260000 – ELECTRICAL / BAS

I. DESIGN

A. Electrical Main Services

1. Main Service:
   a. Where appropriate a three-phase four wire 277/480 volt main service is preferred.
   b. A circuit breaker coordination study shall be provided when the complete single line diagram is established and with the final sizing of the main service.
   c. Two (2) sets of spare fuses for each phase shall be provided for the Main Service served by a Fusible Main Service Disconnect.
   d. Site Plans shall indicate the routing of the incoming electric utility lines from the supply source to the electric room in the building.
   e. A spare underground conduit shall be provided from the utility pole to the pad mounted transformer for high voltage lines, as required by the utility.
   f. A spare conduit shall also be provided from the utility pad mounted or pole mounted transformer to the CT cabinet for future use.
   g. All building wiring shall comply with the requirements of the Fairfax County adopted version of the National Electrical Code (NEC).
   h. The A/E shall send building load letter and plans to the electric company with copy to BDCD Project Manager at appropriate times during design.

2. Main Switchboards/Switchgear:
   a. Main Switchboard/Switchgear or the Main Distribution Panel (MDP) shall be provided with at least 25% spare capacity and space for future use.
   b. Provide a spare breaker corresponding to each nominal panel board size such as 100A, 225A, and 400A for building greater than 50,000 square feet.
   c. In all buildings less than 50,000 square feet in size, provide two spare breakers in the switchboard for future use as a replacement or addition for renovations.
   d. For 480 Volt systems, provide a spare 100 amp-42 circuit-120/208 Volt panel board with a built-in step down transformer.

3. Emergency Power Distribution System (Life Safety):
   a. The emergency power distribution system (Life Safety), without an emergency generator, battery back-up or UPS system, shall not be permitted.
   b. The designated emergency service must be an entirely separate service, and sufficiently remote from the main to minimize the possibility of simultaneous interruption of power supplied.
   c. Emergency power systems shall comply with the requirements of the Fairfax County adopted versions of the NEC and NFPA 110.

4. To comply with OSHA's lock out and tag out requirements disconnects, panel boards and all other electrically powered equipment shall have a means of de-energizing and locking out the equipment for service and repairs.

5. Trapeze Mounted Transformers:
   a. Trapeze mounted transformers are discouraged.
   b. Trapeze mounted transformers 75 kVA and above, shall not be permitted.
   c. Trapeze mounted transformers should have supporting structure that has been designed by a structural engineer.

6. Equipment rooms where switchboards, panel boards or transformers are installed shall be properly ventilated and conditioned to prevent ambient temperature from exceeding the listed environmental limits of the equipment residing in the space. Refer to Division 230000 for specific room temperature requirements.

7. Data and Communications Rooms:
   a. Data and communication rooms shall be designated as separate rooms from the electrical rooms. This is necessary to keep cable clutter, risk of electrical shock, heat, and EMF interference to a minimum.
   b. Data and communications rooms shall be provided with receptacles that are powered by standby generator circuit.
   c. No electrical transformers or distribution panels shall be permitted in telephone/data or communications rooms or closets.

8. Working Space and Access for Electrical Panels and Other Electrical Devices:
   a. The working space around electrical panels and other electrical devices must meet NEC requirements for clearance, and provide necessary space for access, although, the standard NEC required clearances may not be sufficient in all cases.
   b. The working space in front of electrical panels and other electrical equipment shall be sufficient to provide safe working space to minimize exposure to flash hazard.
   c. Access to the electrical panels and other electrical equipment shall be limited to qualified electrical staff by providing locks and appropriate signage to restrict direct entry and prevent flash hazards.

9. Arc Flash Analysis
   a. An arc flash hazard analysis shall be performed on all panels, switchboards, motor control centers and control panels, and an arc flash hazard warning label shall be posted on the equipment in accordance with the Fairfax County adopted versions of the NEC and NFPA 70E.
   b. A circuit breaker coordination study and an arc flash analysis are required for all new and modified services.

10. Specifications shall require installation of electric demand meters/monitors as part of the Building Automation System.

11. Main Electrical Room lighting in non-generator or UPS powered emergency systems shall have a self-contained battery back-up or a separately mounted (wall or ceiling)

unit rated for a minimum of 90 minutes. Provide one 20 ampere duplex receptacle for all indoor main service room fed from the Emergency System.

12. The use of motor control centers is discouraged and shall require approval in writing by BDCD Project Manager and FMD if requested to be used.

13. Surge Protection Device (SPD) or Transient Voltage Surge Suppressor (TVSS) shall be installed at all building facilities' electrical system. Provide surge protection devices in two stages: the first SPD shall be installed at facility main service entrance. Then, any residual voltage can be further suppressed by installation of the second SPD at power panel of critical loads (i.e data room). Proper attention must be given to coordination of cascaded surge protection devices. Integrated SPD is preferred, complete with indicator lamp to signal the need for replacement.

14. Main Electric Room shall be designed to have a minimum of 20 percent future use wall space with available NEC clearance.

15. For projects where there is a potential for solar panels to be installed, install one 4" conduit for power and one 1" conduit for communications from the roof to the electrical room.

B. Riser Diagrams and Panel Schedules on Electrical Drawings

1. Specifications shall require the installing Electrical Contractor to provide 1/4"=1' scale layouts of all electrical and data/communications rooms showing dimensioned Switchboard/Switchgear, MDP, panel boards and transformers prior to installation. This shall also be required as a submittal in the Submittal part of the applicable specification sections.

2. Indicate on each panel schedule as "Fed from ----------". This designation shall be required to be shown on typed panel schedules posted inside the panels and labeled on the panel's front cover with an engraved phenolic plate. Phenolic plates shall be red background for emergency power systems and black background for normal power, both with white filled lettering. Plates shall be installed in the field by the Electrical Contractor.

3. Provide computed NEC demand load on all panels and sub-panels utilizing NEC demand factors as per panel schedule attached as 260000 - Exhibit #1. In addition, show the load corresponding to the "feeder ampacity" and the "connected load" to determine the adequacy of the panel per NEC. A "Total Facility Load Analysis Table" based on the connected loads shall also be provided on the riser diagram at 100% Construction Documents submission.

C. Emergency Generator and Transfer Switches

1. The A/E shall coordinate the requirements for the connection of building systems to the generator per project. New buildings shall have emergency equipment and distribution above grade and comply with Article 708 of the NEC for Critical Operations Power Systems requirements for equipment and materials used in the project. Existing facilities with new or reused equipment shall be installed above grade, in locations as allowed in Article 708 of the NEC. Branch feeders and circuits in existing facilities shall be installed in a method allowed by NEC 708.10, exclusive of the 2 inches of concrete requirement. In police stations and fire stations, all facility systems shall be on the generator including the air cooling system. Coordinate with the BDCD Project Manager for all other facilities.

2. The emergency generator system for new construction projects shall be designed such that load shedding is not required in order to pick-up the required connected emergency loads. Generator Systems to be refurbished or upgraded from the existing systems, where physical size constraints limit the generator size and/or the fuel tank capacity, load shedding shall be permitted (subject to FMD direction) only to ensure critical operations portion of the building shall be energized by emergency power during an outage. Connected loads on the emergency system shall be limited to the minimum code requirements and other operational requirements. Provide generator sizing calculations and projected run time utilizing any of the manufacturer's available generator sizing programs at 75% load.

