SECTION D SERVICES

D10 CONVEYING

D1010 Elevators and Lifts

D1010.01 Elevators

Manufacturer: Kone, Otis, Schindler, Thyssen

Hydraulic passenger elevator.

- Capacity: 3500 pounds.
- Travel: 2 landings; approximately 14'-0" rise.
- Car Inside Dimensions: To meet requirements of the Massachusetts Elevator Code, 17.40 and the Massachusetts Architectural Access Board (MAAB); nominal 6' 8" wide by 5'-5" deep.
- Speed: 125 fpm.
- Car and Hoistway Doors: Center opening.

D20 PLUMBING

D2000 Overview

D2000.01 Scope of Work

Scope of work will include the installations of new systems to accommodate the new space configurations:

- Plumbing fixtures and trim.
- Domestic cold water and hot water distribution systems.
- Sanitary waste and vent systems.
- Storm water drainage system.
- Natural gas system.

D2000.02 Codes and Standards

Massachusetts Plumbing and Fuel Gas Code, 248 CMR

Massachusetts State Building Code 780 CMR, Seventh Edition

Massachusetts Fire Prevention Code 527 CMR

D2010 Plumbing Fixtures

Plumbing fixtures will be mounted in accordance with the plumbing code, and industry standards. Fixtures designated as "accessible" will be mounted in accordance with the regulations of the Massachusetts Architectural Access Board (MAAB) and the Americans with Disabilities Act Architectural Guidelines (ADA). As required by MAAB and ADA, a percentage of water closets, urinals, lavatories, sinks, drinking fountains and showers will be made accessible.

D2010.01 Water Closets

Institutional grade white vitreous china, wall hung, with open front white plastic seat with self-sustaining check hinge. Water closets will be mounted on commercial grade, floor supported chair carrier.

Water closets in toilet rooms will be provided with dual flush valves and will use either 0.8 or 1.6 gallons per flush.

- Basis of Design: Toto Model #CT708E water closet with Sloan uppercut flush valve, with Model #SC534 seat.

D2010.02 Urinals

Institutional grade, white vitreous china, wall hung 0.5 GPF. Toilet rooms will be provided with rechargeable battery-operated, electronic, automatic flush valves. Fixtures will be mounted on commercial grade, floor supported chair carriers.

- Basis of Design: Sloan Model #UT104E urinal with Model #TEU1LN, 0.5 gpf battery operated automatic flush valve.

D2010.03 Lavatories

Institutional grade, white vitreous china, wall-hung type, with front overflow for individual staff and kitchen staff toilet rooms. Those fixtures designated as accessible will have the exposed water and waste piping below the fixture insulated with pre-molded type insulation.

- Basis of Design: Toto Model #LT307.4 lavatory with 4" faucet centers and Toto Model #TEL5GSC-10 faucet (10 second run time) with vandal resistant aerator and concealed thermostatic mixing valve with locked access panel.

D2010.04 Sinks

Ceramics: Commercial grade, 18 gauge, Type 302 stainless steel, counter-mounted, with gooseneck faucet and wrist blades.

- Basis of Design: Elkay Model LRAD 2521, 3-hole, 6"deep with Chicago Faucet Model 201-GN2A-E3-317. Provide plaster trap for each sink, Jay R. Smith Model 8710 or 8730.

Teacher's work room and classrooms: Commercial grade, 18 gauge, Type 302 stainless steel, counter-mounted, with gooseneck faucet and wrist blades. Drinking fountains provided at all classroom sinks.

- Basis of Design: Elkay Model LRAD 2521, 3-hole, 6"deep with Chicago Faucet Model 201-GN2A-E3-317.

D2010.06 Drinking Fountains/Coolers

Institutional grade, wall hung, stainless steel finish, self-contained electric water cooler type, dual height to satisfy Massachusetts Architectural Access Board (MAAB) requirements.

- Basis of Design: Halsey Taylor Model OVL-II SER-Q.

D2010.07 Mop sinks

Floor mounted, mop service basins, molded plastic composition, with stainless steel grid drain, chrome plated mixing faucet, bumper guards on basin rim, and stainless steel wall splash guard.

- Basis of Design: Fiat MSB-2424 with E-77 Bumper guards, MSG2424 stainless steel wall guards and 832-AA hose and hose bracket. Faucet to be Chicago #445CR 20089.

D2010.08 Emergency Plumbing Fixtures

Mechanical Rooms: Emergency shower and eyewash units will be free-standing, stanchion type in mechanical areas and recessed type in classrooms with Science component.

- Basis of Design: Haws 8309

Nurse's Suite: Eyewash unit to be wall mounted, recessed pull down cabinet.

- Basis of Design: Haws 7657WC.

D2010.09 Other Plumbing Fixtures

Exterior wall hydrants will be strategically placed around the building and mounted approximately 18 inches above grade. Units will be non-freeze type with integral vacuum breaker.

- Basis of Design: Jay R. Smith Model 5560QT recessed box

Interior hose bibbs, with loose key and integral vacuum breakers, shall be provided at all Toilet rooms (except single person type), Mechanical rooms, and rooms with floor drains.

- Basis of Design: Chicago #952-1/2CP for toilet rooms and Chicago #998-RCF for mechanical rooms.

- Can Washer in Custodial Area.

D2020 Domestic Water Distribution

D2020.01 Cold Water

Domestic cold water will be supplied from an onsite public well. Service entrance will be equipped with a strainer, backflow preventer and water meter that meets the requirements of the local water department. Water will be stored in a 500 gallon tank, sized for peak demand and distributed by a duplex booster pumping system. The water will be filtered and treated with water softeners prior to use, as the water quality has been problematic at the existing schools in this area.

Separate backflow preventers will be provided as needed for equipment and systems such as heating boilers, ice machines, dishwashers, and non-potable water systems.

