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Wilmington Public Safety Facility

Beaver Street

Wilmington, Vermont

Electrical Systems Design Concept

June 30, 2020

DIVISIONS 26/27/28 ELECTRICAL

1. General

- a. Provide a complete electrical system in accordance with all applicable codes, to include electrical service, electrical distribution, general power, lighting, lighting controls, telecommunications systems, communications and fire alarm systems as appropriate for this building which will house the Wilmington Police Department and Fire Department. Codes applicable to the electrical work on this project are the Code of Ordinances of the Town of Wilmington and the State of Vermont which include, but are not limited to:
 - i. State of Vermont, 2015 Fire and Building Safety Code
 - ii. IBC-2015, International Building Code, with State of Vermont amendments
 1. Business Group B
 2. Residential Group R-2
 3. Storage, Moderate Hazard Group S-1
 4. Section 406 Motor-Vehicle-Related Occupancies, Public Parking Garage
 - iii. NFPA 1-2015, Fire Code, with State of Vermont amendments
 - iv. NFPA 70-2017, National Electrical Code (NEC), with State of Vermont amendments
 - v. NFPA 72-2013, National Fire Alarm Code, with State of Vermont amendments
 - vi. NFPA 101-2015, Life Safety Code, with State of Vermont amendments
 1. Chapter 22 – New Detection and Correctional Occupancies
 2. Chapter 38 – New Business Occupancies
 3. Chapter 42 – Storage Occupancies
- b. Provide electrical installation, specifically lighting, lighting controls and maximum voltage drops meeting the requirements of the 2020 Vermont State Commercial Energy Standards (CBES) and the Federal Energy Code, as appropriate.

- c. Provide coordination with Efficiency Vermont to implement energy savings measures that are practical and cost effective for the building and its use and to obtain maximum available incentive dollars for the measures that are implemented.
 - d. Coordinate with power and telecommunication utility companies and their requirements as necessary.
 - e. All devices and controls that may need to be accessed by occupants for adjustment, control or communications shall be arranged and located to meet 2012 Vermont Access Rules (amended 2010 ADA Standards for Accessible Design).
 - i. Maximum height: 48" AFF to centerline
 - ii. Minimum height: 18" AFF to centerline
2. Electrical Service and Distribution
- a. Provide coordination with Green Mountain Power (GMP) for electrical service to the building. All aspects of the service wiring installation shall be as per GMP requirements.
 - b. Electric service to the building will be underground from GMP owned, pad mount transformers. Transformer to be tentatively located on the north east corner of the project property.
 - c. The electric service is preliminarily sized be 120/208V, 3 phase, 4 wire, 600 Amp.
 - i. Refer to Electrical Conceptual One Line Diagram drawing EC1.
 - d. A diesel generator shall be provided which will power life safety and standby building loads as well as the electric fire pump.
 - i. Generator is tentatively sized as 200KW/250KVA, diesel fired with integral base tank for 24 hour operation, weatherproof, level 1 sound attenuated enclosure, battery charger, engine heater and two circuit breakers to serve life safety and standby loads.
 - ii. Generator is sized to power the entire building.
 - iii. Generator distribution shall be divided into two portions, from two automatic transfer switches, one for Life Safety loads (lighting, fire alarm) and the other for Standby loads (balance of building).
 - e. Basis of design for electrical distribution equipment is Square D. Equal products from General Electric, Eaton or Siemens shall be considered, as well. All equipment shall be provided from a single manufacturer.
 - i. Basis of design products for distribution panelboards and lighting panelboards are indicated on the Schematic Design Electrical One Line Diagram.

- ii. Distribution panels shall have bolt-on circuit breakers, panels shall be fully rated.
 - iii. Lighting panels shall have plug-on circuit breakers and may be series rated.
 - iv. All panels shall have door-in-door front enclosure covers.
- f. Wiring Methods:
- i. Follow all applicable codes and use good electrical construction practices when determining types of wiring methods and sizing of conductors and conduit. Install all power, control and signal wiring using methods as follows.
 - 1. Underground Wiring or Beneath Concrete Slab: Individual conductors in schedule 40 PVC rigid non-metallic conduit (RNC) for direct burial; transition to galvanized steel rigid metallic conduit (RMC) where conduit rises to be exposed above grade or concrete slab, from a minimum of 24" below finished grade.
 - 2. Exposed Exterior Wiring: Individual conductors in galvanized steel rigid metal conduit (RMC).
 - 3. Exposed Wiring in Utility Areas (Mechanical, Electrical Rooms, Mezzanine, etc.): Individual conductors in electrical metallic tubing (EMT) with set screw fittings and metal clad (type MC).
 - 4. Concealed Wiring above accessible ceilings: Individual conductors in electrical metallic tubing (EMT) with set screw fittings and metal clad (type MC) cable.
 - 5. Concealed Wiring in inaccessible walls and ceilings: Individual conductors in electrical metallic tubing (EMT) with set screw fittings and non-metallic (type NM) cable.
 - 6. Final connections to mechanical/vibrating equipment will be maximum 4' flexible metallic conduit (FMC) in dry areas and liquid tight flexible metallic conduit (LFMC) in damp/wet areas.
 - ii. All wiring in finished areas will be routed concealed and devices will be flush/recessed mounted. Wiring in the utility areas will be exposed where no wall finish exists. Wiring routed exposed on vertical surfaces will be routed vertically; horizontal wiring will be routed at the ceiling level of these spaces, not on the walls.
 - iii. Service and feeder wiring shall be aluminum conductors, XHHW insulation. All branch wiring shall be copper, THHN/THWN-2 insulation.
 - iv. Provide an insulated equipment ground conductor within all cables and raceways.

