing all system extension numbers and their status and capable of extending calls via single touch operation.
- G. Provide a minimum of two (2) consoles per building for load sharing and redundancy.

1.9 ADMINISTRATIVE DISPLAY DIGITAL VOICE TERMINAL

- A. Provide one administrative phone for all administrative areas, conference rooms, small group rooms, nurse/health office, and special needs rooms.
- B. At least sixteen characters display window.
- C. At least sixteen programmable keys.
- D. Hands free, Full-Duplex Speakerphone.
- E. Display caller name and extension/telephone number.
- F. Message Waiting Lamp.
- G. Pre-programmed E-911 button that automatically puts the phone into a hands-free mode, and initiates a 3-way conference call with the central console, as well as the local 911 center.

1.10 STANDARD DISPLAY DIGITAL VOICE TERMINAL

- A. Provide one standard 8 button phone for all classrooms, labs, general offices, and other areas not covered above in section 1.9.
- B. At least sixteen characters display window.
- C. At least eight (8) programmable keys.
- D. Hands free, Speakerphone. Full Duplex required if One Way Paging Variance is utilized.

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- E. Display caller name and extension/telephone number.
 - F. Message Waiting Lamp.
 - G. Pre-programmed E-911 button that automatically puts the phone into a hands-free mode, and initiates a 3-way conference call with the central console, as well as the local 911 center.
- 1.11 CONFERENCE PHONE
- A. As a minimum, provide Multi-User, Full-Duplex conference Speakerphone for Conference Rooms and/or Principal's Office.
- 1.12 VoWLAN PHONES
- A. Provide a minimum of two Wireless VoIP (VoWLAN) Phone instruments, with carrying case and charger units.
 - B. Provide integral VoWLAN 802.11e QoS capability or SVP server for VoWLAN QoS.
- 1.13 VOICE MAIL SYSTEM
- A. System shall have the following number of voice ports:
 - 1) Minimum of 4 ports (450 students).
 - 2) Minimum of 8 ports (650 students).
 - 3) Minimum of 12 ports (850 students).
 - B. System shall have the following capacity:
 - 1) One voice mail box per station plus 20% minimum spares.
 - C. System shall have an automated attendant.
 - D. System shall be fully integrated with IP-Enabled PABX.
 - E. System shall activate telephone station "message waiting" light.
 - F. System shall have Integrated Messaging capability. Supply based on District's requirements. Verify E-Mail Server compatibility (Exchange, Notes, Groupwise, etc.)
- 1.14 E-911 CONSOLE
- A. System shall support Call Bridging at Console for all E-911 calls.
 - B. System shall provide Call Recording for E-911 Calls.
 - C. System shall support full NENA Compliant ANI and ALI data transmission from local Data Base to PSAP.
 - 1) ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***
- 1.15 UNINTERRUPTIBLE POWER SUPPLIES (UPS)
- A. Provide Dual Conversion UPS units for Main Telephone Switch, providing sufficient protection from power anomalies for two (2) busy hours.

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- B. Provide multiple UPS Units based on expected power load or a single large UPS Unit. Locate the multiple UPS units in the associated equipment racks or locate a larger central UPS unit in the Room.
- C. Connect the UPS Units to Building Emergency Generator.
- D. For buildings without a Generator, supply a four-hour (4) standby.
- E. Provide shutdown connections from the UPS for graceful power down in the event of a power failure.
- F. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.
- G. Connect the UPS SNMP Management to the Management VLAN.
- H. Coordinate UPS voltage, circuit size, and connection requirements with the Electrical Design Professional.

1.16 INSTALLATION

- A. Coordinate complete system installation, and Technology Head End Integration with District and other Technology Trades.
- B. Coordinate installation and interconnect with local and long-distance Service Provider (SP). Contractor shall be responsible for all final cross connects and system Data Base loading and verification.
- C. Contractor shall connect to, and interface with the in-house paging system and provide paging from any telephone handset.
- D. Connect system to IP Data Network and program required VLANs and 803.11e support.
- E. Interconnect with existing systems via VoIP trunking.
- F. Integrate system with District's Numbering Plan.

1.17 SYSTEM PROGRAMMING

- A. Contractor shall provide the District/architect with a complete set of forms for the entire system and extension features for final programming.
- B. Final programming of the system shall be co-developed between the District/architect and the contractor and must be approved prior to being implemented for system start-up.
- C. Contractor shall supply the "latest" software updates as part of the system configuration or **three (3)** years after system acceptance.

1.18 TRAINING

- A. ***Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:***
 - 1. ***System Equipment Connectivity***
 - 2. ***Device Configurations***
 - 3. ***Operations, maintenance, and upgrade procedures.***
- B. ***Training to be arranged with District Personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 9 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 years).***

END OF SECTION

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SECTION 273123

IP ONLY PABX SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for a uniform IP ONLY PABX System that shall be followed for all OSFC Technology construction projects.
- B. Refer to Section 8500, Technology Systems, 27 13 13, Copper Back Bone Systems and 27 31 13, IP-Enabled PABX System for additional information.

1.2 SECTION INCLUDES

- A. Central IP PABX.
- B. Attendant Console Terminal.
- C. Executive Display Voice Terminal.
- D. Standard Display Voice Terminal.
- E. Single Line Voice Terminal.
- F. Voice Mail with Automated Attendant.
- G. E-911 Console.
- H. Uninterruptible Power Supply (UPSs).

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. Compliance with the National Electric Code.
- C. Compliance with FCC rules.
- D. Comply with latest NENA E-911 requirements.

1.4 SYSTEM WARRANTY

- A. ***The IP PABX System and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warrant with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system, after the initial warranty period.***

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1.5 GENERAL REQUIREMENTS

- A. Each Building's telephone system must provide the following minimum requirements:
 - 1) Support for E-911.
 - a) ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***
 - 2) Support for the following carrier and Inter-switch interfaces:
 - a) Digital (T-1, PRI)
 - b) Session Initiation Protocol (SIP)
 - c) Analog (POTS) lines
 - d) Provide carrier circuit interfaces adequate to handle ALL incoming and outgoing calls.
 - 3) Support for Direct inward Dialing (DID).
 - 4) Support for the following endpoints (phones/devices):
 - a) Digital (TDM)
 - b) IP (must support non-proprietary H.323 and SIP-compliant devices)
 - c) Analog (phones/faxes etc.)
 - d) Endpoints that provide "full duplex speakerphone" capability must be provided in specific rooms.
 - e) Provide system with capacity for all endpoints required plus 10% spare.
 - 5) Provide support for a minimum of two (2) fax stations per building.
 - 6) Provide UPS.
- B. System to have maintenance and administration terminal and remote access capabilities.
- C. A common Telephone Switching Platform shall be used across the District to insure inter-operability. In the event that the District already has an established Telephone System that meets OSFC requirements, additional buildings may be added to the District, specifying existing Vendor's system.
- D. In the event that no standard system exists for the District, then the OSFC PA shall decide if the first systems bid establish a critical mass and if the multiple vendor requirement can be waived.

1.6 WORK BY LOCAL UTILITIES

- A. Coordinate all work with the local and long-distance Service Providers (SPs).

1.7 IP PABX

- A. The Central Switching Exchange shall be a fully-digital, IP Based PBX Telephone Switch.
- B. The IP PABX must be modular in design.
- C. The IP PABX shall be sized according to student population and traffic requirements and shall be equipped with carrier circuit interfaces for incoming/outgoing call lines. The minimum circuits shall be as follows:
 - 1) One PRI or equivalent SIP trunk for up to 100 stations.

- 2) Two PRIs or equivalent SIP trunks for greater than 100 stations.
 - 3) Additional PRIs or equivalent SIP trunks based on traffic requirements.
 - 4) The use of an analog central office (CO) line interface is acceptable if system is supporting existing analog phone service and as long as adequate line capacity is provided to support call traffic. System must still include digital carrier interface for future growth.
- D. The IP PABX shall be equipped with full Name and Number Caller ID functions for incoming and outgoing calls.
 - E. With few exceptions, the IP Only PABX system shall provide the same basic features and functionality as an IP-Enabled PABX.
 - F. The IP PABX must be equipped with a minimum of three (3) analog lines to the local Service Provider for E-911 services and PRI backup.
 - a) ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***
 - G. Connect the Analog Lines to a Power Failure Transfer (PFT) Unit and supply a minimum of three (3) analog phones, located in the Central Office Area for emergency operation.
 - H. The common control units for the IP PABX shall be fully duplicated.
 - I. The media gateways and other ancillary devices shall be distributed across a minimum of at least two (2) units for redundancy. For example, analog interfaces, PRI interfaces, etc. shall be duplicated.
 - J. For single building configurations, the duplicate Common Control Units, media gateways and other common devices shall all be located in the Main Equipment Room.
 - K. For multiple building configurations, consideration shall be given to distributing the common control units and media gateways between two buildings.
 - L. When an IP PABX system is deployed across the District, all carrier circuits and Voice mail and other common Services shall be centralized – a minimum of two central locations is required.
 - M. Design the District-Wide system to provide for Least-Cost Routing and Toll-Bypass when applicable. Supply additional PRI circuits as required.
 - N. All buildings shall be equipped with a survivable remote unit that shall continue to provide basic call processing for users via the back-up analog lines. Voice mail will not be required during a WAN Link cut between a remote building and a Core Building.
 - O. When the Wide Area Network permits, remote buildings shall be configured in such a fashions as to “dual-home” on the two, distributed Central Processing units.

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- P. With few exceptions, all IP station devices shall be served by a dedicated Work Area Cable and Voice traffic shall be segregated from standard data traffic by providing dedicated 802.3af Power Over Ethernet (POE) Switches for the Voice Network.
- Q. The POE switches shall follow the same design rules as the Data Network Switches, namely, one (1) dedicated GBE link to the Data Network Layer-3 Core switch per 24 10/100 ports.
- R. The designer shall adjust the quantity of L-3 Core switch ports and associated fiber and UPS units to accommodate the additional POE switches.
- S. All IP Phone instruments shall be 802.3af powered from POE Ethernet switches.
- T. Due to the advanced features available on some IP Phones, consideration shall be given to locating selected IP instruments on desktops rather than wall mounting the units.
- U. Consideration shall be given to supplying additional call processing software to enable user desk-top PCs to interoperate with the IP PABX advanced SIP based presence features (audio and video conferencing, integrated messaging, etc.).
- V. Connections between the Data Network and the voice network shall be made via a vendor supplied firewall device.
- W. As a minimum, the Call Accounting shall include date, time, duration of call, extension number, account code (if applicable) and number dialed along with software export features to standard spread sheets.
- X. The IP PABX telephone system must have the following minimum features:
 - 1) Access Codes.
 - 2) Attendant's Console.
 - 3) Automatic Location Identifier (ALI).
 - 4) Automatic Number Identification Support (ANI).
 - 5) Call Accounting Software and Hardware.
 - 6) Call Conferencing.
 - 7) Call Forwarding on Busy.
 - 8) Call Forwarding External Calls
 - 9) Call Forwarding Internal Calls.
 - 10) Call Hold.
 - 11) Call Pickup.
 - 12) Call Screening.
 - 13) Dialed Number Identification Service (DNIS).
 - 14) Direct Inward Dialing (DID).
 - 15) Distinctive ring tones.
 - 16) Do Not Disturb
 - 17) E-911 and latest NENA support. ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***
 - 18) E-911 Call Recording and Bridging to E-911 Central Console.
 - 19) FCC Registration.
 - 20) Full Caller ID – Incoming/Outgoing.
 - 21) Full duplex, Digital Display, Speaker Phones.
 - 22) Hands Free Intercom – Phone-to-Phone.
 - 23) IEEE 802.3af compliant VoIP Power

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- 24) Least Cost Routing.
 - 25) Maintenance and Administration Terminal.
 - 26) Malicious Call Trace/Hold.
 - 27) Message Waiting Lamp.
 - 28) Paging Interface (minimum 6 zones).
 - 29) Minimum of eight (8) Pre-program buttons.
 - 30) PRI/T-1 Trunking.
 - 31) Remote diagnostics.
 - 32) SIP Signaling Protocol
 - 33) Standards Based, VoIP Phone Support.
 - 34) Support wireless 802.11 VoWLAN phones
 - 35) System Speed Dial.
 - 36) Unified Messaging.
 - 37) VoIP Trunking – H.323 and SIP.
- Y. The IP PABX shall be dimensioned to support a minimum ABH traffic capacity of 7.0 ccs per line.
- Z. Inter-Building Trunks (Links) between Systems shall be designed using T-1 Lines, PRI Lines or VoIP Trunking. A minimum capacity of 23 inter-building links shall be provided. Dimension all Trunks based on a minimum of P=0.01 Grade of Service.
- AA. When a high-speed WAN connection exists, use a VoIP connection between buildings.
- BB. Provide IEEE 802.3af compliant Power Injectors/switches for all VoIP Phone instruments.
- CC. Each District Building's IP PABX shall be capable of complete stand-alone operation (with the exception of centralized voicemail) in the event that the Inter-Building Trunks (Links) are not operational. Calling operation shall be limited only by the external links (trunks) available,
- DD. District-Wide Systems shall function as a single system with Common Features, Centralized Voice Mail, and Centralized Call Detail Recording with a single record per call and the ability for Centralized Attendant Service for the entire District.
- EE. When more than one building per District is involved, all incoming and outgoing calls shall be routed over PRI Line(s) connected to a Central IP-Enabled PABX. The Central IP-ENABLED PABX capacity shall be dimensioned to handle all current and planned District buildings.
- FF. IP PABX units shall employ a hardened Operating System that is not susceptible to Internet Computer Viruses.
- GG. IP PABX units shall be provided with a minimum of 10% spare line/station capacity at initial installation.
- HH. The all IP Based system shall maintain the same high level of functionality, redundancy and programmable features as originally specified. Any all-IP system shall employ standards based signaling, instrument powering and redundant call servers in each District Building served by the system.

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- II. Provide centralized PABX and phone instrument power with a minimum of two (2) Busy-Hour standby capabilities for all PABX equipment. IP Based systems shall also be provided with two (2) Busy-Hour standby capabilities for all powered Switches or Patch Panels located in each Telecommunications Room (TR). Connect the Central Power Supplies to Building Emergency Power when available.
- JJ. All IP Instruments and power sources shall be IEEE 802.3af compliant.
- KK. All PABX systems shall support IP Inter-building trunking (H.323 or SIP) and the attachment of IP Instruments such as IP Phones, PDAs, Soft Phones and 802.11 Phones.

1.8 ATTENDANT CONSOLE TERMINAL

- A. Minimum of 32 Character LCD Display.
- B. Display day, date and time.
- C. Display call durations.
- D. Display caller name and extension/telephone number and incoming caller-ID information
- E. Hands free, Full-Duplex, Speakerphone.
- F. Shall have a system display panel capable of showing all system extension numbers and their status and capable of extending calls via single touch operation.
- G. Provide a minimum of two (2) consoles per building for load sharing and redundancy.
- H. Optional soft consoles should be considered by the designer for the attendant.

1.9 ADMINISTRATIVE DISPLAY IP VOICE TERMINAL

- A. Provide one administrative phone for all administrative areas, conference rooms, small group rooms, nurse/health office, and special needs rooms.
- B. At least sixteen characters display window.
- C. At least sixteen programmable keys.
- D. Hands free, Full-Duplex Speakerphone.
- E. Display caller name and extension/telephone number.
- F. Message Waiting Lamp.
- G. Pre-programmed E-911 button that automatically puts the phone into a hands-free mode, and initiates a 3-way conference call with the central console, as well as the local 911 center.

- H. IEEE 802.3af powered.

1.10 STANDARD DISPLAY DIGITAL VOICE TERMINAL

- A. Provide one standard 8-button phone for all classrooms, labs, general offices, and other areas not covered in section 1.9 above.
- B. At least sixteen characters display window.
- C. At least eight (8) programmable keys.
- D. Hands free, Speakerphone. Full Duplex required if One Way Paging Variance is utilized.
- E. Display caller name and extension/telephone number.
- F. Message Waiting Lamp.
- G. Pre-programmed E-911 button that automatically puts the phone into a hands-free mode, and initiates a 3-way conference call with the central console, as well as the local 911 center.
- H. IEEE 802.3af powered.

1.11 CONFERENCE PHONE

- A. At a minimum, provide Multi-User, Full-Duplex conference Speakerphone for Conference Rooms and/or Principal's Office.

1.12 VoWLAN PHONES

- A. Provide a minimum of two Wireless VoIP (VoWLAN) Phone instruments, with carrying case and charger units.
- B. Provide integral VoWLAN 802.11e QoS capability or SVP server for VoWLAN QoS.

1.13 VOICE MAIL SYSTEM

- A. System shall have the following number of voice ports:
 - 1) Minimum of 4 ports (450 students).
 - 2) Minimum of 8 ports (650 students).
 - 3) Minimum of 12 ports (850 students).
- B. System shall have the following capacity:
 - 1) One voice mailbox per station plus 20% minimum spares.
- C. System shall have an automated attendant.
- D. System shall be fully integrated with the IP PABX.
- E. System shall activate telephone station "message waiting" light.
- F. System shall have Integrated Messaging capability. Supply based on District's requirements. Verify E-Mail Server compatibility (Exchange, Notes, Groupwise, etc.)

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1.14 E-911 CONSOLE

- A. System shall support Call Bridging at Console for all E-911 calls.
- B. System shall provide Call Recording for E-911 Calls
- C. System shall support full NENA Compliant ANI and ALI data transmission from local Data Base to PSAP. ***Allow the caller to be located down to the specific office/room on a particular floor of a building.***

1.15 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

- A. Provide Dual Conversion UPS units for call processing equipment, providing sufficient protection from power anomalies for two (2) busy hours.
- B. Provide multiple UPS Units based on expected power load or a single large UPS Unit. Locate the multiple UPS units in the associated equipment racks or locate a larger central UPS unit in the Room.
- C. Connect the UPS Units to Building Emergency Generator when available.
- D. For buildings without a Generator, supply a four-hour (4) standby.
- E. Provide shutdown connections from the UPS for graceful power down in the event of a power failure.
- F. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.
- G. Connect the UPS SNMP Management to the Management VLAN.
- H. Coordinate UPS voltage, circuit size, and connection requirements with the Electrical Design Professional.

1.16 INSTALLATION

- A. Coordinate complete system installation, and Technology Headend Integration with District and other Technology Trades.
- B. Coordinate installation and interconnect with local and long-distance Service Provider (SP). Contractor shall be responsible for all final cross connects and system Data Base loading and verification.
- C. Contractor shall connect to, and interface with the in-house paging system and provide paging from any telephone handset.
- D. Connect system to IP Data Network and program required VLANs, Firewall and 803.11e support.
- E. Interconnect with existing systems via VoIP trunking.
- F. Integrate system with District's Numbering Plan.

1.17 SYSTEM PROGRAMMING

- A. Contractor shall provide the District/architect with a complete set of forms for the entire system and extension features for final programming.

- B. Final programming of the system shall be co-developed between the District/architect and the contractor and must be approved prior to being implemented for system start-up.
- C. Contractor shall supply the “latest” software updates as part of the system configuration for **three (3)** years after system acceptance.

1.18 TRAINING

- A. ***Provide a minimum of forty (40) hours of training to the District’s personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:***
 - 1. ***System Equipment Connectivity***
 - 2. ***Device Configurations***
 - 3. ***Operation, maintenance, and upgrade procedures.***
- B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***
- C. ***Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
- D. ***Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
- E. ***Training shall be by certified manufacturer instructor.***
- F. ***Training schedule shall be coordinated with District personnel and their needs.***
- G. ***Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
- H. ***Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
- I. ***Provide a digital video copy of the training sessions***

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SECTION 274119

VIDEO DISPLAY EQUIPMENT

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for uniform Interactive Video Display Equipment that shall be followed for all OSFC Technology construction projects.
- B. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. VIDEO DISPLAY EQUIPMENT
 - 1. Flat Panel **Monitor** Mounts
 - 2. Flat Panel Monitors
 - 3. Projector **Mounts**
 - 4. **Ultra-Short Throw Interactive Projector**
 - 5. **Large Venue Projector**
- B. **CLASSROOM INTERACTIVE EQUIPMENT**
 - 1. **Interactive Tablets**
 - 2. **Student Response System**
 - 3. **Document Camera**
 - 4. **Webcam**

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment and Installation Practices shall comply with the Local Electric Code.
- D. All equipment and Installation Practices shall comply with the latest InfoComm International Installation Handbook.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM).
- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards as applicable.

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****1.4 SYSTEM WARRANTY**

- A. The Video Display Equipment Systems and associated software shall be warranted by the contractor for a period of **three (3) years** from date of substantial completion.

1.5 FLAT PANEL MONITORS AND PROJECTOR MOUNTS

- A. Provide wall type flat panel mounts with appropriate forward tilt, or fully articulating arm, as required. **Provide appropriate provisions for electrical outlet and A/V cables.**
- B. Provide Ceiling or Wall Mounts for projectors with appropriate provisions for electrical outlet and A/V cables.
- C. Utilize security/theft-deterrent mounting hardware on all projectors, displays and mounts as required.

