

# **Mechanical, Electrical, Plumbing and Fire Protection Recommended Systems Report**

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Chester Public Library  
Chester, CT 06412

Prepared for:

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CES PN 2016165.00

## **EXECUTIVE SUMMARY**

Consulting Engineering Services has been retained by LLB Architects to provide a design for the mechanical, electrical, plumbing and fire protection systems for the construction of the Chester Public Library in Chester, CT. The proposed library is approximately 8,000 square feet. This schematic design narrative includes recommendations for Heating, Ventilation and Cooling, Plumbing, Fire Protection and Electrical Systems for costing purposes.

## **APPLICABLE CODES AND STANDARDS**

The mechanical, electrical, plumbing, and fire protection systems will be provided in conformance with the requirements of the following codes and regulations and all applicable local authority requirements.

- A. 2016 Connecticut State Building Code
- B. 2016 Connecticut State Fire Safety Code
- C. 2012 International Building Code
- D. 2012 International Plumbing Code
- E. 2012 International Mechanical Code
- F. 2012 International Energy Conservation Code
- G. 2014 National Electrical Code (NFPA 70)
- H. NFPA, All applicable code sections, Latest Version

Note that CES understands that Connecticut will be revising the building code to adopt the 2012 International Codes in the fall of 2016. As such, this project will be designed to meet the anticipated codes rather than the codes currently in effect.

## **PLUMBING NARRATIVE**

### **RECOMMENDED PLUMBING SYSTEMS**

1. A new 2-inch domestic water service shall be provided to serve the domestic water demands of the facility. The new domestic water service shall be supplied from the existing water main. The new water service equipment shall include water meter, isolation valves, pressure reducing valve, reduced pressure backflow preventer, strainer and bypass and shall meet all current code requirements and the requirements of the Connecticut Water Company. This new water meter assembly shall meter all water use for the entire library.
2. Provide new 50 gallon high efficiency propane fired water heater (AO Smith or equal).
3. Install new domestic cold water, hot water and hot water recirculating piping throughout the building to serve all new plumbing fixtures. Domestic hot water, cold water and re-circulating hot water piping shall be Type L copper conforming to ASTM B 88 with sweat fittings using 95/5 solder. All domestic water piping shall be insulated with rigid molded, noncombustible glass fiber insulation conforming to ASTM C335. All domestic water piping throughout the building shall be installed above ceilings and concealed within wall cavities.
4. Install a new system of sanitary, waste, and vent piping for all new plumbing fixtures. Sanitary waste and vent piping shall be plain end cast iron with stainless steel clamp and shield assemblies conforming to ASTM B 42 for above ground piping. Buried piping shall be ASTM D2665 PVC

with solvent cement joints conforming to ASTM D2855 with ASTM D2564 solvent cement. All sanitary waste and vent piping shall be concealed within chases and walls where ever possible. Waste services shall exit the building below slab at multiple locations to be coordinated with the civil engineer. All sanitary waste shall be piped to the municipal waste water systems. Vent piping shall exit the building through the roof with a 4" diameter pipe and shall extend a minimum of 12" above the finished roofline.

5. Plumbing Fixtures:

- 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 battery operated, by Sloan or approved equal.
- Lavatories shall be countertop type, vitreous china, by American Standard or approved equal. Faucets shall be low consumption battery operated, by Symmons or approved equal.
- Wall hangers for water closets, urinals, and lavatories shall be heavy duty adjustable height type installed within chase spaces provided behind fixtures, by J.R. Smith or approved equal.
- Water coolers shall be stainless steel, 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.
- Kitchen sinks shall be stainless steel, by Elkay or approved equal with gooseneck faucets, by Simmons or approved equal.
- Cast iron floor drains shall be installed at all gang toilet rooms. Heavy-duty cast iron floor drains shall be installed in all mechanical rooms. Floor drains shall be by J.R. Smith or approved equal. Trap primers shall be provided for floor drains.
- Lockable hose bibs with vacuum breakers shall be installed in all group toilet rooms, by Woodford or approved equal.
- Lockable wall hydrants with vacuum breakers shall be installed on exterior walls every 100 feet. Wall hydrants shall be non-freeze type by Woodford or approved equal.

6. One 1000 gallon underground propane tank will be provided and shall enter the building in the main mechanical room after connecting to the pressure regulator assembly. The pressure regulator assembly shall consist of shut-off valves, pressure regulator and meter. Gas piping shall be ASTM A53 schedule 40 black steel. Gas piping will serve the boilers and domestic water heater.