3. The AE shall prepare a life-cycle cost analysis for diesel versus natural gas fired generators and furnish to BDCD Project Manager. BDCD Project Manager will advise AE which system to specify. Propane is not allowed as a fuel source.

4. The one-line diagram and specifications for the generator is to only have one circuit breaker and not three. The County cannot rent a portable generator with three separate circuit breakers in the event that the fixed generator fails. The engineer can use a trough and disconnects to feed the loads separately from one larger circuit breaker on the generator. The double throw switch is also required.

5. Where load shedding is permitted, the operation of life safety emergency egress and exit lighting, alarms and alerting systems, communications systems, sump pumps, automatic door operators shall be Priority Level I. Loads of refrigeration equipment, elevators, supplemental security systems and supplemental communication systems, critical operations lighting and power, and disaster shelters shall be Priority II. Cooking equipment and non-essential operations shall be Priority Level III.

6. All lighting in electrical and mechanical rooms shall be connected to the emergency system. All but one fixture in the room shall be switched to reduce electrical load and extend lamp life. Use illuminated toggle switch.

7. Where it is not feasible to size the replacement generators and associated fuel supplies to power the entire facility, the generator shall power the emergency life

safety system and designated standby power for elements of the facility in accordance with the Priority Levels established in the above paragraph. BDCD Project Manager in coordination with FMD shall designate which elements will receive direct emergency standby power and which elements shall be subject to load shedding.

8. The Emergency Generator system shall be designed to operate for 96 continuous hours.

9. Where an Uninterruptible Power Supply (UPS) or any non-linear loads are connected to the generator, proper allowances shall be made for such loads in the generator sizing computer program. Leading power factor equipment (such as UPS systems) shall not comprise more than 40% of the generator capacity. Provide approximately ten percent (10%) spare capacity in the generator to carry future loads.

10. Evaluate emergency generator system to determine whether or not an air permit will be required based upon Virginia Department of Environmental Quality standards. Where it is found necessary, the A/E shall make the application and obtain the permit.

11. Generators shall not be placed within the building envelope without BDCD Director approval. Locate the generator exhaust as far away as possible from the building air intakes and/or any operable windows. The minimum separation distance shall be 25 feet. If not feasible to provide the minimum 25 feet, written approval is required from FMD and the BDCD Project Manager. The generator muffler shall be located inside the outdoor generator set enclosure.

12. The specifications for the generator shall include the following items:

    a. [*Leak detection information moved to HVAC 230000*].

    b. The Jacket Water Heater shall be provided with a set of water shutoff valves for all units greater than 50 kW to facilitate jacket water hose and heater replacement without the necessity of draining the engine coolant system.

    c. The main circuit breaker shall be provided with auxiliary contacts to indicate light and alarm on the engine generator control panel and the Remote Generator Annunciator Panel (RGAP) when the main circuit breaker is in “OFF” position. Also provide a Red Mushroom “Emergency Stop Button” on the engine control panel. Depression of this emergency stop button shall trip the main circuit breaker and initiate generator shutdown.

    d. Provide a break glass type of “Emergency Stop Button” at the egress point of the generator room or enclosed space. If located outdoors, a NEMA Type 3R enclosure shall be provided for the “Emergency Stop Button.”

e. Specify that EPA Emission Levels shall be in accordance with a minimum of Level III of the EPA New Source Performance Standards (NSPS) regulations. Indicate manufacturer's published emissions for the style, model and capacity of the generator provided on the drawings.

f. The mode switch located on the generator control panel shall be labeled "Run-Off-Auto" per NFPA 110. Provide contacts to indicate light and alarm when the mode switch is "not in Auto position" on the generator control panel and the RGAP. Provide for remote monitoring of the generator status to the fire alarm panel and be compatible with incorporation into and reporting to the County EDGAR software program.

1 g. *Deleted article (battery requirement)*

h. The generator shall be required to meet Fairfax County Noise Ordinance Requirements at the property line. A/E shall stipulate what the maximum allowed db level is within the specifications.

i. Manufacturer's recommended electronic interface device shall be provided to the Owner, by the contractor, for diagnostics on all new generators. Manufacturer's representative shall fully train FMD O&M staff designees on new generator's diagnostics.

j. A 100 amp, single phase Generator Accessory Panel (GAP) with 8 (eight) circuit capacity, including the main circuit breaker integral to the generator shall be specified and mounted nearest to the engine control panel inside the protective housing for units 100 kW and greater and all units with Day Tanks. The GAP shall be factory hard wired to provide power circuits for the jacket water heater, battery charger, generator service lighting, and the 20-amp duplex receptacle which shall be also located on the side of the engine control panel inside the generator housing. Provide two spare 15 ampere circuit breakers – (one for wiring the day tank controls and other for future use). Provide the remaining two slots in the generator panel as spaces for future use. Provide a 1-1/2" conduit from the designated Life Safety panel to provide power conductors for the GAP.

k. Specifications for 250 kW and larger shall require data from a factory reactive load bank test and a resistive load bank test prior to shipment. The Contractor shall conduct an on-site field load bank performance test with unity power factor in accordance with NFPA 110 requirements for all new emergency generators. Final mechanical (Generator, Main Fuel Tank and Day Tank) inspections shall have been completed prior to initial start-up of the generator. Two weeks' notice shall be given to the Project Engineer to coordinate the initial start-up tests. Approval of preliminary electrical inspection shall be a pre-requisite for the start of performance and acceptance (Load Bank) tests. Load Bank Test shall be witnessed by the BDCD Project Manager (Construction Project Engineer or FMD

Project Engineer). Two weeks' notice shall be given to the Construction Manager to coordinate the performance and acceptance tests. The performance test results shall be signed off by the Owner (Construction Project Engineer or FMD Project Engineer). The building loads shall be transferred to the generator system after the load bank tests have been accepted.

l. All new or replacement generators shall have a non-fusible 3 position double throw disconnect and a connection box for a roll up temporary generator, installed for units up to 1200 amperes. Generators rated at or greater than 1200 amperes shall be provided with a tap - box to facilitate the connection to a manual transfer switch. Refer to Exhibits in 260000.

m. Provide a 24 (twenty four) light LED Remote Generator Annunciator Panel (RGAP) next to the Fire Alarm Control Panel (FACP) or in another location as determined by specific needs of the facility. A separate 1" 1-1/4"conduit with 2 4 twin axial 4 conductor shielded cables (Beldon 9413 8404 or equivalent) and twelve (12) #12 stranded copper conductors shall be provided from the generator control panel to the RGAP. The RGAP shall comply with the requirements of NFPA 110 with the following extra lights as optional on all projects (Additional lights may be added as necessary):

- Day Tank Trouble Alarm
- Normal Power
- Generator Running
- Generator Fault (Trouble)
- Main Circuit Breaker "OFF" position
- Green Light indicating "Panel Disarmed Temporarily"
- Fuel Supply Leak Detection System
- Spare
- Spare

n. Provide a separate 1-1/4" conduit with 16- Cat 5 control wires from the Automatic Transfer Switch (ATS) to the Generator Engine Control Panel (GECP) for the purpose of providing start-stop controls and ATS position indication, other required controls, and future controls.

o. Provide a separate 1" conduit from the generator control panel for connecting the Day Tank control wires. This conduit may be buried under gravel to provide mechanical protection between the Day Tank pad and the generator.

