

FORT CAMPBELL, KENTUCKY

TECHNICAL DESIGN GUIDE

Revision Date: 4/15/2015

Instructions for Use

Technical Design Guide (TDG) contents are controlled by Fort Campbell, Kentucky, Directorate of Public Works (DPW) and is prepared and revised with subject matter expert (SME) input from within DPW and the Louisville District Army Corps of Engineers (USACE-LRL). It is updated by DPW System Engineers and housed on the Directorate of Public Works website. The document contains mandatory criteria, policies, and procedures that apply to all design and construction at Fort Campbell.

To aid the reader, the document utilizes (blue) hyperlink text, which can be accessed by “clicking” the colored text.

The TDG is written using MasterFormat (Construction Specifications Institute (CSI)) division categories, as implemented in the Unified Facilities Guide Specifications (UFGS), where possible. Additional information is added preceding the Division specific entries where items do not fit within a specific section.

Any highlighted text is not intended and is an artifact. The Revision Status page is provided for revision date. Revisions marked “Current” have had no changes made in this revision and the present revision date is not known.

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			SME
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General Information and Administrative Requirements

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1-1 Purpose

- 1-1.1 Fort Campbell Requirements are considered mandatory. Requirements shall be reflected on construction contract documents and support data.
- 1-1.2 The Fort Campbell, Kentucky, Technical Design Guide provides a single-source, comprehensive resource for technical requirements regarding all MILCON and OMA program projects located on post.
- 1-1.3 The technical guidance and criteria in this document is considered specific to Fort Campbell and it applies to all engineering and construction efforts completed by the Directorate of Public Works (DPW), the US Army Corps of Engineers (COE), and all Contract A-E designers.
- 1-1.4 The Fort Campbell, Kentucky, Technical Design Guide is the result of ongoing joint efforts between Fort Campbell and the Louisville District Army Corps of Engineers (USACE-LRL) and is the property of the Fort Campbell, Directorate of Public Works.
- 1-1.5 The Fort Campbell, Kentucky, Technical Design Guide is maintained by the DPW and the current revision is made available at the public access website, under the Technical Design Guide link. The DPW URL is :
<http://www.campbell.army.mil/campbell/directorates/DPW/Pages/DPWHomePage.aspx>

Currently, the entire, direct link is:

http://www.campbell.army.mil/campbell/directorates/DPW/Documents/Docs/FTC_Tech_Design_Guide.pdf

- 1-1.6 A joint DPW and COE committee oversees maintenance, evaluation, and revision of the technical contents. Specific guidance and criteria contained within are developed through specialized sub-committees with representatives from engineering, construction, and maintenance personnel from Ft. Campbell and Louisville COE. It is intended by the committee that the document continuously grows to accept additional information, accept changes in technology, and reflect changes in Army guidance, policies and visions.
- 1-1.7 The Fort Campbell DPW vision includes the need for consistent design and construction of environmentally sound, energy efficient, easily maintainable facilities. This technical document is part of an ongoing commitment to bring that vision into reality at Ft. Campbell.

1-2 Document Format

1-2.1. The TDG is written using MasterFormat (Construction Specifications Institute (CSI)) division categories, as implemented in the Unified Facilities Guide Specifications (UFGS), where possible. Additional information is added preceding the Division specific entries where items do not fit within a specific section.

1-2.2. Instructions to Designers provide technical directions and describe where Fort Campbell Requirements shall be stated in contract and supporting documents.

1-3 Application

1-3.1 Contents of this document shall apply to design and construction effort for all MCA funded and OMA funded projects completed by the DPW and/or the USACE-LRL. It applies to both in-house staff and to contracted designers.

1-3.2 This document shall be used in collaboration design and Urban Design requirements described in companion document: ACSIM, Army Installation Design Standards, also available on the Internet.

1-4 Design Submittals

1-4.1 All MILCON funded project designs shall follow design and submittal procedures outlined in the Project Management Plan (PMP) together with the A-E Scope of Services, or the in-house Quality Control Plan/Contract.