**FIRE PROTECTION NARRATIVE**

**RECOMMENDED FIRE PROTECTION SYSTEMS**

1. Provide a new 6" fire protection water service from main in street to the building sprinkler room.

2. A flow test is currently pending with the Connecticut Water Company. A fire pump is not currently anticipated.
3. A new wet pipe fire protection sprinkler system shall be installed throughout all areas of the library, including the attic area and above the cathedral ceilings, as follows:
  - The new system shall conform to the requirements of NFPA 13 and the Connecticut Fire Safety Code
  - The sprinkler system shall provide complete coverage throughout the entire library and shall be a hydraulically designed system. All book storage and large stack areas shall be installed to ordinary hazard, group two occupancy, 0.20/15000. All other storage rooms and other hazardous areas shall be installed to ordinary hazard, group one occupancy, 0.15/1500. All other areas shall be installed to light hazard occupancy, 0.10/1500. Fire protection system will be designed and installed in accordance with the State of Connecticut building code, NFPA 13, and the Town of Chester Fire Marshal.
  - The Sprinkler Contractor shall be responsible for providing complete drawings and calculations as required by NFPA 13. All drawings shall be computer generated. A Professional Engineer shall seal drawings and calculations.
  - Seismic bracing shall be provided per NFPA 13 and the State of Connecticut Building Code.
  - New sprinklers shall be concealed, fully recessed in finished areas with ceilings. Sidewall exposed extended coverage sprinklers shall be installed where necessary. Upright sprinklers with wire guards shall be installed within all mechanical and storage rooms. Sprinklers shall have a 1/2" orifice, 165 degree temperature rating, 5.6 K-factor, brass finish. All sprinklers shall meet the above requirements unless noted otherwise, and shall be as manufactured by the Viking Corp. or approved equal.
  - The new fire service equipment shall be provided with alarm check valve riser. Alarm valve shall be check type with divided seat ring, rubber faced clapper to automatically actuate electrically & hydraulically operated devices and alarms, pressure retard chamber and associated trim. Alarm valve shall be as manufactured by the Viking Corp. or approved equal.
  - A 6-inch double check valve assembly, bronze body, with two independently operating, spring-loaded check valves, assembled with two gate valves shall be provided at new service entrance as required by the local water authority.
  - A 2-1/2" x 2-1/2" x 4" brass fire department connection shall be provided.
  - Piping up to and including 2-inch shall be ASTM A135, black steel pipe with threaded joints. Piping 2-1/2-inch and larger shall be ASTM A135, black steel pipe with grooved joints. Sprinkler piping shall be installed above ceilings and concealed within chases unless noted otherwise.
  - Fittings up to and including 2-inch shall be threaded. Fittings 2-1/2-inch and larger shall be rolled grooved fittings.
  - Tamper switches shall be provided to prevent unauthorized shutdowns of any parts of the fire protection system. Tamper switches shall be provided with two form C contacts; rated 10 amps at 120 volt, and shall be UL and FM approved.

## **MECHANICAL SYSTEMS:**

### **RECOMMENDED MECHANICAL SYSTEMS**

1. The library heating system shall be as follows:

- The hot water heating plant serving the library will consist of two propane fired condensing boilers nominally rated at 285 MBH input (Viessmann Vitodens 200-W B2HA-80 or equal). The boiler will be piped in a primary/secondary arrangement and a 15 gpm constant speed boiler circulation pump will be provided for each boiler. Two variable frequency driven secondary hot water pumps sized for 100% capacity (approximately 30 gpm) will be provided for complete redundancy. The pumping will send hot water to the building for space heating systems and terminal heating units (perimeter radiation, cabinet unit heaters, unit heaters etc.). The space heating hot water temperature will be reset inversely with outside air to minimize energy consumption. The system fluid shall be a 30% propylene glycol / water mixture.
- Pedestal type fin tube radiation will be provided at the perimeter of the building for space heating.
- The children's area and vestibule will be provided with radiant floor heating with dedicated manifolds and pumps. Radiant piping shall be ¾" pex and spaced at 9" centers. Provide recessed wall cabinet with manifolds, mixing valves and dedicated circulators.
- Cabinet unit heaters will be provided at vestibules (including the main vestibule with the radiant floor) and unit heaters will be provided at mechanical spaces