NOTE: Connection to an Assabet Water pressurized water main is being considered. A storage tank, booster pump system, and water treatment will not be needed if a decision is made to have water delivered by Assabet Water.

D2020.02 Hot Water

Domestic and protected hot water will be provided by two ASME gas-fired condensing type water heaters in parallel. Each heater will be sized to provide 66% of the demand. Water will be delivered at 140 degrees Fahrenheit to the kitchen and 120 degrees Fahrenheit to all other fixtures throughout the school. Lavatories and showers will have integral temperature limit stops and/or point-of-use mixers to provide 110 degrees Fahrenheit maximum temperature.

Hot water will be pre-heated by rejected heat from the HVAC chiller heat recovery system.

All domestic hot water supply systems will be circulated using bronze circulating pumps controlled by immersion aquastats.

Heat tracing for hot water temperature maintenance will be provided on hot water supply piping where needed as a supplement to or substitution for hot water recirculation to insure hot water delivery.

D2020.03 Piping Insulation

Insulation will be applied to cold water, hot water, hot water return, Insulation will be continuous through supports and include a vapor retarding jacket. Insulation for cold water piping 1" and smaller will be 1/2" thick. For cold water piping 1-1/4" and larger will be 1" thick. For hot water and hot water

return piping, insulation shall be 1"thick. Insulation shields will be installed to protect insulation at all pipe hangers.

D2030 Sanitary Waste

D2030.01 Waste and Vent Piping

Piping will be designed to collect liquid wastes from all plumbing fixtures, equipment, and drains requiring waste connections. Horizontal collection of the vertical stacks will be primarily below the first floor slab, to minimize the potential for interference with work of other trades.

Several building drains will exit the building and connect by gravity to the site sanitary sewer system 10"-0" outside the building.

Kitchen wastes will be piped separately by gravity to 10'-0"outside the building. Extension to exterior grease traps will be provided by the general contractor. Kitchen waste and vent piping to and from the exterior grease traps will be cast iron.

D2030.02 Waste Piping Specialties

Floor drains will be cast iron body construction, heavy duty grade, PDI approved. Those for use in toilet rooms and other finished spaces shall be rough bronze exposed finishes. Those for use in mechanical rooms and other unfinished spaces will be all cast iron.

Point-of -use grease traps will be provided to receive waste discharge at the kitchen triple pot sink. The grease trap will be floor mounted. The unit will be PDI and ASSE approved and equipped with automatic collection device. All other kitchen waste will be conveyed to an exterior grease trap.

Indirect waste piping receiving cold liquid waste and subject to condensation will be provided with 1/2" thick insulation.

D2040 Storm Water Drainage

The system will collect discharge of storm water from all roof drains. Where possible, the pipe routing will run directly from the roof drain locations, vertically down at building columns or chases and be collected below the first floor slab. Several building drains will extend by gravity to 10'-0" outside the building.

Roof drains will be cast iron construction, heavy duty, with flashing clamp for membrane roofing, under deck clamping device, and aluminum domes.

Insulation will be applied to all horizontal storm water piping and roof drain bodies to prevent condensation. Insulation will be 1/2" thick and be continuous through supports and include a vapor retarding jacket. Insulation shields will be installed to protect insulation at pipe hangers.

A secondary overflow roof drainage system will not be required.

D2050 Natural Gas System

The permanent natural gas service will be brought to the exterior of the building by the gas company and include a meter and primary pressure regulator as needed.

From the outlet of the meter/regulator set, natural gas piping will be extended throughout the building and serve all equipment requiring gas service. Gas pressure within the building will be low pressure, under 1/2 psig (14"wc).

The primary gas utilization equipment will be boilers, make-up air units, rooftop HVAC equipment, kitchen cooking appliances and central domestic and protected water heating equipment.

Gas piping to cooking equipment will have a mechanical, emergency gas shut-off valve that will automatically close upon operation of the kitchen exhaust hood fire suppression system. A solenoid valve with shut-off gas flow to equipment when the exhaust fans are turned off.

D2060 OTHER PLUMBING SYSTEMS

D2060.04 Trap Primers

Trap primer systems will provide make-up water to fixture and drain traps where necessary to maintain liquid trap seals. In general, trap primers will automatically operate based upon pressure fluctuation in the cold water system. Where multiple traps in one area require trap priming, an electric, time clock-operated automatic trap primer will be used.

Insulation will be applied to all trap primer piping above and below ground. Insulation will be continuous through supports and include a vapor retarding jacket. Insulation for trap primer piping will be 1/2" thick. Insulation shields will be installed to protect insulation at all pipe hangers.

D2090 PLUMBING SYSTEM MATERIALS

D2090.01 Pipe and Fittings

Buried exterior water systems: Class 52 cement-lined ductile iron pipe with restrained mechanical joints.

Buried interior water system; Type K copper with brazed copper joints.

Above ground water piping: Type L with 95/5 soldered copper joints.

Buried storm, sanitary waste and vent: Cast iron bell and spigot with neoprene gasket joints.

Above ground storm, sanitary waste and vent: No-hub cast iron with Mass. approved stainless steel clamps. Two inches and smaller may be type DWV copper with soldered copper drainage pattern fittings.

Natural Gas: 2" and smaller shall be Schedule 40 black steel with malleable iron threaded fittings. 2-1/2" and larger shall be Schedule 40 black steel with welded joints.

D2090.02 Valves

Water: Shut off and balancing 3" and smaller shall be full port ball valve, bronze body, chrome-plated bronze ball. Shut off larger than 3" shall be iron body, bronze mounted, inside screw, non-rising stem gate valve.

Water: Check valves shall be bronze body, bronze swing disc.

