



Ohio School Facilities Commission

Design Manual Update

2014



April 24, 2014

Ohio School Facilities Commission
2014 Design Manual Update

Dear Commission:

The Design Manual continues to be a guide to provide quality standards and flexible guidelines for use by the Commission, School Districts, and Design Professionals. Changes and updates to the Manual are important each year to accommodate current needs, new products and systems, changes in the construction industry, and changes in teaching methods. The Update Committee has reviewed all suggestions and incorporated appropriate changes. Herein is a summary of the changes made for the 2014 edition of the Manual.

Planning

This year's update includes a separate volume titled "EDUCATIONAL FACILITY PLANNING GUIDE" which is a stand-alone guide for Ohio school districts to use as a guide for facility planning.

The EDUCATIONAL FACILITY PLANNING GUIDE begins the exciting process of developing learning facilities that respond to the needs of learners. This guide incorporates the development and outcome of the district's vision into the design process which will reinforce transformation to learner centered facilities.

This stand-alone guide outlines the process from inception up to the design phase of a facility project. The EDUCATIONAL FACILITY PLANNING GUIDE volume includes an appendix which contains examples, worksheets, checklists, program of requirements (PORs), and funding calculation spreadsheets. This separate volume provides school districts the planning tools required for a facility project without the length and quantity of the entire Design Manual.

Materials and Systems and HVAC

1. Added diagram and components of vented, shingle roof system.
2. Added specification sections for asphalt shingles. Emphasized proper ventilation for shingle roofs as "lessons learned."
3. Storage rooms shall not be required to be exhausted if there is no objectionable transfer of odors or hazardous gas to adjacent spaces.
4. Demonstrate a 30% improvement in the energy cost rating compared to the baseline building performance rating per ASHRAE/IESNA Standard 90.1 2007 (without amendments).
5. Included stainless steel, aluminum alloy, and cast iron as options for finned tube design for heat exchangers.
6. Removed leak testing of ductwork as a requirement of ASHRAE Standard 90.1.

7. Changed qualitative requirements for low pressure sheet metal duct work from 2-inch Wg to 3-inch Wg and below pressure class. Changed high pressure duct work from 3-inch Wg to 4-inch Wg and higher pressure class.
8. Added that the design professional shall evaluate the impact in first cost and operating cost of a system with low supply water design temperature versus a system with a high supply water design temperature with a more aggressive reset schedule.
9. Eliminated specific refrigerant listings in all chillers, condensing units, variable refrigerant flows (VRF), etc., and replaced with "refrigerants must comply with the requirements of the U.S. EPA Clean Air Act."

Plumbing and Electrical

1. Indicated that the domestic water supply shall be "lead free."
2. In stairways of a multi-level building, locate light fixtures above landings for ease of lamp replacement.
3. For T8 rapid start fluorescent lamps, the color temperature shall be 4100 K.
4. Change armored cable and metal clad cable from raceway to cable assembly.

Technology

1. Highlighted the need for the Technology Designer to coordinate incoming bandwidth requirements with the District. (Ref.: 8500.1.01.P).
2. Requirement added for CAT 6a cable utilized for the wireless access points to be "shielded" cable. (Ref.: 8500.1.02.C.2.b and Sections 271513 and 272133).
3. Updated network electronics requirements for all switch ports to be GB, POE+ and comply with current industry standard of 802.11ac. (Ref: 8500.1.02.C.3 and Section 272100 and 272133).
4. Requirements added for Interactive Projectors to have capability to wirelessly interface with mobile devices, such as tablets, iPads, etc. (Ref.: 8500.1.02.C.11.e.8 and Section 274119).
5. Provided the District an opportunity for an OSFC variance regarding selection of an alternative means to obtain digital media content instead of installation of a system within the District or use of a hosted solution. Related savings could be redirected to other technology components. (Ref.: 8500.1.02.C.14.b.1.c and Section 274125).
6. Provided optional use of Interactive Flat Panel Displays (IFPDs) instead of classroom interactive projectors, if able to obtain within the project technology budget. (Ref.: 8500.1.02.C.15.k and Section 274119).
7. Updated portions of the IP based Video Surveillance System and clarified an IP based system is required via removal of the section referring to a Hybrid-Analog / IP CCTV System. (Ref.: Section 282300).

Career Technical

1. The Career Technical Education Section was reviewed within the Ohio Department of Education and revisions were made.
2. Career Technical programs are moving to the two digit Program Code identifier from subject code. Several new programs were added.
3. The program and the space requirements were defined for eleven new programs.
4. Additionally, minor name changes were made to nine programs.
5. The Program of Requirements spreadsheets and space plates were updated to reflect name and program changes.

Costs

1. OSFC developed a list of suggested OSDM changes to review for potential cost impact. The list was pared down from 46 suggested changes for this year. There were 10 suggested changes that were identified as having a potential cost impact and a cost impact analysis was performed for 2014. Seven of the suggested changes did have a cost impact but were not adopted as the changes were viewed as optional.
2. The Regional Cost Factors for the 2014 OSDM have been adjusted due to current market trends in different regions of the state based on labor and material cost data.
3. The Non-Construction Cost percentages for the 2014 OSDM have not been adjusted.
4. There were 25 cost updates impacting 5 assessment categories within the Assessment Cost Guidelines for 2014. The most significant changes were changing the calculation for the waste water treatment plant from a per student cost to a cost per square foot.
5. Allowances for Swing Space and Reprogramming were evaluated for the 2014 OSDM. A minimal cost change was made to Swing Space based on current market pricing.
6. An annual inflation factor of 2 percent has been applied to the new square foot costs indicated in the 2014 OSDM.

A. APPLICATION

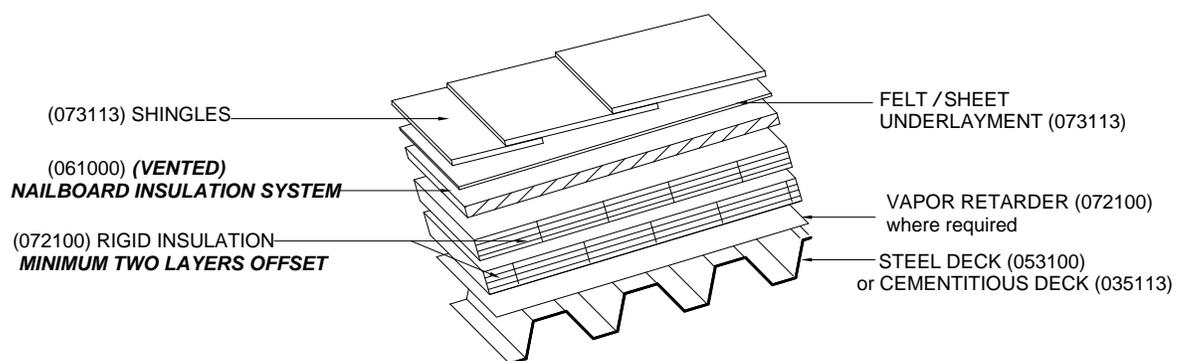
1. Steep Roofing
2. Slope - Minimum 4:12
3. Hip roofs require special consideration