2. The library cooling systems shall be as follows:

- The cooling plant for space cooling will consist of a Variable Refrigerant Flow (VRF) system with heat recovery capability. The library shall be provided with a 16 ton air cooled grade mounted VRF heat pump condensing unit (Mitsubishi PURY or equivalent). The indoor units and the outdoor condensing unit will be connected via refrigerant piping.
- The individual offices/library spaces will be served by ducted concealed VRF indoor air handlers (Mitsubishi PEFY-NMAU or equivalent) or floor standing VRF indoor air handlers (Mitsubishi PFFY-NRMU or equivalent). VRF air handlers shall be fed by branch selector boxes, each branch selector box shall serve multiple air handlers and be connected to the outdoor heat pump condensing unit. There will be approximately 7 ducted VRF air handlers and 4 floor standing VRF air handlers.
- Ventilation air will be provided by an energy recovery ventilator (ERV) (Mitsubishi LGH-F1200 or equivalent) ducted to a VRF dedicated outside air handling unit with reheat capability (Mitsubishi PEFY-AF or equivalent). A hot water heating coil will be provided upstream of the ERV and downstream of the dedicated outside air handling unit for supplemental heating. Ventilation air will be ducted to the indoor ducted air handling units. The dedicated outside air handling unit will be supported by a dedicated 10 ton outdoor condensing unit (Mitsubishi PURY-P120 or equivalent).
- Provide a Mitsubishi DC-A210 Advanced HVAC Controller (or equivalent) to control the VRF system and the ventilation hot water coils. The controller also shall be capable of operating the relief/exhaust fan on a time of day schedule.

- The A/V closet will be served by one ton ductless split unit consisting of an indoor wall mount air handler and grade mount condensing unit.
3. Relief and exhaust will be provided via the ERV with ductwork distribution from the spaces to the ERV.
  4. The following materials and methods shall be utilized:
    - All motors provided shall be high efficiency or better.
    - All ductwork and accessories shall meet SMACNA standards.
    - Air distribution shall be accomplished by using sheet metal duct for supply, return and exhaust ductwork, no plenum air will be allowed
    - Provide all HVAC equipment with extra set of filters.
    - Seismic restraints shall be installed as required per the State of Connecticut Building Code and Fire Safety Code. This includes piping, ductwork, and equipment. The contractor shall engage a qualified structural engineer to design the seismic restraint systems.
    - Provide glass fiber insulation with vapor barrier for all hydronic piping and ductwork. Insulation shall be installed to meet the Energy Code.
    - Provide flexible elastomeric insulation on all refrigerant piping with aluminum jacket on exterior piping. Insulation shall be installed to meet the Energy 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 by the Contractor where necessary.
    - Provide vibration isolation for hydronic piping, ductwork, and equipment.
    - Hydronic piping shall be Type K copper with soldered or mechanical coupling joints or shall be ASTM A 53; Schedule 40 black steel pipe with threaded (2" and smaller), welded (2-1/2" and larger) or mechanical coupling joints (all sizes).
    - Refrigerant piping shall be ASTM B280 (ACR) copper tubing with brazed joints.
    - All equipment served by hydronic piping shall have isolation valves on the supply and return lines with auto flow balance valves and a strainer.
    - The contractor shall provide testing, adjusting and balancing (TAB) services for the hydronic and HVAC systems.

- Building will be designed to meet the minimum ventilation requirements of the current ASHRAE 62.1 using the Ventilation Rate Procedure for mechanical systems.

