Kirtland Air Force Base Low and Medium-Voltage Electrical Design and Equipment Requirements

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General

- Project specifications shall reference all applicable Air Force Regulations and Standards (UFCs, AFIs, AFMANs). This includes projects managed by the US Army Corps of Engineers (USACE).
- New construction shall meet or exceed all current UFC, AFI, AFMAN, NEC and NESC Codes.
- All construction submittals and design drawings shall be routed through the CE Operations Engineering Office, 853-1817, and the CE Exterior Electric Shop, 846-8145, for review & comment.
- Kirtland AFB has a "No Energized Work" policy. Contractors are responsible for installing safety grounds prior to working on the de-energized portions of Kirtland's primary electrical distribution system. KAFB's CE Exterior Electric Shop will perform all switching to de-energize these lines.
    - 10 business days at a minimum is needed to de-energize any portion of Kirtland's primary electrical distribution system, the contractor must submit a form AF-103 to the BMC's R&O Department.
    - Primary contact at the BMC's R&O Department is Stanice Elliott at 263-2750 or stanice.elliott.ctr@us.af.mil
    - Secondary contact at the BMC's R&O Department is Matthew Cayo at 505-712-6571 or matthew.cayo.ctr@us.af.mil
    - A Scheduled Power Outage email will be sent out notifying "Start Time" – "End Time" – "Buildings Impacted."
- All new installations and modifications shall connect to the existing 15kV system when available and shall not be allowed to use the 5kV system, even if more cost effective.
- The first device out of any substation, on a feeder, shall be an S&C PMH-style, or equivalent, pad-mounted switch. This device will be used to tie to another feeder or contain spare switch bays for future installations.
- All new electrical equipment installations shall have its protective devices coordinated with KAFB's current upstream fault protection devices.
- The coordination study provided to the Base at the completion of the project shall be compatible with KAFB's current software. As of Oct 2024, this was Easy Power, Version 11.0.1.8039.
- One (1) copy shall be provided to the CE Operations Engineering office, 853-1817, and one (1) copy to the CE Exterior Electric Shop, 846- 8145.
- PNM Distribution Standards are preferred for medium voltage construction, but usage must be reviewed and approved by the CE Operations Engineering office, 853-1817, and the CE Exterior Electric Shop, 846-8145.
- Removal of old equipment and off-site disposal shall be the responsibility of the Contractor.

Kirtland Air Force Base Low and Medium-Voltage Electrical Design and Equipment Requirements

Scope

1. Pad Mounted Transformers: At a minimum, they must have:

- a liquid level gage,
- pressure-vacuum gage,
- liquid temperature indicator,
- drain and filter valves,
- pressure relief device,
- (5) full capacity voltage taps,
- bay-o-net fusing,
- primary surge arresters,
- high-voltage load break switch,
- dead front primary, and
- Nameplate

The color shall be Sand Dollar, Sherwin Williams #6099.

New pad-mounted transformers installed at renovated facilities currently being fed from 5kV feeders should have dual-voltage primaries (12,470V:4,160V).

New pad-mounted transformers shall be labeled and routed through the CE Operations Engineering office, 853-1817, and the CE Exterior Electric Shop, 846-8145, for review & comment.

Transformers shall not be used to loop-feed other transformers on KAFB because it makes maintaining the piece of equipment difficult with no visibility.

Ref: UFC-03 550 01 chg3 (2019); Sections 3-2.4, 3-5.1 – 3-5.6, & 3-14.1 - 3-14.3

2. Pad-Mounted Switches:

- All pad-mounted switches shall be air-insulated and fused; vacuum-type is also acceptable. Switches must be of a dead-front design (S&C PMH-style, or equivalent), with 24” housing extensions, and cable fault indicators with the sight glass on the exterior of the housing. New pad-mounted switches shall be labeled and routed through the CE Operations Engineering office, 853-1817, and the CE Exterior Electric Shop, 846-8145, for review & comment.

The color shall be Sand Dollar, Sherwin Williams #6099.