1.6 INTERACTIVE PROJECTORS

- A. Ambient light considerations shall be coordinated with the Architect and Electrical Engineer/Lighting Designer to produce a minimum contrast ratio of 10:1. This often requires blocking of daylighting and dimming of electric lights to produce no more than 10-14 vertical foot candles (108-151 lux) on the projection surface.
- B. Provide high resolution video/data projectors for each classroom, laboratory, and media center.
- C. Conference Rooms may be equipped with either a small venue projector or a flat-panel TV/Monitor.
- D. Ultra-short throw interactive projectors are required in classrooms. They shall be capable of being interfaced with any interactive technology in the classrooms.
 - 1. Verify ADA requirements are met for mounting locations.
- E. The aspect ratio of projectors shall be 16:9 or 16:10. Aspect ratios of 4:3 should be used only to accommodate legacy equipment.
- F. Provide all projectors with an Ethernet control interface, either through direct connection or via Ethernet-to-RS-232 adaptor. Provide global central management control/tracking software.
- G. Small Venue (Classroom/Labs/Small Rooms) Interactive Projectors
 - 1. The projector shall produce a minimum of 3000 ANSI Lumens for standard projectors or 2500 ANSI Lumens for ultra-short throw projectors.
 - 2. It shall have a minimum native resolution of 1280 x 800 and be capable of displaying resolutions up to 1080p (720p).
 - 3. Inputs/Outputs – Shall consist of the following:
 - a. HDMI
 - b. Computer / component video: D-sub 15 pin
 - c. Composite video: RCA
 - d. Audio in x 3: RCA (L and R), Mini stereo
 - e. Variable audio out: Mini stereo

- f. LAN networking: RJ-45
 - g. Serial: RS-232c
 - h. Monitor out: D-sub 15 pin
 - i. USB Type B (USB display, mouse, interactivity)
 - j. USB Type A (USB memory/document camera)
 - k. Wireless port 802.11 b/g/n/**ac**
 - l. Microphone port
 - m. EDID capable and HDCP compliant
- 4. Shall be connected to classroom sound reinforcement system for sound
- 5. Shall be able to use any interactive software (open architecture)

- H. LARGE VENUE (STUDENT DINING) PROJECTORS
 - 1. The projector shall produce a minimum of 6000 ANSI Lumens.
 - 2. It shall have a minimum native resolution of 1920 x 1200 and be capable of displaying resolutions up to 1080p.
 - 3. Inputs/Outputs – Shall consist of the following:
 - a. HDMI
 - b. Computer / component video: D-sub 15 pin
 - c. Composite video: RCA
 - d. Audio in x 3: RCA (L and R), Mini stereo
 - e. Variable audio out: Mini stereo
 - f. LAN networking: RJ-45
 - g. Serial: RS-232c
 - h. Monitor out: D-sub 15 pin
 - i. USB Type B (USB display, mouse, interactivity)
 - j. USB Type A (USB memory/document camera)
 - k. Wireless port 802.11 b/g/n/**ac**
 - l. Microphone port
 - m. EDID capable and HDCP compliant.
 - 4. Provide a lift system in lieu of a mount, allowing multiple height positions for storage, projection and service. As required.
 - 5. Provide either front or rear screen projection based on District/Architect preferences and/or good projection system design.
 - 6. Coordinate screen (size and type) specifications to provide an integrated design based on best practices and project-specific factors.
 - 7. **OSFC baseline funding is for only 1 projector in each large venue area.**

1.7 FLAT PANEL TV/MONITOR

- A. The Flat Panel TVs/Monitors shall be equipped with a QAM 181-channel tuner and shall have minimum native resolution of 1080p without the use of scan-converters.
- B. The minimum Flat Panel TV/Monitor shall be 32 inches.
- C. Provide Flat Panel TV/Monitor for Public viewing in Entrances, Corridors and/or Reception areas, small conference/meeting rooms, and Small Self-Contained Classrooms.
- D. Provide Flat Panel TV/Monitor Units with Ethernet control connection and central management software.

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- E. Provide an Ethernet or wireless connection to Digital Media Management System.**

1.8 OPTIONAL EQUIPMENT AND SYSTEMS (not baseline)

A. INTERACTIVE TABLETS

- 1. Considerations and guidelines:**
 - a) Tablets should be specified based on each school's curriculum needs.**
 - b) Assessment should be done about licensing and number of users**
 - c) Charging stations/policies should be considered**
 - d) Considerations regarding the iPad**
 - 1) iPads have lower transmit power (10dBm)**
 - 2) iPads use a single spatial stream with 802.11n. They are unable to do channel bonding, limiting the link rate to a maximum of 65Mbps**
 - 3) iPads have dual band support. They can operate on both 2.4GHz and 5GHz frequencies. They default to the 5GHz band.**
- 2. Recommended screen size is 7" – 12"**
- 3. Touch screen**
- 4. Wi-Fi optional**
- 5. Wireless connectivity to all other classroom A/V equipment (interactive projector, etc.)**
- 6. Minimum resolution 1280 x 600**
- 7. Minimum processor 1GHz**
- 8. Minimum storage 16GB**
- 9. Minimum battery life 9 hours**

B. STUDENT RESPONSE SYSTEM

- 1. Should have a full keyboard with direction pad and hot keys**
- 2. Wireless range minimum of 328ft (100m)**
- 3. Operates on batteries or charge by USB connectivity**
- 4. Communication through wireless connection to computer with host software**
- 5. All licenses should be included in specification**

C. DOCUMENT CAMERA

- 1. Minimum 2.0 megapixels**
- 2. Full autofocus lens**
- 3. 3x digital zoom**
- 4. Up to 30 fps live video capture**
- 5. USB 2.0 minimum interface**
- 6. Windows and Mac compatible**
- 7. Open architecture to use multiple application software**
- 8. Capture both digital and printed material**

D. WEBCAM

- 1. Full 1080p live video**
- 2. Minimum of 2 Mbps upload/download**
- 3. H.264 video compression**

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4. Autofocus lens
 5. Built-in mic with auto noise reduction
 6. Automatic low-light correction
 7. USB 2.0 interface
 8. Tri-pod ready
- E. A/V CONTROL SYSTEM
1. Full user control of program source device(s), projector, and lights through either web-based application or touch panel.
 2. System diagnostics and scheduled operation of media devices via web-based application.
- 1.9 INSTALLATION
- A. Mount Projectors and Flat Panel TV/Monitors using manufacturer's recommended hardware.
 - B. Connect Devices to IP Network for Central Control.
 - C. Adjust all Projectors for proper focus, keystone correction and display size.
 - D. Install all associated software monitoring and control programs.
- 1.10 TESTING
- A. Verify picture and sound quality on all A/V inputs.
 - B. Test all associated software control programs.
 - C. The devices and associated software systems shall be tested end-to-end complete.
- 1.11 TRAINING
- A. ***Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:***
 1. ***System Equipment Connectivity***
 2. ***Device Configurations***
 3. ***Operation, maintenance, and upgrade procedures.***
 - B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***
 - C. ***Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
 - D. ***Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
 - E. ***Training shall be by certified manufacturer instructor.***
 - F. ***Training schedule shall be coordinated with District personnel and their needs.***
 - G. ***Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
 - H. ***Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
 - I. ***Provide a digital video copy of the training sessions.***

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 274125****DIGITAL MEDIA MANAGEMENT SYSTEM****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Digital Media Management System that shall be followed for all OSFC Technology construction projects.
- B. Figure 1 describes Typical Digital Media Management System.
- C. Refer to Section 8500, Technology Systems, and Section 8600, Electrical Systems, for additional information.

1.2 SECTION INCLUDES

- A. DIGITAL MEDIA MANAGEMENT SYSTEM
 - 1. Digital Video On-Demand System.
 - 2. Digital Video Control and Scheduling System.
 - 3. Video Bulletin Board System.
 - 4. Video Camera System.
 - 5. Digital Video Source System.

1.3 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.
- E. All equipment and Installation Practices shall comply with the latest BICSI[®] Telecommunications Distribution Methods Manual (TDMM).
- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.

1.4 SYSTEM WARRANTY

- A. The Digital Media Management System and software shall be ***fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warrant with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system, after the initial warranty period.***
- B. Provide advanced replacement for all Digital Media Management Equipment for the ***three (3)*** year-period.

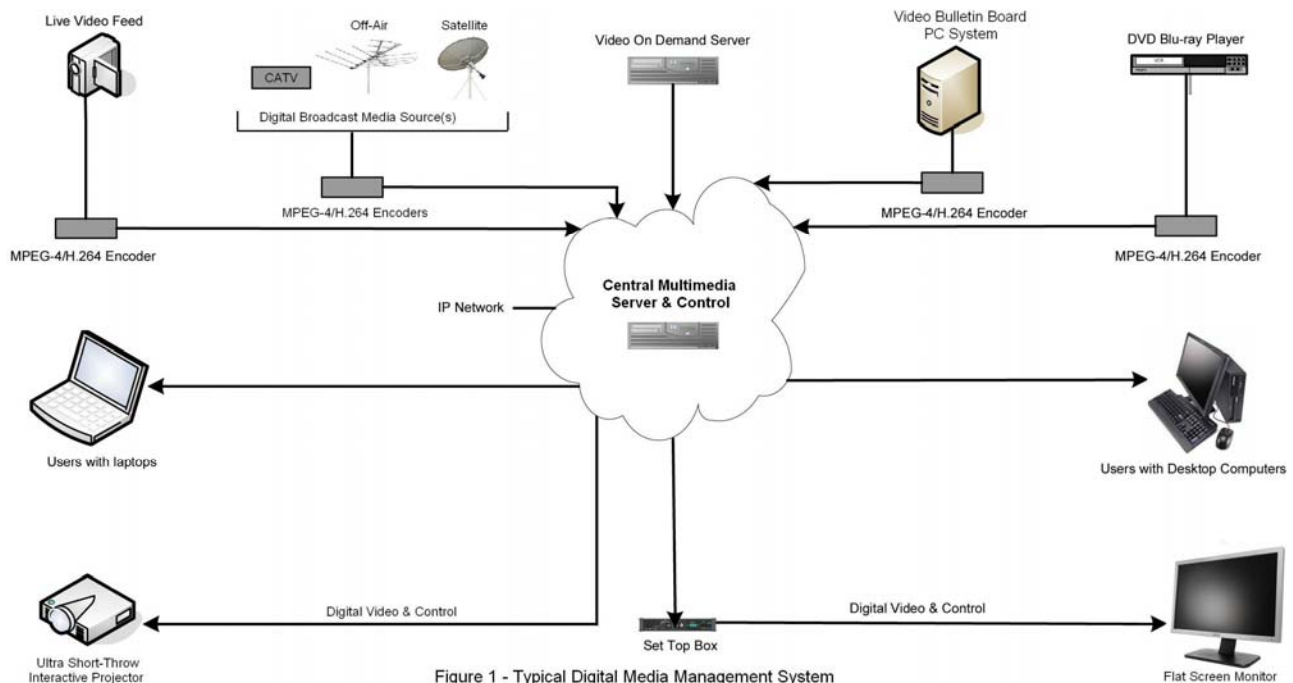


Figure 1 - Typical Digital Media Management System

Figure 1 – Typical Digital Media Management System

1.5 DIGITAL VIDEO ON DEMAND SERVER

A. GENERAL

1. The system shall include a centrally based media retrieval system consisting of a video server-based, on-demand, MPEG-4, H.264 streaming video delivery system.
2. System shall include a video billboard message and information system delivered over the network or via Digital Decoders.
3. Control of the Central Media System components shall be via a WEB Browser interface from a PC or from a Digital Set-Top-Box.
4. The Digital Media Management System shall provide remote access to centrally stored digital video sources. The system shall transmit the video as a streaming data file format (H.264 or MPEG-4) over the Ethernet IP Network.
5. The system shall also be capable of direct access to the Internet (MPEG-4 /H.264). Program the required VLANs and provide sufficient **100/1000** Ethernet Ports for connection of all associated devices.
6. Classrooms may be equipped with Set-Top-Box (STB) for receiving streamed and pre-recorded Digital Video Signals. The STB shall be connected to the associated Classroom Projector and Audio System.
7. Provide Central Control System for Projectors for turning units on/off, selecting inputs and streaming scheduled program sources. Unit should turn all Projectors off at end of day.
8. Playback of the Videos at classroom and Lab PCs shall be through a standard WEB Browser interface using a standard Media Player such as Windows Media Player, Real Player or Apple Quick-Time.

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B. DIGITAL VIDEO SERVER - VOD

1. Supply a centrally located MPEG-4 and H.264 Video Server Unit consisting of a PC based, Digital Video on Demand Server connected to the Network Electronics on a separate Video VLAN.
2. Consider supplying one large VOD Server per District when WAN bandwidth permits.
3. The Digital Video Server shall support True Video-on-Demand (VOD), Near-Video-on-Demand (NVOD), and Subscription-Video-on-Demand (SVOD).
4. The Digital Video Server shall have a scalable output from a minimum of 25 to 200 – 3 Mbps digital video streams.
5. The Digital Video Server shall have fault-tolerant, RAID storage with minimum capacity of 200 hours with hot-swappable drives.
6. The Digital Video Server shall be connected to the local area network through a minimum of one (1) Gigabit Ethernet connection.
7. Size the VOD Server based on District Video Storage requirements.
8. ***Hosted service can be utilized as long as all required features are provided.***

1.6 DIGITAL VIDEO CONTROL AND SCHEDULING SYSTEM

- A. The Video Control and Scheduling System shall provide a simple interface to easily locate available Live and On Demand media assets on Windows PCs, Macs, and Set Top Boxes.
- B. Users shall be able to navigate and search for specific videos, select the video, and it immediately begins playing. For On Demand videos, users shall have full Fast Forward and Rewind capabilities.
- C. The Video Control and Scheduling System shall provide a calendar-based scheduling system that shall allow users to quickly and easily schedule Live Broadcasts from MPEG encoders, Stored Broadcasts from Video on Demand servers, Recordings, and Conferences. Scripting functionality shall also allow users to set up custom schedules.

1.7 VIDEO BULLETIN BOARD SYSTEM

- A. Provide a PC based Bulletin Board system consisting of a Pentium-4 PC, minimum 2.0 GHz, equipped with minimum of 1 Gb of RAM, minimum of a 80 Gb, 7200 RPM Hard Drive, 15 inch Color Monitor/Panel, Multi-output Digital Video Card, Microsoft Windows XP-Pro or later, and Microsoft Office 2010 or later (BBS Software will consist of Power Point Presentations), and PC Anywhere Remote Control Software.
- B. Connect Digital Video and Audio output of Bulletin Board PC to A/V MPEG-4/H.264 Encoder input for streaming of Bulletin Board Broadcasts to PCs and Set Top Boxes.
- C. Connect the Bulletin Board PC to Network Electronics via a **1 Gb** Ethernet Connection.
- D. ***Digital messaging can be part of the Digital Media Management System.***

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1.8 VIDEO CAMERA SYSTEM

- A. Provide 1 digital Video Camera with a wheeled tripod for remote origination of video broadcasts, and announcements. Equip each camera with a dual MPEG 4/H.264 Encoder Unit for broadcasting low and high bit rate digital streams.
- B. It shall be possible to broadcast the portable camera signal across the IP Network to Monitors, Projectors and/or PCs in the school or any of the other schools within the District, and simultaneously record the signal if desired. The Camera can be used for Video Announcements, recording of lessons and/or events or as a point-to-point link between any two (2) schools.

1.9 VIDEO BLU-RAY SYSTEM

- A. Provide 1 Blu-Ray player located in the Media Center for live streaming and recording. Equip each unit with a dual MPEG 4/H.264 Encoder Unit for broadcasting low and high bit rate digital streams.

1.10 DIGITAL BROADCAST MEDIA SOURCE SYSTEM

- A. Provide 6-12 channels of digital broadcast media sources. Connect sources to A/V MPEG-4/H.264 encoder input for streaming to the network.
- B. The Technology Designer shall coordinate with the District to determine applicable digital broadcast media sources, such as specific CATV channels, off-air channels and satellite channels, as can be incorporated within the budget.

1.11 INSTALLATION

- A. Contractor shall install and program all Digital Video Distribution Equipment and establish all necessary VLANs as required.

1.12 LABELING

- A. Cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District.
- B. All Video Cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.

1.13 TESTING

- A. Video Wiring system and associated systems shall be tested end-to-end complete.

1.14 TRAINING

- A. ***Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:***
 - 1. ***System Equipment Connectivity***
 - 2. ***Device Configurations***
 - 3. ***Operation, maintenance, and upgrade procedures.***
- B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS**

- C. Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
- D. Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
- E. Training shall be by certified manufacturer instructor.***
- F. Training schedule shall be coordinated with District personnel and their needs.***
- G. Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
- H. Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
- I. Provide a digital video copy of the training sessions***
- J. MPEG-4 encode and place a copy of training video on VOD server.***

END OF SECTION

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COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 275121****STUDENT DINING / AUDITERIA SOUND REINFORCEMENT SYSTEM – HIGH SCHOOL****GENERAL GUIDELINES****1.1 GENERAL**

- A. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Sound Reinforcement System
- B. Stage/Production Intercom System
- C. Assistive Listening System
- D. Monitor/Effects Foldback System
- E. Backstage Monitor/Cue System

1.3 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code.
- B. Underwriter's Laboratory.
- C. TIA/EIA-607 Telecommunications Grounding.
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).
- E. Americans with Disabilities Act (ADA).
- F. Federal Communications Commission Part 15.
- G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.
- H. Audio Systems Design and Installation (Giddings) 1990.

1.4 SYSTEM WARRANTY

- A. The Student Dining/Auditeria Sound Reinforcement System shall be warranted by the Contractor for a period of **three (3)** years from date of substantial completion.

1.5 RELATED SECTIONS

- A. Specification section 271543–Audio-Video Communications Horizontal Transport System
- B. Specification section 274119 – Video Display Equipment

1.6 MATERIALS

- A. Stationary Main Equipment Cabinet with the following rack mounted equipment:
 - 1. Mixer/Preamplifier
 - 2. Power Amplifier(s)
 - 3. Digital Signal Processor(s)
 - a. RS-232 Interface for Configuration and Tuning
 - b. Equalization Filters – graphic and/or parametric
 - c. Compressor/Limiter
 - d. Digital Delay for cluster alignment (if applicable)
 - e. High and Low Pass and Shelving Filters
 - f. Feedback Suppression (may be incorporated in DSP or a stand-alone unit)
 - g. Crossover (if bi-amplified speaker system is utilized)
 - h. Selectable scene presets
 - 4. AM/FM radio tuner
 - 5. Assistive Listening Transmitter (provide with ADA-compliant quantity of receivers)
 - 6. Monitor/Effects Foldback System amplification and signal processing, including feedback eliminators and equalization
 - 7. Sequencing AC Power Control System
 - 8. Passive or Active thermal control
 - 9. Microphone termination/splitting panel in Main Equipment Cabinet
- B. Program Source Cabinet
 - 1. i-Pod Docking Station
 - 2. Wireless microphone receivers (minimum qty. 4) and antenna distribution system. Provide with handheld and/or lavalier microphones.
 - 3. CD/CD-R/CD-RW/MP3 Player
 - 4. Digital audio recording device.
 - 5. Production Intercom Wireless Base Station – Provide with a minimum of four (4) wireless belt packs and headsets
 - 6. Input/output jack panel
 - 7. AC power distribution panel
- C. House Speaker Options:
 - 1. Point source speaker or speaker cluster suspended from structure.
 - 2. Speaker cluster with delayed satellite speakers.
 - 3. Distributed full range speakers.
 - 4. Sub Woofer(s) – (optional)
- D. Monitor Speakers – floor wedge or stand-mounted – minimum qty. 2. Provide with rubber-jacketed speaker cables.
- E. Distributed Jackplates:
 - 1. Microphone jackplates (XLR-F connectors).
 - 2. Monitor/Effects speaker jackplates (Speakon style).
 - 3. Multi-pin send/return connectors at mixing locations in Control Room and at rear of audience seating area.
- F. Multi-pair “snake cable” with individually shielded pairs, connectorized at both ends.

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- G. Direct box(es) for insertion of line level and laptop sound card signals into microphone jacks.
- H. Mixing Console – Minimum requirements: 24-microphone input channels; 2-stereo line level input channels; stereo and mono output busses; 4-aux output busses
- I. Hanging microphones – for use over stage (minimum qty. 2).
 - 1. Microphones, microphone stands, cords, and connectors.
- J. Handheld, lavalier or boundary microphones. (minimum qty. 2) Include floor or desk stands and cords.