## **ELECTRICAL NARRATIVE**

### **RECOMMENDED ELECTRICAL SYSTEMS**

1. A new electric service with utilization voltage at 208/120 volt, 3 phase, 4 wire, rated for a minimum of 600 amperes shall be provided in a dedicated electric room. The new service equipment shall consist of:
  - Utility company owned and maintained pad mounted transformer, with concrete pad and all appurtenances provided and installed as part of the building contract. Underground ducts for primary electric shall be extended to a designated service origination point determined by the utility company. Secondary service conductors shall be extended from the pad mounted transformer location to the main switch located inside the building.
  - Main switch and utility metering equipment shall be a freestanding NEMA 1 enclosure with a main circuit breaker utilizing a solid state trip unit with an LSI programmer, suitable for reverse feed. The configuration shall be cold sequence in conformance with the prevailing utility company requirements for metering provisions.
  - The electric service entrance shall be provisioned with equipment suitable for the interconnection of a roof mounted solar photovoltaic power production source. All equipment necessary for complete integration shall be included in the package such as a bi-directional utility meter, solar sub-panel, visible blade disconnect switch on the building exterior, solar production meter and grid-tie inverters.
2. The building shall be provided with a Standby Generator backup power system to support the following building systems upon loss of the normal utility supply:
  - Building heating systems including the boiler plant and circulating pumps for perimeter radiation, radiant floor, cabinet heaters and unit heaters.
  - Selected air handling equipment.
  - Emergency lighting, exit signage, egress lighting, select pedestrian walkway lighting.
  - Data network server equipment with UPS backup to ride through short duration outages and the 10 second automatic transition to the standby power generator.
  - It is anticipated that a 30kw / 37.5kva 208/120v-3ph-4w 60hz generator will be the minimum size requirement to handle the above mentioned loads. The unit shall be a propane fueled pad mounted rotary engine generator with a sound attenuating weatherproof enclosure by Kohler, Cummins or Cat. The unit shall be fueled by a suitably sized dedicated line connected directly to an underground propane tank array capable of providing a minimum of 24 hours of run time at 100% rated load. The unit shall incorporate (2) output circuit breakers; (1) 50 ampere output for the building emergency/life safety lighting (NEC Article 700) requirements, (1) 50 ampere output for the building optional standby (NEC Article 702) requirements. The generator shall be interconnected to the building through auto transfer switches that shall pick up the necessary building loads automatically upon loss of the utility supply.

- The generator shall be mounted at grade level with all required service clearances from doors and windows. The generator shall be installed to satisfy NFPA 110 Level 1 performance requirements.
3. Normal Power Electrical Distribution Equipment:
- One new general purpose main distribution panel for normal power shall be 208/120V, 3PH, 4W, 42-pole, 600 amp main circuit breaker type dedicated for large HVAC equipment connections and panelboard feeders to the various sub-panels indicated herein.
  - One interior / exterior normal lighting panel shall be 208/120V, 3PH, 4W, 42-pole, 125 amp main circuit breaker type dedicated for normal power lighting loads internal to the building and external site lighting requirements for both pole and building mounted equipment.
  - One (general purpose) receptacle panel for normal power shall be 208/120V, 3PH, 4W, 84 pole (2 sections), 225 amp main circuit breaker type dedicated for miscellaneous receptacle and equipment loads.
4. Emergency Life Safety Distribution Equipment shall consist of the following:
- (1) 70 amp automatic transfer switch (life safety) will be included. This switch shall receive a dedicated emergency power feed from the standby generator.
  - One Lighting panel shall be 208/120V, 3PH, 4W, 30-pole, 60 amp main circuit breaker type dedicated for emergency lighting loads.
5. Optional Standby Distribution Equipment shall consist of the following:
- (1) 70 amp automatic transfer switch (optional standby) will be included. This switch shall receive a dedicated optional standby power feed from the standby generator.
  - One Lighting and appliance panelboard shall be 208/120V, 3PH, 4W, 30-pole, 60 amp main circuit breaker type dedicated for heating, data processing and small appliance loads.
6. Lighting systems shall be provided throughout the building and grounds as follows:
- Interior open ceiling spaces shall receive arrays of decorative pendant mounted linear LED lighting systems. The fixtures shall provide an average of 40 footcandles of illumination into the space. Energy codes shall be observed relative to design requirements of watts per square foot limitations and any required occupant controls. In areas where vertical fenestration is of considerable quantity daylight harvesting shall be incorporated via light level sensors and dimming control to promote the highest energy savings possible.
  - Interior offices and conference rooms with acoustical tile suspended ceiling shall be lit with recessed 2x2 direct/indirect LED pendant fixtures on 8'-0" x 8'-0" center spacing.
  - Toilet Rooms, hallways, vestibules and other similar rooms featuring drywall ceiling shall be provided with recessed 6" diameter LED downlights on 6'-0" x 6'-0" spacing or 6'-0" on center in corridors. Where appropriate matching wall sconces in conformance with good design shall be utilized that are selected to promote an upscale modern building presentation.