Ref.: UFC-03 550 01 chg3 (2019); Sections 3-2.4, 3-7

3. Sectionalizers:

- Note: Due to the excessive installation of sectionalizers in the past, KAFB’s primary distribution system has become increasingly incapable of isolating individual sections of the system. For this reason, it is strongly recommended and requested that designs include the replacement of existing sectionalizers with pad-mounted switches whenever possible. New pad-mounted sectionalizes shall be labeled and routed through the CE Operations Engineering office, 853-1817, and the CE Exterior Electric Shop, 846-8145, for review & comment.

If installation of a sectionalizer is warranted and approved, it shall have fused load side taps, 24" housing extensions, cable fault indicators with the sight glass on the exterior, elbow connections, penta-head bolts, and a padlock slot.

The color shall be Sand Dollar, Sherwin Williams #6099.
Ref.: UFC-03 550 01 chg3 (2019); Sections 3-2.4, 3-8 & 3-10.9

4. Concrete Pads (for equipment detailed above):

- Concrete pads may be prefabricated concrete or cast-in-place concrete. In either case, if the pad contains a 'trough' for conduit access, this trough must be covered with expanded metal grating or filled with non-shrink grout to prevent the incursion of burrowing animals into the termination compartments. Filling with non-shrink grout is the method preferred by Kirtland AFB.

  The top of outdoor switchgear pads should be elevated a minimum of 4 inches above grade.

Ref.: UFC-03 550 01 chg3 (2019); Section 3-12

5. Electrical Distribution Manholes:

- KAFB prohibits manholes to be installed indiscriminately in the primary distribution system. When cable lengths and routings are such that a project does require a 'pull-point', the following criteria shall be met.

  Vaults or sectionalizes are required over traditional manholes. Vaults will be precast concrete set at-grade with a traffic rated, rectangular, two-piece galvanized, spring-loaded, lockable, 'clamshell'-type access lid. Vaults depth shall not be more than 48 inches to bottom. Round entry rings and lids are to be avoided. Manhole access lids shall be bonded to ground via a ground strap tied to the manhole ground rod. All manholes will be grounded and will have an appropriately sized ground cable around the inside of the manhole. A ground rod shall be installed outside the manhole, with the grounding conductor penetration no lower than 18 inches below the top of the manhole. Access lids will be clearly marked "Electric" in a permanent method. All manholes will be supplied with cable racks; high strength plastic (non-metallic) racks are preferred. All manholes will be provided with a sump with a removable cover. This is also recommended for communications manholes.

6. Poles:

- Do not use pole-platform mounting (two-pole structure or H-frame).

Ref.: UFC-03 550 01 chg3 (2019); Section 3-10.4.3

46kV or above: Metal Poles shall be installed.
Distribution Poles shall be cross-arm construction, with a center pin insulator.
All poles that are touched at any point during a project, must be replaced, including new hardware, guy wires and anchors. All poles shall be independently labeled with permanent signage to identify the pole number using the existing numbering system. Poles that do not have an ID, shall be labeled and routed through the CE Operations

Engineering office, 853-1817, and the CE Exterior Electric Shop, 846-8145, for review & comment.

7. Medium-Voltage Conductors:

- 15kV, EPR or XLP, 133% insulation level. Tape shields are acceptable only if installed with a separate insulated ground conductor and/or a full-sized insulated neutral. Metallic sheathed cable (Type MC) or Armored Cable (Type AC) will not be used, exceptions shall be considered on a case-by-case basis. Aluminum conductors shall not be used.

Ref.: UFC-03 550 01 chg3 (2019); Sections 3-11.1, 3-11.2, 3-11.8, & 3

8. Low-Voltage Conductors:

- Copper (no aluminum) with THHN/THWN installation. Minimum wire size shall be #12. All buildings with computer loads shall have oversize neutral or a full size neutral for each phase conductor.

  Aluminum conductors shall not be used.