- g. Photovoltaic Solar Generation: Conduits shall be installed Pad Mount Transformer to the Electrical Room, and from the Electrical room to the Roof for future PV solar generation system to allow direct connection to the utility. Capacity will be provided in the main distribution panelboard for connection of future PV solar to be on the load side of the utility meter.
3. Lighting
- a. All general lighting will utilize LED (light emitting diode) light source luminaires. Lighting controls spaces will incorporate automatic measures allowing the lighting levels to be reduced or lights turned off based upon occupancy and/or daylight contribution, as possible, as required by the Energy Code, as a minimum.
- i. Interior automatic lighting controls will operate through the “vacancy” technique requiring manual control to turn lights on, and either manual or automatic control to turn lights off. This will require occupancy sensor switches for smaller spaces and power packs with sensors and low voltage manual controls in larger spaces.
 - ii. All spaces with daylight controls where required by Energy Code shall incorporate 0-10VDC daylighting dimming controllers, dimming the light to maintain a set, minimum light level in the space.
 - iii. Basis of design for general use interior lighting controls are products from Acuity, nlight localized, space-by-space lighting controls.
 - iv. Basis of design for lighting controls in Apparatus Bay, Sally Port, Vestibules and Corridors are products from Acuity, nLight Air, wireless, networked digital lighting control system.
- b. Luminaires: Luminaire appearance and locations shall be coordinated with and acceptable to the Owner and Architect. All locations shall be coordinated with Owners equipment and mechanical equipment and services to ensure luminaires are accessible for maintenance and do not hinder access to mechanical equipment.
- c. Controls: Controls will be coordinated with the size, use and arrangement of the space as well as to accommodate building and operations equipment. Automatic (occupancy, time) lighting controls shall be incorporated where required by Code. Daylight controls will be provided if a source of daylight is available in the space and it is required by Code.
- i. Occupancy sensor controls shall be adjusted to accommodate the use of the space, fine tuning the “off delay” of the control to ensure the luminaires do not turn off prematurely.
- d. Pole top and building mounted exterior lighting will be provided to illuminate the driveways, parking areas and the building perimeter. Luminaires will be LED light source luminaires, full cut-off type pole top shoe boxes, wall packs or downlights.

- i. Pole top area lighting shall be provided at the perimeter of each parking area section and shall have controls to reduce light output by at least 50% when no human presence is detected.
 - ii. Balance of exterior shall be illuminated with building mount full cut-off luminaires.
 - iii. Exterior lighting shall be controlled utilizing a multi-channel time astronomic controller with photocell input. Building mount and pole mount lighting shall be on separate exterior lighting control channels.
- e. The life safety lighting within the building (exit and emergency lighting) will be provided throughout the public areas of the building and in the utility spaces as necessary. Exit signage will be LED type powered from the life safety portion of the generator power distribution. Emergency lighting fixtures will be general use luminaires powered from the life safety portion of the generator power distribution system.
- i. UL924 relays shall be utilized to energize emergency lighting luminaires during a loss of utility power, as necessary, bringing luminaires to 100% output.
 - ii. Exit signs shall be white with red letters, internally illuminated with LED source, >2 Watt per face.
- f. Spaces, light levels, luminaires, controls
- i. Area light levels shall be as per Illuminating Engineering Society, North America (IESNA) "The Lighting Handbook", 10th Edition. Minimum egress lighting light levels are as per NFPA 101-2015 "Life Safety Code".
 - 1. Minimum level egress lighting allowed per 101-2012 for egress pathways under normal conditions:
 - a. Stairs 10 foot-candle, minimum
 - b. All egress paths except stairs: 1 foot-candle, minimum
 - 2. Minimum level egress lighting allowed per 101-2012 under emergency lighting conditions (loss of normal power) is not less than an average of 1 foot-candle and, at any point, not less than 0.1 foot-candle measured along the path of egress at floor level.
 - 3. All lighting levels listed are foot-candle, average, maintained.
 - ii. Provide for slight, initial over lighting of the spaces which will be trimmed down to proper light levels during the programming of the lighting control system.
 - iii. Corridors, Public Lobbies, Vestibules
 - 1. Light level 10 foot-candle
 - 2. Controls Utilize occupancy sensors to bring lighting to 100% when occupancy is detected. When no occupancy is detected

lighting levels shall reduce to approximately 20%. Utilize network time control to have lights off at night when no presence is detected.