Natural Gas: Two inches and smaller shall be Massachusetts approved threaded bronze ball valve. Larger than 2" shall be semi-steel, lubricated, wrench operated, plug valve.

D30 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

D3000 Design Basis

D3000.01 Reference Standards

- The Massachusetts State Building Code, Seventh Edition.
- International Mechanical Code (IMC), 2003.
- International Energy Conservation Code (IECC), 2003.
- NFPA 101 - Life Safety Code.
- Guide Books of The American Society of Heating, Refrigerating and Air Conditioning Engineers.

D3000.02 Outdoor Design Conditions

Summer: 87 degrees Fahrenheit db/74 degrees F db

Winter: 7 degrees Fahrenheit

Source: Massachusetts State Building Code Chapter 13; Seventh Edition.

D3000.03 Indoor Design Conditions

Summer Cooled areas: 72 degrees Fahrenheit db/50% Relative Humidity.

Non-Cooled Spaces: Ventilated with no humidity control.

Winter All spaces: 72 degrees Fahrenheit db/no humidity control.

D3000.04 Outdoor Air Ventilation

Minimum outside air will be introduced as required by the greater of ASHRAE Standard 62 1-2004, "Ventilation for Acceptable Indoor Air Quality," International Mechanical Code 2006, or the requirement to make up exhaust air.

D3010 Energy Supply

D3010.01 Gas Supply System

The boilers and kitchen rooftop make-up air unit shall be gas-fired.

D3010.02 Cooling Energy/Supply

Air cooled chillers and administration area packaged roof top unit will be direct expansion, electrically powered.

D3020 Heat Generation/Heat Generating Systems

D3020.01 Water Boiler Plant

The boiler plant will be a hybrid plant located in the mechanical room, above the building services space. The plant will be configured with gas-fired condensing boilers sized to serve the off-peak load that occurs in spring and fall and with gas-fired non-condensing boilers sized to serve the incremental load up to the peak heating load. Each boiler will have a constant-volume primary pump to serve a primary loop. The secondary loop will include two pumps (one as primary and one standby) with VFD control to serve the building load, which will have 2-way modulating valves for each terminal unit; a modulating bypass valve will be installed to ensure minimum flow is maintained at low-load conditions.

The boilers as well as the gas-fired DHW heater will be vented through the exterior of building, provide separate flues for each boiler. Each gas-fired appliance will have a dedicated combustion air intake.

Condensing Boilers: Provide two 1,000 MBH input gas-fired condensing boilers with direct venting. Provide two constant-volume, inline pumps, each 70 GPM and 20 foot head, each pump to be dedicated to a single boiler.

Conventional Boilers: Provide two 2,000 MBH input gas-fired non-condensing boilers. Provide two constant-volume, inline pumps, each 140 GPM and 20 foot head, each pump to be dedicated to a single boiler.

Secondary Pump Loop: Provide two base-mounted pumps, each with VFDs and each rated at 300 GPM and 80 foot head (One as primary and one as standby). Provide a 3" modulating differential bypass valve to ensure minimum flow within the system at low-load conditions. New schedule-40 steel piping will provide distribution via the corridor ceilings throughout the school to terminal heating units. Controls to be provided separately through controls vendor, including valves and actuators.

Hydronic Specialties: Provide a 6" air separator, two vertical expansion tanks (bladder type) and a makeup water connection. Provide a propylene glycol fill system to maintain 30% propylene glycol in the hot water system.

Combustion and Ventilation Air: Combustion air shall be direct connected. Ventilation shall be provided by a roof mounted centrifugal fan, a wall louver shall provide outside air.

D3030 Refrigeration

D3030.01 High Efficiency Air Cooled Scroll Water Chillers

The chiller plant shall be sized to satisfy the cooling requirements for conditioning ventilation air and heat gain through the building envelope. The plant shall be configured with two nominal 90-Ton roof mounted air cooled chillers. Each chiller will have variable-volume primary pumps to serve a supply loop. The pump system will include three (3) pumps (two as primary and one standby) with VFD control to serve the building load, which will have 2-way modulating valves for each terminal unit; a modulating bypass valve will be installed to ensure minimum flow is maintained at low-load conditions.

Pumps: Provide three base-mounted pumps, each with VFDs and each rated 300 GPM and 80 feet head (two as primary and one as standby.) Provide a 4 inch modulating differential bypass valve to ensure minimum flow within the system at low load conditions. New schedule- 40 steel piping will provide distribution via the corrido4r ceilings throughout the school to rooftop units and unit ventilators (K/Pre-K.) Controls to be provided separately through controls vendor, including valves and actuators.

Hydronic Specialties: Provide an 8 inch air separator piped in a side stream configuration, two medium-sized vertical expansion tanks (bladder type) and a makeup water connection. Provide a glycol fill station to maintain 30% propylene glycol to the chilled water loop.

Chiller will be specified with a heat recovery option that when the chiller is operational, allow for either preheating of domestic hot water or boosting domestic hot water supply temperature for kitchen use.

D3030.02 Packaged Roof Top Units

A nominal 10 Ton rooftop-type direct expansion with gas heat will be provided for the Administration area. Each unit will be provided with integrated economizer mixing box, MERV 7 pre-filter, MERV 13 final filter, refrigeration section with DX coil, and gas heating section.

D3030.03 Other Refrigeration Systems

Ductless split air conditioning systems will be complete with direct expansion cooling coil, supply fan, motors, and filter. Condensing units will be complete with compressors and condenser fans. The systems will be provided with equipment manufacturer's packaged controls including compressor anti-short cycle and low ambient start features. System operation will be monitored by the building management system. The area that will have this type of air conditioning unit shall be the Tel/Data Closets.

D3040 HVAC Distribution

D3040.01 Air Distribution System

The majority of the building will be air conditioned. The only spaces that are not to be cooled are the Gymnasium, Building Storage, Servery and Kitchen.