Ref.: UFC 3 520 01, Sec. 3-6.3 and UFC 3 550 01, Sec. 3-10.4 & 3-11.8

9. Medium voltage splices and terminations:

- Hot or Cold Shrink terminations are preferred. Splices shall be cold shrink and molded rubber splice kits for shielded power cables. Taped splices are not allowed. Molded, porcelain and tape terminations are not acceptable. Mechanical terminations are not approved. Terminations should be irreversible, i.e., crimped or exothermically welded.

10. Grounding:

- Ground rods, where used, shall be 3/4" copper clad, minimum length of 10'. Ground resistance shall normally be less than 25 Ohms though certain AF facilities may require ground resistance to be less than the minimum specified in the NEC. Transformer grounds shall be a 4-rod grid, 2 feet from the pad.

  All ground rod connections below ground shall be exothermic or high compression irreversible connectors. Grounding for lightning arrestors on distribution lines shall be 15 ohms or less. Equipment ground conductors shall be an insulated conductor except lighting fixtures may be grounded through conduit.

Ref.: UFC 3 520 01, Sec. 3-11 and UFC 3 550 01, Sec. 3-14

11. Lightning and Surge Protection:

- A Lightning Protection System will require a Risk Assessment to justify if a facility actually "needs" or just "wants" a Lightning Protection System installed. Authority having jurisdiction (AHJ) will decide based on local conditions, strike density, and other variables which might make an LPS necessary for one military installation where it would not be necessary for a military installation at another location, even if

using the same design. Depending on location, if direct strikes are not probable, and if assets are less than the cost of the LPS and its maintenance, use surge protective devices to provide protection for indirect strikes and voltage surges from other sources. SPDs will also protect against switching surges from power outages and restorations of power.

Ref.: UFC 3 575 01, Sec. 3-1.1.1 and UFC 3 575 01, Sec. 3-1.1.3

KAFB <u>only</u> requires Lightning Protection Systems for Nuclear-Capable Weapons and Munitions Storage and Maintenance Facilities.

Provide UL 1449 listed lightning/surge protection for all phase and neutral conductors at service entrance and branch panels for the appropriate category as defined in ANSI C62.1, and C62.45 and tested as defined in ANSI/IEEE C62.41. Test Wells will be installed at ground level points to access ground grid. Periodic testing of lightning protection systems is required by DoD.

Engage a qualified installer to design and install the lightning protection system. Installer shall have either a current LPI Master Installer certification or current UL listing (Category OWAY) for Lightning Protection Installation. The installer shall have successfully completed not less than 5 lightning protection installations of similar scope to this project. KAFB will inspect the lightning protection system for acceptance in accordance with AFMAN 32-1065, NFPA 780 and UL 96A. Provide products that are NRTL listed for lightning protection use.

Testing of the lightning protection system shall be by a certified third-party testing agency, who is not affiliated with the designing or installing contractor. This certified third-party testing agency will be the BMC.

Ref.: UFC 3 550 01, Sec. 3-10.6 and UFC 3 575 01

<u>12. Ductbanks:</u>

- All underground primary circuits shall be concrete-encased Sch. 80 PVC conduit, with spare and include phase identifying tape, cable identification labels, and have a metallized marking tape installed 12” above the new ductback. Concrete should be dyed red in color. Direct burial of underground primary distribution cables is not approved.

Ref.: UFC-03 550 01 chg3 (2019); Sections 3-11.2 and 3-12

<u>13. Conduit:</u>

- EMT or PVC may be used where permitted by NEC. Galvanized rigid conduit or intermediate metallic conduit may be used for all locations. Conduit for underground primary distribution shall be no less than 5” schedule 80 PVC with spare concrete encased in red dyed concrete. For transitions from underground to aboveground, the first 10 ft. must be Rigid Galvanized Metal (RGS).

The below grade portion of RGS shall be protected with factory-applied PVC coatings, two layers of 10-mil PVC pipe wrap tape, or two coats of asphaltic paint (tar) applied after assembly.

All underground primary distribution conduits shall be encased in red dyed concrete. Base preference is for all outside conduit/conductors to be placed underground.

