

**Mechanical, Electrical, Plumbing and**  
**Fire Protection Systems**  
**Schematic Design Narrative**

**For**

**Oxford Middle School**  
Oxford, CT

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CES PN 2018166.00

## **OVERVIEW:**

The following describes the proposed mechanical, electrical, plumbing and fire protection systems, which shall serve the proposed new construction of an educational building, Oxford Middle School, located in Oxford, Connecticut. After project completion the building will be approximately 81,991 gross square feet in size.

Mechanical, Electrical, Plumbing, and Fire Protection systems shall be in accordance with the current Building Code of the State of Connecticut including but not limited to International Energy Code (2015) and shall comply with the State of Connecticut High Performance Building Standards.

This narrative is meant to assist in the development of a schematic estimate for the purchase and installation of the MEP systems.

## **DIVISION 21 - FIRE PROTECTION SPRINKLER SYSTEM**

- A new fire protection system, in accordance to NFPA 13, shall be installed throughout all areas of the building.
- A new 6" fire protection line will be routed to the building from water mains located in Great Oak Road.
- Results from a recent flow test shall be provided by the water utility company. At this time it is assumed that the available flow and pressure are adequate for the building without the assistance of a fire pump.
- A new 6" main fire protection water service with a double check backflow preventer assembly shall be installed, within the Mechanical Room.
- Alarm valves shall be installed to properly zone the sprinkler system. Sprinkler Zone A and Sprinkler Zone B will each require one (1) wet alarm valve assembly. There will also be flow control valve assemblies with tamper & flow switches on each floor level.
- Sprinklers shall be concealed, fully recessed in finished areas with ceilings. Sidewall, exposed, extended coverage sprinklers shall be installed where appropriate. Upright sprinklers with protective baskets shall be installed within the gymnasiums, storage and mechanical areas. Quick response sprinkler heads shall be used in light hazard locations. Sprinklers, unless noted otherwise, shall have a 1/2" orifice and a 165°F temperature rating. Intermediate temperature classification sprinklers shall be installed within the mechanical room, skylights and other applicable areas.
- Piping for the sprinkler system shall be steel pipe, ASTM A 53; Schedule 40 seamless carbon steel. Schedule 10 pipe shall be allowed for pipe sizes larger than 2" diameter when roll grooved mechanical couplings are used. Sprinkler piping shall be installed above ceilings and concealed within chases where applicable.
- Fittings shall be grooved mechanical fittings: ANSI A21.10 ductile iron; ASTM A47 grade malleable iron. Couplings shall be ASTM A 536 ductile iron or malleable iron housing, EPDM gasket with nuts, bolts, locking pin, locking toggle or lugs to secure roll grooved pipe and fittings.

- Kitchen hoods and kitchen exhaust ductwork shall be protected by dry chemical type systems and shall be connected to the fire alarm system.

## **DIVISION 22 - PLUMBING SYSTEMS:**

### **22 10 00 Plumbing and Piping Systems**

- Storm, waste, and vent piping shall be hub-less cast iron with standard torque clamps, conforming to CISPI 301 for above ground piping and hub & spigot cast iron conforming to ASTM A 74 for piping installed below the floor slab. Storm, waste, and vent piping shall be concealed within chases and walls. Storm and waste services shall exit the building below slab at multiple locations to be coordinated with the site engineer. The secondary storm system shall exit the building separate from the primary system; discharge shall be above grade, at locations visible to the building maintenance staff.
- The 4" domestic water service, which shall originate from Great Oak Road, will enter the building below slab, and rise up to a service assembly located in the Mechanical Room. The service assembly located within the Mechanical Room shall consist of shut-off valves, pressure reducing valves, backflow preventers, and a meter. Results from a recent flow test shall be provided by the water utility company to confirm or deny sufficient pressure is available. It is assumed at this time that a domestic water booster pump is not required. Domestic cold water, domestic hot water, and domestic hot water recirculation piping shall be Type L copper conforming to ASTM B 88. Domestic water piping shall be insulated with rigid molded, noncombustible glass fiber insulation conforming to ASTM C335. Domestic water piping throughout the building shall be installed above ceilings and concealed within walls. Jacketing shall be provided on piping exposed in occupied areas (when exposed pipe is located below 10').
- Propane serving the buildings shall originate in (1) 10,000 gallon buried propane tank. The propane service shall enter the building in the Mechanical Room after connecting to the pressure regulator assembly. The pressure regulator assembly shall consist of shut-off valves, pressure regulator, vaporizer, and meter. Gas piping shall be ASTM A53 schedule 40 black steel. Gas piping will be used to serve the HVAC equipment, water heaters, and kitchen appliances.

### **22 11 00 Hot Water Systems**

- The hot water distribution system shall include 140°F piping for the kitchen (boosted to 180°F at the dishwashing area) and 110°F piping to serve the remainder of the building. The water in the storage tanks will be stored at 140°F. An automatic High/Low tempering valve, by Leonard or approved equal, will reduce the water to 110°F for the building piping. For controllability reasons a second High/Low tempering valve will be installed on the kitchen 140°F water feed.
- Hot water recirculation pumps shall be installed to maintain the appropriate temperatures in the domestic hot water distribution system. The pump shall be controlled by the building management system (BMS) to minimize energy consumption. Hot water recirculation piping shall be brought to all lavatory and sink locations.

### **22 00 00 Hot Water Plant**

- Domestic hot water shall be generated by two (2) 130 gallon, propane gas fired water heater/storage tank, 399 MBH each, PVI Conquest or approved equal, located in the Mechanical Room.