B. COMPONENTS

1. Roof Membrane
 - a. Shingles
 - b. Underlayment
 - c. **Nailable sheathing**
2. **Roof Insulation**
 - a. **(Vented) nailboard/insulation (2" minimum air space)**
 - b. **Rigid insulation**
3. Vapor Retarder
 - a. Where required. Refer to Chapter 9.
4. Structural Support
 - a. Steel deck or cementitious deck
5. **Air Barrier System Required**

C. PERFORMANCE

1. Features
 - a. **Detail roof/wall and roof plane intersection and all openings and penetrations to provide a continuous air barrier system.**
 - b. **Refer to NRCA Roofing Manual: Chapter 3, "Condensation Control & Ventilation for Steep-Slope Roof Assemblies"**



Shingle Roof System
Figure A-1

SECTION 073113

ASPHALT SHINGLES

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for roof shingles, underlayment, and fastening products and methods.

1.2 QUALITY ASSURANCE

- A. All products used must be approved by shingle manufacturer prior to use.
- B. Exterior Fire-Text Exposure: Class A; ASTM E108 or UL 790, for application and roof slopes indicated.

1.3 WARRANTY

- A. Special Warranty
 - 1. Material Warranty Period: 40 years from date of contract completion, prorated, with first 5 years nonprorated.
 - 2. Wind-Speed Warranty Period: Resist blow-off or damage caused by wind speeds up to 80 m.p.h. for a minimum 5 years from date of contract completion.

1.4 SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
- B. Hip roofs require special consideration.

1.5 ROOFING ACCESSORIES

- A. Felt Underlayment.
- B. Self-Adhering Sheet Underlayment.

1.6 METAL TRIM AND FLASHING

- A. Perimeter Edge Metal: Provide one of the following metal types and thickness:
 - 1. 26 gauge (0.019 inch thick), prefinished galvanized steel
 - 2. 0.032 inch thick, prefinished aluminum
- B. Penetration Flashings: Provide one of the following metal types and thickness:
 - 1. 26 gauge (0.019 inch thick), prefinished galvanized steel or stainless steel.
 - 2. 0.032 inch thick, prefinished aluminum.
 - 3. 16 ounce (0.022 inch thick), copper.
- C. Valley Construction (Open Valleys): Provide one of the following metal types and thickness:
 - 1. 26 gauge (0.019 inch thick), prefinished galvanized steel or stainless steel.
 - 2. 0.032 inch thick, prefinished aluminum.
 - 3. 16 ounce (0.022 inch thick), copper.
- D. Apron, Step, Cricket, or Backer Flashings: Provide one of the following:
 - 1. 26 gauge (0.019 inch thick), prefinished galvanized steel or stainless steel.
 - 2. 0.032 inch thick, prefinished aluminum.
 - 3. 16 ounce (0.022 inch thick), copper

1.7 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations but not less than those recommended by ARMA's "Residential Asphalt Roofing Manual" or "The NRCA Steep Roofing Manual."
 - 1. Fasten asphalt shingles to roof sheathing with **galvanized roofing** nails.

LESSONS LEARNED

- 3.1** *The emergence of structural insulated roofing panels and the use of rigid insulation laminated to wood-based sheathing panels as structural roof deck have highlighted ventilation needs. For maintaining warranties, asphalt shingle manufacturers require an unobstructed air space immediately below the roof-deck sheathing. To permit air movement under the roof-deck sheathing, a number of proprietary products have been developed that use battens as spacers and an added sheathing layer as the asphalt shingle substrate. This air space can be vented with continuous soffit or eave intake vents combined with continuous ridge exhaust vents.*
- A.** *Proper ventilation extends the life of shingled roofs by minimizing the temperature differential between the attic air and outside air. It keeps the roof system cool during the hot summer months, preventing premature deterioration and less shingle replacement.*
 - B.** *Proper ventilation prevents ice damming caused when the heat from inside the building and the sun melts the snow at the ridge. This causes water to run to the eaves and refreeze and the repetition of this process causes ice dams.*
 - C.** *Proper ventilation provides energy savings in the summertime by cooling the roof sheathing, preventing premature roof deterioration, premature roof replacement, and increased servicing of cooling units due to their excessive use. It prevents heat build-up in unvented systems which radiates downward and increased the demand on cooling systems.*
 - D.** *Proper ventilation provides energy savings in the wintertime by preventing hot and cold air to interact and cause moisture from condensation that causes soaked insulation, corrosion, and water infiltration.*

END OF SECTION

PURPOSE	The purpose of this Chapter is to provide the school district and the Design Professional with the guidelines and relationships for the Elementary School spaces identified in Chapter 2: Bracketing.
INTRODUCTION	<p>This Chapter begins with an overall building diagram showing how the various areas of a school could be arranged. The diagram is meant only to demonstrate the relationships between various parts of the building.</p> <p>Along with the overall building diagram, there are various program area diagrams throughout this chapter which demonstrate how specific spaces may relate to each other within a particular program area.</p>
NO SMOKING SIGNS	As required by the Ohio Revised Code, post “No Smoking” signs at every entrance door into the building. If a door is for exit only, there is no need for a sign. Post the signs on entrance glass or other appropriate surface. Signs shall contain a telephone number for reporting violations. (866/559-6446)
DIAGRAM	Diagrams of the space have been developed to show how some of the features and loose furnishings may be organized. The space is not required to be designed in the configuration shown.
PROGRAM ACTIVITIES	Program activities indicate the type of activities that may occur in the space. These activities will vary from school district to school district depending on the educational program.
SPATIAL RELATIONSHIPS	Relationships of a particular room to other spaces and activities have been identified to assist the Design Professional in the design of the facility.
ENVIRONMENTAL CONSIDERATIONS	Environmental considerations are items that may affect the educational program. They are the basis of some requirements of Finishes, Features, Plumbing, HVAC, Electrical, and Technology. <i>Storage rooms shall not be required to be exhausted if there is no objectionable transfer (odors or hazardous gas) to adjacent spaces.</i>
FINISHES	The finishes stated for the spaces have been developed based on the function of the room. The spaces adjacent to the room or a building system may change the finishes stated.
OPERABLE WINDOWS	Operable windows are optional in exterior window fenestration.
LIGHTING	Interior lighting shall be controlled by occupancy sensors, automatic timed lighting controlled system or a combination of both to comply with ASHRAE 90.1. Exterior lighting shall be controlled by photosensor or astronomical time clock to comply with ASHRAE 90.1 to automatically turn lighting off when sufficient daylight is available.
AREA	Square foot area given for the room is the necessary area. This area is given in net square feet – defined as the area within the walls of the room.