p. Provide a separate 1-1/4" conduit from the 60 amp GAP to the Day Tank for the power conductors. This flexible conduit may be buried under gravel to provide mechanical protection in the space between the Day Tank pad and generator pad in order to avoid a tripping hazard.

q. Provide an RS Generator Alarm Panel.

r. The generator must be designed to run on ultra-low sulfur diesel fuel.

s. Diesel emergency generators shall be supplied by an independent fuel tank and fuel delivery system. Packaged units with main fuel tanks, sub-base fuel tanks, belly tanks, on-board tanks or rail mounted tanks are not acceptable.

t. For fuel system requirements, refer to HVAC Guideline Division 230000.

u. Provide a Generator Connection Box per attached 260000– Exhibit #2 with separate 1" conduits from each ATS and the Generator containing 2 sets of four (4) conductor Biaxle Cable Belden #8404 or equivalent number #20 stranded copper control wires. Provide conduit and wiring for the two receptacles in the Generator Connection Box to be fed from the Life Safety and Standby panels respectively. Life Safety Panels shall be designated as EHLS & ELLS for 480 Volt Systems and ELS for 120 Volt Systems with corresponding Automatic Transfer Switches as EHLS and ELS respectively. For the Stand-by Panels the designation shall be EHSB & ELSB for 480 Volt Systems and ESB for 120 Volt Systems. Corresponding Automatic Transfer Switches for the standby panels shall be designated as EHSB and ELSB for 480 Volt and 120 Volt respectively.

v. Provide a roll-up generator feeder connection point with appropriately size connection lugs and approved quick connect cable connectors. Feeders shall connect to the emergency manual transfer switch.

w. The generator and automatic transfer switch shall be covered by the full one-year warranty for the project, in addition to a five-year warranty more extensive warranties offered by the specified manufacturers for equipment and labor. The contractor shall respond within two hours for any generator failures or problems that occur during normal or after hour timeframes during the one-year contractor warranty period, including weekends and holidays.

x. The Automatic Transfer Switch shall be specified and provided complete with a bypass-isolation feature to facilitate the equipment servicing without shutting off normal or emergency power to the facility. The bypass and isolation feature allows inspection, testing, and maintenance of the automatic transfer switch without interrupting power to the load.

y. Final inspection of the Emergency generator and the fuel tanks (main and Day Tanks) and fuel piping associated with the emergency generator system shall be performed by the Fire Marshall's office and the County's mechanical and electrical inspectors after the start-up of the generator has been completed, all wiring has been installed, and prior to the performance of the load bank test. After the load bank test has been accepted, the building loads are to be transferred

to the generator system. A generator schematic detail shall be provided indicating all conduit stub-ups emanating from the generator pad to the Three Position Switch, Generator Connection Box, any Equipment Rack, Day Tank and Electric Room similar to illustration shown as 260000 – Exhibit #3.

z. O&M training for Emergency Standby Generators and Automatic Transfer Switches shall be conducted by a certified training instructor provided by the manufacturer and shall be performed on-site after the startup and acceptance tests of the generator have been completed.

aa. Generator pad shall be minimum 6" above grade monolithic pad. Outside dimensions of the pad shall exceed that of the generator set a minimum of 6" on all sides with ¾" chamfer.

bb. Specialized maintenance servicing tools (diagnostic tool, laptop computers, I-pads or android pads, etc.) required for Emergency Standby Generators and Automatic Transfer Switches shall be provided by the installer and shall be transmitted to the Construction Manager then provided to FMD. IT equipment shall have prior approval by Fairfax County DIT and be compatible with the Fairfax County network.

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13. Facilities with Photovoltaic (PV) (Solar Panels) installed:

a. The PV system shall shut off during the operation of a generator (it will no longer receive voltage from the grid, therefore it islands itself (UL1741, which is a requirement for all grid-tied PV inverters)). There are typically two scenarios:

i. <u>Whole Building Backed Up</u> – If the entire building is backed up by the generator, the PV system gets interconnected on the "line/utility" side of the transfer switch in the building. This allows the generator to kick on and satisfy loads in the building, while the PV remains off since it's on the utility side of the transfer switch. The generator shall not back feed the PV system.

ii. <u>Partial Loads Backed Up</u> – If a portion of the building is backed up by the generator, these loads shall typically be isolated from the main distribution panel and have their own separate critical loads sub panel and a transfer switch. This isolates the non-backed up loads in the event of an emergency and allows the generator to feed the backed up loads panel only. In this scenario, the PV interconnection can follow the "standard" interconnection guidelines, which is either a back-fed breaker or supply side interconnection.

D. Grounding and Bonding

1. Provide grounding as per NEC. Additional grounding rods may be required to achieve ~~5~~ 10 ohms or less. Single point ground system may be required in a portion of the building. A test well shall be provided for one of the main grounding grid rods

and the location of the test shall be marked on the Site Plan. Furnish a copy of the ground test report to BDCD Project Manager prior to substantial completion and include in O&M documents.

2. Under no circumstances is an isolated ground to be installed. All grounds shall be bonded.

3. A green insulation ground conductor is required in all raceways. Conduit or cable tray is not to be relied upon as the ground path.

4. Fully rated circuit breakers shall be used. Series connected rated circuit breakers are not to be used.

5. Switchboard construction shall be utilized for electrical distribution of 400A or greater.

6. A main grounding bar shall be installed inside the electrical room, and connected to the grounding rods, lightning protections system (where necessary), building steel, counterpoise and main water pipe. All secondary transformer neutrals shall be connected to this grounding bar.

7. Main service neutral shall be bonded at the service entrance disconnect and the grounding bar in accordance with NEC requirements.

8. A counterpoise or grounding grid around the entire generator is required as per 260000 – Exhibit #4. The generator and the Main Fuel Storage Tank and the Day Tank shall be grounded and this grounding grid shall be bonded with any other building grounding grid or the Lightning Protection System grounding.

E. Receptacles

1. GFCI and AFCI receptacle circuits shall not share neutral wires with normal circuits or multiple receptacle circuits. Sharing of neutral wires should also be avoided on receptacles that may be used for any type of computer or equipment with a switch-mode power supply**.** Each branch circuit shall be provided with its own neutral wire.

2. Use of outdoor receptacles shall be minimized. Where provided, outdoor receptacles shall be GFCI and designed to limit access to authorized personnel, only. Provide receptacles adjacent to exterior mechanical equipment for maintenance purposes per NEC requirements.

3. Use Arc Fault Circuit Interrupters (AFCI) to protect all circuitry (excluding smoke

alarms) in sleeping and living areas (except for those with GFCI protection). Protection may be circuit breaker or receptacle type. Receptacle based protection shall have code compliant branch circuitry.

4. Provide Tamper Resistant receptacles for areas specified in Article 406.12 of the NEC

F. Fire Alarm System

1. The installer of the fire alarm and Fire Suppression Systems (see Section 230000) shall provide four complete sets of Maintenance and Operation manuals, parts manuals, and list of local vendors for the system to the Owner at Substantial Completion.

2. Provide a locked document box adjacent to the main fire alarm panel that contains a full size set of as-built drawings, ½ size set of as-built drawings, a flash drive with PDFs of the as-built drawings, and all product data and calculations. The box shall be keyed to match the fire alarm panel.