iv. Lockers/Showers/Restrooms

1. Light level 10-15 foot-candle
2. Controls Manual control with dual-technology occupancy sensors, programmed for occupancy control.

v. Offices

1. Light level 35-40 foot-candle
2. Controls Manual switch with dimming control with dual-technology occupancy sensors, programmed for vacancy control. When lights are turned on, they shall be programmed to provide approximately 20FC at the desk allowing manual dimming control to bring luminaires to full brightness. Offices with windows shall be provided with daylight dimming control to maintain 35FC at desktops, unless otherwise dimmed by the control system or manual control.

vi. Conference, Patrol, Dispatch, Interview, Evidence, Armory, Records, Gear Room

1. Light level 35-40 foot-candle
2. Controls Manual switch with dimming control with dual-technology occupancy sensors, programmed for vacancy control. Rooms with windows shall be provided with daylight dimming control to maintain 35FC at desktops, unless otherwise dimmed by the control system or manual control

vii. Booking

1. Light level 80-100 foot-candle
2. Controls Manual switch with dimming control with dual-technology occupancy sensors, programmed for vacancy control. When lights are turned on, they shall be programmed to provide approximately 50FC at the desk allowing manual dimming control to bring luminaires to full brightness. Offices with windows shall be provided with daylight dimming control to maintain 50FC at desktops, unless otherwise dimmed by the control system or manual control.

viii. Holding

1. Light level 15-20 foot-candle
2. Controls Manual switch with dimming control.

ix. Bunk

1. Light level 15-20 foot-candle
 2. Controls Manual switch, dual-technology occupancy sensor, programmed for vacancy control.
- x. Training/Fitness Room
1. Light level 15-20 foot-candle
 2. Controls Manual switch with dimming control with dual-technology occupancy sensors, programmed for vacancy control. The space shall be provided with daylight dimming control to maintain 20FC, unless otherwise dimmed by the control system or manual control.
- xi. Kitchen, Break Room, Dayroom, Laundry
1. Light level 35-40 foot-candle
 2. Controls Manual switch with dimming control with dual-technology occupancy sensors, programmed for vacancy control.
- xii. Apparatus Bay, Sally Port
1. Light level 35-40 foot-candle
 2. Controls Utilize occupancy sensors to bring lighting to 100% when occupancy is detected. When no occupancy is detected lighting levels shall reduce to approximately 20%. Utilize network time control to have lights off at night when no presence is detected.
- xiii. Janitor Closet, Storage Spaces
1. Light level 20-25 foot-candle
 2. Controls Manual switch, passive infrared occupancy sensor, programmed for vacancy control.
- xiv. S.C.B.A
1. Light level 35 to 40 foot-candle
 2. Controls Manual switch, dual-technology occupancy sensor, programmed for vacancy control.
- xv. Mechanical Room
1. Light level 20 to 25 foot-candle
 2. Controls Manual switch, dual-technology occupancy sensor, programmed for vacancy control.
- xvi. Electrical Room
1. Light level 20-25 foot-candle
 2. Controls Manual switch, only; automatic controls not allowed per Code
- xvii. Parking, Driveways, Walkways (exterior)

1. Light level 0.5 to 2 foot-candle
2. Controls On/off control via time-controller with photocell input (photocell on, time clock off), both building and pole mount luminaires. Pole mount luminaires shall be outfitted with motion sensors and dimming controls. Luminaires to turn on at dusk, full brightness for 4 hours, then dim down to 20% output. When a motion sensor on a luminaire senses human luminaire will return to 100% output until 10 minutes after no longer sensing a person or vehicle. Automatic raising and lowering of light levels shall be gradual, not instant.