1.03. COMPUTER INPUT DATA (cont.)

- I. The infiltration expectation for each building must be included as part of each building load and energy evaluation. Consider only the effects of infiltration during the unoccupied times of the building. Both cooling and heating infiltration loads must be considered. The entry doors are to be calculated at a minimum of 100 CFM of air infiltration for each 3-foot wide exterior door. Window infiltration is to be considered negligible as to its affect on the building load.
- J. The ventilation requirements for the building load are required to adhere to the Ohio Building Code requirements and ASHRAE Standard 62. Specific rates of flow per building occupant as scheduled in Section 8420.

1.04 SYSTEMS EVALUATION REQUIREMENTS

- A. In the event a detailed systems evaluation is generated for a proposed heating, ventilating, and air conditioning system, it will be necessary that the evaluation generate cost values for the following specific items. This data will be presented in an organized form per ASHRAE 90.1 appendix G to the Ohio School Facilities Commission for review and consideration:
 - 1. Installed cost per square foot
 - 2. Annual operating cost per square foot
 - 3. Annual maintenance cost per square foot

1.05 OPTIMIZE ENERGY PERFORMANCE

- A. Demonstrate a 30% improvement in the proposed building performance (energy cost) rating compared to the baseline building performance rating per ASHRAE/IESNA Standard 90.1 **2007** (without amendments) by a whole building project simulation using the Building Performance Rating Method in Appendix G of the Standard.
 - 1. Appendix G of Standard 90.1 **2007** requires that the energy analysis done for the Building Performance Rating Method include ALL of the energy costs within and associated with the building project. The proposed design:
 - a. Must comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4) in Standard 90.1 **2007** (without amendments)
 - b. Must include all the energy costs within and associated with the building project
 - c. Must be compared against a baseline building that complies with Appendix G to Standard 90.1 **2007** (without amendments). The default process energy cost is 25% of the total energy cost for the baseline building. For buildings where the process energy cost is less than 25% of the baseline building energy cost, the submittal must include supporting documentation substantiating that process energy inputs are appropriate. For the purpose of this analysis, process energy is considered to include, but is not limited to: office and general miscellaneous equipment, computers, elevators and escalators, kitchen

SECTION 233113

LOW-PRESSURE DUCTWORK

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for low pressure supply (**3-inch wg and below** pressure class) sheetmetal ductwork; and low pressure return, relief and exhaust (2-inch wg pressure class negative) sheetmetal ductwork.
- C. Qualitative requirements for duct insulation liner. Application shall be limited; external wrapped insulation is preferred.

1.2 SUBMITTALS

- A. Submittals are required and shall include 1/4 inch scale layout shop drawings showing duct location sizes, elevations and air flow quantities for each air terminal device. Electronic drawing files of floor plans and structural plans are available from the Architect/Engineer upon request.

1.3 QUALITY ASSURANCE

- A. SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- B. UL181.
- C. NAIMA AH124-94: Fibrous Glass Duct Liner Standard.
- D. NFPA 90A and 90B.
- E. ASHRAE Handbook, HVAC Systems and Equipment.
- F. **Ductwork shall be sealed as required** by ASHRAE Standard 90.1.

1.4 COMPONENTS

- A. Supply air, return air, relief air and exhaust air (except shower rooms, kitchen exhaust hoods, dishwasher exhaust and fume hood exhaust) shall be galvanized steel lock-forming quality ASTM A 653/A 653/M, G90 (Z275) coating designation; milliphosphatized finish for surfaces of ducts exposed to view. Gauges shall be per the latest issue of SMACNA for listed pressure requirements.
 - 1. Provide Class B seals for all joints.
 - 2. Bolted-flange style duct connections shall be acceptable.
- B. Fume hood exhaust shall be Type 304 stainless steel or PVC -coated galvanized steel lock forming quality meeting UL 181, ASTM A 653/A 653/M, G90 (Z275) coating designation. Provide 4-mil PVC coating on the interior of the duct and fittings. Gauges shall be per the latest issue of SMACNA for listed pressure requirements.
 - 1. Provide Class A seals for all joints.
- C. Shower exhaust ductwork shall be aluminum construction conforming to ASTM B 209 Alloy 3003, Temper H14, Gauges shall be per the latest issue of SMACNA for listed pressure requirements. Seal all joints liquid-tight. Pitch ductwork back toward grille.
- D. Kitchen exhaust hood exhaust ductwork shall be 16 gauge steel with weld joints as required by the Ohio Basic Mechanical Code. All joints shall be welded liquid tight.
- E. Dishwasher exhaust ductwork shall be 16 gauge type 304 stainless steel with liquid tight welded joints all the way to the fan. Pitch ductwork back toward dishwasher.
- F. Flexible duct liner shall be a minimum of 1 inch thick and shall be applied in accordance with the latest addition of the SMACNA's Duct Liner Application Standard. All dimension shown on the plans are inside duct dimension and do not include the dimension of the duct liner.

END OF SECTION

SECTION 233115

MEDIUM-PRESSURE DUCTWORK

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for medium-pressure round or flat oval supply (***4-inch wg and higher pressure class, including all ductwork in VAV systems between the air handling units and VAV terminals.***)

1.2 SUBMITTALS

- A. Submittals are required and shall include 1/4 inch scale layout shop drawings showing duct location sizes, elevations and air flow quantities for each air terminal device. Electronic drawing files of floor plans and structural plans are available from the Architect/Engineer upon request.

1.3 QUALITY ASSURANCE

- A. SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- B. UL181.
- C. NFPA 90A and 90B.
- D. ASHRAE Handbook, HVAC Systems and Equipment.
- E. Ductwork shall be sealed and leak tested as required by ASHRAE Standard 90.1.

1.4 COMPONENTS

- A. Supply air shall be spiral seam round or flat oval duct work constructed of galvanized steel lock-forming quality ASTM A 653/A 653/M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view. Gauges shall be per the latest issue of SMACNA for listed pressure requirements.
- B. Minimum round duct sheet metal gauge shall be as follows:

<u>Duct Diameter</u>	<u>Spiral Seam Gauge</u>	<u>Longitudinal Seam Gauge</u>
3 through 14 inches	26	24
15 through 26 inches	24	22
27 through 36 inches	22	20
37 through 50 inches	20	20
51 through 60 inches	18	18
61 through 84 inches	18	16

1.01 GENERAL

- A. The descriptions of the four accepted heating, ventilating, and air conditioning systems have been included in this manual as listed below. It will be the responsibility of the HVAC Design Professional to utilize a system as described in this section, unless suitable documentation to justify a different system type has been submitted.

