



GUIDELINES FOR ARCHITECTS AND ENGINEERS

Revised November 2024

County of Fairfax, Virginia
Department of Public Works and Environmental Services



Developed and Issued by:
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A copy of these guidelines may be obtained via:
<https://www.fairfaxcounty.gov/publicworks/guidelines-architects-and-engineers>

GUIDELINES FOR ARCHITECTS AND ENGINEERS
Fairfax County BDCD

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The November 2024 version incorporates the following updates:

Rev.	Spec. No.	Revision Description	Date Approved
2	010000- General Design Requirements	I.X.g – Added EV Charging Station model number. I.FF – Added Delegated Design requirements	11/21/2024
2	090000- Finishes	I.C.1, II.A.6, II.C.3, II.D.4, & II.E.5, Updated Attic Stock requirements. (Ceramic Tile, Ceiling Tiles, Resilient Flooring, Carpet, & Special Flooring	11/21/2024
2	100000- Specialties	I.F.14 – Added Shelter in Place Signage information II.A.1 & II. B.7 - Updated fountain and hand dryer model numbers	11/21/2024
1	120000- Furnishings	II.A. Updated System Furniture Specifications	11/21/2024
2	220000- Plumbing	II.A.3.c- added Zurn to Flush Valves II.A.3.d – Removed “battery back-up” on Faucets.	11/21/2024
2	230000- HVAC	I.B.4.b. Changed utility rate source from FMD to PM. I.F.8 – Revised attic stock requirements for filters	11/21/2024
2	260000- Electrical	I.F.19 and 22 – Updated Auto Dialer requirements I.G.2.a – Requires interior light fixtures to be bug resistant I.G.2.e – Added requirement not to connect shades or curtains to lighting controls. I.G.2.h and i – moved hose tower lighting info to Fire Station Manual I.G.3.b – Added exterior puck type light fixtures as not allowed. I.G.3.k – Added minimum distance for buffer around exterior ground light fixtures. I.G.3.m – Added exterior light fixtures to be IP67 rated and bug resistant. I.H.1 – Added information on BAS server locations. I.H.12.b & I.H.14 – Updated BAS meter display requirements. I.L.1 – Added EV Charging manufacturer information.	11/21/2024
1	280000- Electronic Security	I.F – New section on cabling information	11/21/2024
0	480000- Power Generation	New guide on solar power generation.	11/21/2024

The June 2024 version incorporated the following updates:

Rev.	Spec. No.	Revision Description	Date Approved
2	270000- IT Infrastructure Guidelines	Added the following attachments: Cable and Patch Panel Identification Generic LCD Display Elevations Telecommunications Symbols	6/13/24

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The March 2024 version incorporated the following updates:

Rev.	Spec. No.	Revision Description	Date Approved
1	010000-General Design Requirements	I.F – New – Cover sheets only needs to be stamped I.Q - For non-essential facilities, AE shall review with the PM emergency generator requirements I.X – Energy strategy updated to reflect current County policy.	3/28/24
1	070000-Thermal and Moisture Protection	I.L – Revised to require safety rail on all roof hatches. I.M – New – added safety pin information on roof access hatches. I.Y – Added requirement for access to all roof areas.	3/28/24
1	080000-Doors and Windows	I.M – Operable windows to be tied into the BAS. I.Q - Moved Physical Access Control System (PACS) information to new section 280000. I.S – New – residential grade windows not allowed. I.T – New – specify doors inside apparatus bays exposed to exterior as exterior grade. Misc. – Updated acceptable lock hardware products (removed Corbin & Sargent) and procedure (Section III)	3/28/24
1	090000-Finishes	II.A.4 Added CertainTeed and USG as acceptable manufacturers of ceiling tiles. II.D.6 – Updated link to Carpet End Use Application Table II.E.2 – Bamboo flooring no longer allowed	3/28/24
1	100000-Specialties	I.C – Added User supplies flags. I.D.1 – Added piano style hinges on partition doors. I.D.4 – Added that paper towel dispensers are not allowed. I.E.3.m – Janitor closet light to be sensor operated. I.H new – Added requirement to label stairwells per office of Fire Marshal. II.B.1 – Corrected model on bottle filling station. II.B.7 – Deleted obsolete hand dryers, added new dryers	3/28/24
1	110000-Equipment	I.A.1 and I.D.1 – Changed clothes dryers and ranges from gas to electric. I.A.5 – Added that dryer vents shall be accessible. I.H. Moved Electronic Security information to new section 280000.	3/28/24
1	220000-Plumbing	I.A.4 New, added requirement to use electric equipment in lieu of gas fired equipment. (also revised products section accordingly) I.B.3.e – Battery operated, or backup fixtures not allowed on lavatories.I.B.3.r New – Water piping not allowed in unheated spaces	3/28/24
1	230000-HVAC	I.A.1, New, added requirement to use electric equipment in lieu of gas fired equipment. I.A.9 – New – Cooling tower drains to be routed to sanitary sewer. I.B.4 – Updated Life Cycle Cost Analysis requirements. I.C - Main Fuel Tank, Day Tank & Piping for Diesel Generators updated. I.C.21 – Added training requirement for Veeder Root leak detection system.	3/28/24

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Rev.	Spec. No.	Revision Description	Date Approved
		I.C.22 – Added to connect Veeder Root to BAS. I.E.2.b – Added layout space requirement on roof top equipment. II.A.q Changed fire station exhaust extraction from Plymovent to Air Vacuum Corporation	
1	260000-Electrical	I.C.3 Added note that propane is not allowed as a generator fuel. I.C.12.g – Deleted specific use of 4-D battery requirement on Emergency Generators. I.C.12.u – Corrected 48 conductor to 4 conductor. I.G.2.t – New - Telecom wiring not allowed for lighting. I.I.5/I.I.12.b/I.I.13 – Updated LEED metering information I.L – Added New MC Cable use restrictions. I.H.51 - Added Fire Alarm Document Cabinet requirement II.F.4 - Added PowerLogic meter	3/28/24
1	270000-Information Technology	Was Appendix B. Miscellaneous information revised and added. Changes shown in red.	3/28/24
0	280000-Electronic Safety and Security	New division, transferred from 080000 and 110000. Information rewritten by Department of Emergency Management and Security.	3/28/24

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The December 2022 version incorporates the following updates:

Rev.	Spec. No.	Revision Description	Date Approved
1	110000-Equipment	I.H.7 – New Security Programming requirements	11.30.2022
1	140000-Conveying Systems	I.T – Added illumination requirement II.A.1. – Added elevator suppliers (non-proprietary only allowed)	11.30.2022
1	210000-Fire Suppression	8. – Added clarification of Hazard Group selection in shell spaces.	11.30.2022
1	220000-Plumbing	I.B.3.d – Revised to include water meter information previously in Electrical Guideline.	11.30.2022
2	230000-HVAC	I.A.6.c – Added access panel minimum size. I.C.11 – Moved fuel leak detection requirement from 260000 Electrical. I.D.5 – Revised to clarify compressors on DX units. I.E.1.d – Revised lower end of temperature range to 69 degrees from 71 for Sleeping Areas in Fire Stations. I.E.2.j – Added HVAC shutdown on condensate drain water detection. I.G – Replaced all “EMCS” terminology with “BAS” and added BAS Graphics requirements. I.G.5 – Added FMD’s Energy Metering System (BuildingLogiX) requirement for natural gas metering. I.G.6 thru 10 – Added BAS Graphics requirements. I.H.5 Commissioning Report Review II.A.1.f & i – Added Daiken as approved Air Handler and Rooftop Unit manufacturer. II.A.1.m - Updated Veeder Root model number. EXHIBIT 230000-A – Added cost data.	11.30.2022
2	260000-Electrical	I.A.13 – Added surge protection information. I.A.14 – Added Main Electric Room requirement to have a minimum of 20 percent future use wall space. I.A.15 – Added conduit requirements for future solar panel additions. I.C.3 – Emergency Generator – Added requirement to evaluate diesel versus natural gas. I.C – Emergency Generator – moved fuel system requirements to HVAC Guideline 230000 I.E.4 – Added Tamper Resistant receptacle requirement. I.F.22 – revised Auto-Dialer to be cellular. I.G – Lighting. Organized into General, Interior & Exterior I.G.c.4 – Revised exterior CCT to match Zoning requirements I.G.c.7 – Revised photocell and timer requirements on pole type fixtures. I.I – Term “EMCS” replaced with “BAS” sections, I.I.12 – Moved and updated metering information from Product section and added requirements for loading into FMD’s Energy Metering System. II.E.1 – Added manufacturers for Exterior Site Lights. II.F – Revised Meter from Schneider PowerLogic to Honeywell E-Mon, added main meter and meter for Solar applications.	11.30.2022

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The March 2022 version incorporated the 2021 revisions and following updates:

Rev.	Spec. No.	Revision Description	Date Approved
1	030000-Concrete	I P. - Field bending of concrete reinforcement	3.10.2022
1	080000-Doors and Windows	I Q.2 - Correction to Card Readers Specification	3.10.2022
1	230000-HVAC	I.E.1 - Deleted use of VRF Systems I.E.2.k - Moved article from specs to design criteria I.F.29.a/b - Deleted VRF specifications I.F.32 - Added note to not allow crimping of refrigerant tubing.	3.10.2022
1	260000-Electrical	I.A.13 - Added Service Entrance-rated Transient Voltage Surge Suppressor I.F.49/50 - New, Fire Alarm wiring requirements I.G.18.c - Occupancy (Motion) Sensors II.D.1 - Revised Silent Knight model from 5820XL to 6820. II.E.3 - Revised vendors for Occupancy (Motion) Sensors	3.10.2022
1	300000-Sitework	I.D.2 – Add BMP 3 rd Party Inspection requirements I.D.8 – Requires all U.G. stormwater pipe to be RCP. I.I.2 – Added minimum paving thicknesses.	3.10.2022

010000- GENERAL DESIGN REQUIREMENTS

I. DESIGN

- A. Materials contained in the Fairfax County Guidelines for Architect and Engineers (Guidelines) are provided for information and guidance to preferred practices, and shall not be construed as waiving or granting exceptions to any element of federal, state or local building codes, ordinances, and regulatory requirements as applicable to the specific project. Any conflict between these Guidelines and the governing local, state, or federal codes shall be brought to the immediate attention of the Building Design & Construction Division (BDCD), Fairfax County Department of Public Works and Environmental Services (DPWES).
- B. The Architect/Engineer (A/E) is responsible to assure that the most current version of referenced design standards in the Guidelines is used for the project. The Owner does not guarantee that Exhibits and Appendices are the most current versions.
- C. Any variance from these Guidelines must be submitted in writing to the BDCD Project Manager prior to 100% design submission.
- D. The project plans and specifications shall reflect the information and requirements of these Guidelines as applicable to each project and shall provide the following information:
 - 1. Fairfax County project number, contract number, quality control signoff block, and bid authorization signature block on the cover sheet for all plan review submittal phases (see Exhibit 010000-A).
 - 2. Building address and key map.
 - 3. Site area (acres) and building square footage.
 - 4. Soil boring logs and locations.
 - 5. U-values for walls, roof/ceiling, door and window.
 - 6. Design roof and floor loads, soil bearing value and structural material strengths.
 - 7. Doors, windows, finish schedules; lighting fixture, equipment and signage schedules.
 - 8. Site plan drawings shall be at a common scale and be oriented the same direction on all sheets.
 - 9. Building Plans for all disciplines shall be at a common scale and oriented the same direction and include a true North arrow on all sheets.
 - 10. The standard industry convention for referencing note and details shall be used on the construction documents.
- E. The A/E shall complete a Quality Control (QC) sign-off block on the cover sheet for plan submittals. The QC block shall include the number of QC hours spent by

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each discipline and be signed off by the responsible person reviewing each discipline. The QC block is to be included on the cover sheet for all submittals except for the bid set and the permit set and conforming set if issued.



- F. The cover sheet of the bid set drawings and the cover sheet of the bid set specifications shall be sealed, original signed and dated by an Architect or Engineer registered in the State of Virginia.
- G. Drawing Standards
1. All civil, architectural, structural, electrical, mechanical, and plumbing floor plans (including reflected ceiling plans), as a minimum, shall be prepared using the most current version of AutoCAD (CAD) to assure improved functionality when using a Building Information Modeling (BIM) program.
 2. Use of BIM and Revit program is acceptable but not required at this time. When using BIM, the A/E shall coordinate with the BDCD Project Manager for advance approval if a program other than Revit will be used.
 3. Quality Control of plans shall include overlaying CAD floor plans to check for conflicts. AutoCAD layering convention shall conform to AIA and AutoDesk standards.
 4. AutoCAD drawings shall be formatted as follows:
 - a. Zoomed to Extents
 - b. UCS set to World
 - c. Free of all extraneous lines or entities
 - d. Purged of all unused layers and blocks
 - e. Lines and polylines shall not be duplicated or contain unnecessary verticals
 - f. X-refs attached at 0,0,0
 - g. All entities placed on their correct/standard layer, with no entities on layer 0.
 - h. Units set to Architectural feet and inches.
 - i. All entities drawn with color and line type by layer
 5. Revit Files shall be formatted when submitting a BIM Model:
 - a. Ensure all files from different disciplines are on the same coordinate.
 - b. Ensure work from different disciplines are linked in and not imported in.
 - c. Units set to Architectural feet and inches.
 - d. Purge all unused families.
 - e. Delete all design options.

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6. A/E shall include County's General Notes, sheets 1 and 2 on all projects with site work. Request ACAD version from BDCD Project Manager.
 7. A/E shall incorporate County's ADA Standard Details drawing sheet on all projects as applicable as part of the construction document set on A/E's standard drawing border, and this sheet shall be signed and sealed. This sheet does not represent the entirety of the current ADA Standard, and additional project specific ADA information may have to be provided. Any revisions to these furnished details shall be approved by the BDCD Project Manager. Request ACAD version from BDCD Project Manager.
- H. Specifications shall follow CSI, 50-division format; and be specific regarding the codes to be met. Sections of specifications that are performance based must be clearly identified as such. Owner must approve use of performance specifications.
- I. Project specifications shall require that operations and maintenance (O+M) manuals include a complete paint schedule for the entire building; manufacturer and color information for plastic laminates, floor tiles, stains and varnishes, ceiling tiles, ceramic tiles; and all hardware model numbers. Brand names and specific information required for future ordering from manufacturer must be provided. These requirements are to be coordinated with County General Conditions and Division 010000 Specifications for O+M manuals and as-built documents. The Contractor must be required to provide as-built information to meet these requirements.
- J. The A/E shall coordinate with the BDCD Project Manager for allowances to be included in the specifications General Conditions, to include items and work scope required for unforeseen conditions. The allowance items, quantities and the associated costs are subject to Owner's verification and approval. The common allowances may include the following:
- Unsuitable soil undercut
 - Rock excavation
 - Additional signage
 - Contaminated soil removal
 - Partnering
 - Aggregate material (VDOT 21A or 21B)
 - Utilities
 - Geotextile fabric
 - Additional fire marshal requirements
- K. Requirements of these Guidelines must be coordinated with the County's Fire Station Design Manual, Police Station Design Manual and the Library Design

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Manual for applicable projects. All conflicts shall be brought to the attention of the BDCD Project Manager for resolution.

- L. The A/E is responsible for submitting and tracking project plans through the County building and site plan review process; Land Development Services (LDS), in a timely and diligent manner, and for making all required corrections, inserts, re-submissions, etc. Designers shall follow the latest edition of the Engineers & Surveyors Institute (ESI) Site Plan Peer Review checklist in the preparation of site plans.
- M. The A/E must carefully review the County's Special Conditions Sections A thru E and Division 1- General Requirements and coordinate all design specifications with these County requirements. Any conflicts or proposed modifications impacting standard County specifications shall be brought to the attention of the BDCD Project Manager.
- N. All applicable requirements of the Fairfax County Special Inspections Program must be reflected in the project specifications. The structural engineer must comply with all requirements of the Special Inspections Program including stamping shop drawings as reviewed or approved, as required.
- O. For buildings that are classified as critical structures under the Fairfax County Special Inspections Program <https://www.fairfaxcounty.gov/landdevelopment/special-inspections-program> ,the A/E will hire a testing agency as a sub-consultant on their prime contract to perform all critical structure required inspections in the building. The Contractor shall still be responsible for all required testing and inspections not falling under the County's Special Inspection Program. If the building is not classified as a critical structure, the Contractor shall have all required inspections performed in the building. The project specifications must reflect these inspection and testing requirements for the contractor.
- P. The A/E shall coordinate with the Owner to determine if the facility or any portions of the facility are to be designated as an "Essential Facility" as defined in IBC 1604.5 as Risk Category IV, and incorporate requirements for such facilities into the project plans and specifications.
- Q. For non-essential facilities, AE shall review with the Project Manager if an emergency generator or a hook-up for a rollup generator is required.
- R. In buildings with fixed shelving and stacks, such shelving and stack floor areas, shall be deducted from the net square foot floor area calculations, as approved by code.

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S. Fairfax County Office Space Standards

The Fairfax County Office Space Standards were developed as a space planning tool for the allocation of space within the Government Center Complex. The "Style" categories "A", "B", and "C" represent private (drywall) offices. Categories "E" through "G" are systems furniture workstations. Square footage figures are intended for planning purposes. Actual sizes of offices or workstations may vary due to the building floor plate, column placement, or standard workstation component dimensions.

Space Category	Title	Square Footage
Group A	Director	240 SF
Group B	Director & Assistant Director	180 SF
Group C	Director, Assist. Director, & Branch Chief	120 SF
Group E	Professional & Technical Staff	64 SF
Group F	Technical & Clerical Staff	48 SF
Group G	Temporary & Shared Workstations	30 SF

T. Public Art

The Owner may desire or require Public Art for the project and will take the lead to generate a Call for Arts during the project design or construction.

The Public Art, though generally located outside, may be in an interior location in which case the A/E shall coordinate the location, lighting, display requirements or other logistics. When located outside, Public Art shall be visually and physically accessible to the public. The site location, and construction information, including foundation that may be necessary, if available, shall be included in the permit documents. Alternatively, a separate permit can be obtained if details of the Public Art are not available however, the site plan must take into account a proposed location and coordinate with utilities, landscaping, lighting and other site features to avoid conflicts for the future Public Art installation.

U. Practices for Commercial Trash and Recyclables Handling


1. Refer to Fairfax County Public Facilities Manual (PFM) Section 10-0300 for Solid Waste and Recycling system requirements, and PFM Plate 28-10 for site layout requirements for a two dumpster trash and recycling containers area. Any variations from these requirements shall be coordinated with the BDCD Project Manager and DPWES Division of Solid Waste Collection and Recycling.
2. Collection containers described by Section 109.1-5-6 of the *Code of the County of Fairfax* shall not obstruct access to sanitary sewer manholes. A

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clear zone is required for a distance of 3 feet around the rim of any sanitary sewer manhole cover to provide access to the sanitary line in the event of an emergency and an area for erection of equipment for safe entry into the manhole.

3. The recycling collection system within the building shall include central collection containers for office paper in copier/printer rooms and other major generation areas.
 4. If recycling carts are emptied directly into a dumpster or compactor, the receiving equipment shall be clearly marked to identify it as a recycling unit; “Recyclable Paper and Cardboard Only, No Trash”.
 5. Recycling containers shall be different and readily distinguished from those used for refuse.
 6. Trash and recycling rooms shall meet current code requirements for separation from the rest of the building or protected by automatic sprinklers.
 7. Fairfax County places purple bins at various parking lot locations throughout the county for the public to dispose of glass bottles for recycling. Coordinate with the BDCD Project Manager to determine if this will be required for the project and obtain details if needed.
- V. Specifications shall require that the Contractor provide written, biweekly updates to the Owner/Architect detailing the status of all trade inspections including building, mechanical, electrical, plumbing, Fire Marshal, and Health Department, as applicable. Contractor’s written updates shall specifically identify all items of work, which have been rejected or otherwise not approved by inspectors.
- W. Specifications shall require contractor to submit detailed coordination drawings for all central mechanical, electrical and equipment rooms or areas of congestion to confirm that all equipment will fit with the required clearances. Trades to be included but not limited to shall be Mechanical, Fire Protection, Electrical, Plumbing and Telecom. A/E shall make CAD files available to contractor for required coordination drawings.
- X. All projects shall comply with the current version of Fairfax County’s Operational Energy Strategy, which is available on the County’s website. Requirements for facilities with an occupied area greater than 10,000 square feet include but are not limited to the following (refer to the policy for current requirements). Projects of smaller size shall strive to meet the same requirements where practical (review with Project Manager).

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- a. All new construction and major renovations beginning planning and design in or after 2021 meet Net Zero Energy (NZE) standards unless the Board of Supervisors is advised prior to the 30% design phase as to why the project cannot meet the NZE standard.
 - b. The minimum required certification is LEED® Gold plus 50% more efficient (based on energy consumption) than baseline. Baseline is ASHRAE 90.1 2016 edition or as used per latest LEED version.
 - c. Where appropriate, design for LEED Platinum.
 - d. All new facility construction and renovations shall use electric equipment and appliances, unless no alternative can be identified.
 - e. For new construction, design and build net-zero energy (NZE) structures that incorporate best practice energy-efficient design, with use of electricity-based space and water heating, and on-site renewable electricity generation.
 - f. Install solar photovoltaic systems at county facilities, using power purchase agreements or county capital funds as appropriate for the size and setting of each site. Direct on-site use of renewable energy systems is a key component of net zero energy construction. Review specific project requirements with the Project Manager at start of Schematic Design.
 -  g. Install necessary charging infrastructure to support Electric Vehicles (EV's) and other alternative-fueled vehicles as directed by County Project Manager. It is not required to include EV charging in building energy calculations for Net Zero. **If EV Charging Stations are provided, at least one space shall be 11'x 20' and compliant with the recommendations provided by the US Access Board, including but not limited to providing "Accessible EV Charging - Use Last" sign at the intended parking spot. Basis of Design is ChargePoint ® CP6000 Series, Power Select set at 40-amp input current. Refer to ChargePoint's website for design guide. Provide sub-metering as required in section 260000 Electrical.**
- Y. The A/E shall incorporate all LEED Prerequisite requirements and submit list of proposed systems and methods to obtain enough credits to achieve required LEED status to the BDCD Project Manager for review with the County's Environmental and Energy Coordination Committee. A/E shall prepare and submit a LCCA when there are options to achieve points by static measures, such as improved building envelopes, versus complex mechanical equipment or systems. Maintenance costs (refer to 230000 – HVAC for table of costs) shall be included. The A/E shall clearly identify all products in the specifications that contain post-industrial recycled content materials, and all regionally manufactured materials as defined by USGBC LEED® criteria. Selection of products to meet

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- these guidelines shall be coordinated with the Owner prior to final specifications. Project drawings to include the county's infrastructure requirements for photovoltaic panel installation after substantial completion. Note: Use the Fairfax County exterior smoking area policy which is stricter than the LEED requirement. Fairfax County policy states the following: If an exterior smoking area is to be provided for a County facility, County policy requires that it be located 50 feet from all public and all accessible entrances and 15 feet from all other entrances.
- Z. All site retaining walls, freestanding monumental site signs, and bus shelters and public art must be identified on the building permit application; otherwise, a separate building permit is required. The A/E is responsible to obtain all permits. As applicable, the pre-approved bus shelter model and plan control number must be shown on plans. A state building permit is also required for all bus shelters with any part located within the VDOT right-of-way.
- AA. Where site and/or rooftop mechanical equipment is unavoidable and visible to the public, the A/E is responsible to provide appropriate screening into the design and shall clearly represent aesthetic impact in all renderings.
- BB. The A/E shall verify and obtain the most current version of the "Code Reference Package for Architects, Engineers, Designers and Installers" from the Fire Prevention Division of The Fairfax County Fire and Rescue Department (FRD), and all requirements of the Code Reference Package shall be reflected in the plans and specifications. A copy is available from the Fire Prevention Division's website at:
<https://www.fairfaxcounty.gov/fire-ems/fire-marshall/code-reference-packages>
- CC. Provide storage space identified as "FMD Storage" sized to house attic stock for the building. Ideally, locate FMD storage space within or adjacent to the mechanical room.
- DD. Accessible Design

The most recent ADAAG requirements are to be used. Additional items noted in this section are based on lessons learned and past practices in county projects that the A/E is encouraged to meet to provide a greater accessibility beyond the minimum ADAAG requirements for the facility. In addition, the A/E shall coordinate closely with DPWES to strategize and determine a plan for how to most effectively allocate the 20% ADA required funding commitment for renovation projects. The building's design shall:

All design and construction shall comply with the most current Americans with Disabilities Act Accessibility Guidelines (ADAAG), as issued by the Department of Justice under Title II Regulations for scoping and technical requirements, and

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the most current ICC/ANSI 117.1, whichever is more stringent. Accessible design concepts based on lessons learned referenced within this document, must be complied with as may be applicable with each project.

1. Provide for equal access and use by everyone.
2. Provide for the usability of the design features in more than one prescribed way.
3. Make it easy to understand the purpose of each design feature and how to use it.
4. Provide all essential information in a variety of modes.
5. Eliminate, isolate or shield any design feature that could prove hazardous or inconvenience any user.
6. Employ design features that require little or no physical force to use them.
7. Provide an adequate amount of space in all program areas that is appropriately arranged to enable anyone to use them.
8. Provide seating, such as benches, seat walls, etc., along path of travel for those who cannot stand or walk long distances without resting.
9. Provide for accessible counters and sinks in break rooms and kitchenettes and locate them in a central or easily reached area of a room. Provide “dummy” cabinet doors in kitchenettes as may be applicable to conceal the sink pipes for ADA.
10. Provide for easy maneuvering and passage by mobility devices such as wheelchairs, when selecting furniture and furnishings in all spaces, especially conference and meeting rooms
11. Provide adjustable desks, chairs, and podiums for conference and training rooms as applicable.
12. Provide fully automatic (sensor operated) or push-button activated automatic door (s) at the main public entrance.

EE. A/E shall review project design and shall advise BDCD Project Manager if there are any potential concerns of Radon impact.

FF. **Delegated Design:**

- a. A/E to provide a list of delegated design items during the Design Development phase for BDCD Project Manager’s approval.
- b. Clearly state on the drawings and specifications the items that are to be delegated design by the contractor.

II. PRODUCTS

- A. The A/E shall coordinate with the BDCD project manager to identify any products or manufacturers that may need to be specified which are proprietary or limited to less than three acceptable manufacturers as No Substitution/No Equal

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Products. Justification for No Substitution/No Equal Products must be provided in advance.

- B. Any specified material, equipment or system which will be a No Substitution/No Equal Product, must be approved in writing by DPWES, prior to advertisement for bids. BDCD will obtain a letter from the “No Substitution/No Equal Products” vendor prior to advertisement of bids, stating the value of the subject work, and that the same pricing will be provided to all the contractors.
- C. The A/E is responsible for verifying that the manufacturer and product numbers for all materials and products included in the specifications are current at the time of bid. This shall include verification of all material and product designations included in these Guidelines.
- D. No Asbestos Containing Materials (ACM) are permitted to be specified, or otherwise approved, for use on any County project, unless the County specifically provides advance written approval.



PROJECT NAME

Project Location (address/locality)

Magisterial District: _____

Project number (including fund #)

A sample elevation/3D picture as space permits

Project Submittal Phase and Current Date

Department of Public Works and Environmental Services

QC Block

(See Exhibit A, Page 2)

Show on SD, DD,
and CD Sets only

Do not show on
Final Bid Set

DPWES LOGO

Design Team

Name

Discipline

Address

Phone

Approval Block
(See Exhibit A, Page 2)

APPROVALS

RECOMMENDATION FOR APPROVAL OF CONSTRUCTION:

 Director – Building Design and Construction Division, DPWES Date

 Using Agency Director (show agency name) Date

APPROVED:

 Deputy Director Date
 Department of Public Works and Environmental Services

QUALITY CONTROL SIGN-OFF

(for all submittals with the exception of Bid Set)

NAME	DISCIPLINE	HOURS
	Architectural	
	Civil	
	Structural	
	Mechanical/Plumbing	
	Electrical	

Guidelines for Architects and Engineers
Fairfax County, BDCD

030000 CONCRETE

I. DESIGN

- A. All structural calculations, drawings, and mix designs for cast-in-place, structural precast and architectural precast concrete shall be prepared under the supervision of a Professional Engineer (PE) licensed by the Commonwealth of Virginia. All drawings, calculations, and mix designs shall be sealed, signed and dated by a PE licensed in the Commonwealth of Virginia. Specifications shall require the Contractor to provide PE certification of shop drawings, calculations, and mix designs.
- B. Specifications and drawings of cast-in-place and precast concrete elements shall include requirements of the latest version of the Fairfax County Special Inspections Program (FC-SIP).
- C. Project specifications shall state that the Contractor is not authorized to proceed with manufacture or procurement of cast-in-place or precast elements until applicable shop drawings, mix designs and color samples are approved; and any required mock-ups are constructed and approved.
- D. Specifications shall reflect that the Contractor is responsible for scheduling and complying with all concrete inspections and associated reports. This includes inspections performed by the Owner-provided third-party inspection agency for the Critical Structures inspection per the FC-SIP. Refer to and coordinate with Division 01 – Testing and Quality Control.
- E. All testing and inspection of concrete work not included by the FC-SIP shall be performed by the Contractor's testing agency. This requirement is to be included in the specifications.
- F. Calcium chloride use shall be limited to the values in ACI 318 Chapter 4. Calcium chloride use is not permitted in concrete for reinforced concrete pipe or drainage structures as per VDOT requirements.
- G. Where concrete work abuts the building structure, plans will specify that the expansion joint will be caulked with a traffic grade caulking.
- H. Architect and/or engineer shall determine locations of construction and expansion joints and note specific requirements and locations on plans.
- I. Mix design for sidewalks, curb and gutter, and other site work concrete shall meet VDOT A4 (4000 psi) mix design specifications.
- J. Mix design for concrete surfaces that will be exposed to deicing salts shall be per ACI 318, Chapter 4 Durability Requirements.

Guidelines for Architects and Engineers
Fairfax County, BDCD

030000 CONCRETE

- K. Project specifications shall require that all structural precast or architectural precast elements be manufactured at a precast plant that is a certified member of the Pre-stressed Concrete Institute (PCI) and is operated under the supervision of a PE licensed by the Commonwealth of Virginia.
- L. For cast-in-place concrete structures and pavements exposed to freeze-thaw conditions, the project specifications shall identify requirements for Water/Cement Ratio and Entrained Air Content. On-site testing for Air Content and laboratory testing for Water/Cement Ratio will be conducted by Owner's Testing Agency.
- M. On renovation projects where a portion of the existing slab on grade is removed, the documents must show a detail with appropriate notes to identify the requirement to maintain the integrity of the under-slab vapor barrier at areas where existing slab is removed and then replaced. Where extensive saw cutting is required, contiguous larger area, slab removal is recommended instead of piecemeal slab removal and replacement to simplify the retention of a continuous vapor barrier.
- N. Concrete thickness for floor slabs directly on grade shall not be less than 3 ½".
- O. The use of fly ash (ASTM 311 and ASTM C618, Class F) and/or ground iron furnace slag (ASTM C989, Grade 100 or 120) in the concrete mix design specifications is encouraged where the finish of the concrete will not be adversely impacted.
- P. Specifications shall reflect that field bending or straightening of reinforcement partially embedded in concrete shall not be allowed, except as shown in the contract documents or permitted by the licensed design professional engineer of record.

II. SHOP DRAWING

- A. Project specifications shall require the Contractor to provide shop drawings for all cast in place, structural precast and architectural precast concrete, and all mix designs and connection details which are sealed, signed and dated by a PE licensed in the Commonwealth of Virginia, as required by the FC-SIP. Any documents required to be sealed, signed and dated by a PE by the FC-SIP that are not identified as a requirement of the Contractor in the specifications shall be considered to be a requirement of the Architect and the Structural Engineering Consultant.

Guidelines for Architects and Engineers
Fairfax County, BDCD

040000 - MASONRY

I. DESIGN

- A. Repairs and/or infills to existing structures shall be designed with matching mortar color, joint type, masonry color and texture, and masonry coursing pattern for all exposed masonry elements. Rake joints are not acceptable. Joints should be concave or grape vine to ensure weather resistant type of joint.
- B. Masonry specifications and drawings shall include requirements of the Fairfax County Special Inspections Program (FC-SIP).
- C. All testing and inspection of masonry work not covered by the FC-SIP shall be performed by the Contractor's testing agency.
- D. All exterior brick shall be Grade SW.
- E. Testing of mortar shall comply with ASTM C270, Specification for Mortar for Unit Masonry. The compressive strength shall be specified by mortar type applicable for the type and location of masonry as required. Note: Testing of mortar cubes in the field is not required by code nor recommend by ASTM C270. IBC Code inspection require that masonry assembly compressive strength be verified by either prism testing or unit strength method.
- F. Glass block shall not be used on exterior walls without written approval by Building Design and Construction (BDCD) Project Manager.
- G. Specify bull nosed block corners, for exposed block at occupied interior locations.
- H. Stock mortar colors are preferred. Written approval by BDCD Project Manager is required for any custom or specialty colors.
- I. Project specifications shall specifically require compliance with all applicable requirements of the FC-SIP, where applicable. Any requirements of the FC-SIP not specifically identified as a requirement of the Contractor shall be considered to be a requirement of the A/E and the Structural Engineering consultant.
- J. Project specifications shall state that Contractor is not authorized to proceed with manufacture or procurement of masonry elements or mortar until all related shop drawings, mix designs, and color samples are approved; and any required mock-ups are constructed and approved.
- K. A/E to include specifications for masonry cleaning to remove dirt, stains, efflorescence or other debris resulting from new work.

Guidelines for Architects and Engineers
Fairfax County, BDCD

040000 - MASONRY

- L. Confirm that the dimensioning of masonry openings for windows, doors, vents etc. fall on the masonry module sizes in the design and at shop drawing review to achieve brick coursing around the entire building both horizontally and vertically to avoid costly field cutting of masonry units.

Guidelines for Architects and Engineers
Fairfax County, BDCD

050000 - METALS

I. DESIGN

- A. All design and related calculations for structural elements and connections falling under this section shall be performed under the supervision of a Professional Engineer (PE), licensed in the Commonwealth of Virginia; and, all structural drawings and calculations shall be sealed, signed and dated by the PE.
- B. Structural steel specifications and drawings shall include requirements of the Fairfax County Special Inspections Program (FC-SIP) and American Institute of Steel Construction (AISC)).
- C. Project specifications shall specifically require the Contractor to comply with all requirements of the FC-SIP and AISC where applicable. Any requirements of the FC-SIP and AISC which are not specifically identified as a requirement of the Contractor shall be considered to be a requirement of the Architect and the Structural Engineering Consultant. Any offsite structural steel should be completed in certified shop verified by FC-SIP 3rd party firm hired by the A/E.
- D. All welders must be certified by American Welding Society (AWS). Contractor must submit copies of certifications for all welders before the welders will be permitted to work on the project.
- E. Contractor must touch up paint and/or primer after erection of steel or other metals. Specifications must be clear that primer is not considered a finish coat where finished metal is required.
- F. Roof access ladders that lead out from the building need to be fixed aluminum "Ships Ladder" with the following specifications: Angled 60-75 degree slope, 2' wide, 2"x 6" x 1/8" aluminum extruded channel stringers, 4" x 1/4" aluminum serrated tread on rungs, 1.666" aluminum Schedule 40 pipe on handrails. Need to be OSHA and ANSI 14.3 certified. O'Keeffes, Inc. **or Approved Equal (must be approved by FMD).**

060000 - WOOD AND PLASTICS

I. DESIGN

- A. Refer to the Fire Station Design Manual for fire station kitchen cabinets and countertops.
- B. Counter tops shall be either cabinet supported or front/side leg or panel supported. Unsupported spans in excess of 3'-6" are unacceptable. Larger spans to be supported with structural member or vertical support. All counter tops in wet and humid locations must have all undersides, edges and cutouts sealed with waterproof coating. Ensure that pipes, etc., do not interfere with recessed mountings. Counter supports and base cabinets must not preclude handicap accessibility requirements.
- C. All counter tops at wet areas such as public restrooms, kitchens, and other high use areas are to be a solid surface material. Particleboard counters are not to be specified at wet areas such as pools, shower rooms, locker rooms, kitchens, kitchenettes, bathrooms etc.
- D. Counters shall be supported by a continuous rail along the wall fastened to structural members in the wall at maximum 16" on center.
- E. All surfaces of solid wood used for finishes at interior spaces must be sealed to prevent damage due to fluctuations in humidity and temperature. Wood paneling must have built-in expansion strips.
- F. All millwork and cabinetry shall be specified to be custom grade, as a minimum, as defined by the Architectural Woodworking Institute (AWI).
- G. All millwork and cabinetry substrate shall meet ANSI Standards for Medium Density Fiberboard for interior use.
- H. All cabinetry and millwork hardware shall be specified to be quality grade and meet minimum Builders Hardware Manufacturers Association (BHMA) standards for each type. Verify with BDCD Project Manager for instances where heavy duty hardware may be applicable and/or required.
- I. Shop drawings for wooden roof trusses must be submitted to Land Development Services (LDS) for review and approval; and, drawings and calculations must be sealed, signed and dated by a Professional Engineer (PE), licensed in the Commonwealth of Virginia. Specifications shall reflect that the Contractor shall be responsible for paying LDS review fees for wood truss shop drawings.
- J. Accessible Design:
 - 1. Evaluate use of rounded corners and top edges (drip lines) for counters, cabinetry and protruding trim.

Guidelines for Architects and Engineers
Fairfax County, BDCD

060000 - WOOD AND PLASTICS

2. Provide roll under counters in all kitchenette and kitchen areas for access by wheelchairs to sinks and appliance use. Minimum clear width of the opening and the knee clearances must meet ADA Guidelines. Provide “dummy” cabinet doors in kitchenettes as may be applicable to conceal the sink pipes for ADA access.
3. A conveniently and centrally located portion of all public counters should be accessible from a standard seating position to the maximum extent possible.