- Building exterior lighting shall be wall mounted decorative cast LED type lighting fixtures with full cutoff optics and style and color selections that compliment the architectural design.
  - Pedestrian walkways, driveways and parking areas shall be illuminated with low level pole mounted LED area lights that are high cutoff and do not exceed a 12'-0" mounting height. Site lighting shall be designed to promote common pedestrian pathway marking and alleviate security concerns. Automobile parking areas shall be lit to provide an average of 1.0 footcandle, drives shall be lit to a minimum of 1.5 footcandles. Site lighting shall employ photo-cell on control at dusk with time clock off at predetermined times.
  - Specialty landscape lighting for planting areas, building façade uplights, playgrounds, gazebo areas, etc to be provided on request.
  - Exit signs shall be provided throughout that feature LED high efficiency long life types that are in conformance with Connecticut building codes. Signs shall be provided that contain the International Symbol of Accessibility where required. Exit signs shall feature a premium edge-lit design and shall be fed through the emergency power auto-transfer switch.
  - A lighting control system shall be incorporated to promote time of day control, daylight harvesting; occupancy sensing and occupant preference light level control to promote compliance with the applicable energy code.
7. Duplex receptacles for miscellaneous power and convenience requirements shall be provided as follows:
- Along common area walls and corridors at a maximum spacing of 25'-0" on center.
  - One per wall in each office space.
  - Two per wall in large rooms and conference rooms.
  - As required for dedicated equipment connections.
  - Outside each egress door.
  - Along the building perimeter at intervals not to exceed 40'-0" or as requested by the owner.
  - At mechanical equipment locations for maintenance purposes.
8. Voice Communication services shall be provided as follows:
- New Telephone service shall be brought into the building. A 50 pair copper cabling plant shall be requested from the utility. Internal infrastructure to support building wide distribution shall be designed utilizing conduits, backboxes and pullstring throughout the building with specific requirements clarified with the owner during the design development stage.
  - The copper cabling plant shall be suitable to support fax, RJ31X secured lines for Intrusion Detection, Fire Alarm monitoring, POTS (Plain old telephone service) lines for PBX or VOIP backup; or T1 data or voice communications.

9. Broadband / Cable TV service shall be brought into the building to support cable broadband service to be utilized for television, internet, or digital based cable telephone communication.
10. Data Network – Provisions shall be made throughout the building to extend a computer network throughout the building. New data outlet locations in walls shall be provided with backboxes and conduit stubs at the desired workstation locations. Conduits shall be stubbed into the ceiling cavity above suspended ceilings and provided with a pullstring for installation of data cabling by others. Wireless access points, data jacks, faceplates, horizontal cabling, patch panels, network switches and servers shall be furnished and installed by the owners vendor.
11. Access Control - Raceway and power requirements shall be incorporated into the building design to promote secured remote access at designated entries to the building. where requirements that reflect any access control equipment design that has been performed by others.
12. Intrusion Detection - Raceway and power requirements shall be incorporated into the building design to support security equipment installation that will be performed by the owner. The system shall consist of the following:
  - Main Security Control Panel
  - Security contacts on each door at grade.
  - Security contacts on each operable window accessible from grade.
  - Interior motion detectors where required by the owner.
13. Surveillance - Raceway and power requirements shall be incorporated into the building design that reflect any surveillance camera and recording equipment installation that will be performed by the owner.
14. Roof Mounted Renewable Power Production Source: A roof mounted photovoltaic solar panel array shall be provided and installed that features (110) solar panels with a minimum generating capacity of 33.0 kW. The system shall be installed complete with grid-tie inverters, rapid shutdown contactors, production meter and all wiring run concealed within the building structure.
15. Fire Alarm System: The building shall be provided with an addressable fire alarm protective signaling system to promote building occupant notification in the event of a fire emergency and to alert the local fire officials. The system shall be in compliance with all federal, state and local code requirements, and ADA regulations. The system shall be provided with a fire alarm control panel utilizing an auto-dialer. Standard horn / strobe annunciation capabilities shall be provided throughout the building with audible and visual signaling devices installed in all areas including corridors, toilets, offices, conference rooms, etc. Manual pull stations shall be installed in egress paths at all exterior doors. The system shall include the following equipment:
  - Main Control Panel located in a remote electric or utility room.
  - Remote annunciator mounted at main entry door.
  - (1) Horn/30 candela strobe in all rooms less than 900 square feet.
  - (2) Horn /30 candela strobes in all rooms that are 901 to 1600 square feet.

- Horn /30 candela strobes within the corridors, maximum 100 feet on center.
- Monitoring modules for sprinkler tamper and flow switches.
- Manual pullstations at each egress door with Stopper II covers as a false alarm deterrent.
- All fire alarm system wiring shall be plenum rated fire alarm MC cable assemblies where run above suspended ceilings and EMT conduit with type THHN wire where concealed in walls.
- Smoke damper (smoke detector) connection to the fire alarm system where ductwork passes through smoke rated walls.
- Smoke detectors shall be installed in storage rooms. Heat detectors shall be installed in any environmentally adverse areas requiring smoke detection.
- Carbon monoxide sensors will be provided in any Mechanical rooms where fossil fuel burning equipment is located.