### **22 40 00 Plumbing Fixtures and Specialties**

- All plumbing fixtures required to be accessible shall be in accordance with the Americans with Disabilities Act (ADA), 504 and UFAS standards.
- Water closets and urinals shall be wall hung, vitreous china, low consumption (0.125 gallon per flush urinals and high efficiency 1.28 gallon per flush water closets), by American Standard or approved equal. Flush valves shall be manually operated, by Sloan or approved equal.
- Lavatories shall be wall hung, vitreous china, by American Standard or approved equal. Faucets shall be low consumption manually operated, by Symmons or approved equal.
- Multi-user Lavatories shall be wall hung, solid synthetic surface with integral soap dispensers by Bradley or approved equal. Faucets shall be low consumption manually operated by selected manufacturer.
- Wall hangers for water closets, urinals, and lavatories shall be heavy duty adjustable height type by J.R. Smith or approved equal. Hangers shall be installed within chase spaces provided behind fixtures.
- Drinking fountains shall be stainless steel, wall recessed, two-tier, ADA style, vandal resistant manufactured by Elkay or approved equal.
- Mop basins shall be floor mounted, 24"x24", molded stone, with wall mounted faucet & trim, by Fiat or approved equal.
- Classroom sinks shall be stainless steel, by Elkay or approved equal with gooseneck faucets, by Symmons or approved equal.
- Cast iron floor drains shall be installed at all toilet rooms. Heavy-duty cast iron floor drains & floor sinks shall be installed in the Mechanical Room. Floor drains shall be by J.R. Smith or approved equal. Trap primers shall be provided for floor drains. In the kitchen area trap primers shall be Pressure Drop Activated by PPP or approved equal. In bathrooms and mechanical room areas trap primers shall be waterless by ProSet Trap Guard or approved equal.
- Emergency gas solenoid valves shall be provided in the kitchen.
- Hose bibbs shall be installed in all toilet rooms, by Woodford or approved equal.
- Wall Hydrants shall be installed on exterior walls every 100 feet. Wall hydrants shall be non-freeze type by Woodford or approved equal.

- A concrete 2000-gallon grease interceptor shall be coordinated and then installed below grade at the exterior of the kitchen. The waste connection exiting the grease interceptor shall connect to the sanitary system serving the buildings. The interceptor shall prevent grease from entering and clogging the sanitary system.

### **DIVISION 23 - MECHANICAL SYSTEMS**

- The mechanical systems are based on heating and cooling the building while meeting the objective for energy efficiency. Heating design shall be 70 degrees and cooling design shall be 75 degrees.

#### **23 09 23 HVAC Controls**

A Building Management System (BMS) shall be installed to control the mechanical and selected electrical systems. BMS shall be by the Temperature Control vendor approved by the owner.

- The system shall include a personal computer with graphics based display and capabilities for alarming off-site.
- The BMS shall provide temperature control for all HVAC systems and control select lighting in the building.
- The system shall be programmed for occupied/unoccupied cycles for the air handling equipment, with an override feature for spaces that would be utilized after-hours.
- The system shall monitor occupancy sensing devices to control the amount of outside air being brought in to each classroom to assist in energy conservation.
- The BMS shall be accessible from any Web browser and mobile device with proper authorization.

#### **Geothermal System (Alternate Bid)**

- Geothermal Bore Field located on site (location to be determined). 100 vertical closed loop u-tube bores that are each 500 feet deep, 5 ¼" diameter, bentonite filled 1 ¼" HDPE supply and return tubing, including spacer clips, and the bores to be separated from each other by not less than 20 feet; piped to a header vault located outside the building. All buried HDPE piping will include tracer wire for future locating needs. 6" HDPE buried piping shall be installed from the single header vault to the Mechanical Room.
- (2) Additional pumps shall be included for the geothermal alternate bid. The pumps will be for the circulation of water from the bore field loop and back through the source side of the heater/chillers. 25 HP by Armstrong or approved equal.
- The heater/chillers will consist of (5) 40-ton chiller modules combined to make one unit. The unit's total capacity shall be 200-ton. Heater/chiller shall be 4-pipe, heat recovery type chiller, Multistack VMEII or approved equal.

#### **23 52 00 Heating Plant (Base Bid)**

- The heating plant, for both space heating, will generally consist of (3) propane fired boilers, Aerco Benchmark Model BMK 1000, 1,000,000 BTU/hr input each. The boilers will be mounted on 6" thick reinforced concrete housekeeping pads.
- The primary heating hot water pumping plant will generally consist of one pair of pumps. Each of the pumps will be sized for 100% capacity, for complete redundancy. The pumping will be a variable primary arrangement for the boilers and will send 140°F water to the building for space heating systems and terminal heating units (baseboard fin tube, radiant ceiling panels, air handling units, cabinet units heaters, etc.) throughout the facility. The space heating hot water supply piping temperature will be reset inversely with outside air temperature, to minimize energy consumption. Heating hot water pumps shall be vertical inline type, 7.5 HP by Armstrong or approved equal, Pumps will be mounted on 4" thick concrete housekeeping pads in the Mechanical Room.
- Pumps will be mounted on 4" thick concrete housekeeping pads in the Mechanical Room.

### **23 64 00 Chiller Plant (Base Bid)**

- The chiller plant for space cooling, will generally consist of (2) site mounted air cooled chillers, Trane Sintesis RTAF or approve equal, 130 tons each. The chiller will be mounted on an exterior concrete pad. Chiller shall have sound enclosure surrounding it on all sides, consult chiller manufacturer on exact size and thickness of enclosure to provide acceptable sound levels in residential neighborhood.
- The primary chilled water pumping plant will generally consist of one pair of pumps. Each pump will be sized for 100% capacity, for complete redundancy. The pumping will be a variable primary arrangement with the chillers in a parallel configuration and will circulate 42°F chilled water to the space cooling system and terminal cooling units (air handling units, DOA's, chilled beams, etc.) throughout the facility. Chilled water pumps shall be vertical inline type, 15 HP by Armstrong or approved equal. Pumps will be mounted on 4" thick concrete housekeeping pads in the Mechanical Room.
- The chilled beam chilled water pumping plant will generally consist of two pair of pumps. Each pump will be sized for 100% capacity, for complete redundancy. The pumping system will circulate 57°F chilled water to the chilled beams throughout the facility. Chilled beam chilled water pumps shall be vertical inline type, 10 HP by Armstrong or approved. Pumps will be mounted on 4" thick concrete housekeeping pads in the Mechanical Room.