The following system zoning is proposed, where each zone will be served by dedicated systems of the type listed and will either be heated, ventilated and air conditioned (HVAC) or heated and ventilated, only (H&V):

Zone	Unit Type
1st Floor Addition Classroom Wing	Rooftop ERU
2nd Floor Addition Classroom Wing	Rooftop ERU
K/Pre-K Classroom Wing	Unit Ventilators
Library/Computer Lab	Rooftop ERU
Cafetorium	Rooftop ERU
Music	Indoor ERU or Unit Ventilators
Art	Rooftop ERU
Administration	Package Dx Rooftop Unit
Gymnasium	Rooftop ERU (Heating Only)
Kitchen/Servery	Rooftop MAU + Exhaust
Tel/Data Room(s)	Ductless Split AC Unit

HVAC Packaged Rooftop Unit with Integral Energy Recovery Units

Rooftop energy recovery units provide conditioned air to the building. The curb mounted units will include a return (or exhaust) fan with variable frequency drive, economizer section, pre-filters (for outdoor air intake and for exhaust to enthalpy wheel) and MERV 13 cartridge filters, enthalpy economizer wheel (with VFD), hot water preheat coil, chilled water cooling coil, supply fan with variable frequency drive, discharge plenum and supply and return sound attenuators. Controls to be by automatic temperature controls contractor with the control system type specified below.

Medium pressure ductwork will distribute conditioned air to variable air volume boxes and diffusers. Fan powered variable air volume boxes with hot water reheat coils will serve perimeter spaces, and variable air volume boxes with and without hot water reheat coils will serve interior spaces.

Perimeter heat in these zones will be provided by radiant heating ceiling panels, zoned separately per room (controls to be coordinated with VAV air distribution zoning.)

Unit Ventilators

K/Pre-K Classroom Wing will be heated and cooled by four pipe unit ventilators. Each room will be separately zoned, and each classroom will be supplied with two unit ventilators rated at 750 cfm. Two smaller unit ventilators are recommended for lower ambient/room noise. Unit ventilators will be controlled through the DDC system. Unit ventilators will consist of outdoor air and return air dampers, MERV 7 filters, chilled water cooling coil, hot water heating coil and supply fan(s).

Make-up Air Unit - Kitchen

Heating and ventilation will be provided by a gas-fired make-up air handling unit. The unit shall be configured as a draw through type with outside air intake louvers, outside air control damper, outdoor air intake plenum, 30% pre-filters and MERV 13 final filters, centrifugal supply fan with premium efficiency motor and modulating-control, gas-fired heating section.

Split System AC Units

Ductless (and other) split air conditioning systems will use non-CFC and non-HCFC refrigerants and will accommodate low-ambient operation (down to 0°F). Provide wind screen to control system operation in unprotected condensing unit locations. Systems will provide interface for start/stop, alarm and space temperature monitoring to the building control system.

General System Design

Carbon dioxide sensors will be installed in all air conditioned systems in order to maintain acceptable levels of indoor air quality due to the varying occupancies.

Supply, return and exhaust sound attenuators shall be installed in all central air distribution systems noted above.

Except as outlined below, the air distribution systems will be constructed of galvanized steel and constructed to the appropriate pressure class.

- Dishwasher: Welded aluminum; pitched towards appliance for drainage
- Kitchen Hood: Carbon steel with required fire-rated covering; or approved double-wall pre-fabricated duct system listed for the application

D3040.02 Special Exhaust Systems

Dedicated exhaust systems will be provided for the following spaces and equipment due to their significant heat rejection and/or contaminated air streams.

- Kitchen Hood(s)
- Mechanical Room
- Electrical Closets
- Toilet Rooms
- Dishwasher
- Garbage disposal recycling areas

D3060 HVAC Instrumentation and Controls

The facility will be provided with a microprocessor-based, web-accessible, direct digital control (DDC) building management system (BMS). The BMS will consist of system-, equipment- and building-level controllers that communicate via BACNET protocol (ASHRAE Standard 135) to an operator workstation. Each controller will be capable of full, stand-alone operation and have integral permanent memory to maintain control and set points in case of network or power failure.

User interface with the BMS will be through a combination of a local operator workstation, portable operator workstations and through web access. A dedicated phone line and modem(s) will be provided to allow for communication with the remote devices. All operator workstations will be provided with easy to use, color, graphics-based software for communicating with equipment controllers and between workstations. The operator

workstation (a personal computer) will be located on site. One portable operator workstation(s) (laptop personal computer) will be provided for communication in the field with individual equipment controllers to facilitate troubleshooting and maintenance.

All set points, hours of operation, maintenance alarms, critical alarms, trend logs and some sequences of operation and safeties will be user adjustable through the operator workstations. Most equipment will be provided with occupied and unoccupied modes of operation for energy savings.

The DDC system will provide scheduled start/stop control and monitor the operational status of equipment. It will also incorporate control algorithms to optimize the efficiency and performance of the school's HVAC systems.

All mechanical equipment provided with manufacturers control shall have open protocol capabilities so manufacturers control will seamlessly communicate with BMS.

All mechanical systems, with the exception of small split-systems and the air-cooled chiller will incorporate controls installations, including devices and sensors and implementation of all sequences of operation that are provided and installed by the controls contractor.

D3070 Systems Testing, Adjusting and Balancing

D3070.01 Piping Systems Testing, Adjusting and Balancing

The piping systems testing, adjusting and balancing will be performed by an Air Balancing Contractor certified by either Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB).

D3070.02 Air Systems Testing, Adjusting and Balancing

The air systems testing, adjusting and balancing will be performed by an Air Balancing Contractor certified by either Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB).