070000 - THERMAL AND MOISTURE PROTECTION

I. DESIGN:

- A. All roof designs to comply with National Roofing Contractors Association (NRCA) guidelines.
- B. A metal coping system is preferred over a stone or pre-cast coping system. The BDCD Project Manager must specifically approve use of a stone or pre-cast coping.
- C. Exterior soffit should be constructed of anodized aluminum panels; Hardie Board; Dura Rock; Cement Board; or metal lathe with plaster. Gypsum board (drywall) and Green Board are not acceptable at exterior soffits.
- D. Asbestos containing materials are not to be specified for roofing, insulation, fire stopping, fireproofing or any other materials on the project.
- E. Adequate attic stocks for each type of sealant used must be required in specifications.
- F. Pitch pockets should be avoided to the extent possible and should not be used where pipe columns penetrate the roofing system. An alternate method such as typical vent flashing should be used at pipe columns. All pitch pockets shall be fabricated from stainless steel or cooper, be half-filled with non-shrink grout and a pourable sealer and shall comply with National Roofing Contractors Association (NRCA) recommendations.
- G. Roof drain design must be coordinated with roof ballast specifications to ensure that ballast does not clog the drains. Specify screens at roof drains, as required.
- H. The use of internal gutter systems shall be avoided.
- I. All roofs will be designed with a fall protection system as required by OSHA regulations and VMC Ch3 Sec304.11 governing Fall Protection.
- J. Snow guards shall be shown at appropriate locations (at least over doors) on the roof plan for all sloped roofs and shall be mechanically fastened (no adhesives).
- K. The BDCD Project Manager must specifically approve use of skylights on the project.
All skylights shall have a screen that complies with 29 code of Federal Regulations 1910.23(a)(4) which reads “*Every skylight floor opening and hole shall be guarded by a standard skylight screen or a fixed standard railing on all exposed sides*” or become constructed with material and manner that meets the OSHA requirements to withstand an accidental fall of person on the skylight.

070000 - THERMAL AND MOISTURE PROTECTION



- L. All roof access hatches shall be protected as required by 29 CFR 1910.23(a) *“Every hatchway and chute floor opening shall be guarded...”*. All roof hatches shall have comprehensive all sided hatch safety rail with self-closing spring tension gate coverage at opening.



- M. Roof access hatches shall have a safety cotter pin equipped with a device that secures the pin in place, however, during an emergency exit the pin can be removed with minimal effort for a safe exit from the inside.
- N. Plans and specifications shall include language requiring the contractor to completely seal all return air plenum AND obtain independent third party certification that the return air plenum envelope is appropriately sealed.
- O. All roof access is to be secured. All roofs to be provided with access ladders or stairs. Refer to Division 050000 for preferred access ladder specification.
- P. Plans and specifications shall identify a continuous vapor barrier at the exterior envelope, including at either the roofline or at the ceiling line of the top floor. An interior and exterior vapor barrier should be specified and detailed for the entire building envelope. The thermal envelope must be completely sealed to the exterior including attic and plenum spaces, as appropriate.
- Q. The design documents shall provide for a “hard” flashing detail (metal flashing or equivalent) at all joints, with adequate allowance for flashing height, between the roofing and vertical building elements, such as clerestories, walls etc.
- R. High reflectivity roofing should be provided on flat roofs and at sloped roofs where aesthetics are not adversely impacted. Intent is to minimize the heat island effect per Green Building protocol.
- S. Roofing systems shall carry a minimum 20-year warranty. Roofing installation shall carry a minimum of two-year installation warranty.
- T. Pavers shall be provided on flat roofs, for access and maintenance of roof top mechanical equipment to help minimize accidental or incidental membrane damage. Concrete pavers shall be used only as recommended by the manufacturer. Compatible "membrane pavers" are acceptable.
- U. The roofing details shall include umbrella or continuous flashing details with minimum height of 18” at all non-curb mounted equipment to avoid blocking equipment air flow.
- U. All roof top equipment to be set on curbs with a minimum height of 18” and never placed directly on roof.

070000 - THERMAL AND MOISTURE PROTECTION

- V. Refer to the DIT Guideline Appendix B for additional information on required roof vaults and roof curbs.
- W. Roof expansion joints to be provided per NRCA guidelines.
- X. All low slope roof designs to incorporate positive drainage to roof drains/roof scuppers via sloping the structural framing or roof deck, designing a tapered insulation system, or a combination of both.
- X. Where Lightning Protection is installed, provide UL Certification letter as well as record drawings.
- Y. All roof areas are required to have access for personnel to perform maintenance duties (inspection and repair).



II. PRODUCTS

- A. Built-Up Roofing System
Johns Manville, Firestone, Soprema, Garland or GAF built-up 3 or 4 ply systems or **Approved Equal (must be approved by FMD)** with a minimum 20-year warranty.
- B. Modified Bitumen Roofing System
Johns Manville, Firestone, GAF, Siplast, Soprema, Garland or **Approved Equal (must be approved by FMD)** with a minimum 20-year warranty.
- C. Single Ply Roofing System/IRMA System
 1. EPDM is preferred on flat roofs.
 2. Rubber membranes may be acceptable, on an as project basis. The rubber membranes need to be reinforced and be installed by a fully adhered application. Non-reinforced EPDM membranes are not acceptable. The minimum acceptable systems for rubber membranes, EPDM, is Goodyear, Firestone, Carlisle, and Johns Manville 60 mil systems or Approved Equal, with a minimum 20-year warranty. PVC and CPE systems are not recommended.
 3. TPO Roofing are not allowed due to seam and membrane failures as a result of intense weather application. If a special circumstance, written approval is required from FMD thru the Building Design and Construction Division Project Manager on project by project basis.
 4. Ballasted single ply systems are not recommended because of poor maintenance and performance history.
 5. Fully adhered single ply systems are preferred.
- D. Shingles-Architectural shingles with lifetime (if applicable) warranty preferred, a minimum 20-year warranty is required.

080000 - DOORS AND WINDOWS

I. DESIGN

- A. Specify a key cabinet. The cabinet should be designed to accommodate 50% more keys than the current project requirements. The specifications shall require the Contractor to sort, label, and tag all keys (as applicable); set up key cabinet with index; and review it with the Owner.
- B. The A/E shall coordinate keying schedule with the DPWES, Facilities Management Department (FMD) and the using agency. Using agency will sign off on an approved schedule. All changes will be coordinated with FMD.
- C. Provide adequately sized access doors or panels in all walls and ceilings to permit access to all mechanical, plumbing, electrical, or fire alarm equipment which may require maintenance or updating. A minimum access door dimension is 15"; a minimum access door size in ceilings is 24" x 24".
- D. Steel sash windows should not be used. All new or replacement windows shall utilize thermo-pane glass, with thermal break sash and low-E coating. All windows shall have proper flashing (or thru wall flashing, if applicable) and sill receptor if required.
- E. The A/E shall specify field quality control and testing for curtain wall systems. The testing must be conducted by a qualified independent testing and inspections agency and issue test report. The testing shall include air infiltration (ASTM E783), water penetration (ASTM E 1105), and water spray (AAMA 501.2) tests on two or more representative areas of curtain wall conditions to determine compliance of installed system with the specified requirements. Curtain wall shall be repaired or replaced where test results and inspections indicate that it does not comply with specified requirements. Additional testing and inspections at contractor's expense will be performed to determine compliance of replaced or additional work.
- F. All doors within a building, both interior doors and fire rated doors, shall have matching finishes.
- G. Office, meeting, training and data room doors that exceed 7 feet in height require FMD approval.
- H. If possible, industrial use areas (mechanical, shop, electrical, data centers, etc.,) shall have double access doors. A/E shall confirm that door opening allows for all equipment within the space to be taken out of the space for repairs and replacement.
- I. All roof access doors shall have a minimum of 6" height above finished roof or platform level.
- J. All coiling grilles shall be designed with governors. Additional structural support for coiling grilles and overhead doors shall be shown on the plans.

080000 - DOORS AND WINDOWS

K. Door numbers in the design documents shall match the final operational door numbers/room numbers so that signage, keying and move-in are made easier. The numbers & signage should reflect East, West, North or South sides of buildings in large facilities.

L. In areas with drywall partition, all doors shall have floor mounted door stops.



M. Operable windows are permitted only when approved in writing by DPWES and FMD for specific use type. Locking mechanisms with key must be provided for such windows. Screens must be provided for operable windows when approved. Where operable windows are approved, windows shall be interlocked to BAS so that the HVAC shuts off for that area when a window has been opened. AE shall review with BDCD Project Manager if this impacts other areas in the building other than the room where the window is open.

N. The maximum recommended clearance for the bottom of any vehicle security gate in county facilities is 6”.

O. Accessible Design

1. Use automatic door openers on main entry door. Ensure barrier-free access to door opening mechanism. Doors may be push button or automatic sensor operated. Verify with the BDCD Project Manager.
2. Do not install door closers unless necessary. If necessary, provide delayed action door closers that open freely before the closing cycle begins. If delayed action door closers can not be used, be mindful of closers on heavy doors. The door closing speed and operating pressure must comply with ADAAG.
3. If accessible corridor is less than 60” wide, provide recessed doors. Recess door design for space and approach must comply with ADAAG.
4. Dead-end hallways should be designed with sufficient wheelchair turnaround space.

P. Plans showing all door and hardware locations and a complete hardware schedule detailing all lock manufactures, functions, designs and finishes shall be provided at the start of construction to DPWES and FMD locksmith. A lock cylinder keying meeting with the building users, DPWES, general contractor, lock hardware supplier and the FMD locksmith shall be held at the start of construction. Upon completion of the building and acceptance by the Owner, Fairfax County’s permanent Schlage security lock cylinders shall be installed by FMD.



Q. ~~Electronic Access Control System~~ – *Moved to new section 280000 Electronic Safety and Security.*

R. Hardware Design for Doors with Electronic Access

080000 - DOORS AND WINDOWS

1. Builder's locksets for electric access controlled doors - The preferred lockset shall be a mortise lock with a ¾ inch latch bolt throw, it may be of a standard type (non-electric operation) and an electric strike may be used to open the door or it may be an electric operation mortise lock. All locksets used on fire doors shall be fire rated. The trim of the lock shall be a lever handle that returns to the door within ½ of an inch of the door face. All finishes shall be either US 626 or US 32.
2. Non-acceptable builder's locksets for electric access control doors - Cylindrical key in lever locksets shall not be used with electric strikes.
3. Panic exit hardware devices for electric access controlled doors - The preferred panic exit hardware device shall be a rim mounted latch retraction panic hardware device or a mortise panic hardware device with electric operation. Standard rim mounted panic hardware devices may be used with jamb mounted electric strikes. Panic hardware devices shall be of the standard panic hardware device type or fire exit panic hardware device as required by the Fairfax County VA fire code. The operating trim of any panic hardware device shall be a lever handle that returns to within ½ inch of the door face. All finishes shall be either US 626 or US 32
4. Non acceptable panic hardware devices for electric access controlled doors - Vertical rod panic hardware devices shall not be used with any electric access controlled door.
5. Electrical specifications: Voltage of electric access control hardware- Voltage of all electric access control hardware shall be determined by the requirements of the controlled access system. Consult the BDCD Project Manager and FMD for details.
6. Electrical specifications: Fail secure or fail safe function for electric access hardware- The function of all electric access control hardware shall be as required by the Fairfax County fire code.



- S. Residential grade windows shall not be specified in any County building. Only commercial grade windows are acceptable.



- T. Interior doors in apparatus bays that are located such that they may be exposed to exterior conditions when apparatus bay doors are left open, shall be specified as exterior grade doors.

II. PRODUCTS




- U. All locksets and hardware shall be compatible with 6 pin tumbler Large Format Interchangeable Core (LFIC), also known as Full Size Interchangeable Core (FSIC), lock

080000-3

080000 - DOORS AND WINDOWS

cylinders to accommodate Owner's permanent Schlage cylinders. Owner's permanent cylinders for door hardware shall be Schlage cylinders to be purchased by the contractor, and installed by the Owner (FMD). A/E shall note in the Hardware Schedule "Schlage 6 pin Large Format cylinder to be installed by Owner but purchased by contractor" for each hardware set (group). Refer to Section III for additional coordination requirements for locksets and hardware.

-  V. Construction cores shall be provided by the Contractor on an as needed basis to secure the building. Construction master keys and cylinder core removal keys (control keys) shall be provided to DPWES immediately after turnover. Upon completion of the building FMD will remove all construction cores and FMD shall install owner's permanent lock cylinder cores purchased by contractor. FMD shall retain all construction cores and keys.

- W. All finish hardware with exception of electronic access control doors, exterior accessed mechanical and electrical rooms shall be selected from the following manufacturer (cylindrical lockset with 6 pin lock cylinder).

-  1. Schlage, (No Equal Products or Substitutions)

- a. Schlage ND-Series US 32D or 626 Finish Rhodes Design Lever

- X. All finish hardware used on doors for securing exterior accessed mechanical and electrical rooms shall be from the following manufacture (mortise locksets).

-  1. Schlage, (No Equal Products or Substitutions)

- a. Schlage L-Series US 32D or 626

- Y. All hardware for electronic access doors shall be from the following manufacture (mortise locksets). These locksets shall be furnished with 6 pin tumbler Large Format Interchangeable Core Cylinders (LFIC) for manual key bypass in the event of fire or emergency.

- a. Electric mortise locks

-  1. Schlage, (No Equal Products or Substitutions)

- a. Schlage L series electrified mortise locks. 06 or ND Rhodes lever design trim

- b. Non electrical mortise locks to be used with electric strikes

-  1. Schlage, (No Equal Products or Substitutions)

- a. Schlage L series mortise locks. 06 or ND Rhodes lever design trim.

080000 - DOORS AND WINDOWS



c. Electric strikes to be used with non-electrical mortise locks

1. HES 4500 series electric strikes

Z. All hardware for panic exit devices for electronic access doors shall be selected from the following manufacture (electric operation panic exit hardware). This hardware shall be furnished with 6 pin tumbler Large format interchangeable core cylinders for manual key bypass in the event of fire or emergency.



a. Electric operation panic or fire exit device hardware

1. Von Duprin (Schlage), (No Equal Products or Substitutions)

a. Von Duprin 99EL series electric rim device
99E electric mortise E7500 device with 06 lever design trim



b. Electric strikes to be used with non-electric operation rim latch panic hardware

1. HES 9500 series electric strikes (fire rated doors)

2. HES 9600 series electric strikes (non-fire rated doors)

AA. Where handicap accessibility is not required, surface mounted door closers should be Norton #1603 or #1604 or Approved Equal. Handicap accessible closers should be LCN 1461 or Approved Equal.

BB. Floor type door closers should be Rixson #27 or #28, or Approved Equal. Where handicapped access is required, use Rixson PH27 or PH28, or Approved Equal.

CC. Coordinate panic hardware with ADA requirements to ensure that a minimum of 32" clearance for door opening width, exclusive of hardware, is maintained.

DD. Hydraulic actuators should not be used for accessible door openers.

EE. Hinges at all doors should be ball bearing type.

FF. Fairfax County Fire Prevention Code requires the installation of an approved emergency building entrance system (key box or Knox box) for all buildings with the exception of single-family dwellings. See Fairfax County Fire Prevention Code at <https://www.fairfaxcounty.gov/fire-ems/fire-marshal/fire-department-key-boxes>

080000 - DOORS AND WINDOWS



GG. Electric Strikes shall meet Underwriters Laboratories burglary resistance specification UL 1034. The preferred electric strike shall be HES 4500 series. All electric strikes shall be US 626 or US 32D finish. Electric strike voltages and functions shall be compatible with access control system requirements.

HH. For partial renovations, all door hardware shall be specified to match the existing hardware in finish, style and keyway in order to maintain continuity. A propriety or sole source procurement approval must be prepared and identified in the specifications as required.

II. Door Hardware Functions: The door hardware is to be specified with the following functions. Coordinate with BDCD Project Manager for additional variations:

Door Type	Hardware Function
1. Standard Offices	Push button office or entry function – Allows quick simple locking with no key required.
2. Doors without locking function	Passage lockset- No locking needed just latching.
3. Restroom - Single Fixture Use i.e. family toilet room, unisex toilet rooms)	Bathroom function- Allows privacy but can be opened with any key in emergency.
4. Meeting Rooms, Classrooms in Offices, Group Rooms, Large Suite Public Areas	Classroom lockset- Can only be locked with a key.
5. Storage Room/Mechanical Or Electrical Rooms	Storeroom lockset -Stays locked can only be opened with a key.
6. Public Restrooms- Multi-fixture Use	School house safety deadbolt lock -Can be locked by key only from exterior. Person locked in can release deadbolt but can not lock themselves in, used to lock off bathrooms in case of plumbing problem.

080000 - DOORS AND WINDOWS

- | | |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7. Roof Access | Double Sided Storeroom lock- Stays locked on both sides. |
| 8. School Classroom , Child Day Care Centers | Classroom intruder lockset- Always free to exit, locks only by key from inside the classroom, door does not need to be opened to lock from outside as a regular classroom lock. |
| 9. Exterior accessed mechanical and electrical rooms | Hotel function- provides a self-locking storeroom function lockset and a separate deadbolt to provide extra security |
| 10. Hotel function | Hotel function is specified as it provides a self-locking storeroom function lockset and a separate deadbolt to provide extra security to exterior accessed mechanical and electric rooms. These mortise locks shall be provided with removable core lock cylinders as section A of this specification indicates. |

Note:

These functions are for standard finish hardware. Electric hardware on electronic access doors stays locked at all times and opens only with a card access or keypad. The key is only to open the door in an emergency like a storeroom lock. Electric locks can be left "open" at all times but are either powered up and unlocked (fail secure is locked with power off) or they are fail safe and not powered (fail safe is unlocked with no power going to the lock).

III. LOCKSETS AND HARDWARE

All locksets and hardware shall be Schlage full size/large format interchangeable core lock cylinders to accommodate Owner's permanent Schlage cylinders. Owner's permanent Schlage cylinders will be purchased by the Contractor. Permanent full size/large format interchangeable core cylinders in Schlage Classic keyways shall be provided by the contractor. AE shall include in drawings and specifications for Contractor to request CM contact the FMD Lock Shop to determine final keyway types required prior to placing order. (CM or PM can initiate work order through FMD's ESMP system or contact the Lock Shop Supervisor).



090000 - FINISHES

I. DESIGN

A. Lath & Plaster

At a minimum, the industry standard for expansion joints shall be required by the design documents.

B. Gypsum Board

1. The application and finishing of Gypsum board shall conform to ASTM C840 - 11 Standard Specification for Application and Finishing of Gypsum Board.
2. A UL number must be specified for all gypsum fire-rated assemblies.
3. Access panels must be provided in gypsum board ceilings for maintenance access. See previous section 070000 for roof access door sizing. Panels must be provided for all maintained elements. If provision of the access panels compromises the aesthetics of the ceiling, either relocate the maintained elements to an accessible ceiling or change the design of the ceiling.
4. Water-resistant gypsum board must be specified for wall and ceiling use in toilet rooms and locker room areas. Durock or equal product must be used in shower areas and wet walls in toilets and lavatories.
5. The finish levels shall follow the requirements of ASTM C840 and Gypsum Association. The following finish level schedule shall be included in the documents and shall be coordinated with paint types for each area of the building:
 - a. Level 1: Above finished ceiling concealed from view.
 - b. Level 2: Utility areas and areas behind cabinetry.
 - c. Level 3: Areas that will receive heavy grade wall covering.
 - d. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish
 - e. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

C. Ceramic Tile

1. The floor and the full height of wet walls in toilet and shower rooms (toilet and urinal areas may be at the toilet partition height) shall be ceramic tile. All ceramic floors shall be sloped to drain. A/E to coordinate to reduce cut tiles. The preferred method for floor tiles is the full mud-set tiles, and thin set mortar for setting wall tiles. Walls not receiving ceramic tile shall have a ceramic tile base of a minimum 6" above finished floor. All grout to be sealed.

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- a. Attic Stock- Specify 2 unopened boxes of each type of ceramic tile used. Except for borders and accents where 10 LF of each type is required.

D. Wall Surfaces

1. All wall finishes at kitchens, food preparation and serving areas are required by the Health Department to be completely smooth and cleanable. No surface texture is permitted at these locations. CMU walls with block filler and paint/epoxy finish systems have been deemed unacceptable due to the reflection of the block texture through the finish system.
2. Wall coverings such as wallpaper are not acceptable unless written approval is provided with concurrence by the Director of Facilities Management Department and Director of the Building Design and Construction Division.

E. Parking Garages

1. Underground, enclosed levels of parking garages shall have the walls and columns painted white to allow better distribution of reflected light.

II. PRODUCTS

A. Acoustical Ceiling Tile

1. Use of any ceiling system other than a 2 x 4 or 2 x 2 lay-in should be brought to the attention of the BDCD Project Manager and will be coordinated with FMD.
2. Access to maintained elements above the ceiling must be provided in any ceiling system used. Use of a ceiling system that does not provide access for maintenance will not be permitted.
3. Recycled content ceiling tile should be specified. Use Humiguard or other microbial prevention treated tiles as applicable.
4. Acceptable manufacturers of ceiling tiles are as follows. (No substitutions) Specific models are listed below for Armstrong for each application. If CertainTeed or USG is used, they shall supply the equivalent model to the Armstrong model listed in this guide below.
 - Armstrong
 - CertainTeed
 - USG



The acoustic ceiling tiles shall be equivalent to the tiles listed below for each application:

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- a. Standard Areas
 - Armstrong 756 for 2' x 2'
 - Armstrong 755 for 2' x 4'
- b. Standard Areas (for sag/humidity resistance and 90% light reflectance)
The following should be used for the conditions and the facilities types below:
 - ✓ Any building with operable windows.
 - ✓ At primary entrance doors and bay doors and from those doors to the immediate first interior closed hall fire or security door. If there are no closed hall doors, then up to each room door. In the case of vending and similar areas where there may be no closed access door continue the 1910 or 1913 through the open space.
 - ✓ All fire stations, shelters, detox centers, community centers, labs, negative pressure/sick rooms, day care, residential care, and child care facilities.
 - Armstrong ULTIMA Fine Texture
 - 1910 for 2' x 2'
 - 1913 for 2' x 4'
- c. “Wet” Areas
 - Armstrong Ceramaguard Fine Fissured – Perforated
 - 607 for 2' x 2'
 - 608 for 2' x 4'
- d. Kitchens
 - Armstrong
 - 673 for 2 x 2
 - 672 for 2 x 4
5. The use of concealed spline ceiling system is discouraged. The A/E shall coordinate with the BDCD Project Manager for advance approval if the system is proposed for use in selected areas.
6. Attic Stock- Provide the following:
 - a. Provide one unopened carton of each type of ceiling tile that complies with standard requirements above, and 4 unopened cartons that are an exception to the standard.

B. Paints

1. All interior paints and primers shall be low VOC products. All surfaces shall receive a minimum of two coats of paint, in addition to an appropriate primer coat. Each coat must be allowed to dry completely before application of the next coat. Specify at

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least three color choices for the walls. Painting of interior surfaces shall be of the following paint types:

- a. Walls (Level 4 or 5, see finish level schedule in I.B.5) - Eggshell latex (Semi-gloss in high traffic areas and other appropriate spaces as coordinated with the Owner)
 - b. Ceilings and bulkheads (Level 4 or 5)- flat latex
 - c. Doors and frames (metal/wood) - semi-gloss latex (Alkali for exterior)
2. Attic Stock- Provide the following:
- a. One gallon of each color and type of paint used, with paint information legibly noted on each unopened container. No partial cans accepted.
3. Acceptable manufacturers are:
- a. Sherwin Williams
 - b. Benjamin Moore
 - c. No Equal Products or Substitutions
4. White-board paint, Scuffmaster or Polymix paints are not acceptable due to increased maintenance.
5. Specifications must note that paint overspray on IT/Telcom cables must be prevented.

C. Resilient Flooring

1. The desired resilient flooring is 12" x 12" (300mm x 300mm) Vinyl Composition Tile (VCT) or 18"x18" or 18" x 36" Luxury Vinyl Tile. Specifications shall include three color choices for tile, base and treads. Other elements shall be coordinated with the VCT/LVT color(s).
2. All telecommunication and audio/video rooms shall use anti-static VCT flooring.
3. Attic Stock- Provide the following:
 - a. VCT - 1 unopened carton of each color and type.
 - b. Rubber base - 1 unopened carton of each type and color.
 - c. Rubber accessories - **15 linear feet (5 meters)**
 - d. Rubber stair treads - **5 each of each color or type, w/ information on box**



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D. Carpet

1. Square carpet tiles shall be used. Specify a choice of at least three colors and/or patterns of carpet.
2. If sheet stock is to be specified, prior approval must be obtained from the BDCD Project Manager, who will coordinate with the FMD.
3. Carpet installation shall be by installer approved by the carpet manufacturer.
4. Attic Stock for Carpet Tile- Provide the following:



- a. Specifications shall require to provide 4 unopened cartons of each matching dye lot.
5. Low VOC, recycled content carpet shall be specified. Carpet tiles must be specified from the mid range product lines of the following manufacturers:
 - a. Milliken Modular Carpet Tile
 - b. Interface Carpet Tile
 - c. Shaw Contract Group
 - d. Patcraft Commercial Carpet
 - e. Specifications must note that No Equal Products or Substitutions for carpet tiles will be allowed.
6. Carpet tile must have a minimum TARR rating of 3.0 for heavily used areas and 3.5 for severely used areas. Heavy rating would be for more administrative functions with minimal public use. Severe rating shall be used for high traffic areas which get a lot of public use such as family / human services, and library functions. Refer to the End Use Application table at <https://carpet-rug.org/wp-content/uploads/2018/08/Taking-the-Guess-Work-Out-of-Specifying-Carpet.pdf>
7. Entryway/Walk-off mat to be glue down, carpet style.



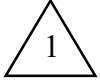
E. Special Flooring

1. Prior approval of special floorings is required and the use of any such flooring shall be brought to the attention of the BDCD Project Manager. Examples of special flooring are hardwood, rubber, concrete, laminate, terrazzo, epoxy or resin floors. Prior approval must be obtained from the BDCD Project Manager for use of wood floors and for design of the support system for the wood floors.

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2. Use of linoleum flooring, or other rapidly renewable products is encouraged for consideration, at appropriate locations and as coordinated with the BDCD Project Manager.



3. Cork or bamboo flooring is not acceptable due to increased maintenance.
4. Specification for concrete or terrazzo flooring shall include information but not limited to the process, grinding, cleaning, mixture ratio and special mix. Discuss specialty flooring with contractor at the pre-construction meeting.
5. Attic Stock – Provide the following:



- a. Specifications shall require to provide 2 unopened cartons of each color.

F. Floor surfaces shall be non-slip and non-glare.

G. Kitchens to have scrub-able flooring with cove base.

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I. DESIGN

- A. Countertop supports shall be designed so as to conform to requirements of the ADAAG. Counter tops shall be either cabinet supported or have front leg and side panel supports. Unsupported spans in excess of 3'6" are unacceptable. Larger spans shall be supported with structural members or vertical support. Counter tops shall have all undersides, edges and cut outs sealed with waterproof coating. Ensure that pipes, etc., do not interfere with recessed mountings.
- B. Fire extinguishers shall be hung, or cabinet mounted with a maximum permissible mounting height to top of extinguisher of 48". The certification date tagged on all fire extinguishers shall be the date of substantial completion. Fire extinguishers must be provided at elevator machine rooms, fuel sites, and mechanical equipment rooms. Provide recessed fire extinguisher mounting as required to meet ADAAG access and projection requirements.
- C. Flagpoles shall be designed for ease of maintenance, and for simple rope and halyard replacement. Flagpoles shall be anodized aluminum or aluminum and have internal halyard. County facilities that will require 3 flagpoles are courts, fire stations, police stations, and government centers. All other County facilities are required to have one flagpole. Flagpole design must conform to U.S. Flag Standards. All flags shall be lighted, and lighting shall comply with the zoning ordinance glare and lighting standards. Use of energy efficient lighting is encouraged. Flags will be provided by Using Agency.



D. Toilet Rooms

1. Toilet partitions must have both floor-to-ceiling and wall bracing. Urinal screen shall have floor to ceiling pilaster support. Toilet partitions, doors, pilasters and screens shall be constructed of solid Phenolic or similar homogeneous plastic material. Recycled content material is preferred. Overhead bracing is acceptable when partitions are floor mounted. Panels shall be a minimum of ½" thick. All partition finish, including decorative, shall be an integral part of the core material. Doors and Pilasters shall be a minimum of ¾" thickness and all finish including decorative, shall be an integral part of the core material. Partition door hinges shall be continuous stainless-steel style (piano hinge).
2. Design must avoid line of sight from entry door to urinals and to mirror reflections.
3. Wall backing at wet walls of all rest rooms shall be cement board such as Durock (or equal).



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4. All public and staff toilet rooms shall be provided with automatic hand dryers. Installation of hand dryers must meet ADAAG requirements for access and projection clearances. Paper towel dispensers are not acceptable.
5. All public toilet rooms shall be provided with baby changing stations. Use of family restrooms shall be considered at lobby of very large, public facilities and as required by code. Installation of changing table must meet ADAAG requirements.
6. All sink counters to be a solid surface material.
7. Provide floor drains at all toilet rooms and shower areas. Design floors to provide positive drainage to floor drains. (Reference Division 220000 - Plumbing)

E. Janitor's Closet

1. Janitors' closets used for storage of any quantity of highly combustible material must have an automatic sprinkler system.
2. Provide one closet per 25,000 square feet gross floor area, at a minimum of one closet per floor (or increase size of closets proportionally). Janitor's closet must be vented independently.
3. Standard janitor's closet requirements:
 - a. Walls to be water-resistant gypsum board, such as Durock, Hardy Board, or equal, covered with sanitary type vinyl to 48" Above Finish Floor (AFF). Walls to receive coating of Sanitile 550 or equal above the vinyl. Ceiling to receive enamel painted wall board.
 - b. Floor shall be slip resistant, sealed concrete.
 - c. Provide 24" mop rack with 3 mop holders.
 - d. Provide two double coat hooks.
 - e. A 110-volt outlet must be provided at all janitors' closets.
 - f. Provide 3'-0" x 6' 8" door (minimum size).

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- g. Provide five wall-mounted shelves, 12" deep x 48" long, 12" on center vertically. First shelf to be 18" AFF.
- h. Provide heavy duty vinyl or stainless steel corner guards at appropriate locations including the door and door frame.
- i. Mop sink to be constructed of monolithic, preformed basin material with stainless steel sill.
- j. Include hose and reel as part of mop sink.
- k. Faucet shall be type a/b/e specialty mop sink with pail hook and wall brace, or equal.
- l. All plumbing connections shall be ½ mnps threads.
- m. Light fixture shall be Stonco vapor tight fixture with grill, or equal. Light fixture shall be sensor operated.



F. Interior Signage and Labeling

- 1. Signage to comply with requirements of ADAAG as to character, proportion, height, finish, mounting location and Braille content where required.
- 2. Exact signage requirements will be specified during the design phase.
- 3. Each room in the facility shall be labeled or numbered to facilitate maintenance and emergency response.
- 4. Room names in the design documents shall match the final operational room names to ease the coordination of signage preparation and move-in. Room numbers on final plans shall also be the same as room numbers on signs for alarm and security use in the facility operation.
- 5. Rooms which are identified (labeled) as to use do not need to be numbered, unless there are more than one of each such rooms in a facility. Examples:

"Men"	"Women"
"Janitor"	"Telephone Equipment"
"Electrical Equipment"	"Mechanical Equipment",
"Stair", etc.	
- 6. Rooms that are not signed shall have numbers provided on the upper corner of each door or door jamb of main door to each room. Numbers shall be

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small 3/4" and applied so as to be of use only to County maintenance personnel; or, if the numbering system is to be referenced on the Building Directory, utilize larger more visible numbers.

7. Rooms shall be numbered from left to right beginning at the suite entrance door, as practical.
8. All workstations shall be numbered independent of room numbers.
9. Any room containing equipment related to the fire alarm system, must have signage meeting the Fire Marshal's requirements in terms of lettering size (1 ½") and contrasting colors. Typical rooms may include but are not limited to Main Electric Room, Fire Control Room, Fire Pump Room, Sprinkler Riser Room and Sprinkler Control Room.
10. All mechanical or electrical equipment located above a suspended ceiling shall be labeled/ identified at the suspended ceiling. Fire alarm devices located above a suspended ceiling must have a nameplate identifying the device at the appropriate suspended ceiling location and also at the point of access to the device if different from the suspended ceiling. Nameplates for fire alarm devices shall be ½" minimum height white letters engraved on a minimum 1" wide red plastic laminate plate.
11. The street address number must be provided, clearly visible on the front of the building.
12. For emergency response purposes, all exterior doors in public safety facilities shall be clearly labeled with an identifying door number at the interior and exterior and with door numbers visible from an aerial position. For all other facilities, the A/E shall coordinate with the BDCD Project Manager at the early design phase to determine signage requirements.
13. A/E to provide emergency evacuation plans.



14. Shelter in Place Signage

- a. AE shall coordinate with the BDCD Project Manager to determine locations of rooms to be designated as Shelter-in-Place. The Department of Emergency Management and Security will assist with review if needed. The general requirements are:
 - i. Interior room(s) with no or minimal windows, usually conference rooms, storage closets, and copier rooms.
 - ii. Shades or blinds to be able to block visibility thru windows.
 - iii. If possible, the room(s) should have adequate space for everyone to

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- be able to sit in.
- iv. Avoid overcrowding by selecting several rooms if necessary.
- v. Large storage closets, utility rooms, pantries, copy and conference rooms without exterior windows will work well.
- vi. It is ideal to have a telephone in the room(s) you select.
- vii. Other areas that may work as shelter-in-place locations include all restrooms, interior stairwells, interior rooms with no windows.
- viii. Ideally the room should be able to be secured, such as with the use of a lock or proximity lock.
- b. Shelter-in-place doors to the SIP rooms shall be labeled with a green sign or sticker with “Shelter in Place” in white. Text shall be approximately 5/8” in height.

G. Exterior Door Labeling

1. Exterior door designation is recommended for county facilities with three or more public entrances. The following guidelines are based on the National Incident Command System which is used by firefighters and police departments and would benefit many County Human Service facilities. The BDCD Project Manager is to coordinate with FMD and provide written direction to A/E on doors that require the signage.
2. Numbering Sequence
 - a. All door numbering shall start with the letter A, B, C, or D. This is based on the side of the building on which the door is located.
 - b. The number will follow, starting from the first door on the right, for that designated side, as A1, and increase sequentially to the left.
 - c. The front of the structure is Side A. Usually it is the main entrance of the building and is usually the address side.
 - d. If the main entrance or address side is not identifiable, Side A will be the side facing the street.
 - e. Side B will be the next side to the left of Side A, and Side C is the back and to the left of Side B. The remaining side is Side D.
 - f. The first door on the right on Side B will be door B1, and so on.

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- g. This system will readily identify the side of the building for first responders who will pronounce the letters phonetically, as Alpha, Bravo, Charlie, and Delta.

3. Sign Construction

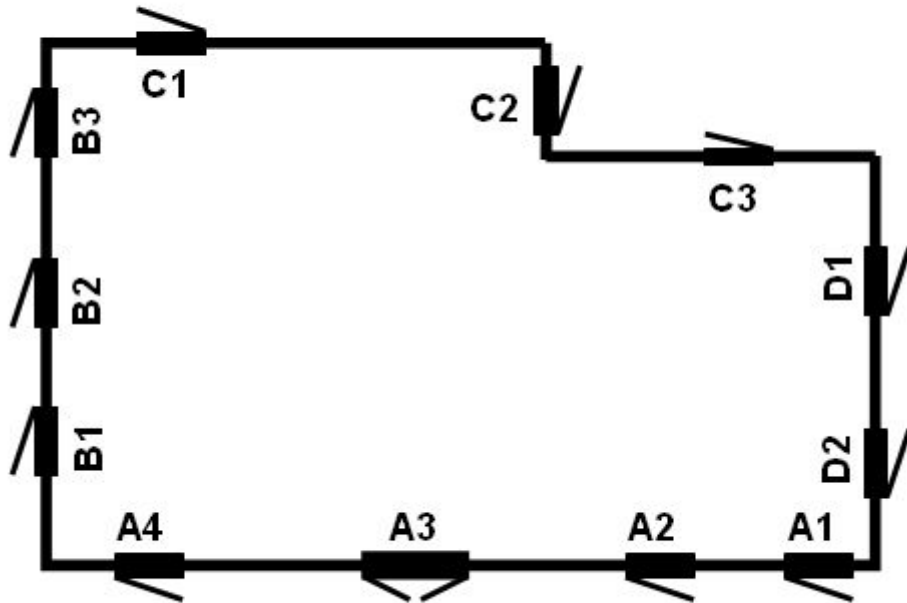
- a. Material: Minimum 1/8" thick aluminum
- b. Size: Exterior signs are 18" x 18". Interior signs matching the number of the exterior are 15" x 15".
- c. Signs have contrasting colors for the background and number with the background being reflective (example: 3M™ Scotchlite™ Reflective Material). Most Fairfax County schools use a black number on a white background. Selected colors must have a strong contrast between the number and the background.

4. Sign Placement

- a. All doors will be numbered, but not all doors require a number to be posted. Doors thought to be significant for entry or evacuation should have a number posted. Less significant doors such as storage and utility room doors do not have their numbers posted.
- b. The exterior numbers should be placed high enough to be out of reach. They are placed where they can be seen from the greatest distance with the widest line of sight. The signs should not be placed under an overhang because they would be blocked from the view of the police helicopter.
- c. The interior numbers are usually placed above the exit door facing down the hall so they can be seen by the greatest number of people.

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**Fairfax County Security Program
Door Designation Guidelines**



Main Entrance, Address Side, or Side Facing Main Street



- H. Stairwells – All stairwells shall be labeled, and signs provided in accordance with Fairfax County Office of the Fire Marshal website regardless of number of floors.

Stairway Identification Signs | Fire and Rescue (fairfaxcounty.gov)

- I. Automated External Defibrillators (AEDs) will be installed in all County worksites as part of the County's Public Access to Defibrillation (PAD) program. The Risk Management Division manages the PAD program and is responsible for installation of AEDs in accordance with County and ADAAG standards. Appropriate locations in the public area of the building must be provisioned and coordinated with Risk Management staff.
- J. Portable Fire Extinguishers shall be provided as required per code and certifications dates to be the date of substantial completion.
- K. Space for recycled material collection/storage must be provided and designated, preferably near the loading dock or dumpster area.