1.02 CENTRAL PLANT VARIABLE AIR VOLUME SYSTEM WITH HOT WATER REHEAT TERMINALS

- A. Central Heating Plant
1. A minimum of 2 heating water boilers shall be provided. Boiler selection shall consider the operating efficiency of the heating plant. Boiler shall be capable of providing up to 95% efficiency and shall not be below 83% efficiency at any point in the operating range. Electric resistance heating is discouraged from use when other fuel sources are readily available.
 - a. Gas-fired, forced draft boilers
 - b. Gas-fired, atmospheric boilers
 - c. Fuel oil boilers
 - d. Dual-fuel (fuel oil and gas) boilers
 - e. Gas-fired, high efficient, forced draft boilers
 2. Total heating capacity of the boiler plant shall be approximately 130 percent of the building design load.
 3. Design water supply temperatures shall be in the range of 130 to 190 degrees Fahrenheit. Heating plant shall be capable of resetting supply water temperature in order to optimize performance based on equipment efficiency ratings and reduced heating requirement. Reset supply water temperature shall be lower than design supply water temperature. Low supply water temperatures will necessitate the use of at least one condensing boiler. If a combination of condensing and non-condensing boilers is selected, care shall be given to ensure that non-condensing boilers do not operate when return water temperature is below 140 degrees Fahrenheit. ***The Design Professional shall evaluate the impact in first cost and operating cost of a system with low supply water design temperature versus a system with a high supply water design temperature with a more aggressive reset schedule.***
 4. Design water temperature drop in the system shall be maintained between 20 degrees Fahrenheit and 40 degrees Fahrenheit.
 5. Heating water distribution loop shall make use of a reverse return or direct return piping arrangement. Direct return systems shall use flow controllers for water balancing.
 6. The use of a primary/secondary-piping loop is not mandatory.
 7. A minimum of 2 pumps shall be used for water circulation to the building system. It is recommended to use 2 pumps, each sized between 50-75 percent of the total system flow at 100 percent of the required pressure. Design Professional shall evaluate pump operation range against the system curve to ensure stable operation with one or both pumps operating. Additional pumps will be required if a primary/secondary-piping loop is included. Direct return systems shall use automatic flow controllers for water balancing.

1.02 CENTRAL PLANT VARIABLE AIR VOLUME SYSTEM WITH HOT WATER REHEAT TERMINALS (cont'd)

- a. A parallel pumping configuration is required (not necessarily running at the same time).
 - b. The heating water system shall be capable of a minimum 50 percent flow reduction through the use of two-way control valves, three-way control valves, and variable speed pumps.
8. Variable speed pumping shall be utilized on systems that require 10 horsepower or greater pump horsepower. Variable speed pumping shall not be utilized where detrimental to the equipment. Each pump shall have its own variable frequency drive and is not permitted to share a variable frequency drive with another pump.
 9. Air removal and/or containment methods are required on closed loop applications.
 - a. Expansion tanks
 - b. Air separators
 - c. Air vent
 10. Each system shall be provided with water treatment system to prevent corrosion and scaling in the heating water system.
 11. A combustion air system for each boiler shall be installed to meet the code. The HVAC Design Professional must provide a means for preheating the incoming air or maintaining a minimum of 55 degrees Fahrenheit within the boiler room area. Control of the dampers shall be through the direct digital control system and will include dampers and control for the water heater system.
 12. The heating water plant shall be designed to account for the effect of the heat recovery equipment.
- B. Central Cooling Plant**
1. Chiller system shall be either air-cooled or water-cooled and shall utilize one of the following compressor types:
 - a. Centrifugal
 - b. Rotary screw
 - c. Scroll
 2. It is recommended that the quantity of chillers be determined based on the total building cooling requirement. Each chiller shall have the ability to reduce down to a minimum of 10% capacity without surging.

Total Chiller Plant Capacity	Number of Chillers
≤300 tons	One
<300 tons, <600 tons	Two
≥600 tons	Two minimum, with chillers added so that no chiller is larger than 800 tons

1.01 GENERAL

- A. This section establishes the minimum design requirements that must be met by the Plumbing Design Professional. Local codes and standards may take precedence over these requirements.

1.02 SITE DESIGN PARAMETERS

- A. Determination of the available site services with regard to gas service, sanitary systems, domestic water system, and fire suppression system is necessary as a part of the site selection process. Refer to Chapter 3, Site Design, for additional information.
- B. The building plumbing system design is to be complete to 5 feet outside the perimeter of the building foundation system. There may be some exceptions to this requirement for placement of food service grease interceptors, science room acid neutralizing sumps, water services, gas piping and regulators, and storm water structures. In these cases, the piping structures will be included as part of the building plumbing system design.
- C. The Plumbing Design Professional is required to evaluate the need and method to provide gas service to the building. If natural gas service is not available, the installation of liquid propane gas should be investigated. The estimated gas loads for operation of the heating water boilers, domestic water heaters, food service equipment, science program usage, and miscellaneous items are obtained from the appropriate disciplines by the Plumbing Design Professional and totaled with the inclusion of a 10 percent safety factor. Discussion with the local gas company is necessary, both to determine potential service costs and to determine the responsibilities of the building owner and the gas company regarding installation. It is also important to determine the gas pressure requirements for the equipment in the building and communicate this need to the gas company. The Plumbing Design Professional shall design the gas service.

1.03 POTABLE WATER SYSTEM

- A. All buildings shall include a potable **“lead free”** domestic water system serving all sinks, toilets, showers, food service, custodial needs, hose bibbs, heating and chilled water plant fill systems, and drinking water coolers/fountains. All municipal domestic water entering the building must pass through a reduced pressure backflow preventer to protect the outside water source from contamination in the building. A main pressure-reducing valve is required if the incoming water pressure exceeds 80 psi.
- B. Water distribution throughout the facility will be through piping systems located above ceiling areas. Piping installed under slab areas will not be permitted, unless accessible for maintenance on the system. Cross-linked polyethylene (PEX) hot and cold water piping will be acceptable under slab if it is installed in a conduit or sleeve stubbed above the floor. Piping under floor is permitted to be connected to the floor drains/trap primer connections.
- C. Domestic water systems within the building shall be copper tubing. The use of polyvinyl chloride, chlorinated polyvinyl chloride, polyethylene, or polybutylene material will not be permitted. An option to the copper pipe is polypropylene SDR 11 (cold water) and SDR 7.4 (hot water supply and return). Piping in ceiling plenum spaces shall have an approved foil fire wrap.