D40 FIRE PROTECTION

D4000 General Design Considerations

D4000.01 Codes and Standards

- Massachusetts State Building Code 780 CMR
- Massachusetts Fire Prevention Code 527 CMR
- NFPA 13, 14, 20 and 25.

D4010 Wet-Pipe Sprinkler System

D4010.01 System Overview

The building will be protected throughout with an automatic wet sprinkler system with sprinklers spaced to comply with NFPA 13. The systems will be hydraulically calculated to provide a water application rate of 0.10 GPM per square foot over the most remote 1500 square feet for light hazard areas, 0.15 GPM per square foot over the most remote 1500 square feet for ordinary hazard group 1 areas and 0.20 GPM per square foot over the most remote 1500 square feet for ordinary hazard group 2.

Light Hazard areas will include: Office areas, general classrooms, commons, library and cafeteria seating.

Ordinary Hazard Group 1 areas will include: Storage areas, gymnasium and kitchen.

Ordinary Hazard Group 2 areas will include: Mechanical rooms.

Sprinklers will be recessed type, white sprinkler and white escutcheon, at hung ceiling areas and concealed with white cover plate at all gypsum ceilings

Mechanical rooms and other unfinished areas will be provided with exposed brass finish sprinklers. Sprinkler guards will be provided at the Gym and Mechanical and Storage rooms.

Concealed areas of combustible construction (above ceilings) in the renovated building will be protected with exposed upright sprinkler heads.

Areas of the building that will not be provided with wet sprinkler protection are:

- Areas above suspended ceilings of non-combustible construction

- Main Electric Switchgear Room
- Elevator shafts and pits
- Elevator machine rooms
- Emergency electrical closets

The sprinkler system will be separated into multiple zones per floor for the purposes of monitoring water flow. The inspector's test valves for each zone will be located in the stairwells above the entry door soffit with a vertical access panel for testing and maintenance. Test drain piping to discharge outside the building to an appropriate location.

D4020 Standpipes

A standpipe system is not required for the building per building code requirements. Fire department valves will be provided at horizontal exits and where required per NFPA 14.

D4030 Fire Protection Equipment

Water for fire protection will be stored in an underground, 35,000 gallon tank. The tank will be connected to a smaller, underground vault which will supply water to a vertical turbine fire pump. The fire pump will supply water to the sprinkler system, fire department valves, and fire hydrants around the building.

Two Fire Department pumper truck connections (FDC) will be provided – one at each access loop. The FDC's will be provided to match the requirements of the Stow Fire Department.

A wall indicator valve will be provided, as required.

All shut-off valves will be UL listed and FM approved type, and be equipped with supervisory tamper switches. These switches along with the flow switches will be monitored by the building fire alarm system.

NOTE: Connection to an Assabet Water pressurized water main is being considered. The 35,000 gallon storage tank, pump vault, fire pump, jockey pump, and associated appurtenances will not be needed if a decision is made to have water delivered by Assabet Water.

D4040 Fire Protection Specialties

D4040.01 Fire Extinguisher, Cabinets, and Accessories

Fire Extinguishers: Multi-purpose dry type, 20A-60BC.

Fire Extinguisher Cabinets: Fully-recessed cabinet; painted steel trim and door with full-glass panel, DSA glass. Baked enamel primer finish; field painted.

Fire extinguishers and cabinets will be provided by the general contractor and located to meet the requirements of NFPA 10.

D4040.02 Wet Chemical Fire Extinguishing Systems

Wet chemical fire extinguishing systems will be provided at kitchen exhaust hoods by the kitchen equipment contractor.

D4050 Materials

D4050.01 Pipe and Fittings

Sprinkler piping 2" and smaller to be Schedule 40, black steel with black cast iron screwed fittings.

Sprinkler piping 2-1/2" and larger to be Schedule 10 black steel pipe, roll grooved, with mechanical grooved end fittings.

D4050.02 Valves

Gate valves 2-1/2" and larger to be iron body, bronze mounted, taper wedge, outside screw and yoke, rising stem and flanged ends. Indicating valves to be butterfly type, bronze type with grooved ends.

D50 ELECTRICAL

D5001 Reference Standards

- Massachusetts Electrical Code, 527 CMR, 2008 edition.
- Life Safety Code NFPA 101
- National Fire Alarm Code, NFPA-72 2007
- Massachusetts Building Code, 780 CMR Seventh Edition.

D5010 Electrical Service and Distribution

D5010.01 Primary Service

Existing electrical service is provided from the Hudson L&P overhead medium-voltage line at Route 117 to the riser pole at the school building. Three 25 kVA single phase transformer barrels are located on the riser pole with a total service capacity – 75 kVA at 120/208 volt 3-phase. This service will continue be energized until a new service and a power distribution system will be built and made operational.

Hudson L&P primary feeder for a new service will originate at the same existing utility pole at Route 117 and will extend underground to the location of the pad-mounted transformer.

The electrical service pad-mounted transformer will be furnished, installed, owned and maintained by Hudson L&P. The transformer will be sized by the utility company based on the load data provided to utility by Symmes, Maini & McKee Associates. The primary conduit installation, the secondary conduit installation, the transformer pad construction and the secondary feeder installation shall be the responsibility of the Electrical contractor.

The transformer will be located adjacent to the building in close proximity to the building main electric room. The recommended distance from the transformer to the building is at least 10 feet. The transformer will be of the pad mounted type with a secondary voltage of 480Y/277 volts.

One Hudson L&P electrical energy meter will be provided for the entire building.