### **23 34 00 Heating, Ventilating and Air Conditioning**

#### **Systems for Specific Areas**

##### 1. Cafeteria/Stage

- The Cafeteria/Stage areas will be served by a rooftop mounted, single zone variable air volume indoor air handler (AHU-2) with integral heating hot water coil (360 MBH) and chilled water cooling coil (25 Tons). This unit will have a 7,500 cfm supply fan. The Air handler shall be by Trane or approved equal. The unit will also incorporate demand control ventilation which will modulate the amount of outside air to the space based on

occupancy and CO<sub>2</sub>. This unit will also have an energy recovery wheel. This space will also have perimeter fin-tube radiation running along exterior walls, the radiation will run wall to wall and be double row enclosure by Rittling or approved equal.

2. Gymnasium

- The Gymnasium will be served by an indoor, single zone variable air volume air handler (AHU-1) with integral heating hot water coil (320 MBH) and chilled water cooling coil (22 Tons). Air Handler shall be by Trane or approved equal. The units will also incorporate demand control ventilation which will modulate the amount of outside air to the space based on occupancy and CO<sub>2</sub>. The Gymnasium shall be mechanically exhausted by dedicated rooftop exhaust fan equal to Loren Cook or approved equal. The Gymnasium will also have hot water radiation with in a heavy duty enclosure on the perimeter. The Gymnasium Storage room adjacent to Gymnasium (Area B) will have a horizontal hot water unit heater by Rittling or approved equal.

3. Kitchen

- Kitchen exhaust hoods (Dishwasher (Type II) & Grease (Type I)) shall be designed and specified by the Kitchen Equipment Consultant. Grease exhaust hoods as required shall be installed per NFPA 96 with carbon steel ductwork and up-blast exhaust fans with ventilated curbs. Fan serving grease hood shall 4,500 CFM be by Loren Cook or approved equal. Dishwasher exhaust fan shall be 1,250 CFM by Loren Cook or approved equal. Make-up air will be provided by adjacent cafeteria unit (AHU-2) deleting the need to provide a dedicated make-up air unit for the kitchen.

4. Academic Areas (Including Special Classrooms and Small Instructional Spaces), Administration Areas

- Each of the Classrooms, offices and conference rooms shall be served by active chilled beams located in the ceiling with each zone having an individual room temperature sensor. The space's sensible loads will dictate the quantity of active chilled beams. Preconditioned outside ventilation air will be distributed through ductwork to each active chilled beam to address latent and ventilation loads. Each zone for the chilled beams will have a six way valve associated with it. There will be approximately 80 zones in the building, with approximately 150, 8' chilled beams. Chilled beams shall be by Dadanco or approved equal.
- Preconditioned air to the Classrooms and Small instructional Spaces will be provided by dedicated outdoor air systems (DOAS). This air will be distributed directly to each space. Each classroom will have a variable air volume (VAV) box on the outside air ductwork as enters the space. Upon detection of vacancy (by occupancy sensor provided by Div. 26) this VAV box will close to a minimum position as an energy efficient measure. Administration spaces and offices will be served by active chilled beams and controlled by room temperature sensors. Exhaust air from the spaces will be ducted back to the DOAS unit. There will be two (2) separate Dedicated Outdoor Air units (DOA-1 & DOA-2). These units will be approximately 12,500 CFM and 11,000 CFM respectively and will be located on the roof. Each DOA unit will have a hot water heating coil, a chilled water coil, a dehumidification wheel, a supply fan, an exhaust fan and an energy recovery wheel. DOAS units shall be Trane or approved equal. All exterior spaces in the building will also have perimeter fin-tube radiation running along exterior walls, the radiation will run wall to wall and be double row enclosure by Rittling or approved equal.

5. Tel/Data and security equipment rooms

- Data closets will be served by ductless split units, by Mitsubishi or approved equal. Total units will be (2) 2 ton unit and (2) 1 ton units. Unit consists of indoor wall mount air handler and roof mount condensing unit.

6. Corridors/Miscellaneous areas

- All restrooms, mechanical/electrical rooms and storage areas shall be provided with exhaust that will be connected to the DOA units thought the building. The exhaust rate to these rooms will be provided based on ASHRAE 62.1 Requirements.
- The stairwells, entrances and vestibules shall be served by hot water cabinet unit heaters with return air temperature sensors and control valves. All storage areas, mechanical rooms and electrical rooms shall be provided with hot water unit heaters.

7. Motors:

- All motors (fan and pump) 3 HP and larger shall be high efficiency and provided with VFD. VFDs shall be by ABB or approved equal.

**Code Compliance**

- All systems will be designed to code compliance for percentage of outside (fresh) air and will meet the requirements in ASHRAE 90.1, 2007, International Mechanical Code, 2009 International Energy Code as well as ASHRAE 62.1.

**Materials and Methods**

1. Include the following basic materials and methods of construction:

- All ductwork and accessories shall meet SMACNA standards.
- Provide all HVAC equipment with extra set of filters.
- Seismic restraints shall be designed and installed as required per State of Connecticut Building Code and Fire Safety Code which requires the seal of a licensed professional engineer. Abovementioned professional engineer will be required to verify installation is correct and complete per seismic code. This includes piping, ductwork, equipment, and equipment bases.
- Provide glass fiber insulation for all hydronic piping and ductwork. Insulation shall be installed to meet the Energy Conservation Code.
- Provide firestopping around mechanical penetrations in accordance with fire stopping requirements. System shall be capable of maintaining against flame and gases. System shall be UL listed and comply with ASTM E814.
- Provide mechanical identification for mechanical systems. Identification shall comply with ANSI A13.1.
- All pipe connections shall be installed to allow for freedom of movement of the piping during expansion and contraction without springing. Swing joints, expansion loops and expansion joints with proper anchors and guides shall be provided where shown.
- Provide vibration isolation for hydronic piping, ductwork, and equipment.
- Hydronic piping 2 1/2"φ and under shall be Type L copper. Piping 3" φ and over shall be ASTM A 53; Schedule 10 black steel pipe with welded, flanged or grooved joints.