1.7 INSTALLATION

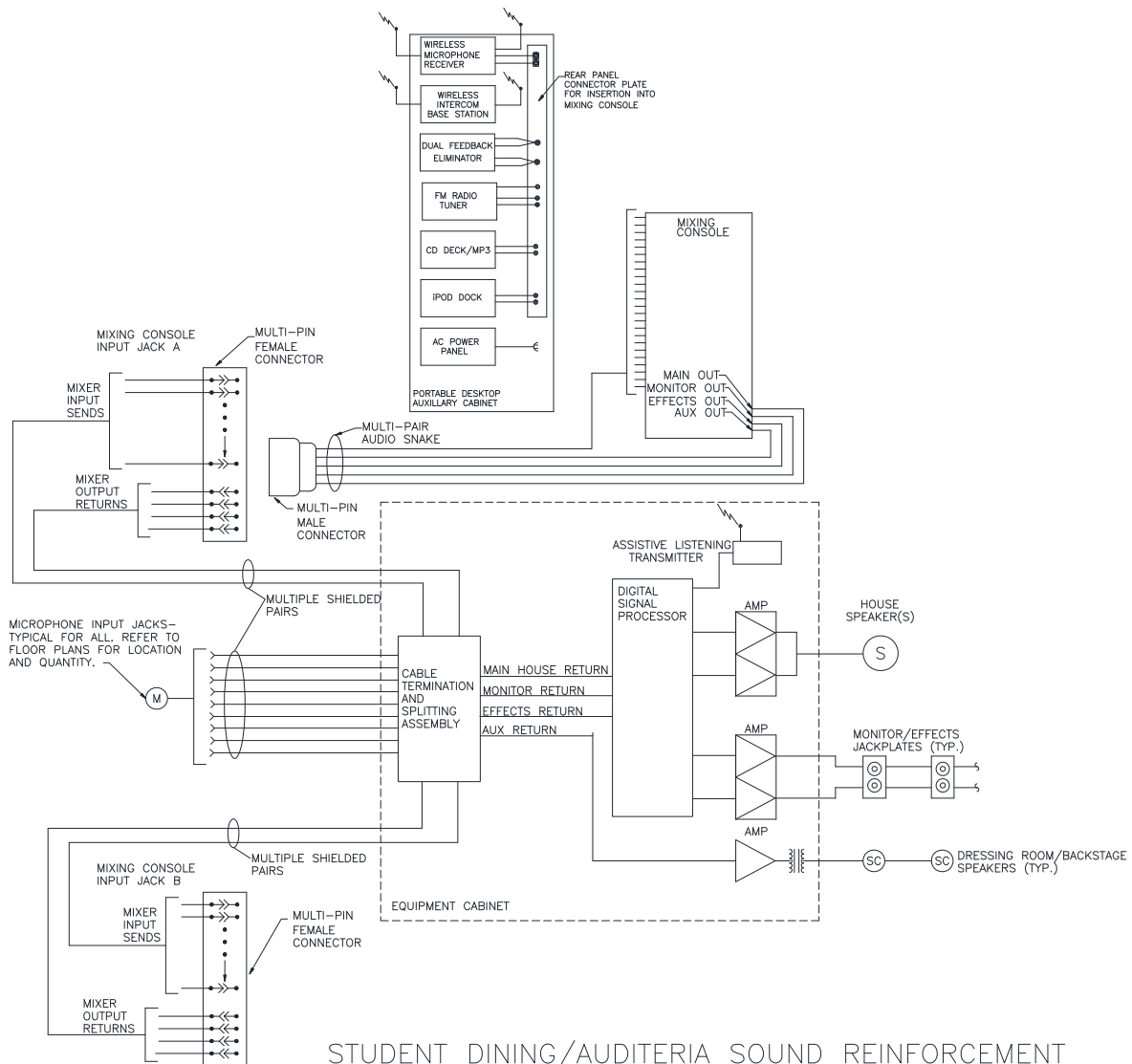
- A. Install and balance system. Adjust all sound levels for desired operation levels and evenness of coverage.
- B. Adjust all wireless equipment and verify coverage areas.
- C. Check polarity of all input jacks, signal chains, and speakers.
- D. Check gain structure.
- E. Connect FM Tuner to external, building mounted FM Antenna Distribution System. Ground antenna in accordance with NEC and TIA/EIA-607.
–OR–
Receive radio reception from Distributed Broadband RF system.
- F. Ground equipment cabinet and associated equipment to cabinet-mounted telecommunications grounding buss bar in accordance with NEC and TIA/EIA-607.
- G. Install in accordance with manufacturer's installation instructions.

1.8 PERFORMANCE TESTING

- A. Frequency response: 80Hz – 14kHz +/- 3 dB.
- B. Loudness: At least 96dB-SPL program level with an additional 6 dB Crest factor.
- C. Evenness of coverage: Variation of less than +/- 3dB (400Hz to 4000Hz) at all seats.

1.9 TRAINING

- A. Provide eight (8) hours training for District's personnel on the operation and maintenance of the system.
- B. Provide **a digital video** copy of all training.



SCALE: NONE (RE: 27 51 21)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 275122****STUDENT DINING / CAFETERIA SOUND REINFORCEMENT SYSTEM****GENERAL GUIDELINES****1.1 GENERAL**

- A. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Sound Reinforcement System
- B. Assistive Listening System

1.3 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code.
- B. Underwriter's Laboratory.
- C. TIA/EIA-607 Telecommunications Grounding.
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).
- E. Americans with Disabilities Act (ADA).
- F. Federal Communications Commission Part 15.
- G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.
- H. Audio Systems Design and Installation (Giddings) 1990.

1.4 SYSTEM WARRANTY

- A. The Student Dining/Cafeteria Sound Reinforcement System shall be warranted by the contractor for a period of **three (3)** years from date of substantial completion.

1.5 RELATED SECTIONS

- A. Specification Section 271543–Audio-Video Communications Horizontal Transport System
- B. Specification Section 274119 – Video Display Equipment

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1.6 MATERIALS

- A. Stationary Main Equipment Cabinet with the following rack mounted equipment:
 - 1. Mixer/Preamplifier (minimum of 8 channels)
 - 2. Power Amplifier(s)
 - 3. Digital Signal Processor(s)
 - 4. RS-232 Interface for Configuration and Tuning
 - 5. Equalization Filters – graphic and/or parametric
 - 6. Compressor/Limiter
 - 7. Digital Delay for cluster alignment (if applicable)
 - 8. High and Low Pass and Shelving Filters
 - 9. Feedback Suppression (may be incorporated in DSP or a stand-alone unit).
 - 10. Crossover (if bi-amplified speaker system is utilized)
 - 11. Selectable scene presets
 - 12. AM/FM radio tuner
 - 13. i-Pod Docking Station
 - 14. CD/CD-R/CD-RW/MP3 Player
 - 15. Digital audio recording device
 - 16. Wireless microphone receivers (Minimum Qty. 1) and antenna distribution
 - 17. Assistive Listening Transmitter (provide with ADA-compliant quantity of receivers)
 - 18. Sequencing AC Power Control System
 - 19. Passive or Active thermal control
- B. Speaker Options:
 - 1. Point source speaker or speaker cluster suspended from structure.
 - 2. Speaker cluster with delayed satellite speakers.
 - 3. Distributed full-range speakers.
- C. Distributed Jackplates
 - 1. Microphone input jackplates (XLR-F connectors).
 - 2. Balanced, auxiliary-input, jack plate assemblies.
- D. Microphones, microphone stands, cords, and connectors (minimum qty. 4).

1.7 INSTALLATION

- A. Install and balance system. Adjust all sound levels for desired operation levels and evenness of coverage.
- B. Adjust all wireless equipment and verify coverage areas.
- C. Check polarity of all speakers and adjust all microphone and source input levels.
- D. Connect FM Tuner to external, building mounted FM Antenna and Distribution System. Ground Antenna in accordance with NEC and TIA/EIA-607.
–OR–
Receive radio reception from Distributed Broadband RF system as specified in another spec section.
- E. Ground equipment cabinet and associated equipment to cabinet-mounted telecommunications grounding busbar in accordance with NEC and TIA/EIA-607

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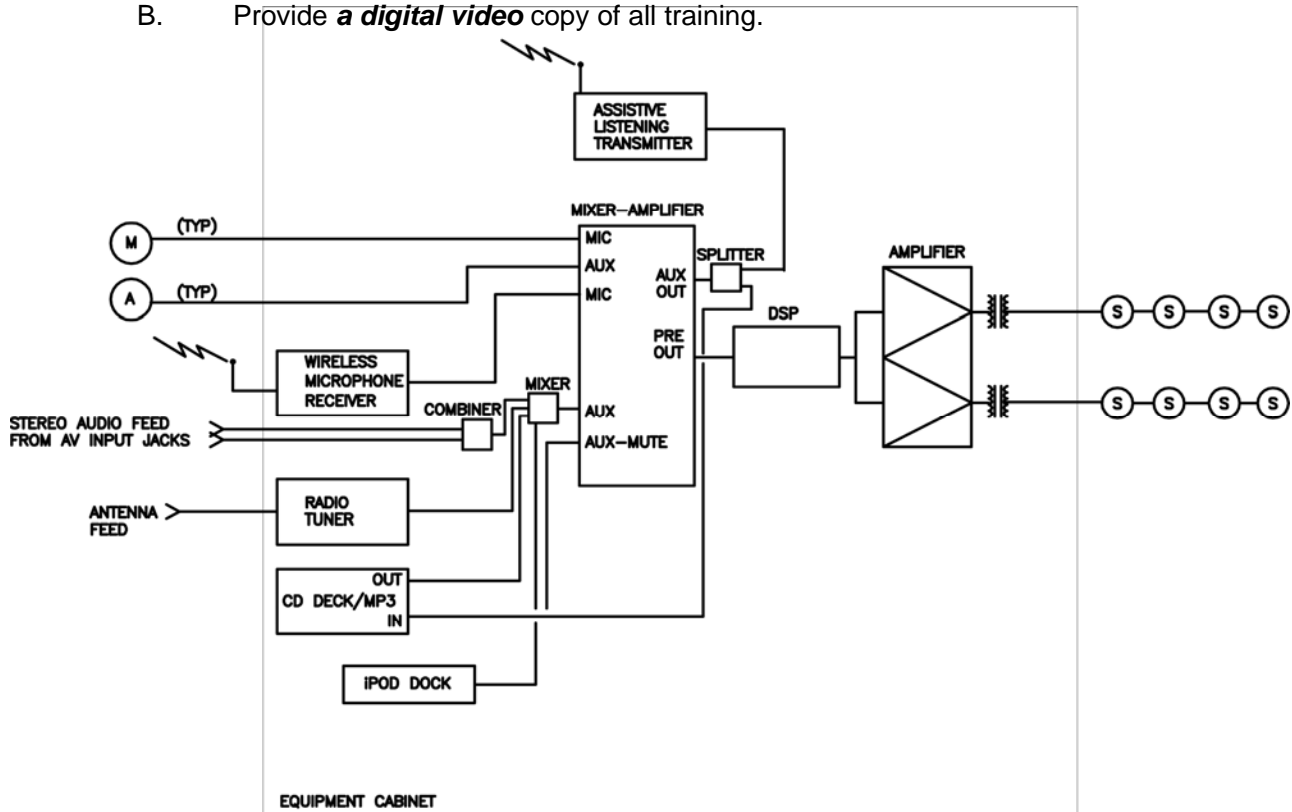
- F. Install in accordance with manufacturer's installation instructions and recommendations.

1.8 PERFORMANCE TESTING

- A. Frequency response: 80Hz – 14kHz +/- 3 dB.
- B. Loudness: At least 90 dB-SPL program level with an additional 6 dB Crest factor.
- C. Evenness of coverage: Variation of less than +/- 3dB (400Hz to 4000Hz) at all seats.

1.9 TRAINING

- A. Provide eight (8) hours training for District's personnel on the operation and maintenance of the system.
- B. Provide **a digital video** copy of all training.



STUDENT DINING/CAFETERIA SOUND REINFORCEMENT SYSTEM DIAGRAM

SCALE: NONE (RE: 27 51 22)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.

END OF SECTION

SECTION 275123

CENTRAL SOUND AND PAGING SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This section defines the general design requirements for a uniform Central Sound and Paging System that shall be followed for all OSFC Technology construction projects.
- B. The basis of design is a full-function, microprocessor-based, two-way intercommunications/zoned paging/program distribution system interfaced with and operated by the telephone system (specified elsewhere).
- C. An optional one-way zoned paging system, interfaced and operated by the telephone system (specified elsewhere) shall require an OSFC variance.
- D. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Central Sound and Paging System and all related components.

1.3 QUALITY ASSURANCE

- A. NFPA 70 – National Electrical Code
- B. Underwriter's Laboratory
- C. TIA/EIA-607 Telecommunications Grounding
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM)
- E. Americans with Disabilities Act (ADA)
- F. Federal Communications Commission Part 15
- G. Sound Systems Engineering (Davis & Patronis) – 3rd Edition 2006
- H. Audio Systems Design and Installation (Giddings) 1990

1.4 SYSTEM WARRANTY

- A. ***The Central Sound and Paging System shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warrant with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system, after the initial warranty period.***

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS**

1.5 RELATED SECTIONS

- A.** Specification section 275313 – Clock Systems
- B.** Specification section 273113 – IP-Enabled PABX System
OR Specification section 273123 – IP-Only PABX System

1.6 MICROPROCESSOR-BASED TWO-WAY INTERCOM / PAGING / PROGRAM DISTRIBUTION SYSTEM (Base Design)

- A.** PABX System Interface
- B.** Administrative communications console – located in main office or at equipment headend
- C.** Microprocessor-based with RS-232 Interface for setup and/or control
- D.** Minimum eight (8) paging and time tone distribution zones
- E.** Internal time-tone schedule programming and software
- F.** Synchronization with clock system
- G.** Input signal prioritization
- H.** Dedicated home-run speaker circuits from each classroom or special function room (gymnasiums, dining rooms, multi-purpose rooms, exterior spaces, etc.). Call button cabling is included in baseline system whether the call button is installed or not. Extend to speaker location if call button is not installed.
- I.** Base Line - Call origination switches or handsets in each classroom with annunciator display in central school reception office. Variance required if District elects not to include. Technology Designer to review system with District, determine need for conduit/box rough-ins for future if District elects not to include in project via variance.

1.7 ONE-WAY ZONED PAGING SYSTEM (Optional System Requires Variance)

- A.** PABX System Interface.
- B.** Microprocessor-based, zoned paging/program distribution system
- C.** Minimum of six (6) paging zones
- D.** Distribution of class-change time tones as scheduled by Clock System
- E.** Input signal prioritization
- F.** One-Way Zoned Paging System Options:
 - 1.** High impedance, constant voltage system with centrally located power amplifiers and passive speakers with 25-volt transformers. Each classroom speaker circuit is to be individually wired and extended to head end equipment. Corridor and common area speakers are to be grouped according to zones.

2. Low-voltage, amplified speakers with central power supplies and star-wired CAT3 cabling system terminated on 110-style cross-connect blocks, located on the backboard in main Equipment Room (ER). Each speaker wired with dedicated, individual home-run cable. Use pair 1 for paging signal and pairs 2-4 for power.
- G. Central paging power supplies based on system load. Connect to Main Equipment Room (ER) UPS unit, powered by building emergency generator circuit(s).

1.8 COMPONENTS COMMON TO ALL SYSTEMS:

- A. **PROGRAM SOURCE CABINET** - Locate a wall-mounted or desktop cabinet in the central school reception office area and place within the cabinet:
 1. i-Pod Docking Station (optional)
 2. Weather radio and associated antenna (optional)
 3. CD player or changer
 4. AM/FM radio connected to the building antenna/RF distribution system
 5. Monitor speaker panel for program cueing and preview
 6. Connect audio outputs to audio inputs on the paging adapter (when applicable)
- B. **EMERGENCY/EVACUATION ALARM TONE PANEL**
 1. Locate in central school reception office area – either as a stand-alone wall-mounted device or within Program Source Cabinet.
 2. Minimum of three (3) clearly labeled switches to activate distinct tones: EMERGENCY, EVACUATION, ALL-CLEAR.
 3. Assign highest priority level
- C. **ALL-CALL PAGING MICROPHONE**
 1. Locate in central school reception office area. Use of receptionist's telephone handset is permissible, if acceptable to the school.
- D. Locate a minimum of one (1) paging speaker or horn in all building rooms, including Mechanical areas. Base the quantity of speakers/horns on the required signal level and the size of the area to be covered.
- E. **Speaker and horn types:**
 1. Flush-mounted ceiling speakers with all metal protective dome enclosures and ceiling bridge support.
 2. Surface-mount wall or ceiling speakers
 3. Compression driver paging horns in gymnasiums, shop areas, mechanical rooms, exterior of building (weather-proof type) and other areas with high ambient sound levels.
 4. Wall mounted volume controls in meeting rooms and other District specified areas.

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1.9 INSTALLATION

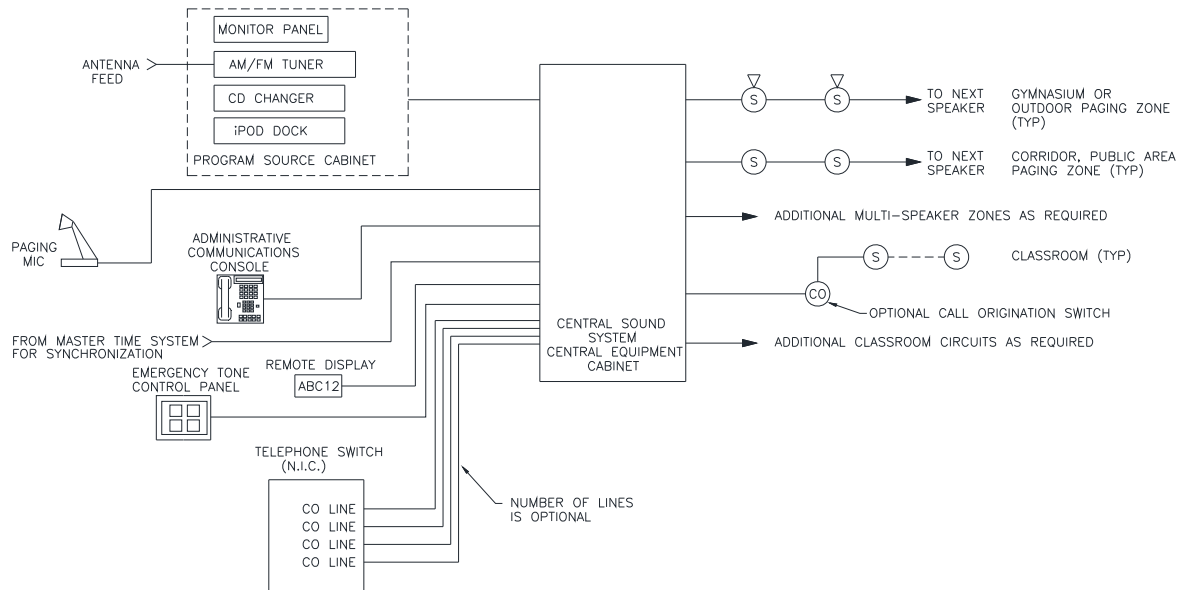
- A. Install and balance the paging system volume levels according to ambient noise levels.
- B. Integrate with Telephone System PABX for access to zone paging and intercom (if applicable) functions.
- C. Establish building paging zones as directed by the School District.
- D. Provide programming and setup of paging zones, signal priorities, and bell (time tone) schedule.
- E. Connect to building antenna (if applicable) and ground in accordance with NEC and TIA/EIA-607.
- F. Install in accordance with manufacturer's installation instructions and recommendations.