D5010.02 Secondary Service Power Distribution

The transformer secondary feeder will be terminated at the building main electrical switchboard. 277/480 volt 3-phase. The switchboard will be dead front, front assessable, NEMA 1 indoor type assembly rated at 277/480 volt 3-phase, 4-wire, proposed 1,600 amp rating (final size to be determined during subsequent design phase) and will include a main protective device, utility metering compartment (to be coordinated with Hudson L&P), distribution sections with the feeder circuit breakers, service entrance rated TVSS device, and a customer digital metering unit to monitor voltage, current, power factor and demand kW. A separate section for the fire pump service disconnect (connected on the line side of the main protective device) will be required.

Main protective device is an insulated case circuit breaker 100% rated, with phase protection and solid state tripping capable of adjusting long time, short time, and ground fault protection characteristics. Feeder devices in the distribution section will be group mounted molded case type circuit breakers.

A sub-metering system will be installed to allow recording and analyzing electrical energy kWH consumption separate for the building lighting, HVAC and kitchen loads. Sub-metering system will use the current transformers (CTs) that allow an interface with a building management system (BMS) via a data twisted pair line. Quantity of the required power metering points will be reviewed and defined during subsequent design phase.

Electrical power distribution equipment will be located in the main electrical room and the electrical closets. It is estimated that two (2) electrical closets will be required on the ground floor, and one closet - on the second floor. Electrical panels in each electrical room or closet will support lighting, power, and HVAC loads in the associated areas.

A typical closet will house a 225 Amp 277/480 volt power panel as a power source for HVAC circuits, 100 Amp 277/480 volt lighting panel, dry-type transformer sized 45 kVA and two 150 Amp , 120/208volt, 3-phase panelboards.

Major HVAC equipment such as the roof air handling units, make-up units, energy recovery units and exhaust fans will be power fed from the dedicated panels located in the upper floor closet.

Two air cooled chillers will be power fed with 200 amp feeders directly from the main switchboard.

Power panel (on the generator power system) in the mechanical room will be a power source for boiler plant equipment.

Dedicated dry-type 75 kVA transformers and 250 Amp, 120/208 volt panels will be provided for the Kitchen and Cafetorium. These transformers will be power fed directly from the main electrical switchboard.

The building elevator will be power fed directly from the main electrical switchboard.

D5010.03 Estimated Electrical Loads

New electrical service is sized for the building gross area of approximately 97,000 square feet.

- Interior Lighting – 100 kVA
- Exterior and Site Lighting – 10 kVA
- Air cooled chillers and CW pumps – 275 kVA
- Boilers, HW pumps – 18 kVA
- Ventilation, heat pumps, exhaust and make-up units – 180 kVA
- Computer and Small Power – 75 kVA
- Convenience Power – 50 kVA
- Kitchen (full service) – 60 kVA
- Elevator -30 kVA
- Cafetorium Performance Lighting - 40 kVA
- Fire pump – 30 kVA

Total Connected Load:
868 kVA or 1,045 Amps rated for a 277/480 volt 3-phase 4-wire system.

D5010.04 Interior Electrical Distribution Transformers

Interior electrical distribution transformers will be provided in each electric closet to reduce 480 volt, three phase interior distribution voltage to 208Y/120 volts for small power requirements and convenience outlets. Transformers will be general purpose aluminum wound, low noise, dry type, air cooled, with indoor ventilated enclosure, and will comply with NEMA standard ST 20 and energy-efficiency standard NEMA TP1. Where required, the transformers will

be K-factor rated, and be provided with electrostatic shielding to protect computer equipment.

D5010.05 Grounding

All exposed, non-current carrying metallic parts of electrical equipment, the raceway system, and the neutral conductor of the wiring system will be grounded in accordance with MEC.

Separate copper equipment grounding conductor will be installed with the all feeder and branch circuits. Grounding cable connections to structural steel, grounding rods and other grounding cables will be of the thermal fusion type. Grounding rods (where shown) will be copper clad steel, driven full length into the earth with a minimum cover of one foot.

All communication closets will be provided with a grounding bar bonded to the building steel and electric service grounding electrode.

D5010.06 Branch Circuit Panelboards

Branch circuit panelboards will be dead-front type, equipped with the thermal-magnetic bolt-on type molded case circuit breakers. Panelboards' phase and neutral buses will be aluminum, and an equipment ground bus will be copper. The panels will be fully rated, and AIC rating will be coordinated with the available fault current value provided by the utility company at the service demarcation point for this project.

Where required for computer and electronic equipment protection, the panels will be provided with TVSS device.

Panels rated 480Y/277 volt, 3-phase, 4-wire will be used for the large motors, elevators, HVAC equipment, and lighting loads. The 208Y/120 volt, three phase, four wire rated panelboards will be used for small power and convenience outlets. All panelboards will be Underwriters Laboratories (UL) listed and labeled, and comply with NEMA standard PB1 for panelboards.

D5010.07 Motor Control

Individually enclosed combination motor starter/disconnect switch will be provided for the control and overload protection of the motors as required by MEC unless the motor starters are integral part of the equipment. Motor starters will be magnetic type and have overload relays in each phase for three phase motors, hand-off-automatic selector switch, lock-out/tag-out hasp and control power transformer. Motor starters will comply with ANSI-C37.96 and NEMA ICS2 standards.

D5020 Lighting and Branch Wiring

D5020.01 Electrical Branch Wiring

Electrical branch wiring will consist of insulated copper conductors in the steel conduits, electrical metallic tubing (EMT), or metal clad (MC) cable s as required for the installation condition. Conductors will be copper with type XHHW or THHN/THWN, 600 volt insulation. Minimum wire size for power and lighting circuits will be #12 AWG. Control wiring conductors for 120 volt circuits will be #14 AWG.

Feeder conductors (panelboards and specific equipment) and all exposed branch circuit wiring in unfinished spaces (electrical and mechanical rooms, etc.) will be installed in conduit.