- All equipment served by hydronic piping shall have isolation valves on the supply and return lines. Isolation valves shall also be provided at branch take-offs.

## **DIVISION 26 - ELECTRICAL SYSTEMS**

### **Main Service and Distribution**

1. The building shall be provided with a 3000A, 208/120V, 3-phase, 4-wire, main electrical service with circuit breaker distribution and integral TVSS and ground fault. The main switchboard shall be located in a Main Electrical Room. Include the following;
  - Electrical service shall be provided underground from the Utility pad mount transformer in schedule 40 PVC conduit. When crossing roadways, sidewalks, etc, concrete encased conduit shall be provided.
  - All conductors shall be copper.
  - Run 1#4/0 copper in 1 ¼-inch conduit each from the main switch to the water main, gas main, and sprinkler main, building steel.
  - Run 1#4/0 copper from the main switch enclosure to (3) ¾"x10' ground rods driven at the exterior of the building and 1#4/0 copper from the main switch to the concrete footing rebar.
  - Provide (4) 4"C from the utility company point of connection to the equipment backboard for the Telephone, Cable Television services and Network interface cabling.
  - Shunt trip device for first responder (Fire Department) to disconnect building power.
2. The building shall be provided with 400Kw emergency / standby diesel generator, 60Hz, 1800RPM, 3phase 208Y/120Volt, with weatherproof sound attenuated enclosure and tank capable of providing 36 hours of run time. Provide two circuit breakers, one 100Amp 3pole for ATS #1- Life safety/ Emergency lighting requirements, one 400Amp 3pole for ATS #2 - standby load requirements.

### **Distribution**

1. The building shall be provided with panelboards and feeders as follows:
  - Main Electrical Room shall contain:
    - 3000A, 208/120V main switchboard. Metering will be provided separately for lighting loads, receptacle loads, kitchen loads, and HVAC loads. Switchboard shall include TVSS device and ground fault.
    - One distribution panel (Lighting) shall be 208/120V, 3PH, 4W, 42-pole, 400amp main circuit breaker type.
    - One distribution panel (General Receptacle) shall be 208/120V, 3PH, 4W, 42-pole, 800amp main circuit breaker type.
    - One distribution panel (Mechanical Equipment) shall be 208/120V, 3PH, 4W, 42-pole, 800amp main circuit breaker type.

- One Life Safety distribution panel (Emergency Lighting) shall be 208/120V , 3PH, 4W, 42-pole, Bussman Quik-spec fusible type with 100Amp main switch.
- One distribution panel (Standby Load) shall be 208/120V, 3PH, 4W, 42-pole, 400amp main circuit breaker type.
- One general purpose panelboard (Lighting) shall be 208/120V, 3PH, 4W 42-pole, 100 amp main circuit breaker type.
- One general purpose panelboard (General Receptacle) shall be 208/120V, 3PH, 4W 84-pole, 250 amp main circuit breaker type.
- ATS #1 100Amp, 208/120V, 3phase- Life Safety / Emergency Lighting distribution.
- ATS #2 400Amp, 208/120V, 3phase- Standby Power load distribution.
- Main Boiler Room shall contain:
  - One general purpose panelboard (Equipment) shall be 208/120V, 3PH, 4W 42-pole, 400 amp main circuit breaker type.
  - One general purpose panelboard (Standby Equipment) shall be 208/120V, 3PH, 4W 42-pole, 200 amp main circuit breaker type.
- Lower Level Kitchen / Multi-Purpose Room / Cafeteria shall contain:
  - One general purpose panelboard (Kitchen Equipment/Receptacle) shall be 208/120V, 3PH, 4W 84-pole, 400amp main circuit breaker type.
  - One general purpose panelboard (Standby Equipment/Receptacle) shall be 208/120V, 3PH, 4W 30-pole, 100 amp main circuit breaker type.
- Main Level Remote Electrical Room
  - One general purpose panelboard (Lighting) shall be 208/120V, 3PH, 4W 42-pole, 100 amp main circuit breaker type.
  - One general purpose panelboard (General Receptacle) shall be 208/120V, 3PH, 4W 84-pole, 250amp main circuit breaker type with integral transient voltage surge suppression.
  - One general purpose panelboard (Emergency Lighting) shall be 208/120V, 3PH, 4W 42-pole, Fusible Branch with 50Amp main switch (Bussman Quik- spec) type.
- Upper Level Remote Electrical Room
  - One general purpose panelboard (Lighting) shall be 208/120V, 3PH, 4W 42-pole, 100 amp main circuit breaker type.
  - One general purpose panelboard (General Receptacle) shall be 208/120V, 3PH, 4W 84-pole, 250amp main circuit breaker type with integral transient voltage surge suppression.