- Y. *In stairways of a multi-level building, locate light fixtures for general illumination and emergency at or above landings for ease of lamp replacement.***

SCHOOL LIGHTING LEVELS	
ROOM TYPE CLASSIFICATION	RECOMMENDED DESIGN FOOTCANDLES DIRECT LIGHTING(1)
ADMINISTRATIVE	
Offices/Receptionist	40
Storage Rooms	15
Restrooms	15
Conference/Resource Rooms	40
Health Clinic	40
Teacher Prep/Workroom	40
CLASSROOMS-GENERAL	40
Art Rooms/Kiln	50
Modular Technology Labs	40
CADD Labs	30
Industrial Tech/Production Labs	50
Computer Labs	30
Graphics Labs	40
Life Skills Labs	50
Science Labs	50
Laundry Rooms	30
Music Rooms	30
Large Group Instruction Rooms	40
MEDIA CENTER	30
Active Areas	30
Inactive Areas	20
ATHLETIC AREAS	
Gymnasium - Elementary School	30
Gymnasium - Middle School	50
Gymnasium - High School	50
Multi-use P.E. Rooms	50
Locker Rooms	15

SCHOOL LIGHTING LEVELS	
ROOM TYPE CLASSIFICATION	RECOMMENDED DESIGN FOOTCANDLES DIRECT LIGHTING(1)
STUDENT DINING/AUDITERIAS	
Assembly	20
Stage/Work Lights	30
Make-up/Dressing Rooms	30
Theatrical Control Room	30
Equip room with dimmable LED lighting offering 10-foot candles of illumination.	
STUDENT DINING (Used for testing)	40
Cooking	50
Food Preparation	50
Serving Line	50
Ware Washing	50
ELECTRICAL ROOMS	20-30
MECHANICAL ROOMS	30
PARKING AREA	1 (3)
DRIVEWAYS	.5 (3)
CIRCULATION AREAS	
Building Entries	5-10 (3)
Corridors	15
Corridors with Lockers	15
Stairways	10
(1) See article 1.02 Lighting, page 8600-5, for lighting maintenance.	
(2) Foot candles shall comply with local health department regulations	
(3) Foot candles shall conform to section 3211.	

CONSIDERATIONS

1. Providing minimum or no building night lights allows background security if undesired entry occurs with visible lights.
2. Parking lot lighting shall be circulated to allow building management system to darken unnecessary lighting during unoccupied periods.

- 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 **of 4100K** 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 **of 4100K** 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 **of 4100K** 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 **of 4100K** 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 **of 4100K** 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 **of 4100K** and average rated life 20,000 hours, unless otherwise indicated.
- G. Compact Fluorescent Lamps: 4-pin, low mercury, CRI 80 (minimum), color temperature **of 4100K** and 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

SECTION 236213

REFRIGERANT CONDENSING UNITS

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for air-cooled refrigerant condensing units with single compressors.

1.2 SUBMITTALS

- A. Submittals are required and shall include product data noting capacities at the specified conditions, materials, sizes, and dimensions.

1.3 QUALITY ASSURANCE

- A. ASHRAE Standard 15.
- B. Certified performance to ARI 210/270/340.
- C. UL construction.
- D. Units must meet minimum efficiency requirements of ASHRAE Standard 90.1.

1.4 WARRANTY

- A. Compressors shall include an extended 5 year parts warranty.

1.5 COMPONENTS

- A. Air-Cooled Units, single compressor 1 to 10 tons
 1. Compressor: Reciprocating or scroll type, hermetically sealed and isolated with single-speed or two-speed motor, crankcase heater, and internal temperature and motor overloads.
 2. Condenser: Copper-tube, aluminum-fin coil with integral liquid subcooler.
 3. Condenser Fan: Vertical discharge, direct-drive, propeller.
 4. Accessories: Suction and liquid line service valves with gauge ports, replaceable core filter driers, sightglass/moisture indicator, thermal expansion valve, automatic reset timer, and relief solder joints.
 5. Casing: Heavy-gauge, zinc-coated galvanized steel with baked enamel finish.
 6. Provide condenser coil protection.
 7. Refrigerant: **Must comply with the requirements of the U.S. EPA Clean Air Act**
 8. Provide all required safeties including: overcurrent, thermal overload, and single-phasing motor protection.

1.6 INSTALLATION

- A. Install the unit per the manufacturer's recommendations.

END OF SECTION

SECTION 236215

MULTIPLE-COMPRESSOR REFRIGERANT CONDENSING UNITS

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for air-cooled refrigerant condensing units with multiple compressors.

1.2 SUBMITTALS

- A. Submittals are required and shall include product data noting capacities at the specified conditions, materials, sizes, and dimensions.

1.3 QUALITY ASSURANCE

- A. ASHRAE Standard 15.
- B. Certified performance to ARI 340/360.
- C. UL construction.
- D. Units must meet minimum efficiency requirements of ASHRAE Standard 90.1.

1.4 WARRANTY

- A. Compressors shall include an extended 5 year parts warranty.

1.5 COMPONENTS

- A. Air-Cooled Units, multiple compressors
 1. Compressor: Rotary screw or scroll type; semi-hermetic for the rotary screw, hermetically sealed for the scroll type. Compressors shall be isolated from the unit frame for vibration control. Compressors shall include crankcase heaters, suction strainer, oil strainer, and oil charging connection. Motors shall have internal thermal protection.
 2. Condenser: Copper-tube, aluminum-fin coil with liquid subcooler.
 3. Condenser Fans: Minimum one fan per compressor. Vertical discharge, direct-drive, propeller.
 4. Accessories: Delay timer, automatic reset timer, suction and liquid line service valves with gauge ports, replacable core filter driers, sightglass/moisture indicator, thermal expansion valve, automatic reset timer, suction accumulator, liquid receiver, and relief solder joints.
 5. Casing: Heavy-gauge, zinc-coated galvanized steel with baked enamel finish.
 6. Refrigerant: **Must comply with the requirements of the U.S. EPA Clean Air Act**
 7. Provide all required safeties including overcurrent, thermal overload, and single-phasing motor protection.

1.6 INSTALLATION

- A. Install the unit per the manufacturer's recommendations.

END OF SECTION

- J. The specification of Technology Equipment (computers, A/V displays, etc.) that have the Energy Star label is preferred, when applicable.
- K. The Technology Designer shall coordinate specific requirements of extended learning areas (ELAs) with the School District. As a minimum, provide access to the data network and one (1) video port for each ELA.
- L. The Technology Designer shall verify with the School District during the Programming Phase if they will be implementing any special technology applications or interfacing with third party entities (i.e. hosting or cloud computing solutions) that would affect the Technology or Facility Design.
- M. The Technology Designer shall submit required technical data validating the WLAN design to achieve ***ubiquitous high-density coverage throughout the building*** with the technology phase submissions. Refer to Section 27 21 33 for requirements.
- N. The Technology Designer shall coordinate with other Design Professionals adequate dedicated rooftop space to accommodate current or future system antennas.
- O. The Technology Designer shall coordinate with the District regarding their on-line testing assessment procedures and policies. This is to ensure that the technology design and infrastructure will meet the District requirements.***
- P. The Technology Designer shall coordinate with the District regarding the bandwidth needs of the District. The increase of wireless devices and increased bandwidth requirements, may necessitate an increase of bandwidth coming into the District building(s). Review should also consider ongoing maintenance cost for increased bandwidth.***
- Q. Note that an OSDM Technology and Security Checklist is located on the OSFC website. It is intended as a reference tool for use by the Technology Designer.***

1.02 TECHNOLOGY SYSTEMS

- A. Each OSFC Construction Project for new and remodeled facilities shall provide the baseline Technology systems. Additional non-baseline (optional) systems shall be added based on budget limitations.
- B. The Technology Designer shall design the following required Technology Systems for all new and remodeled buildings. Refer to the OSDM sections listed below for additional information:
 - 1. COMMUNICATIONS – DIVISION 27
 - a. Section 27 05 26 -- Grounding and Bonding for Communications Systems.
 - b. Section 27 11 00 -- Communications Equipment Room Fittings.
 - c. Section 27 13 13 -- Communications Copper Backbone Cabling.
 - d. Section 27 13 23 -- Communications Optical Fiber Backbone Cabling.