Branch circuit wiring may utilize metal clad (MC) cable where it is allowed by MEC. Metal clad (MC) cable typically may be used for branch circuit wiring above suspended ceiling and in dry wall partitions. MC type cable shall not be acceptable for the branch circuit homeruns (panel to the first junction or pull box on circuit).

Underground conduits, concrete encased conduits and conduits installed under concrete slabs will be PVC Schedule 40 with rigid steel sweeps rising out of floor slab or grade. Conduits exposed to weather will be rigid steel.

D5020.02 Wiring Devices

Duplex receptacles will be 20 ampere, 125 volt grounding type, specification grade, UL-listed, equal to Hubbell 5362. Toggle switches will be 20 ampere, 120/277 volt, specification grade, UL-listed.

D5020.03 Interior Lighting

The overall intent of the lighting design is to provide a visual environment for the students and faculty that is supportive of the educational activities within the building.

In general, building interior lighting will be with the fluorescent lamps. Incandescent and HID lighting will be limited to only special applications which cannot be satisfied with fluorescent type lamps.

Fluorescent fixtures will use T5, high performance T8 or compact fluorescent lamps with the electronic ballasts. HID fixtures will utilize high power factor regulator ballasts.

Lighting systems will comply with energy use limitations of Massachusetts Building Code (latest adopted version of the IBC 2006 with amendments), and the MA-CHPS requirements.

- Proposed Illumination Levels:
  - Classrooms: 45 - 50 FC
  - Offices: 35-50 FC
  - Circulation Corridors: 20-25 FC
  - Gymnasium: 40-50 FC
  - Cafetorium: 35-50 FC
  - Kitchen: 50 FC
  - Mechanical and Storage Rooms: 20 FC
- Classroom Lighting: Direct /indirect pendant mounted fluorescent fixtures.
- Corridor lighting will consist of fluorescent fixtures recessed in ceiling and bordering the walls to provide lighting of posted images.
- Dining and common areas will have fluorescent fixtures that will afford a more pleasant appearance and appropriate for the respective function of the space.
- The gymnasium will have high intensity fluorescent fixtures with multi-level control switching arrangement.
- Cafetorium is a multiple function space and the lighting system will be designed to accomplish the different tasks. Recessed downlights and decorative direct/indirect pendant fixtures pre-wired for a multi-level lighting controls will provide a proper lighting quality and lighting levels appropriate for cafeteria and auditorium lighting conditions. Cafetorium performance lighting will be dimmable to allow for the performances and lecture presentations. The Cafetorium lighting system will have controls which bring lighting to full light levels in the event of a fire alarm.
- Building interior lighting will have some form of automatic lighting controls to meet Massachusetts Building Code.

- Classrooms, offices, and conference rooms will have dual technology occupancy sensors for automatic control as well as local toggle bi-level switches for manual control. The same sensors will provide a signal (via a dry contact) to the BMS for a shutdown of the HVAC equipment serving the same space.

- Daylight sensors/system will be used in classrooms, library, as well in the spaces with skylights. The rest of the building will be controlled by a programmable low voltage relay system. Low-voltage control panels will be programmed to shut lighting off during non-use hours and shall provide warnings (blinking lights off and on) to allow occupants to override a planned shutdown in their area.

- Low-voltage lighting control system will be tied into the building DDC system for monitoring and overrides.

- Exit signs and egress lighting will be connected to the emergency power distribution system to provide illumination level required by Code for emergency egress in a case of normal power failure. The generator power will eliminate any need in the emergency battery lighting units as currently installed in the existing school.

- Lighting control will be designed to have a "dark" school at night time including a shutdown of the emergency egress lights in the corridors, lobby, stairs, etc. These emergency lights will be switched ON either automatically by low-voltage control panel, upon building fire alarm or security breach, or manually by Fire Department, police or a Custodian.

D5020.04 Exterior Building Lighting

Exterior building lighting will consist of building mounted shielded fluorescent fixtures (at egress doors) and pole-mounted high intensity discharge or LED full cut-off fixtures (for parking lot, roadways and walkways). Lighting design will incorporate product selection that will reduce light pollution to abutters. Exterior building mounted fixtures at immediate discharge areas will be supported from emergency power system. Exterior lighting design will be in compliance with the Town of Stow Zoning By-Laws.

Exterior lighting will be time switch and photo-cell controlled via low voltage lighting control system. Lighting systems will comply with energy use limitations of Massachusetts Building Code (latest adopted version of the IBC 2006 with amendments).

D5030 Communication and Security

D5030.01 Detection and Alarm; Fire Alarm

Existing fire alarm panel (total – 8 zones) by Notifier and a radio-type master box will remain operational until new system will be built, tested and become operational. New addressable fire detection and alarm system with voice capabilities will be provided to meet the requirements of the Massachusetts Building Code, NFPA-72, and local fire department requirements.

New fire alarm system will consist of a fire alarm control panel, remote annunciator, area and duct type smoke detectors, manual pull stations, speaker/strobe signaling units, connections to the automatic fire suppression systems, and a radio type master box for transmitting alarm signals to the local fire department.

FACP will provide an alarm and annunciation capability in case of activation of any manual fire alarm station, smoke detector, heat detector, duct smoke detector, sprinkler water flow switch or fire suppression system. The fire alarm control panel will be located in an area as directed by the Fire Department. Audible and visual high intensity strobes alarm devices will be installed in the all classrooms.

Smoke detectors will be provided in compliance with the applicable Codes. System type smoke detectors will be installed in the main electrical room, electrical closets, data/telephone rooms, school corridors, elevator machine room, elevator lobbies and at the top of the stairways. Addressable type duct smoke detectors will be installed in supply and return air ducts as required by NFPA-90A.