1-4.2 All OMA funded project designs shall follow design and submittal procedures identified in the designer prepared "Statement of Work" or "Performance Work Statement".

1-4.3 It is the responsibility of the Designers of Record to insure technical contents of this document are incorporated into design documents prior to submission for review.

1-5 Document Improvements and Deviations

1-5.1 Recommended changes, additions and requests for deviation are invited. Recommended changes, additions, additional guidance topics and requests to deviate from the guidance are accepted at any time. Recommendations can be offered electronically or in paper form. To assist those reviewing recommendations, a sample form containing the needed information is available in [Figure 1](#). Completed forms shall be provided to the DPW System Engineers or Louisville COE Committee Member identified below:

Fort Campbell System Engineers

Robert Galbraith, Electrical System Engineer/Manager
Phone: 270.798.2940
robert.t.galbraith2.civ@mail.mil

Mir Khan, Mechanical System Engineer/Manager
Phone: 270.412.0811
mir.f.khan.civ@mail.mil

Robert MacKay, PE Civil System Engineer/Manager
Phone: 270.412.0870
robert.b.mackay14.civ@mail.mil

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Chapter 1
Figure 1:
Recommended Document Change

Please Indicate the Type of Proposed Change:

____ Modification ____ New Topic

Please Indicate the Recommended Priority:

____ Routine ____ Urgent

Please Explain the Proposed Change:

Please identify any guidance, criteria, or reasons causing the proposed change:

Please Provide the Point of Contact who generated this proposal:

Name: _____

Phone: _____

Email: _____

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CHAPTER 2

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2.0 General Design Criteria

MILCON Projects

For new construction in the MILCON program, design effort will be completed in accordance with the approved Project Management Plan (PMP), design contract scope of services, and identified criteria. The ACSIM, [Army Installation Design Standards](#), together with this document shall both apply to engineering and construction actions.

OMA Projects

For Operations and Maintenance projects, design effort will be completed in accordance with the DPW contract scope of services. Scope of design services shall be based upon the designer prepared project specific [Scope Definition Document](#) that is completed after a pre-design conference and site evaluation.

MILCON and OMA Projects

The designer must carefully consider the mounting location of each HVAC equipment from a maintenance standpoint. If the equipment must be mounted above the floor, it must easily accessible from a step ladder or include a catwalk and ladder for maintenance or filter changes. Equipment should be located so that moving furniture is not necessary. VAV boxes or other HVAC equipment above a suspended ceiling must be mounted low enough that a mechanic can service it using a ladder without having to disassemble the ceiling grid. Designers must show the mounting height and insure access to all sides of equipment.

The designer will ensure that the mechanical and electrical areas are located for easy access.

Four-pipe heating, ventilating, and air conditioning (HVAC) systems shall be installed for year-round heating and cooling in barracks and administrative spaces. Radiant heat shall be installed in all high bay areas that require heating. Steam is not preferred.

When new equipment is added to an existing building, the new mechanical systems must be compatible with the existing systems and composed of standard commercially available items with readily available service and repair parts into the foreseeable future.

Any mechanical rooms above the first floor shall have access (door, removal louvers, etc.) of ample size such that the largest piece of installed equipment could be removed through the opening and transported to the outside of the building.

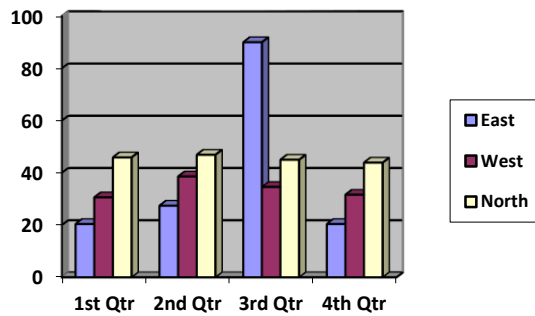
For each piece of equipment ask yourself how the maintenance technician will access the equipment for service, repair, and removal and replacement of heavy parts such as motors.