- e. Section 27 15 13 – Communications Copper Horizontal Cabling.
 - f. Section 27 15 43 -- Audio-Video Communications Horizontal Transport System.
 - g. Section 27 21 00 -- Data Communications Network Equipment.
 - h. Section 27 21 33 -- Data Communications Wireless Access Points.
 - i. Section 27 31 13 -- IP-Enabled PABX System.
 - j. Section 27 31 23 -- IP Only PABX System.
 - k. Section 27 41 19 -- Video Display Equipment.
 - l. Section 27 41 25 -- Digital Media Management System.
 - m. Section 27 51 21 -- Student Dining / Auditoria Sound Reinforcement System – High School.
 - n. Section 27 51 22 -- Student Dining / Cafeteria Sound Reinforcement System.
 - o. Section 27 51 23 – Central Sound and Paging System
 - p. Section 27 51 24 -- Gymnasium Sound Reinforcement System.
 - q. Section 27 51 25 -- Music Room Audio Program Playback System - Middle School.
 - r. Section 27 51 26 -- Music Room Audio Recording/Playback System - High School
 - s. Section 27 51 27 -- Classroom Sound Reinforcement System.
 - t. Section 27 53 13 -- Clock Systems.
2. ELECTRONIC SAFETY AND SECURITY – DIVISION 28
- a. Section 28 13 00 -- Access Control System.
 - b. Section 28 16 00 -- Intrusion Detection System.
 - c. Section 28 23 00 -- Video Surveillance System.
 - d. Section 28 26 00 – Area of Refuge Intercommunication System
- C. The following items summarize the Technology Systems provided. The Base Line (required) systems are listed as well as the Optional Systems.

1. TECHNOLOGY ELECTRICAL WORK

- a. These items are generally bid out as the Technology Electrical Package and are usually included in the Project's Electrical Bid Package.
- b. Back Boxes.
 - 1) Includes back boxes and floor boxes that are part of the Technology system
- c. Cable Tray
 - 1) Includes an OSDM Compliant, wire mesh, Cable Tray system.
- d. Conduits.
 - 1) Includes Technology conduit sleeves and conduits back to the cable tray as per OSDM.
- e. Entrance Conduits – typical.
 - 1) Includes an allowance for a typical Service Provider UG Conduit System - if you have an unusually long Entrance (greater than 400 feet) adjust as required.
- f. Telecom Grounding.
 - 1) Includes Telecom Grounding System, Ground Bars, and Cable Tray Grounding.
- g. Backboards.
 - 1) Includes Painted Plywood backboards in Telecom Closets.
- h. Power.
 - 1) Includes Rack and Cabinet Power Conduits, Stubs and pigtails to Junction Box only.
 - 2) Does NOT include Technology Power wiring -- part of Electrical Package.

2. TECHNOLOGY CABLING

- a. This Section includes the Technology Data Cabling and is based on an OSDM Compliant CAT - 6 system.
- b. Wireless Access Points (WAP's) are to be served by **a shielded** CAT-6a system.
- c. User Cabling Drops, Faceplates and Jacks.
 - 1) Includes all Technology related Data Cables.
- d. Patch Panels.
 - 1) Includes Data and backbone patch panels.
 - 2) Cable Organizers.
- e. M/M & S/M Fiber Cabling.
 - 1) Includes internal fiber cabling and materials

- f. Backbone Copper and Fiber Cabling.
 - 1) Includes internal copper and fiber cables.
 - 2) M/M fiber shall be 50 micron OM4 laser optimized for new work or special applications.
 - 3) SM fiber shall be OS2.
 - 4) IP-Enabled PBXs include copper backbone cabling and associated 110 blocks and patch panels. All-IP PABX systems may not require copper backbone cabling and associated 110 blocks and patch panels.
- g. Fiber Patch Panels
 - 1) Includes fusion spliced ends for all M/M and S/M cables or preterminated fiber and associated cassette system.
- h. 110 Blocks.
 - 1) Includes miscellaneous backbone cable blocks -- PBX & Paging blocks in other sections.
- i. Telecom Racks.
 - 1) Includes Telecom Closet Racks, Cabinets and associated Cable Ladder Rack.
- j. Monitor/Projector Brackets.
 - 1) Includes projector ceiling brackets, conduits and monitor brackets (NO Electrical).

3. NETWORK ELECTRONICS

- a. This Section includes the Network Electronics as based on an OSDM Compliant Network.
- b. L-3 Core Switch.
 - 1) Includes Layer-3 Chassis Core switch and associated Copper and Fiber Interfaces.
 - 2) Includes **GB** TX ports for common devices and local **GB** switches.
 - 3) Includes F/O ports for remote switches and WAN interface.
 - 4) Switch shall include both 1GB and 10GB interfaces.
 - 5) 10 GB interface for WLAN minimum 10GB.
- c. **GB** User Switches
 - 1) Switches shall provide user ports equal to the number of devices plus 15% spare.
 - 2) Provide either switch stacks utilizing 48 port switches or modular chassis. **All switch ports shall be 802.11ac at POE+.**
 - 3) Provide dual 10GB uplinks to each switch stack/chassis.
- d. Wireless Access Points (APs).
 - 1) **802.11ac standard shall be followed** and ubiquitous high-density coverage throughout the building.