1.10 TRAINING

- A. ***Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:***
 - 1. ***System Equipment Connectivity***
 - 2. ***Device Configurations***
 - 3. ***Operation, maintenance, and upgrade procedures.***
- B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***
- C. ***Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
- D. ***Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
- E. ***Training shall be by certified manufacturer instructor.***
- F. ***Training schedule shall be coordinated with District personnel and their needs.***
- G. ***Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
- H. ***Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
- I. ***Provide a digital video copy of the training sessions.***

CHAPTER 9: SPECIFICATIONS

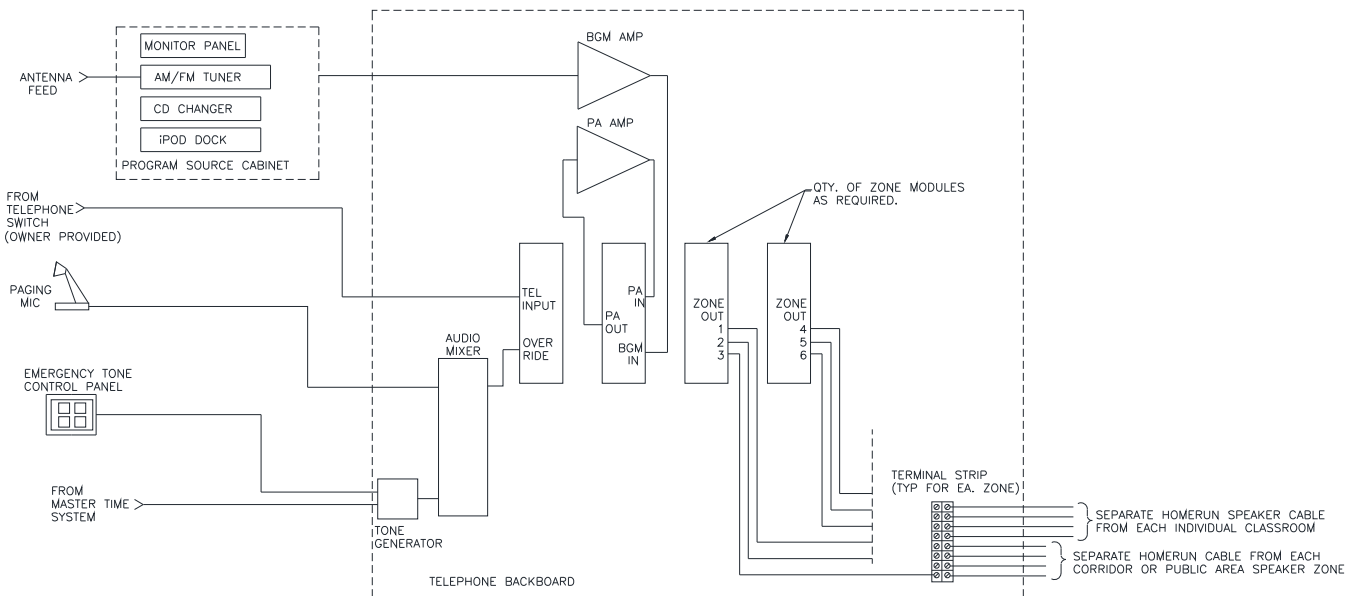
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CENTRAL SOUND/INTERCOM SYSTEM DIAGRAM (BASELINE SYSTEM)

SCALE: NONE (RE: 27 51 23A)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.



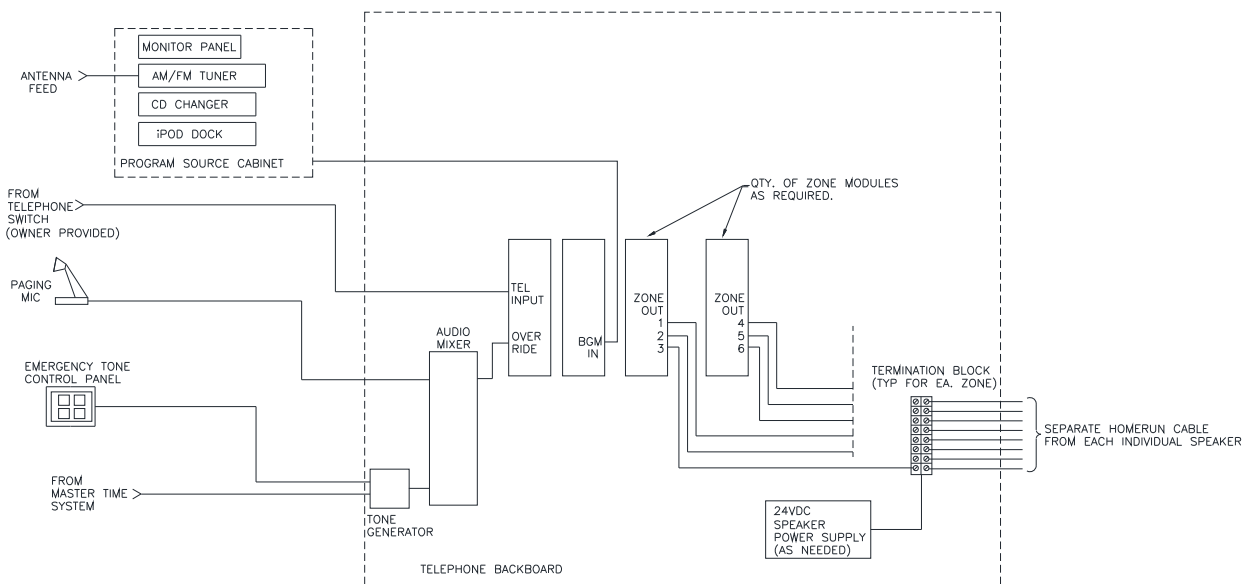
CENTRAL SOUND PAGING/PROGRAM DISTRIBUTION SYSTEM DIAGRAM – PASSIVE SPEAKERS

SCALE: NONE (RE: 27 51 23B) (OPTIONAL – REQUIRES VARIANCE)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.

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CENTRAL SOUND PAGING/PROGRAM DISTRIBUTION SYSTEM DIAGRAM – POWERED SPEAKERS

SCALE: NONE (RE: 27 51 23C) (OPTIONAL – REQUIRES VARIANCE)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.

END OF SECTION

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COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS**

SECTION 275124**GYMNASIUM SOUND REINFORCEMENT SYSTEM****GENERAL GUIDELINES****1.1 GENERAL**

- A. This section defines the general design requirements for a uniform Gymnasium Sound Reinforcement System that shall be followed for all OSFC Technology construction projects – High School, Middle School, and Elementary School facilities.
- B. The variations as related to school type are defined in Parts 2 and 3 of this guideline.
- C. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Gymnasium Sound Reinforcement System and all related components.

1.3 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code.
- B. Underwriter's Laboratory.
- C. TIA/EIA-607 Telecommunications Grounding.
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).
- E. Americans with Disabilities Act (ADA).
- F. Federal Communications Commission Part 15.
- G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.
- H. Audio Systems Design and Installation (Giddings) 1990.

1.4 SYSTEM WARRANTY

- A. The Gymnasium Sound Reinforcement System shall be warranted by the contractor for a period of **three (3)** years from date of substantial completion.

1.5 MATERIALS

- A. Stationary Main Equipment Cabinet with the following rack mounted equipment:
 - 1. Mixer/Preamplifier
 - 2. Power Amplifier(s)
 - 3. Digital Signal Processor(s)
 - a) RS-232 Interface for Configuration and Tuning
 - b) Equalization Filters – graphic and/or parametric
 - c) Compressor/Limiter
 - d) Digital Delay for cluster alignment
 - e) High and Low Pass and Shelving Filters
 - f) Feedback Suppression (may be incorporated in DSP or a stand-alone unit)
 - g) Crossover (if bi-amplified speaker system is utilized)
 - h) Selectable scene presets
 - 4. AM/FM radio tuner
 - 5. Digital audio recording device.
 - 6. Assistive Listening Transmitter (provide with ADA-compliant quantity of receivers)
 - 7. Sequencing AC Power Control System
 - 8. Passive or Active thermal control
- B. Mobile Equipment Cabinet shall contain the following equipment for mic level signal insertion into a wall or floor mounted microphone jack:
 - 1. Rack-mounted mixer with mic level output
 - 2. Wireless microphone receiver with handheld and/or lavalier microphone
 - 3. CD/CD-R/CD-RW/MP3 Player
 - 4. i-Pod Docking Station
 - 5. Input/output jack panel
 - 6. AC power distribution panel
 - 7. Note: In Middle and Elementary School Gymnasium systems, the mobile equipment cabinet may be eliminated with the associated components being located in the Stationary Equipment Cabinet.
- C. Speaker cluster or distributed speakers suspended from structure.
 - 1. Middle School and Elementary School Gymnasium speaker systems shall provide even coverage of both the entire floor area and seating areas.
 - 2. High School Gymnasium speaker systems shall provide switchable speaker zones as follows: Home Bleachers, Visitors Bleachers, Floor, and Mezzanine (where applicable). The zone selection shall be performed via selector switches in the Stationary Equipment Cabinet.
- D. Microphone input jack at scorer's table.
- E. Distributed mic/aux level input jacks on end walls –OR- mic level input jacks only (provide with aux/line level-to-microphones level direct box(es)).

1.6 INSTALLATION

- A. Install and balance system. Adjust all sound levels for desired operation levels and evenness of coverage.

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- B. Adjust all wireless equipment and verify coverage areas.
- C. Check polarity of all speakers and adjust all microphone and source input levels.
- D. Connect FM Tuner to external, building mounted FM Antenna and Distribution System. Ground Antenna in accordance with NEC and TIA/EIA-607. –OR- Receive radio reception from Distributed Broadband RF system as specified in another spec section.
- E. Ground equipment cabinet and associated equipment to cabinet-mounted telecommunications grounding buss bar in accordance with NEC and TIA/EIA-607.
- F. Install in accordance with manufacturer's installation instructions and recommendations.

1.7 PERFORMANCE TESTING

- A. Frequency response: 100Hz – 14kHz +/- 3 dB
- B. Loudness: High School Varsity Gym: At least 100dB-SPL program level with an additional 6dB Crest factor; Middle, Elementary School and Auxiliary Gym: At least 90dB-SPL program level with an additional 6 dB Crest factor
- C. Evenness of coverage: Variation of less than +/- 3 dB (400Hz to 4000Hz) at all seats.

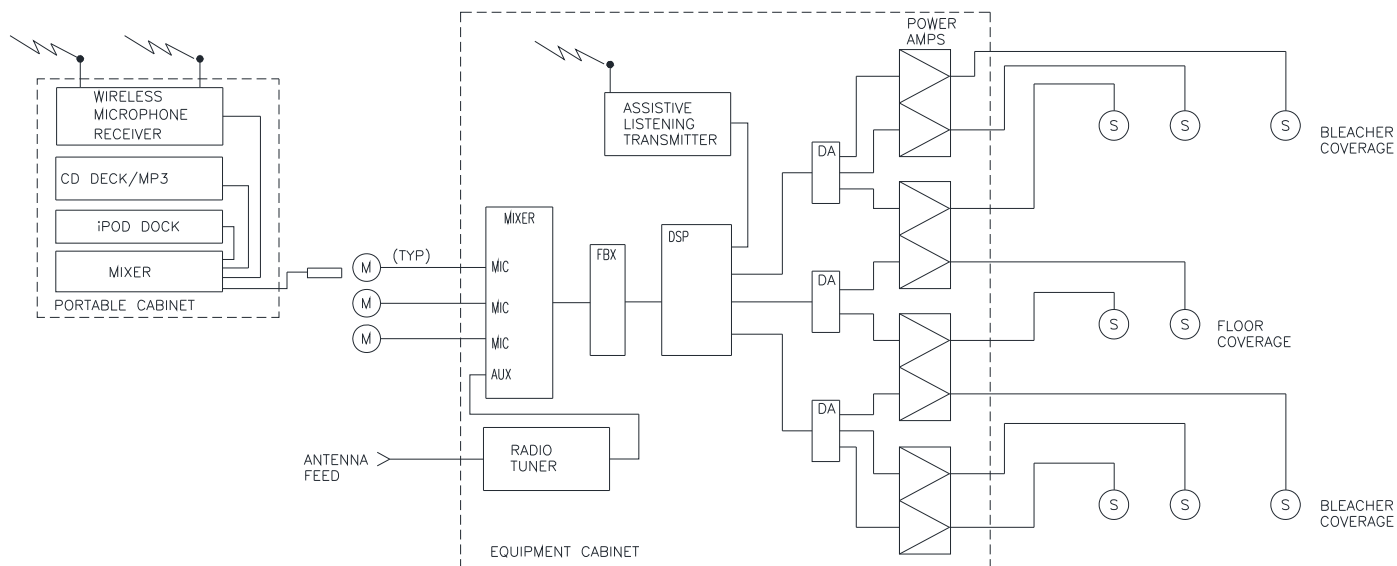
1.8 TRAINING

- A. Provide minimum eight (8) hours training for District's personnel on the operation and maintenance of the system.
- B. Provide **a digital video** copy of all training.

(See diagrams on next page)

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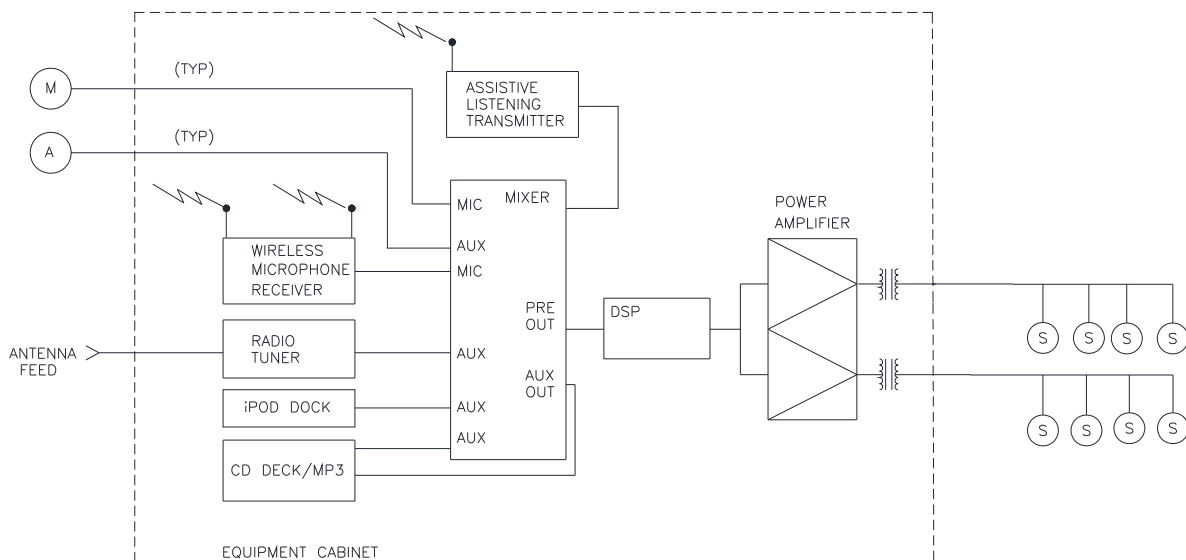
COMMUNICATIONS



HS GYMNASIUM SOUND SYSTEM DIAGRAM

SCALE: NONE (RE: 27 51 24A)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.



MS/AUX GYMNASIUM SOUND SYSTEM DIAGRAM

SCALE: NONE (RE: 27 51 24B)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.

END OF SECTION

SECTION 275125

MUSIC ROOM AUDIO PROGRAM PLAYBACK SYSTEM - MIDDLE SCHOOL

GENERAL GUIDELINES

1.1 GENERAL

- A. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Music room sound system and components for playback of audio program material.

1.3 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code.
- B. Underwriter's Laboratory.
- C. TIA/EIA-607 Telecommunications Grounding.
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).
- E. American with Disabilities Act.
- F. Federal Communications Commission Part 15.
- G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.
- H. Audio Systems Design and Installation (Giddings) 1990.

1.4 SYSTEM WARRANTY

- A. The Sound System shall be warranted by the contractor for a period of **three (3)** years from date of substantial completion.

1.5 MATERIALS

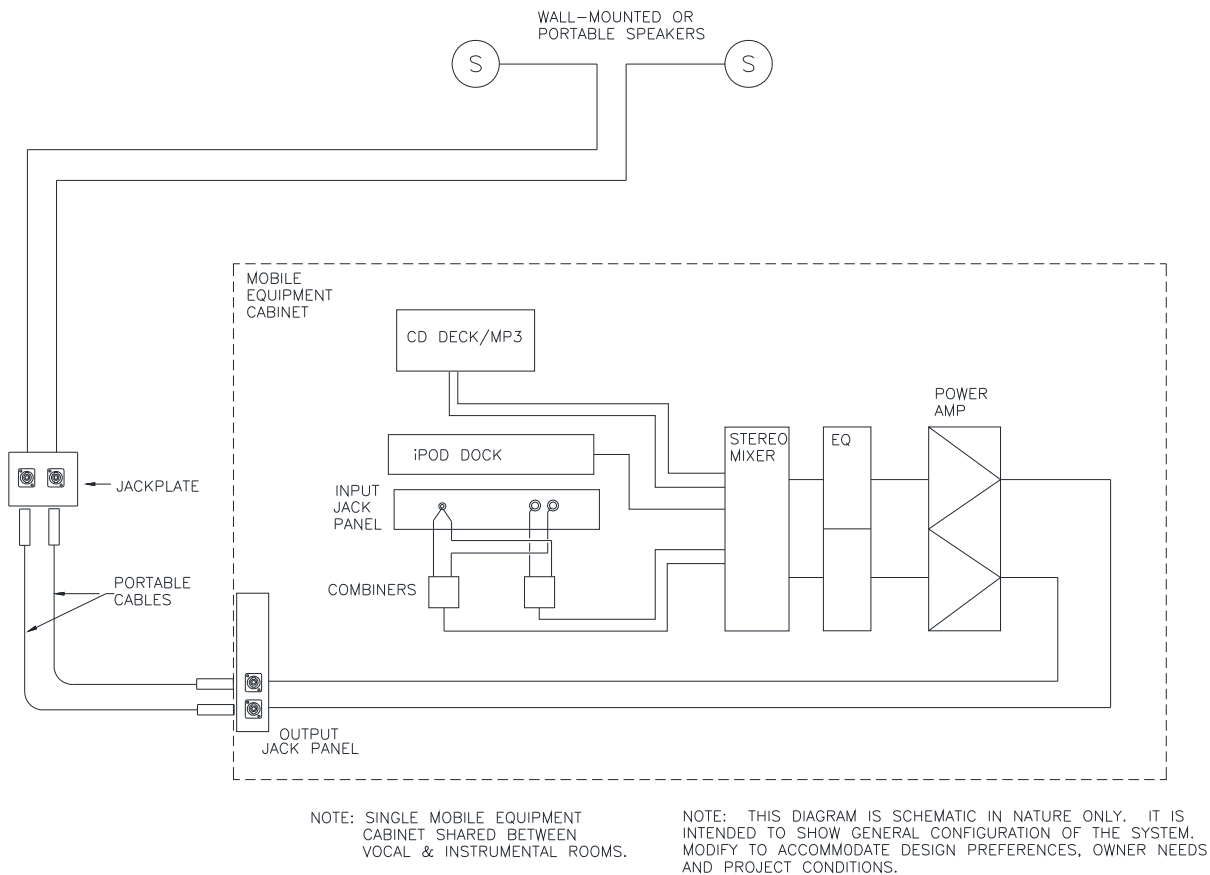
- A. Mobile or permanently mounted main equipment rack.
 - 1. Stereo Mixer or Source Selection Device – rack-mounted.
 - 2. Dual channel Amplifier.
 - 3. Dual channel octave band equalizer.
 - 4. CD/CD-R/CD-RW/MP3 Player.
 - 5. i-Pod Docking Station.
 - 6. Input Jack panel for insertion of external sources.
- B. Wall mounted or tripod mounted speakers – stereo pair.
- C. Wall-mounted speaker jack plate – for connection of amplifier in mobile rack to permanently-mounted speakers.

1.6 INSTALLATION

- A. Install and balance system volume levels.
- B. Check polarity of all speakers.
- C. Install in accordance with manufacturer's installation instructions and recommendations.

1.7 TRAINING

- A. Provide four (4) hours training for District's personnel on the operation and maintenance of the system.
- B. Provide **a digital video** copy of all training.



MS MUSIC ROOM PLAYBACK SYSTEM DIAGRAM

SCALE: NONE (RE: 27 51 25)

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 275126****MUSIC ROOM AUDIO RECORDING/PLAYBACK SYSTEM - HIGH SCHOOL****GENERAL GUIDELINES****1.1 GENERAL**

- A. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Music room sound system and components for recording and playback of audio program material.

1.3 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code.
- B. Underwriter's Laboratory.
- C. TIA/EIA-607 Telecommunications Grounding.
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).
- E. American with Disabilities Act.
- F. Federal Communications Commission Part 15.
- G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.
- H. Audio Systems Design and Installation (Giddings) 1990.

1.4 SYSTEM WARRANTY

- A. The Sound System shall be warranted by the contractor for a period of **three (3)** years from date of substantial completion.

1.5 MATERIALS

- A. Mobile or permanently mounted main equipment rack.
 - 1. Stereo microphone mixer/pre-amplifier – rack-mounted.
 - 2. Recording Input patch panel for insertion of external microphones or mixing consoles.
 - 3. Stereo program playback mixer or source selection device – rack-mounted.
 - 4. Program source, playback patch panel for insertion of external playback devices.
 - 5. Dual channel amplifier.
 - 6. Dual channel, octave band equalizer.
 - 7. CD/CD-R/CD-RW/MP3 Player

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8. i-Pod Docking Station.
9. Digital audio recording device
10. Stereo hanging and/or floor stand microphones as required.