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L. Accessible Design:

1. Evaluate use of Family Restrooms, if applicable to specific building. Include baby changing tables at public area restrooms.
2. Soap dispensers in toilet rooms, shall be provided to the side of the wash bowl in the counter instead of along the rear wall. If automatic soap dispensers are specified, they shall be sensor operated with hardwiring (no batteries permitted).
3. Clearance at paper towel dispensers, trash receptacles and lavatories shall not overlap with common circulation and meet ADAAG standards.
4. Locate hooks no taller than 48” on the back of toilet stall doors, if applicable.
5. Wall mounted objects such as hand dryers, baby changing stations and other dispensers, within the toilet rooms, shall meet the requirements of ADAAG for protrusion into the accessible path.
6. No shelving shall be provided in restrooms. Where exceptions are requested such as in Libraries, A/E shall ensure compliance with ADA requirements.
7. Accessible drinking fountains shall be provided in an alcove or with wing walls in compliance with ADAAG requirements for protruding objects.
8. Evaluate use of front-loading washer and dryers, where applicable.
9. Evaluate the installation of at least one assistive listening system in each building in an area of assembly such as, classrooms, meeting areas, conference rooms, or theaters.
10. Card access system for entry, must provide for sufficient time for opening of the door for a person to pass.
11. Lettering size for informational signage shall be as large as practical in consideration of those with low vision.
12. Accessible routes and equipment accessibility shall be considered when locating and purchasing vending machines, copiers, kiosks, and other specialized equipment.

II. PRODUCTS

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- A. The preferred drinking fountain is as follows. Notify the BDCD Project Manager for alternate model if the one listed below is discontinued or another model proposed (see also 220000 Plumbing):



1. Elkay EZH20 Bottle Filling Station with Integral SwirlFlo Fountain – **Model LZWS-LRPBM28K**

- B. The preferred toilet accessories are as follows. Notify the BDCD Project Manager for alternate model if those listed are discontinued:



- | | |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Toilet tissue dispenser | Bobrick B-274 |
| 2. Toilet Tissue Dispenser and Utility Shelf | Bobrick B-2840 |
| 3. Sanitary Napkin dispenser | Bobrick B-4706 25 |
| 4. Napkin Disposal | Bobrick B-270 |
| 5. Toilet Seat Cover Dispenser | Bobrick B-221 |
| 6. Waste Receptacles (recessed only) | Bobrick B-3644 |
| 7. Hand Dryers | Saniflow M14ACS-UL
AIKE AK2005H
World Dryer – VMax V2
Bobrick B-7128 Quiet Dry
(for Libraries only) installed
to meet ADA |

Towel dispensers are not permitted in toilet rooms or kitchenettes unless approved in writing by project manager. If permitted, using agency, not FMD, provides paper towels.

- C. All toilet accessories and their installation must comply with ADA requirements for reach, operation, and wall projection.
- D. All toilet accessories model numbers should be confirmed during specifications. Any updates or necessary revisions must be coordinated with the BDCD Project Manager.

110000 – EQUIPMENT

I. DESIGN

A. Clothes Washers and Dryers



1. Specify electric clothes dryers, subject to using Agency concurrence. Voltage for clothes dryers shall be 208/277.
2. Coordinate voltages for washing machines and dryers between electrical plans, specifications, schedules, and disconnects.
3. Commercial washing machines and dryers must be bolted to a minimum of a 4" level concrete pad; and must be provided with vibration isolators, as required. Any washing machines which are to be located on an elevated, structural slab must be analyzed for harmonic impacts in conjunction with the structural plans, and the appropriate vibration isolation or dampening provided.
4. Coordinate design of fresh air intake and exhaust flues for dryers with dryer manufacturer.



5. All dryer vents shall be located no higher than 8 feet from the access level (ground or flat roof surface) and have clear access (no trees or shrubs blocking access).

B. Direct exhaust fumes away from air conditioning intakes.

C. Kitchen Equipment



1. Equipment plans for any kitchen equipment must be closely coordinated with electrical power drawings to ensure consistency between power requirements and power provided. Use electric kitchen appliances, subject to using Agency concurrence.

D. Ranges



1. When gas fired range is required, they shall use an electric spark ignition – no standing pilot lights.
2. Provide 30" ADA pull-in access adjacent to range.

E. Type I Kitchen Hoods

1. A heat sensor shall serve as an interlock between the kitchen hood exhaust fan and the cooking appliances to automatically activate the exhaust hood system whenever cooking operations occur.

110000 – EQUIPMENT

2. Any make-up air systems that are required for the hood exhaust system shall be interlocked with the kitchen hood exhaust fan to automatically operate whenever the exhaust fan is energized.



3. When gas fired appliances are required, a solenoid valve shall serve as an interlock between the gas piping supplying the cooking appliances below the kitchen exhaust hood and the hood fire suppression system, to automatically activate gas shutoff in the event of a fire. The valve installation shall meet the Fire Marshal requirements.

4. Electric ranges shall comply with similar ventilation requirements as noted for gas ranges.

F. All fixed equipment and appliances shall be high-energy efficiency and carry the Energy Star® label, where available.

G. Dividing Partitions

1. Design of dividing partitions in meeting rooms must be carefully reviewed to accommodate life safety requirements for exiting from all areas as required.
2. Use of automatically operated partitions is acceptable however, must be reviewed with the using agency based on the room conditions to determine if necessary for the size and height of the room. The physical convenience of the day-to-day users/operating staff usually determines the need for automatically operated partitions in lieu of the manually operated ones.

a. Police Facilities

There is no strong intention to use automatic partition for police facilities. Police staff are physically capable of operating manual ones.

b. Library

There is a desire for automatic partition since some users might have difficulties manually open/close them.

c. NCS/Community Center

There is a desire for automatic partition since some users might have difficulties manually open/close them.

d. Stormwater/Wastewater

There is a desire for automatic partition since some users might have difficulties manually open/close them.

3. Safety Features of Automatically Operated Partitions

110000 – EQUIPMENT

- a. Control Stations
Provide two (2) single-key-operated, constant-pressure control stations or two (2) Code Protected Touch Pads, with one at opposite end of the partition, which shall be simultaneously activated in order to operate the partition.
- b. Pressure Sensitive Leading Edge
Provide contact pressure sensitive safety edge along partition's leading edge so that as little as 9 lbf of force applied to the leading edge will stop the forward motion.
- c. Obstruction Detection Devices
Provide obstruction detection devices such as Infrared obstruction detectors, at each side of the partition to stop the partition movement if people or objects are detected in the path of the partition.
- d. Weight Sensitive Floor Mat
Provide weight sensitive floor mat in the storage/stacking area to stop partition movement with as little as 5 lbs of weight applied to the mat.
- e. Signage
Post a laminated sign on how to safely and properly operate that particular partition. The sign must be posted at all electric operating stations, along with a strong warning of injury or possible death on the sign as well as the inspection certificate.



H. ~~Security Systems~~ - *Moved to new section 280000 Electronic Security and Safety*

II. PRODUCTS



A. *Electronic Security products moved to new section 280000 Electronic Security and Safety*

120000 - FURNISHINGS (Free Standing and Systems Furniture)

I. DESIGN



- A. All system furniture provided on Fairfax County projects is to be specified to have a County standard fabric pattern. ~~The standard pattern is “Labyrinth; Pebble” by Knoll.~~
- B. The plans must indicate that the Contractor is responsible for making the final electrical connection of the systems furniture whip (pig tail) to the electrical junction box. The A/E is required to obtain the separate systems furniture permit as required.
- C. All free-standing furniture to be specified from products on County furniture contracts.
- D. Wire management is to be addressed for all furniture selections, especially in public areas such as libraries.
- E. When specifying waiting room or conference center seating, the A/E is required to provide options for bariatric chairs. BDCD project manager and the Using Agency will review options to determine final accommodation for bariatric seating.
- F. Accessible Design
 - 1. Evaluate use of seating/benches in lobby or main entrance areas, and seating near elevators.
 - 2. Provide adjustable podiums/lectern for accessibility (seated/small persons) where provided. This may be fixed equipment or owner provided loose equipment item.
 - 3. Provide enough circulation space around fixed and loose furniture to enable easy movement by all users, including people with wheeled mobility devices. Evaluate this requirement as part of the schematic loose furniture layout plan.
 - 4. In areas requiring a reception desk, an ADA accessible height counter shall be provided.

Guidelines for Architects and Engineers
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120000 - FURNISHINGS (Free Standing and Systems Furniture)

II. PRODUCTS

A. Systems furniture shall be designed based on the companies currently under contract with the County:



- | | |
|----------------------------------|----------------------------------------------|
| 1. Manufacturer: | Knoll |
| 2. System: | Dividends |
| 3. Installer: | Per County Contract as coordinated by Owner. |
| 4. Electrical | 8 wire, 4 circuit 2+2 Electrical System |
| 5. Colors shall be as follows: | |
| a. Worktop Laminate: | Folkstone Grey |
| b. Edges: | Folkstone Grey |
| c. Panel Fabric: | Messa/Fossil |
| d. Metal Storage and Trim Paint: | Silver |
| e. Glass: | Powder Tempered Glass (GL13) |

B. Coordinate with BDCD Project Manager and FMD to assure conformance to County space standards and workstation configuration standards.

C. Workstation electrical base infeed needs to be accessible for maintenance purposes.

D. If using Knoll Morrison inventory stock:

- | | |
|--------------------|-------------------|
| 1. Laminate | Fog |
| 2. Overheads/Files | Fairfax Grey |
| 3. Fabric | Labyrinth; Pebble |

E. Special Glass Stacker Panels to be Knoll Metal Window Frames with Reff Wafer glass “MP3”.

F. All under shelf lights are to be LED.

G. All work surfaces to be 1-3/4” thick.

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130000- SPECIAL EQUIPMENT

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140000 - CONVEYING SYSTEMS

I. DESIGN

- A. All elevator equipment shall be “non-proprietary” equipment. Non-proprietary is defined as equipment generally available for purchase by any qualified elevator contracting business, with spare parts available to any qualified purchaser, all equipment or tools necessary for diagnostics/maintenance/adjustment/troubleshooting shall be available to any qualified contractor. Additionally, replacement documentation shall be available to any qualified elevator contractor at a fair and reasonable cost.
- B. A machine room will need to be incorporated into the design, regardless of any space constraints within the building or structure footprint. Use of Machine-Room-Less (MRL) Elevators or other similar conveyance technologies, must be approved in writing by BDCD Project Manager with written concurrence from FMD.
- C. All service tools, programmers, computers, software chips, etc., necessary to maintain service and/or troubleshoot the elevator system shall be furnished to the County and shall be permanently left on the job site. This hardware and software shall not have any time limits or expiration dates set on them. The elevator equipment shall not require any external proprietary service tool(s). A minimum of three copies of all instruction manuals for these tools, programmers, etc. are to be provided to the County.
- D. Copies of all technicians’ manuals, wiring diagrams, training materials, etc. for all elevator components shall be furnished to the County for each model of elevator. A minimum of three copies shall be provided for the main bank of elevators of each model, and one more copy for each additional elevator in the building.
- E. All large multi-story buildings shall have a designated “Freight Elevator” with direct and convenient access to a loading dock or freight entrance. The exact requirements for elevators will be determined during the Programming and Conceptual Design phases.
- F. A full, two-year warranty for labor, parts, and materials shall be provided for elevators from date of substantial completion. The installer shall provide full maintenance service and inspections during the two-year warranty period for elevators.
- G. Provide sump pit and pump in elevator pits as required by elevator code (ASME A17.1) Provide pumping mechanism which prevents oil in elevator pit from being pumped out, as required by code.
- H. Provide vandal resistant fixtures and push buttons with directional symbol for all elevator hall station panels and car operating panels.
- I. For garage elevators provide water resistant components in areas that are not temperature controlled, to include hall station panels, car operating panels, infra-red door edges/light

140000 - CONVEYING SYSTEMS

screens, position indicators, hall and car lanterns, pit stop switches, hoistway limit switches, interlocks, leveling selector, stainless steel or galvanized selector tape, car top inspection station, car door operating equipment and emergency phones.

- J. For garage elevators, to resist corrosion use Type 316 stainless steel or galvanized for car doors, hoistway doors, door bucks, car door operating equipment and fixtures. Use minimum 16 gauge stainless steel or galvanized.
- K. Fire service key switches for all elevators in a building, including additions to existing buildings, shall be operable by the same FEOK1 key as required by elevator code.
- L. Shunt trip disconnect shall be used in elevator machine room, not panel board, per code requirements.
- M. Provide protective cages for light fixtures in elevator machine rooms.
- N. Contractor is responsible to provide, install, and wire the emergency elevator phone.
- O. Any surfaces that project out into the elevator shaft must be angled from the wall surface down. No flat surfaces in the horizontal plane are allowed in the shaft.
- P. Specifications shall require that the contractor comply with County (Facilities Management Department) maintenance protocol for all maintenance and inspection work performed.
- Q. Specifications shall require the use of energy efficient AC motor technology for elevator motors.
- R. In buildings with more than one elevator, escalator, or lift each piece of equipment shall be assigned a unique identification number as required by elevator code ASME A17.1. When adding an elevator, escalator or lift to an existing building, or when adding equipment in a new wing of an existing building, the new identification numbers shall start at a number higher than the existing numbers (do not start over at #1).
- S. Elevator penthouse and/or roof top access shall be limited by key and/or access control card. A method to override the access card or key switch shall be provided to allow unrestricted access during special projects or events.
- T. All lighting in elevator cabs, machine rooms, and pits shall be energy efficient LED fixtures. Elevator illumination shall meet requirements specified in Section 2.14 of ASME A17.1.

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- U. Elevator doors must be double-sided, not single-sided. Door hangers must be separate components from the doors, and not be an integral part of the doors. All elevator anti evacuation devices on car doors are to be collapsible vane type.
- V. Accessible Design
 - 1. Evaluate use of verbal communications in lieu of chimes within elevators. Provide required ADA brail.
- W. Escalators shall be provided with on-board or built-in diagnostic service tools. All service tools, programmers, computers, software chips, etc. necessary to maintain, service, and or troubleshoot the escalators shall be furnished to the County and permanently left on the job site. This hardware and software shall not have any time limits or expiration dates set on them. A minimum of three copies of all instruction manuals for these tools, programmers, etc. are to be provided to the County.
- X. A full, two-year warranty for labor, parts, and materials shall be provided for escalators. The installer shall provide full maintenance service and inspections, during the two-year warranty period for escalators.
- Y. Any other conveying systems (wheelchair lifts, dumbwaiters, materials lifts, etc.) shall have a full, two-year warranty for labor, parts, and materials. Other conveying systems shall include full maintenance and inspections by the installer during the two-year warranty period.
- Z. Copies of all technicians' manuals, wiring diagrams, training materials, maintenance manuals and procedures, etc. shall be furnished to the County for each model of conveying system. A minimum of three bound hard copies and two electronic (CDR or DVD) copies shall be provided.

II. PRODUCTS

A. Conveying Systems

- 1. Elevator Suppliers (elevator and all components shall be non-proprietary):
 - a. Delaware Elevator Inc.
 - b. MEI
 - c. Canton Elevators Inc.
 - d. no substitutions/no equal products
- 2. Elevator Components (all components shall be non-proprietary):
 - a. Elevator Motors, Traction Machines, Governors:
 - i. Hollister-Whitney

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- ii. MEI
 - iii. or FMD approved equal
- b. Controllers:
 - i. Motion Control Engineering (MCE)
 - ii. Smartrise
 - iii. GAL Manufacturing
 - iv. no substitutions/no equal products
- c. Hydraulic Pumps:
 - i. Allweiler (basis of design)
 - ii. EECO
 - iii. IMO
 - iv. no substitutions/no equal products
- d. Sump Pumps:
 - i. Zoeller Oil Smart System
 - ii. Seewater Oil Smart System
 - iii. Stancor Elevator Oil-Minder Control System
 - iv. Or product approved by the Fairfax County LDS Plan Review and Inspections Division
- e. Oil Alert System:
 - i. Dorlen Oil-Alert Liquid Leak Detector
 - ii. or product approved by the Fairfax County LDS Plan Review and Inspections Division
- f. Hydraulic Valves:
 - i. Maxton (basis of design)
 - ii. Blain
 - iii. EECO
 - iv. no substitutions/no equal products
- g. Fixtures:
 - i. Innovation (basis of design)
 - ii. GAL
 - iii. EPCO
 - iv. Monitor (Janus)
 - v. C.J. Anderson
 - vi. no substitutions/no equal products

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210000 FIRE SUPPRESSION

NOTE: Fire Suppression Division was formerly included in Division 15000 Mechanical Plumbing, Section D.

1. Sprinkler System shall be designed, installed, and tested in accordance with all applicable codes and reviewed and approved by local authorities having jurisdiction. Contractor is responsible for all shop drawing review fees and permit fees charged by the Fire Marshal's office.
2. Fire protection drawings and calculations shall be prepared by or under the direct supervision of an individual having a NICET Level III or IV certification in water based systems layout or a Professional Engineer that passed the NCEES Fire Protection Engineering exam.
3. Specifications shall include requirement for contractor to provide hydraulic calculations for all new sprinkler systems and any retrofit projects as a submittal. Hydraulic calculations shall be prepared using a commercially available computer model such as HASS or HydraCALC.
4. Hydraulic calculations shall be done using the area/density method as outlined in NFPA 13 over the hydraulically most remote 1,500 sq. ft. The quick response area reduction is not permitted unless otherwise approved by the County for a specific reason.
5. Hydraulic calculations shall utilize hydrant flow test data that is less than 1 year old.
6. De-rate the water supply to the low hydraulic gradient. Provide a minimum 5 psi safety factor on all hydraulically calculated systems.
7. Properly adjust the water flow test data to the building from the effective point of the flow test.
8. Sprinkler systems for shell spaces shall be designed at Ordinary Hazard Group 2 (0.20 gpm/ sq. ft. over the most remote 1,500 sq. ft). Hazard Group 2 was chosen for situation when type of occupancy is not known. If occupancy type can be identified, Hazard Group may be specified to match occupancy type. BDCD PM will request Using Agency to confirm in writing. Head spacing shall be limited to 100 sq. ft. 1" outlets with 1" x 1/2" reducers shall be used for each sprinkler head. Each branch line shall be sized to allow for an additional two sprinkler heads. The pipe shall be installed as high as possible to avoid the need for relocating the lines during the tenant fit-out.
9. Sprinkler piping is not to be routed over top of electrical panels or equipment, except as specifically permitted by NEC. Route sprinkler lines into electrical rooms above the door. Provide an isolation valve on the lines that serve the main electrical and telecom rooms.

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10. The inspectors test valve shall be located in a readily accessible location. This is essential to minimize the impact to the user agencies during the cyclic testing. Provisions for discharging the water during the cyclic system test shall be made by piping the drain to the exterior of the building. The use of buckets for cyclic testing is not acceptable.
11. Sprinkler devices, valves, etc., shall be permanently tagged noting the device and its purpose. Valves or devices that are located above accessible ceilings shall be marked at the ceiling level indicating a device or valve above.
12. The use of McDonnell & Miller flow switches for the sprinkler system is unacceptable. These are not rated for use with fire alarm systems.
13. Do not specify any currently or previously recalled sprinkler heads for use on any Fairfax County project without prior, written approval from the Fairfax County Fire Marshall.
14. Specifications shall require contractor to provide appropriate quantities of spare sprinkler heads and spare sprinkler head wrenches (for each type installed) as required by code.
15. All sprinkler piping shall be Schedule 40. Schedule 10 is not acceptable as it tends to fail after a few years with pinhole leaks.
16. All riser fittings and inspectors test line shall be brass ball valves.
17. All 2" main drain lines shall be piped to the exterior of the building. This is necessary to facilitate the annual testing and maintenance of the lines. The floor drains will not handle the rate of flow required for the Fire Marshall's annual test and recertification.
18. All miscellaneous drain piping shall be internally and externally galvanized.
19. Coordinate the type and location of the fire department connection with the Fire Marshal.
20. Standpipe and hose valve locations shall be located as necessary to support the required 130' maximum hose and stream reach pursuant to the requirements of the VCC section 905.3. Distance shall be determined as path of access and not necessarily a straight line between points.
21. Recessed sprinkler heads shall be fully recessed. A maximum +/- 1/4" tolerance shall be permitted in a visual area.
22. Changes in direction shall be done with fittings.

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23. Do not use tees and plugs as a substitute for elbows.
24. Pipe size transitions shall be made with reducing fittings. Bushings are not permitted.
25. Do not use extended coverage sprinkler heads in Mechanical Rooms or other potentially obstructed locations.
26. Dry sprinkler valves shall be installed so that a proper test, reset, and maintenance can be performed from one location. Pressure gauges, drains and valves shall be installed as required to accomplish this. Line shall be installed with sufficient slope and no pockets to allow line to be completely drained. This shall be indicated on the drawings. A/E shall confirm as part of walk thru.
27. Use of dry sprinkler systems is discouraged and should only be used where required by code or operational requirements due to high maintenance and expensive repairs. Use is subject to FMD review and approval. If used:
 - a. Specify self-restorable valves to be reset by County's FMD staff.
 - b. Specify oil-less type air compressor.
 - c. Avoid using in unconditioned, hard to access areas, but if absolutely necessary, provide heat trace tape on sprinkler piping.
 - d. All dry sprinkler piping and fittings shall be galvanized.
28. Where there are exterior Drum Drips that are exposed to extreme temperatures, they shall be enclosed in an insulated Heat Box to prevent freezing and/or bursting of pipes. Heat tape of any type shall not be permitted. Provided Heat Box shall be red in color, feature secure locking, resistant to corrosion and provide required signage adhering to NFPA guidelines. Heat boxes shall communicate with a remote panel or Fire Alarm system to identify malfunction.
29. Seismic bracing shall be provided in accordance with the VUSBC and NFPA 13.
30. Provide seismic separation assemblies at all building expansion joints.
31. Provide a full-size set of as-built drawings, half size set of as-built drawings, and a flash drive that contains PDFs of all as-built drawings and hydraulic calculations in a locked document box adjacent to the sprinkler backflow preventer or alarm valve.
32. Assure location of key box as required by the Fire Marshall for the Fire and Rescue Department key access to building is located on floor plans. The contractor shall coordinate with Fire Marshall's office on exact location and provide and install all required key boxes.
33. Ceiling grid shall not be cut/notched to accommodate sprinkler pipe, valves or heads.
34. Dry Sprinkler valves to be TYCO or Viking.

220000 PLUMBING

I. DESIGN

A. Submission Requirements

1. The A/E shall send building load letter and plans to the water company with copy to BDCD Project Manager at appropriate times during design.
2. A/E shall submit cut sheets for the major equipment components which form the basis for design, at the Design Development phase. The cut sheets must identify equipment dimensions. Final construction documents shall include detailed part plans and section views (1/4" = 1'- 0" or larger scale) dimensioned to show the major equipment, duct work, and piping located within the mechanical spaces. Detailed plans must reflect that adequate space and clearances are provided for inspection, maintenance and replacement access, and all major mechanical equipment. It is preferred that these clearances be indicated by light dashed lines.
3. For building footprints too large to fit on a single plan sheet, provide a key plan on all plan sheets. Provide a key plan on any sheet where partial plans are utilized and indicate in a light hatch pattern for the area(s) of work. Where feasible, maintain same building orientation for all plans and include column lines even on key plans, as applicable.
4. Per Fairfax County 2021 Operational Energy Strategy, for new construction and major renovations, design Net-Zero Energy (NZE) structures to incorporate best practice energy-efficient design, using electricity-based space and water heating.



B. Plumbing

1. In addition to the code required locations, provide sanitary sewer clean-outs at each end of building at main sanitary sewer trunk lines. Provide accessible sanitary sewer cleanouts in all locker rooms and rest rooms.
2. Specifications shall require the contractor to conduct camera inspection of sewer lines to confirm lines are clean of all debris. Provide pictures from camera of sewer lines in the O&M manual. Provided pictures must show the main sewer line from beginning to end.
3. The following criteria is to be included in the Plumbing system specifications and indicated accordingly on the plans:
 - a. No plumbing piping is to be installed over electrical panels or other distribution equipment, unless in compliance with NEC limitations.

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- b. No plumbing piping is to be installed over food service areas, server or data room equipment or books in libraries or within required egress stairs.
- c. Freeze proof, lockable/keyed, 3/4" hose spigots with backflow prevention shall be provided near outside and rooftop mechanical equipment, to include a shutoff valve with air vent placed upstream of hose spigots. For applications where a roof hydrant is the only option, specify and detail a support system and indicate robust roof sealing so as to prevent pooling and leaks at the roof's penetration.
- d. Water Meters
 - i. Facility main water meter: Install utility meter plus EMCS integrated submeter.
 - ii. Irrigation water, cooling tower water feeds, fire station water filling stations and architectural water features: Install Utility and EMCS integrated submeter. The utility meters servicing a cooling tower or irrigation shall be installed to ensure Fairfax County is not charged for Sewer charges on irrigation or cooling tower water feeds. Provide a manual bypass for the automatic fill.
 - iii. Note: utilities generally do not accept owner provided meters for sewer credits. Most water providers will provide water meters at a reasonable cost but these meters are generally not compatible with EMCS remote metering systems.
 - iv. The EMCS submeter may be a separate meter installed in line or a device that reads the utility meter and provides 95%+ accurate water consumption data to the EMCS and the FMD central energy meter system (BuildingLogiX).
 - v. If a water pressurization pumping system is utilized to feed the entire facility, if so equipped, the digital meter output from the Water pumping system can be used to feed EMCS and the central metering system instead of a separate in line meter. Tigerflow manufactures flow controller and pump systems equipped with a BacNet output. This controller can be integrated with most EMCS.
 - vi. Refer also to Metering, Section 260000 Electrical and <https://www.fairfaxwater.org/rules-and-regulations>.
- e. Lavatories at all publicly accessible restrooms shall have hard wired infrared sensor controls with power backed-up by generator and have grid drains. Battery operated and/or backup sensor controls are not acceptable for lavatories. Lavatories and pantry sinks in staff only areas may have manual controls and grid drains.
- f. All piping that will gain or lose energy to/from the surrounding atmosphere, or may cause condensation problems, shall be properly insulated to minimize energy costs and condensation problems. Insulate piping in accordance with the International Energy Conservation Code. All roof drain bodies and horizontal piping including the down turn elbow shall be insulated. All pipe insulation joints must be properly sealed.
- g. Electric heat trace, tape system shall not be specified for domestic hot water systems.



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h. Hot Water Piping

- i. Avoid long runs of hot water piping, but where impractical provide hot water circulator pump and recirculation piping of at least $\frac{3}{4}$ " diameter. Unless determined otherwise, it is permissible to control the pump's operation with an aqua stat and 24/7 time clock.
- ii. Recirculation loops shall extend as close to the most remote fixture as practical. Domestic hot water should be delivered at each hot water outlet within 15 seconds of the time of operation. Design hot water velocity of 4 - 5 feet per second (fps).
- iii. The heat loss in the domestic water distribution system shall not exceed 6 °F. Size hot water return lines according to the heat loss method in ASHRAE Applications Handbook, Service Water Heating.
- iv. Insulation and pump size shall be selected to limit the hot water system temperature loss to 6°F maximum.
- v. Show balancing valves on plans and indicate flow rate.
- vi. Include requirements in the Specifications to balance the hot water circulating system and test and balance report shall be submitted by the Contractor for approval.



- i. Domestic tank type water heaters shall have glass lined tanks. ~~Gas-fired~~ Instantaneous water heaters are acceptable, but a minimum of two heaters shall be provided at 75% capacity.
- j. Storage type water heaters shall utilize DDC EMCS to minimize water heater "standby" losses during the building's unoccupied schedule.
- k. Floor or trench drains shall be installed for intentionally level floors and shall be shown on drawings. Provide floor drains at all toilet rooms and shower areas. Design floors to provide positive drainage to floor drains.
- l. Provide pressure gauges at high points of piping branches / points furthest away from building's source and at building service. Provide an isolation valve up-stream of pressure gauge. Indicate locations on the riser diagrams as well as on plans.
- m. In restrooms, coordinate the requirement for a centralized floor drain with the BDCD Project Manager. Utilize a "water saver" type trap primer directly connected to a nearby lavatory tailpiece or water closet vacuum tube to avoid the maintenance associated with mechanical trap primers.
- n. Fixture units shall be tabulated on drawings. Where fixtures have been demolished, demolished fixture units shall also be tabulated on drawings.

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- o. Low flow fixtures shall be used in order to meet minimum water conservation requirements of the EPA's WaterSense Program. All materials and equipment must be WaterSense labeled or meet or exceed WaterSense program performance requirements.

Plumbing fixtures shall have flow rates/water consumption as follows:

- i. Water Closet 1.28 gallons per flush (gpf)
 - ii. Dual flush water closet 1.6 gpf/1.1 gpf
 - iii. Urinal 0.5 gpf
 - iv. Low flow urinal 0.125 gpf
 - v. Public lavatory 0.25 g per cycle/0.5 (gpm)
 - vi. Mop sink 2.5 gpm
 - vii. Kitchenette/pantry sinks 2.2 gpm
- p. As a general rule, garbage disposers are not permitted in commercial applications unless required by code. They will be considered and approved by the BDCD Project Manager on a case by case basis for applications such as fire stations and other residential facilities where the end user will be solely responsible for their servicing.
 - q. Gas piping shall be painted bright yellow with a minimum of two coats of industrial grade enamel and labeled with use. Domestic piping shall be labeled with use and flow directional arrows on the exterior of the insulation. Drainage piping shall be labeled with use and flow directional arrows.
 - r. Water piping shall not be routed in unheated spaces where there is a potential for freezing.



C. Commissioning

1. Requirements for the domestic hot water system commissioning process shall be included in the construction contract. An independent Commissioning Authority may be hired by the Owner through the A/E's contract. ASHRAE Guideline O or other industry recognized guidelines for commissioning shall serve as the basis for all domestic hot water commissioning and the guidelines will be tailored to the specific requirements of the project.
2. The A/E and Plumbing Engineer and Commissioning Authority will perform reviews of the Plumbing system design from a commissioning perspective at all review phases of the design process and will cooperate fully with the Owner's Commissioning Authority throughout the design review process as applicable.

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3. The contract specifications must clearly spell out the responsibilities of the General Contractor and all appropriate subcontractors relative to commissioning and shall also define the role of the Commissioning Authority.
4. The A/E and Plumbing Engineer shall coordinate and cooperate fully with the Owner's Commissioning Agent and with DPWES representatives throughout the actual commissioning process prior and subsequent to, system acceptance. The A/E and Plumbing Engineer shall provide all design and or system information that is requested by the commissioning team members and respond to all comments from the Commissioning Authority from design through system acceptance.
5. The final commissioning reports and documents shall be provided in the Operations and Maintenance Manuals.

II. PRODUCTS

A. Plumbing Equipment Preferences

1. For plumbing systems, American Standard, Kohler, or Moen fixtures with Sloan or Zurn flush valves are preferred. Provide ball type shut off valves to isolate individual rest room areas and provide access to valves in janitor's closets adjacent to rest rooms.
2. All plumbing fixtures shall be specified and installed to be compliant with ADAAG requirements.
3. Provide service valves to enable segmented shutdown of building's water lines. Provide repair kit for any non-standard type plumbing fixtures and faucets.

a. Water Closets:

Water closets shall be floor mounted. American Standard, Madera 1.1-1.6 gpf ADA Universal Flushometer Toilet or FMD Approved Equal

b. Urinals

Low flow as approved by Fairfax County Project Manager and as needed for water savings. Waterless urinals NOT permitted.

c. Flush Valves:

Sloan, **Zurn** or FMD Approved Equal
Dual flush or low flow valve as appropriate to meet water savings requirements in water closets and urinals.



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- d. Faucets: Infra red sensor- auto type, hard-wired with ~~battery back-up~~ above deck actuators, in public restrooms. Manual in staff toilet rooms. No self-closing metering faucets unless required by code. No plastic handles or knobs. No faucets which require cartridges.
Sloan ETF-610-4, Moen, American Standard, ~~Kohler~~ Chicago and T&S-Single lever, No Equals or Substitutions.

- e. Frost Free Hydrants: Josam, Woodford, or FMD Approved Equal

- f. Vitreous China Fixtures: American Standard, Kohler, Zurn, or FMD Approved Equal
Integral bowl w/ solid surface preferred.

- g. Garbage Disposals: Insinkerator (I.E.S.); or FMD Approved Equal
(Garbage disposals are typically not allowed except in food prep kitchens)

- h. Valves: All valves 2" and smaller should be ball type valves



- i. Domestic Water Heaters: Tank Type - AO Smith, State, PVI, or Lochinvar
~~Gas Fired~~ Instantaneous Water Heaters – Rheem.
Rinnai
(No Equals or substitutions)

- j. Domestic Booster Pumps: Bell and Gosset, Tigerflow, or Ironheart
(No Equals or substitutions)

- k. Water Cooler/Bottle Filler: Elkay EZH2O Model LZWS-LRPBM28K
(No equals or substitutions) Note: unit requires ~12" clear space in the wall to mount this model.

- l. Water Sub-Metering: Sensus "OMNI C² Series"
(No Equals or substitutions)

4. Specifications shall identify at least three acceptable plumbing equipment manufacturers for competitive bidding; unless otherwise noted herein, or unless limited source procurement is approved in advance by the owner.

230000 – HVAC

I. DESIGN

A. A/E Coordination



1. Per Fairfax County 2021 Operational Energy Strategy, for new construction and major renovations, design Net-Zero Energy (NZE) structures to incorporate best practice energy-efficient design, using electricity-based space and water heating.
2. For design of Clinical Facilities with Negative Pressure Rooms refer to Appendix A.
3. For design of Evidence or Forensic Rooms in Law Enforcement or Public Safety Facilities refer to Police Station Design Manual.
4. Mechanical Room General Design Criteria:
 - a. Mechanical equipment shall be located on the ground floor and provided with double doors, or doors sized to be able to remove the largest piece of mechanical equipment. When conditions require roof mounted mechanical equipment, units shall be mounted on 18” high curbs and never placed directly on roof. Additional clear height is required for larger equipment and shall be in accordance with the recommendations of the American Roofing Contractors Associations latest reference manual. Fans ventilating kitchen hoods: At least 24 inches (610 mm), or more if required to place discharge of fan 40 inches (1016 mm) above roof surface. In addition, all roof mounted mechanical equipment required to be screened (refer to Division 010000) shall be designed to allow required access and airflow.
 - b. Paved access for maintenance vehicles shall be as close as possible to the mechanical room access.
 - c. Rooms shall be of sufficient size for all required clearances and all proposed piping and duct layouts and must accommodate replacement of each piece of equipment without removing any other piece of equipment or any part of the building. Sufficient space shall be shown on the plans and designated in the room by striping, for the replacement of the largest piece of equipment in the room to allow assembly and testing of the replacement piece of equipment prior to switch over and removal of the piece of equipment being replaced.
 - d. Travel paths shall be clearly indicated which present no to minimal obstacles for equipment replacement and servicing.

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- e. Where it is not practical to design equipment rooms on the ground floor level, the room design, and if necessary adjacent spaces, shall incorporate clearly defined provisions for equipment replacement and servicing. Necessary adjacent spaces shall not include spaces critical to the operation of the building function.
- f. Mechanical rooms that serve as air plenums shall be designed according to prevailing code, shall be void of combustible materials, and shall not permit untreated outside air delivery into the room.
- g. Mechanical room floors shall be painted or otherwise treated with an industrial grade, slip resistant, water-proof type coating of a light gray color and curbs and equipment pads painted/trimmed out in yellow color slip resistant, industrial grade treatment.
- h. Rooms shall have proper drainage depending on the type of equipment housed.
- i. Where there is equipment to be cleaned, etc., there shall be a ¾” hose bib with backflow protection.
- j. Noise attenuation measures shall be incorporated into the design of the mechanical room(s). Provide an NC of 35 for office spaces. A lower value of NC-30 is appropriate for classrooms and sleeping rooms.

Noise Criterion	Octave Band Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
	Sound Pressure Levels (dB)							
NC-30	57	48	41	35	31	29	28	27
NC-35	60	52	45	40	36	34	33	32
NC-40	64	56	50	45	41	39	38	37

- k. Equipment rooms must be weatherproofed and have secured locking hardware.
 - l. A/E must clearly show HVAC equipment and screening located on the roof and/or on the site on all renderings and elevations to show accurate representation on the overall design.
5. Roof Guards:
- a. Refer to the Mechanical Code for requirements to provide guardrails at the edge of roof areas adjacent to rooftop equipment that require maintenance access at the roof level.

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- b. If guard rails are unavoidable, the A/E is to indicate and specify railing that is compatible with the building's structure and aesthetics.

6. Roof Access to HVAC Equipment:

- a. All roof levels shall be accessible for maintenance – no exceptions. Provide OSHA approved safety tie-off/anchor points on all roofs without code minimum railing /parapet wall.
- b. Roof walkways must be provided in all expected travel areas and around roof mounted equipment.
- c. Provide platforms around cooling towers and other HVAC units elevated above roof surface. Provide permanent ladders to access platforms.
- d. Ladders must be provided to all roof levels and interior ladders are preferred where practical. Provide a ship's ladder with straight steps (no alternating treads) to the main roof levels.
- e. Refer to Accessibility and Maintainability section (I.E.2) for detailed access criteria.
- f. Kitchen exhaust fans must be provided with proper access in accordance with NFPA 96 8.1.1.3

7. Ceiling Access to HVAC Equipment:

- a. In ceiling areas where HVAC equipment, such as VAV boxes, need to be located, A/E shall provide appropriate ceiling space such that equipment, dampers, valves, etc., can be easily accessed for maintenance. Where access to equipment is required maximum ceiling height shall be 9'-0".
- b. Ceiling access shall be accessed no greater than that required from 8' step ladder. For ceiling spaces only requiring junction boxes, cabling and other miscellaneous items the ceilings can be up to 10'-0".
If there is nothing (including junction boxes) in the ceiling requiring service/maintenance, ceilings can be higher in special areas but shall be specifically requested to FMD in writing no later than the design development submission and the design must illustrate that access above such higher ceilings is not required. VAV boxes and similar equipment can be located in lower ceiling areas (9'-0"), if need be, to allow for limited higher ceiling areas, but specific parameters for this accommodation must be detailed on the drawings.