Energy Conservation Program

Section 2, Executive Order 13423 states “(a) Improve energy efficiency ...through reduction of energy intensity by 3% annually...” , “(c) Beginning in FY 2008, reduce water consumption intensity...by 2 percent annually...”.

Fort Campbell’s preferred manufacturers are shown on the following table:

Item	Preferred Manufacturer	Model/Remarks
Plumbing Systems		
Circulating Pump	Bell and Gossett or Taco	Bronze body or suitable for the service specified
Commodes – flush valve type	Kohler or American Standard	1.6 gallons Sloan flush valve, manually operated
Commodes – tank type	Kohler or American Standard	1.28 gallon per flush with 3-inch glazed trapway
Faucet - lavatory	Delta or Moen	Metal body, Single handle – or as specified
Faucet - shower	Delta, Moen, or Simmons	Temperature and pressure balanced, single handle. No institutional shower heads allowed.
Urinals	American Standard or Kohler	1/8 gallon per flush, ultra low flow, flush valve, manually operated.
Water Boiler	Lokinvar or Raypack	Copper fin tube non-condensing type
Water Cooler – Wall Hung	Sunrock	As specified
Mechanical Systems		
Air Compressors	Quincy	
Air Conditioners, DX and heat pump, 5-ton cooling capacity, or less	Trane, American Standard, or Carrier	
Chillers	Trane or Carrier	Magnetic Bearing
Furnaces, 200,000 BTU/hr heat capacity, or less	Trane or Carrier	
Steam regulators	Leslie	
Electrical Systems		
Building Controls	Johnson or Honeywell	
Utility Monitoring & Controls	Tritium or Lon Works	



Copper-fin-tube hot water boilers, non-condensing type, are preferred for all comfort heating and large domestic hot water requirements, in lieu of cast iron sectional or fire tube boilers.

Outdoor copper fin tube boilers shall be equipped with freeze protection. Primary/secondary piping with primary loop pump interlock as primary freeze protection is preferred. Freeze valve or solenoid that flows water through the boiler on power failure is acceptable.

Install emergency boiler shutoff (push button) switches just inside mechanical room door.

In converters, use stainless steel converter tubes instead of copper.

Include manufacturer approved devices installed for testing samples of water and steam in the system (both in the mechanical room and at the ends of the system).

At the steam entrance into a building, install a double-block-and-bleed valve arrangement for positive isolation and venting of the steam during maintenance of the downstream system components.

For oil containing equipment, design a containment curb under the equipment.

Do not install equipment in pits.

Roadway Construction

All roadways shall be designed in accordance with the AASHTO Green Book.

Pipes shall have low profile headwalls or flared end sections. Pipes under roadways will have a minimum diameter of 15 inches or have an equivalent capacity with an elliptical pipe. Pipes under driveways must have a minimum of 12 inches in diameter. All pipe under roadways must be reinforced concrete pipe unless approved DPW.

Sidewalks and parking lots must meet ADA requirements. A red truncated rubber mat will be placed at the end of a ramp in accordance with ADA requirements.

All entrances that may now or later be used by truck or buses shall have a minimum 45 foot radius. Entrances that will only be used by cars shall have a minimum of 25 foot radius.

New roadways and bridges shall be designed for MLC 24 loadings unless otherwise specified or approved by DPW.

No temporary construction equipment or facilities including fence shall be placed closer than 10 feet to the edge of pavement. The clear zone must be kept clear of obstacles.

Temporary Traffic Control (TTC) will be the contractor's responsibility. A TTC plan must be submitted to DPW for its review. All TTC shall be in conformance with Chapter 6 of the MUTCD. Signs, pavement marking and barricades shall be inspected on a daily basis and a log showing the inspection, the deficiencies and the corrections must be submitted to the engineer on a weekly basis. Signs shall be cleaned as necessary to keep the message visible.