3. The Contractor shall turn over fire alarm system keys, operations and maintenance manuals, and as-built drawings to Owner at or before Substantial Completion.

4. The Contractor shall provide as-built drawings prints, as-built schematic diagrams and wiring diagrams, keys to cabinets, panels, and manual stations and any access codes shall be provided to the Owner at Substantial Completion.

5. The contractor shall provide a non-proprietary system for which repair parts and service is readily available to the County from local vendors. The County shall not be bound to an exclusive vendor for repair, maintenance or material procurement for the system or its components.

6. Fire alarm devices vary widely in their electrical characteristics and must be carefully matched with suitable control panel to assure proper performance. Fire alarm devices, control panel and annunciator panel must be from the same manufacturer. Modifications to existing fire alarm systems shall utilize equipment that is compatible with and by the same manufacturer as the existing system.

7. Provide a graphic annunciator in accordance with the Fire Marshal's requirements.

8. Ensure all addressable interface modules are located in a conditioned space.

9. Verify if a voice fire alarm system is required by the VUSBC.

10. Provide 20% space capacity in NAC and AMP panels. Provide calculations for the NAC and AMP panels with the shop drawings.

11. Provide 20% spare capacity on each circuit. Provide circuit calculations with the shop drawings.

12. Provide 20% spare battery capacity. Submit battery calculations with the shop drawings.

13. All fire alarm devices shall be readily accessible for testing, repair and maintenance purposes. All fire alarm devices located above a suspended ceiling must be clearly labeled as such on the ceiling. An LED light must be provided at the ceiling to show annunciation of that device, and access must be provided through the ceiling.

14. Smoke detectors shall be provided in accordance with NFPA 72 and the applicable text and tables. Avoid specifying and locating smoke detectors in addition to that required by Code.

15. Carbon monoxide device detectors shall be located in each space where fossil fuel equipment/appliances are located. All carbon monoxide detectors and devices shall directly interface with and be monitored by the fire alarm system. Fire Alarm system shall provide master control for all devices.

16. The contractor shall be required to provide the County with replacement initiation devices and audio-visual devices, equaling 10 percent of the total number of installed devices but not less than one of each type device, within seven days of Substantial Completion.

17. The specifications shall require that the contractor notify the Owner (Project Engineer to coordinate with FMD) at least 7 days in advance of the final complete test of the entire system to witness the testing prior to the acceptance by the County. Testing shall consist of, at a minimum: smoke and alarm, each smoke and duct detector, pull and reset, each pull station. Specifications shall require that the Contractor provide a complete overview of the system at the time of this system test.

18. The installer shall maintain the color-coding established by the manufacturer throughout the system. The terminations or connections in the control panels or junction points shall be clearly marked and the corresponding field wiring shall be permanently tagged.

19. Must provide multiple communication technologies to communicate with Central Monitoring Station; one must be a dedicated IP and one must be cellular connectivity. Provide all telecommunication network equipment required for the multiple communication technologies operation.

20. Auto-dialer program and format codes shall be transmitted to Owner at the Substantial Completion walk-through, and a copy shall be included in the operations manual for the fire alarm system.

21. An auto-dialer shall be provided and connected to support the Fire Alarm Control Panel (FACP). The auto-dialer, which serves the FACP, shall not serve any other equipment.

22. *Deleted*

23. The auto-dialer, which serves the security system, shall not serve other equipment.

24. Facilities with an elevator shall be provided with an auto-dialer for the elevator, connected to the emergency phones in the elevator cabs and elevator lobbies. The auto-dialer shall connect to the County's contracted monitoring service as directed by the Owner.

25. The FACP, the Fire Alarm Annunciator Panel, and auto-dialer shall be programmed to automatically reset once a trouble or fault is cleared, as required by the Fairfax County Fire Marshall.

26. The auto-dialer for the Fire Alarm system and the elevator emergency phones shall have manual onsite reset capabilities and shall automatically reset once the trouble or phone line or power interruption has cleared.

27. The auto-dialers shall automatically restore and or reset upon power or phone line interruption, once the power or the phone line restores and or stabilizes.

28. The auto-dialers shall be programmed to monitor/report events as required by the Fairfax County Fire Marshall's office. These events shall be sent via the dedicated phone lines to the County's contracted monitoring company as directed by the Owner.

29. The auto-dialer test timer test shall be programmed to perform between 7:00 A.M. and 1:00 P.M.

30. The contractor shall be required to arrange to receive and respond to all trouble and alarms received by the County's monitoring service prior to building occupancy by the County.

31. Duct detectors shall be programmed for Supervisory alarm as required by code.

32. Shelters and drug treatment facilities sleeping quarter's smoke detectors shall be programmed for Supervisory alarm as required by code.

33. The contractor shall transmit a copy of the Fire Marshall's final inspection report to the owner for transmittal to FMD prior to building occupancy by the County.

34. A key box is required by the Fire Marshall's office for the Fire and Rescue Department key access to buildings. The contractor shall coordinate with the Fire Marshall's office for the location and provide and install all required key boxes.

35. A/E shall obtain the most current copy of the Code Reference Package (CRP) for Architects, Engineers, Designers and Installers from the Fairfax County Fire & Rescue Department, Fire Prevention Division, Engineering Plans Review Section, and shall incorporate all requirements CRP into the design documents. All requirements of the CRP which are intended to be the responsibility of the Contractor shall be clearly identified as such in the contract documents.

36. Specifications shall clearly state that the Contractor is responsible for paying for all shop drawings, review fees, and permit fee associated with the review, approval and permitting necessary for a complete fire alarm system. The Contractor shall also pay any additional costs for Fire Marshall's inspections beyond those paid for by the Owner as part of the building permit and inspection fees.

37. All FACP auto-dialers shall have external surge suppression to protect the systems from lightning and voltage surges both from the line voltage and the phone lines. The surge suppression shall be in addition to the manufacturer's built-in suppression system. The surge suppression shall be installed and located adjacent to the FACP and the auto-dialer. A separate surge suppressor shall be installed for each of the FACP's and the auto-dialers.

38. Warranty for Fire Alarm Systems, shall be the system manufacturer's standard warranty (one year minimum parts and labor), with options to purchase additional coverage.

39. Owner training (4 hours) for the Fire Alarm Systems shall be conducted by a certified training instructor provided by the manufacturer and shall be provided on-site after startup, and final Fire Marshall's inspections are completed and accepted.

40. Provide access panels to duct detectors for routine service and testing in a readily accessible and safely serviceable location. The access panel shall be located to allow for clear access with no obstructions such as, ducts, conduits, pipes or wires. The use of removable fixtures is not acceptable for access.

41. Fire Alarm System maintenance servicing tools (device programmer/diagnostic tool, interface devices etc.) shall be provided by the installer and shall be transmitted to the Owner for use in servicing, testing and maintaining the systems.

42. The contractor shall be responsible for all Fire Alarm System service and trouble calls on the equipment during normal and after normal work hours with a maximum response time of two hours, until the system is turned over and accepted by the Owner.

43. A plan of the fire alarm initiating devices and the corresponding device address shall be provided and installed adjacent to the FACP. These locations shall also be shown on the as-built floor plans for the fire alarm system. A copy of this plan shall be included in the Fire Alarm Systems O&M Manual.