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- c. For inaccessible ceilings, the A/E shall indicate and specify compatible access panels of sufficient size (20" x 20" minimum) that have been coordinated with the Engineering layout and requirements.
 - d. It is permissible to specify cable operated volume dampers for individual air devices where access panels may be less desirable.
 - e. Equipment shall be a minimum of 3'- 6" from a wall.
NEC requires 42" to grounded sources from live electrical components.
NEC defines walls, ceiling grids, sprinkler piping etc. as grounded source.
 - f. Where built-in systems (furniture and/or shelving) are planned and basic layout can be determined, VAV boxes/AC equipment shall be located above the walkways and not directly over furnishings that cannot be easily moved.
8. Return Air Paths:
- a. Buildings with tall, vaulted attic spaces require close coordination between Architect and Engineer.
 - b. Use of attic space as an air plenum is not permissible.
 - c. Design and specify ducted supply/return systems where ductwork must traverse through an attic space or within vaulted elements. Ducts shall be insulated as required by the Energy Code for exterior ductwork in all unconditioned spaces.
 - d. For "flat" ceiling applications, plenum returns are preferred unless there are compelling reasons for ducting back to the air mover(s). Extreme caution must be taken when creating a return air plenum in an existing building as all materials within the plenum must be confirmed by the design team in advance of issuance of the design documents to be safe and plenum rated as required by code. This requires observation and testing, and complete removal of materials not allowed per code for plenum use. Do not make it the responsibility of the contractor to determine the suitability of the above ceiling area to meet the code requirements related to return air plenum.
 - e. Where ceiling return air plenums are utilized, coordinate the design intent and use of return air light fixtures and other architectural return air measures with the BDCD Project Manager. Ensure replacement light fixtures are equipped with equal return air capacity of the fixtures being replaced (this is particularly important with LED fixtures which are much more compact and do not always have as much room in the housing for return air openings). Add appropriate sizes and quantities of return air grilles if replacement light fixtures reduce the net opening for return air flow.

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- f. The A/E shall coordinate all full height walls, obstructions, and prevailing code requirements such that the return air plenum is viable. Provide transfer ducts or openings where necessary with appropriate fire dampers and/or smoke dampers. If the full height wall/partition is sound attenuated, then “Z” or “U” type sound-lined transfer air ducts as appropriate shall be provided.



- 9. Cooling tower emergency drain down and water treatment drains shall drain to sanitary sewer and not to storm drain.

B. Submission Requirements

- 1. The A/E shall send building load letters and plans to the electric and gas companies with copy to BDCD Project Manager at appropriate times during design.
- 2. A/E shall submit cut sheets for the major equipment components which form the basis for design, at the Design Development phase. The cut sheets must identify equipment dimensions. The construction drawings shall include detailed part plans and section views (1/4" = 1' or larger scale) dimensioned to show the major equipment, duct work, and piping located within the mechanical spaces. Detailed plans must reflect that adequate space and clearances are provided for inspection, maintenance and replacement access, and all major mechanical equipment. These clearances, along with those required by code, NEC etc., shall be indicated by light dashed lines on all plans for all equipment.
- 3. A/E shall use eQuest, Trane Trace, DOE-2 or other pre-approved equivalent building simulation programs to conduct energy modeling to aid in preparing a life-cycle cost analysis for mechanical system selection, optimized building orientation, architectural shading methods, building envelope characteristics, and day lighting options during the Schematic/ Design Development phases. The BDCD Project Manager and A/E shall meet with the Using Agency to determine actual building operations plan and schedule and what options shall be evaluated and to review costs/benefits of various design alternatives. The A/E shall provide the Owner an annual energy budget model based upon the computer simulation. Report shall include the program outputs and list of input assumptions.



- 4. A/E shall conduct a Life Cycle Cost Analysis of alternate HVAC systems at Schematic Design Phase. Submit brief description of proposed system options for County approval prior to performing LCCA. Owner's final selection shall be subject to County approval, based on considerations such as reliability, energy consumption, maintenance cost, etc. For maintenance costs, A/E shall request to BDCD Project Manager for FMD to complete applicable equipment maintenance

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costs in Exhibit 230000-A. Where specific costs are unavailable, RS Means cost data shall be used. Life cycle cost analysis shall consider installation costs and energy cost reductions associated with renewable energy systems for each mechanical system option. Final system selection must achieve County energy goals which may not be the option with the lowest life cycle cost. The following parameters shall be used for evaluating life-cycle cost analysis.

a. 5% discount factor for capital costs.



b. Current utility rates should be confirmed with BDCD Project Manager (OEEC provides) and the escalation rate should be discussed at the time of the study as they can vary widely and have a big impact on life cycle analysis. 3% escalation rate has been used recently.

c. Study period shall be for 30 years. Use the following for life cycles for replacement for the below listed equipment:

- Packaged roof top equipment – 15 years
- Boilers – 15 years for condensing
- DX equipment – 15 years.
- Air handling units with water coils – 17 years.
- Control Systems – 10 years
- Piping – 30 years
- Ductwork - 30 years

d. All life cycle costs shall be in “Present Worth” format.

5. The A/E shall confirm design conditions early in the project and submit all heating and cooling load calculations for review by the end of Design Development. Revised load calculations shall be resubmitted to the Owner as required to reflect revised loads based on Owner & HVAC Peer Reviewer comments.

6. Provide a points list and sequence of operations for each project.

a. Within the Sequence of Operations, the A/E shall clearly separate the sequences between those performed by the Energy Management System and those performed by packaged equipment controllers.

b. Where there is communication between the Building Automation System (BAS) and packaged equipment the hard wire points shall be specified and a separate list of points provided for all BACnet mapped points.

c. Sequences shall be provided at the DD phase.

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7. Show true North arrow on all Mechanical plan sheets for all submissions. Provide graphic scales on all sheets including scaled drawings.
8. For building footprints too large to fit on a single plan sheet, provide a key plan on all plan sheets. Provide a key plan on any sheet where partial plans are utilized and indicate in a light hatch pattern for the area(s) of work. Where feasible, maintain same building orientation for all plans and include column lines even on key plans, as applicable.
9. Provide outside air calculations to the BDCD Project Manager by no later than the Design Development review. Calculations to be performed in accordance with the Virginia Mechanical Code, ASHRAE 62.1 and ASRAE 90.1. A-E shall verify any additional requirements from LEED. Fairfax County LDS provides a spreadsheet for Mechanical Ventilation which shall be submitted with each set of permit application drawings.
10. Equipment schedules for major equipment shall contain capacities required by load calculations and capacities of proposed equipment. This applies for heating and cooling BTUH's and GPM. This will allow the county to more easily verify that equipment has not been oversized (requirement of IECC) and facilitate future equipment replacements based on actual required capacities instead of what was installed.



C. Main Fuel Tank, Day Tank & Piping for Diesel Generators (Applicable only when natural gas fired generator is not selected)

1. Engineer shall evaluate if a day tank is required based on the generator mounted fuel pump (available Net Positive Suction Head). A day tank is only to be supplied if the main fuel tank is not located immediately adjacent to the generator and there is not sufficient head.
2. Main fuel tank or day tank shall not be located or mounted on the same frame as the emergency generator. Packaged units with main fuel tanks, sub-base fuel tanks, belly tanks, on-board tanks or rail mounted tanks are not acceptable. The Day Tank (when required) shall be mounted on a slab on grade, independent of the emergency generator. Simplex Day and Pryco Day Tanks are reference suppliers of the day tank.
3. The main fuel tank can either be an Underground Storage Tank (UST) or an Aboveground Storage Tank (AST) mounted on a slab independent of the generator in accordance with UL listing. An AST is preferred over an UST. The AST shall be securely bolted to the slab and properly grounded. AST's, UST's,

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and Day Tanks (when provided) shall be double wall. AST and Day Tanks shall comply with UL-2085.

4. Above ground Fuel Storage Tanks shall be located at or near grade and shall be easily accessible for ease of maintenance, repair or replacement. There shall be no obstacles to accessing the generator with dollies and 55-gallon drums. Underground tanks shall be located away from structures to not interfere with the structure during replacement.
5. The fuel system shall be sized to support the generator for a period of 96 hours at full load capacity. The main tank shall be sized to be full at 3/4 capacity. When serving dual systems (such as heating equipment), the generator fuel quantity for required Life Safety loads must be clearly identified on the exterior of the tank.
6. The A/E shall include in the specifications that the contractor is required to provide a 4-hour step load bank test and that the contractor is responsible for providing a minimum of half tank (Main Tank) of fuel at the time of generator startup.
7. All fuel piping and fuel tank designs should be approved by the system manufacturer of the generator set.
8. Fuel oil return piping must be provided from the generator to the the Main Fuel Tank or to the Day Tank (if provided) and from the Day Tank to the Main Fuel tank.
9. A remote fill line shall be supplied on the Main Fuel Tank with an overfill protection valve in the tank. A spill containment box shall be supplied. Morrison Brothers and Fairfield Industries are reference suppliers.
10. Provide level indication on the tank.
11. Fuel system piping shall be black pipe and painted with Corrosion-resistant black paint. Copper piping is not to be used for fuel supply or return.
12. Fuel return line piping must be properly sized as per manufacturer's recommendations. Generally, the return line will be equal to or one size larger than the supply line.
13. The fuel piping and the electrical conduit between the generator and the Day Tank and fuel piping between the Day Tank and the Main Fuel Storage Tank shall be routed to allow easy access around these items without conflict.
14. In the event the supply line fuel piping is elevated, provide an anti-siphon valve on top of the tank. An anti-siphon valve will prevent the free flow of oil from the storage tank through a break in the fuel piping.

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15. A foot valve is to be installed on the suction line drop tube to maintain a prime if the fuel level can drop below the elevation of the pump suction. The use of a check valve close to the pump set is an alternative to the foot valve.
16. Operations will need to treat the diesel in the tank. Provide connections to circulate the diesel (the fill line can be used to return the fuel).
17. When a Day Tank is not required, provide a hand pump on the supply line to the return line near the generator to prime the supply line from the tank.
18. Day Tanks (when required):
 - a. Day tank shall be sized for a minimum of 4 hours of continuous operation of the generator at full load.
 - b. A duplex fuel pump system shall be provided to fill the Day Tank from the Main Fuel Tank. The pump shall be capable of filling the day tank at a minimum rate of 4 times the generator fuel usage rate at full load. This pump system may be supplied as an integral part of Day Tank.
 - c. A hand pump shall be specified to pump from the main tank to the day tank as a backup to the electric pumps.
 - d. A duplex fuel pump shall be provided with a return line from the Day Tank to the Main Fuel Tank. The function is to drain the day tank for maintenance. This pump may be supplied as an integral part of Day Tank.
 - e. The day tank piping shall be provided with unions so that the Day Tank may be isolated and replaced without redoing the piping. The return line shall have no valves, as required by code.
19. Main fuel tank, Day tank and fuel lines shall be installed by a certified contractor in accordance with manufacturer's installation requirements and the requirements of the NFPA, IBC, NEC. The main fuel tank and Day Tank may be painted with the same color as that of the generator.
20. Provide fuel leak detection system. It shall be located next to the Remote Generator Annunciator Panel (RGAP) or in another location as determined by specific needs of the facility. The International Fire Code (IFC) Paragraph 3404.2.7.10 requires there be immediate reporting to the fire department, code official and other AHJ's. Underground double walled tanks are required to have an approved method of leak detection per IFC 3404.2.11.5.2.
21. AE shall include in the specifications that training for the leak detection system (Veeder Root) (for the tanks supplying the emergency generator only) is to be included in the training/demonstration specified under specification 017900 Equipment Demonstration / Instruction when FMD is present.

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22. The leak detection system (Veeder Root) monitoring the tank(s) supplying the emergency generator only (not vehicle fueling systems) shall be connected to the BAS displaying only that the system is in alarm.

D. Heating, Ventilation and Air Conditioning System Selection (Refer to Energy Efficiency section I.E.1 for additional information)

1. The A/E shall coordinate with DPWES and FMD prior to selection of the mechanical system.
2. Where building size and use (generally greater than 100,000 sf and of a Government Center or other major function) require complex multi-zone comfort systems, central plant configurations are preferred. In such cases, the basis of the heating and cooling system shall incorporate the following:
 - a. Centrifugal chillers above 120 tons and scroll or screw type chillers below 120 tons supplying chilled water, with VAV air handling units are strongly preferred.
 - b. A four-pipe system is preferred.



- c. Heat pump chillers or other electric powered heat source supplying hot water to perimeter baseboard or VAV terminal mounted heaters and air handlers (use hot water coils for morning warm-up) should be used for the heating system. For VAV systems, the decision to use terminal unit electric reheat will be made on a case by case basis.



- d. If the County approves an exception to use natural gas heating in lieu of all electric heat source, the use of condensing boilers is preferred for new installations. For retrofits, the use of condensing vs. non-condensing boilers will be made on a case by case basis. Multiple boilers should be incorporated for redundancy and shall use cascading controls between the boilers. A minimum of two boilers shall be used and each sized such that when a boiler is out of service, remaining capacity shall produce a minimum of 75% of the total heating load.
 - e. Temperature controls shall be Direct Digital Control (DDC).
 - f. Chillers should be located in an enclosed mechanical room. Avoid locating chilled water units above the roof line. Specify glycol and for piping to enter the unit directly below the unit, when no other acceptable options are available. Provide refrigerant monitoring, detection, alarms, and ventilation as required to meet Mechanical Code requirements and ASHRAE standards. Smaller chillers that use scroll compressors can be packaged units located outdoors but must be

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designed to include glycol to prevent freeze-ups and/or the need to drain/fill the system seasonally. Glycol feeders shall be included for such systems instead of make-up water connections. Heat tracing of the exterior piping shall be included, and the heat tracing shall be monitored through the **BAS**. CFC and HCFC refrigerants are not to be used in mechanical equipment on County projects. The County goal is to achieve the LEED Enhanced Refrigerant Management Credit, and the use of HFC refrigerants is strongly encouraged.

- g. AHUs located in mechanical rooms are the owner's preference to achieve extended AHU life cycle. Mechanical rooms shall be sized such that replacement units can be assembled adjacent to the existing operating unit and readily ducted into the existing duct system to allow minimal down times for systems replacements. These added costs shall be accounted for in the Life Cycle Cost Analysis (LCCA).
- h. Avoid designs that require heating plant operation in the summer, which are not typically run during the summer months.
- i. Avoid designs that require chiller operation during the winter. Any space that requires 24/7 cooling should use a DX system. County chillers typically, are not run during the winter months.



- 3. In small, less complex buildings, VAV or constant volume roof top units with fully modulating natural gas heat and DX cooling are preferred as they minimize floor space required for mechanical rooms. *(By exception only, requires PM approval)*
- 4. Hot water systems designed to be outside the building envelope are not permitted.
- 5. Where commercially available, DX units shall have at least one inverter driven fully variable compressor to ensure that humidity is controlled in low load, high OA humidity conditions and to avoid excessive cycling of compressor(s).
- 6. VAV systems are preferred for indoor comfort control (humidity). Variable volume and temperature (VVT) systems are not permitted. Constant and variable air volume systems shall utilize modulating hot gas reheat for humidity control. In single zone spaces a space humidity sensor may be used. In multiple zones, a return humidity control system shall be integral with the unit controls.
 - a. Ensure that discharge temperature (DAT) reset is coordinated with the hot gas reheat (HGRH) so that the reset is lowered to the point required to maintain humidity levels and minimize any heating required at the VAV boxes; i.e. it shall not automatically set back to the lowest DAT when dehumidification mode is enabled if a higher DAT will dehumidify

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sufficiently. This will prevent/at least minimize using new energy to reheat any zones that become overcooled.

- b. For conference rooms and other high cooling load spaces, the VAV box(s) serving these spaces and their air distribution system shall be sized for a DAT reset condition of 62 degrees F. vs. the typical peak cooling day DAT (+/- 55 degrees F).
- c. Where constant volume systems are deemed appropriate, design and implementation of a “single zone VAV” approach is preferred.



~~7. Where natural gas is not available, packaged air to air heat pump units with 100% electric back up are acceptable.~~

- 8. If the motor operated damper is in series with a gravity damper, it can be in two positions (open/close). Packaged equipment shall only be specified with a motor operated damper or a barometric backdraft damper, not both.
- 10. Supply air shall be directed away from thermostat/sensors. Thermostat/sensor locations must be shown on the drawings. Before locating, coordinate thermostat/sensor locations with loose and fixed furniture plans to avoid conflicts and poor sensing capabilities. For exterior zones, avoid locating thermostat/sensor too far from the exterior wall.
- 11. Interlock exhaust fans with associated AHU to assure they are included in controls package and don't run continuously. This will also save control points.
- 12. Provide telecom and elevator machine rooms with independent split system units where appropriate to the facility's operations. The unit shall be wall mounted, located above the door to maximize wall space available for the intended use of the room.
- 13. An evaluation of the building criticality shall be completed to determine required redundancy of the heating system. Criteria such as the need for continual occupancy and risk of pipes freezing in event of an equipment failure shall be considered. The system shall be designed to address these concerns.

E. Heating, Ventilation and Air Conditioning Design Criteria

Optimal design will emphasize energy efficiency, accessibility, and maintainability.

1. Energy Efficiency

- a. The HVAC system shall meet all building code requirements for heating and cooling loads and shall be designed to meet project target for LEED. The use of VRF or equivalent type systems may not be considered. Refer to section

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010000 General Design Requirements. Building envelope components shall be designed for energy efficiency in compliance with ASHRAE, IMC, and other applicable building and energy codes. Special attention shall be paid to the International Energy Conservation Code requirements for equipment sizing criteria.

- b. The HVAC designer shall pay close attention to actual building occupant load patterns and anticipated actual building loads to ensure that the system efficiently meets these requirements. Fairfax County has had problems with systems that meet the code requirements but do not effectively heat, cool or dehumidify the building in actual loading conditions. A/E shall:
- i. Use all code approved methods to reduce occupant loads to match actual conditions and to reduce fresh air quantities to lowest possible levels
 - ii. In buildings with fixed shelving and stacks, such as libraries, such shelving and stack floor areas, must be deducted from the net square foot calculations.
 - iii. Use occupant averaging, room volume, transfer air techniques or other approved code methods to reduce fresh air requirements. This is mandatory for all meeting rooms, conference rooms, or other assembly areas. Use LDS occupancy load program to calculate outside air quantity reductions for variable and intermittent occupancies where possible. Coordinate with the BDCD Project Manager or contact Building Plan Review in County's Land Development Services to obtain the most current copy.
 - iv. In renovation projects, ensure the remaining portions of any mechanical systems that are to be reused are coordinated with the new/planned use of the building. This shall include a detailed evaluation of the exhaust systems to ensure they are not oversized for the new/planned use. Otherwise oversized exhaust systems will often dictate an increase in the amount of fresh air required (buildings overall must be designed to be positive) and drastically affect energy use and potentially humidity levels.
 - v. Size cooling equipment to match actual building occupant load conditions.
 - vi. HVAC loads shall be based on actual lighting loads wherever possible. If actual lighting loads are not available at the time HVAC loads are calculated, lighting load shall be estimated by maximum lighting power density permitted by space type according to IECC. Do not use 2 W/SF as standard lighting load for all spaces.
 - vii. Central plant equipment shall be sized for the building peak, not the sum of the zone peaks.

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- viii. If packaged DX equipment is used, they shall have multiple/variable cooling and heating stages to meet part load conditions for proper humidity control. Design CFM range for DX equipment that serves occupied spaces shall be in the range of 340-360 CFM/Ton. Design CFM/ton for equipment that primarily serves equipment such as server rooms shall be at the equipment manufacturer's rate to adhere to the cataloged cooling capacity.
 - ix. HVAC systems shall be designed to limit indoor humidity levels in the cooling mode to an average 50% with an upper limit maximum of 55% per OSHA requirements and recommendations, as levels above 60% promote and support mold growth.
 - x. Variable speed compressors, hot gas reheat, dedicated outside air units and other active humidity control systems shall be used. New energy reheat shall not be used.
- c. Provide HVAC zones for different functional areas and to allow for night use in appropriate areas.
- i. Where design loads for a space may vary significantly from actual loads, the system shall be designed with capacity reduction capability.
 - ii. CO₂ sensors shall be provided to control amount of fresh outside air intake.
- Effort should be made to properly design the outside air intake boundaries so that the equipment is not oversized. Outside air (OA) quantity when CO₂ is below setpoint shall be half the calculated code required ventilation. When CO₂ exceeds setpoint, OA shall increase to the calculated code required ventilation rate. If upper and lower limits for OA intake are included, it will allow the TAB contractor to properly setup the outdoor air control on AJ+HU's and RTU's. The OA lower limit needs to be calculated based on the amount of exhaust to always keep the building positive. The maximum OA should be the calculated code minimum as it is typically more as it based on the calculated occupancy rather than the actual occupancy.
- d. Systems designed shall maintain the following temperature settings:

Type of Area	Summer Range Occupied ^{1,2}	Summer Range Unoccupied ^{1,2}	Winter Range Occupied ^{1,5,2}
General Office	72-75	85	72 - 75

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Type of Area	Summer Range Occupied ^{1,2}	Summer Range Unoccupied ^{1,2}	Winter Range Occupied ^{1,5,2}
Sleeping Areas (Fire Stations)	69-74		69-74
Corridors	75		72
Building Lobbies ⁶	75		72
Toilets	75		73
Locker Rooms	73		74
Electrical Closets	78		55
Mech. Spaces	95 ³		55
Elec. Switchgear	95 ³		55
Elevator Mach. Room ⁶	78		55
Emerg. Gen. Room	95 ^{3,4}	95 ^{3,4}	55
Transformer Vaults	95 ³		
Stairwells	(none)		65
Comm./Tel. Frame Room	75	45	72
Storage Room	74		65
Conference Room ⁷	72-75		72-75
Auditorium ⁶	72-75		72-75
Kitchen ⁶	72-75		72-75
Dining ⁶	74		76
Cafeteria ⁶	74		76
Courtrooms	72-75		72-75
Data Center ^{6, 2}	65-72		65-72
Data/Security Equipment Closet ²	77		77
Specialty Rooms & Labs ^{6,8}	TBD ⁸	TBD ⁸	TBD ⁸
Apparatus Bays	Heat Exhaust		56

1. Temperatures are degrees Fahrenheit and shall be adjustable within the provided range.
2. Maximum permissible relative humidity is 50 percent in conditioned areas. Data Centers and data closets adjustable range shall be 40%-45%.
3. Maximum temperature. Space to be mechanically cooled if necessary.
4. Room must not exceed temperature with generator running.
5. Minimum temperature in a building and all associated spaces to include mechanical must be 55 °F even when unoccupied.
6. System shall be designed for process cooling. Cooling system shall be a dedicated independent system.
7. Provide independent temperature control.
8. To be determined by end user and certification/licensing requirements

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- e. Outside Air Design Parameters (temperatures) for General Building Areas.

Winter	13°F
Summer	95/ 75°F

(Verify design temperatures with ASHRAE Standards.)

- f. The building thermal envelope shall be maximized as these items are static and the added thermal performance does not add maintenance and directly saves energy no matter the efficiency of the HVAC system. In any case, the minimum values shall be per the Energy Code or as listed below, whichever is more stringent:

Window U-Factor Metal Frame	0.50 Max
Window U-Factor Nonmetal Frame	0.40 Max
Window Solar Heat Gain Factor	0.40 Max
Mass Wall U Factor	0.104 Max (R9.5 c.i.)
Steel-Framed U Value	0.064 Max (R-13 + R-7.5 c.i.)
Metal Building	0.084 (R-19)
Soffit/Floors U-Factor	0.10 Max
Roof Insulation entirely above Deck	0.048 (R-20 c.i.)
Roof Metal Building	0.055 (R-13 + R-13)
Roof Attic and Other	0.027



- g. Warehouses, garages and Fire Station Apparatus Bays should be provided with ~~infrared tube~~ in slab radiant heating systems (where feasible) and should not be air-conditioned. For retrofit projects or other exceptions approved by the County, gas infrared heat systems which have more than five burners shall be “Co-Ray-Vac” Class I serpentine infrared system manufactured by Roberts Gordon or approved equal. Infrared heat systems with less than five burners can be specified as a Class II, open to several manufacturers. Whenever possible, eliminate or reduce the use of make-up air heaters. Use single bulb temperature sensors (Accustat) set at 65 degrees in lieu of factory controls. Bring in un-tempered air at the ceiling level, with the infrared systems sized for the additional load. Exhaust systems shall be automatically controlled by exhaust gas sensors. For maintenance garages, provide ceiling mounted commercial grade propeller fans for summer ventilation. For all bay doors provide BAS interlock to shutdown conditioning system in bay area(s) when a bay door is open and to re-energize heat when the space is in danger of freezing if doors remain open and initiate BAS or local alarm. Provide local temperature controls with BAS monitoring and override controls.

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- h. Energy recovery shall be used whenever possible to reduce energy use. The use of air to air heat exchangers should be used when airstreams cannot be mixed, otherwise energy recovery wheels shall be used. Energy recovery devices can be integral to air handling equipment or be separate units to pretreat the outside air. Generally separate energy recovery units are preferred.
- i. All air handling units/cooling equipment (including DOAU/energy recovery units) with outdoor air intake greater than 20% of the supply air volume shall be sized to meet both the peak cooling on a 0.4% day and the peak dehumidification on a 0.4% day. Each of these required capacities shall be included on the equipment schedules.
- j. All control dampers critical to emergency systems operation shall fail to the position required to allow this system to operate (fail safe operation).

2. Accessibility and Maintainability

- a. Planning and coordination are required during design and construction to assure accessibility to new mechanical equipment. The long-term equipment maintenance requirements must be evaluated so that reliable, sustainable, maintainable and replaceable mechanical systems are installed. This will help the systems operate efficiently and safely throughout the life of the building.
- b. Design shall provide for adequate access and work space to all HVAC equipment for maintenance, inspections, repairs, cleaning and replacement. Clearances shall be sufficient so that any piece of equipment can be replaced without the removal of any other equipment. Designate an area on the plans needed for laydown of the existing and new rooftop equipment so that the area it is not taken by solar panels or other equipment.
- c. Mechanical rooms shall, to the degree possible, be located on the ground level, at an outside wall with maintenance vehicle parking spaces and loading zone immediately adjacent to the mechanical room door. All major HVAC equipment shall be located in the mechanical room(s).
- d. Maintenance, repair, and replacement requirements must be carefully considered and evaluated, during the design phase, for all equipment mounted on the roof or located in the attic to assure reasonable and appropriate access.
- e. All HVAC equipment located in the ceiling such as VAV boxes shall have unimpeded access from an 8' step ladder and the bottom elevation of the equipment shall be designed to be at 9' - 4" AFF. Maximum ceiling height shall be 9'-0" in areas with equipment above the ceilings.



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- f. All HVAC equipment shall have accessibility details noted on the mechanical and architectural plans and specifications, including, but not limited to: walkways, cat-walks, access doors, maintenance areas, electrical disconnects, electrical control panels, VAV box maintenance areas, equipment coil, filter and belt access locations.
- g. The manufacturer's minimum clearance requirements shall be provided. At least 42 inches of clearance is required for maintenance around all mechanical equipment, unless otherwise recommended by the manufacturer, and allowed by NEC.
- h. Avoid locating ceiling mounted HVAC equipment over areas that would be adversely affected by daytime service, such as a kitchen or other equipment and furnishing or office cubicles.
- i. Air conditioning condensate drain piping shall discharge to a storm drain or directly outdoors by gravity. Liquid combustion byproducts from fuel fired boilers and furnaces shall discharge to an approved location in accordance with the appliance manufacturer's instructions. All condensate piping shall discharge to a location where it will not cause a nuisance. Piping shall be properly anchored. Condensate drains from rooftop equipment shall terminate directly at roof drain and be supported by premanufactured piping supports compatible and suitable with the roofing. Provide drainable P-traps for systems subject to freezing.
- j. All HVAC condensate drains shall be equipped with a shunt trip to shut-down the unit off upon detection of water and interlocked to annunciate and alarm at the BAS.
- k. Non-curb mechanical equipment shall be supported by platforms with pipe columns with umbrella flashings where applicable. Height of column should be a minimum of 8" above roof membrane. Additional clear height is required for larger equipment and shall be in accordance with the recommendations of the American Roofing Contractors Associations latest reference manual.
- l. If roof mounted A/C units are used, provide a power receptacle, an interior stepladder with handrails, steps 12" apart and top step no more than 15" from opening of roof hatch.

F. Heating, Ventilation and Air Conditioning Specifications

- 1. Boilers (County Approved Exception) - The specifications shall include:

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- a. Outside Air Reset - For non-condensing units, provide hot water reset based on outside air temperature by the use of a three-way mixing valve.
 - b. Combustion Efficiency Test - Burner shall be tuned up for maximum performance, including correct nozzle size, flame shape, and air damper adjustment for minimum excess air. Performance shall be verified via written results of an instrumented combustion efficiency test, including test data net stack temperature, percentage CO₂ or O₂ oil smoke spot or percentage CO, and total combustion efficiency percentage.
 - c. Boiler Water Flow - Consider boiler re-circulation pumps or injector pumps for boilers to maintain water flow. Re-circulation pumps shall maintain minimum flow in the boilers as recommended by boiler manufacturer. The water flow can be a problem where three-way valves are used for outside air reset at warmer OA air temperature when most water is by-passed, and the boilers have very low flow. Systems shall also be designed to avoid thermal shock to boilers at start-up.
2. Where removable printed circuit boards are provided, an extra set shall be furnished including description, manufacturer, and source of supply identified.
 3. Provide spare relays for A/C units and identify manufacturer and source of supply (include in Operations and Maintenance Manual).
 4. Specify direct drive fans when possible as they are more efficient and require less maintenance/adjusting and replacement of belts.
 5. Provide one extra set of belts for each belt driven unit including axial HVAC fans, centrifugal HVAC fans, and/or HVAC power ventilators.
 6. In designs where the number of similar sized VFD units exceeds 10 units, provide a spare VFD to minimize spare parts and to obtain parts and service from one source and provide with communication between VFDs similar to Smartlink.
 7. Use of lining for ductwork shall be limited and will be determined on a case by case basis and all ductwork lining shall include perforated metal liner. ~~If possible,~~ where required for acoustics, use perforated metal liner for inner wall or sound attenuator.
 8. ~~Provide two extra changes for each type filter, 2" pleated are preferred.~~ Install new filters at Substantial Completion ~~in addition to supplying the two spare sets for attic stock.~~

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9. Provide proper set of any non-standard test tools/equipment and appropriate training for installed equipment. Avoid specifying non-standard test tools/equipment, as applicable.
10. The temperature control system and the energy management control system shall be provided by one manufacturer.
11. An instructional session shall be held after systems are functional to familiarize Fairfax County staff (FMD) mechanics with the design and construction of the system. Time shall be set up during the warranty period for "shake down" meetings as needed. Total instructional and "shake down" time provided by the design engineer and installing Contractor shall be coordinated with the Owner prior to bidding but shall not be less than six hours. Contractor shall video record all instructional sessions and provide the DVD to the Owner.
12. The specifications shall provide for a full one-year warranty period for all HVAC systems equipment and associated controls, in addition to more extensive standard warranties carried by the specified systems and equipment. Require a minimum 10-year warranty of gas fired heat exchangers. Additional special or extended warranties must be evaluated and approved by the Owner during the design process. Include a separate consolidated list of all warranties including duration, vendor and contact information in the O&M Manual and in the Mechanical room framed under glass.
13. Provide wall mounted control diagrams in all boiler and mechanical rooms. The diagrams shall be framed and covered with Plexiglas or laminated.
14. Provide engraved equipment labels for the newly installed HVAC equipment. Lettering on labels shall be 3/4" tall for equipment designation and 1/2" tall for the installation date (mm/dd/yy format), warranty, and contact information. Plastic laminated engraved labels shall be black with white lettering and be permanently affixed in a conspicuous location approved by the BDCD Project Manager. Provide label submittal with full scale drawing(s) of labels for review prior to fabricating/ordering.
15. All valves shall be numbered with brass tags and referenced to operational instructions.
16. Provisions shall be made for metering of heating fuel oil consumption. Provide back flow preventers in fuel lines, as required. Exposed exterior fuel lines must be insulated/heated.

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17. Coordinate with DPWES to notify FMD staff when system balancing is scheduled so FMD HVAC mechanics can observe the procedure.
18. Access panels or doors must be provided for any equipment located in all wall or ceiling spaces that may require maintenance, repairs, or modifications.
19. All equipment, smoke detectors, heat detectors, etc., HVAC equipment which are located above a suspended ceiling must be clearly labeled at the appropriate location on the ceiling.
20. CFC and HCFC refrigerants are not to be used in mechanical equipment on County projects. The County goal is to achieve the LEED Enhanced Refrigerant Management Credit. Use of HFC refrigerants is strongly encouraged.
21. In DX units that have multiple compressors, cooling coils shall be intertwined.
22. All motors are to be NEMA Premium efficiency.
23. A minimum of three-foot- six inches (42”) clearance is required at electrical elements at VAV boxes, fan coil units, etc. per National Electric Code (NEC.)
24. All ductwork and piping that will gain or lose energy to/from the surrounding atmosphere, or may cause condensation, shall be properly insulated per ASHRAE 90.1 2010 to minimize energy costs and condensation. All duct and pipe insulation joints must be properly sealed. Insulation shall be continuous through hangers, supports, and building construction elements such as walls, floors and ceilings.
 - a. Exterior ductwork shall be completely sealed and waterproofed and tapered insulation used on any surface, which shall be installed and shall prevent water from collecting. The entire duct system shall be covered with an approved weatherproof cladding with overlapping seams, on the underside of the duct only.
 - b. Specification shall include requirement for the contractor to request a pre close-in inspection and sign-off by Owner-M/E/P consultant for duct and pipe insulation for walls and ceilings.
25. All hydronic piping shall be run in conditioned space to avoid freezing. Where it is unavoidable to run in spaces subject to freezing, thermostatically controlled electric heat tape shall be provided on piping. In cases where emergency generators are specified, the electronic heat tape shall be connected to the emergency generator. All heat tape shall be monitored by the EMCS and an alarm sent when a failure is detected.

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26. Provide Aegis grounding rings for all motors controlled by a VFD.
27. Fire dampers shall be type B (out of the air-stream) and are to be dynamic type and shall be mounted in accordance with their UL Listing and per SMACNA.

28. VAV Systems

- a. ~~VAV systems are the preferred systems in buildings of any significant size depending on the size and building layout they can either be chilled & hot water central air handlers or gas-fired/DX roof-top units.~~
- b. For smaller buildings gas fired single zone RTUs are acceptable.



29. *Deleted VRF Systems Specifications*

30. For design of Clinical Facilities with Negative Pressure Rooms refer to Appendix A.
31. For design of Evidence or Forensic Rooms in Law Enforcement or Public Safety Facilities refer to Police Station Design Manual.
32. Specifications shall include prohibition of crimped connections and process tubes used for the evacuation and charging of the refrigerant cycle: Assemblies for HVAC cooling system components such as RTU's and modular air handling units charged with refrigerant shall not include process tubes or other direct connections to refrigerant piping closed at the factory or in the field by crimping. The presence of crimped tubes or piping in these systems shall be considered a Contract non-conformance to be corrected by the Contractor without delay and at no cost to the Owner. Correction of this condition by the Owner following a seven (7) day notice period shall not void or shorten any warranty.

G. Building Automation Systems (BAS)

1. In all buildings, a DDC Building Automation System (BAS) shall be installed. Refer to Division 260000 Electrical, Section I.I for additional design requirements of the BAS system.
2. The Building Automation System shall control HVAC operations and conditions, alarm abnormal conditions and index control modes and provide AHU optimized start/stop operations, AHU/RTU fan optimization options, and provide reporting and trend logs. The specific system requirements shall be reviewed with the County during design.

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3. The plans and specifications for the mechanical system must include a detailed points list showing all monitor and control points and must also include a sequence of operations for all equipment and systems.
4. The BAS must be capable of performing the following functions:
The details and requirements of how the BAS should monitor and control equipment including custom program load shedding interface with third-party devices, shall be elaborated in the specifications based on the specific building/system requirements. There are differences between hardwire points and mapping points through BACnet.
 - a. Monitor and Alarm Selected Conditions: Temperature; Pressure; Flow; On/Off, Start/Stop Status; Safety Control Status (Fire, Freeze, Smoke); all critical applications.
 - b. Initiate Selected Control Sequences: AHU/Chiller/boiler/pump; Start/Stop; Occupied/unoccupied modes; Optimized Equipment Start/Stop operation, unoccupied night set-back/set-up, monitor total building electric usage and provide demand limiting routines as determined by Owner. The A/E should note that if required, the sequence of operations should include keeping the DOAH HW valve open at all outside air temperatures in order to allow the freeze protection pump to run continuously.
5. Metering: Natural Gas shall be metered either through a separate meter or through the utility company's meter and integrate with the building's BAS and FMD's Central Energy Meter System (BuildingLogix – BDX). 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. Refer to Guideline 220000 Plumbing for additional information for water metering and 260000 Electrical for electrical metering.
6. BAS Graphic Template Requirements
 - a. Graphical User Interface (GUI) Screen Design - The system GUI refers to the browser-based mechanical system flow diagram served by the B-OWS or the B-BC. Provide a single flow diagram populated with dynamic display of all points for each mechanical system. All inputs, outputs, Set Points (SP), and logical mode values are to be displayed at the system GUI. All SPs are to be adjustable at the system GUI. All alarms are to be annunciated at the system GUI and have a color code in table -1. All schedules are to be adjustable at the system GUI.
 - b. Graphics shall have tab pages for all rooftop units, exhaust fans, electrical meters, split system, make up air units, fan power VAV boxes, chillers, pumps

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and for all control sequences of operation. All graphics shall be approved by FFX County FMD before system is uploaded.