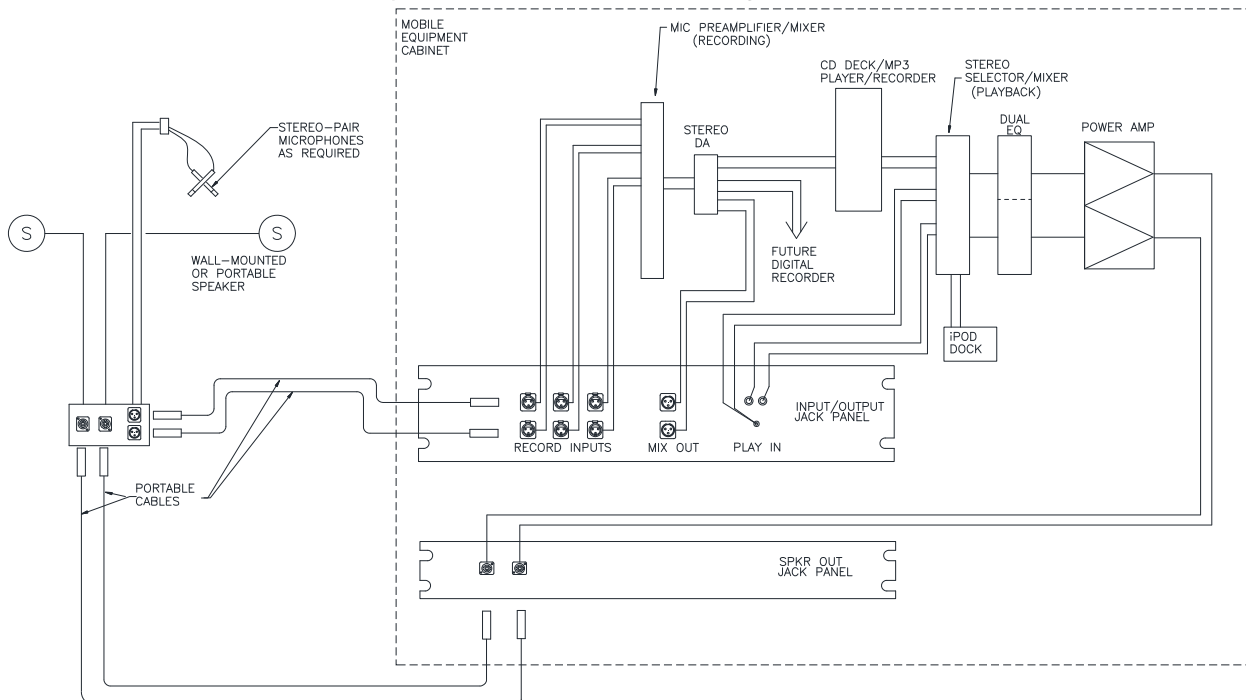
- B. Wall mounted or tripod mounted speakers – stereo pair.
- C. Wall mounted speaker jack plate – for connection of amplifier in mobile rack to permanently mounted speakers.

1.6 INSTALLATION

- A. Install and balance system volume levels.
- B. Check polarity of all speakers and microphones.
- C. Install in accordance with manufacturer's installation instructions and recommendations.

1.7 TRAINING

- A. Provide four (4) hours training for District's personnel on the operation and maintenance of the system.
- B. Provide **a digital video** copy of all training.



HS MUSIC ROOM RECORD/PLAYBACK SYSTEM DIAGRAM

SCALE: NONE (RE: 27 51 26)

NOTE: THIS DIAGRAM IS SCHEMATIC IN NATURE ONLY. IT IS INTENDED TO SHOW GENERAL CONFIGURATION OF THE SYSTEM. MODIFY TO ACCOMMODATE DESIGN PREFERENCES, OWNER NEEDS AND PROJECT CONDITIONS.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS****SECTION 275127****CLASSROOM SOUND REINFORCEMENT SYSTEM****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Classroom Sound Reinforcement System that shall be followed for all OSFC Technology construction projects.
- B. Refer to Section 8500, Technology Systems for additional information.

1.2 SECTION INCLUDES

- A. Classroom sound reinforcement system and components.

1.3 QUALITY ASSURANCE

- A. NFPA 70 – National Electrical Code.
- B. Underwriter's Laboratory.
- C. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Eleventh Edition (or later).
- D. Eleventh Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).
- E. American with Disabilities Act.
- F. Federal Communications Commission Part 15.

1.4 SYSTEM WARRANTY

- A. The Sound System shall be warranted by the contractor for a period of **three (3)** years from date of substantial completion.

1.5 CLASSROOM SOUND REINFORCEMENT SYSTEM

- A. IR or RF Receiver/Amplifier, equipped with:
 - 1. Minimum of 30-Watts RMS Watts total output.
 - 2. Minimum of 50-20 KHz frequency response.
 - 3. Two (2) wireless microphone input channels with individual volume controls.
 - 4. Tone Controls or Equalizer.
 - 5. Minimum of three (3) auxiliary line inputs with individual volume controls.
 - 6. Minimum of one (1) line output for optional ADA, wireless headphone system.
 - 7. System Power Supply.
 - 8. Power Switch.
 - 9. Minimum of two (2) wireless microphone frequencies.
 - 10. Minimum of one (1) ceiling-mounted, Infrared sensor or RF antenna with plenum rated cabling.

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11. One (1) Lavalier or collar microphone, with NiMH rechargeable batteries and charger.
12. One (1) Handheld microphone, with NiMH rechargeable batteries and charger.
13. Minimum of four (4) acoustical ceiling mounted, 360-degree dome speakers with all metal acoustical back enclosure and ceiling tile bridge, minimum 15-Watt capacity and minimum of 65-20KHz frequency response.
14. Receiver/Amplifier must be capable of being placed in Instructor's casework or cabinet mounted with no loss of infrared signal strength.
15. Unit must provide uniform pickup from the Instructor's microphone throughout the classroom.
16. Provide means for the central paging system to mute or override the classroom sound reinforcement system when a central page occurs.
17. Both IR or encrypted RF technologies are acceptable, providing transmission does not interfere with reception in other rooms. Multi-channel, encrypted RF systems shall provide auto frequency selection.

B. *Optional – Provide quantity of two (2) FM/Bluetooth Assisted Listening Systems interfacing with Classroom Sound Reinforcement System per school building.*

1.6 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Per Speaker, provide minimum of 16 AWG, CMP rated speaker wire. Wire gauge based on cable lengths and power ratings.
- C. Route speaker wires through associated faceplate Space speakers in classroom to provide uniform coverage.
- D. For rooms using Overhead Mounted Projectors:
 1. Provide a wall bracket/shelf for mounting Infrared Receiver/Amplifier or mounted in cabinet or casework.
 2. Provide Line Level cabling from Instructor's PC, DVD/Blu-Ray Unit and MPEG Set-Top-Box Line Outputs to Auxiliary Line Inputs on Infrared Receiver/Amplifier.
 3. Balance and adjust all volume levels.
 4. Check uniform polarity of speakers.
- E. Add additional speakers and infrared sensors in large classrooms, as required, to maintain complete coverage.
- F. Classroom Sound Reinforcement system shall be installed in all classrooms/labs for K-12.
- G. Classroom Sound Reinforcement system shall be integrated with the classroom A/V system.

1.7 TRAINING

- A. Provide four (4) hours training for District's personnel on the operation and maintenance of the system.
- B. Provide **a digital video** copy of all training.

END OF SECTION

COMMUNICATIONS**CHAPTER 9: SPECIFICATIONS**

SECTION 275313**CLOCK SYSTEMS****GENERAL GUIDELINES****1.1 GENERAL**

- A. This Section defines the general design requirements for a uniform Building-wide Synchronized Clock System that shall be followed for all OSFC Technology construction projects.
- B. The options are defined in Parts 2 and 3 of this guideline.
- C. Refer to Section 8500, Technology Systems, for additional information.

1.2 SECTION INCLUDES

- A. Master Clocks, Secondary Clocks and accessory components.

1.3 QUALITY ASSURANCE

- A. NFPA 70 – National Electrical Code
- B. Underwriter's Laboratory
- C. TIA/EIA-607 Telecommunications Grounding
- D. *Eleventh* edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM)

1.4 SYSTEM WARRANTY

- A. The Clock System shall be warranted by the Contractor for a period of **three (3)** years from date of substantial completion.

1.5 RELATED SECTIONS

- A. Specification Section 275123 - Central Sound and Paging System

1.6 GENERAL

- A. Synchronized with the United States Atomic Clock via GPS receiver with external antenna, NTP Internet connection, or CDMA.
- B. Self-correcting for Daylight Savings Time changes.
- C. Analog Secondary Clocks:
 - 1. 12" diameter minimum, surface-mounted.
 - 2. Metal hour, minute, and second hands with impact resistant molded plastic case.

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- 3. Corridors: Double-faced, securely mounted perpendicular to wall or ceiling mounted.
- 4. Gymnasiums: 15" diameter minimum. Provide wire guards in gymnasiums, auxiliary gymnasiums, and locker rooms.
- D. Digital Secondary Clocks:
 - 1. 2.3" height minimum, 4-digit, 7-segment LED display with metal case.
 - 2. Corridors: Double-faced with perpendicular wall or ceiling mount.
 - 3. Gymnasiums: 4" height minimum, 4-digit, 7-segment LED display with metal case. Provide wire guards in gymnasiums, auxiliary gymnasiums, and locker rooms.
 - 4. Optional Text Messaging capability.
- E. Master Clock with software-programmable, integral building bell schedule and audible tone generator with selectable tones to provide class change tones to input of Central Sound System.
 - 1. Minimum of four (4) selectable, pre-programmed class change schedules, easily selectable from the main school office.
 - 2. Manual activation of audible tone from the main school office.
 - 3. Permanent or periodic temporary RS-232 connection to PC for data download update of class change schedules.
 - 4. NOTE: Where Central Sound Systems with built-in tone generator and programmable bell schedule function are utilized, the Master Clock need only to be able to synchronize time with the Central Sound System headend processor.

1.7 WIRELESS CLOCK SYSTEMS

- A. Battery-operated - minimum 5-year battery life
- B. Provide RF transmitters and antennas, as required to provide complete building-wide coverage.

1.8 WIRED CLOCK SYSTEMS

- A. Low-voltage power – 24V or less
- B. Central or distributed power supplies as required
- C. Optional IEEE 802.3af, Power Over Ethernet (POE) connectivity

1.9 INSTALLATION

- A. Securely mount the clocks flush on the walls in classrooms and office areas.
- B. Connect tone generator output to input of Central Sound System if function is not provided by that system.
- C. Synchronize time with the Central Sound System master clock if the tone generation and program schedule functions are provided by that system.
- D. Program initial bell schedules as provided by the Owner.

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- E. Located schedule selection and manual bell activation functions in main school office.

1.10 TRAINING

- A. Provide four (4) hours training for School/District personnel on the operation, programming, and maintenance of the system.
- B. Provide **a digital video** copy of all training.

END OF SECTION

28

DIVISION

ELECTRONIC SAFETY AND SECURITY

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DIVISION 28: ELECTRONIC SAFETY AND SECURITY

281300	<i>Access Control System</i>
281600	<i>Intrusion Detection System</i>
282300	<i>Video Surveillance System</i>
282600	<i>Area of Refuge Intercommunication System</i>
283111	Digital, Addressable Fire-Alarm System

SECTION 281300

ACCESS CONTROL SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for a uniform Access Control System that shall be followed for all OSFC Technology construction projects.
- B. Refer to Sections 8500, Technology Systems, 28 16 00 Intrusion Detection System, and 28 23 00 Video Surveillance System for additional information.

1.2 SECTION INCLUDES

- A. Integrated Security Management (ISM) System
- B. Uninterruptible Power Supply (UPS).

1.3 QUALITY ASSURANCE

- A. National Fire Protection Association.
- B. NFPA 730 – Guide for Premises Security
- C. NFPA 731 – Standard for the Installation of Electronic Premises Security Systems
- D. National Electric Code.
- E. American with Disabilities Act.
- F. Underwriter's Laboratory.
- G. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Eleventh Edition (or later).
- H. BICSI Telecommunications Distribution Methods Manual (TDMM).

1.4 SYSTEM WARRANTY

- A. ***The Access Control System and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.***

1.5 GENERAL

- A. Furnish a new Integrated Security Management (ISM) system that provides a simple and easy-to-use graphical user interface.
- B. The system shall provide local **and remote** operational control of all access points and alarm sensors.

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- C. The ISM System client and server software shall be used in conjunction with intelligent controllers to provide a distributed access control and alarms monitoring system.
- D. In the event of a communications failure between the host server and the remote controllers, the controllers shall continue to make local access control decisions and save all transactions in memory until communications are restored. At that time the controller shall upload all stored transactions to the Central Server.
- E. When a District has more than one building, the Central Server shall be located in one of the District's buildings and the other buildings shall be attached to the Central Server via the Wide Area Network. All buildings in the District shall interface to the Central Server and Control Consoles.
- F. The ISM System shall seamlessly integrate the functions of Access Control, Alarm Monitoring and Response, Digital Video Imaging and Badge Design/Creation, and Visitor Management.
- G. Access Readers supporting various technologies shall provide data from proximity card presentations via a door control unit that includes the electrical interface to the reader as well as inputs for door sensors and relays for outputs.

1.6 HARDWARE FEATURES**A. MODULAR SYSTEM DESIGN**

- 1. Device Control Modules shall be located in the Telecommunications Rooms (TRs) and connected to the Building Controller via hardwired bus connections or via an Ethernet TCP/IP Network.
- 2. The Building Controller shall be located in the Main Equipment Room (ER) and connected to the Central Server via an Ethernet TCP/IP connection over the District's Wide Area Network (WAN). All WAN communication shall be AES encrypted.
- 3. ***Individual IP-based door control modules may be field located at the door.***

B. ELEVATOR CONTROL, AS APPLICABLE

- 1. The system shall have the ability to provide elevator access control by (1) using a card reader to activate the elevator call button, (2) using a card reader in the cab to activate the correct floor selection button, or (3) a combination of both of these functions.
- 2. Each cardholder shall then have floor permissions assigned as part of the normal access rights. The system shall provide outputs to the elevator controls to verify which floors are authorized for each cardholder. The system shall be capable of tracking which floor was enabled/selected by that person

C. AVAILABILITY AND DISASTER RECOVERY

1. The system shall automatically synchronize any distributed databases.
2. The system shall be capable of having a redundant or clustered Central Server.
4. In the event of loss of communications with the Central Server, the Building Control Units shall revert to a survivable remote operation and continue operation until communications is restored.

1.7 SOFTWARE FEATURES**A. PERMISSIONS**

1. The system shall support multiple Operator permission levels.

B. VIDEO IMAGING AND ID BADGE PRINTING

1. The system shall incorporate video imaging as a fully integrated function to customize access control cards by printing an identity badge directly onto the card.
2. The badge design and image capture capabilities shall combine with the latest technology card printers to allow the production of an ID badge pass for each cardholder at the time of registration.
3. For each cardholder both a facial image and a signature shall be able to be captured, or imported, and stored as part of the card record.
5. A comprehensive integrated badge design and printing facility shall also be provided, allowing an unrestricted number of custom badge layouts to be defined then saved with a suitable description as a reference.
6. When creating a new card record a badge preview screen shall also be included that displays the specific card's details on the selected badge design to allow confirmation prior to requesting the badge to be printed.
7. Each new cardholder record shall have the option to be flagged for future printing. Cards flagged in this manner shall be easily recalled at a later stage and processed for output to the printer in a single action.
8. The ISM System shall support any manufacturer's ID badge printer with a **current** Microsoft **platform** (depending on the workstation configuration) compatible printer driver.
9. Provide one (1) Video Camera and Badging system per District.

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C. VIDEO VERIFICATION

1. Depending on the District's needs, a Video Imaging option shall be available to provide a monitoring screen that will automatically display the stored image for a card when used at a reader.
2. This screen shall operate in conjunction with a live video input from a CCTV camera viewing the selected access point, allowing the operator to verify that each card offered is in fact being used by the person to whom it was issued.
3. **Optional** - This screen shall also be frozen and printed to provide a hard copy evidence of any abuse observed by the operator. For District's with high security access points, the system shall be configured to not grant access until the operator has verified the stored and live images are the same person, with the door release being controlled by the system operator.

D. REPORT GENERATION

1. Extensive history reporting shall be a standard integrated feature and shall include the ability to review all system alarms, access control activity, and operator actions. These reports shall be made available for review via the operator's display screen, a printer, or to another disk media. Extensive sort parameters shall include by any of the "Personal Details" fields or Titles, for example, by "Department", and only Names commencing with "Sm*".
2. The system shall also support generation of reports detailing the system operation such as:
 - a. Cards on site.
 - b. Hours on site.
 - c. Cardholders with access to each door.
 - d. Access rights of each cardholder.
 - e. System Configuration.
 - f. Scheduled and Conditional Commands defined.
 - g. System operator transaction history.
3. It shall be possible to replay video clips associated with events by directly interacting with the report as published to the computer screen.

E. ADDITION OF CARDHOLDERS TO THE SYSTEM DATABASE

1. The system shall provide a means of assigning access control rights to each cardholder. Access control rights determine which access points are accessible to the cardholder based on date and time of day.

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2. The software shall also provide an ALTERNATE set of Access rights to a cardholder on a temporary basis. The change may be initiated at any time by an authorized operator, or automatically between specified dates. This shall provide the ability of automatically changing a card's rights between a specified date range, after which the card will revert to its normal Doors and Times. Alternate access rights shall be able to be configured for multiple date ranges.
3. Each cardholder shall either be associated with standard door timings, for door release, door open and door pre-held or be given extended timings for disabled persons or someone who has to push a cart.
4. The system shall permit individual Access Rights or Group Access Rights to be assigned.

F. CARDHOLDER DETAILS

1. Cardholder information shall include first and last name, card number, PIN code and valid period to provide automatic expiration. Each cardholder record shall also incorporate at least 50 user-defined personal data fields, independent of user-defined fields for visitor management.
2. Data base synchronization utilities shall be provided to synchronize the Access Control Database with the District's HR database. Removing an individual from the District's HR database shall automatically be queued for removal from the Access Control Database.

G. LOCATOR

1. This feature shall provide a quick method of locating cardholders by displaying the last 10-25 valid history events along with the time, date and access point used. This information shall be available for an individual or group of persons by name, card number or by personal data.

H. CARD WATCH FEATURE

1. It shall be possible to easily track any individual as they move around a large site by selecting a card watch. As the person uses their access control card, the system shall have the ability to automatically notify the operator of the person's presence at each location.

I. MASTER CARD MODE

1. Master card mode authority shall be assigned to special cardholders, such as building maintenance, principals, etc. These features should be enabled on a per reader basis. This shall allow a person when vacating an area or building to change the reader's mode of operation from normal access control to Master Card Out operation.
2. When in this condition only persons with Master card privileges shall gain access through the door, all non-Master card users are rejected regardless of their card's current access rights.

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3. This special feature shall be activated/deactivated by the Master cardholder, using a card presentation followed by a special code entered via the reader's keypad.

J. AUTOMATIC HOLIDAY OVERRIDE

1. The software shall be able to be programmed by the operator to recognize special or holiday dates, which in turn can be linked to operational changes in how the site is to be managed on these specific days.
2. This feature shall notify a system operator of individual holiday dates up to seven days prior **to provide** a useful check on the date's current validity.
3. Multiple types of holiday dates shall also be provided so that partial school days or early closing requirements on specific dates can be accommodated.

K. ALARM MANAGEMENT

1. The system shall provide flexible alarm management.
2. The system shall support the ability to selectively choose alarms to acknowledge and/or clear.
3. Each alarm shall be capable of linking video from the CCTV digital video recorders for incident playback – fully integrated system.
4. An alarm monitor display shall support the display of alarm statistics.
5. Alarms shall be capable of being routed to specific client machines by time of day or day of week.
6. Unacknowledged alarms shall be capable of being routed to alternate client or Email address based on age and priority of alarm.
7. The display of reader door alarms shall be automatically enabled or disabled by the use of timed commands, either by reader or by a group of readers.

L. GRAPHICAL SITE MAPS

1. To further enhance the presentation to the operator, the system shall have the ability to import and use graphical maps. Individual building Maps shall be linked together using a tiered tree structure. To speed the location of an incident, each map level shall contain a clearly visible indicator as to which sub map the operator should select next to find the device that is in alarm.
2. The status of readers, doors, monitor points and auxiliary outputs shall be requested from any map by simply selecting the icon representing the device and its current state will be displayed.

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3. Maps shall be created using standard office tools such as Paint® or drawing packages such as AutoCAD®. It shall be possible to import drawings in the following formats: JPEG, Bitmap, Windows metafile or DXF. The maps shall be prepared by the Contractor for the District.
4. Icons representing access points, monitoring points, switching outputs, alarm inputs, CCTV cameras or intercom call stations shall be placed on any map at the required location in a drag and drop manner.
5. It shall be possible to define on the map the location of readers, access doors, alarm-monitored points, output switching relays, CCTV cameras, Digital Video Recorder Cameras, Intercom call stations and alarm panel devices.
6. The map display shall allow the operator to switch the video display of any defined CCTV camera to any defined CCTV monitor. The map display shall allow the display of stored and live Digital Video Clips – fully integrated system.
7. The map display shall include the option to group and display similar devices as a single icon. Once devices are grouped it shall be possible to change their status. For example, it shall be possible to unlock/lock all Building or District entrance doors by executing a single command from the map display.

M. MANUAL AND AUTOMATIC COMMANDS

1. The system shall provide for both manual and automated commands. For example it shall be possible to schedule a command to automatically lock/unlock all doors at a specified time.