44. Automatic HVAC shut down shall occur during fire alarm when alarm is initiated by automatic devices. HVAC shall not shut down if there is a manual trip of the alarm.

45. Provide interface wiring and conduit connection between fire alarm control panel and the remote generator alarm panel. Program Fire Alarm Control Panel to annunciate generator status alarms and have ability to connect into the County EDGAR system.

46. Fire alarm wiring protection for new critical operation facilities shall comply with NEC 708.14. Fire Alarm control panels and automatic dialers shall be on generator back-up powered systems where generators are available.

47. Fire alarm drawings and calculations shall be prepared by or under the direct supervision of an individual having a NICET Level III or IV certification in fire alarm systems or a Professional Engineer that passed the NCEES Fire Protection Engineering exam.

48. On renovation/expansion and capital renewal projects, AE must verify that existing Fire Alarm Control Panel and annunciator panels are capable of interfacing with new devices and has the capability of being modified or expanded based on renovation or expansion plan. AE shall include existing FACP model and make in the contract documents.

49. Fire alarm wiring shall be class A for IDC (Initiating Device Circuit) or SLC (Signal Line Circuit) loop for survivability.

50. Fire alarm wiring shall be class B for NAC (Notification Appliance Circuit) loop complete with EOL (End of Line).

51. AE shall specify and locate on the drawings a Fire Alarm Document Storage Cabinet in accordance with NFPA Code 72, section 7.7.2. Full size drawings may be located in tube, with the location noted in the cabinet. Representative cabinet is an SDB System Document Box, by Space Age Electronics, Inc.

G. Lighting

1. General

a. Lighting loads shall comply with the requirements of the most recently-adopted version of the International Energy Conservation Code. Provide an energy use calculation at 95% CD drawings. Complete Electrical Energy Certification Form at https://www.pdffiller.com/55503276-electrical-energy-certification-nec-2011pdf. Exhibit 260000 A shall be reviewed by the BDCD Project Manager before submission to the County with Permit set submission.

b. Lumen output shall not be achieved by overdriving LED lamps to produce high lumen ratings at the expense of lamp life; LED driver current shall be 500mA [or 700mA, as preferred by Owner] or lower. LED fixtures shall be rated for a minimum 70% lumen maintenance (L70) at 50,000 hours of operation, or higher.

c. Lighting fixtures with self-contained battery backup, fluorescent or LED, are not acceptable, except where specifically identified in this document. Where buildings are served by Emergency Generators, battery backup light fixtures shall not be permitted. Existing battery backup lighting shall be removed, except those serving the generator equipment room, or facilities not served by Emergency or Standby Power. Those in generator rooms shall be provided with dual head LED battery pack flood type fixtures for ease of maintenance.

2. Interior Lighting

a. Lighting shall be designed for the foot candle levels per the table listed in paragraph I.G.15 below with task lighting provided to supplement where higher levels are desired. For any space type not listed, follow the illuminance recommendations in the latest edition of the Illuminating Engineering Society (IES) Lighting Handbook.

Interior lighting fixtures shall be: LED 2' x 2' or 2' x 4' lay-in with A15 *[or A19, as preferred by Owner]* prismatic lenses with minimum thickness of 0.15" and overlay to diffuse LED diode image or 2' x 4' lay-in indirect with reflector surfaces. (277 volt preferred).

Color temperature for indoor applications shall be 4000K. Consider warmer color temperatures (3000K or 3500K) for some interior applications be used instead of the 4000K Follow IES handbook recommendations for specialty spaces.

Other fixture types should be considered, such as recessed "volumetric" troffers with microprismatic lenses (where ceiling height is limited) and linear direct/indirect pendants (where ceiling height is tall enough).

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Specify light fixtures which are bug resistant if available. Require fixture to be sealed to prevent pest intrusion if bug resistant fixture is not practical.

b. Light fixtures used as HVAC diffusers are not acceptable. Return air lighting fixtures are allowed with specific BDCD Project Manager approval.

c. Atrium areas, libraries**,** workspaces, and high ceiling areas shall utilize LED fixtures with Class A sound ratings. Alternately, remote drivers located in a properly vented area are acceptable. Ready access to all light fixtures is essential to properly maintain the designed lighting levels. Fixtures in high ceiling areas such as libraries shall be accessible from a ten-foot stepladder or capable of remote or manual lowering to a minimum of three feet from the ground. Fixtures should be laid out so that it does not require the use of specialized personnel lifts with articulating booms or build up scaffolding. Fixtures that are not readily accessible are not acceptable.

d. The use of incandescent fixtures, HID**,** and induction is prohibited. Lamps shall be a common stock trade item standardized so that lamps need not be special ordered. LED fixtures shall have drivers and LED boards/modules that are easily field replaceable.

2 e. Lighting control systems shall be designed to meet project target for LEED (refer to section 010000 General Design Requirements) and shall be provided with local control through occupancy, dimming and harvesting sensors **that do not communicate over the network or Building Automation System (BAS)**. All lighting control systems in a facility shall be supplied by a single sourced manufacturer and system type. Avoid overly complicated lighting control systems. Automatic dimming or switching systems shall be utilized in areas where "daylight" harvesting may provide all or most of the required light level, and/or where required by code. Coordinate with BDCD Project Manager for prior approval of any proposed dimming system when using energy conserving lighting systems. Stand-alone local lighting controls shall not interconnect with curtain controllers and Audio/Video systems or any auxiliary systems.

f. In libraries where stack lighting is accepted for use by Owner to be used, locate the lights where they are accessible for maintenance or repairs.

g. Where low voltage controls are incorporated for local switching, a layout of the relays shall be permanently placed in the facility's main electrical room and panels and circuits shall be clearly identified.

2 *h. Deleted (moved to Fire Station Manual)*

2 i. *Deleted (repeat)*

j. Day lighting and indoor lighting shall comply with ANSI/IESNA RP-1-04. Target maintained illuminance values are as listed below for spaces or tasks not listed, refer to the latest edition of the IES Lighting Handbook. These values may need to be

modified to suit the specific application in each facility. Submit documentation of the light loss factor(s) used in illuminance calculations.

a.	Corridors	10 foot candles
b.	Lobbies	10 foot candles
~~c.~~	Means of Egress	Per Code
d.	Storage Area	10 foot candles
e.	Waiting Rooms & Lounge Areas	30 foot candles
f.	General Office Areas	40 foot candles
g.	Desktops	30 foot candles
h.	Conference Tables	30 foot candles
i.	Secretarial Desks	30 foot candles
j.	Filing Cabinets	30 foot candles
k.	Book Shelves	30 foot candles

Public Spaces:

l.	Library Reference Areas	50 foot candles
m.	Library Reading Areas	50 foot candles
n.	Auditoriums	30 foot candles dimmable to 1 FC
o.	Cafeterias	30 foot candles
p.	Multipurpose Rooms	30 foot candles
q.	Parking Structures	(Varies with area of structure**,** level of use**,** and security. Follow recommendations in IES RP-20-14 and **r**eview with the BDCD Project Manager.)

k. High bay areas such as garages, gymnasiums or warehouses shall use pendant type LED fixtures with durable lenses. All fixture lenses shall be easily removable for repair or replacement. Cord and plug connection is preferred. Safety chains must be provided on each fixture. Where emergency generators supply the power, connect adequate quantity and layout of LED fixtures to emergency circuits for instantaneous illumination in accordance with Life Safety Code requirements for emergency egress

l. Occupancy Sensors shall be installed in areas with automatic lighting control requirements, such as parking garages (dependent on security requirements), warehouses, conference rooms, offices, rest rooms, data centers, cafeterias, etc.