No work shall be done within 25 feet of the center of the railroad track and any work done on or near the railroad will need coordination with the DOL Transportation Office before work commences.

2.0.1 Deliverables

Drawing Standards

- All CADD drawings shall be done on Bentley Microstation Release 8 or a compatible approved equal system.
- Drawing scale units shall be in the English system. Regardless of the CADD program the Contractor uses in-house, drawing submittals all drawings shall be in a Bentley Microstation release V8, V8i, or a compatible, approved equal.
- Cardinal North shall be oriented either to the top or upper right quadrant.
- Sheet border shall be provided by DPW-EDB.
- A graphic scale shall be shown on each sheet of the drawings.

The CADD Drawing file naming convention shall follow Chapter 2 of the "A/E/C CADD Standards" Document within the Spatial Data Standards Facilities/Infrastructure/Environment (SDS/FIE) model maintained by the CADD/GIS Technology Center (<http://tsc.wes.army.mil>).

Layer/Level assignments of feature data within the CADD drawings will follow 'Appendix A: Model File Level/Layer Assignment Tables' of the "A/E/C CADD Standards" Document within the Spatial Data Standards Facilities/Infrastructure/Environment (SDS/FIE) model maintained by the CADD/GIS Technology Center (<http://tsc.wes.army.mil>).

The "A/E/C CADD Standards" Document (26MB) are available at the following internet site:
<http://tsc.wes.army.mil/products/tssds-tsfmts/tssds/projects/sds/>

To request an "A/E/C CADD Standard" CD, go to
http://tsc.wes.army.mil/comments/aecstds_comments/AECSDS-CommentForm.asp and fill out the CD request form.

The 'CADD Drawing file naming convention' is referenced in the '*Release 2_x Document*' folder on of the "A/E/C CADD Standards" CD. It is an Adobe Acrobat PDF document named 'volume1.pdf'. See Chapter 2 for 'CADD Drawing Naming Convention' standards.

The 'Layer/Level assignments of feature data within CADD drawings' is referenced in the '*Release 2_x Document*' folder on the "A/E/C CADD Standards" CD. It is an Adobe Acrobat PDF document named 'volume1.pdf'. See 'Appendix A: *Model File Level/Layer Assignment Tables*' within the PDF document.

For MILCON projects, Drawings shall also be prepared in accordance with USACE Standards available from the PE/A.

For OMA projects, Drawings shall also be prepared in CADD format using standard 24" X 36" sheets.

Drawings for all projects that are Ready to Advertise (RTA) shall be in the approved electronic format.

Hard-copy Drawings

- Final construction contract drawings and as-built drawings submitted for official government records shall be digital and placed on 24" x 36" white bond paper.
- Sheet border shall be provided by DPW-EDB.
- A graphic scale shall be shown on each sheet of the drawings.

Digital Drawings

- Searchable PDF shall be provided for each final design drawing.

Specifications

For MILCON projects, specifications for projects that are RTA shall be included only in the approved electronic format.

For OMA projects, Construction specifications shall be prepared as agreed in the Scope Definition Document. Specifications for projects that are RTA shall be included only in the approved electronic format.

Calculations

- Supporting calculations shall be provided for all engineered designs.
- The Designer of Record must provide calculations (in accordance with all required regulations, codes, specifications, UFGS, UFCs, etc.) to verify proper design and operation of the facility in all disciplines.
- Calculations must be described fully, written clearly, and lead the reviewer through the design by stating all assumptions and design inputs.
- Computer printouts are acceptable only if accompanied by explanations to allow adequate independent review of calculation methods and results.

Design Analysis

For MILCON projects, design support documentation shall be provided. The Design Analysis shall be completed in the approved format and as required in the appropriate UFC. At the conclusion of the design effort, the documentation shall be provided in an approved electronic format.

2.0.2 Antiterrorist / Force Protection

All new construction projects including additions and alterations shall include antiterrorist / Force Protection (AT/FP) features in accordance with UFC 4-010-01, DOD Minimum Antiterrorism Standard for Buildings.