Ref.: UFC 3 520 01, Sec. 3-6.2 and UFC 3 550 01, Sec. 3-11.2

14. Emergency Generator:

- Fuel for emergency generators shall use diesel only with fuel on site to operate a minimum of 72 hours. Use caution during design to ensure that generator fueling access is included. Base Fuels refueling vehicles have a limited hose length and adequate fueling access (within 50 feet of the tank) is critical. Auto transfer switches shall be 4-pole only (switched neutral), with maintenance bypass isolation. No exercise timer. Transfer switch to operate by linear solenoid.

  KAFB has a Manufacturer Standardization signed by the BCE in 2022 for Cummins/ONAN. KAFB preferred Manufacturer for Transfer Switches is Cummins.

  All stationary generators are required to have a 20.11.41 NMAC Authority to Construct (ATC) permit from the Albuquerque Environmental Health Department (AEHD) Air Quality Division (AQD). The ATC permit must be in place prior to "commencing construction" (20.11.41.7.C NMAC and prior to purchasing the unit). It may take as long as seven (7) months from the initiation of the permit application preparation process to receive a permit from the Albuquerque Environmental Health Department (AEHD) Air Quality Division (AQD). The project is expected to pay for the cost of preparing the permit application and the associated AEHD air quality permit fees. The organization must also plan to pay emission fees for the generator on an annual basis. Any generator purchased for use on KAFB must have the appropriate emission certification from the EPA. Generator engines are subject to New Source Performance Standards (NSPS) which require engines to meet strict emission standards. Once the generator is in place and in operation, the tenant is responsible to maintain the equipment until it becomes Real Property Equipment. Maintenance shall be according to the manufacturing specification and operation of the generator shall be in accordance with the conditions of the air quality permit.

Ref.: UFC-03 540 01

15. Service Entrances and Distribution Equipment:

- New electric service entrances shall be underground in conduit. 600-volts and below rated cables may be in direct buried conduit. All new service transformers shall be pad-mounted type. Transformer service shall be underground to service disconnect.

Ref.: UFC 3 520 01, Section 3-2

16. Panelboards:

- Bolt-on breakers shall be specified. Provide 25 percent, minimum of 4, spare 20 Amp single pole breakers and an equal number of spaces. Provide at least two 1" conduits to above ceiling at panel location. Use only copper buses. Provide 200 percent neutral bus where required.

Ref.: UFC 3 520 01, Sec. 3-2.5

17. Revenue Metering:

- Electrical Meters: Exterior (Honeywell/Elster A3TL) Interior (Schneider PM5560). All new and modified electrical installations shall have metering installed by the contractor. KAFB does not supply parts or meters.
  Electric Meters shall meet Department of Defense cybersecurity and technical requirements that shall be provided by the Civil Engineering Operation's Utility Manger.

  Electric Meter Installation for DOD/Air Force Facilities:
  Exterior (Honeywell/ Elster A3TL) capable of connecting and communicating advanced metering infrastructure operating at 902 MHz to 928 MHz radio frequency. Internal metering Schneider PM5560 Interior (Schneider PM5560) connected and communicating within the AF Cybersecurity protocols. All new meter installations for Department of Defense and Air Force Facilities shall include the installation of new properly sized split or solid core current transformers (CTs). All new meter installations shall be connected from the meter to a RJ45 jack in the mechanical room, to a patch panel in the communications room, and then to the Air Force switch in the communications.

  New Meter Installation for Non-DOD/AF facilities:
  If facility requires a new transformer providing power, transformer shall have a Honeywell Elster type AT3L meter installed capable of connecting and communicating advanced metering infrastructure operating at 902 MHz to 928 MHz radio frequency. Recommended Internal metering Schneider PM5560. With the capability to be connected from the meter to a RJ45 jack in the mechanical room, to a patch panel in the communications room, and then to the Air Force switch in the communications.

  A temporary electric meter will be required to be installed at each construction site (for reporting utility consumption during construction).

Ref.: UFC-03 520 01 (2015); Sec. 3-5 (as it relates to AMRS projects) and UFC 3 550 01, Sec. 3-15

18. Lighting:

- LED is preferred.