- c. Graphics for VAV boxes shall have the CFM setpoints, heating and cooling output, damper position, operating mode, temperature setpoints, and CO2 readings.
- d. Graphics for air handlers and rooftop units shall have supply air temperature, outside air temperature, outside air CFM percentage, cooling and heating percentage, damper positions, fan percentage, and duct pressure.
- e. Floor graphics shall have 3D mechanical layout, VAV box number as on the mechanical drawings, control address, CO2/NO2 sensor layout, duct static sensor location, room layout and room numbers used in the building.

Table 1 - Alarm Color Codes

Alarm	Color
High	RED
Low	BLUE
Sensor failure	BLACK
Dirty filters	Flash RED
Pump, fan, Etc.	Flash RED

7. System Requirements

a. Operator Interface:

- i. Controllers shall communicate using BACnet protocol. Control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.
- ii. Operating system shall meet or exceed the DDC System manufacturer's minimum requirements for their software. Acceptable systems include, but not limited to latest FFX County Windows enterprise SQL Server.

b. System Graphics:

- i. The operator interface software shall be graphically accurately based and shall represent the physical layout of the systems equipment, sensors, piping and floor layouts to include at least one graphic per piece of

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equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of the building.

- ii. **Functionality.** Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit set points and other specified parameters.
 - iii. **Animation.** Graphics shall be able to animate by displaying different image files for changed object status.
 - iv. There shall be a tab page for each part of the system and the sequences of operation.
 - v. **Alarm Indication.** Indicate areas or equipment in an alarm condition using color or other visual indicator.
 - vi. **Format.** Graphics shall be saved in an industry-standard format. Web-based system graphics shall be viewable on browsers compatible with browser standards. Web graphic format shall require no plug-in.
 - vii. **Custom Graphics.** Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in the same formats as are used for system graphics.
 - viii. **Graphics Library.** Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program. A backup of the graphics package must be installed on Fairfax County network.
8. **System Applications**
- a. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from web browser interface Automatic System Database Configuration. All third-party devices and software need to be approved by FFX County DIT.

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9. BAS Associated Hardware Requirements

- a. The main BAS system controller, IP Patch Panel (12 Port) and the BAS UPS shall be wall mounted in a designated location in the main mechanical room or as otherwise designated on the Contract Documents. The system controller and the BAS UPS shall be mounted in NEMA 3R enclosures. The UPS shall be sized for the required load of the BAS controller, also have status feedback from the UPS and integrated into the BAS to show alarming of UPS and conditions of power.

10. Set-up trending at 15-minute intervals for all BAS points.

H. Commissioning

1. Requirements for the HVAC system commissioning process shall be included in the construction contract. An independent Commissioning Authority may be hired by the Owner through the Architect's contract. ASHRAE Guideline 0, or other industry recognized guidelines for commissioning shall serve as the basis for all HVAC commissioning and the guidelines will be tailored to the specific requirements of the project.
2. The Architect and Mechanical Engineer and Commissioning Authority will perform reviews of the HVAC system design from a commissioning perspective at all review phases of the design process and will cooperate fully with the Owner's Commissioning Authority throughout the design review process as applicable.
3. The contract specifications must clearly spell out the responsibilities of the General Contractor and all appropriate subcontractors relative to commissioning and shall also define the role of the Commissioning Authority.
4. The Architect and Mechanical Engineer shall coordinate and cooperate fully with the Owner's Commissioning Agent and with DPWES representatives throughout the actual HVAC system commissioning process prior and subsequent to, system acceptance. The Architect and Mechanical Engineer shall provide all design and or system information that is requested by the commissioning team members and respond to all comments from the Commissioning Authority from design through system acceptance.
5. The Architect and Mechanical Engineering team shall review the Commissioning Report to confirm that the full scope of the Commissioning scope as required by the Contract Documents has been completed before it is deemed to be "Final".
6. The Architect or BDCD Construction Manager shall include the final commissioning reports and documents provided by the Commissioning Agent in

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the Operations and Maintenance Manuals supplied by the Contractor. This shall include the final Testing and Balancing Report for the air and water of the entire HVAC system , and the final control drawings and sequences.

II. PRODUCTS

A. Mechanical Equipment Preferences

1. Below are listed preferred equipment brands for which supply of repair parts exist (specifications shall include at least three acceptable equipment options for competitive bidding, unless a limited source procurement is approved in advance by the owner):

a. Chillers: Trane, Airstack by Multistack (air cooled) or Carrier (coordinate with the Owner for the most recent updates) (No Equals or Substitutions) Provide modular chillers with factory accessories to allow individual modules to be isolated for servicing and cleaning, both on the water side and electrically, all while the other modules remain in full service.

b. Cooling Towers Baltimore Aircoil, Evapco, or Approved Equal

c. Pumps: Bell & Gossett, Taco, Goulds, or Approved Equal



d. ~~Non-Condensing Boilers: Natural gas/#2 oil Fired Burnham 4F or Approved Equal~~



e. Condensing Boilers: Lochinvar, Veissmann; or Approved Equals presented by the A/E during the design phase (based on technical specs including turndown ratio and cascading abilities) (Use by exception only for high-capacity requirements)

f. Air Handlers: Trane, Carrier, Air Enterprises (AEI), Liebert, Valent, Daiken or Aaon

g. VAV Boxes: Titus, Trane, Nailor, or Approved Equal (Electronically controlled)

h. BAS: 1. Trane

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2. Siemens
 3. Automated Logic
 4. Delta
 - (No Equals or Substitutions)
- i. Rooftop Units: Trane, Carrier, Valent, Air Enterprises (AEI),
AAON, Innovent, and Daiken
(No Equals or Substitutions)
- j. Variable Frequency Drives: Yashikawa, Danfoss ABB, or Square-D
- k. Baseboard Heaters: Trane without Dampers, or Approved Equal
- l. Underground Storage Tanks: Double wall, urethane coated steel. Act 100U,
Type II, and approved by U.L.58 for
underground storage of motor fuel. Double wall
welded steel with a primary (internal) tank and a
secondary (external) tank; as manufactured by
(Highland, General Industries or Approved
Equal). UST shall include quick release filler
neck; 9 watertight raised access to filler neck;
and shall support accessory equipment including
drop tubes, two tank sumps, and submersible
removable pumps. UST design shall allow for
continuous monitoring of the interstitial spaces
between the two walls and the two manways.
- m. Fuel Storage Monitoring and
Leak Detection System: Veeder Root Model TLS-450PLUS
(No Equals or Substitutions)
- n. Submersible Fuel Pump: Redjacket (submerged turbine); or Approved
Equal
- o. Fuel Dispensers: Gas Boy (No Equals or Substitutions)
- p. UST Fill Caps and Overflow
Devices: Ohio Pipe Works (OPW) Model 2100 overflow
containment basin (5 gallon); or Approved
Equal
- q. Fire Station Diesel Exhaust
Extraction System: Refer to Fire Station Manual



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- r. Gas Fired Infrared Heaters: Superior Radiant Product “Co-Ray-Vac” Class I or II by Roberts Gordon. (By exception only. For new applications, use alternate heat source)
- s. Airflow Measuring Stations: Ebtron or Kele (No Equals or Substitutions).
- t. Gas Sub-Metering: Onicon with flow conditioner

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EXHIBIT 230000-A
FAIRFAX COUNTY MAINTENANCE COST
FOR
LIFE CYCLE COST ANALYSIS

Notes:

1. BDCD Project Manager to coordinate with Facilities Management Department (FMD) to provide the current staff rates.
2. BDCD Project Manager to coordinate with Facilities Management Department (FMD) to confirm the Parts Cost are current.
3. Maintenance costs are per year.

Equipment	Staff Rate <i>Note 1</i>	Hours	Total	Parts	Parts Cost (2018 Costs) <i>Note 2</i>
Air Cooled Chiller <40T	\$90.00	12	\$1080	Coil cleaner, contactors, MISC	\$100.00
Air Cooled Chiller >40T	\$90.00	15	\$1350	Coil cleaner, contactors, MISC	\$100.00
Water Cooled Chiller	\$160.00	18	\$2880	Contactors, MISC,	\$300.00
Cooling Tower	\$90.00	18	\$1620		
Water Treatment - Single Closed Loop	\$65.00	14	\$910	chemicals	\$1,500.00
Water Treatment - Single Open Loop	\$65.00	14	\$910		
Condensing Boiler	\$120.00	12	\$1440	Break down kit for winter service	\$1,200.00
Inline Pump	\$90.00	2	\$180	oil, grease	\$30.00
Base Mounted Pump	\$90.00	3	\$270	coupling, grease	\$50.00
Rooftop Packaged RTU DX Gas Fired <10T	\$90.00	12	\$1080	Filters	\$400.00
Rooftop Packaged RTU DX Gas Fired >10T	\$90.00	12	\$1080	Filters	\$400.00
rooftop Packaged RTU Heat Pump <10T	\$90.00	10	\$900	Filters	\$400.00
rooftop Packaged RTU Heat Pump >10T	\$90.00	10	\$900	Filters	\$400.00

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Equipment	Staff Rate <i>Note 1</i>	Hours	Total	Parts	Parts Cost (2018 Costs) <i>Note 2</i>
Indoor AHU - Chilled/hot water	\$90.00	8	\$720	Filters	\$400.00
Kitchen Make-up-Air Units Gas Fired	\$90.00	4	\$360	Filters, heating parts	\$100.00
DOAS units - Flat Plate HX	\$90.00	4	\$360	Filters	\$600.00
DOAS units - Heat Wheel	\$90.00	4	\$1620	Filters	\$600.00
Outdoor Condensing Units >10 T	\$90.00	8	\$720	Coil cleaner, contactor	\$200.00
Split System AC Units	\$90.00	3	\$270	Coil cleaner, contactor	\$75.00
Split System Heat Pumps	\$90.00	3	\$270	Coil cleaner, contactor	\$75.00
VAV terminal - Shut-off, Electric	\$90.00	2	\$180		
VAV terminal - Fan Powered, Electric	\$90.00	2	\$180	Filters	\$20.00
VAV terminal - Shut-off, Hydronic	\$90.00	2	\$180		
VAV terminal - Fan Powered, Hydronic	\$90.00	2	\$180	Filters	\$20.00
Fan Coil Unit - 2 Pipe Floor Mounted	\$90.00	1	\$90	Filters	\$20.00
Fan Coil Unit - 4 Pipe Floor Mounted	\$90.00	1	\$90	Filters	\$20.00
Fan Coil Unit - 2 Pipe Above Ceiling	\$90.00	2	\$180	Filters	\$20.00
Fan Coil Unit - 4 Pipe Above Ceiling	\$90.00	2	\$180	Filters	\$20.00
Exhaust Fan - Roof Mounted	\$90.00	3	\$270	belts, grease	\$20.00
Exhaust Fan - Inline above ceiling	\$90.00	1	\$90		
VFD - Wall Mounted, separate from packaged equipment	\$90.00	2	\$180		
DDC Controls (\$/SF) Yearly Service contract value \$850,000	\$0.00	360		This is divided between 4 contractors on 5 BAS systems	

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Equipment	Staff Rate <i>Note 1</i>	Hours	Total	Parts	Parts Cost (2018 Costs) <i>Note 2</i>
DDC Controls (\$/SF) FMD staff	\$0.00	12		FMD staff make sure the panels are clean and check alarms	

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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.

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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)

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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

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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



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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.”

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- 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.



- 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

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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.

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- 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 Bixale 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

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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.



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. Whole Building Backed Up – 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. Partial Loads Backed Up – 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

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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

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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.

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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.**



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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.

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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.

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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

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- 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-2011.pdf>. 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).



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.

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

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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 review 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.

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- 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 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.
- 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.



- 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

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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

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- 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 larger 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.



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.

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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.
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.



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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:

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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

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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.
- 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.



14. BAS Sample Displays:

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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.

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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

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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



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.



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.

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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.

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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 & Seymour
- d. or FMD approved equal



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

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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



PANEL:

VOLTAGE: 208/120V

LOCATION:

BUS: 200A

FED FROM:

MAIN: MLO

SECTION: 1 OF 1

AIC: 22,000

MOUNTING: SURFACE

SOURCE: NORMAL

LOAD TYPE	LOAD DESCRIPTION	FDR SIZE (KVA)	BKR (A)	CKT NO	LOAD (KVA)			BKR (A)	LOAD (KVA)	FDR SIZE	LOAD TYPE
					A	B	C				
N				1	0.0						N
N				3		0.0					N
N				5			0.0				N
N				7	0.0						N
N				9		0.0					N
N				11			0.0				N
N				13	0.0						N
N				15		0.0					N
N				17			0.0				N
N				19	0.0						N
N				21		0.0					N
N				23			0.0				N
N				25	0.0						N
N				27		0.0					N
N				29			0.0				N
N				31	0.0						N
N				33		0.0					N
N				35			0.0				N
N				37	0.0						N
N				39		0.0					N
N				41			0.0				N

Notes:

- 1.
- 2.
- 3.

KVA/PHASE 0.0 0.0 0.0

(KVA) (AMP)

TOTAL CONNECTED: 0.0 0 0

PANELBOARD SPECIAL FEATURES

☐ SURGE PROTECTION DEVICE (SPD)

☐ OTHER

LOAD TYPE CODE LETTERS

(KVA) (AMP)

C	CONTINUOUS LOAD (125% OF CONTINUOUS LOAD)	0.0	0
K	KITCHEN DEVICES (SIX OR MORE AT 65% OF LOAD)	0.0	0
L	LARGE MOTOR LOAD (LARGEST MOTOR x125%)	0.0	0
M	MOTOR LOAD (100% OF LOAD)	0.0	0
IM	INTERMITTENT MOTOR LOAD (85% OF LOAD)*	0.0	0
N	NON-CONTINUOUS LOAD (100% OF LOAD)**	0.0	0
R	RECEPTACLE LOAD (FIRST 10KVA AT 100%. REMAIN. AT 50%)	0.0	0
TOTAL DEMAND:		0.0	0

* FAIRFAX COUNTY @ (100% OF LOAD)

** REMAINING LOADS

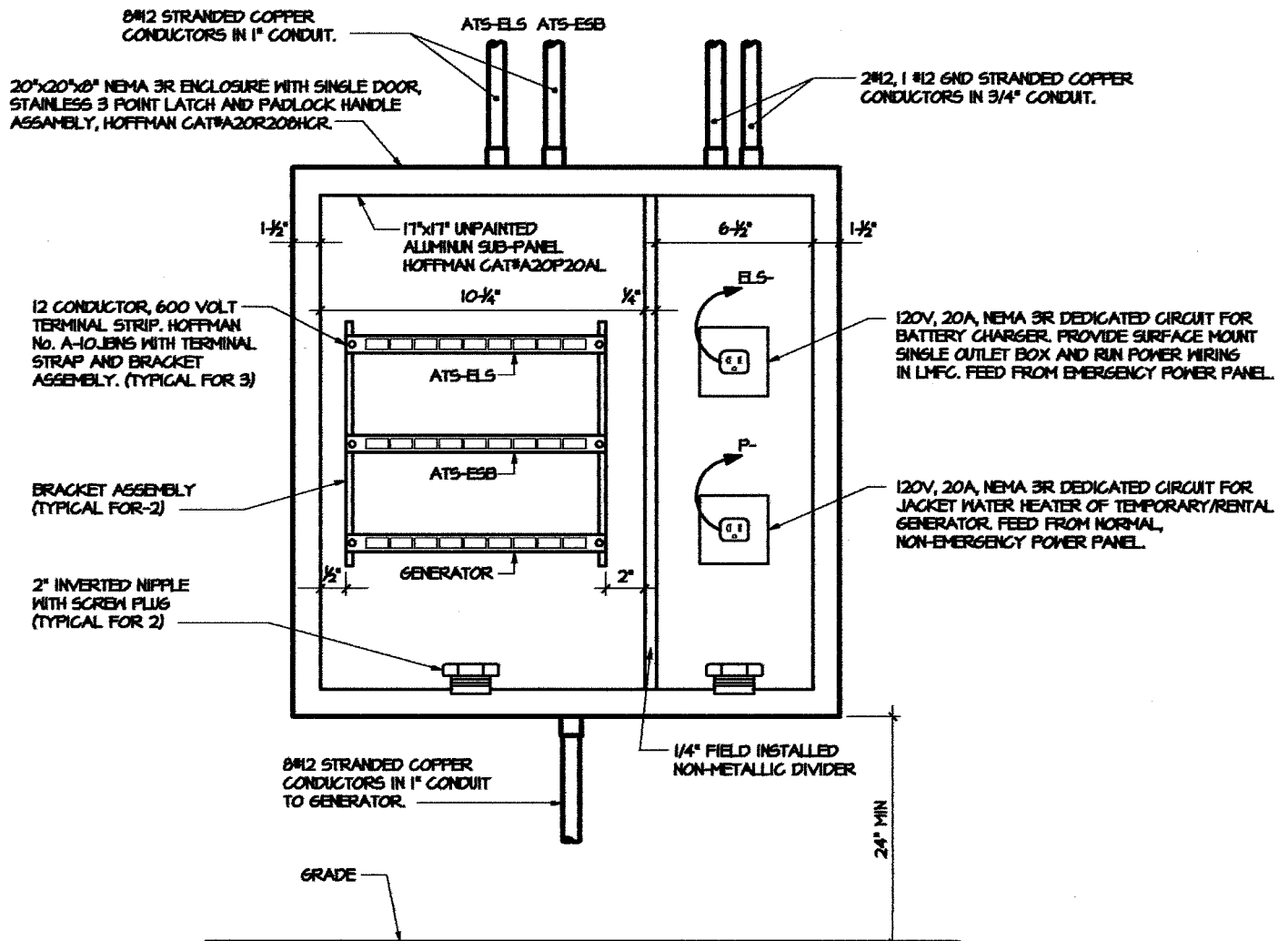
FEEDER SIZE:

1
2
3
4
5
6
7
R
X
E

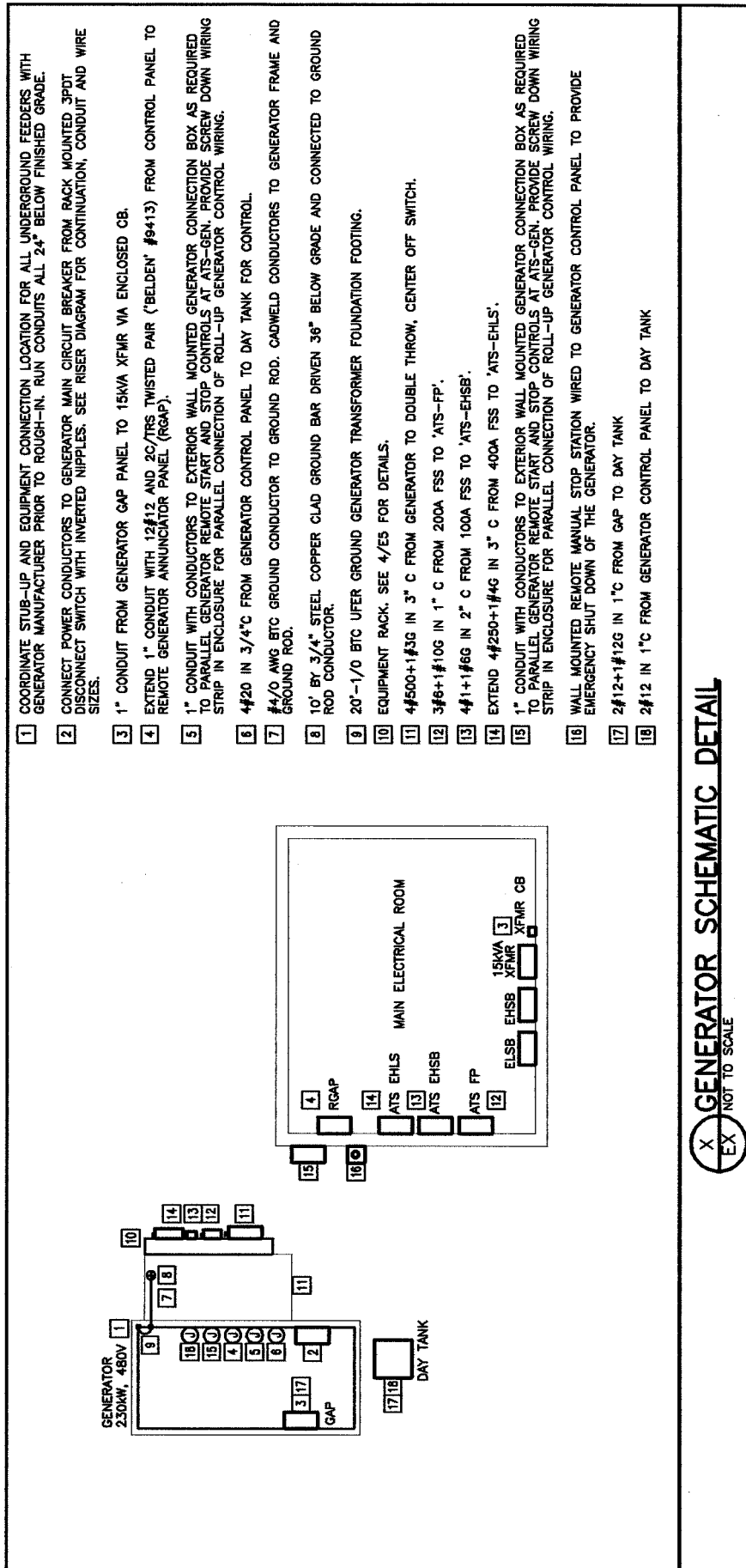
RELOCATE EXISTING CIRCUIT

REMOVE EXISTING CIRCUIT (CONDUIT AND WIRE)

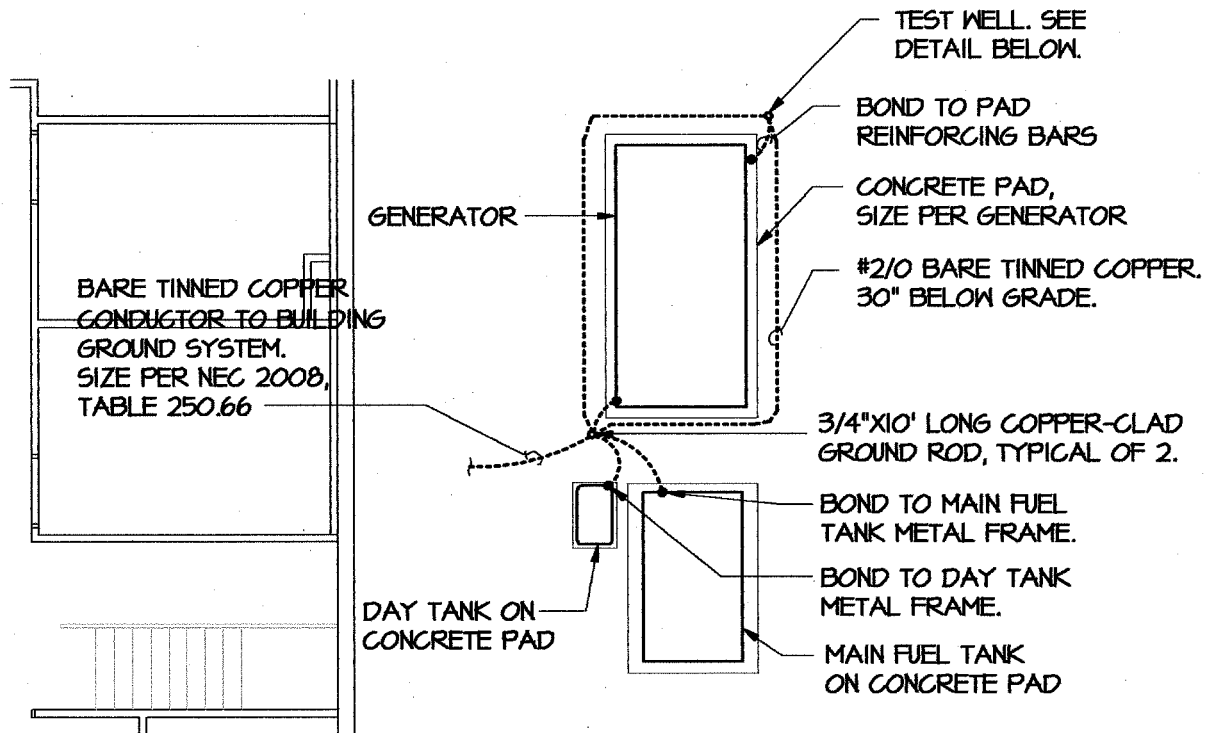
EXISTING CIRCUIT TO REMAIN



GENERATOR CONNECTION BOX
NOT TO SCALE



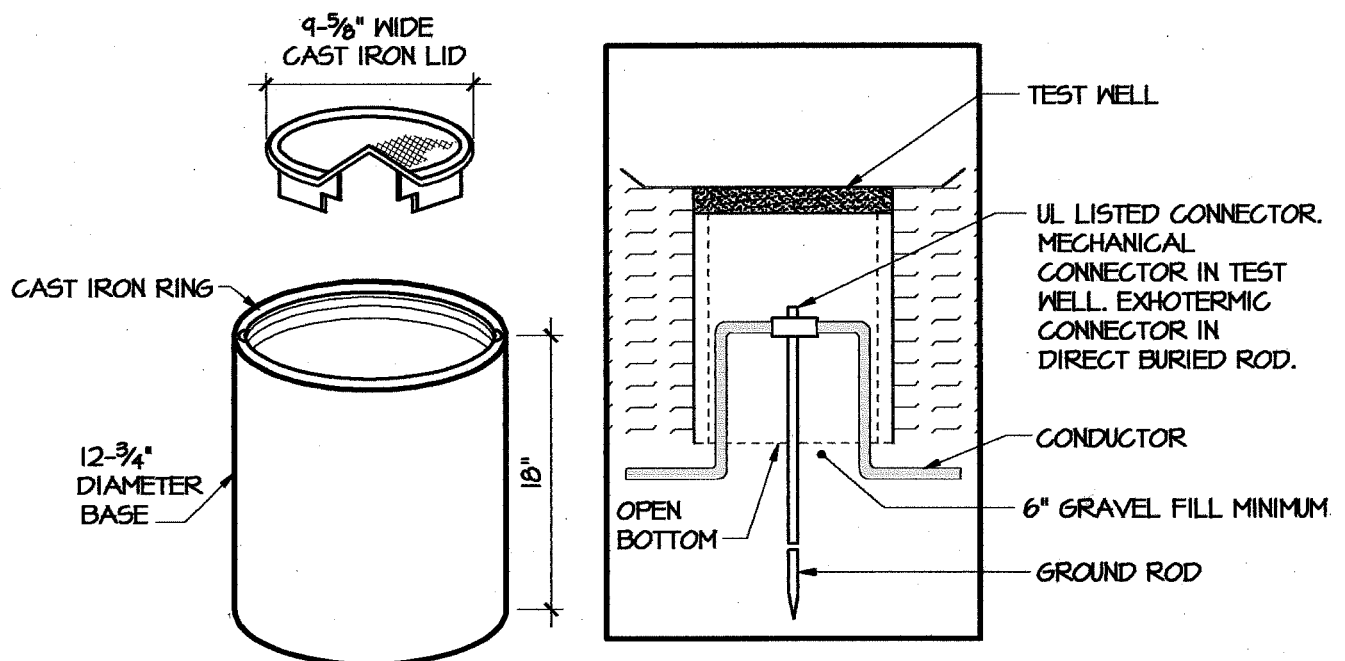
GENERATOR SCHEMATIC DETAIL
EX NOT TO SCALE



GENERATOR GROUNDING DETAIL

NOT TO SCALE

NOTE: ALL EQUIPMENTS SHALL BE GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE 2008 EDITION ARTICLE 250, GROUNDING AND BONDING.



3/8" STEEL GROUND TEST WELL DETAIL

NTS

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Developed by:
Department of Information Technology (DIT)

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1.0 Introduction

- 1.1 General:** Provision of the Information Technology (IT) infrastructure and equipment is essential in the design, construction and the subsequent operation of all new building construction and renovation projects. Whether it is voice, data, building automation systems, access control, security, or other specialized communications technologies, early coordination and full integration of these complex systems is critical.

This document provides information and guidance to preferred practices and does not waive or grant exceptions to any element of federal, state, or local building codes, ordinances, and regulatory requirements as applicable to the specific project. Any conflict between these Guidelines and the governing local, state, or federal codes shall be brought to the immediate attention of the Building Design & Construction Division (BDCD), Fairfax County Department of Public Works and Environmental Services (DPWES).

In the design of the IT infrastructure, the Architect/Engineer (A/E) is responsible for ensuring that the most current version of referenced design standards in the Guidelines is used for the project. The Consultants shall verify with the Owner that Exhibits and Appendices are the most current versions. Any variance from these IT Guidelines must be submitted in writing to the BDCD Project Manager / Project Coordinator no later than 50% design submission.

1.2 Standards and References:

- A. Fairfax County communications systems shall follow all applicable codes and standards set forth in the following: National Electrical Code (NEC); National Fire Safety Council (NFSC); National Fire Protection Association (NFPA); American National Standards Institute (ANSI); Telecommunication Industries Association (TIA); Electronic Industries Alliance (EIA); Telecommunication Building Wiring Standards; Federal Communications Commission (FCC); Institute of Electrical and Electronic Engineers (IEEE); and Building Industry Consulting Service International (BICSI) - Telecommunication Distribution Methods Manual. These standards and other governing codes and requirements are to be used as reference when designing telecommunication systems.
- B. These standards are not intended to be used as the final specifications for any specific project, as they set the starting point in the process of coordination and collaboration between the A/E and the owner, including DIT, for any given capital project.

2.0 Telecommunication Services

- 2.1 General:** Department of Information Technology (DIT) provides telecommunication (voice and data) services to county agencies for capital and maintenance projects, consisting of a vast range of information-transmitting technologies such as wireless, land lines, VoIP, and broadcast networks. This is accomplished by the installation of required infrastructure and the core technology network that provides the required services to

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customers. DPWES and DIT are responsible for overseeing the design, construction, and integration of the range of technology systems as required in each project.

The following general guidelines are provided for clarity of roles and responsibilities for the base building infrastructure and the telecommunications equipment:

- A. A/E shall design and identify the locations of the conduits with mule tape, pull boxes, junction boxes, grounding wire and buss bar, electrical outlets, HVAC system, and fit-up of Telecommunication Room with plywood, as described in these guidelines.
- B. General contractor shall install the required telecommunication equipment identified by the A/E. This shall include conduits with mule tape from the property line to the IT room.
- C. All voice and data jacks, cabling and cover plates, racks, cable trays, servers, and other IT in the Telecommunications Rooms will be furnished and installed by Fairfax County's authorized Telecommunication Vendors (Telecom Vendors). DIT is responsible for overseeing the procurement, design, and installation of the required servers/equipment.
- D. DIT is responsible for recommending the computer hardware and software that may be required as part of the project. This is to ensure that all computer hardware and software follow DIT standards for compatibility required for the County's IT infrastructure.
- E. No non-DIT network hardware shall be connected to the DIT network without the prior approval of DIT.
- F. A/E shall incorporate symbols as provided in Attachment "Telecommunications Symbols" into the drawings (refer to Attachment at the end of this section).



2.2 Telecommunications Room:

- A. Telecommunication Room (TR) must be of adequate size to accommodate requirements for County voice, data, security, fire alarm system and cable television (CATV) infrastructure and equipment. Therefore, TR must be minimum 10' X 12' with 8 feet ceiling height. Additional systems placed in the TR will require coordination with DIT for additional space to be allocated.
- B. TR provides a connection point between backbone and horizontal cabling. Backbone is a facility (pathways, cable, conductors, structured wiring) that allows the placing of main and high-volume cables between cross-connect points within the buildings and between buildings. Horizontal cabling extends from work area telecommunications outlet/connectors to the horizontal cross-connect. This consists of connectors (patch panels, punch down blocks) that allow horizontal backbone, and equipment cabling to be cross connected with patch cords or jumpers.

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- C. TR shall be a secured room dedicated to telecommunications services with no other building services sharing the space. This shall be separated from the electrical room.
- D. Minimum of one TR must be provided on each floor of a facility with additional rooms as required to accommodate the communications equipment and wiring requirements. The rooms shall be stacked when on different floors. However, if the TRs are not stacked between the two floors above and below metal conduits or sleeves shall be provided.
- E. Workstation cable runs cannot exceed 290 feet from the Telecommunications Room. When the distance exceeds 290 feet from workstation to the TR an additional room/closet may be required as follows:
 - If the additional serve area is less than 5,000 square feet provide 10'x 8' with 8' ceiling height TR.
 - If the additional service area is between 5,000 to 8,000 square feet provide 10'x 9' with 8' ceiling height TR.
- F. All walls shall be covered with 4'x 8'x 3/4" fire retardant plywood for County voice, data and CATV equipment and shall have two coats of fire-retardant white paint. Fire-retardant stamp on the plywood must be in full view for inspection. Additional plywood backboards may be required for voice, CATV, and other telecommunication equipment.
- G. Floor shall be anti-static VCT flooring.
- H. Exposed ceiling or tiles shall be fire-rated in accordance with ASTM standards.
- I. The room door shall be a minimum of 36" wide. The door shall open outward and be secured by lock and key and access control system.
- J. Provide a minimum of 3 feet of clear, unobscured space for the installation and maintenance of all cabling and equipment mounted on walls, racks, cabinets, or enclosures. Allocate 3 feet by 7 1/2 feet high for each equipment, rack, or cabinet.
- K. Provide floor space for three (3) 19" wide by 26" deep by 84" high cable racks with a minimum of 3 feet of clear space on all sides of electrical/communications racks.
- L. Clear spaces around racks, cabinets, equipment, or enclosures may not overlap per NEC 110.26.
- M. Ductwork assemblies larger than required to service the HVAC requirements of the TR shall not be located within the TR.
- N. Plumbing supply lines shall not be located within the TR.

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- O. Fire sprinkler supply lines shall not be located over equipment racks or enclosures where possible. Where fire sprinkler supply lines must be located over equipment racks or enclosures a drip tray shall be mounted below the supply line above the rack or enclosure. The drip tray width shall extend a minimum of 2” on either side of the supply line and shall extend lengthwise a minimum of 3” beyond the equipment.
- P. Electrical Requirements:
- See Figure 1 Telecommunications Room Electrical Requirements
 - Provide a two hundred (200) amp electrical panel in the Telecommunications Room dedicated to low voltage equipment.
 - For every rack included in the design, provide two (2) 120Vac/20A quadplex outlets at 90” AFF behind the proposed rack location (s) or installed on the rack. Each outlet shall be on a dedicated circuit.
 - For all walls provide one 120Vac/20A electrical duplex outlet every 4 feet at 12” AFF.
 - Provide a dedicated twenty (20) amp quadplex outlet on wall behind rack 18” AFF (supplies power to UPS).
 - DIT will provide an Uninterruptable Power Source (UPS) for the IT equipment; no central UPS is required.
 - Provide a minimum of two ceiling-mounted, LED tube light fixtures with cover guard and a separate wall-mounted switch connected to emergency power (UPS or generator). The fixture shall provide a minimum of 50-foot candles at 3’ above finish floor.
- Q. HVAC Requirements: All Telecommunications Rooms shall be provided with a dedicated HVAC system capable of maintaining the temperature of the room between 64 to 75 degrees F with humidity between 35 and 55 percent non-condensing. Split system units and/or other HVAC systems are acceptable.

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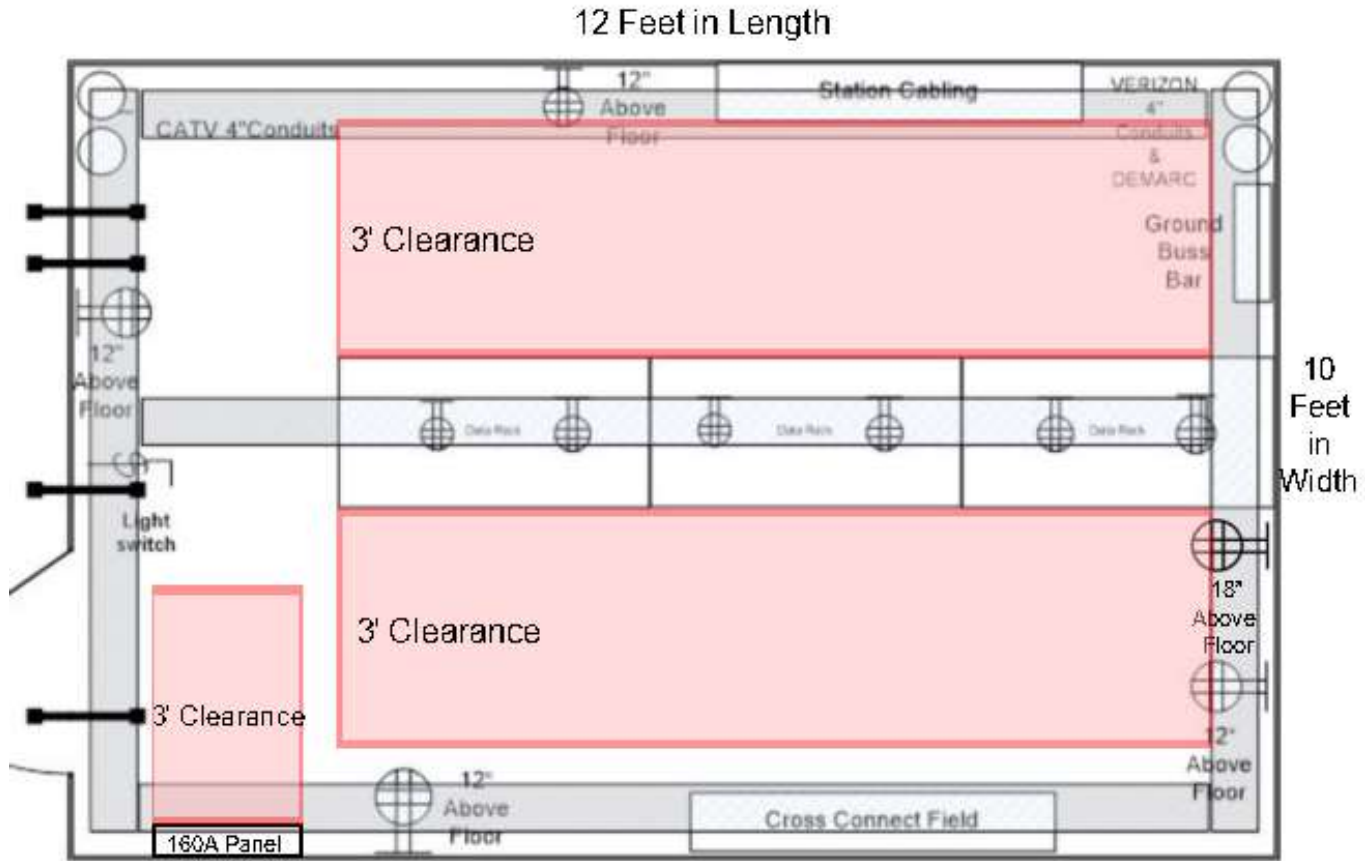


Figure 1 Telecommunications Room Electrical Requirements

2.3 Grounding:

All cabling systems and electronics distribution equipment shall be grounded for both safety and minimization of electromagnetic interference. A 12-inch bus bar with eighteen (18) ¼" pre-drilled holes with insulators (See Figure 2) shall be installed. An insulated #1/0 ground wire shall be installed from the bus bar to the main building ground using a double lug nut, in accordance with the NEC guidelines. All building wiring, pathways and spaces, grounding and bonding shall meet or exceed the ANSI/EIA/TIA Telecommunications Infrastructure Standards as well as the NEC Electrical Code (NFPA 70). See Figure 2 for TR grounding requirements.