N. USER CODE MODE

1. The System shall support the ability to put a keypad-equipped reader into User Code Mode. This feature shall allow a cardholder to gain access by entering a valid card's number at a reader keypad, therefore not requiring the holder to carry a card.
2. User code mode shall be enabled on a per reader basis.

O. VISITOR MANAGEMENT - OPTIONAL

1. Visitor Management shall be incorporated as an optional feature of software, as coordinated with the School District's requirements. Operators shall be able to pre-enroll visitors. Any operator with visitor permissions assigned **has** the ability to pre-enroll visitors.
2. Visitor time of arrival and time of departure shall be tracked by the system. This feature shall be available even if a visitor is not issued a card or card number in the system.
3. The System shall support an optional driver's license scanner including optical character recognition to ease data entry.

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4. The System shall support capture of a business card image.
 5. The system shall include the ability to monitor the occupancy of an area.
- P. WINDOWS DAYLIGHT SAVING AUTO ADJUSTMENT
1. The system shall support automatic Daylight Savings Time Adjustment.
- Q. HISTORY ARCHIVE AND SYSTEM BACK UP
1. The system shall allow on line archiving of history logs, along with database back up of system configuration and cardholder details. This function shall be able to be automated to occur without intervention at a pre-set time.
- R. SMART CARD ENCODING
1. The system shall provide the ability to encode contactless smart cards with access control information.
 2. On a timed or manual basis the system shall be configurable to allow entry using the smart card only, thereby raising or lowering the level of security as required.
- S. DIGITAL VIDEO MONITORING AND CCTV MATRIX SWITCH CONTROL OPTION
1. For larger Districts, the system shall provide an option to interface to a CCTV matrix switcher. This component shall allow an operator with appropriate privileges to display any available video source on any available video monitor.
- T. DATA IMPORT/EXPORT
1. The system shall support a data import/export ability to permit the District to bulk-load employee information at the beginning of a school year.
- U. BUILDING CONTROL MODULE
1. The system shall provide a Building Control Module, to allow the definition of one or more building controls, each used to control a separate HVAC or other building system. Readers and/or motion detector inputs shall be able to be used to determine the occupancy of the area represented by the building control – a fully integrated solution.
 2. The Building Control Module shall support standard BACnet communications to project the current status of building controls, monitor points, doors and the last alarm generated to third-party building systems.
 3. The system shall allow manual commands to interface with (turn on or off) building controls through the BACnet protocol. It shall be possible to issue these commands from on-screen graphical maps or plans of the building.

4. The system shall allow scheduled commands to interface with (turn on or off) building controls through the BACnet protocol. It shall be possible to issue these commands automatically at any time of the day, any day of the week or holiday dates.
5. The system shall allow conditional commands to interface with (turn on or off) building controls through the BACnet protocol. It shall be possible to issue these commands automatically depending on another event occurring. For example, a cardholder could use a "card command" at an access control reader to switch an HVAC system on or off.
6. It shall be possible to view the current status of a building control from the View/Status screen in the System software.
7. The system shall allow the definition of groups of building controls, which enables, for example, a single command to switch on several building controls in one operation.

V. E-MAIL ALARMS

1. The System shall support the ability to automatically e-mail alarm condition messages.

W. INTERCOM INTEGRATION OPTION

1. The system shall support a serial or other high-level connection to an intercom system. The intercom system shall be accessed by users through a call station -- typically installed outside the building at doors, parking barriers, etc.
2. Visitors or other personnel generally ask permission to gain entry at the intercom call stations.

X. INTRUSION DETECTION SYSTEM INTEGRATION

1. The System shall support a high-level (serial interface) to an intrusion detection system (IDS). The IDS shall be UL 1076 listed. The System shall support events to be recorded and displayed from the IDS system on the alarm management screen and in the transaction history reports – fully integrated system.

1.8 CARD READERS

- A. Furnish Card Readers at all Controlled Access Entrances, Elevators, Food Storage areas and Technology Rooms, as required by the District.
- B. All Card Readers shall be Proximity Type (no Card swipe type readers) as required by the District.
- C. Card readers **may** include a keypad for duress entry or PIN Number entry.

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1.9 POWER SUPPLIES

- A. All system Power supplies shall be centrally located in the Technology Rooms and connected to the Technology Room Generator Powered, UPS units.

1.10 INSTALLATION

- A. The Administrator Terminal shall be connected to the remote terminals before connecting to any card reader processors.
- B. The Contractor shall coordinate with the District's locksmith if converting from mechanical to electric locks.
- C. The Contractor shall install the appropriate cable from the CPU to readers, door contacts, request-to-exit devices, and electric locks at each door and/or gate.
- D. All communications cables shall be kept away from power circuits.
- E. The Contractor shall install the power supply(s) for electric locks in locations where they will not interfere with other operations.
- F. The Contractor shall do nothing to modify a UL. rated door or frame that would void the UL label or fire rating.
- G. All cables shall be labeled with self-laminating, machine-printed, wrap-around labels.
- H. Review and coordinate door hardware characteristics and integration requirements with the Design Professional.

1.11 INITIAL PROGRAMMING AND CONFIGURATION

- A. Contractor shall provide initial programming and configuration of the Integrated Security Management (ISM). Programming shall include defining hardware, doors, monitor points, clearance codes, time codes, door groups, alarm groups, operating sequences, camera call-ups, and the like. Input of all program data shall be by Contractor. Contractor shall consult with Security Consultant and District to determine operating parameters.
- B. The Contractor shall develop and input system graphics, such as maps and standby screens. The District shall provide floor plan **record ("as-built")** drawings as the basis for the creation of maps. Development of maps shall include the creation of icons for all doors, monitor points, and tamper circuits. Owner shall provide floor plan **record ("as-built")** drawings, in the form of AutoCAD .DWG or .DXF files, as the basis for the creation of maps.
- C. The District, with the cooperation and assistance of Contractor, will input the cardholder data for each access card.
- D. The system shall be configured with a minimum of 1 user license per building.

1.12 TRAINING

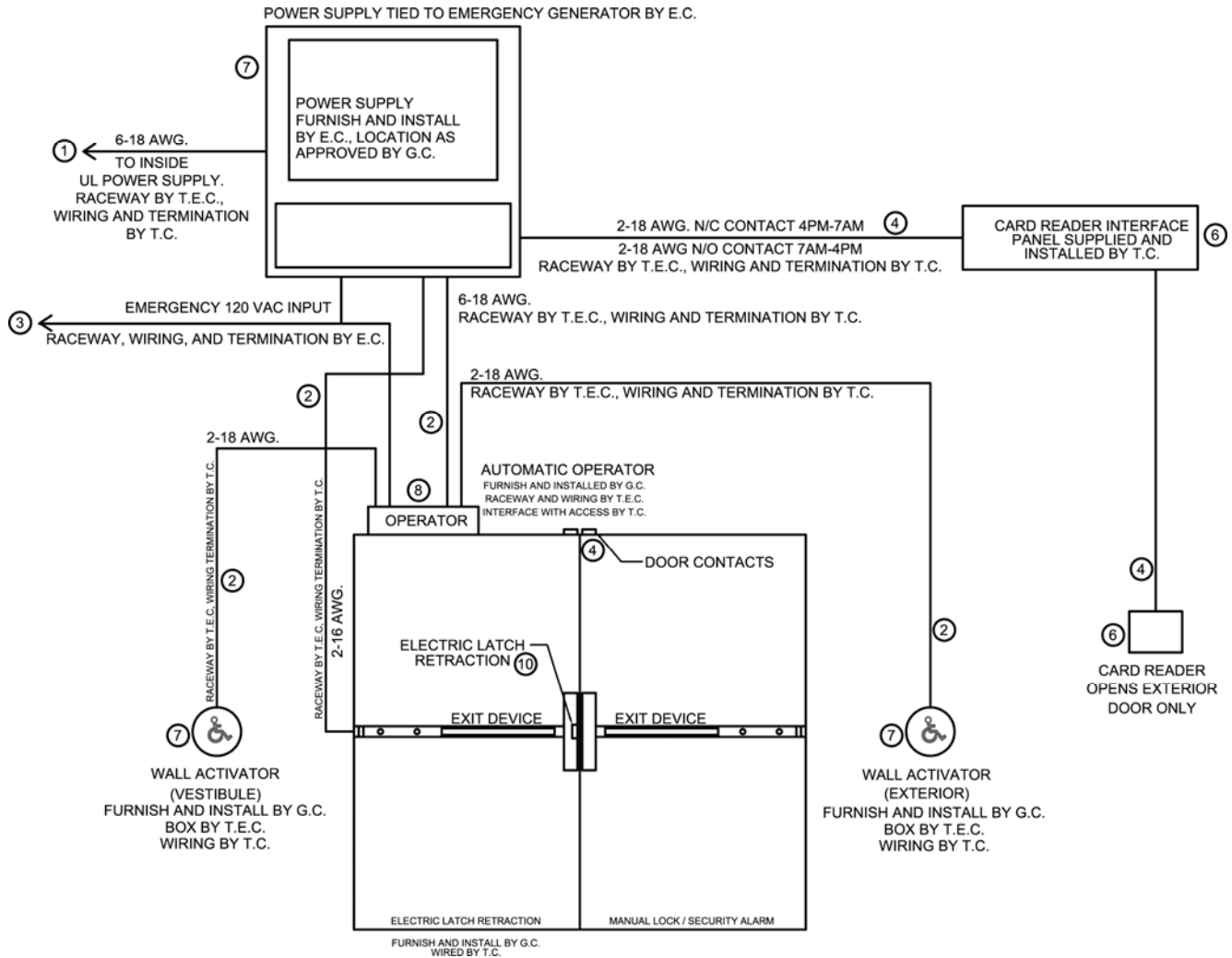
- A. Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:**
 - 1. System Equipment Connectivity**
 - 2. Device Configurations**
 - 3. Operation, maintenance, and upgrade procedures.**
- B. Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3year.)**
- C. Training to occur in maximum of 2 hour increments per personnel or groups or personnel.**
- D. Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.**
- E. Training shall be by certified manufacturer instructor.**
- F. Training schedule shall be coordinated with District personnel and their needs.**
- G. Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.**
- H. Warranty certificate and agreement shall be provided to District IT personnel at initial training session.**
- I. Provide a digital video copy of the training sessions.**

1.13 SEQUENCING

- A. The following figures provide recommendations for the sequencing and operation of the Access Control for the building's main doors. Suggested breakdown of tasks by trade are also provided. The Designer should consult with the District to determine final operating parameters.**

(please see following diagrams)

2009

TYPICAL DOOR 1**Door 1:**

Push plates needed for assisted access to and from vestibule 7 a.m. – 4 p.m.

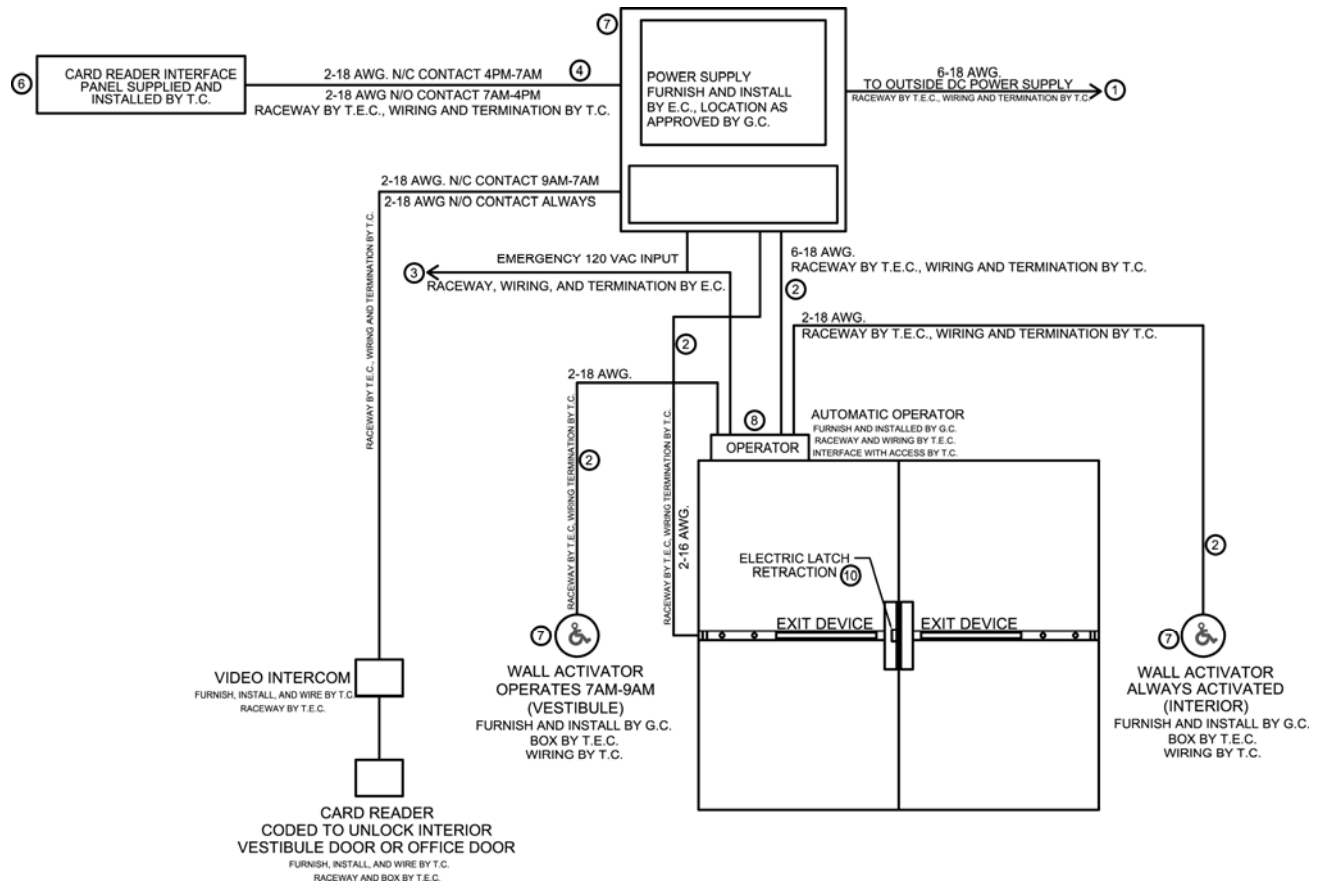
Card reader access to unlock door 4 p.m.-1 a.m. weekdays and weekends.

Only one door has power for card reader and push plates. All others need security power.

All other doors are manually locked 4 p.m.-7 a.m. They will open from inside vestibule via panic devices.

All exterior doors have security breach alarm hardware.

All components should be installed in one location as designated by G.C., 8" above ceiling (typical).

TYPICAL DOOR 2**Door 2:**

This door will be unlocked between 7 a.m.-9 a.m. and both push plates will work.

After 9 a.m. the door will be locked and the vestibule push plate will not work but the interior push plate will still unlock the panic bar and open the door.

There will need to be one set of contacts to the inside door to control the locking and unlocking of the panic bar between 7 a.m.-9 a.m.

This door can be opened by card reader at all times.

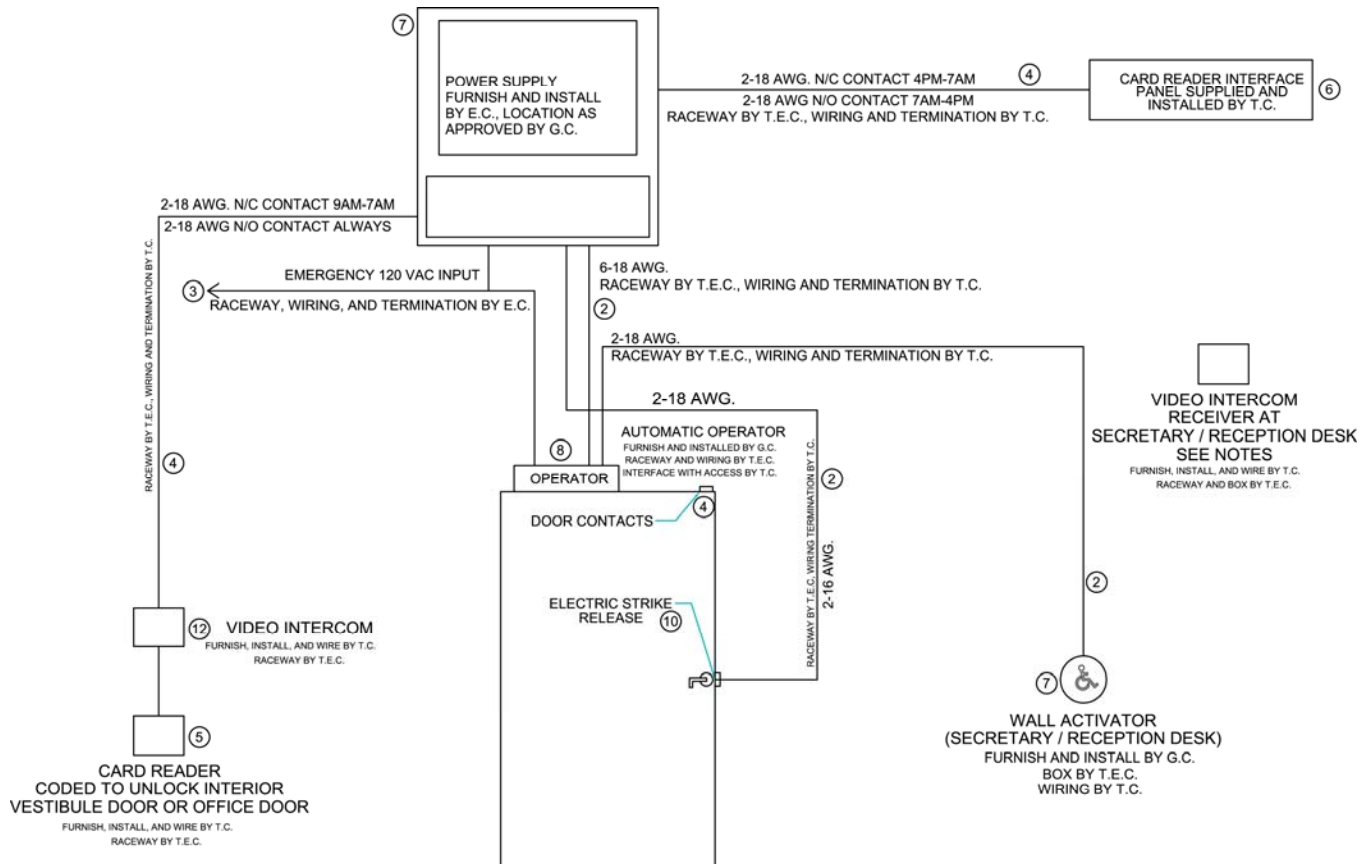
All interior vestibule doors have electric latch retraction and are connected to building security.

All interior vestibule doors lock from 9 a.m.-4 p.m.

All interior doors can be opened from inside the building at all hours via panic hardware.

Lock out of doors can be overridden during fire drills or other events.

All components shall be installed in one location as designated by G.C., 8" above ceiling (typical).

TYPICAL DOOR 3**Door 3:**

This door is locked at all times.

Entry is only allowed via card reader or by push plate located at the office personnel's desk.

Visitors must first be identified at the video intercom located in the vestibule by the office personnel through their video receiver.

There is a push plate inside the office to let visitors out when they are leaving.

There are no push plates inside the vestibule to let people into the office.

All visitors must be identified prior to gaining access to the rest of the building.

The security/receptionist has control over releasing the door strike to unlock the door or releasing the strike and activating automatic door operator, depending on which button is pressed on the intercom receiver.

All components should be installed in one location as designated by G.C., 8" above ceiling (typical).

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SECTION 281600

INTRUSION DETECTION SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for a uniform Intrusion Detection System that shall be followed for all OSFC Technology construction projects.
- B. Refer to Sections 8500, Technology Systems, 28 13 00 Access Control **System** and 28 23 00 Video Surveillance **System** for additional information.

1.2 SECTION INCLUDES

- A. Intrusion Detection System.
- B. Uninterruptible Power Supply (UPS).

1.3 QUALITY ASSURANCE

- A. National Fire Protection Association.
- B. NFPA 730 – Guide for Premises Security
- C. NFPA 731 – Standard for the Installation of Electronic Premises Security Systems
- D. National Electric Code.
- E. American with Disabilities Act.
- F. Underwriter's Laboratory.
- G. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Eleventh Edition (or later).
- H. BICSI Telecommunications Distribution Methods Manual (TDMM).
- I. UL 1610 -- Central-Station Burglar-Alarm Units.
- J. UL 1023 -- Standard for Safety Household Burglar-Alarm System Units.
- K. UL 609 -- Standard for Safety Local Burglar Alarm Units and Systems.
- L. UL 365 -- Standard for Safety Police Station Connected Burglar Alarm Units and Systems.
- M. UL 985 -- Household Fire Warning System Units.
- N. Products -- Factory Mutual approved.