- One general purpose panelboard (Standby Equipment/Receptacle) shall be 208/120V, 3PH, 4W 30-pole, 400 amp main circuit breaker type.
  - One general purpose panelboard (Equipment) shall be 208/120V, 3PH, 4W 42-pole, 400 amp main circuit breaker type.
  - Gymnasium
    - One general purpose panelboard (Lighting) shall be 208/120V, 3PH, 4W 42-pole, 100 amp main circuit breaker type.
    - One general purpose panelboard (General Receptacle) shall be 208/120V, 3PH, 4W 42-pole, 100amp main circuit breaker type with integral transient voltage surge suppression.
3. Branch circuits shall be installed in EMT conduit. Type MC cable shall be limited to concealed spaces above finished ceilings in classrooms or drywall type partitions after first device. EMT conduit shall be used to the first device in a branch circuit and shall be used in all masonry or CMU partitions.
- (8) Duplex receptacles and (5) quadruplex receptacles per classroom, (4) circuits per classroom.
  - (4) Floor boxes with power (2) circuits and data per classroom.
  - (3) Duplex receptacles and (1) quadruplex receptacle per office, (1) circuit per office. Selected receptacles per office will be provided with USB charging ports.
  - (24) Floor boxes with power, (3) circuits and data in the Library/Computer Hub.
  - (1) Duplex receptacle (GFCI type) mounted above sink in each toilet room.
  - (4) Duplex receptacles, (8) quadruplex receptacles, (6) L5-20R twist-lock receptacles per MDF room, (9) circuits per MDF.
  - (4) Duplex receptacles, (5) quadruplex receptacles, (4) L5-20R twist-lock receptacles per IDF rooms, (4) circuits per IDF rooms.
  - All receptacles located in public and student areas are to be tamperproof type.
  - Circuits for all HVAC equipment as required including radon system components. 120V Wiring to control panels, control transformers, etc shall be provided by the electrician while low voltage control wire shall be included in division 23.
  - Circuits for all plumbing equipment.
  - Circuits for the Fire Alarm Equipment and Sound Equipment as required.
  - Circuits for office equipment as required.
  - Circuits for security system and devices as required.

### Areas of Refuge

1. Master annunciator with two-way voice communication located in a constantly attended location, two-way voice communication station at each area of refuge location, and a dedicated outside telephone line to report to local emergency services.

### Fire Alarm System

1. The building will be provided with an addressable fire alarm system in compliance with code requirements and ADA regulations. Voice evacuation shall be provided throughout the building. The system shall be provided with a fire alarm control panel with a Zetron panel to contact the local fire department. Manual pull stations with lexan pull station guards shall be installed in the egress paths at exterior doors and at entrances to stairwells. Audible and visual signaling devices shall be installed in classrooms, corridors, large toilets, etc. Visual-only signaling devices shall be installed in all conference rooms, work rooms, small toilet rooms, etc. The system shall include the following equipment:
  - Remote annunciator mounted at main entry doors and secondary entry doors.
  - (1) Speaker/75 candela strobe in all classrooms 900sqft or less.
  - (2) Speaker/75 candela strobes in all spaces occupied by students that are 901 to 1600 square feet.
  - Speaker/75/15candela strobes within the corridors, 40-50feet on center.
  - Speaker/ 110 candela strobe units with voice evacuation equipment shall be provided in the Gymnasiums/Cafeteria/ Multi-purpose room.
  - Monitoring modules for sprinkler tamper and flow switches.
  - (2) Duct smoke detectors for each air-handling unit, (1) in the supply, and (1) in the return duct. Test switches shall be located in accessible locations.
  - Signal to BMS system for fan shut-down, and damper actuation on alarm condition.
  - Magnetic door hold-open devices at all required corridor doors, connected to the FACP.
  - Smoke detector within five feet of both sides of the corridor doors with magnetic hold-opens, where required by building fire separation.
  - Monitor module for Food Service Hood fire extinguishing system (Ansul System).
  - All fire alarm system wiring shall be plenum rated fire alarm MC cable where concealed and EMT conduit with type THHN wire where exposed.
  - Smoke damper (smoke detector) connection to the fire alarm system where ductwork passes through smoke rated walls
  - Carbon monoxide sensors will be provided in the Mechanical rooms where fossil fuel burning equipment is located.

### Lighting Systems

1. Exit signs will be self-contained, universal mounted, LED illuminated, low energy usage fixtures.
2. Typical illumination levels include:
  - a. 15fc - Corridors, toilet rooms, storage rooms, stairways.
  - b. 35 - 45fc – Offices, Conference rooms and utility rooms.
  - c. 45 – 50fc – Classrooms, music suite, art suite, technical education, science room, food service.
  - d. 50fc – Gymnasium/Cafeteria/Multi-purpose Rm.
3. The following fixtures will be provided:
  - 2' x 4' recessed LED parabolic fixtures in each classroom and other select locations. Typical classroom (900sqft or less) will have 3 rows of 3 fixtures parallel to the teaching headwall, typical classrooms ( greater than 900sqft) will have greater than 3 rows of fixtures parallel to the teaching headwall. (Refer to attached cut sheets).
  - 2' x 4' recessed high efficiency architectural LED fixtures in office/work areas, and other select locations (Refer to attached cut sheets).
  - 2' x 2' recessed high efficiency architectural LED in corridors. (Refer to attached cut sheets).
  - 1' x 4' surface / pendant mounted industrial LED fixtures with wire guards in utility spaces. (Refer to attached cut sheets).
  - 1' x 4' surface mounted wraparound LED fixtures in storage spaces. (Refer to attached cut sheets).
  - Pendant direct LED fixtures in Gymnasium. (Refer to attached cut sheets).
  - Pendant direct LED fixtures in Cafeteria/Multi-purpose Rm. Fixtures shall have integral dimming and DMX control protocol. (Refer to attached cut sheets).
  - 2' x 2' recessed high efficiency architectural LED fixtures and 6" wide recessed LED perimeter light fixture at the mirror in toilet rooms.
  - 1' x 4' surface / pendant mounted industrial LED fixtures with wire guards in mechanical and electrical rooms. (Refer to attached cut sheets).
  - 1' x 4' surface mounted wraparound LED fixtures in MDF and IDF rooms. (Refer to attached cut sheets).
  - Accent and feature lighting shall be provided as selected by the Architect, in areas such as corridors, main lobby etc.
4. Daylight sensors and dimming control shall be provided in all classrooms and other select rooms containing exterior window walls. The light fixture row closest to the window wall will be dimmed via a daylight sensor. The remaining rows of lights will be able to be manually dimmed by the occupants via a multi-button switch. There will be one master on/off toggle

switch for all the lighting in the room. This will allow turning off the lights and overriding the sensors. Lighting control wiring to be low voltage. Lighting control system by Crestron GLPAC or GLPP series or equivalent.