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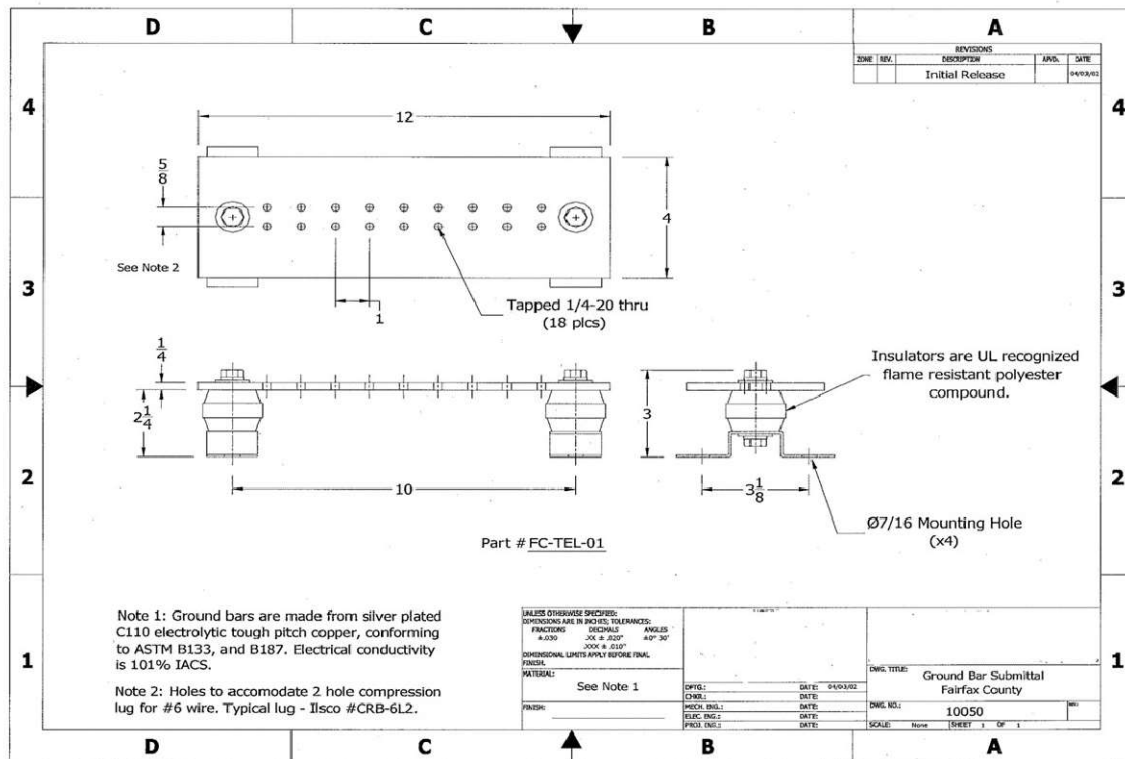


Figure 2. Telecommunications Room Grounding Requirements

2.4 Conduit and Jack Requirements:

- A. Exterior Conduits: A minimum of four (4) 4" conduits must be provided from the Quazite pull boxes located near the property line to the Telecommunications Room. Each conduit must have mule tape with footage markings.
- B. Interior Conduits (connecting telecommunication rooms): Shall have a minimum of three (3) 4" conduits with mule tape identified with footages. One shall be dedicated to telecom, one for other low voltage, and one for future expansion of both. Within the building, conduits must be provided vertically and horizontally between all Telecommunications Rooms that are wired in a series. The number, locations, and routing of these conduits are to be reviewed and approved by the DIT.
- C. A 1 1/2" conduit with pull-string must be provided to each communication device location that is not accessible through the drop ceiling and homerun to the Telecommunications Room or stubbed to the nearest drop ceiling area. Cable trays may be required based on the overall density of the voice and data cabling and will be provided by Telecom Vendors. Only metallic conduit or PVC (schedule 40) smooth conduit are allowed.
- D. Where conduits for communication device locations exit the building a 12"x12"x3/4"

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fire-rated plywood backer board or 12"x12"x6" junction box must be provided to accommodate indoor/outdoor cable transition hardware.

- E. J-hooks installed for telecom cabling shall be for the exclusive use of telecom cabling. No other low voltage may share the J-hook.
- F. Co-located voice and data communications cables may utilize the same 1 1/2" conduit into a single gang box. There should be a minimum of 2' separation between electrical and telecom cabling to minimize interference.
- G. Inaccessible or secure areas must have an entire conduit system from communication jack to the Telecommunications Room.
- H. Provide appropriately sized conduit in all plenum and/or hard ceiling areas.
- I. Provide two (2) 1-1/2" sleeves as required to provide cable pathway into each room from the main cable pathway. One shall be reserved for telecom, the other for other low voltage.
- J. Empty conduits and boxes in concrete slabs or an under-slab duct /conduit distribution system such as Walker Duct system, are required for systems furniture and/or freestanding furniture requiring communications outlets. Provide sleeves through floors and ceilings as required for cable pathways.
- K. All conduits shall be fire-stopped with the appropriate method, per NFPA standards. Fire-stopping shall be performed by the installer to place cabling in the conduit. Spare conduits shall be fire-stopped by the general contractor.
- L. Provide a pull box every 200 feet and at each 90-degree bend. Total of (2) sweeping bends (90-degree bend) per each run of 200 feet are allowed.
- M. Turn up Under Floor Duct (UFD) at least three inches above the finished floor and three inches away from the wall.
- N. Accessible pull boxes can be used as a junction point for several 1 1/2" inch conduit runs. Provide a 4" conduit with mule tape and footage markings home run to the nearest Telecommunications Room.
- O. 1" conduit shall be installed between drop ceiling and FACP cable trough.
- P. 1" conduit shall be installed between FACP cable trough and FACP.

2.5 Cabling: Cabling Infrastructure consisting of cables, patch cords, and accessories will be provided and installed by County's authorized Telecommunications Vendors. The following guidelines must be followed for all new construction jobs. Any deviation must

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be pre-approved by DIT.

A. Station Cabling consists of cables from Telecommunication Room to communication jacks, and the wireless access point (WAP)

1. Data – Single CAT 6A, Siemon Premium, UTP (unshielded) Plenum (Blue).
2. Fire Alarm & Elevator – Single CAT 6A, Siemon Premium, UTP (unshielded), Plenum (Blue)
 - Terminate FACP ends with RJ31X jacks.
3. Wireless Access Point (WAP) & Distributed Antenna System (DAS) – Dual CAT 6A Siemon Premium F/UTP (shielded) Plenum (White).
4. Wall phone outlets must be installed 40” to the bottom of the J-box above finished floor and a minimum of 8” from door frames or any other device. This will provide adequate space to install 10”x10” phone.
5. Install 12-strand armored single-mode fiber between closets and 12-strand single-mode OSP fiber when required based on structured cable standard.
6. Television – RG6 Quad shielded Plenum coaxial cable when under 150’. RG11 Quad shielded Plenum coaxial cable when beyond 150’.

B. Patch Panels Standard

1. Siemon 48 Port CAT 6A Unshielded Patch Panel.
2. Siemon 24 Port CAT 6A Shielded Patch Panel.

C. Patch panels for telecom shall be for the exclusive use of telecom systems. No other low voltage shall share patch panels with telecom.

D. Patch Cords Standard

1. RJ45 to RJ45 8-pin-to-8-pin 568B CAT 6A (gray).
2. RJ45 to RJ45 8-pin to 8-pin 568B CAT 6A Shielded (white).

E. Racks Standard

1. Siemon or similar 2 Post Rack, 7’x 19”, with vertical organizers, 20 AMP power strips, and ground racks to local bus bar using double lugs.

F. Cable Management

1. For each rack mount two 6” vertical organizers.
2. If there is more than one rack mount 10” vertical organizer between each pair of racks.
3. Between each patch panel install one 1.75” (1U) horizontal organizer.

G. Under Floor Duct Systems

1. General Contractor is responsible for providing Walker Duct system for flush-mounted jacks within concrete floors.

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2.6 Backbone and Tie Cabling:

- A. Outside plant tie cabling from structure to structure requires lightning protection on each end, protectors must be grounded.
- B. Backbone tie cables between closets terminate on 110/66 blocks as required.

2.7 Standard Numbering Plan for Cabling Systems:



- A. DIT contractor shall install labeling to conform to the latest DIT published standard “Cable and Patch Panel Identification.” (refer to Attachments)

3.0 Video Teleconferencing (VTC)

- A. Video teleconferencing equipment that includes a television, speaker/microphones, camera, and associated control hardware.
- B. When television size is not known, one data outlet shall be installed 70” AFF offset 18” to the right of the center of the television mount. One (1) 15amp duplex outlet shall be installed 70” AFF offset 18” to the left of the center of the television mount.



- C. When television size is known, refer to mounting drawings in Attachments.

4.0 Distributed Antenna Systems (DAS)

- A. Extends mobile wireless signals within the building, whereby improving voice and data connectivity for end users by using network of antennas distributed throughout the building using carrier’s licensed frequencies. The network system typically utilizes coaxial, high-speed balanced twisted-pair copper and/or optical fiber cabling to connect antennas and support the delivery of wireless service.
- B. Radio Shop must evaluate each site to identify the need for DAS. If determined to be required, a Radio Shop contractor will be engaged to work with the A/E on coordinating the design of the DAS system in the facility.
- C. Radio Shop contractor will be responsible for the installation of cable, antenna, grounding wire and the required equipment.
- D. General contractor will be responsible for the following:
 - 1. The installation of the conduits and the vault with curb.



- 2. Procure and install five Monitor Modules (MM) compatible with the existing Fire Alarm Control Panel (FACP). Each module shall be mounted on a 4” x 4” x 2 1/8” junction box within 48” of the FACP.

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- a. Dual units can be used.
 - b. All dry contacts to be wired for Normally Open (NO)
 - c. Install resistors as specified for the MM use.
 - d. Wire to the closest FA device for a loop connection
 - e. Address and program to the FA panel for five supervisory alarms to be monitored for the integrity of the DAS.
- These alarms will work with the Bi-Directional Amplifier (BDA) and Battery Backup Unit (BBU) dry contacts.
 - The alarms will be labeled in the system as stated below.
 - BDA
 - Component Fail
 - Antenna Malfunction
 - BBU
 - AC Fail
 - Battery Low
 - Charger Fail
 - f. Test in advance and during the FA inspection.

5.0 Public Radio System

- A. Public radio system shall be installed at all Fire and Police Station. The radio system at the fire station shall be utilized with fire station alert system. This is a system that is IP based and connected to the Computer Aided Design (CAD) system.
- B. Radio Shop (DIT) will work with the A/E on the coordination of the conduit location for antenna cable.
- C. General contractor will be responsible for the installation of conduits and installation of the vault with curb.
- D. Radio Shop contractor will be responsible for the installation of cable, antenna, grounding wire and the required equipment.

6.0 Roof Curb, Vault, and Conduits:

6.1 General: Provide a roof curb manufactured of 14-gauge galvanized steel with continuously welded seams and mitered corners providing air and watertight construction. The curb shall be minimum of 18” high, internally reinforced as needed for the installation of the vault.

6.2 Aluminum Vault

- A. The vault shall be minimum of 0.080-inch-thick aluminum with gaskets and stainless-

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steel hardware.

- B. It shall have UV protected powder coating.
- C. The vault is to be the minimum size of 12" (L) x 12" (H) x 20" (H) and constructed of aluminum or stainless-steel flange and have tight exit seals with inserts for the two (2) 4" conduits.

6.3 Conduits

- A. Install two (2) 4" PVC conduits with mule tape having footage marking, from the vault to a pull box located in an accessible space with a floor drains such as a janitor's closet. From the pull box install two (2) 4" conduits and terminate them into the Telecommunication Room.
- B. Conduits shall be installed with minimum fitting consisting of 45- and 90-degree bends. All 45-degree bends shall be sweeping bends, and at each 90-degree bend install a pull box.

7.0 Standards and References: All building wiring/cabling, pathways, space grounding and bonding shall meet or exceed industry codes, standards, and current references as of the time of the project design.

- A. TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
- B. TIA/EIA-568-B.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements - Addendum 1 – Minimum 4-Pair UTP and SCTP Patch Cable Bend Radius
- C. TIA/EIA-568-B.1-2 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 2 – Grounding and Bonding Requirements for Screened Balanced Twisted-Pair Horizontal Cabling
- D. TIA/EIA-568-B.1-3 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 3 – Supportable Distances and Channel Attenuation for Optical Fiber Applications by Fiber Type
- E. TIA/EIA-568-B.1-5 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 5 – Telecommunications Cabling for Telecommunications Enclosures
- F. TIA/EIA-568-B.1-7 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 7 - Guidelines for Maintaining Polarity Using Array Connectors

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- G. IA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
- H. TIA/EIA-568-B.2-1 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 1
– Transmission Performance Specifications for 4-Pair 100-ohm Category 6 Cabling
- I. TIA/EIA-568-B.2-2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 2, Revision of Sub-clauses.
- J. TIA/EIA-568-B.2-3 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 3, Additional Considerations for Insertion Loss & Return Loss Pass/Fail Determination.
- K. TIA/EIA-568-B.2-4 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 4, Solderless Connection Reliability Requirements for Copper Connecting Hardware
- L. TIA/EIA-568-B.2-5 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 5, Corrections to TIA/EIA-568-B.2
- M. TIA/EIA-568-B.2-6 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 6, Category 6 Related Component Test Procedures
- N. TIA/EIA-568-B.2-11 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 11, Specification of 4-Pair UTP and SCTP Cabling
- O. TIA/EIA-568-3 Optical Fiber Cabling Components Standard
- P. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
- Q. TIA-598-C Optical Fiber Cable Color Coding
- R. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure
- S. J-STD-607-A Commercial Building Grounding (Earthling) and Bonding Requirements for Telecommunications
- T. TIA-758-A Customer-owned Outside Plant Telecommunications Infrastructure Standard

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U. TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable
Plant – OFSTP-7



The following are included as attachments:

- A. Fairfax County - Cable and Patch Panel Identification
- B. Fairfax County – Generic 55 Inch LCD Display Elevation
- C. Fairfax County – Generic 65 Inch LCD Display Elevation
- D. Fairfax County – Generic 75 Inch LCD Display Elevation
- E. Fairfax County – Generic 85 Inch LCD Display Elevation
- F. Fairfax County – Telecommunications Symbols

End of Section.

Cable & Patch Panel Identification

A. Copper Patch Panel Identification:

1. Patch panels installed before the adoption of this standard shall maintain their previous labeling standard.
2. Patch panels shall be labeled as they are installed. All DIT patch panels in the same Telecommunications Equipment Space (TES) shall be uniquely labeled. Labels shall start from A and continue alphabetically, skipping the letters D and V. If more than 24 patch panels are installed in a single Telecommunications Equipment Space the patch panel identifier for additional panels shall be prepended with A (AA, AB, AC, AE, etc.). Labels shall be applied to the left and the right sides of the front face of patch panels. Standard identifying information on the front of the patch panel shall not be obscured. Branding shall not be obscured where possible. (See Figure 1)
3. Patch panel ports shall have a label affixed above the port identifying the room or space number the station termination is in. If the station termination is not in a clearly labeled space reach out to Infrastructure Construction Group Analysts for guidance. Port usage information shall be printed on a second line on the label when required.
4. All labels shall be TIA-606 compliant. Labels may not be handwritten. Patch panel labels shall be black text on a white background, minimum 24-point font. Port labels shall be black text on a white background, minimum 9-point font. Labels shall not obscure other patch panel label information. Labels shall be of a uniform appearance.

B. Station Identification

1. Faceplates shall be labeled with the TES identifier, followed by the patch panel identifier, followed by the port number identifier. The separator used between identifiers shall be “-“. Where faceplates contain multiple cable terminations on the same patch panel, port identifiers shall be separated by “/”. Where faceplates contain multiple cable terminations on different patch panels the upper and lower label spaces on the faceplates shall be labeled for the different patch panels where practical. Labels on faceplates shall identify ports beginning from left to right, proceeding from the top of the faceplate to the bottom. The top of the faceplate shall be the side of the faceplate opposite the center edge of the 8P8C retention clip slot. (See Figure 2)
2. Where it is not practical to label ports on different patch panels in separate label spaces a “/” shall be inserted between the last port identifier on the first patch panel and the patch panel identifier for the second patch panel. (See figure 3)
3. Where cables are terminated to a wall-mounted patch panel for BAS or similar the wall-mounted patch panel shall have standard station identifier labels affixed above each terminated port. If the patch panel is in the same TES, the TES identifier may be omitted.

4. Where cables are not terminated to ports housed in a faceplate (FACP, elevator control panel), cable jacket labels with the same information as faceplate shall be affixed. Label each cable within 4" (100 mm) of each termination.
5. All labels shall be TIA-606 compliant. Labels may not be handwritten. Labels shall be black text on a white background, minimum 9-point font.

C. Coaxial Cable Identification

1. Faceplates shall be labeled with the TES identifier, followed by "CATV", the coaxial cable identifier, followed by a 2-digit sequential number identifier. Sequential number identifiers shall be unique per TES. The separator used between identifiers shall be "-".
2. Within the TES coaxial cables shall be labeled with a cable jacket label with the cable's faceplate information followed by the room or space number the station termination is in. Where a cable termination is in an unnumbered space the room or space number shall be omitted.
3. All labels shall be TIA-606 compliant. Labels may not be handwritten. Labels shall be black text on a white background, minimum 9-point font.

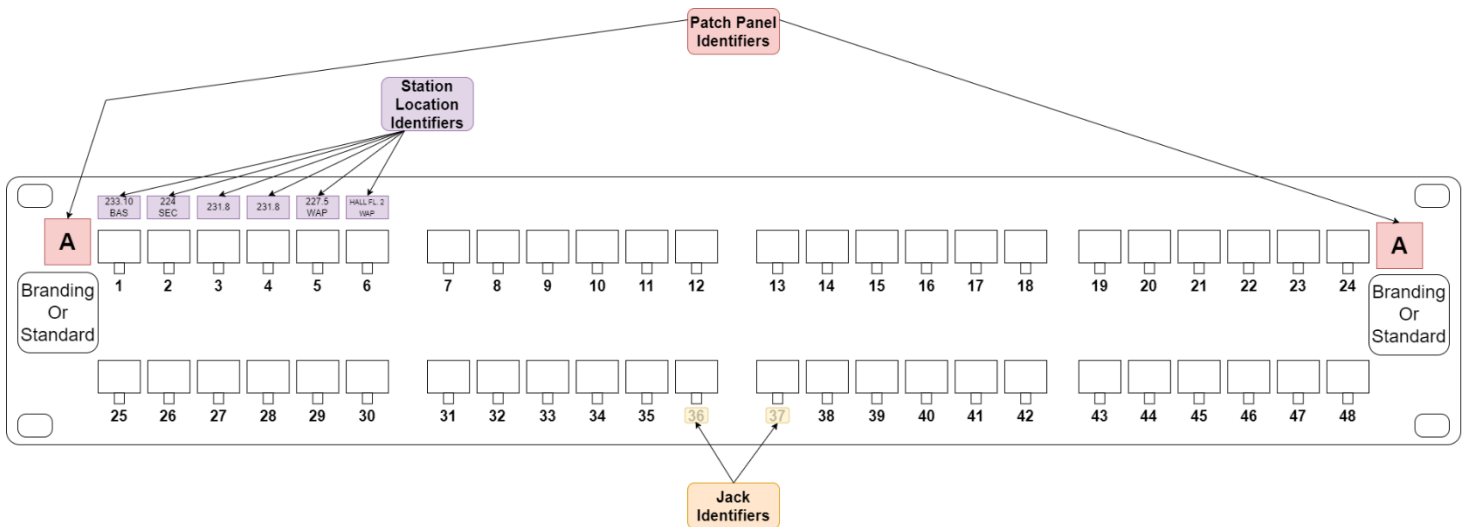


Figure 1

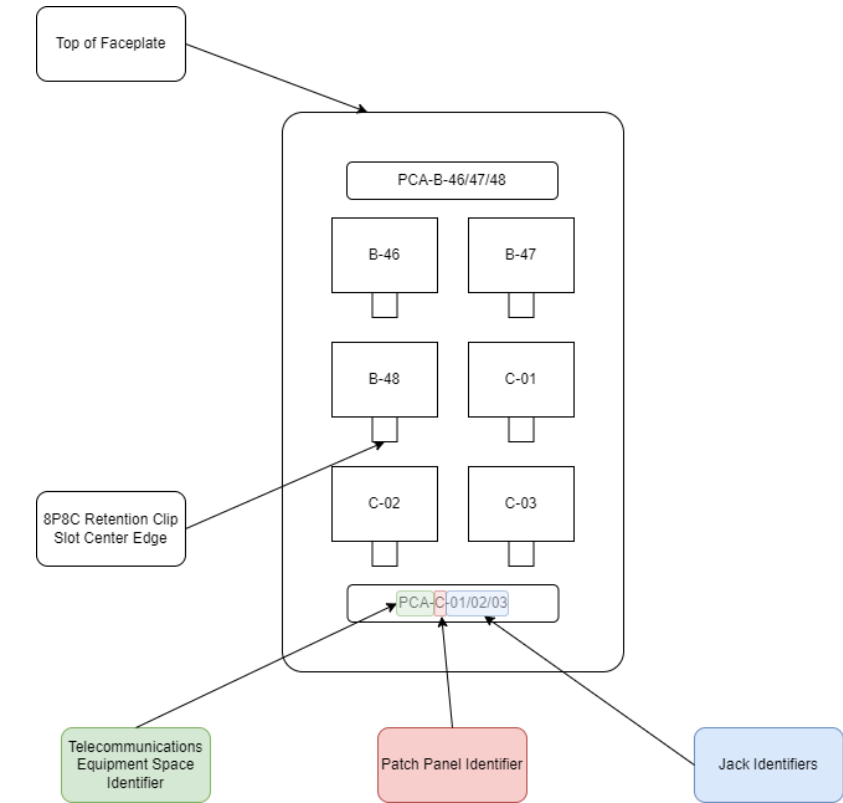


Figure 2

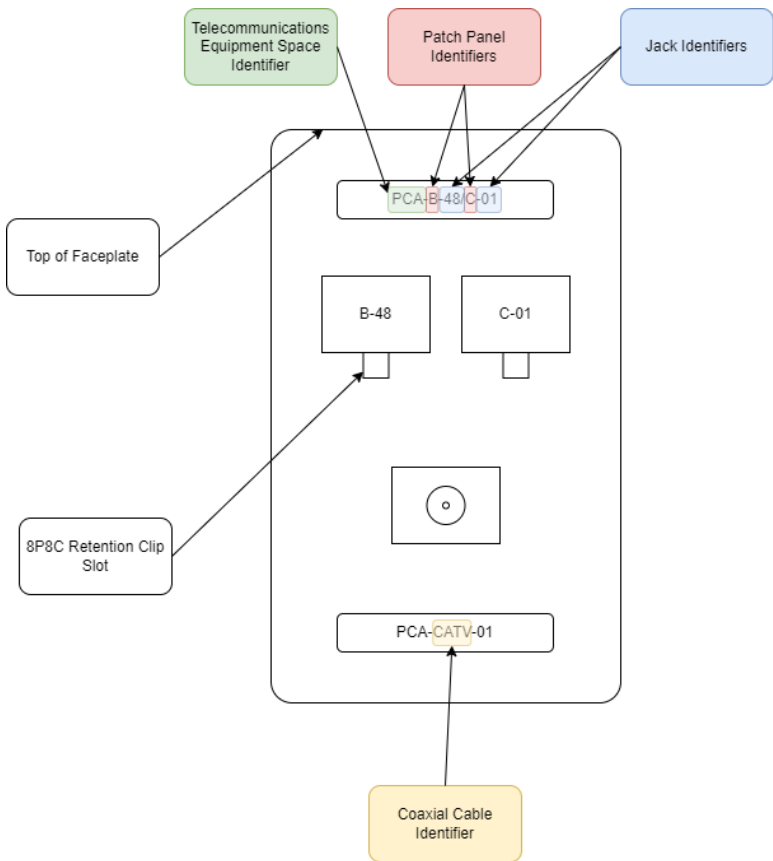



Figure 3



REVISION HISTORY			
REV	ZONE	DESCRIPTION	BY DATE

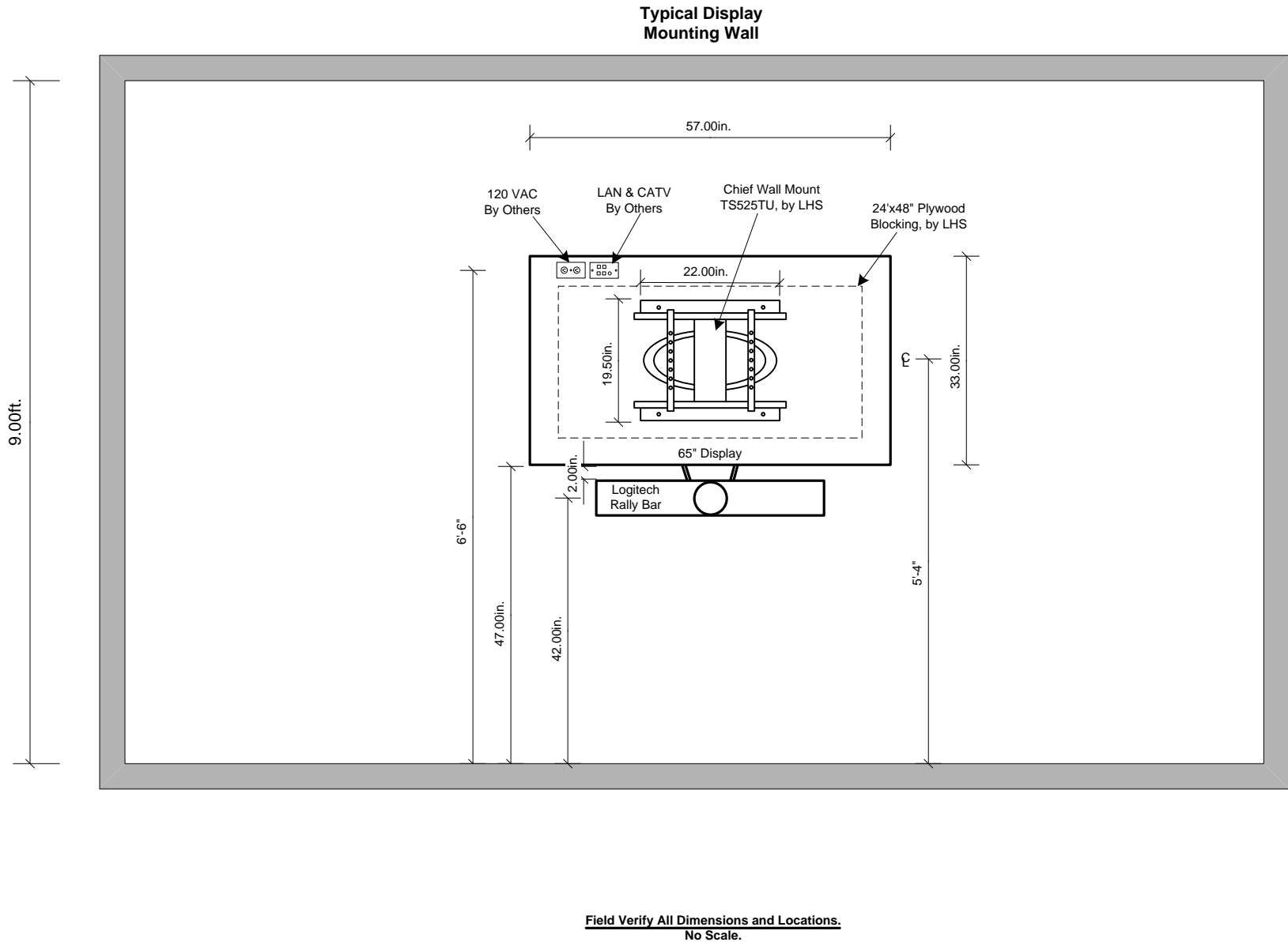
Fairfax County Government



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DATE		2023-12-04	
ISSUE		AS NOTED	
SALES	PROGRAMMER	ENGINEER	
	TBD	JH	
JOB #		*****	
FOR Review			
TITLE			
Airfax County Government			
Generic 55 Inch			
LCD Display Elevation			
DWG.#			
AV10-55			



LEE HARTMAN
& SONS INC.

8839 Kelso Drive
Suite M
Baltimore, Md. 21221
(410) 686-6975

Client

Fairfax County
Government

Title

Generic 65 Inch
LCD Display
Elevation

Project Number

DATE

2/16/2022

SHEET

AV-101

SCALE

NONE

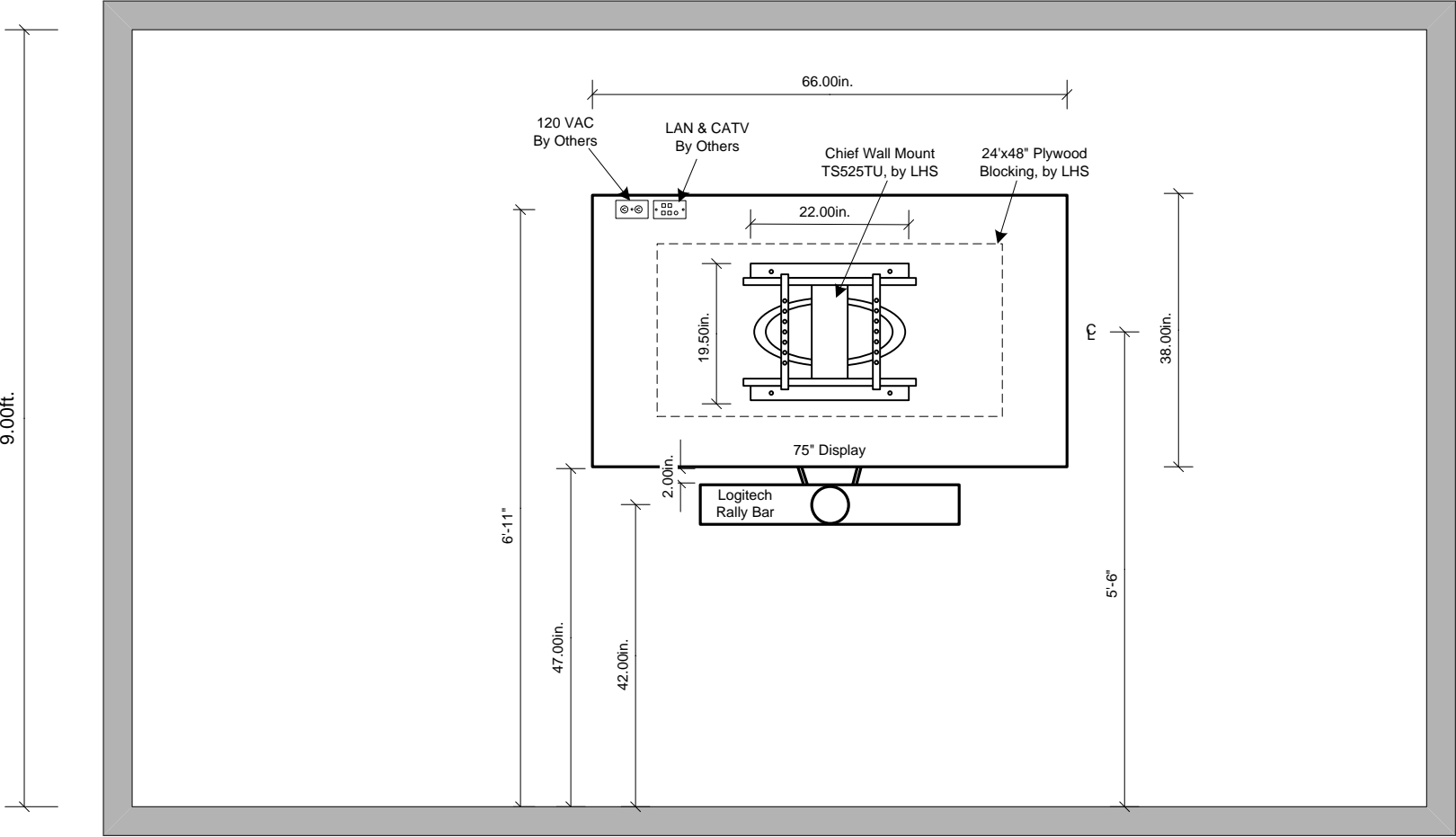
REV.

1.0

DRAWN BY

BY

Typical Display
Mounting Wall



Field Verify All Dimensions and Locations.
No Scale.

LEE HARTMAN
& SONS INC.

8839 Kelso Drive
Suite M
Baltimore, Md. 21221
(410) 686-6975

Client

Fairfax County
Government

Title

Generic 75 Inch
LCD Display
Elevation

Project Number

DATE

2/16/2022

SHEET

AV-101

SCALE

NONE

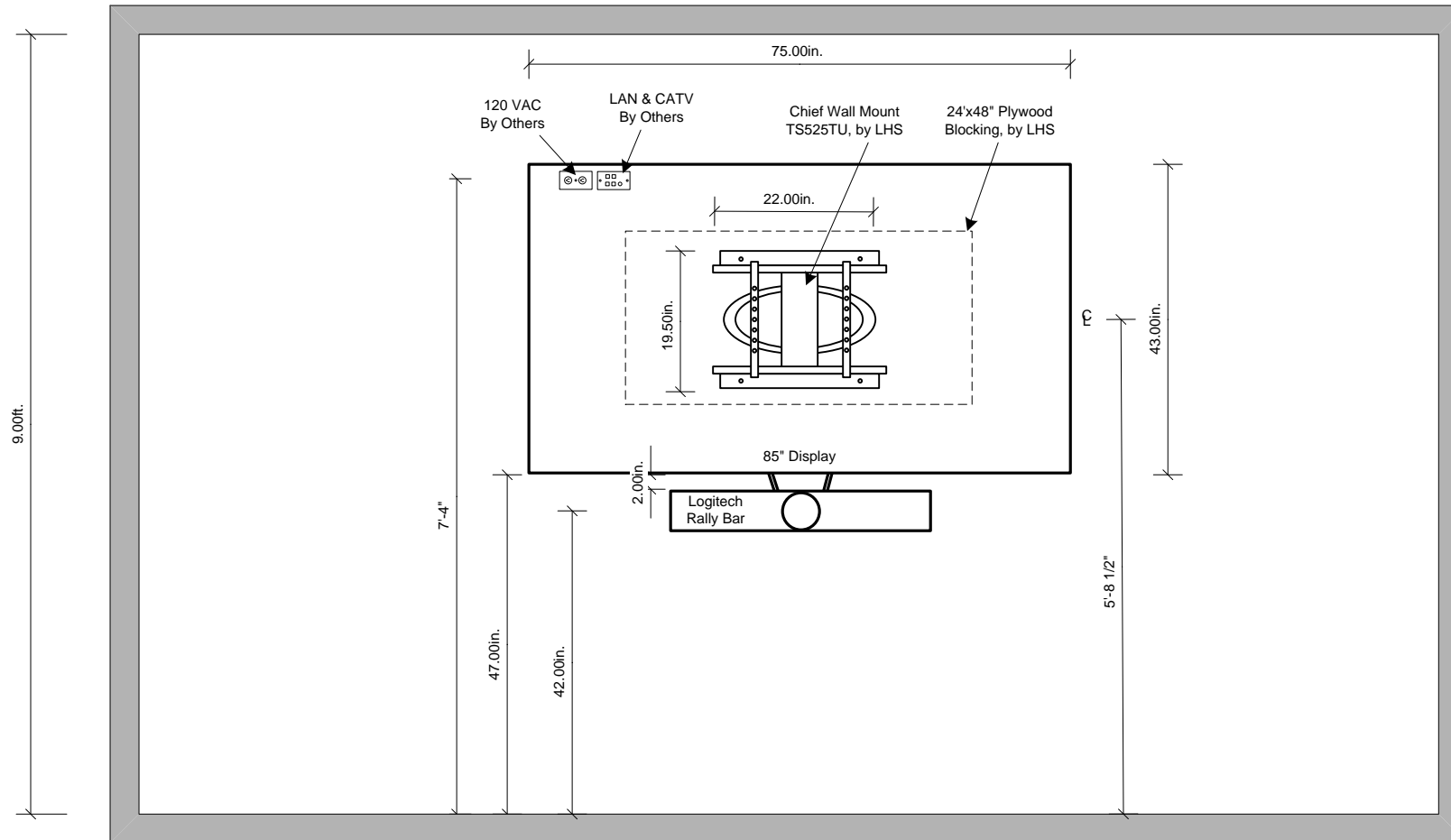
REV.