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1.4 SYSTEM WARRANTY

- A. *The Intrusion Detection System and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.***

1.5 SYSTEM OPERATION

- A.** Upon entering a valid access code via a system control keypad, the system shall disarm the applicable zones, disarm the alarm system, and log the transaction pertaining to time, date, and user.
- B.** The Intrusion Detection System shall provide the following functions:
1. A system control panel, control keypads, magnetic door contacts, motion sensors, and alert sirens.
 2. Provide interconnection to the District provided dedicated telephone connection for monitored response to after-hours alarms. Consider cellular backup system.
 3. Provide interconnection to the central control panel for monitoring all applicable doors with door contacts.
 4. System shall be fully integrated with the building's Access Control and CCTV System.
 5. The System shall be integrated with the building lighting system and shall activate the corridor lights and other selected areas in the event of alarm activation.
 6. The System shall be supervised, i.e. power failure, line cuts and communication failures shall signal the monitoring station(s) of the problem.
 7. The fire system flow and tamper points shall be attached to the system.
 8. The System shall provide monthly reports, detailing as a minimum:
 - a. Alarm System usage.
 - b. Door Openings.
 - c. Door Closings.
 - d. Alarm Conditions.
- C.** The System shall be programmed to accept individual access codes from authorized employees. Codes shall not be shared.

1.6 EXTERIOR ENTRANCE / EXIT DOOR**A. KEYPAD**

1. A keypad shall be mounted within six (6) feet of the entrance on the inside of the facility.
2. The keypad shall utilize a minimum of a two (2) line, 32-character LCD display and an integral multi-tone speaker.
3. The keypad shall contain an internal diagnostics program allowing for system troubleshooting without disabling the system.
4. The keypad shall allow for the use of three dedicated keys to function as panic keys.
5. Keypads shall have a keypad activated duress code feature.
6. All keypads shall be interfaced with the Control Panel.

B. DOOR CONTACT

1. A magnetic door contact switch shall be installed at each exterior door to provide door open/closed status to the system.
2. The contact switch shall be installed recessed into the doorframe where applicable.

C. CENTRAL CONTROL PANEL

1. Provide one Central Control Panel, which shall be equipped with a lock and transparent door panel.
2. The Central Control Panel shall provide the required input zones, operate on 24V D.C., indicate ground fault, and activate audio and visual devices.
3. The Central Control Panel shall have a battery charging system and battery(s).
4. Connect the Central Control Panel to the Main Equipment Room, generator powered, UPS Units.
5. Provide necessary auxiliary contacts (alarm and trouble), for sending signals to the digital communication system.
6. Provide necessary auxiliary contacts to power the exterior bell.
7. The Central Control Panel shall provide a telephone digital communication actuation and supervisory circuit.

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8. Connect Central Control Panel to the District provided telephone line(s).

D. P.I.R. MOTION SENSOR - ***Optional***

1. ***The Technology Designer shall verify requirements of motion sensors with the school district.***
2. The system ***type*** shall be passive infrared motion detectors.
3. The sensors shall be microprocessor controlled and contain a false alarm protection feature.
4. The sensors shall provide a minimal coverage pattern of 50 feet by 50 feet to 120 feet by 12 feet based on interchangeable lenses. Select lenses based on coverage area required.
5. Short, medium and long-range motion detectors shall be selected as required to suit the area to be covered.
6. The sensors shall be capable of mounting either on a ceiling, wall surface or in a corner.
7. ***Consider sensor installations*** on all floors of the facility, in corridors and all rooms with outside access.
8. ***Consider*** each entry point backed up by Motion Detectors.
9. ***Consider motion detectors in computer labs.***
10. Locate motion detectors to provide full coverage and minimize false alarms.
11. Provide single or dual technology motion detectors based on application.
12. Dual Technology sensors shall employ both Microwave and Passive Infrared.

E. ALARM SIREN

1. The system shall be provided with an external alarm siren(s) (horn) and strobe light as required.
2. The alarm sirens and strobes shall be housed in a tamper proof, weather resistant metal enclosures.

1.7 INSTALLATION

- A. The system wiring and installation shall comply with all applicable codes and drawings, and shall be installed in accordance with the manufacturer's recommendations.

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- B. All wiring shall be color-coded and labeled at each end with self-laminating, machine-printed labels.
- C. All wiring shall be installed in metallic raceways and shall comply with the latest edition of the National Electric Code (NEC).

1.8 MOUNTING HEIGHTS

- A. All mounting heights shall comply with the Americans with Disability Act (ADA).
- B. Mount Motion Detectors to provide maximum coverage, and minimal false alarms. Do not obstruct viewing angle.

1.9 TRAINING

- A. Provide a minimum of four (4) hours training on the operation of the system.
- B. Provide **a digital video** copy of all training.

END OF SECTION

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SECTION 282300

VIDEO SURVEILLANCE SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for a uniform Video Surveillance System that shall be followed for all OSFC Technology construction projects.

1. Figure **1** describes a Typical District-Wide ALL IP CCTV System.
2. Refer to Sections 8500, Technology Systems, 28 13 00 Access Control **System** and 28 16 00 Intrusion Detection **System** for additional information.

1.2 SECTION INCLUDES

- A. Integrated Video Surveillance System
- B. Uninterruptible Power Supply (UPS).

1.3 QUALITY ASSURANCE

- A. National Fire Protection Association.
- B. NFPA 730 – Guide for Premises Security
- C. NFPA 731 – Standard for the Installation of Electronic Premises Security Systems
- D. National Electric Code.
- E. American with Disabilities Act.
- F. Underwriter's Laboratory.
- G. FCC Class B.
- H. NEMA Type 4AX.
- I. NEMA Type 1.
- J. NTSC/EIA.
- K. ISO/IEC 14496-2 MPEG-4.
- L. H.264.
- M. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Eleventh Edition (or later).
- N. BICSI Telecommunications Distribution Methods Manual (TDMM).

ELECTRONIC SAFETY AND SECURITY

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1.4 SYSTEM WARRANTY

- A. ***The Video Surveillance System and software shall be fully warranted for three (3) years from date of substantial completion by the contractor and manufacturer. If any defects are found within this warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor. Provide a statement of this warranty with the O&M manuals and to the Director of IT. Make available a service contract offering continuing factory authorized service of this system after the initial warranty period.***

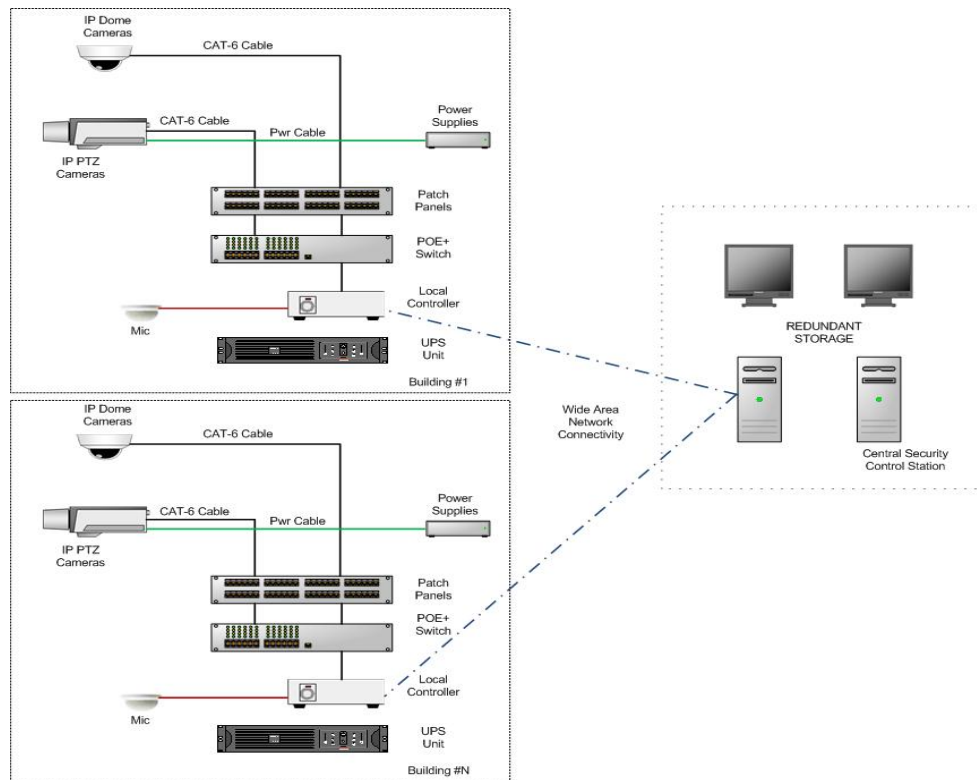


Figure 1 – Typical District-Wide ALL IP CCTV System

1.5 GENERAL

- A. Furnish a new Integrated Video Surveillance System that provides a simple and easy-to-use graphical user interface.
- B. The system shall provide local and central operational control and viewing of all cameras
- C. Provide ALL IP System as shown in Figure 1 above.
- D. All IP systems provide minimum **2** mega pixel technology that permits greater image resolution and detail, and enable advanced video analysis and recognition technologies.
- E. ***All*** Designs shall use IP for new Cameras, POE+ Ethernet Switches and Local ***NVR*** units per building.

CHAPTER 9: SPECIFICATIONS

ELECTRONIC SAFETY AND SECURITY

- F. When a District has more than one building, the **Video Management** Server and **Remote** Viewing Station may be located in one of the District's buildings and the other buildings may be attached to the Central Server via the Wide Area Network. All buildings in the District shall **have local recording NVR units and** interface to the Central Server and Control Consoles and shall function as a single unified system.
- G. The Video Surveillance System shall seamlessly integrate with the Access Control and Intrusion Detection Systems.
- H. The Systems shall be located in the Main Equipment Room (ER) and connected to generator-powered UPS Units. Backup power shall be provided for both cameras and recording equipment.
- I. Provide sufficient cameras to cover the entire school and surrounding lots.
- J. As a minimum provide fixed focus camera coverage for:
 - 1. All entrances/exit doors.
 - 2. Hallways.
 - 3. Restroom entrance/exit doors.
 - 4. Loading docks.
 - 5. Kitchen areas.
 - 6. Lunch lines.
 - 7. Cafeteria.
 - 8. Auditoriums.
 - 9. Playgrounds.
 - 10. Bus pickup/delivery.
 - 11. Parking lots.
 - 12. Athletic Areas.
- K. As a minimum provide additional PTZ camera coverage for:
 - 1. All outside building corners.
 - 2. Parking lots.
 - 3. Playgrounds.
 - 4. Bus Drop-Off.
 - 5. Building Services Areas.
- L. Mount external cameras to the side of the building for most situations. Use pole mounting for special circumstances, as required.
- M. Connect a minimum of one building mic to the CCTV Recording system. Locate the Mic in the Central Office area (typical). Connect the audio output from the building paging system to the CCTV recorder. Consider connecting the audio output from the PABX E911 calling system to the CCTV recorder.
- N. Systems shall be monitored with **an HDTV** monitor in the Central Office area. Supply monitors based on system camera requirements. **If required by the owner**, post the appropriate signs advising the public that audio/video recording is taking place in the facility.

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS****1.6 CAMERAS**

- A.** All cameras shall be contained in smoked-dome, impact and vandal-resistant enclosures. Consider bulletproof enclosures for high crime areas.
- B.** Compatible lenses specific to each placement and required field of view will be used. In addition, MPIX cameras require specialized MPIX compatible lenses.
- C.** Typical lenses shall range from 2.3 mm (wide) to 12 mm (long range). Consider using vari-focal lenses (typical 3.6 – 8 mm) for fine-tuning.
- D.** Coordinate lens type with CCD sensor size.
- E.** Place multiple cameras in hallways and avoid single cameras covering a long hallway.
- F.** Limit camera spacing to 75 feet maximum.
- G.** Camera placement guidelines:
 - 1. Avoid backlight (this problem can occur when attempting to capture an image from behind a window, etc.). Utilize wide dynamic range cameras in these applications.
 - 2. Always use auto iris lenses for outdoor applications.
 - 3. Avoid direct sunlight – try to position the camera the same direction as the sun.
 - 4. Avoid viewing too much sky – it results in too much contrast.
 - 5. Avoid reflections.
- H.** Cameras shall have integral motion detectors for changing the frame per second recording rate, depending on system set up.
- I.** Coordinate placement of all cameras with District and a Qualified Security Professional.
- J.** All cameras shall be equipped with an auto-iris, automatic gain control and automatic white balance.
- K.** All cameras shall be centrally powered from associated Telecommunication Room, generator powered, UPS Unit.
- L.** All exterior PTZ cameras shall be contained in a pendant **or recessed 180 degree** style, vandal proof, exterior enclosure with integral heater module. **Verify enclosure style with the Design Professional.**
- M.** All PTZ cameras shall meet the following minimal features:
 - 1. 22X Optical Zoom, 10X Digital Zoom.
 - 2. Window Blanking.
 - 3. 64 Presets.
 - 4. 0.5° Preset Accuracy.
 - 5. 140°/second Pan Speed.
 - i. Rotating Discreet Liner.

- ii. One Dynamic Window Blanking Area.
- iii. Proportional Pan and Tilt.
- iv. Programmable Zoom Speeds.
- v. 360 Degree scan.
- vi. Day/Night Operation.
 - 1. 0.08 lux at ½ sec shutter (Color).
 - 2. 0.30 lux at 1/60 sec shutter (B/W).
 - 3. 0.013 lux at ½ sec shutter (B/W).
- vii. 30 fps – NTSC.

- N.** Provide fiber-optic interfaces for all external, pole-mounted cameras.
- O.** All IP cameras shall meet the following minimal features:
 - 1. Powered via 802.3af Power-Over Ethernet (**POE+**) using standard Category 6 cable.
 - 2. Optional additional power for External PTZ cameras.
 - 3. MPEG-4, MJPEG, and H.264 video compression. Minimum dual stream.
 - 4. Audio capabilities with optional mic.
 - 5. Optional DSP for video intelligence and recognition techniques.
 - 6. **Removable storage slot (Micro SD) with minimum 4GB memory.**
 - 7. Digital Pan/Zoom.
 - 8. CCD sensor – **1/2**-inch minimum.
 - 9. Integrated PZT control over one Category-5e cable.
 - 10. IR Cut Filter for low-light conditions.
 - 11. SNMP support for management.
 - 12. HTTPS for encrypted Communications.
 - viii. Built-in Web Server.
 - ix. Fixed IP address.
 - x. 30 fps – at full resolution.

1.7 **NETWORK VIDEO RECORDER (NVR)**

- A.** New installations shall use Network Video Servers (NVS).
- B.** The **NVR** shall provide a high quality, **up to 64 camera** recorder capable of storage and playback of images from **all cameras at full resolution and frame rate**. The **NVR** shall support new IP cameras **with ONVIF compliance**.
- C.** The **NVR** shall be able to record full-screen video images continuously, upon motion detection, or according to a time schedule to its internal hard drives.
- D.** The **NVR** shall have the capability to simultaneously record, archive background images, and allow multiple user network viewing and playback with no loss of performance.
- E.** Internal **NVR** hard drives shall provide for 30 days of storage at an average rate of **7.5** fps per camera, **full HD** resolution.
- F.** All recording to the hard drive shall have a digital signature applied to the disk file including time, date and camera info.

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS**

- G. The **NVR** shall support simultaneous audio recording and playback on at least one channel in real time.
- H. The **NVR** shall have video motion search to allow recorded searches on the hard disks, based on movement in a particular area of the image.
- I. The **NVR** shall provide a list of the activity events that occurred within a defined area.
- J. The **NVR** shall have a standard Ethernet connection and The Ethernet connection shall allow live and recorded viewing on a networked PC using a manufacturer's Network Viewer or via web pages over a standard Internet browser.
- K. The **NVR** shall support file export of digitally signed images over the network.
- L. The **NVR** shall provide a user-friendly, paged menu system that is controlled from the face of the **NVR** and viewable **through a KVM switch. Each NVR shall be connected to a multi-port, IP enabled KVM with integrated flip up monitor/keyboard/mouse.**
- M. The **NVR** central Viewing station shall be completely integrated with the Intrusion Detection and Access Control Systems.

1.8 REMOTE VIDEO SERVERS

- A. Remote Video Servers shall have the following minimum features:
- B. Store and Forward capability - Store data at the edge of the LAN/WAN and only forward over the network when required.
- C. Event based recording for intrusion or access control activity.
- D. Provide local storage of video streams in the event of WAN communication failure to the Central Storage Servers.
- E. Complete control over frame rate, video resolution and other settings on a timed and trigger basis.
- F. **All current** compression **technologies.**
- G. Integrated with Access Control and Intrusion Detection Systems.
- H. PTZ support.
- I. Motion detection support.
- J. Integrated web server for configuration.
- K. Video loss alarm capability.

CHAPTER 9: SPECIFICATIONS

ELECTRONIC SAFETY AND SECURITY

1.10 IP VIDEO DECODERS

- A. In all IP installations, any place where **remote** video is to be provided for local viewing, a multi-stream decoder (minimum 2x2 image per display) will be required.
- B. A local PC, running the CCTV remote view software and connected to the local monitor, can also be utilized for this purpose.

1.11 INSTALLATION

- A. The system wiring and installation shall comply with all applicable codes and drawings, and shall be installed in accordance with the manufacturer's recommendations.
- B. All wiring shall be color-coded and labeled at each end with self-laminating, machine-printed labels.
- C. All wiring and component installations shall comply with the latest edition of the National Electric Code (NEC).

1.12 TRAINING

- A. ***Provide a minimum of forty (40) hours of training to the District's personnel. Plan for multiple training trips to the site. Training session(s) shall cover the following topics at a minimum:***
 - 1. ***System Equipment Connectivity***
 - 2. ***Device Configurations***
 - 3. ***Operation, maintenance, and upgrade procedures.***
- B. ***Training to be arranged with District personnel. 40 hours should be spread out over the length of the warranty (Ex: 8 hours at project turnover/completion, 8 hours at 3 months, 8 hours at 6 months, 8 hours at 1 year, 4 hours at 2 years, 4 hours at 3 year).***
- C. ***Training to occur in maximum of 2 hour increments per personnel or groups of personnel.***
- D. ***Consider requiring Contractor to provide manufacturer training vouchers for a portion of the training, which are valid during the warranty period.***
- E. ***Training shall be by certified manufacturer instructor.***
- F. ***Training schedule shall be coordinated with District personnel and their needs.***
- G. ***Training plan, time line, and agenda shall be provided to District IT personnel and signed off by District and Contractor.***
- H. ***Warranty certificate and agreement shall be provided to District IT personnel at initial training session.***
- I. ***Provide a digital video copy of the training sessions.***

END OF SECTION

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SECTION 282300

VIDEO SURVEILLANCE SYSTEM

GENERAL GUIDELINES

1.1 GENERAL

- A. This Section defines the general design requirements for a uniform Video Surveillance System that shall be followed for all OSFC Technology construction projects.

- 1. Figure **1** describes a Typical District-Wide ALL IP CCTV System.
- 2. Refer to Sections 8500, Technology Systems, 28 13 00 Access Control **System** and 28 16 00 Intrusion Detection **System** for additional information.

1.2 SECTION INCLUDES

- A. Integrated Video Surveillance System
- B. Uninterruptible Power Supply (UPS).

1.3 QUALITY ASSURANCE

- A. National Fire Protection Association.
- B. NFPA 730 – Guide for Premises Security
- C. NFPA 731 – Standard for the Installation of Electronic Premises Security Systems
- D. National Electric Code.
- E. American with Disabilities Act.
- F. Underwriter's Laboratory.
- G. FCC Class B.
- H. NEMA Type 4AX.
- I. NEMA Type 1.
- J. NTSC/EIA.
- K. ISO/IEC 14496-2 MPEG-4.
- L. H.264.
- M. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Eleventh Edition (or later).
- N. BICSI Telecommunications Distribution Methods Manual (TDMM).

ELECTRONIC SAFETY AND SECURITY

CHAPTER 9: SPECIFICATIONS

1.4 SYSTEM WARRANTY

- A. The Video Surveillance System shall be warranted by the contractor for a period of **two (2)** years from date of substantial completion.