m. Occupancy sensors shall be set to remain "on" for a minimum of 15 minutes before cycling off. They shall be adjustable to 30 minutes or more of **"**on**"** time**.**

n. Life Safety Lighting may be controlled with occupancy sensors, provided they have a fail-safe design and comply with the Life Safety Code and the Fire Marshal's requirements. Emergency lighting equipment shall comply with UL 924.

o. Occupancy sensors shall be wireless RF standalone type and shall be approved by BDCD Project Manager.

p. Provide occupancy sensors to automatically shut off lights for offices, conference rooms, storage rooms, gymnasiums, and other appropriate spaces. Coordinate with the owner/occupier for specific rooms in a given building. The occupancy sensor must be located in an appropriate location for optimum operation.

q. Emergency Exit lights shall be LED type.

r. Track lights, Mono, Twin Rail, Low Voltage Decorative lights are ~~a~~ not permitted as they are a high maintenance item and should be avoided and provided only if absolutely necessary.

s. Remote drivers shall be grouped in a space with sufficient size and ventilation to support the equipment and shall be readily accessible for maintenance purposes. Remote drivers located above ceilings requiring ladder access are not considered readily accessible.

1 t. Telecom wiring shall not be used for lighting circuits.

3. Exterior lighting

a. The A/E shall coordinate with the BDCD Project Manager prior to selection of the site lighting. The site lighting shall be provided and installed by the general contractor using Fairfax County approved site lights or by Dominion Energy under Dominion Energy and NOVEC Municipal Street Lighting contract. Subject to advance approval by the Owner, Contractor installed Induction or Light Emitting Diode (LED) site lighting fixtures may be used. See Products section for more details. The lights are to be used on small to medium size parking lots where cobra-head type fixtures are not appropriate and appropriate types and sizes of fixtures may not be available thru Dominion Energy.

2 b. Parking lot lighting may be provided and maintained by the local utility or included as part of the project. Coordinate with the BDCD Project Manager prior to selection. Outdoor walkway lighting will be provided and maintained by the Owner and included as part of the design documents. Bollard and puck type fixtures are strongly discouraged and must be approved by BDCD Project Manager and FMD.

c. In facilities that do not operate 24/7, the lighting levels must be reduced after the facility closing hours, to meet the Fairfax County Zoning Ordinance, Outdoor Lighting article. The A/E shall specify appropriate equipment to comply with the Zoning Ordinance.

d. Correlated Color Temperature (CCT) shall comply with Fairfax County Zoning Ordinance (currently maximum of 3000K). Maintain consistent color temperature

throughout site, unless special circumstances warrant otherwise, such as required by law enforcement or fire and rescue, Virginia Department of Transportation, or other emergency response agencies to perform emergency work.

e. All site and open garage lighting shall be provided with full cut-off to limit light pollution per Fairfax County Zoning Ordinance and LEED requirements. Locate exterior fixtures to minimize light spill onto adjacent properties and comply with all local ordinances regarding light trespass.

f. Exterior lighting fixtures shall have glass lenses. Plastic acrylic or polycarbonate are not acceptable as these degrade the light output by becoming yellow and are a maintenance burden.

g. All exterior lighting shall be controlled by photocell on and time clock controls. Building wall fixtures shall have time clocks located in the main electrical room and the photocells shall be located on the roof, installed and oriented as recommended by the manufacturer. Site area lights on poles shall have photocells, timer and motion detectors integral to the fixture and programmable locally.

h. Plans must show Contractor provided conduit for all site lighting circuits. The use of UF cabling for exterior lighting is not acceptable. All circuits for exterior lighting shall be routed in conduit.

i. Exterior building and walkway lighting not installed and maintained by Dominion Energy must be durable and vandal resistant. Metal bollard fixtures are not acceptable.

j. All wall mounted lighting control switches (and other similar wall mounted control switches) shall be toggle type switches. Rocker type switches for energy saving lighting control systems is acceptable.

k. Provide a mulch bed around ground light fixtures such as flag pole lights or building sign lights with a minimum distance of 5 feet between the fixture and the grass area so that a lawn mower will not come into contact with the fixture head.

l. Where appropriate, the fuel site lighting and the power shall be on the emergency generator.

m. Exterior lighting fixtures shall be IP67 rated for dust and water resistance. Specify bug-resistant fixtures and require sealing of all gaps with long-lasting caulk and weather stripping.

4. Parking Garage Lighting

a. Independent lighting control systems shall not be used in parking garages. Garages shall be designed with LED fixtures augmented with integrated photo cells and motion sensors.

b. The lighting controls within each fixture shall require only initial programming, which shall be pre-set at the factory before installation.

c. The fixtures shall permit fine tuning adjustments by maintenance personnel without the use of proprietary equipment or programming.

d. All control parameters shall be adjustable via a wireless configuration device capable of storing and transmitting sensor profiles. The device shall meet Fairfax County Department of Information and Technology standards and requirements. The devices shall be no large**r** than a cellphone. Three devices shall be provided to the Owner.

e. The occupancy sensors and the photo sensors addition improve the energy efficiency of the LED's by 50 to 80% more, depending on the configuration. The brighter fixtures are used to highly illuminate the entrances and exits to aid the human eye in adjusting from daylight to a garage interior without significantly increasing the fixture density. Some of the entrance and exit fixtures shall be reverse programmed to reduce the unnecessary brightness that occurs at night. The fixtures shall also contain 0-10Volt dimmable LED drivers. Selected fixtures in the project shall be bi-level fixtures that remain on at a lower lighting level for the entire evening and switched to a high level when motion is sensed.

H. Building Automation Systems (BAS)

1. In all buildings, a DDC Building Automation System (BAS) shall be installed. Computer based BAS that interfaces, monitors, and automatically controls heating, ventilating, air conditioning and other designated equipment is critical to the efficient operation of modern public buildings. The consultant shall integrate the building automation systems, with the exception of fire alarm, security and lighting systems, which must function as stand-alone systems. Refer to Division 230000 HVAC for additional design requirements of the BAS system.

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For most projects, the BAS is housed on FMD's server at the Government Center, however for projects under Using Agencies including but not limited to the Park Authority, Solid Waste Management, and Water Resources and Infrastructure, the server may be located and under control with that Using Agency. Coordination of the BAS server location and procedures required to install the BAS on those servers will be required with the Using Agency during the design stage. The contract document to be coordinated accordingly.

2. For new control systems, the protocol shall be based on BACnet. System Database shall host on a server, and use software to remotely view system graphics, and monitor, control, and configure the HVAC system and its properties. BAS shall include Owner approved graphics including Floor-level graphics with links to equipment for each building system.

3. The main BAS building controller and the workstation computer shall have UPS backup for 24 hours and shall be connected to generator power where available. When connected to a generator the UPS duration can be reduced to 2 hours.

4. All necessary provisions shall be made in the design of electrical systems to support the implementation of a BAS. These include sensors, control devices, instrumentation, motors, wiring and conduit.