D5030.02 Security Access and Surveillance

A building security system will be provided to protect the building from unauthorized entry. This security system will consist of a main control panel, up to five IP-based proximity readers/keypads installed at specified doors, door contact switches, three IP-based CCTV cameras installed at the two entrance doors and at the back of the building, six exterior CCTV cameras installed on the site and a video intercom at the main entry with electrified lock control in the door operation.

The system will be programmable such that upon detection of an unauthorized building entry it will transmit an alarm signal to the main office during school hours and to the local police department or the Owner's selected service during non -school hours.

D5030.03 Clock and Program Systems

A clock and program system will be provided for originating and distributing time and time correction signals, and for programming and initiating audible program signals. System will consist of a master control unit, indicating clocks, and connections to the public address and music system. Master control unit will transmit time and time correction signals to all system clocks throughout the building and generate program tone signals for broadcasting over all speakers on the public address and music system.

D5030.04 Voice and Data Systems

Verizon is the telephone service provider for the existing school, and Comcast provides CATV service. The Town is in the process of installing a fiber optic cable to the school building this summer. Existing services are installed overhead from the utility poles at Route 117, and they will remain operational until new services will be made operational.

New underground conduits will be installed from the riser pole(s) at Route117 to extend communication service cables to the new demarcation room.

A voice and data distribution system will be provided consisting of Category 6 unshielded twisted pair (UTP) cabling systems and outlets for local area data network (LAN) and voice communications. A fiber optic backbone network will be provided to connect Telecommunication Rooms (TRs) to the Telecommunications Equipment Room (TER). Outlets will be provided in the classrooms, offices, library, computer lab, cafetorium, and as additionally decided. All wiring, outlets and terminations will be installed to comply with EIA/TIA 568 standards.

Wall outlets shall have EMT conduit stub-ups into ceiling space for cabling. Cables may be routed above ceiling space being grouped with distribution rings and routed though conduit sleeves in wall penetrations to the communications closets. All TRs and TERs will be connected with a backbone cabling raceway system of sleeves, j-hooks and cable trays.

D5030.05 Public Address and Music Systems

A public address, music and intercommunication system will be provided consisting of an office console, microphones, amplifiers, AM/FM tuner, audio CD player, speakers, wiring, telephone paging adapter, clock/program system interface, room call switches, and classroom telephone handsets. The system will allow broadcasting of program tone signals for classroom changes, radio and CD program material, and microphone originated announcements to all areas throughout the building by individual area or on an all-call basis. Private

two way communications can be established between any classroom and the office, utilizing individual classroom telephone handsets. All electronic equipment will comply with applicable Electronics Industries Association (EIA) Standards and according to the Technology Program.

D5030.06 Video Cabling

A video cabling system will be provided for the distribution of signals from the CATV service provider and/or central media distribution system to outlets located throughout the building. The system will consist of a head end equipment rack, outlets, splitters, trunk and branch cable. Outlets will be provided in all classrooms, library, computer lab, cafetorium, gymnasium and as additionally decided. All wiring, outlets and terminations will be installed to comply with Industry standards.

Wall outlets shall have EMT conduit stub-ups into ceiling space for cabling. Cables may be routed above ceiling space being grouped with distribution rings and routed through conduit sleeves in wall penetrations to the communications closets. All communication closets shall be connected with a coaxial backbone system.

D5030.07 Local Sound Systems

Local sound systems will be provided for the cafetorium and gymnasium for sound amplification from microphone, audio CD and portable audio sources via auxiliary input jacks. The systems will provide high quality sound reproduction for use during meetings, lectures, theatrical productions and public functions, and will be interconnected with the fire alarm system so fire alarm notification circuits override the local sound system.

D5080 Commissioning

D5080.01 Electrical Systems Commissioning

Lighting system and associated control system, main electrical switchboard and a generator power system will be commissioned. Commissioning will involve drafting a checklist of the components, installation and performance tolerances that will be used by the engineer during site inspection at punch list time. The system checklist will enable the engineer to provide an opinion as to the design compliance and the ability for the system to function properly and efficiently.

D5090 Other Electrical Systems

D5090.01 Packaged Engine Generator Systems

A packaged engine-generator system will be provided to supply power to the building life safety and standby loads upon loss of the normal utility power. The unit shall start automatically on loss of normal utility power source and transfer to the generator power system within 10 seconds.

The generator power system design will include:

- Outdoor soundproof type diesel-generator set 250 kW (estimated, exact size will be determined at subsequent design phase) with a skid- based fuel tank for at least 24 hours of the generator operation without re-fueling. Fuel tank shall be of double-wall construction and shall be furnished with leak detection system.
- Two automatic transfer switches (ATS) and the associated power distribution panels.
- Lighting panels, dry-type transformers and branch panelboards to serve the emergency (life safety) loads. Emergency (life safety) power distribution equipment including ATS, panelboards and feeders shall be installed in 2-hour fire-rated closets and shafts in compliance with the requirements of the Massachusetts Electrical Code. MI cables may be used for the emergency feeders installation if 2-hour fire-rated shafts are not available.
- Power panels, dry-type transformers and branch panelboards to serve the standby loads.

Emergency branch of the generator power system will provide power for the life-safety loads including:

- Emergency exit and egress lighting (interior and exterior)
- Fire alarm system
- Fire pump 30 HP

Standby branch of the generator power system will feed:

- Heating system boilers with the associated pumps
- Boiler control panel and DDC panels
- All kitchen equipment and lighting
- Gymnasium, adjacent corridors, shower and locker rooms lighting

- Cafetorium general lighting, lobby, adjacent corridors and bathrooms lighting
- Domestic hot water system equipment
- Security system equipment
- Communication systems (telephone and public address systems)
- Septic pump system
- HVAC equipment (air supply and exhaust) serving the cafeteria, kitchen, gymnasium, lockers, showers, bathrooms, telephone/ data rooms and closets.