1.0

DRAWN BY

BY

Typical Display Mounting Wall



Field Verify All Dimensions and Locations.
No Scale.

LEE HARTMAN
& SONS INC.

**8839 Kelso Drive
Suite M
Baltimore, Md. 21221
(410) 686-6975**

Client

**Fairfax County
Government**

Title

Generic 85 Inch LCD Display Elevation

Project Number

DATE _____

2/16/2022

SHEET

AV-101

SCALE

NONE











REV.

1.0

DRAWN BY

BY

ATTACHMENT F - TELECOMMUNICATION SYMBOLS

	<p>Wall telephone outlet at 42" AFF OC.</p>
	<p>Wall data drop at 18" AFF OC unless otherwise noted. # indicates drop count if >1.</p>
	<p>Floor flush mounted data drop. # indicates drop count if >1.</p>
	<p>Ceiling mounted data drop. Flush mounted unless otherwise noted. # indicates drop count if >1.</p>
	<p>Ceiling mounted wireless access point. Flush mounted unless otherwise noted.</p>
	<p>Wall mounted wireless access point. #" indicates height AFF OC.</p>
	<p>Wall television data/coax outlet. #C indicates coax count if other than 1, #D indicates data drop count if other than 1, #" indicates height AFF OC. See monitor specification reference documents for mounting heights based on display size.</p>
	<p>Wall Virtual Teleconference Outlet. 1 coax, 2 data. #" indicates height AFF OC. See monitor specification reference documents for mounting heights based on display size.</p>
	<p>Wall communication connection for systems furniture.</p>
	<p>Floor communication connection for systems furniture.</p>

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Note: This section was added in March 2024 with information transferred from 080000 Doors and 110000 Equipment and updated per County's Department of Emergency Management and Security.

I. SCOPE

- A. Access Control (Card Readers/proxy)
- B. Camera Surveillance System
- C. Duress alarms
- D. Burglar alarms/Intrusion Detection Systems (IDS) (i.e., glass break sensors, door sensors, and motion sensors)
- E. Lock down buttons, if required. These allow a button to be pushed that automatically signals the electronic door strike to lock all the doors. There are also buttons that allow a door to be locked/opened from a reception desk.
- F. **Cabling**



II. DESIGN

A. Physical Access Control System (PACS)

1. The requirement for inclusion and scope of physical access control systems (PACS) in each facility shall be evaluated with County Security – Department of Emergency Management and Security (DEMS) during the design phase. The County's standard access control system for all facilities (except the Fairfax County Courthouse) is Honeywell Winpak PE Software. **(County Security – DEMS needs to be consulted on PACS for the Fairfax County Courthouse, Fairfax County Adult Detention Center, and Fairfax County Juvenile Detention Center & Shelter).**
- ~~2.~~ A complete, ready for operation access control system, including but not limited to electronic locks, card readers, reader boards, power supplies, and any other equipment required for the access control system, shall be identified during the planning phase. The programming of the PACS to interface with the Fairfax County's central system shall be coordinated between the installation contractor and the Security Systems Project Manager.
3. Legacy PACS – DEMS (County Security) shall be notified on projects that have existing legacy ProWatch hardware for access control projects. Installing vendors / contractors must verify compatibility with existing headend hardware.
4. Proximity Access Card Readers:
All access control proximity card readers shall be HID Corporation capable of reading the standard 26-bit proximity card (open format), 125 khz (HID®), with the exception of McConnel Public Safety Transportation Operations Center (MPSTOC) which currently uses a dual technology proximity card / smart card technology.

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(County Security – DEMS needs to be consulted on new card reader installations at the MPSTOC).

Proprietary access control system equipment, components and software are not acceptable. Installer must identify all installed components and identify all component's terminations. The installer will be responsible for ensuring that testing and verification of all installed PACS equipment and systems are completed and in coordination with the Fairfax County Security Systems Project Manager (SSPM).

5. Proximity (Access) cards will be provided by County Security – DEMS .

B. Security Equipment

1. The A/E shall coordinate with the BDCD Project Manager and the Fairfax County Security Consultant - DEMS for security requirements applicable for each project. If additional on-site monitoring is required of the security video or PACS, the request will be evaluated by the Fairfax County Security Consultant who will make the determination as to what level of security monitoring is required or needed.
2. The design shall incorporate the principals of Crime Prevention Through Environmental Design (CPTED), wherever possible.
3. Locate duress alarms /panic buttons or switches at all client-facing receptionist desks, point-of-sale locations where monies are collected, client screening areas, and executive level reception areas. The A/E shall coordinate with the BDCD Project Manager and the Fairfax County Security Consultant - DEMS to confirm all duress alarm locations. Duress alarms that are connected to the Fairfax County's PACS (WinPak) or report to the Fairfax County Security Operations Center (SOC) located in the Fairfax Government Center at 12000 Government Center Parkway, Fairfax, Virginia. Duress alarms reporting to the SOC are monitored 24/7/365 by a county security officer.
 - a. Duress alarms / panic buttons or switches need to be installed in a manner that is hidden / concealed underneath a desk or counter on the right-hand side.
 1. Wall mounted duress alarms need to be approved by Fairfax County Security Consultant – DEMS.
 2. Wall mounted duress alarms need to be installed at a height, to be determined by the Fairfax County Security Consultant – DEMS and enclosed in a protective cover to prevent accidental or inadvertent activations.
 - b. Duress alarms / panic buttons or switches need to be connected to the Fairfax County's PACS (WinPak) or and programmed to communicate with the Fairfax County Security Operations Center.

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- c. Duress alarms / panic buttons that cannot be connected to the Fairfax County's PACS (WinPak) can be installed on the IDS system and monitored by the County's approved Alarm Monitoring Central Station with a reoccurring monthly monitoring fee.

C. Site Security Camera Requirements

Site security camera monitoring will be accomplished using fixed, varifocal, multi-sensor and/or Pan Tilt Zoom PTZ Video Camera Systems. Video from the camera will be routed to Network Video Recorders (NVR). The Security Video Camera System should be designed to provide remote visual surveillance of the building and grounds from a local control post within the building and from offsite locations through the Fairfax County's communications infrastructure if connected to the Fairfax County Network or an authorized cable provider. NVRs need to be secured in a location away from public viewing and access in an IT/Electrical room, office, or closet, or for larger facilities, in dedicated security closets built to IT standards. The security video camera client workstation monitors need to be out of the view of the public.

a. Site Surveillance Cameras

Fixed, varifocal, multi-sensor and PTZ cameras will be dome type cameras with either smoked or clear high impact polycarbonate lower sections and aluminum casing with hard coated dome. The cameras should not be intentionally located to be covert. No false or fake cameras are allowed. The cameras should not resemble any fire devices (such as smoke detectors) by Fire Code.

b. Network Video Recording System (NVR)

The current standard for network video recording is the ExacqVision Technologies NVRs. The-ExacqVision Technologies NVRs will accommodate **up to** 30ips per camera. The ExacqVision Technologies NVR will have a LINUX operating system. NO substitutes are accepted for the operating system.

D. Rack Mounted ExacqVision NVRs

- 1. IP xxU recorder with 4 IP cameras licenses (64 max). ExacqVision Enterprise server, client, web/mobile software pre-installed with 3 years software upgrades and hardware warranty. Ubuntu Linux 20.04 on SSD. HDMI, DisplayPort, VGA (3 max simultaneous), Dual NICs. Keyboard and mouse included.

**** All models specifications should have preferably a minimum 60-day video retention capacity and capture 15 IPS (image per second). Depending on the quantity of cameras that are used and if continuous recording is required, a higher TB storage NVR will be necessary to capture the desired IPS requirement. Each unit should have a UPS backup power supply with sufficient power for all hardware connected. 30 minute backup minimum.**

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NVR Capacity Example

#Cameras	Resolution	IPS (Image Per Second)	Days Stored	Total Storage
10	1080P	15	60	16.14 TB
10	1080P	30	60	32.27 TB

E. Intrusion Detection System or Burglar Alarm Systems (IDS)

The IDS will be stand-alone, not connected to the PACS or camera system, and monitored by an outside alarm monitoring service. A land line (POTS) shall be provided for communication with third party supplier.



F. CABLING

1. Access Control Equipment Devices (Plenum-Rated Composite Cable)

a. Recommended Wire Type:

Composite Cable: Combines power, data, and signal wires into a single plenum-rated jacket, simplifying installation and meeting NEC/UL standards for plenum spaces.

Example: Genesis 31961002 Plenum Composite

b. Specifications:

1. Card Readers/Keypads:

- Type: Plenum-rated composite cable, 18/6 or 22/6.

Includes:

- 2 Power wires: 12V/24V DC.
- 2 Data wires: Wiegand.
- 2 Ground/Auxiliary wires.

Example: West Penn 25826 (18/6 composite plenum-rated).

2. Locks (Maglocks/Electric Strikes):

- Type: 16/2 or 18/2 plenum-rated cable (FPLP, CMP).

Example: West Penn 18/2 plenum-rated cable.

3. Request-to-Exit (REX) Devices:

- Type: 22/4 plenum-rated cable.

Example: Belden 6300FE (22/4 plenum-rated).

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2. Network Cameras (Plenum-Rated Wiring)

a. Recommended Wire Type:

1. Ethernet Cable (CAT5e/CAT6): Use plenum-rated cables for PoE and data.
2. Power Cable (if non-PoE): Use plenum-rated low-voltage power cables.

b. Specifications:

1. PoE Cameras:

- i. Type: Plenum-rated CAT6 or CAT5e Ethernet cable.
- ii. Bandwidth: 1 Gbps (CAT5e), 10 Gbps (CAT6).
- iii. PoE Standard: IEEE 802.3af (PoE), 803.3at (PoE+).
- iv. Shielding: STP (shielded twisted pair) for high-interference areas.
Example: Berk-Tek LANmark-6 CMP (plenum-rated CAT6).

3. Network Intrusion Detection System (IDS) Devices (Plenum-Rated Wiring)

a. Recommended Wire Type:

1. Use plenum-rated multi-conductor cables for low voltage power and data.

b. Specifications:

1. Control Panels:

- i. Type: Shielded 18/4 or 22/4 plenum-rated cable (CMP).
Example: West Penn 25424F (18/4 plenum-rated).

2. Motion Detectors:

- i. Type: Shielded 22/4 or 18/4 plenum-rated cable.
Example: Belden 9504 (22/4 shielded, plenum-rated).

3. Door/Window Contacts:

- i. Type: 22/2 or 18/2 unshielded plenum-rated cable.
Example: Genesis 22/2 CMP.

4. Glass Break Detectors:

- i. Type: Shielded 22/4 plenum-rated cable.
Example: West Penn 25224F (shielded plenum-rated).

5. Sirens/Strobes:

- i. Type: 16/2 or 18/2 plenum-rated cable.
Example: West Penn 16/2 CMP plenum-rated.

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III. PRODUCTS

A. HONEYWELL HEADEND COMPONENTS

New Install:

The controllers are to be Honeywell PRO4200 Professional Series Access Modules. All Panels should be mounted to fire rated backboard. Wire Trough should be used. Utilizing the large 2” hole on left side of the Honeywell cabinet. **Each unit should have a UPS backup power supply with sufficient power for all hardware connected. 30 minute backup minimum.**

<http://www.security.honeywell.com/product-repository/pro4200>

Each facility must be specified with one of the following:

Pro22ENC1	Enclosure with 4amp 12VVD power supply
Pro42PSU120	Power supply
Pro42IC	Controller Board
Pro42R2	Reader Board
Pro42OUT	Output Board
Pro42IN	Input Board
Pro22BAT1	Battery Back up
Pro22DCC	Daisy Change Cable
Pro4200IC	Controller Installation Manual

Each 4200IC controller board can manage up to 32 doors. The quantity of kits must be adjusted based on the number of applicable doors in each project.

B. Security Cameras

The County only uses Axis, American Dynamics, and Avigilon for their security cameras. No substitute cameras are authorized unless approved by Fairfax County Security Systems Administrator / DEMS.

<u>Device Description</u>	<u>Manufacturer</u>
1. Pan Tilt Zoom Camera	Axis, American Dynamics, Avigilon
2. Fixed Dome Camera	Axis, American Dynamics, Avigilon

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- | | |
|----------------------------------------|--------------------------------------|
| 3. Panoramic / Multidirectional Camera | Axis, American Dynamics, Avigilon |
| 4. Network Video Recorder | ExacqVision Technologies Linux Based |
| 5. Video Decoder | ExacqVision Technologies |
| 6. Video Acquisition Unit | ExacqVision Technologies |
| 7. POE Ethernet Switch | Netgear, Cisco,(minimal PoE+) |
| 8. System Manager | ExacqVision Technologies |
| 9. Client Workstation | ExacqVision Technologies |
| 10. HD Video Monitor | Min 24" Monitor |
| 11. UPS Power Backup | APC |

C. Intercoms

Aiphone -JP Series or IX Series or approved equal.

– Non-Network Based, 24V DC (Supplied by PS-2420UL), Hands-free or Push-to-talk,
7" TFT color touchscreen LCD, Surface wall mount or desk mount using MCW-S/B

D. Duress alarms /Door Release/Lock Down switches specifications

1. GRI GR3045 Series (Duress)
2. RCI 909SMOW (Door Release)
3. Honeywell Home 269R (Lock Down)

E. IDS (Intrusion Detection System)

DMP Panels

1. XT50DNM-G : 58 Zones, Dialer/Network, Wireless Received, 349-G Medium Gray Enclosure
2. XR150DNL-G: 142 Zones, Dialer/Network, 350 Gray Enclosure, 50 VA Transformer
3. XR550DNL-G: 574 ZONES, Dialer/Network, 350 Gray Enclosure, 50 VA Transformer

DMP Devices

1. 7060-W Keypad: Green LCD, shortcut keys, white
2. 7070-W Keypad: Green LCD, 4 zones, shortcut keys, white
3. 714-8 Expansion: 8PT zone expander in 340 enclosure
4. 714-16 Expansion: 16PT zone expander in 340 enclosure
5. 716 Expansion: Relay output expander module

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I. DESIGN

A. All site design must conform to the requirements of the Fairfax County Public Facilities Manual (PFM), Fairfax County Zoning Ordinance (ZO), Americans with Disabilities Act Accessibility Guidelines (ADAAG), and other governing codes and ordinances. All references for site construction and site details shall be to the PFM and/or to Virginia Department of Transportation (VDOT) standards.

B. Drainage

1. All storm sewer systems shall be designed for the 10-year storm event. It is recommended that all storm sewer pipes shall have no less than 1% slope, and all designs shall conform to PFM requirements. If slopes less than 1% are required, these storm sewers are to be noted on the plans for field verification of slope on site by Contractor with notice to the Owner prior to backfilling.
2. Drainage systems shall be designed to convey water to a natural watercourse or to an existing storm drainage facility on or off site. Outfalls of drainage systems which discharge onto adjacent property shall be in easements from the property line to either an existing easement or to a natural watercourse with bed and banks, per the PFM.
3. Overland relief shall be provided so that buildings will not be flooded during major storms. Overland relief shall be evaluated using the 100-year storm event.
4. The drainage system, including overland relief, shall be designed to account for flows from both on site and off site areas.
5. Grate inlets are prohibited on County maintained facilities unless approved in writing by DPWES-Maintenance and Stormwater Management Division (MSMD).
6. No buildings or parts of buildings, including overhangs and footings, retaining walls, or other building structures shall be constructed or placed within, or encroached upon, County storm drainage, sanitary sewer, or utility easements, unless prior approval received. In some cases, utilities can be “sleeved” under a retaining wall to prevent future maintenance issues.
7. All storm drainage pipes shall be reinforced concrete pipe with a 15” diameter minimum, unless otherwise approved in writing by the BDCD Project Manager and MSMD. For heavy traffic bearing surfaces or deep excavation applications, RCP is required to be used.

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C. Grading

1. Buildings must be sited so that no flooding will occur even if there is a failure of the piped system.
2. The site must be graded such that if the piped system did not exist, there would be no flooding of any buildings. The site plan will be reviewed against the above standard and must conform to it.
3. The first-floor elevation of the building shall be at least 18" above the 100-year water surface elevation of the flood routing. NOTE: This is in Zoning Ordinance 2-905.2. A/E design must comply or LDS will not approve.
4. The building shall be sited on a pad that slopes away from the building at a slope of 5% for a minimum of 10 feet, except for hardscape areas which should be sloped at 2%.
5. All paved and/or formed surfaces excluding equipment pads shall be designed to slope throughout their entire area for positive drainage unless otherwise noted. Sloped surfaces shall include all indoor and outdoor vehicle storage, maintenance, and parking facilities as well as pedestrian walking areas exposed to outdoor weather.
6. All intentionally level surfaces shall include provisions for drainage such as floor or trench drains.
7. Grading will be designed to provide convenient access to the storm sewer and sanitary sewer facilities for maintenance and use.
8. No plants or landscaping shall be placed where they will interfere with the drainage patterns or where they will block inlets or access. When planting trees 20 feet or closer to a building adhere to Public Facilities Manual Section 12 (vegetation, preservation and plating).
9. All grassed areas shall have a minimum slope of 2% unless otherwise approved in writing by the BDCD Project Manager.

D. Stormwater Management

1. All Stormwater Management (SWM) and Best Management Practice (BMP) facilities shall be designed for 2-year and 10-year storm events and shall pass the 100-year storm event as required by the PFM.
2. Specifications and/or drawings shall clearly state third party inspection requirements of BMP devices. It shall be contractor's responsibility for supplying this inspection when required.

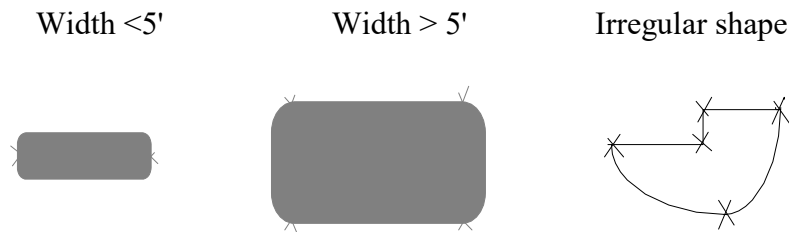
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3. Building Design and Construction Division (BDCD)/DPWES encourages the use of innovative stormwater detention and water quality provisions including the use of rain gardens, sand filters, bioretention ponds, vegetated dry ponds, porous pavement, and conservation easements, where applicable and subject to MSMD and LDS approval. Landscaped dry ponds are preferred, subject to approval of MSMD.
4. Landscaping at all SWM and BMP must be coordinated with and approved by BDCD Project Manager (PM to coordinate with MSMD and LDS).
5. Refer to the Chapter 6 of the latest edition of the PFM for acceptable soil mix and planting materials in the bioretention facilities:
<https://online.encodeplus.com/regs/fairfaxcounty-va-pfm/doc-viewer.aspx#secid-152>
6. Where feasible, use of curb and gutter at on-site roadways and parking areas should be minimized to encourage sheet flow to lawn areas and minimize concentration of stormwater to structures and pipe.
7. Refer to PFM for the design criteria relating to the maintenance of stormwater management facilities (detention and water quality), including the following:
 - a. Access ways to be cleared, graded, or constructed with the facility construction.
 - b. Proximity to a public right-of-way to minimize the length of the access way.
 - c. Multiple access ways for major facilities.
 - d. No plantings, fences, or other obstructions to access.
 - e. No plantings on the dam or berm of any stormwater management pond, without specific approval of the BDCD Project Manager and MSMD.
 - f. No slopes greater than 3:1 along the edge of the access ways.
 - g. One all-weather roadway for access to major facilities.
 - h. A concrete trickle ditch is not recommended;
 - i. Type 20 “Do Not Mow” signs have been revised. The new size is 7” x 12” and shall be mounted at a height of 48” above finished grade.
8. The use and design of underground stormwater detention and BMP chambers shall be reviewed and approved by the BDCD Project Manager and the Maintenance and Stormwater Management Division. All pipes shall be reinforced concrete pipes.

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9. Spot elevations should be provided in sufficient numbers to indicate to the Contractor the clear intent of the design for site grading and top of curb elevations.
10. On parking lot islands, top of curb elevations shall be provided as shown below:



E. Accessibility

1. All site design shall comply with the requirements of the most current ADA Standards. Any potential variance shall be brought to the attention of the County Project Manager before incorporation into the plans.
2. Accessible travel ways can not exceed a 2% cross slope, or a 5% running slope. Slopes in excess of 5% must be designed as ramps per ADA Standards.
3. Accessible path of travel shall be noted on the site plan from public street point of access and other site features to the main entrance.

F. Landscape Development

1. Designer Credentials

Any firm or individual charged with the preparation of landscape plans for new or existing public facilities must submit to the BDCD Project Manager the name of the person or persons who will be responsible for the plan preparation.

2. Plant Recommendations on Fairfax County Properties

The selection of plant materials will, in general, be made from the approved list of plant materials included in the PFM. Plant materials appropriate for the particular site and location should be reviewed and selected to promote short and long term survival and not require irrigation. Common names of plants shall be included in the planting schedule for the site. Additional species may be used with approval of the BDCD Project Manager.

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<https://online.encodeplus.com/regs/fairfaxcounty-va-pfm/doc-viewer.aspx#secid-564>.

3. Spacing

- a. Plants shall normally be spaced so that they will touch when they achieve 2/3 of their largest potential size. This rule varies according to specific design objectives, but over-planting to achieve a premature "finished" look is not acceptable; nor is expanded spacing that results in permanent, unplanted, mulched areas.
- b. No woody shrub is to be planted closer than three feet from a building wall. No tree, other than columnar evergreens should be within 15 feet from a building wall.
- c. Maintain 10 feet clear around siamese connections and four feet clear around fire hydrants.

4. General Suggestions

- a. Locate plants in areas that are compatible with their growth requirements, i.e., azaleas should be used in a semi-shaded, well-drained locations rather than in sunny, pavement surrounded areas.
- b. Large mass planting beds or plants that will achieve a natural height or more than 3 feet shall not be used, except by roads, parking lots, etc. In general, such mass planting beds shall not be greater than 10 feet wide at any given continuous mulched bed. A/E shall consider CPTED principals and sight distance requirements in the site design.
- c. Beds planted solely with low ground cover plants, such as vinca minor, heder helix, or pachysandra, are not acceptable, except on slopes too steep to mow. Such plants (except heder helix) shall be used in conjunction with woody shrubs. Woody ground covers such as horizontal junipers, cotoneaster, helleri holly, germander, or herbaceous materials such as liriop, sedum, etc. are acceptable, provided no planting of a single species exceeds 12 feet in bed width. Exceptions can be made depending on specific site conditions.
- d. All plants specified must be hardy to U.S.D.A. Zone 6. Specifications for all plant materials shall include adherence to the latest Landscape Specifications for the Baltimore-Washington Metropolitan Area.
- e. Specifications shall identify proper preparation of beds for trees, shrubs and ground cover in order to promote best chances for survival of plantings.

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- f. Specifications shall identify a standard schedule of landscape maintenance activities required during the warranty period.
5. Locations for trees and shrubs must be coordinated with wet and dry utilities, utility easements and street/site lighting (including conduit), prior to submission to LDS.
6. Specifications shall provide that all trees, shrubs and lawns are to be have warranty and be maintained by the Contractor (watered, fertilized, pruned, weeded, etc.) to ensure survival. Warranty/maintenance period shall begin at project substantial completion and extend a minimum of two years. The warranty/maintenance period must include one full growing season (April 15 through November 15). That is, if plant material is accepted after April 15 in one year, then the warranty must extend to November of the following calendar year or up to thirty-one (31) months. The plantings shall be reviewed with the Owner and/or Owner's representative twice a year to evaluate the performance and health of the plantings. Upon completion of the maintenance and warranty period, the Facilities Management Department (FMD), Building Design and Construction Division (BDCD) and the Contractor shall conduct a final walk-through of the site to ensure all plantings and lawn areas (grass) are acceptable. Minimum maintenance shall include weekly watering, as required, and spring and fall mulching.
7. The first approximately ten feet of lawn area nearest to the building on all sides shall be planted with sod. The requirement must be clearly reflected on the site plan, with an appropriate specification section included. Sod should be further extended as appropriate on a site-to-site basis to avoid narrow gaps of seeding.
8. All project specifications shall require full lawn/landscape maintenance during the two-year warranty/ maintenance period from the date of substantial completion including watering, fertilizing, mulching, grass cutting, pruning, pest control, weeding of plant beds, edging, etc.
9. All new or disturbed drainage swales are to be sodded; or seeded, mulched and stabilized with biodegradable mat or fabric. Specifications for seeding and mulching must include straw mulch, to protect seed during germination period. Use of rip rap is acceptable if the stormwater volume and/or velocity may necessitate such material.

G. Fire Lanes and Signage

1. All fire lanes and locations of signs shall be marked on the site plan per applicable edition of the Fairfax County Fire Prevention Code and the FRD Code Reference Package. See <http://www.fairfaxcounty.gov/fr/prevention/fmpublications.htm#crp>. Contractor is to provide required signs, curb markings and pavement striping.

H. Screening

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1. If barrier fencing is required, coordinate with Owner for acceptable fencing, that must also comply with Zoning Ordinance requirements. Black, vinyl coated chain link fencing is generally preferred at rear and side yards, where acceptable.
2. If block, masonry, stone or rubble screening or retaining walls are used, all wall elements must be securely anchored in place to prevent vandalism.
3. Screening walls and fence surfaces shall be treated with an anti-graffiti coating.

I. Pavement Design

1. All pavement sections for parking lots and roadways shall be designed based on CBR tests to be performed at appropriate locations during the initial geotechnical investigation. Specifications shall require the contractor to obtain additional CBR test results from soil samples at actual subgrade, and submit CBR results to engineer for final pavement design.
2. Design of the pavement section must accommodate the specific facility needs for types of traffic. The following are minimum thickness requirements for paving.
 - a. Surface Coarse - 1 1/2" Hot-Mix Asphalt
 - b. Intermediate Coarse – 3" Hot-Mix Asphalt Concrete
 - c. Base Coarse – 6" Graded Aggregate
3. Any exterior architectural brick or stone pavers are to have a rough texture finish to minimize risk of slipping. Use of pavers is discouraged along the exterior, accessible path due to risk of displacement leading to ADA non-compliance.
4. Provide a concrete pavement extension at the dumpster pad for truck tires. Include bollards at rear and sides of dumpster location. Refer to PFM for design guides.

J. Site Lighting

1. Site lighting may be installed by Dominion Energy or Northern Virginia Electric Cooperative (NOVEC) under the County's Municipal Street Lighting Contract; or by the General Contractor if County standard site lighting fixtures are used as approved by FMD for operation and maintenance. Coordinate with the BDCD Project Manager. The site lighting design shall be prepared by the Architect as coordinated with the BDCD for County standards. After approval by the County and Dominion Energy (or NOVEC or FMD), the site lighting is to be incorporated into the site plan by the Architect. The empty conduit for the underground cables is to be included in the construction contract in projects where light poles, fixtures and wiring are to be installed by Dominion Energy or NOVEC. Architect is to prepare plats for easement locations based on approved site lighting layout, if required. All

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site lighting designs must comply with Zoning Ordinance Glare Standards and shall utilize sharp cut-off fixtures.

2. All site lighting is to be LED. Refer to Section 260000 for preferred fixtures.

K. General Requirements

1. The Architect is to notify adjacent property owners of submission of site plan per LDS and Zoning Ordinance requirements.
2. Specifications shall require that the Contractor retain a testing agency to perform all site work testing and inspections more than 5' outside the building footprint. The Contractor shall not use the same inspection firm as the County retains for Special Inspections program.
3. The water meter must be properly sized to avoid unnecessary cost of purchasing an oversized meter. The plans must note that the Owner will pay for the water meter and gets a receipt, and the contractor is responsible for the pick up from the Water agency and the installation.
4. The minimum horizontal between water mains and appurtenances (including but not limited to service lines, meter boxes, valve boxes, and hydrants) and gas mains shall be 5 feet. When a water main or appurtenance crosses a gas main, either above or below, a minimum vertical clearance of 12 inches is required. When a concrete pad is required by the pipeline company, the water main shall be routed around the concrete pads, using 4-45° horizontal bends. The requirements shall further be coordinated and verified with the water authority and utility companies as applicable on a project by project basis.
5. If the geotechnical report identifies problem soils, the report must be submitted for the review and approval by Land Development Services (LDS) prior to completion of the Design Development phase.
6. All utility company easements, new and existing, must be shown on the site plan. The A/E shall prepare and submit to LDS signed and sealed originals for all on-site and off-site easement plats for review and approval as part of the Not for Recordation (NFR) Plat process by the end of the design development phase. All easement plats are to be prepared in the LDS standard easement plat format, and all plats must be finalized and approved by Land Acquisition Division (LAD) by the 50% CD stage. It should be noted that easement plats are required for sanitary and storm sewer facilities located on Fairfax County owned properties that convey off-site flow. Fairfax Water (or the appropriate water agency) easements must be recorded before inspections will be made by Fairfax Water (or the appropriate water agency). Easements are also required for Dominion Energy, Verizon, Cable and

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telecommunications lines, but not during site plan review. All easements must be coordinated with site improvements including landscaping.

7. Building corners are to be tied to property lines, using survey coordinates on the site plan (geometric layout plan).
8. Identify the service entry conduits for telephone, cable television (CATV), computer/data (I-NET), and electric into the appropriate room of the building. Provide two four-inch conduits each for all Verizon (telephone) and Cox (CATV and I-NET) from the main telephone room to the property line. Coordinate with utility company all new utility services and relocations, and identify all existing and proposed utility locations on the site plans, and coordinate with all landscaping.
9. Utility meters, transformers, generators, and service yards and the like are not to be located at the front of the facility, and must be screened from view, where appropriate.
10. Delivery doors must be heavy duty and provided with curb cut for materials delivery.

L. Sidewalks and Trails

1. A minimum of two (2) feet is required between the trail edge and any vertical obstructions such as trees, utility poles, signs, or other obstacles.
2. All vegetative material within a clearing envelope of at least 10 feet high by 10 feet wide shall be removed prior to trail construction.
3. The minimum allowable longitudinal slope for trail construction shall generally be no less than one percent (1%). Maximum longitudinal slopes shall meet ADA standards and shall not exceed 5%, or 8.33% if designed as a ramp with handrails. The allowable transverse (cross) slope is 2.0%.
4. If longitudinal slopes on concrete sidewalks are equal to or in excess of three percent (3%) and when the underlying soil has 34% or more passing the No. 200 sieve and has a PI of 13 or less, Fairfax County Standard UD-3 sidewalk under-drain shall be installed.
5. Side slopes adjacent to sidewalks and trails shall not exceed 2:1.
6. All storm pipes associated with sidewalks and trails shall be reinforced concrete pipe, except for UD-3 sidewalk under-drains, where required by PFM.

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7. Generally, 20 feet shall be the minimum allowable turning radius on sidewalks and trails. However, the actual minimum allowable turning radius shall be computed by the design engineer based on expected use and site conditions.
8. Provide a paved surface from all emergency exits leading away from the building to a paved area of refuge.

M. Termite Control

1. The A/E shall provide recommendation whether the termite control may be necessary for each project.
2. If termite control is necessary, the specifications shall require that under the slab termite control be provided with a one-year warranty from the date of substantial completion.

N. Accessible Design

1. Provide easy and direct access to all facilities.
2. Provide proper accessible circulation in/around a bus shelter.
3. Provide continuous accessible path of travel from building entrance to immediately adjacent bus stops and streets crossings.
4. Consider line of sight issues, including signs and sign placement, in all pedestrian access to and from the building.
5. In buildings with multiple functions and where separate entrances are provided for each function, each function shall have an accessible route and entrance.
6. When providing alternate accessible entry points to a room or building, consider the proper signage directing people to the ramp or entry point.
7. Consider two or more exterior accessible evacuation routes for emergency egress away from building.
8. Pavers shall not be used for accessible routes. If a textured surface is desired, consider other materials such as stamped concrete.
9. Consider population to be served when determining amount of accessible parking spaces to be provided. (Example: Senior Centers).

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10. Provide accessible parking spaces adjacent to, or as close as possible to the building.
11. Consider accessible seating at the site/parking lots for rest areas. Consider accessible picnic tables to double for lunchtime/break use. Be mindful of curbs surrounding the area (access from parking lot by wheelchairs).
12. Accessible routes through a parking lot must comply with ADA slope requirements. Parking lots may have up to 10% grades but the accessible routes are limited to 5% running slope, 2% cross slope and 8.33% slope if ramped with handrails.
13. Design curb ramps so that drainage and debris do not collect at bottom of ramp. Do not place obstructions (drainage grates/inlets, trash cans) in the travel path. Pay careful attention to passenger drop off areas.
14. Any crossing signals adjacent to a County facility should be reviewed and coordinated with VDOT for length of crossing time.
15. Replace older (non-compliant) curb ramps that provide direct access to County facilities, including those immediately adjacent in the VDOT right-of-way.
16. Sidewalks should be a minimum width of 5' from the accessible parking area to the entrance(s) of the building.
17. Consider raising any crosswalk elevation to meet the sidewalk elevation. (Creates a subtle speed bump for drivers).
18. All crosswalks should be perpendicular to the roadway.
19. Provide an accessible path and parking for each program area of buildings with multiple entrances for different programs.

O. Natural Landscaping

1. The Fairfax County Natural Landscaping Policy (adopted in September 2007) should be incorporated into all proposed Capital Improvement projects that include landscaping designs.
2. Natural Landscaping is defined as landscaping that improves the aesthetic and environmental function of formal and restored areas by recreating land features and plant communities found in nature.
3. Sustainable landscapes should seek to maximize the use of native plants, remove invasive plant species, reduce turf grass and chemical inputs, improve soils, and retain rain water on-site.

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4. Use only locally common native plant species to provide the greatest possible ecological benefits whenever feasible.
5. Non-invasive exotic plants may be used where appropriate, but the majority of plant cover should be composed of native species that support wildlife.
6. When possible, utilize Low-Impact Development (LID) practices that use trees, vegetated swales, rain gardens, and other natural features instead of concrete structures to treat stormwater.
7. A/E shall coordinate with the BDCD Project Manager to include the Owner standard specifications for Sections 329100 Seeding, Sodding & Topsoil, 329110 Non-Native Invasive Plant Management and 329300 Plantings and update as required.

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I. DESIGN

A. PV Design

1. The Architect/Engineer is responsible for evaluating and maximizing on-site renewables based on available space, targeting 100% or greater of a site's existing/anticipated electrical use.
 - a. If existing utility data is not available, such as in new construction, the A/E shall estimate the building's monthly electric consumption using an approved energy modeling software.
 - b. In accordance with the County's sustainability and renewable energy goals, the A/E shall consider the feasibility, system performance, and cost-effectiveness of solar PV in the following forms:
 - 1) Sloped/Pitched Roof
 - 2) Flat Roof
 - 3) Ground Mount
 - 4) Awnings or Canopies
 - 5) Carport
2. Detailed System Performance Estimates & Life-Cycle cost analysis to demonstrate expected payback calculation.
 - a. The A/E shall include a detailed system performance estimate with the solar PV design. Helioscope, PV Syst, System Advisory Model (SAM) or other approved modeling software shall be used to estimate monthly PV output.
 - b. Inputs should include geographic region, DC system size, AC system size, array azimuth, array tilt, shading, soiling and other factors.
 - c. Display the following as part of an analysis summary:
 - 1) Energy Yield Ratio of the annual kWh produced by the PV system to the array's DC system size. This value is expressed as kWh per kW.
 - 2) Performance Ratio Efficiency of the PV system based on the ratio between actual and theoretical output. This value is expressed as a percentage.
 - 3) Life Cycle Cost Analysis to demonstrate payback calculation.
 - a) A life-cycle cost analysis shall be performed by the A/E, for informational purposes only, to demonstrate the PV system's expected return on investment (ROI).
 - b) System maintenance, PV module performance degradation, structural reinforcement (if necessary), and utility rate increases shall be factored into the total life-cycle cost analysis.

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- 4) A/E is responsible for understanding building's utility rate and communicating the utility breakdown to the BDCD Project Manager.
 - a) Utility Rate Analysis must show distinct \$/kWh and \$/kW charges in lieu of a blended \$/kWh rate.
3. Meeting or exceeding applicable code requirements.
 - a. NEC
 - 1) All Solar PV equipment and wiring shall comply with the requirements of the Fairfax County adopted version of the National Electrical Code (NEC).
 - b. ASCE
 - 1) The structure supporting the Solar PV system shall comply with the requirements of the Fairfax County adopted version of ASCE 7.
 - c. IBC
 - 1) The Solar PV layout shall comply with the requirements of the Fairfax County adopted version of the International Building Code (IBC).
 - d. NFPA 70E
 - 1) Installation of the Solar PV system shall comply with the requirements of the Fairfax County adopted version of NFPS 70E.
4. Spacing, Setbacks, and Clearance Requirements
 - a. Subarray roof edge setbacks and pathways shall be provided in accordance with the requirements of the Fairfax County adopted version of the International Building Code (IBC).
 - b. Subarray shall be setback a distance of 6' or more from all mechanical equipment requiring regular maintenance.
 - 1) A setback of less than 6' shall not be approved unless approved by equipment manufacturer and BDCD project manager following consultation with management agency.
 - c. PV inverters shall be placed 15' or greater from roof edge to maintain safe clearances for operations and maintenance. This allows PV inverters to be outside of the required range for a guard rail, safety net or travel restraint system. See OSHA 1910.28(b)(13)iii
 - 1) Exception: A solar PV design using panel-integrated micro-inverters may locate panels within 15' of a roof edge. However, the A/E shall coordinate with the BDCD project manager to ensure adequate fall protection means are available for long-term maintenance.