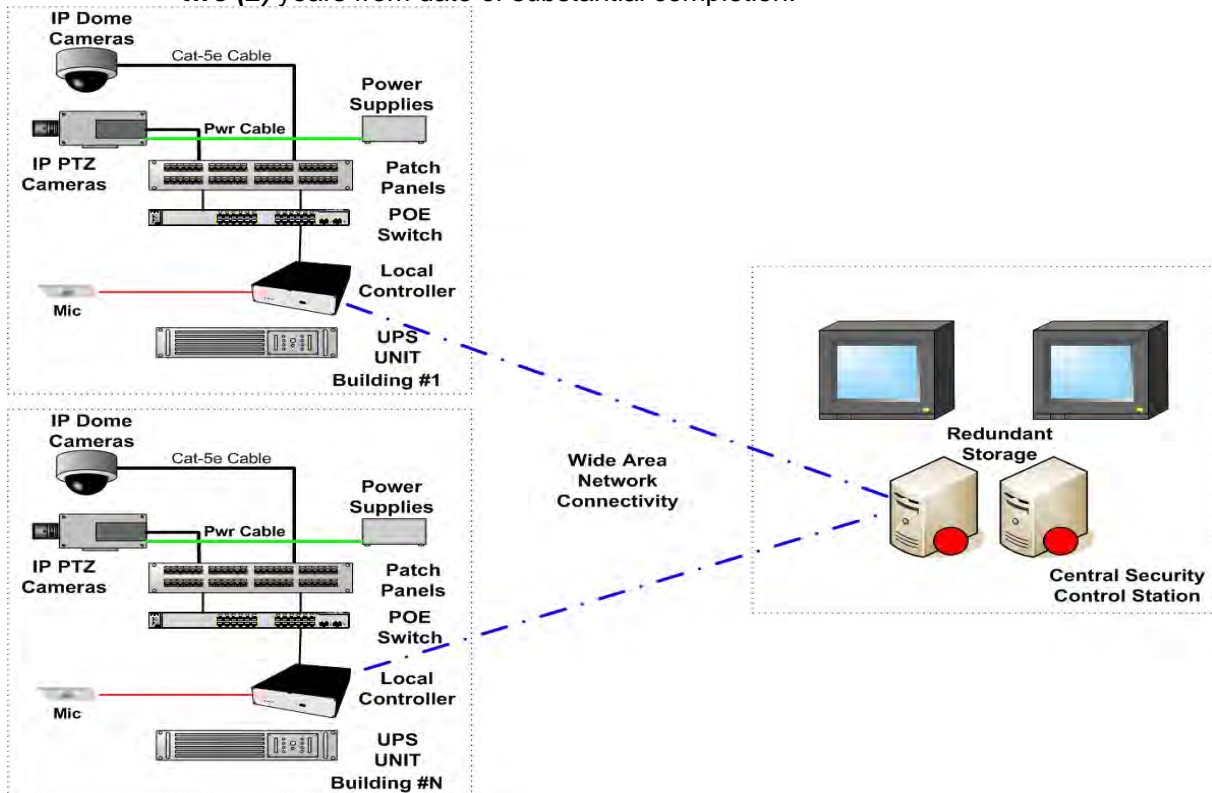


Figure 1 – Typical District-Wide ALL IP CCTV System

1.5 GENERAL

- A. Furnish a new Integrated Video Surveillance System that provides a simple and easy-to-use graphical user interface.
- B. The system shall provide local and central operational control and viewing of all cameras
- C. For Districts with existing Analog Systems, **provide** Hybrid Analog /IP system **to** continue to supply Analog Systems. **All new cameras shall be IP.**
- D. For Districts without an imbedded base of CCTV Systems, **provide** ALL IP System as shown in Figure 1 above.
- E. All IP systems provide **minimum 1.2** mega pixel technology that permits greater image resolution and detail, and enable advanced video analysis and recognition technologies.

- F.** Hybrid Designs **shall** use IP **for new** Cameras, POE Ethernet Switches and Local **HDVR** units per building.
- G.** When a District has more than one building, the Central Server and Viewing Station **may** be located in one of the District's buildings and the other buildings **may** be attached to the Central Server via the Wide Area Network. All buildings in the District shall interface to the Central Server and Control Consoles and shall function as a single unified system.
- H.** The Video Surveillance System shall seamlessly integrate with the Access Control and Intrusion Detection Systems.
- I.** The Systems shall be located in the Main Equipment Room (ER) and connected to generator-powered UPS Units. Backup power shall be provided for both cameras and recording equipment.
- J.** Provide sufficient cameras to cover the entire school and surrounding lots.
- K.** As a minimum provide fixed focus camera coverage for:
 1. All entrances/exit doors.
 2. Hallways.
 3. Restroom entrance/exit doors.
 4. Loading docks.
 5. Kitchen areas.
 6. Lunch lines.
 7. Cafeteria.
 8. Auditoriums.
 9. Playgrounds.
 10. Bus pickup/delivery.
 11. Parking lots.
 12. Athletic Areas.
- L.** As a minimum provide additional PTZ camera coverage for:
 1. All outside building corners.
 2. Parking lots.
 3. Playgrounds.
 4. Bus Drop-Off.
 5. Building Services Areas.
- M.** Mount external cameras to the side of the building for most situations. Use pole mounting for special circumstances, as required.
- N.** Connect a minimum of one building mic to the CCTV Recording system. Locate the Mic in the Central Office area (typical). Connect the audio output from the building paging system to the CCTV recorder. Consider connecting the audio output from the PABX E911 calling system to the CCTV recorder.
- O.** Systems shall be monitored with a 19-inch (minimum) LCD color monitor in the Central Office area. – supply monitors based on system camera requirements. An additional 19-inch (minimum) LCD color monitor should be mounted on the ceiling at the public entrance to show that cameras are being used in the public areas. Post the appropriate signs advising the public that audio/video recording is taking place in the facility.

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS****1.6 CAMERAS**

- A.** All cameras shall be contained in smoked-dome, impact and vandal-resistant enclosures. Consider bulletproof enclosures for high crime areas.
- B.** Compatible lenses specific to each placement and required field of view will be used. In addition, MPIX cameras require specialized MPIX compatible lenses.
- C.** Typical lenses shall range from 2.3 mm (wide) to 12 mm (long range). Consider using vari-focal lenses (typical 3.6 – 8 mm) for fine-tuning.
- D.** Coordinate lens type with CCD sensor size.
- E.** Place multiple cameras in hallways and avoid single cameras covering a long hallway.
- F.** Limit camera spacing to 75 feet maximum.
- G.** Camera placement guidelines:
 - 1. Avoid backlight (this problem can occur when attempting to capture an image from behind a window, etc.). Utilize wide dynamic range cameras in these applications.
 - 2. Always use auto iris lenses for outdoor applications.
 - 3. Avoid direct sunlight – try to position the camera the same direction as the sun.
 - 4. Avoid viewing too much sky – it results in too much contrast.
 - 5. Avoid reflections.
- H.** Cameras shall have integral motion detectors for changing the frame per second recording rate, depending on system set up.
- I.** Coordinate placement of all cameras with District and a Qualified Security Professional.
- J.** All cameras shall be equipped with an auto-iris, automatic gain control and automatic white balance.
- K.** All cameras shall be centrally powered from associated Telecommunication Room, generator powered, UPS Unit.
- L.** All exterior PTZ cameras shall be contained in a pendant **or recessed 180 degree** style, vandal proof, exterior enclosure with integral heater module. **Verify enclosure style with the Design Professional.**
- M.** All PTZ cameras shall meet the following minimal features:
 - 1. 22X Optical Zoom, 10X Digital Zoom.
 - 2. Window Blanking.
 - 3. 64 Presets.
 - 4. 0.5° Preset Accuracy.
 - 5. 140°/second Pan Speed.

6. Rotating Discreet Liner.
 7. One Dynamic Window Blanking Area.
 8. Proportional Pan and Tilt.
 9. Programmable Zoom Speeds.
 10. 360 Degree scan.
 11. Day/Night Operation.
 - a. 0.08 lux at ½ sec shutter (Color).
 - b. 0.30 lux at 1/60 sec shutter (B/W).
 - c. 0.013 lux at ½ sec shutter (B/W).
 12. 30 fps – NTSC.
- N.** Provide fiber-optic interfaces for all external, pole-mounted cameras.
- O.** All IP cameras shall meet the following minimal features:
1. Powered via 802.3af Power-Over Ethernet using standard Category-5e cable.
 2. Optional additional power for External PTZ cameras.
 3. MPEG-4, MJPEG, and H.264 video compression. Minimum dual stream.
 4. Audio capabilities with optional mic.
 5. Optional DSP for video intelligence and recognition techniques.
 6. Optional mega pixel sensor.
 7. Digital Pan/Zoom.
 8. CCD sensor – ¼-inch minimum.
 9. Integrated PZT control over one Category-5e cable.
 10. IR Cut Filter for low-light conditions.
 11. SNMP support for management.
 12. HTTPS for encrypted Communications.
 13. Built-in Web Server.
 14. Fixed IP address.
 15. 30 fps – **at full resolution.**

1.7 **HYBRID** DIGITAL VIDEO RECORDER (**HDVR**)

- A. Existing installations may still use individual **Hybrid** Digital Video Recorders (**HDVRs**) for District compatibility. New installations **shall use Network Video Servers (NVS)**.
- B. The **HDVR** shall provide a high quality, 1- to 16-channel recorder capable of storage and playback of images from 1 to 16 camera inputs. **HDVR** shall support a minimum of 7.5 fps from each attached camera simultaneously. **The HDVR shall support new IP cameras.**
- C. The **HDVR** shall be able to record full-screen video images continuously, upon motion detection, or according to a time schedule to its internal hard drives.
- D. The **HDVR** shall have the capability to simultaneously record, archive background images, and allow multiple user network viewing and playback with no loss of performance.
- E. Internal **HDVR** hard drives shall provide for 30 days of storage at an average rate of 5 fps per camera CIF resolution.

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS**

- F. All recording to the hard drive shall have a digital signature applied to the disk file including time, date and camera info.
- G. The **HDVR** shall support simultaneous audio recording and playback on at least one channel in real time.
- H. The **HDVR** shall have video motion search to allow recorded searches on the hard disks, based on movement in a particular area of the image.
- I. The **HDVR** shall provide a list of the activity events that occurred within a defined area.
- J. The **HDVR** shall have a standard Ethernet connection and The Ethernet connection shall allow live and recorded viewing on a networked PC using a manufacturer's Network Viewer or via web pages over a standard Internet browser.
- K. The **HDVR** shall support file export of digitally signed images over the network.
- L. The **HDVR** shall provide a user-friendly, paged menu system that is controlled from the face of the **HDVR** and viewable on a composite monitor that can be connected to the **HDVR's** main monitor output.
- M. The **HDVR** central Viewing station shall be completely integrated with the Intrusion Detection and Access Control Systems.

1.8 CENTRAL STORAGE

- A. **IP camera** installations shall use a Centralized Digital CCTV Storage system.
- B. Interface the Centralized Digital CCTV Storage System with **HDVRs** in remote buildings or Remote Video Servers.
- C. The Centralized **Digital CCTV** Storage Systems shall function as the main depository for CCTV Videos. Remote Video Servers shall transmit the CCTV Video to the Central Servers.
- D. The Centralized **Digital CCTV** Storage System shall have the following minimum features:
 - 1. Live video review of up to 32 concurrent cameras per client PC attached to the Server.
 - 2. Managed, indexed storage of MPEG-4 video from Remote Video Servers and selected IP cameras.
 - 3. Event-based recording that is fully integrated with the Intrusion and Access Control Systems.
 - 4. Internal redundant hard drives that shall provide for 30 days of storage, based upon minimum 10 ips, MJPEG, or HCIF, per camera.
 - 5. All recording to the hard drives shall have a digital signature applied to the disk file including time, date and camera info.
 - 6. Alarm Management, including video loss alarms.
 - 7. Graphical Maps with interactive video control.
 - 8. Review stored video from **HDVR**, IP camera archive and video servers.
 - 9. Instant Replay of recently recorded videos.

10. Record Now feature -- allows security-monitoring personnel to initiate recording.
11. Flexible event presentation of videos.
12. Integrated HTML Web Page support in virtual matrix for remote viewing.
13. Several Operator permission Levels for Individual Cameras and Videos.
14. PTZ Control support.
15. Management Reports.
16. Support for multiple client PCs – minimum 6.
17. Activity logging.
18. Configuration Change and Operator Activity Reporting.
19. Seamless integration with Intrusion Detection System and Access Control System.
20. Support for various Storage and archiving functions.
21. Connect to the Central Video Servers via IP.
22. Provide support for legacy Analog and new IP cameras.

1.9 REMOTE VIDEO SERVERS

- A. Remote Video Servers shall have the following minimum features:
- B. Store and Forward capability - Store data at the edge of the LAN/WAN and only forward over the network when required.
- C. Event based recording for intrusion or access control activity.
- D. Provide local storage of video streams in the event of WAN communication failure to the Central Storage Servers.
- E. Complete control over frame rate, video resolution and other settings on a timed and trigger basis.
- F. MPEG-4 compression technology.
- G. Integrated with Access Control and Intrusion Detection Systems.
- H. PTZ support.
- I. Motion detection support.
- J. Integrated web server for configuration.
- K. Video loss alarm capability.

1.10 IP VIDEO DECODERS

- A. In all IP installations, any place where analog video is to be provided for local viewing, a multi-stream decoder (minimum 2x2 image per display) will be required.
- B. A local PC, running the CCTV remote view software and connected to the local monitor, can also be utilized for this purpose.

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS**

1.11 INSTALLATION

- A. The system wiring and installation shall comply with all applicable codes and drawings, and shall be installed in accordance with the manufacturer's recommendations.
- B. All wiring shall be color-coded and labeled at each end with self-laminating, machine-printed labels.
- C. All wiring and component installations shall comply with the latest edition of the National Electric Code (NEC).

1.12 TRAINING

- A. Provide a minimum of eight (8) hours training on the operation of the system.
- B. *Provide a minimum of four (4) hours of follow-up training to the District during the 11 month walk-through period.***
- C. Provide **a digital video** copy of all training.

END OF SECTION

SECTION 282600

AREA OF REFUGE INTERCOMMUNICATION SYSTEM

1.1 General

- A. This section defines the general design requirements for an ADAAG compliant Area of Refuge Assistance Intercommunications System that shall be followed for all OSFC Technology projects where applicable.
- B. Coordinate requirements and device locations with the project architect.

1.2 Section Includes

- A. Area of Refuge Intercommunication System

1.3 Quality Assurance

- A. National Fire Protection Association
- B. National Electric Code
- C. American with Disabilities Act
- D. Underwriter's Laboratory
- E. Products – Factory Mutual approved

1.4 System Warranty

- A. The Area of Refuge Intercommunication System shall be warranted by the contractor for a period of **three (3) years** from date of substantial completion.

1.5 System Operation

- A. The Area of Refuge Intercommunication System is used to call for assistance from Areas of Refuge as defined in the Americans with Disabilities Act.
- B. When a call is placed from a remote station, it is annunciated at the master station with both audible and visual signals and displayed on an alpha-numeric display. The alpha-numeric display shall indicate the name and location of the calling station. Once a call is acknowledged at the Master Station, the remote station provides visual and audible confirmation. The Master Console controls the direction of the talk circuit.
- C. A call may only be canceled from the Master Console after it has been acknowledged. After the call has been canceled from the Master Console, the indicators extinguish and communication is terminated.

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS**

- D. The Master Console may initiate audio communication with a Remote Call Station at any time by dialing the station number on its keypad or by pressing the button associated with the station. The Master Console may also page a group of Remote Call Stations to broadcast evacuation information. In the event of circuit trouble with any Remote Call Station, the Master Console will display the location and number of the station and "Trouble."

1.6 System Head-end

- A. Provide a multi-station, ADAAG compliant Area of Refuge Assistance 2-way intercommunications system. System shall consist of a wall mounted master station and remote call in stations as indicated on the drawings. The System shall be micro-processor based and utilize multiplexing technology.

1.7 Call in Stations

- A. The call in stations shall utilize common bus architecture with no home runs. Multiple stations and masters may be on one main.
- B. The station has a flush mounting for standard electrical multi-gang wall box, weather/vandal resistant 11-gauge brushed stainless steel panel with tamperproof hardware, speaker/microphone for voice communication, a call button and two LED indicator. The panel resists damage from common cleaning agents. Supervision of the station is indicated at the Master Console.

1.8 Master Station

- A. Ultra compact console with spill-proof keypad, backlit display panel, low-light readability, alpha-numeric display of station number and name, handset privacy or hands-free communication, auto-answer by lifting handset or scroll to any call, group voice page, digital volume keys, call tones with mute for calls in progress, programmable station name.
- B. Master station may be either desk mounted or flush wall mounted with appropriate hardware.

1.9 Telephone Interface

- A. Telephone Interface – the PBX telephone interface connects a call from a remote station to a PBX telephone system. The interface allows calls from remote stations to be forwarded to outside telephones. Interface is used in conjunction with the Master Station

1.10 Installation

- A. The system wiring and installation shall comply with all applicable codes and drawings, and shall be installed in accordance with the manufacturer's recommendations.
- B. All wiring shall be color coded and labeled at each end with self-laminating, machine printable labels.

CHAPTER 9: SPECIFICATIONS

ELECTRONIC SAFETY AND SECURITY

- C. All wiring shall be installed in metallic raceways from rough-in boxes to above accessible ceilings. Cabling installed open above accessible ceilings shall be supported with manufacturers and approved cable support systems and shall comply with the latest edition of the National Electric Code (N.E.C.).
- D. All equipment shall follow manufacturer's guidelines for mounting heights and installation methods.

1.11 Testing

- A. Verify proper operation of system

1.12 Training

- A. Provide a minimum of **four (4)** hours training including system programming, trouble shooting and basic operation.
- B. ***Provide a digital video copy of all training.***

END OF SECTION

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS****SECTION 283111****DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM****GENERAL GUIDELINES****1.1 SECTION INCLUDES**

- A. Qualitative requirements for fire-alarm control unit, manual fire-alarm boxes, system smoke detectors, heat detectors, notification appliances, magnetic door holders, remote annunciator, addressable interface device, and digital alarm communicator transmitter.

1.2 QUALITY ASSURANCE

- A. NFPA 70 - National Electrical Code
- B. Underwriter's Laboratory

1.3 FIRE-ALARM CONTROL UNIT

- A. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
- B. Addressable initiation devices that communicate device identity and status.
- C. Addressable control circuits for operation of mechanical equipment.
- D. Alphanumeric Display and System Controls
- E. Circuits:
 - 1. Initiating device, notification appliance, and signaling line circuits: NFPA 72, Class B.
- F. Elevator Recall:
 - 1. Smoke detectors shall initiate automatic elevator recall.
- G. Heat detectors in alarm installed in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
- H. Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- I. Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- J. Primary Power: 24-V dc obtained from a 120-V emergency generator branch circuit and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
- K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium
 - 2. Capacity: Comply with NFPA 72

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1.4 MANUAL FIRE-ALARM BOXES

- A. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

1.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors do not require resetting or readjustment after actuation to restore them to normal operation. Integral visual-indicating light: LED type indicating detector has operated and power-on status.
- B. Photoelectric Smoke Detectors:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able identify the detector's location within the system and its sensitivity setting.

1.6 HEAT DETECTORS

- A. Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 degrees Fahrenheit or a rate of rise that exceeds 15 degrees Fahrenheit per minute unless otherwise indicated.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 degrees Fahrenheit.

1.7 NOTIFICATION APPLIANCES

- A. Horns: Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- B. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with a clear polycarbonate lens.
- C. Flashing shall be in a temporal pattern, synchronized with other units.

1.8 NOTIFICATION APPLIANCE CIRCUIT POWER SUPPLY UNITS

- A. Power-limited design, complying with UL 864 and listed and labeled by an NRTL.
- B. Primary Power: 24-V dc obtained from a 10-v emergency generator branch circuit and a power-supply module.
- C. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
 - 2. Capacity: Comply with NFPA 72

ELECTRONIC SAFETY AND SECURITY**CHAPTER 9: SPECIFICATIONS****1.9 MAGNETIC DOOR HOLDERS**

- A. Units equipped for wall mounting complete with matching doorplate.
- B. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.

1.10 REMOTE ANNUNCIATOR

- A. Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
- B. Alphanumeric display with LED indicating lights.

1.11 NON-ELECTRIC GRAPHIC ANNUNCIATOR

- A. Framed plexiglass floor plan display with room numbers assigned by Owner.
 - 1. Color image printed on the reverse side of a polycarbonate Lexan laminated to a rigid backing with a removable adhesive for future replacement.
 - 2. Graphics shall show location of fire-alarm control unit, "YOU ARE HERE", detection devices and nomenclature.
 - 3. Mounting: Adjacent to remote annunciator.

1.12 ADDRESSABLE INTERFACE DEVICE

- A. Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the following:
 - 1. Elevator controller to initiate elevator recall.
 - 2. Circuit-breaker shunt trip for power shutdown.
 - 3. Theatrical lighting controller for panic lighting.
 - 4. Heating, ventilating, and air-conditioning equipment controllers for power shutdown.
 - 5. Smoke dampers for closing.
 - 6. Magnetic door holders, electric locks, coiling doors and grilles for releasing.
 - 7. Building management system for equipment shutdown and alarm notification.

1.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

1.14 DEVICE GUARDS

- A. Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection in gymnasiums and locker rooms.

1.15 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.

- B. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch.
- C. Mounting height of appliances shall comply with Americans with Disability Act.
- D. Grounding: Ground fire-alarm control unit and associated circuits.
- E. *Wiring shall be installed in conduit in compliance with Allowable Conduit Schedule in section 260533.***

END OF SECTION

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