5. Occupancy sensors shall be provided in all lit areas except in utility rooms and other rooms exempted by code.
6. Occupancy sensor switches with wall override shall be provided in all small offices, single occupancy toilet rooms, storage rooms and janitors closets.
7. Corridor and stairwell lighting shall remain on during occupied hours, but will be controlled by occupancy sensors during unoccupied times. This will require communication with the building management system.
8. Site lighting will be as follows:
  - a. Parking lot lighting shall be accomplished using pole mounted, 120V, LED fixtures on 60 foot centers. Fixtures to be full cut-off type and will be fed from a site lighting relay panel and shall be controlled by the building management system and photocell arrangement.
  - b. Walkway lighting shall be accomplished using 3' high bollards, 120V, LED on 20 foot centers. Fixtures will be fed from the site lighting relay panel and shall be controlled by the building management system.
  - c. All egress doors leading directly to the exterior of the building shall have 2-LED array, 2-LED driver fixtures mounted above.
9. Gymnasium lighting shall be controlled via occupancy sensors or lighting control system by Crestron GLPAC or GLPP series or equivalent.
10. Illuminated low level exit signs and handicap accessible exit signs shall be provided where required by code.
11. The Cafeteria / Multi-purpose room shall be provided with a dimming system as follows:
  1. Theatrical lighting control by ETC or equivalent.
  2. System shall have DMX protocol and consist of factory pre-assembled control panel, low voltage wall stations, and control interfaces.

### **Materials and Methods**

1. Include the following basic materials and methods of construction:
  - Wiring shall be THHN/THWN copper, installed in EMT conduit for general circuits.
  - Wiring located in the nurses area shall comply with Article 517 of the 2017 National Electrical Code.
  - Type MC cable shall be used as prescribed in sections above.

- Devices shall be specification grade, NEMA 5-20R etc.
  - Disconnect switches shall be fusible heavy-duty type. NEMA 1, 3R or 4X as required for locations installed.
  - Circuit breakers shall be fixed element, thermal magnetic type.
  - Panelboards shall have copper bussing, with hinged, lockable, door-in-door trim.
  - Branch circuit breakers shall be bolt-on type.
  - All conduits, circuits and devices shall be labeled.
  - Conduits below slabs shall be schedule 40 PVC, with rigid steel conduit sweeps.
2. Include the following miscellaneous items:
- In all single occupant toilet rooms: emergency call light/bell mounted above the doors and associated call switches shall be provided.

#### **Lightning protection system**

1. Lightning Protection shall be provided by a UL Master Listed Lightning Protection System. System shall meet NFPA 780 requirements.

**Photovoltaic System (Add Alternate)** - Provide a 105 kilowatt roof mounted photovoltaic system consisting of the following:

1. (300) polycrystalline, aluminum framed, 350 Watt modules.
2. The modules will be organized in fifty six (24) strings of thirteen (13) panels for a total system size of 105KW.
3. A NEMA3R panelboard will be located on the roof at a strategic location for the back-feed and distribution of solar strings. The panelboard will be sized accordingly, and provided with 20A/2P circuit breakers per string.
4. The Solar Photovoltaic system will be micro-inverter based, by Enphase or equivalent. DC-to-AC conversion will take place at the solar module level via micro-inverters, mounted under each solar module.
5. The modules will be mounted to a self-ballasted racking system that will not require any roof penetrations by Aerocompact or equivalent. The entire system weight including modules shall not exceed 5lbs per square foot and shall be rated at 110mph wind load. Existing structures will require further structural load analysis.
6. The system shall be equipped with a web based monitoring system that will monitor irradiance, temperature, module temperature, and power production as manufactured by Enphase or equivalent.
7. The system will be equipped with a front end display (32" LCD Monitor) mounted at the front lobby of the school that will display the monitored points in real time and history including past day, month and year to date.

8. Net metering and installation will be per the Utility Company requirements and include a system disconnect switch at the utility meter location.

An owners KWH meter shall be provided as well as lightning surge protection on the DC and AC sides of the Solar Photovoltaic System.

### **Energy Conservation**

9. All new equipment specified, shall be designed per the 2015 International Energy Conservation Code.
10. Through the use of the building management system (BMS), occupied/unoccupied cycles shall be established to avoid unnecessary energy consumption.

### **Code Compliance**

11. All electrical systems will be designed in accordance with the State of Connecticut Building Code and high performance standards, the State of Connecticut Fire Safety Code, the 2015 International Energy Conservation Code, Americans with Disabilities Act and the National Electrical Code 2017 edition, 504 and UFAS.

## **DIVISION 27-TELECOMMUNICATION SYSTEMS**

### **Services**

1. Three (4) 4" underground conduits shall be provided for telecommunication services. These conduits shall run from either a utility pole on the street, or the nearest campus utility distribution manhole to the building MDF (if applicable). Exact routing of conduit shall be coordinated with, and dictated by the owner's IT representative. Conduits shall include the following:
  - a. (1) 4" conduit for telephone (copper pairs)
  - b. (1) 4" conduit for fiber
  - c. (1) 4" conduit for cable TV
  - d. (1) spare 4" conduit
2. Service cabling shall be provided by the appropriate utility company.
3. Any dedicated campus fiber cabling will be provided by owner.