- 2) Includes CIPA Compliant System with building-wide **ubiquitous** coverage and rogue signal protection.
- e. Wireless Controller/Switches.
 - 1) Includes Central Wireless Controller, Control Software and Server Appliance **or a “cloud-based” controller.**
 - 2) Includes Location Tracking.
 - 3) Include Mobile Device Management (MDM.)
 - 4) Include App Management Software.
- f. Radius Authentication Server.
 - 1) Includes Radius Server and Software for Network Authentication.
 - 2) Assumes District supplied Authentication Data base.
- g. POE+
 - 1) Provide Power over Ethernet (POE+) **for all ports**, plus 15% spare.
- h. UPS Units
 - 1) Includes UPS Units for Main and Auxiliary Telecom Rooms.
 - 2) Standby based on connection to Building Generator for all Technology Closets.
 - 3) Power Stub up to Junction Boxes in TE Item above.
 - 4) Electrical Circuits to Generator in Separate Electrical Package.
- i. Fiber Patch Cords.
- j. Copper Patch Cords.
4. IP-ONLY PABX SYSTEM – **New System IP-Based Designs**
 - a. This section includes an IP-Only phone system based on OSDM requirements.
 - 1) The typical system shall include Voice Mail and carrier circuits interfaces – these are based on whether the District has a central, redundant, IP-Only phone system that links all buildings together. If a central, redundant, IP-Only phone system exists, then Call Processing, carrier circuits, and Voice Mail are provided at the central location and the remote buildings are interconnected over the fiber-optic WAN. The remote buildings shall have Survivable Remote Units for call processing in the event of a fiber WAN failure.
 - 2) Hosted Solution – Technology Designer to coordinate with the School District if a hosted IP-Only PABX system is the District’s preference. An OSFC variance shall be obtained if it is determined that a hosted IP-Only PABX system is to be implemented. Specific items to review include:
 - a) Method of incorporation into the designed technology system(s).
 - b) Total cost of ownership / annual costs, etc.
 - c) Training requirements.

- d) Cost for systems and equipment not located in the District and/or owned by the District is not OSFC funded.

- b. IP-Only PBX
 - 1) An IP-Only PBX supports both IP phones and analog devices (FAXes, etc.) and IP Trunking between buildings.
 - 2) Includes software for connection to Central District IP-Only PBX.

- c. Digital Display Speaker Phone IP-Instruments
 - 1) Includes classroom and administration phones as per OSDM.
 - 2) Refer to specification sections 273113 and 273123 which describe when full duplex speaker phones for classroom and other spaces could be optional.
 - 3) Shall include E-911 room identification.

- d. 2 Wireless Phone Instruments
 - 1) Includes OSDM compliant wireless phones and chargers.

- e. 2 Attendant Consoles
 - 1) Includes 2 Attendant, PC-based consoles, per OSDM.

- f. Power Failure Transfer (PFT) Unit
 - 1) Includes Power Failure Transfer Unit for E-911 and emergency backup.
 - 2) Includes 2 analog PFT Emergency backup phones.

- g. Interconnect Cables

- h. Analog Trunk Interfaces
 - 1) Includes Analog Trunk Interfaces for E-911 Backup.

- i. Analog Station Interfaces
 - 1) Includes Analog Station Interfaces for FAXes, etc.

- j. Digital Trunk Interfaces – include a minimum of one of the following:
 - 1) PRI Interface (exception see above, add capacity as required at central location to support facility)
 - 2) SIP Trunk Interface (exception see above, add capacity as required at central location to support facility)

- k. Voice Mail System
 - 3) Include a minimum of one mail box for each staff member located at facility plus miscellaneous mailboxes as required by District. (exception see above, if voice mail system is centralized provide additional mail licenses at central location to support facility)

- l. Copper Patch Cords.

- 5) The Central Bell/Clock system is connected to the paging system.
- b. Paging Speakers.
 - 1) Includes speaker and ceiling tile bridge or paging horn as required.
 - 2) Paging Speaker Cable.
 - 3) Includes paging speaker(s) and call-button cable installed in cable tray.
 - 4) All Educational space speaker(s) and call-button cables are home-run to Central Closet. Common area paging zones (i.e. corridors) may utilize daisy chain cabling for speaker(s) associated with that particular zone.
- c. Call Buttons
 - 1) Technology Designer to review with District. Base line item, variance request if District elects not to include. Each Educational space to have wall-mounted call-in button. Review need for conduit/box rough-in for future if District elects not to include.
 - 2) 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.
- d. Paging Adapter.
 - 1) Includes multi-zone microprocessor controlled paging adapter in central Telecom Closet.
- e. Paging Blocks.
 - 1) Includes 110 cross-connect blocks for multi-zone connections.
- f. Paging Power Supplies.
 - 1) Includes Amplified Speaker Power supplies -- connected to UPS/Generator.
- g. Tone Generator.
 - 1) Includes multi Tone Generator for emergency signals.
- h. Emergency Switch.
 - 1) Located in Central Office.
- i. Central FM Tuner.
 - 1) Located in Central Office.
- j. Call Annunciator
 - 1) Base line – Main office to have LCD/LED room call-in annunciator. Variance required if District elects not to include.
- k. Central CD / Digital Player.
 - 1) Located in Central Office.

- l. FM Antenna.
 - 1) FM Amplifier Coax Cabling.
 - m. Admin. Console
 - 1) System Programming Console.
 - n. Mass Notification System - Optional
 - 1) Additional features may be added to the paging system to provide mass notification capabilities.
10. WIRELESS CLOCK SYSTEM
- a. This Section includes the Building Wireless Clock System based on OSDM Requirements.
 - b. Wireless Clocks
 - 1) Single sided in rooms, double sided in hallways
 - 2) Wireless Clock Guards as required -- Gym areas, etc.
 - c. Wireless Transmitter and Receiver and Antennas
 - 1) Larger buildings may require additional transmitters
 - d. Wireless Tone Generator and Scheduling System
 - 1) Includes interface to Paging System
11. CLASSROOM A/V SYSTEMS
- a. This Section includes the Classroom and Misc. A/V Systems based on OSDM Requirements.
 - b. Technology Designer shall coordinate with other Design Professionals for an integrated classroom design to accommodate features such as daylighting.
 - c. The Design is based on Classroom interactive projectors integrated with the **Classroom Sound Reinforcement** system and Digital Media Delivery and Scheduling.
 - d. The Central Media Server and Scheduling system is NOT included and is assumed to be centrally located at the District's NOC.
 - e. Classroom Interactive Projectors.
 - 1) Includes Network controlled/monitored Interactive Projector. Refer to 274119 for Lumen requirements.
 - 2) Ultra-short throw interactive projector is wall-mounted and integrated with Classroom Sound and other audio/visual sources.
 - 3) Interactive Projector is integrated with Instructor's PC.
 - 4) Associated in-wall cabling is included.
 - 5) Web-based Control shall be achieved either through direct network connectivity at projector or through the use of an external IP/RS-232 and control software.