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5. The BAS design concept is to automatically control the operation of the building's mechanical and other designated systems in order to optimize energy efficiency, reduce operating costs, provide preventive maintenance programs and aid in environmental protection and control. It includes the efficient monitoring, calculating and displaying of all utility energy sources used in the building. Energy usage shall be metered and captured by the BAS system as required to meet LEED requirements. Version 4.1 LEED Prerequisite is to install Building Level Energy Metering of all energy sources and metering of electrical as prescribed in ASHRAE 90.1 - 2016. Additional credit can be achieved for additional sub-metering. The concept is also to communicate to the FMD's Central Energy Meter System (BuildingLogix – BDX).

6. Provide a single-web-based command center from a single-source supplier. A building shall have no more than one BAS system. Multiple BAS manufacturers or models shall not be permitted in a building. Where a renovation requires the installation of a BAS in an existing building the legacy BAS shall be completely replaced to ensure that the building is provided one BAS with the same manufacturer, model and program.

7. The BAS shall not be directly involved in the local loop controls, and the local loops shall continue to operate if the BAS fails.

8. Provide individual control modules and any special/critical equipment with battery back-up for normal/non-critical sites. Provide battery/UPS back-up for all control components for critical sites.

9. All BAS components shall have surge suppression devices. Provide secondary stage SPD to protect critical load such as BAS components. Building controllers shall provide a service communication port for connection to a portable Operator's terminal (furnished by contractor). Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure.

10. The BAS must be capable of alarming to and allowing interface and programming by any compatible personal computer via the County's LAN. BAS shall be expandable and be compatible with the electronic equipment controls. BAS must have a security password/code for system entry and programming with multiple security access levels with different password. A network RJ45 jack shall be provided for network communications over the County's LAN. The DPWES project manager shall coordinate these requirements directly with DIT.

11. Specifications shall require contractor to provide on-site operator display LCD panel for local interface and all required interface devices that may include laptop computer, and/or handheld devices. Provide submittal for interface device hardware and software to confirm system configuration and operating system for approval by Owner. All Graphics shall be reviewed and approved by FMD. Remote processing units shall be capable of communicating with the local terminal. Integrate the new site into the County's existing BAS workstation server. Provide licensed software for the BAS. Provide CD copy of graphics package and programming software to Owner and install at Owner's central BAS control station. All hardware including, but not limited to, laptop computers, desk top computers and/or handheld devices shall meet Fairfax County Department of Information Technology requirements. The BDCD Project Manager shall provide requirements to the design firm and contractor.

12. Metering

    a. Energy Meter Standards

       Install dedicated water, electric and gas meters for monitoring of utilities on each utility feed on new construction and significantly renovated facilities. These meters shall be fully integrated with the building's BAS and the FMD Central Energy Meter System (BuildingLogix – BDX).
       Purpose:

1. To provide real time energy and water consumption data for immediate demand management, peak demand and flow alarms, to ultimately reduce energy-water consumption and costs.
2. Provide real-time information for remote monitoring of facilities during off hours and emergency situations.
3. Comply with current version of LEED requirements.

b. General:

In addition to utility meters, dedicated electric, water and gas meters shall be installed to provide accurate consumption and demand data for real-time energy tracking and automated demand management and alarming.

Where at all possible, tenant utilities should be directly connected to the utility provider. If this is not practical due to installation costs, a utility grade submeter must be installed to allow Fairfax to bill tenants for actual utility consumption and demand. Fairfax County Using Agencies are generally not to be considered as "tenants" for metering purposes unless specifically requested by the Project Manager.

For the energy monitoring (BDX-BuildingLogiX system), include in drawings and/or specifications for the Controls Contractor to contract with the County's contractor, Boland Trane to load the meter data (electrical, natural gas and water) into the County's BuildingLogiX system. Boland will make connection to the site through the IP address, create the site in the BDX, build the graphic and then load the square footage of the building and the last months of utility data if applicable and provided.
Boland Trane contacts:
Emily Herchenroeder, emily.herchenroeder@boland.com
Katie Kimmel, katie.kimmel@boland.com

In the BAS system, data for monthly usage shall be trended on a monthly calendar basis for the last 12 months (water, gas and electric).

At completion of the BAS setup, the AE shall arrange for the Commissioning Agent to review and verify the correctness of the data being displayed in coordination with Boland Trane.

13. Electric Meters

a. Main electric services: Install utility meter equipped with axillary pulse outputs fully integrated to the BAS and the central energy meter system (BuildingLogiX). The electric utility will generally provide the pulse output connections on an electric utility meter for a reasonable fee. As an alternative, a BacNet meter can

be installed after the utility provided meter and fully integrated with the BAS and Central metering system.

b. Demand management scenarios shall be programmed as part of the BAS design and installation.

1 c. Submeters: Install utility quality electric submeters for the categories listed below. These are taken from ASHRAE 90.1 – 2016 unless noted.

   i. Total electrical energy
      1. Supply from Utility Company
      2. Supply from Emergency Generator
      3. Supply from Solar Panels
   ii. HVAC systems
   iii. Interior lighting
   iv. Exterior lighting*
   v. Receptacle circuits
   vi. EV Charging (County Requirement)

*-if exterior lighting load is not significant, County will accept to be combined with interior lighting,

Note that up to 10% of the load for each of the categories (ii) through (v) shall be allowed to be from other electrical loads.

When individual circuits are required to be metered to associate with specific category, smart panelboards (indicated on drawings) may be used using BACnet MS/TP communications shall be complete with BCPM monitoring and data acquisition system components for monitoring voltage and power for each breaker. Provide the necessary components for a complete monitoring system including the following:

- BCPM Panelboard Monitoring System with all system components
- Data Acquisition board with mounting bracket
- Up to four (4) 21-unit current sensor strips

In addition, for buildings with tenants, these systems shall be monitored for the total building and (excluding shared systems) separately for each individual tenant. In general, County Using Agencies are not to be considered as tenants for metering purposes unless specifically requested by the Project Manager.

These meters shall be fully integrated with the BAS and the central energy metering system. Sub-Meter shall be programmed to notify BAS/EMCS upon power failure, phase loss or imbalance.

2 14. BAS Sample Displays:

Water - Incoming Meter	
Current Instantaneous Rate	3.5 GPM
Usage –Today (Cumulative)	3000 GAL
Usage – Yesterday	5040 GAL
Usage – Prior Month Total	151,200 GAL

Water – Irrigation / Cooling Tower Meter(s)	
Current Instantaneous Rate	1.2 GPM
Usage –Today (Cumulative)	600 GAL
Usage – Yesterday	1020 GAL
Usage – Prior Month Total	11,200 GAL

Gas - Incoming Meter	
Current Instantaneous Rate	5.0 SCFM
Usage –Today (Cumulative)	5600 SCF
Usage – Yesterday	7020 SCF
Usage – Prior Month Total	216,200 SCF

Electric - Incoming Utility Meter	
Current Instantaneous Rate	5.0 KW
Power Factor	0.91
Power Delivered (from Utility)	
Usage –Today (Cumulative)	71 KWh
Usage – Yesterday	120 KWh
Usage – This Month (Cumulative)	2,200 KWh
Usage – Prior Month Total	3,400 KWh
Power Received (to Utility)	
Usage –Today (Cumulative)	71 KWh
Usage – Yesterday	120 KWh
Usage – This Month (Cumulative)	2,200 KWh
Usage – Prior Month Total	3,400 KWh
Peak Demand – This Month	7.5 KW
Peak Demand – Last Month	8.0 KW

Notes:

1. Peak Demand is calculated as highest average KW load measured in any 30-minute interval during the billing month.

2. When solar is supplied on the building, negative values indicate power is being supplied to the grid. Values shown above will be net amount received from the utility company.