### **Telecommunication Rooms & Pathways**

1. The building will contain one (1) primary telecom room (MDF) and four (4) satellite telecom rooms (IDFs).
2. The MDF is anticipated to be located adjacent to the main electrical room (exact location to be coordinated with Architect).
3. The MDF will contain the following:



- a. Space on the wall for utility company demarcation equipment.
  - b. (2) 2-post, free standing equipment racks for LAN distribution. One of these racks will be used to house owner-provided networking equipment (firewalls, routers, etc.) and a fiber optic distribution patch panel.
  - c. (1) 4-post, free standing equipment cabinet for the housing of building security and other communication system head-ends.
  - d. (2) 4-post, free standing equipment cabinets for owner-provided server equipment.
  - e. Cable management and power distribution for each rack.
  - f. Patch panels and other passive equipment for the routing of horizontal cabling.
  - g. Overhead ladder type cable tray around room and over racks. Dedicated receptacles shall be mounted to the side rails of this ladder tray for the powering of racks.
  - h. Class A fire-rated, 3/4" thick plywood on all walls around room to 8'-0" AFF.
  - i. Minimum of (2) quad receptacles on each wall of room with dedicated 20A/1P circuits. Power will be provided to rack UPS's as required.
  - j. Telecommunications main ground bar and grounding backbone per EIA/TIA-607 standards.
4. Three IDFs shall be located throughout the building (exact locations to be coordinated with Architect). Each IDF shall contain the following:
- a. (2) 2-post, free standing equipment racks for LAN distribution.
  - b. Cable management and power distribution for each rack.
  - c. Patch panels and other passive equipment for the routing of horizontal cabling.
  - d. Overhead ladder type cable tray around room and over racks. Dedicated receptacles shall be mounted to the side rails of this ladder tray for the powering of racks.
  - e. Class A fire-rated, 3/4" thick plywood on all walls around room to 8'-0" AFF.
  - f. Minimum of (2) quad receptacles on each wall of room with 20A/1P dedicated circuits. Power will be provided to rack UPS's as required.
  - g. Telecommunications ground bar and grounding backbone per EIA/TIA-607 standards.
5. The following items located in the MDF/IDFs will NOT be included in the project and shall be provided by owner or outside vendor.
- a. Network switches, routers, firewalls, servers, other active electronic equipment.
  - b. Uninterruptible Power Supplies for the racks.

- c. Head end equipment for the VOIP system.
6. A fiber optic backbone shall be provided between the MDF and each IDF. This shall include the following:
    - a. 12 strand OM4 Multimode fiber optic cable routed via innerduct.
    - b. 12 strand OS2 Single mode fiber optic cable routed via innerduct.
    - c. Fiber optic patch panels and splicing cassettes in each telecom room.
    - d. Fiber optic innerducts shall be run above ceiling in corridors. When rising up to the second floor, all necessary conduit sleeves and firestopping will be provided. Innerduct shall be 1-1/2" in diameter.
  7. Horizontal cabling from the MDF/IDFs to outlets/work stations shall be included in the project. This structured cabling system shall include the following:
    - a. Cabling for data, VOIP, wireless access points, and security system components. All cabling shall be Cat. 6 UTP.
    - b. J-Hooks shall be located above ceiling in the corridors for the routing and support of all telecommunications cabling.
    - c. Data and VOIP station outlets. These shall include backboxes, connectors, faceplates, and all required accessories. Horizontal cabling shall be routed to station outlets from corridor cable trays via above-ceiling J-hooks supporting the cables every 5 feet. Cabling shall be routed within wall cavity down to station outlets via 1" EMT conduits. Locations of all outlets will be coordinated with the owner's representative.
    - d. A copper pair telephone system. This system shall be used for fire alarm, security system, elevator, BMS, and fax machine interfacing, along with any dedicated emergency lines requested by the owner. Copper pairs shall be routed from interface/emergency jack locations back to 110 punch-down blocks located at the utility company demarcation point. All associated faceplates, connectors, etc. shall be included in the project.
    - e. A cable television system. CATV outlet locations shall be coordinated with the owner's representative. Cabling shall be routed from the outlet back to the cable company demarcation point via RG6 cables. All associated faceplates, connectors, etc. shall be included in the project.
    - f. The utility company demarcation point shall be located in the MDF. All required conduits for fiber optic, copper pair, and CATV backbone cables will be included in the project and designed by CES. Sizes and quantities will be coordinated with the appropriate utility company. Backbone cabling, punch-down blocks, connection nodes, and all other service equipment will be provided by the utility company.
    - g. Conduit sleeves through fire-rated floors and walls. These shall be sized to accommodate all horizontal cabling with contingency for future use.

8. Computers, VOIP telephones, and other user-end equipment will NOT be included in the project and shall be provided by owner or outside vendor.

### **Wireless Networking System**

1. Full wireless network coverage shall be provided throughout the building.
2. Cat.6 wiring will be provided to all wireless access devices. Location of devices will be coordinated with heat mapping diagrams provided by the owner's representative.
3. Devices will NOT be included in the project and shall be provided by owner or outside vendor.

### **Paging and Wireless Clock**

1. A wireless clock system will be provided in classrooms and common rooms throughout the building. The system will consist of transmitters and clocks. Clocks will be plugged into recessed simplex receptacles.
2. The building shall be provided with a Public Address system throughout the corridors, classrooms, kitchen, administrative areas, and common rooms.
3. Paging and clock head-end equipment shall be located in the MDF.
4. Interconnection between the public address and VOIP systems shall be provided to allow paging via desk phones. Paging zones will be coordinated with the owner's representative.
5. Speakers located in areas with grid ceilings shall be self-amplified, 2x2 lay-in type.
6. Speakers located in areas with exposed structure shall be self-amplified, pendant type.
7. Speakers located in areas with gypsum ceiling shall be self-amplified, round lay-in type.
8. Speakers shall also be wall-mounted on the building's exterior. Locations of these speakers shall be coordinated with the owner's representative.