- 6) Projector control shall be open source and support multiple projector manufacturers.
 - 7) Wall Bracket for ultra-short throw.
 - 8) ***Interactive projectors shall have the capability to display classroom mobile devices (tablets, iPads, etc.) via wireless interface. Interface shall be open source and support concurrent multiple remote display software.***
 - f. ***Classroom Sound Reinforcement System & Speakers.***
 - 1) Includes min of 4 speakers, IR or RF Receiver, Amp and 2 Mics.
 - 2) Integrated with Projector, PC, and video sources.
 - 3) Amp is located at classroom technology center.
 - g. Classroom A/V Cabling.
 - h. Classroom Blu-Ray Player.
 - 1) Includes Standard Blu-Ray player located at classroom technology center.
 - 2) Optional if teacher PC is utilized as the classroom DVD player.
 - i. Central Blu-Ray Player.
 - 1) Blu-Ray Player and Digital Encoder for Central Usage.
 - j. Bulletin Board Unit.
 - 1) Includes BBS PC and associated Digital Encoder.
 - k. Media Center Cart
 - 1) Includes 1 Media Center Camera, Cart and Digital Encoder.
 - l. Flat panel TVs for Selected Rooms.
 - 1) Includes wall mounted flat panel TV and associated STB.
 - 2) Bracket included in Technology TE Package.
 - m. Provide digital video switcher (HDMI) in rooms where multiple A/V devices and outlets are required to simplify the connection to projector. Locate switcher at the classroom technology center.
12. SPECIALIZED AUDIO SYSTEMS
- a. This Section includes the Specialized Audio Systems based on OSDM Requirements.
 - 1) Note that not all systems are required in every building type.
13. REQUIRED SYSTEMS -- IF NO NOC EXISTS
- a. This Section includes Systems that must be added to the Estimate if there is NO centralized NOC Location for the District.
 - b. These systems are generally located at one building in the District and used to serve all District Facilities over a fiber-optic WAN.
 - c. The following systems are Base Line required systems if no NOC exists.
 - 1) Voice Mail if no Central IP-Enabled or IP-Only PBX Exists.
 - 2) PBX PRI Interface if No Central IP-Enabled or IP-Only PBX Exists.
 - 3) Access Control Software & Console if no Central Unit Exists.
 - 4) Digital Media Management System if no Central System exists.
 - 5) Legacy only - CATV Head End and Coax System. Optional if extending an existing system.

- 6) If the District has NO Digital Headend for Broadcast Media, then provide a Digital Broadcast Media District Head End – 6 or 12 Channels, as required.
- 7) Redundant Central IP Call Processing Units if no Central IP-Only PBX Exists.

14. CURRICULUM TECHNOLOGY

- a. This section includes various types of technology which specifically relates to use within the educational space by the instructor and students alike. The Technology Designer shall review the various technologies that are available with the School District to determine what combination of system(s) should be selected that will meet the needs of the District, within the allotted Baseline Budget. Note that some systems have minimum base line quantities suggested.
- b. Baseline Systems:
 - 1) Digital Media Management System
 - a) System shall consist of server portal that will enable web-based viewing, uploading, and downloading of digital content; management of title database operations; and logging of system parameters. System to allow for multicasting. System shall be sized according to number of users, number of titles, and network bandwidth. Baseline is 1 per District/School. Optional equipment in educational spaces may include: set-top boxes and digital encoders for video sources.
 - b) Hosted Solution – Technology Designer to coordinate with the School District if a hosted Digital Media Management System is the District’s preference. An OSFC variance shall be obtained if it is determined that a hosted Digital Media Management System is to be implemented. Specific items to review include:
 - .1 Method of incorporation into the designed technology system(s).
 - .2 Total Cost of Ownership / Annual Costs, etc.
 - .3 Training requirements.
 - .4 Cost for systems and equipment not located in the District and/or owned by the District is not OSFC funded.
 - c) ***Alternative Digital Media Content Solution - Technology Designer to coordinate with the School District if alternative methods to obtain digital media content is preferred versus local system equipment or a hosted solution. An OSFC variance shall be obtained if it is determined the District prefers to redirect digital media management system budget monies towards other technologies. Specific items to review in the variance submittal includes:***

- .1 **District reason to not include a digital media management system via district owned equipment or hosted solution.**
- .2 **Proposed method to obtain digital media content in District Technology Plan.**
- .3 **Proposed use of re-directed technology budget monies associated with the baseline system, including Total Cost of Ownership/Annual Costs/Training Requirements, if applicable.**
- .4 **Cost for systems and equipment not located in the District and/or owned by the District is not OSFC funded.**

2) Interactive Projectors

- a) Interactive Projector – Baseline is 1 per educational space. Shall be mounted within room and provide interface with instructor’s workstation in the room and provide the ability to record, save and recall presentations. Includes equipment that can transform any writing surface into an interactive surface. Utilize either wired or wireless connections to the instructor’s workstation.

15. OPTIONAL SYSTEMS – Not Baseline Systems

- a. This Section includes Optional Systems that can be added to the Estimate based on Local Requirements if the budget permits.
- b. Interactive Tablets
 - 1) **System shall be wireless**, utilizing RF, **802.11ac**, or Bluetooth technology. System shall provide **wireless** interface with instructor’s workstation **and display device(s)** in the room **including** the ability to record, save and recall presentations. System shall be of the integrated display type or non-display type tablet.
- c. Classroom Digital STBs.
 - 1) Includes Digital STB for delivery of IP Video into Classroom.
 - 2) Web-based Control via Projector IP Connection.
 - 3) Bracket included in Technology TE Package.
- d. Digital Signage
 - a. Single unit flat panel displays utilized for Visitor Information, General Way-Finding or Display Education Content.
 - b. The quantity of Digital Signage shall be minimal and is an Optional System based on budget constraints.
 - c. Digital Signage unit(s) utilized for video walls, sport or food services applications are not OSFC funded.

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.

- 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 1000 Base T Layer 2 Manageable Ethernet Switches with ports in a quantity to support all initially planned devices, **including wireless access points**, with 15% spare.
 - B. 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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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.
- F. **Interactive Flat Panel Display (Classrooms/Labs)**
1. **Backlit LED/LCD display, contrast ratio 3000:1, 3 year warranty.**
 2. **Full HD-1080p with multi-touch (pen or finger) functionality.**
 3. **Inputs/Outputs - Shall consist of the following:**
 - a. **HDMI**
 - b. **Computer / component video : D sub 15 pin**
 - c. **Composite video**
 - d. **Audio in x 3 : RCA (L and R), Mini stereo**
 - e. **Audio out : RCA (L and R)**
 - f. **LAN networking: RJ-45**
 - g. **Serial : RS-232C**
 - h. **AV input/output: DVI-D**
 - i. **USB**
 - j. **Wireless connectivity : 802.11 b/g/n/ac**
 - k. **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).**
 6. **Shall be able to interface wirelessly with mobile classroom devices (tablets, iPads, etc.).**
 7. **Provide either wall mount or portable cart unit as coordinated with the Design Professional and District.**
 8. **Installer shall be authorized service dealer of the unit.**
 9. **Coordinate District operating system platform with specified manufacturers.**
 10. **Provide integral surge suppression protection with the unit.**
 11. **Technology Designer to determine size of the IFPD based on room size and 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