When Applicable:

Electric – Solar Power Meter	
Current Instantaneous Rate	5.0 KW
Usage – Today (Cumulative)	31 KWh
Usage – Yesterday	100 KWh
Usage – This Month (Cumulative)	1,200 KWh
Usage – Prior Month Total	1,900 KWh

Electric – Emergency Generator Meter	
Current Instantaneous Rate	0.0 KW
Usage – Today (Cumulative)	0 KWh
Usage – Yesterday	0 KWh
Usage – This Month (Cumulative)	20 KWh
Usage – Prior Month Total	30 KWh

Sample Sub-Meters (as applicable)

Electric – HVAC Sub-Meter	
Current Instantaneous Rate	3.0 KW
Usage – Today (Cumulative)	24 KWh
Usage – Yesterday	35 KWh
Usage – This Month (Cumulative)	900 KWh
Usage – Prior Month Total	850 KWh

15. Refer to Division 230000 for additional requirements and approved BAS manufacturers and systems.

I. Lightning Protection Integrated with the Main Grounding System

1. Lightning protection system is not a requirement for every facility. A risk analysis shall be conducted per NFPA 780 to verify the level of risk. The results of this analysis shall be provided to the Owner in the design narrative. The decision to include the lightning protection system shall be made based on the risk level and cost.

2. Direct contractor to submit detailed as-built drawings for the lightning protection system with UL certification. As-built drawings must show down-lead locations, conductor routing and conductor connections sites. A copy of the UL Master Label

certification of the lightning protection system must be included in the O&M manuals. Provide a bond for the lightning protection system with the main grounding grid or main grounding bar.

3. Require contractor to also provide as-built drawings for the building grounding system including rod sizes, locations, and configuration and connection details.

4. Specifications shall require that the contractor obtain a UL certification for the grounding system and submit a copy of the certificate to the Architect/Engineer and FMD for review and approval before final submission to the Owner.

J. Telecommunications Guidelines:

b. Refer to Appendix B; DIT Infrastructure Guidelines

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K. Conduits and Wiring

1. The use of Metal Clad (MC) Cables shall be restricted as follows:
   a. circuits shall be 30A or less.
   b. shall not be used at panelboard entry/exit (rigid conduit shall be used from panel/electrical equipment connections in electric rooms through the electric room wall)
   c. shall not be used to penetrate through walls or slabs.
   d. shall have an internal green insulated equipment ground conductor.
   e. Shall be properly fastened and secured every 5 feet.
   f. Shall not be installed where exposed to view or damage, except in electrical rooms.
   g. Shall not be installed in hazardous or wet locations.

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L. Electric Vehicle (EV) Charging Stations

1. Provide design for infrastructure (breakers and conduits) for required EV stations. Refer to Division 010000 for manufacturer and model.

II. PRODUCTS

A. Electrical Main Services

1. Main distribution panels, sub panels and disconnects shall be Cutler Hammer, Square D or Siemens, (no substitutions or equals). FPE and Challenger are not acceptable. Cutler Hammer CH- PRL1a panels are preferred with bolt in breakers. The type PB panels give flexibility by accepting both bolt-in and push-in breakers. Provide one stock circuit breaker for each type installed.

2. Main distribution panels and sub panels shall be constructed with tin plated copper terminations and distribution bus hard drawn copper.

3. The use of aluminum cable is unacceptable. Provide only copper cable. All branch circuits and feeder conductors #6 and larger shall have manufacturer applied phasing color for full length. (SIM PULL by South Wire manufacturer as a reference). Use of phase colored tape is not acceptable.

4. Motor Control Centers: Square D, General Electric Cutler Hammer, or Siemens.

B. Wiring Systems

1. Where a floor wiring system is required, a walker duct type floor system with separate trough for electrical, computer and communication wiring is recommended. Flat wire systems are not permitted and shall not be included in the design.

C. Emergency & Standby Generator and Automatic Transfer Switch Set

1. The acceptable manufacturers for emergency standby generators are: MTU Onsite Energy, Cummins and Caterpillar.

2. The use of a Detroit V-12 engine in generators is not acceptable.

3. Automatic transfer switch manufacturers shall be Zenith, ASCO, Cummins (no equal products).

4. All new transfer switches shall be isolation and bypass type with independent manual switch to facilitate easier maintenance and online reliability. Isolation and bypass ATS shall be maintainable while energized and not have hazardous exposure to the staff.

D. Fire Alarm System

1. Manufacturers for fire alarm devices, control panels, and annunciator shall be Honeywell Silent Knight 6820, Notifier, or Fire Lite or other non-proprietary system. Only listed graphic fire alarm annunciator panels (IEC; NFPA 72A 1-2.2) are to be installed. All fire alarm devices connected to the Fire Annunciator Control Panel (FACP) shall be by the manufacturer of the FACP.

2. System extensions, renovations, or replacements shall be with components wholly compatible with the FACP. Zone or booster panels and power supplies shall be provided as necessary.

E. Lighting

1. Site LED Lights

    a. Manufacturers:
        - Lithonia – (model DSX)
        - Cooper Lighting – Lumark Prevail
        - Holophane
        - Philips
        - General Electric
        - (no substitutions or equals)
    b. Lamp Type: LED
    c. Mounting Height: 20’ at parking lot, direct mounted.
    d. Pole and Fixture Color: Square Squat steel pole, grey pole and fixture
    e. Voltage: 120-277

2. LED Lights-Decorative (Verify with the BDCD Project Manager for current manufacturers and models)

    a. Manufacturer: Holophane (www.holophane.com) or FMD approved equal
    b. Model: WAE3/Washington Postlite Glass
    c. Lamp Type: 100 W LED
    d. Mounting Height: 20’ Base Mounted
    e. Pole and Fixture Color: Black or Grey
    f. Voltage: 120 Volts
    g. Optics Specified: Asymmetric full cutoff flat glass
    h. Ball Finial
    i. Control: Fixture-mounted motion and photo-sensor

3. Occupancy (Motion) Sensors – Wireless RF
    a. Lutron Vive
    b. Hubbell
    c. Legrand - Pass & Seymor
    d. or FMD approved equal

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4. Lighting Control Systems
    a. Lutron Vive
    b. Or FMD Approved Equal

F. Metering

1. Electric Main Meter: Honeywell, E-Mon, Pulse Meter, Class 2000 or equivalent by Schneider Electric, Siemens, or Cutler Hammer

2. Electric Sub-Metering: Honeywell, E-Mon, Smart Meter, Class 3400
   or equivalent by Schneider Electric, Siemens, or Cutler Hammer

3. Electric Sub-Metering of Solar or Alternative Power Generation: Honeywell, E-Mon, Green Class Meter, Class 5000
   or equivalent by Schneider Electric, Siemens, or Cutler Hammer

4. Electric Sub-Metering: Schneider Electric, PowerLogic HDPM 6000 series
   To be used when branch circuit level metering is required.
   or equivalent by Honeywell, Siemens, or Cutler Hammer