  If Fluorescent, use 32-watt T-8 lamps with electronic ballast designed to operate with energy efficient lamps. Lamp color temperature of 4100 K is preferred. If HID, use

metal halide or high-pressure sodium. When an equal is commercially available, use LED fixtures in lieu of HID lamps. Do not use low pressure sodium fixtures.

For street and parking lot lighting, follow the KAFB Integrated Facility Standard (IFS). Per ETL 07-2007 incandescent lights are prohibited on AF Bases, use LED lights.

For airfield lighting requirements, use UFC 3-535-01. Coordinate Lighting Site Plan and Landscape Plan to mitigate light pole and tree conflicts.

Ref.: UFC 3-530-01.

19. Automatic Fire Detection and Alarm system:

- KAFB has a Manufacturer Standardization signed by the BCE in 2022 for Monaco Enterprises Inc. MAAP X fire alarm control panels which operate in a zoned system. All design work shall comply with Unified Facilities Criteria UFC 3-600-01 Fire Protection Engineering for Facilities. Use KAFB's edited 16721 Automatic Fire Detection and Alarm System specifications.

Ref.: UFC 3 520 01, Sec. 3-2.7, for power to these systems

20. As-Built Drawing Files:

- Shall be in AutoCAD 2018, or 2014. One (1) copy of files that show modifications to the primary distribution system, shall be provided to the CE Operations Engineering office, 853-1817, and the CE Exterior Electric Shop, 846-8145.

21. Energy Conservation Initiative:

- Energy performance must meet or exceed the requirement of UFC 1-200-02, High Performance and Sustainable Building Requirements.
  i) New buildings shall be greater or equal to 30 percent more efficient than ASHRAE 90.1 -2007 and renovated buildings shall strive to be greater or equal to 20 percent more efficient.
  ii) When cost justified and applicable to building type, follow ASHRAE 50 percent Advanced Energy Design Guide recommendations
  iii) New buildings must be certifiable for LEED Silver minimum.

Utilize Energy Star qualified products.
Use variable speed fans and pumps unless other alternative provides a lower lifecycle-cost or special system constraint require constant speed equipment.

Lighting: Occupancy/Vacancy sensors: Occupancy or vacancy sensors shall be of the dual-technology type. Use occupancy or vacancy sensors on:

i) All lighting systems with a connected load greater than 1,000 watts.
ii) All Bathrooms
iii) Any area that is frequently unoccupied during duty hours.

Incandescent lights: ETL07-2007 bans incandescent lights. Interlock dimmer system with conventional fluorescent lights to prevent both lighting systems from operating simultaneously.
Non-security outside lights: Interconnect outside lights and photocells with the EMCS system. Program the lights to shut off when not needed.
Exit signs: Use LED type exit signs.

References

(The latest versions should be used. When a version is listed below, it is to assist with locating the applicable reference.)

1. UFC-03 501 01 – Electrical Engineering
2. UFC-03 520 01 – Interior Electrical Systems
3. UFC-03 550 01 – Exterior Electrical Power Distribution
4. UFC-03 560 01 – O&M Electrical Safety
5. AFMAN 32 1062 – Electrical Systems, Power Plants and Generators
6. AFI 32 1064 – Electrical Safe Practices
7. AFMAN 32 1065 – Grounding and Electrical Systems
8. Other UFCs and References as noted in the items below.

It is mandated that, prior to beginning project design efforts, the Designer-of-Record (DoR) and Prime Contractor familiarize themselves with the following Chapters of the above-referenced documents and utilize them in their work:

1. UFC-03 501 01 - Electrical Engineering; Chapters 1, 2, and 3.
2. UFC-03 550 01 chg3 (2019) - Exterior Electrical Power Distribution; Chapters 1, 2 and Appendix C

Revision History

Revision	Date	Change Summary
0	TBD	Initial submission
1	03Feb2023	Update POC's, stringent regulations
2	24Oct2024	Update requirements