### **Audiovisual Systems**

1. A combination Short-throw projector / Interactive whiteboard / Display system is anticipated to be provided in each classroom, and at additional locations determined by the owner's representative. Short-throw projector / Interactive whiteboard / Display system will NOT be included in the project and shall be provided by owner or outside vendor. CES will provide all necessary infrastructure for the system as listed below.
2. A wall-plate style HDBASE-T transmitter and receiver system, and associated CAT6 wiring will be provided for each Short-throw projector / Interactive whiteboard / Display system in each classroom, and at additional locations determined by the owner's representative. Each HDBASE-T A/V interface station will have connections for HDMI, VGA, USB, and audio inputs. Locations to be coordinated with architect and owner's representative.
3. An HDBASE-T transmitter and receiver system, and associated CAT6 wiring will be provided for each projector in the project. Each HDBASE-T A/V interface station will have connections

- for HDMI, VGA, USB, and audio inputs. Locations to be coordinated with architect and owner's representative.
4. A wall mounted keypad controller will be provided for each projector. This will allow the user to turn the system on/off and switch between inputs.
  5. In-wall audiovisual cabling will be provided for the interconnection of the system transmitters, controllers, and receivers. Cabling will be provided in conduit.
  6. A sound reinforcement system will be provided in each classroom. This will consist of the following:
    - a. Two (2) ceiling-mounted recessed loudspeakers per room.
    - b. Flushed wall-mounted amplifier with integral volume controls located on the teaching wall.
    - c. Two (2) IR wireless microphones with charging station and batteries.
    - d. Audio connection to the projector system.
    - e. Assisted listening equipment required by code.
  7. In areas of assembly where ceiling mounted projectors are required, the projector, mounting equipment, and all AV infrastructure will be included in the project and designed by CES.
  8. A specialized sound system will be designed and provided by CES to support the cafeteria/cafeterium and gymnasium. The system will contain the following equipment:
    - a. Digital and Analog head-end controls (mixer, DSP, touchscreen control pad, etc.)
    - b. Amplifiers sized to accommodate the number of speakers being used.
    - c. CD player
    - d. iPod docking station
    - e. AM/FM/XM tuner
    - f. Fire alarm / paging override relays
    - g. Any ADA required equipment
    - h. Remote microphone wall jacks, in locations determined by owner
    - i. Any other equipment required by owner (wireless mics, mobile equipment racks, etc.)
  9. Loudspeakers will be provided in each room equipped with a local sound system. Mounting and finish of speakers will be coordinated with ceiling type. These speakers will be used for both local sound and paging- controlled via relay.

10. A digital signage system will be provided throughout the building. This system will utilize a head-end HDMI-over-Cat.6 extender located in the main admin area, and monitors located per the owner's direction.
11. A video conferencing system is anticipated to be provided in one conference room within the project. This system will consist of an all-in-one control unit, combination microphone/camera, LCD screen, audiovisual transmitter/scaler (for displaying computer data on the same screen), amplifier and overhead speakers. All system components will be housed in a rack within the conference room. Any associated server or VOIP communication equipment will be furnished by owner and located within the MDF.

## **DIVISION 28 – ELECTRONIC SAFETY AND SECURITY**

### **Access Control**

1. A complete card reader based Access Control system will be provided. Access controlled door locations will be coordinated during design for appropriate coverage.
  - a. Anticipated tentative locations include:
    - i. Entrances to the building.
    - ii. The MDF and IDF rooms.
2. Card readers shall be wired back to an access control system head-end. The head-end panel shall have a network connection, allowing control of the system over the building's LAN. All head-end equipment will be located in the MDF. All wiring and other system accessories will be included in the project and designed by CES.
3. Interfacing with the access control system shall be accomplished using computers located in the administrative areas. Software licenses for this system shall be included in the project and specified by CES. Computers will NOT be included and must be provided by owner or outside vendor.
4. All required power supplies for card readers and local controllers will be included in the project and designed by CES.
5. Electric latches and power supplies for latches will NOT be included in the CES scope of work. These must be provided by division 8 (door hardware). Wiring to the latch will be included.
6. Door intercom stations equipped with buzzer, camera and microphone will be provided at the main entrances to the building. These stations will communicate directly with master stations located in the main office, where the control of the door will be accomplished. At the master station, the operator will be able to see and talk to the person at the door.

### **Intrusion Detection**

1. A complete intrusion detection / burglar alarm system shall be provided throughout the building, equipped with door contacts and motion sensors.
2. Door contacts shall be located at each access-controlled door, and at other locations determined by the owner's representative.

3. Ceiling mounted motion sensors shall be located in the corridor on the main floor.
4. Door contacts, motion sensors, and glass-break detectors will be armed/disarmed via keypads located at various entrances to the building.
5. All intrusion detection head-end equipment shall be located in the MDF. System expansion modules will be located in the IDFs.

### **Video Surveillance**

1. A complete Closed Circuit Television system will be provided and laid out to allow video surveillance of the building interior and exterior. Tentative locations of cameras include the following (exact locations will be coordinated with the owner's representative):
  - a. Each egress door.
  - b. Cafeteria
  - c. The MDF and IDFs.
  - d. Gymnasium.
2. Fixed position cameras with digital pan-tilt-zoom will be provided. Cameras will be both ceiling and wall mounted, depending on the location.
3. All cameras will be power-over-Ethernet, and operated via the building's LAN. Cat.6 UTP cables will be provided to each camera location. All Cat.6 cables will be routed back to dedicated patch panels in the MDF's security rack.
4. A video management system will be designed and specified by CES. This system will include an NVR, hard drive, and recording software. All video management hardware will be housed in the MDF's security rack.
5. The CCTV system will be standalone, and NOT integrated with the access control/ intrusion detection system. This system will be controlled via a separate user-interface on any computer in the building with software installed.
6. Two (2) 48" screens and a single computer workstation will be included to display views from specific cameras throughout the building. The workstation will have the capability of handling multiple displays via hardware with additional software settings. Location of the displays to be coordinated during design.
7. The amount of stored video data will be coordinated with all local regulations and owner's staff.