4. General Power

- a. All interior spaces shall have general use receptacles at reasonable locations. Generally maximum 12' spacing in offices and similar, 20' spacing in corridors. Ground fault interrupting type receptacles and circuit breakers shall be provided as necessary within the Apparatus Bay, Kitchen and Bathrooms and within 6' of sinks.
 - i. All receptacles will be labeled with panel and circuit number.
 - ii. Provide floor receptacles with CAT6 jacks where required by Code (Training and Conference Rooms). Basis of design is Walker RFB2 recessed activation floor box. Receptacles in floor boxes shall be powered from a circuit breaker with integral GFCI protection.
 - iii. One duplex receptacle shall be provided in each Gear Room locker.
 - iv. One duplex receptacle shall be provided in each police personnel locker.
 - v. Cord reels shall be provided between vehicle locations in the Apparatus Bays to allow connection of the vehicles while parked. Cord reels shall be industrial grade, 20A1P, dedicated circuits, GFCI protected.
- b. All receptacles will be specification grade 20A 120VAC rated.
 - i. Receptacles with integral ground fault circuit interrupter (GFCI) shall be provided where required and where appropriate. Where the GFCI receptacle would be concealed behind equipment where deemed "not accessible for resetting", a standard receptacle shall be provided with GFCI integral to the circuit breaker serving the circuit.
- c. All receptacle devices shall be white finish with high-impact resistant thermoplastic wall plates, unless otherwise directed by the Architect.
- d. All exterior, damp and wet location receptacles shall be provided with a metallic, weatherproof, while-in-use cover. All exterior receptacles shall be mounted in flush-mount boxes; surface FS/FD boxes shall not be allowed.
- e. Power connections shall be provided to all new HVAC and plumbing equipment provided as part of this project, as well as all 120 VAC systems control wiring.

- f. Power feeds will be provided to all building equipment, including the kitchen equipment, fire and police department equipment, handi-cap access door operators and building controls.
5. Life Safety Systems
- a. Life safety lighting was addressed in the Lighting portion of this design concept.
 - b. A manual fire alarm system will be provided with manual stations and audible/visual signals throughout the building.
 - i. Automatic initiation of the fire alarm system will be provided from sprinkler system flow switch(s), smoke detectors in the Mechanical and Electrical Rooms and aspirating smoke detection system serving the Holding Cell. The fire alarm system will provide supervisory functions as necessary to monitor the sprinkler system.
 - 1. Provide an aspirating smoke detection system to serve the Holding Cells.
 - 2. Provide smoke detection in all bunk rooms, corridors/egress pathways, lobbies and storage rooms.
 - 3. Provide carbon monoxide detection in all corridors and in the booking room (outside holding rooms); generally, outside all sleeping rooms.
 - ii. The fire alarm system control panel and power supplies will be in the main Electrical Room. A remote annunciator at the main entrance to the building for firefighter interface.
 - iii. Audible and visual alarm signals shall be provided throughout the building as required by Code a minimum.
 - 1. System visual signal strobes will be throughout the building.
 - a. Bunk rooms shall have Low-Frequency, 177cd horn strobes.
 - iv. Fire alarm system shall monitor status and alarms of the Apparatus bay and Sally Port gas detection systems.
 - v. Fire alarm system shall have the means to communicate to a central station through two paths.
 - vi. Provide an annunciator and fire-fighters key box. Locations shall be determined as per Fire Department direction.
6. Telecommunications:
- a. Service conduits with pullwires shall be provided from the riser pole located at Beaver Street, underground to a backboard in the Electrical/IT room. Two 4" conduits.

- b. LAN/Voice and cable television cabling will be provided from the telecommunications rack in the Telecommunications Room to device jacks throughout the building. Devices shall be located as described below, and as approved by the Owner, and shall be cabled back and be punched down on patch panels in the rack.
 - i. Voice and LAN will utilize CAT6 cabling
 - ii. CATV will utilize RG6 cabling
 - iii. Wall mount, 2-post racking shall be provided with patch panels for telephone, CATV and LAN, located in the Electrical/I.T. room and A/V room. All cables will be punched down in the panels and labeled by jack. Provide 25% spare capacity in patch panels.
 - iv. Cabling will be complete from the patch panels through to the wall devices in the units. All cabling will be tested upon completion of installation.
 - v. Mechanical controls will have CAT6 devices as necessary with cabling for each jack homerun to the patch panels. Owner cabling will be complete, labeled and tested.
 - c. Wall devices shall consist of two CAT6 jacks, one per office space, at desk location. Provide four wall devices in the Training Rooms and two in each Conference Room.
 - d. Provide wireless access points (WAP's) ceiling mounted, throughout the building to allow for continuous wireless access.
7. Security Systems:
- a. Around the perimeter of the building and selected interior locations. For purposes of schematic design, assume 8 locations.
 - i. Cabling shall be CAT6 shielded, assuming cameras to be POE, back to telecommunications rack.
 - b. Access control system shall be provided by Owner's vendor. The Electrical Contractor shall provide all power supplies, boxes with raceways to above the ceiling.
8. Radio Antenna Cabling
- a. There will be several radio antenna's on the roof of the building. Provide raceways from the Fire and Police Departments Dispatch rooms and Electrical/I.T. room to the Radio room. Provide Raceways from Radio room to antenna mounted on the roof. Cabling by Owner's radio system vendor.