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- d. Subarray shall be setback a distance of 2' feet from all vents, drains, and miscellaneous obstructions.
 - e. Pathways to all vents, drains, and miscellaneous obstructions shall be provided without stepping through subarrays.
 - f. All spacing, setback, and clearance requirements shall be clearly shown and dimensioned on the plans.
 - g. The A/E shall ensure adequate laydown area is considered for future roof replacement and roof top equipment replacement while maintaining setbacks and clear access pathways.
5. Electrical Considerations
- a. Point of Interconnection
 - 1) A/E shall ensure that the PV projects point of interconnection is depicted accurately based on the site conditions and sites electrical infrastructure.
 - 2) The outlined interconnection methods below have been listed in order of preferred priority.
 - a) Back-fed Breaker
 - b) Line-Side Connection
 - c) Switchgear or acceptable electrical equipment
 - d) Secondary of utility transformer if utility approves
 - b. Solar in conjunction with an existing onsite backup generator
 - 1) The solar PV system must be electrically isolated from any existing or planned emergency backup generator.
 - 2) The A/E shall design an automatic transfer switch (ATS) or multiple transfer switches to properly isolate the solar PV system while maintaining emergency backup power.
 - c. Utility power outages due to loss of voltage
 - 1) The PV system shall be designed to properly shut down during a utility power outage (UL1741).
 - 2) Consult with the BDCD Project Manager, FMD, and the OEEC Resilient Fairfax team to consider solar with battery storage as an alternative emergency backup option.
 - d. Electrical Conduit and UAD
 - 1) The A/E shall anticipate placement of the inverters on the rooftop and how AC conductors will be routed to the main electrical room. The A/E shall design interior conduits from the rooftop to the electrical room that are large enough to support the maximum solar array size, as determined by the A/E.

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- 2) Where possible, conduit(s) shall be located in the building interior and routed above ceiling and/or hidden from sight, with pull-boxes located appropriately to allow for installation of solar PV conductors.
 - 3) The A/E shall anticipate and show placement of the utility accessible disconnect (UAD). Conduit shall be designed and clearly indicated for routing from the interconnection point to the UAD and from the UAD to the inverter (or combiner panel if multiple inverters).
 - 4) The UAD shall be designed such that it disconnects power to the entire solar PV array without impacting any other circuits, devices, or equipment.
6. Shading (structures, trees, etc.) rules of thumb and general guidance
- a. A/E is responsible for evaluating potential shading for a given site.
 - b. Shading shall be evaluated by considering surrounding buildings and obstructions (rooftop equipment, trees etc.).
 - c. PV modules shall not be placed in areas on the roof where more than 50% of the annual production is lost due to shading when compared to the performance of non-shaded areas.
 - d. The impact of shading shall be considered in the production model run by the A/E and the electrical PV designer.
7. Documentation – Expected Deliverables
- a. The A/E shall include the following pages in the construction drawings:
 - 1) Site Plan shall indicate the location of all equipment associated with the Solar PV system.
 - 2) Scaled layout of all added electrical equipment shall be provided as part of Electrical Drawings.
 - 3) Single line diagrams, communications diagram, and dedicated PV module stringing diagram.
 - 4) Single line diagrams shall indicate specifications for all equipment, wiring, and conduit.
 - 5) Calculations shall be done and displayed clearly on the drawings to account for AC/DC voltage drop, conduit fill, system voltage, amperage, and grounding.
 - 6) Systems grounding diagram/plan showing Solar PV grounding system and how it connects to or isolates from existing building, separately derived system (generator), low voltage and lightning protection grounding systems.
8. System Production Modeling

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- a. The A/E shall include a production estimate on the drawings, referencing values obtained using a modeling software such as Helioscope, PV Syst, System Advisory Model (SAM), or other approved modeling software.

9. Roofing and Warranties

a. Age Limitations:

- 1) Rooftop PV systems will be prioritized at facilities with roofs that have recently been replaced or coated.
- 2) If the County is planning to replace the roof concurrently with a new solar PV system, the A/E shall design the roof for a minimum 20-year life expectancy.
- 3) A new roof or roof replacement design shall incorporate a membrane with high reflectivity to maximize solar production from bifacial modules.
- 4) Solar PV will be considered on a case-by-case-basis on roofs that are greater than 10 years old.

b. Coatings and Compatibility:

- 1) A facility with an aging roof, that is an otherwise good candidate for rooftop solar, may still be considered for rooftop solar PV. At such facilities, a roof coating shall be considered as an alternative to a full roof replacement.
- 2) The A/E shall specify a roof coating which is designed for a minimum 20-year life expectancy.
- 3) The A/E shall specify a roof coating that extends the existing warranty of the roof in cases where a warranty extension is offered by original roofing system manufacture.
- 4) Any roof coating must be compatible as determined by both the original roofing system manufacturer and the coating manufacturer.
- 5) Provide written documentation of compatibility and warranty extension to the BDCD Project Manager and FMD.

c. Warranty Continuation:

- 1) The A/E shall contact roof manufacturer prior to installation to ensure selected racking system and associated equipment are compatible with the roof manufacturer's requirements and shall not void the warranty.
- 2) The A/E shall require the contractor to obtain a statement of warranty continuation from the roofing system manufacturer after the solar PV system is installed.
- 3) Any roof inspections required prior to, or after, installation of the solar PV system shall be indicated by the A/E as the responsibility of the contractor.

10. Coordination and Arc Flash Studies

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- a. Required Circumstances
 - 1) An arc flash hazard analysis shall be performed on all added or modified panels and disconnect switches, 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. A/E to discuss with BDCD project Manager for exemptions.
 - 2) A breaker coordination study shall be required for all back-fed / Line Side interconnections where applicable. A/E to discuss with BDCD project Manager for exemptions.

11. Training

- a. A/E shall require contractor to perform training for maintenance & operations BDCD staff, FMD staff and the local fire department upon request.
- b. Staff training shall include:
 - 1) Equipment Locations
 - 2) System Components
 - 3) Maintenance of Key Equipment
 - 4) Troubleshooting
 - 5) DC & AC Side
 - 6) Safety
 - 7) Monitoring
- c. Local fire department training shall include:
 - 1) Equipment Locations
 - 2) System Components
 - 3) Emergency Shutdown Process

12. Other

- a. The A/E shall provide all pertinent information to the Building Owner for interconnection application from the electrical service utility prior to construction.
- b. A/E shall provide structural approval with a wind and snow load letter prior to construction.
- c. PV drawings shall be stamped by professional engineer registered in the Commonwealth of Virginia.
- d. A/E shall require contractor to provide I-V Curve test results for every string of the PV System as part of project commissioning. I-V Curve results directly from the inverter shall be accepted.

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- e. The A/E shall specify that the contractor and/or its solar subcontractor must hold a Virginia's contractor's license with the Alternative Energy Systems (AES) and Electrical (ELEC) specialties.
- f. A commercial solar permit shall be obtained prior to construction of the solar PV system. A/E shall specify that contractor shall submit final inspection report to the utility as part of a request for Permission to Operate (PTO) approval of the system.

13. Responsibilities of System Designers

- a. The A/E is responsible for the following items that pertain to the design of the PV system:
 - 1) Site Plan and Overall PV layout
 - a) The A/E is responsible for creating a site plan and overall PV layout, which labels relevant equipment (PV Modules, Inverters, PV Disconnects etc.)
 - b) The A/E is responsible for determining equipment and roof edge setback distances and displaying the relevant dimensions on the PV layout drawing(s).
 - 2) Shading issues
 - a) A/E is responsible for the placement of PV modules in high irradiance areas and shall avoid shaded areas unless directed otherwise by BDCD Project Manager or FMD.
 - 3) Orientation of PV Modules
 - a) The A/E is responsible for specifying the orientation of the PV modules and ensuring modules are placed in an orientation for maximum PV output.
 - b) PV modules may sometimes be located on north-facing roof areas with reduced production in order to support Fairfax County's goals for Zero Energy or Net Zero Buildings. Modules shall only be placed in the north facing direction with the approval of BDCD Project Manager.
 - 4) PV Module Tilt
 - a) The A/E is responsible for specifying the tilt of the PV modules.
 - b) Ideal tilt angles for PV modules range from 5-30 degrees, depending on the roof slope and mounting system. PV modules tilted outside of this range must be approved by BDCD Project Manager.
 - c) Ideal PV tilt angles based on mounting type:
 - (i) Flat Roof: 5-10 Degrees
 - (ii) Pitched Roof: 0 Degrees – Flush with existing roof pitch.
 - (iii) Ground Mount: 25-30 degrees
 - (iv) Carport 2-15 degrees
 - 5) Energy Yield

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- a) The A/E is responsible for specifying the PV yield on the cover page or site plan of the PV design drawing package.
- b) A/E shall ensure PV system can achieve maximum yield given site conditions and overall design.
- 6) Equipment Selection
 - a) A/E is responsible for including full specifications for PV equipment selected as part of the design.
 - b) The design shall include the quantity, make, and model of key PV equipment such as PV modules, PV inverters, PV racking, PV monitoring, and associated BOS (balance of system) components.
- 7) Electrical Design
 - a) A/E is responsible for submitting an electrical design consisting of a single line diagram, communications diagram and dedicated PV module stringing diagram.
 - b) The electrical design shall be stamped by a professional engineer licensed in the Commonwealth of Virginia.
- 8) Occupational Safety Risks
 - a) A/E shall require contractor to be aware of and list potential safety risks that the site may present including, but not limited to electrical and fall protection hazards.
- 9) Access to Designated PV Array Location
 - a) Identify access pathways to PV equipment and access to PV array locations (roof hatch, staircase, etc.).
- 10) Integration with Architectural Features
 - a) The A/E shall consider the need for potential solar PV attachments when designing the architectural roof assembly. Avoid designing sloped roofs that are not standing seam metal where possible to eliminate the need for roof penetrations and attachments.
 - b) Avoid designing sloped roofs that require roof penetrations and racking attachments to the metal roof decking, especially when the metal decking is a specialty noise-dampening type and/or exposed to the space below.

II. PRODUCTS

A. Solar Modules

- 1. Type of Solar Module
 - a. Monocrystalline:

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- 1) The A/E shall specify a PV module for a given design that is monocrystalline. Mono-facial or Bi-facial monocrystalline modules are preferred.
 - b. Alternative Options:
 - 1) Alternative PV modules are permitted as long as the efficiency requirement is met or a special/unique circumstance arises where the PV module is integral to the building design (Eg. Building Integrated PV)
 - a) Thin Film PV modules are permitted given they meet the provided specifications.
 - b) Poly-Crystalline PV modules shall not be used unless approved by BDCD Project Manager following consultation with OEEC.
 2. Module Specifications
 - a. PV Module efficiency shall be 19% or greater.
 - b. PV Module degradation shall not exceed 20% degradation in year 25.
- B. Mounting
1. Racking Compatibility:
 - a. Rooftop solar racking systems must be compatible with the existing or planned roofing material.
 - b. The A/E shall confirm with the racking manufacturer that the specified product is compatible with the roof type.
 - c. Slip sheets shall be specified for flat roof installations where applicable, A/E shall check with roofing manufacturer for PV system design requirements.
 2. Roof Penetrations:
 - a. Penetrations through the roofing system shall be avoided, whenever possible.
 - b. If roof penetrations are unavoidable in the design of the solar PV system, the A/E shall specify a reinforced liquid flashing detail in lieu of a pitch pocket.
 3. Flat Roofs:
 - a. Mounting systems for solar PV arrays on flat roofs shall be designed as a ballasted system.
 - b. The A/E shall indicate the racking type to be used, with a specified tilt of 5 to 10 degrees.
 - c. The A/E shall coordinate with the racking manufacturer to determine the quantity, location, and weight of CMU blocks to be used as ballast for the system.

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- d. Flat roof ballasted mounting systems should avoid penetrations through the roofing system.

4. Sloped/Pitched Roofs:

- a. While the installation of solar PV systems on sloped roofs is possible, particularly those that are not standing seam metal, it's crucial to assess each case individually. This approach will help minimize the need for roof penetrations and attachments to the roof decking. If a PV system is to be installed on a non-metal sloped roof with acoustical qualities, the A/E should evaluate the number of roof attachments required and how this may affect the functionality of the roof decking and the aesthetics of the space below.

Quantify and discuss the number and type of roof attachments with BDCD Project Manager and FMD before proceeding with the proposed roof type, if solar PV is anticipated on that particular roof.

- b. Metal

- 1) Solar PV systems on sloped metal roofs shall be designed to use racking systems which attach directly to the roofing system.
- 2) The A/E shall specify the correct clips/clamps which attach to the particular metal roof seam type or roof channel.
- 3) For racking applications that require penetrations through the metal roof, A/E shall require the use of a butyl style penetrating mount.
- 4) Roof penetrations shall be avoided on metal roofs if possible (e.g. standing seam roof clamp).

- c. Asphalt

- 1) Asphalt Shingle

- a) Solar PV systems mounted on pitched asphalt shingle roofs shall use a flashing style mounting system.
- b) Flashings shall either fasten to existing wooden roof trusses or directly to deck.
- c) The use of flash-less attachment systems may be approved on a case-by-case basis by the BDCD Project Manager and FMD.

- 2) Rolled Asphalt

- a) Solar PV systems mounted on flat or slightly pitched rolled asphalt roof should be designed with racking systems designed specifically for rolled asphalt applications.
- b) Should a penetrating solution be used, A/E shall ensure design requires mounting system to be compatible with existing roofing manufacturer and shall not void roof warranty

- 3) Membrane

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- a) Solar PV systems mounted on flat or slightly pitched membrane roofs should be designed with racking systems specifically for membrane roof applications.
- b) Should a penetrating solution be used, A/E shall ensure design requires mounting system to be compatible with existing roofing manufacturer and shall not void roof warranty.
- c) Adhered non-penetrating attachment solutions are acceptable if roof manufacturer approves of said product and does not void existing roof warranties.

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5. Low Sloped Roofs

- a. On sloped membrane roofs that are pitched at an angle greater than 7 degrees, a hybrid ballasted/attached racking system shall be designed.
- b. The A/E shall coordinate with the racking manufacturer to minimize the number of roof penetrations on the solar PV system design.
- c. Sloped membrane roofs that are pitched at an angle less than 7 degrees shall be classified as a flat roof for the purposes of this guideline and shall be designed as a ballasted system.

6. Carports, Awnings, and Canopies

- a. Carports, awnings, and canopies must be designed by a professional engineer registered in the Commonwealth of Virginia.
- b. Carport, awning, and canopy designs should account for water/snow management and be accessible for routine cleaning and maintenance.

7. Ground Mounts

- a. Ground mount PV systems shall adhere to all local zoning and setback requirements.
- b. The leading edge of all PV modules in a ground mount system must maintain at least 2' of clearance from the ground.
- c. Ground mount systems shall be surrounded by a fence with accessible gates to ensure routine cleaning and maintenance can occur.
- d. Ground mount PV systems shall not be installed in flood plains or areas where large amounts of water consistently pond.
- e. Ground mount PV systems shall be covered aggregate or vegetation.
 - 1) The use of vegetation (e.g. perennial garden) for ground mount systems is encouraged; however, a vegetation management plan and associated long-term costs need to be accounted for by A/E.

C. Inverters

1. Efficiency

- a. Inverters shall have a minimum efficiency of 96% unless justified by a lifecycle cost analysis.

2. Capacity (DC/AC Ratio)

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- a. Systems shall be designed to have a DC/AC power ratio between 1.0 and 1.5, with an ideal power ratio of 1.2. DC/AC ratios that fall outside of this range shall require BDCD approval.
- 3. Monitoring
 - a. Inverters shall provide a minimum of string-level production and error monitoring for all Solar PV installations.
- 4. Rapid Shutdown
 - a. Power Optimizers, Rapid Shutdown Devices, Rapid Shutdown Boxes, and Inverters shall comply with Rapid Shutdown Requirements specified in NEC 690 when applicable.
- D. Balance of System Components
 - 1. DC Combiner Panels
 - a. DC Combiner Panels shall be rated NEMA3R or greater.
 - b. Enclosure shall be rated for the designated PV voltage.
 - c. Enclosure shall be labeled for use.
 - 2. AC Combiner Panel
 - a. AC Combiner Panel shall be rated NEMA3R or greater.
 - b. Enclosure shall be rated for the designated PV voltage.
 - c. Enclosure shall be labeled for use.
 - d. The use of panelboards with breakers or AC fuses is acceptable.
 - 3. Disconnects (Service, Utility Accessible, etc.)
 - a. A/E shall identify disconnects on drawings.
 - b. The utility accessible disconnect shall be within line of sight of the utility meter.
 - c. The use of maps shall be permitted with additional utility approval for disconnects placed in locations that do not have a direct line of sight of the utility meter.
 - d. Disconnects shall be rated NEMA3R or greater.
 - e. Enclosure shall be rated for the designated voltage.
 - f. Enclosure shall be labeled for use.
 - g. Knife blade AC disconnect switches are required unless utility approves an alternative.
 - 4. PV Transformers

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- a. The use of step-up transformers is permitted.
- b. Units shall be rated NEMA3R or greater.
- c. Enclosure shall be rated for the designated voltages.
- d. Transformer shall be compatible with bi-directional current flow.

5. Back-fed Breakers

- a. The use of back-fed breakers is permitted.
- b. Breakers shall be rated for bi-directional current flow.

E. Monitoring / BAS Integration

1. PV Submeters

- a. The A/E shall consult with the BDCD Project Manager and FMD about the type of submetering required for each solar PV system design.
- b. If a solar submeter is desired, it shall be integrated into the facility's building automation system (BAS).
- c. If the facility's BAS accepts BACnet integration, BACnet MS/TP or BACnet IP protocols shall be used.
- d. The A/E shall develop a solar submeter monitoring (controls) package which includes the integration I/O points to be pulled in, displayed on the graphic, and properly trended.
- e. PV submeters shall also be integrated into the PV inverter when possible.
- f. The A/E shall require the contractor to set up trends of daily, weekly, monthly, and yearly kWh production.
- g. Additionally, they shall require trends of peak kW production.
- h. The A/E shall specify that real kW and apparent power kVA be displayed on the graphic of the BAS.

2. Revenue Grade Meter

- a. If a revenue grade electric submeter is required, the A/E shall specify a meter (e.g. Honeywell E-MON Green Class Meter) capable of satisfying the ANSI C-12 requirement (minimum accuracy of +/- 2%).
- b. The BACnet communication protocol of the submeter shall be BTL certified.
- c. A revenue grade meter is required if SREC arbitrage is a short or long-term goal for the solar PV system (See below for SREC arbitrage).
- d. SREC Arbitrage
 - 1) For every MWh (1,000 kWh) produced by a solar PV system, one Solar Renewable Energy Credit (SREC) is generated.

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- 2) An SREC substantiates the sustainability benefits of solar renewable energy production.
 - 3) SREC arbitrage consists of REC's being sold, swapped, retained or retired. SREC swapping consists of selling the PV generated SREC at a higher price to one consumer while purchasing less expensive RECs or SRECs from another party.
 - 4) SREC arbitrage may be used as a strategy to meet the County's renewable energy portfolio goals while improving the ROI of a solar PV system.
 - 5) Consult with the BDCD Project Manager and OEEC to determine if a financial model, incorporating SREC arbitrage, is required for the project's solar PV system.
3. PV Inverter Production Data
- a. Inverter production and error monitoring shall be accessible from a remote location via an online portal. Access to portal shall be provided to system owner post system commissioning and energization.
 - b. Hardwired Inverter
 - 1) Connection to Inverter shall be hardwired to building main distribution frame (MDF) in all cases where access to the MDF is provided by the system owner.
 - c. Cellular Communication Solutions
 - 1) In cases when owner cannot provide access to the MDF, the inverter shall report monitoring data via cellular communication.
 - d. Wi-Fi Based Communication Solutions
 - 1) The use of Wi-Fi for communications purposes shall not be permitted.
- F. Minimum Component Warranties
1. PV Modules
- a. Performance
 - 1) The PV module(s) specified shall have a minimum performance/production warranty of 20 years.
 - 2) Consult with the BDCD Project Manager and FMD to determine if an extended warranty is required.
 - b. Material
 - 1) The PV module(s) specified shall have a minimum product warranty of 10 years.
 - 2) Consult with the BDCD Project Manager and FMD to determine if an extended warranty is required

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2. Inverter(s)
 - a. The inverter(s) specified shall have a minimum product/component warranty of 10 years.
 - b. Consult with the BDCD Project Manager and FMD to determine if an extended warranty is required.
 - c. If an inverter comes with a standard 5-year warranty, a warranty extension shall be provided to meet the 10-year requirement.
3. Rapid Shutdown Devices and Power Optimizers
 - a. The rapid shutdown devices and/or power optimizers specified shall have a minimum product warranty of 25 years.
 - b. Consult with the BDCD Project Manager and FMD to determine if an extended warranty is required.
4. Racking
 - a. The racking system(s) specified shall have a minimum product warranty of 20 years.
 - b. Consult with the BDCD Project Manager and FMD for approval if standard warranty is below 20 years.

STRUCTURAL DESIGN GUIDELINES

I. DESIGN

- A. These guidelines provide structural recommendations for applying gravity, wind and seismic loads in rooftop photovoltaic (PV) array applications to new and existing building roof areas. The guidelines are separated into gravity (Dead Load (DL), Live Load (LL), Rain Load, Snow Load), Wind Load and Seismic Load considerations for Fairfax County Facilities. The scope of these guidelines apply to elevated roof areas only.
- B. These guidelines apply to the Virginia Construction Code (2021) with Specific reference to Chapter 16 (Structural Design), International Building Code (IBC 2021) and International Existing Building Code (IEBC 2021). These guidelines have not been written for applications for one and two-family dwellings governed by the International Residential Code (IRC).

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- C. The designer is encouraged to identify (early in the design process) the type of PV system to be installed. Early identification of the type of PV system will assist the designer in determining the loading demand and load path. Examples include but are not limited to:
1. Low profile, permanently fixed (non ballasted), low slope roof
 2. Rack mounted, permanently fixed (non ballasted), low slope roof
 3. Rack mounted, ballasted, low slope roof
 4. Low profile, permanently fixed, moderate slope roof
 5. Rack mounted on steel dunnage permanently fixed, low slope roof
- D. Structural drawings shall designate the roof areas that are considered **“Solar Ready”**. Solar Ready areas are locations that have been designed (for new construction), verified or reinforced (for existing roofs) to support PV array dead loads. PV dead load design loadings should be identified on the Solar Ready plan with the type of solar panel system the loadings are based on.
1. For new construction, Solar Ready plans shall include all flat (low pitch) roofs and designated moderate pitched roofs.
 - a. Low pitch roofs are roofs with a slope less than 5 degrees.
 - b. For the purposes of these guidelines, Moderate pitched roofs are defined with a slope greater than 5 degrees and less than 40 degrees.
 2. For existing construction, Solar Ready roof areas shall be identified as part of the structural evaluation process. Solar Ready roof plans should identify the following areas:
 - a. Adequate capacity – PV Panels are Permitted
 - b. Strengthening Required – Due to additional PV loads
 - c. Strengthening Required - Due to additional other loads such as Snow drift loads & Include PV loads
 - d. PV Panels Not Allowed – Areas determined by others during the design process where PV panels are not beneficial to the project. Examples include small or not easily accessible roof areas and low roof areas shaded from high roofs.
- E. Structural support systems supporting PV arrays shall be designed to satisfy life-safety performance for a design basis earthquake ground motion event and a design wind event.

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II. STRUCTURAL DESIGN LOADING CONSIDERATIONS

A. Dead Load Requirements

1. PV System weights are generally well known, not movable and contribute to the mass dead load of the building. For these reasons, PV system weights should be considered **dead load**. For design purposes, a minimum of **10 pounds per square foot (psf) dead load** shall be used for **all non-ballasted PV arrays** and **most ballasted systems**. The weight of *PV modules*, supporting system, and ballast are included in the 10 psf dead load and shall be verified by the engineer of record.
 - a. The dead load from the PV system shall be considered in the seismic response analysis (see lateral load requirements).

B. Live Load Requirements

1. New Construction: Roof framing of new buildings must be designed to safely support code minimum roof live load assuming no PV is present, including the 300lb concentrated load requirements and all live load applied to the underside of roof framing members, such as hung loads from truss bottom chords.
2. Considerations for Existing Roofs: Where PV panels are installed relatively close to the roof surface, the physical panels prohibit application of significant roof live loading. Roof live loads shall be taken as zero where the clearance between the PV panels and roof is less than 24in. **See Figure 1**
3. All existing roofs that have adequate area shall be evaluated for the addition of PV panels. Structural capacity of roofs shall be considered for all areas of existing roof members.
 - a. PV panel systems with a clearance greater than 24in do not prohibit roof live load from being applied below the panels. As such, roofs with taller PV panel systems should be designed for all code roof live loads.
 - b. Roofs with PV systems and varying heights should be designed for roof live load in areas greater than 24in clear between the roof surface and PV panel.
 - c. Roof members that support open access aisles and other areas where PV panels are not installed shall be designed to support both PV dead load tributary to that member and code roof live loads over the open area. In addition, roof live load shall be considered in areas below PV panel that are taller than 24in.
4. Live Load Reduction: Individual members that receive large live loads above the threshold limits where reductions are applicable may be reduced per building code standards. Live load reduction shall be based only on the part of the tributary area

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subject to live load. It should be noted that LLR is likely not practical as snow loads, rain on snow surcharge or ponding loads will likely govern the design.

C. Rain Loads and Ponding:

- a. New construction: Where roof systems are adequately sloped to drains at a pitch greater than or equal than $\frac{1}{4}$ in/ft, specific ponding analysis by the code is not required and the subsequent design for rain should not be a factor.
- b. Considerations for Existing Roofs: Dead load from PV arrays will increase demands and deflections of existing roof members. Rain loads on roofs shall be considered whenever water can accumulate on a roof. Consideration should be given to primary and secondary (overflow or scupper) drains where the primary drain becomes blocked resulting in static head in localized areas. Structural framing adjacent to primary and secondary drains should be checked for adequacy considering PV dead load deflections and localized ponding.

D. Snow Loads:

1. PV panels may allow for greater snow accumulation by sheltering the snow from wind that might otherwise blow the snow off the roof. PV panels may also alter drift patterns.
2. Where low profile systems are used and the panels are lower than the depth of snow corresponding to the roof snow load, the panels may have a negligible effect on roof snow loads.
3. Where rack mounted systems are used and the panels are higher than the depth of snow corresponding to the roof snow load, the panels will have a higher effect on roof snow loads, possibly resulting in localized drifting. Special attention should be paid to the thermal factor ($C_t = 1.2$) for unheated open frame systems.

E. Lateral Load Requirements

1. Wind Load
 - a. The Building Risk Category, Building Enclosure Category, Ultimate Wind speed, and Wind Exposure Category shall be designed to and identified on the structural drawings.
 - b. The PV Roof Zones, Effective wind and Normalized Wind area, External Pressure coefficients for effective wind and normalized wind ($GCrn$), ($GCrn$)_{nom}, respectively, and associated PV wind pressures shall be determined by the Specialty Engineer designing the solar panel system.

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- 1) Note that PV Roof Zones are calculated differently in ASCE 7-16 than roof zones for components and cladding.
- c. For New Construction - The structural integrity of the building including all elements of the lateral resisting system shall be determined and verified compliant considering the additional wind load induced to the building from the PV system.
- d. For Existing Construction – For PV arrays added to existing buildings, the lateral force resisting system of the building shall be checked per the requirements of the IEBC.
 - 1) Any existing lateral load carrying structural element whose demand/capacity with the addition of PV panels considered is no more than 10% greater than its demand/capacity ratio with the PV panels ignored shall be permitted to remain unaltered.
 - a) For purposes of this exception, comparisons of demand/capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.
- e. Solar Area ready roofs shall be designed for cases where solar arrays will be installed and cases where solar arrays could be removed.

2. Seismic Load

- a. The Building Risk Category, Seismic Importance Factor, Seismic Design Category, Site Classification, Seismic Response Coefficients (S_s , S_1 , S_{ds} , S_{d1}), Design Base Shear, Seismic-Force Resisting System, Analysis Method and Seismic Response Coefficients (R , C_d , C_s , T_L) shall be determined by the engineer of record and identified on the structural drawings.
- b. For New Construction - The structural integrity of the building including all elements of the lateral resisting system shall be determined and verified compliant considering the additional dead load induced from the PV system.
- c. For Existing Construction – For PV arrays added to existing buildings, the seismic force resisting system of the building shall be checked per the requirements of the IEBC.
 - 1) If the added mass of the PV array does not increase the seismic mass tributary to any lateral-force resisting structural element by more than 10%, the seismic-force resisting system of the building is permitted to remain unaltered.

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- a) For purposes of this exception, comparisons of demand/capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.

III. CONSIDERATIONS SPECIFIC TO EXISTING BUILDINGS

A. General

1. Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design gravity load of more than 5% (5% trigger) shall be evaluated for adequacy, strengthened, supplemented, replaced, or otherwise altered as needed to carry the increased gravity load required by the IBC code for new structures.
2. Existing Wood Framed Roof Considerations
 - a. Consideration of the long-term dead load effects on older wood-framed roof members must be made. Older allowable stresses are not sufficiently conservative. Glue-laminated beams fabricated prior to 1970 also warrant additional consideration.
 - b. If the 5% trigger intends to cover an increase of 5% in any of the load cases involving gravity, the maximum weight of an added PV system would be limited to 5% of the total dead load of the roof assembly, unless the capacity of the existing structure is evaluated.
 - c. For existing buildings where the required moisture content of the wood was not specified as 19% or less, or if the original drawings are not available, or if the existing framing members lack grade stamps, the existing deflections are recommended to be estimated with the assumption that the wood had a moisture content greater than 19% at the time of installation.
 - d. Deflections shall be checked for drainage and ponding issues.
 - e. Deflections of supporting members (compound deflections) shall be considered.
3. Steel Framed Roofs Considerations
 - a. The reduction of live load to justify the addition of PV systems is reasonable, but may not be relevant dependent on snow loads.
 - b. The 5% trigger is permitted to apply only to the critical/governing load case(s).
 - c. Local and compounded deflections shall be checked for drainage and ponding cases.
4. Concrete Framed Roofs Considerations
 - a. The reduction of live load offset to justify the addition of PV systems is reasonable, but may not be relevant dependent on snow loads.
 - b. The 5% trigger is permitted to apply only to the critical/governing load case(s).

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c. Long term deflections shall be checked for drainage and ponding cases.

5. Other Roof Framing Systems

a. Other framing systems may exist that are not identified above. The designer of record shall follow the IEBC requirements when evaluating existing framing systems for adequacy.

IV. MINIMUM STRUCTURAL SUBMITTAL REQUIREMENTS

A. General

a. PV Submittal shall be submitted to Fairfax County for review and shall be signed and sealed by a Professional engineer registered in Virginia. Submittal shall include the following:

- 1) Racking layout with clearances and aisles
- 2) Ballast layout with placement details
- 3) Mechanical anchorage details
- 4) Typical installation details

b. Minimum Calculations

- 1) Calculations shall reflect and confirm the Basic Building Design Criteria identified on the structural drawings
- 2) Ballast weight calculations, if required, to satisfy the loading requirements
- 3) Mechanical fastening capacities, product data and connection information
- 4) Panel specific seismic and wind variables used in the panel submittal design

V. REFERENCES

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2021 - Virginia Uniform Statewide Building Code (Chapter 16)

2021 – International Building Code

2021 – International Existing Building Code

American Society of Civil Engineers (ASCE 7-16)

Structural Engineers Association of California (SEAOC) Solar Photovoltaic Systems Committee,
Structural Seismic Requirements and Commentary for Rooftop Solar PV Arrays – PV1-2012

Structural Engineers Association of California (SEAOC) - Solar Photovoltaic Systems
Committee, Wind Design for Rooftop Solar PV Arrays – PV2-2017

Structural Engineers Association of California (SEAOC) - Solar Photovoltaic Systems
Committee, Gravity Design for Rooftop Solar PV Arrays - PV3-2019

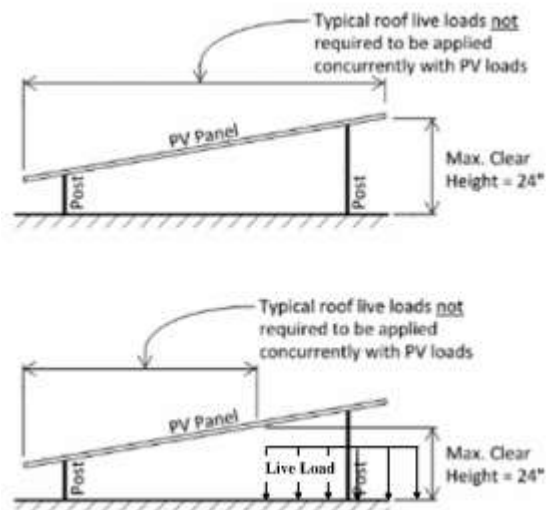


Figure 1: Examples of areas where live loads shall be considered in addition to PV loads

Appendix A – Clinical Facilities with Negative Pressure Rooms

I. General

- A. The room shall be completely sealed (walls, ceiling, light fixtures, etc.)
- B. The room shall have full height partitions that are sealed “deck to deck” at the top and bottom. It shall be interior to the facility (i.e., not in a perimeter location with windows or outside walls).
- C. Wall gaskets shall be provided for all light switches, power receptacles, and data drops (T-stats and fire alarm devices are not to have gaskets).
- D. Level five finished walls as defined by the Gypsum Association (GA 214-10) and incorporated into ASTM C 840 with semi-gloss finish paint shall be provided.
- E. Acoustical ceiling tiles shall be non-perforated and cleanable such as Armstrong vinyl Clean Room VL ceiling tiles. Gypsum board ceilings will be considered if they are finished to the wall standards and there are no above ceiling items that require access. Access panel should be avoided. Where unavoidable, they shall be sealed with latex vinyl adhesive caulk and painted.
- F. VCT flooring shall be provided.
- G. All plumbing and other piping penetrations associated with the fixture itself shall be sealed at the wall(s).
- H. Accessories and/or wall furnishings (such as white boards, posters, etc.) shall be avoided unless affixed using non-penetrating methods such as “double sided” tape.
- I. The door shall be sealed to the frame utilizing non-pervious and cleanable edge seals or weather stripping.
- J. The door shall have an automatic closer.

II. HVAC

- A. Doors shall have static sweeps unless an undercut is deemed appropriate for makeup air purposed; however, the undercut shall not be greater than ½” above the finished floor. The mechanical designer shall ensure there is sufficient makeup air available for transfer from the corridor. Where an undercut is incorporated (i.e. not door sweep), visual airflow aids are required such as Davis “Air-Flow Tels” 950. Provide three (3) equally spaced along the bottom of the door with the tips 1/8” above the finished floor. Refer to paragraph B below for additional makeup air information.
- B. If makeup air is required beyond what a door undercut will provide, the approach is to be from an adjacent return air plenum. The makeup air shall be introduced into the room via an air device similar to the supply air device and immediately adjacent to it.

Appendix A – Clinical Facilities with Negative Pressure Rooms

It shall communicate with the plenum other than directly above the room and be connected via rigid ductwork with a barometric backdraft damper. The duct shall be sealed where it penetrates the room's full height partitions. The mechanical designer shall ensure there is sufficient makeup air for transfer from the plenum.

- C. The exhaust shall be directly to the outdoors.
- D. The room air shall be continuously exhausted during business hours.
- E. There shall be a redundant exhaust fan. If the building has an automation system, the fans shall be programmed to operate in a lead/lag fashion where the lag fan will automatically operate upon the lead fan failure. The fans' daily operational schedule shall be adjustable by the building operators through the automation system.
- F. The exhaust fans shall be direct drive and be on generator power.
- G. Unless the designer can establish a roof mounted location where exhaust can be discharged straight up and away from building elements, and at high velocity, the exhaust air shall be routed through a HEPA filter assembly. The HEPA filter assembly shall be located in an easily accessible location, such as elevated on a flat portion of the roof and shall incorporate differential pressure monitoring. In all cases, the discharge shall be directed away from the building and not near any air intake sources such as windows, doors, louvers, etc. per local building code requirements. It should be noted that a HEPA filter assembly may be required regardless of the intended discharge condition and will need to verify this with the BDCD Project Manager during design.
- H. Round exhaust ductwork is preferred. In rectangular ducts, turning vanes are to be avoided and specify standard or long radius elbows (inside mitered elbows are unacceptable).
- I. Provide permanent (stenciled) warning signs every six (6) feet on both sides of horizontal exhaust ductwork and labeled "NEGATIVE PRESSURE EXAM RM EXHAUST". The lettering shall be 2" high. Airflow direction arrows shall also be provided of the same size on either end of the warning labels. Vertical ducts shall be labeled similarly, but on ALL sides for potentially exposed to view such as if a drywall chase were to be removed.
- J. There shall be a minimum of 2 outside air changes per hour.
- K. There shall be a minimum of 12 total room air changes per hour.
- L. The minimum pressure differential (with door closed) shall be 0.01" water column with respect to immediately adjacent areas and as measured at the room's door. (Room shall not exceed -0.02" water column.) It is recommended that measures (VFDs, speed

Appendix A – Clinical Facilities with Negative Pressure Rooms

controller(s), volume dampers, etc.) be incorporated for adjusting and setting of the airflow to achieve the pressure differential.

- M. Adjacent to the door, specify electronic monitoring of airflow utilizing Siemens SRCM Room Pressure Monitor 547-323A 9 and tap plates) with a 45 second delay (adjustable) to prevent nuisance alarms. Specify a Siemens remote annunciator module (547-199) with acknowledged switch to be tied into the pressure monitor and located in a conspicuous location where operational staff normally reside, such as behind a reception desk.
- N. When there is a building automation system, the room pressure monitor shall be tied into it for monitoring, trending/logging, and alarming. Where possible, an alarm condition will send emails to the building's operation's staff alerting them to the problem.
- O. The airflow path within the room is to be "top down" and maximized such that it flows from behind where the health care worker would normally position their self to behind the patient examination area. This is generally thought of as flowing diagonally from the door side of the room to the wall opposite the door.
- P. The exhaust air shall be captured through a wall grille centered 18" above the finished floor. The A/E shall specify a clear wall cavity of sufficient size to house the required ductwork. The supply air shall be located in the ceiling and be via a register or diffuser.
- Q. It is preferred that the room be serviced by a constant volume system. When there is a VAV system, a dedicated shut-off VAV box shall supply constant airflow (i.e. the VAV box shall be programmed and balanced such that the minimum airflow shall match the maximum airflow.
- R. Light fixtures shall not have return air "slots" nor other openings that allow air passage other than what is factory standard and for cooling and ventilation of the fixture itself.