2.0.3 Fire Protection/Life Safety

Every project including MILCON and OMA shall be designed using only the following DOD directed criteria:

- [UFC 1-200-01, General Building Requirements](#) shall be used mandatory guidance concerning required model building codes for design and construction.
- Fire Protection requirements shall comply with [UFC 3-600-01, Fire Protection Engineering For Facilities](#).
- Exiting requirements shall comply with the Life Safety Code, NFPA 101.
- No asbestos containing materials shall be used for construction.

2.0.4 Metric Design

Consideration of Metric dimensioning (SI) is required for all MILCON projects. Project specific guidance is available through the Louisville District project PE/A. For OMA projects, metric dimensioning is used on a case-by-case basis: If the original project was developed in English (IP) units, follow-on OMA projects can also use English inch-pound (IP) units.

If the original documents were developed in metric units, the OMA projects must also be executed in metric (see contrary requirements in 2.0.1).

2.0.5 Surveying and Mapping Requirements

Coordinate System

- The coordinate system used to maintain digital data will be the Tennessee State Plane Coordinate System (TN SPCS). The datum used will be the North American Datum of 1983 (NAD83). The mapping unit will be 'US Survey foot'. The vertical datum used will be the North American Vertical Datum 1988 (NAVD1988).
- Mapped geographic data will have precision less than one (1) meter vertical and horizontal unless otherwise stated in the Scope of Work.
 - The digital geospatial data will be 99% free of topological errors including, but not limited to: the absence of dangling nodes, undershoots, overshoots, and snapped nodes for line segments; the existence of features that have area (square footage) will have polygon representations (per SDSFIE).
- GPS - Surveyed data shall be within one (1) centimeter horizontal and two (2) centimeters vertical precision unless otherwise stated in the Scope of Work.

Fort Campbell has the following control point network and datum requirements for every MILCON project.

- Two new control monuments shall be established on site and tied to Tennessee State Plane Coordinate System NAD 83.
- The survey control points are GPS Class I and Class II Horizontal with additional elevation coming from an off-post USGS Class I bench mark to establish Second Order Class II vertical on all survey control points.
- Hardcopy books of existing points (including sketches) are maintained at both Fort Campbell DPW Engineering Design Branch and the Louisville District (POC Chris Heintz (502) 315-6408).
- For work contracted by Louisville District, the contractor is required to establish a permanent baseline at the project. In areas where existing concrete monuments are abundant, iron pins with caps are allowed. The contractor supplies CELRL-ED-M-SM (Survey and Mapping Section) with description sheets for the points they establish and the District forwards the information to Fort Campbell.
- Similarly, OMA work performed by Fort Campbell will have the survey control point data reported to the DPW POC for forwarding to the District.

2.0.6 Geotechnical Requirements

The following is a list of aggregate sources for concrete, asphalt, stone-base, sub-base, and DGA which met or exceeded the quality standards set forth in the technical sections of the COE specifications for Fort Campbell projects:

Coarse material sources for base course, bituminous paving, cast-in-place structural concrete, concrete pavements, and pre-cast architectural concrete.

- Hopkinsville Stone, Hopkinsville, KY, Ledges 11 to 17, about 85 feet.
- KY Stone Company, Canton, KY, Ledges 2 and 3, about 33 feet.
- Vulcan Materials, Gilbertsville, Kentucky. Ledges 4 and 26, about 393 feet.
- Martin-Marietta Aggregates, Smithland, Kentucky, Ledges 16 to 19, about 51 feet.
- Vulcan Materials, Clarksville, TN, Ledges 16 & 17, about 30 feet.
- Winn Materials, Clarksville, TN, Ledge 3, about 20 feet.

Natural fine aggregate sources for concrete, asphalt, stone-base, subbase and DGA are listed below.

- Delta Materials, Henderson, Kentucky.
- Ingram Materials, Paducah, Kentucky.
- Mayfield Aggregates, Mayfield, Kentucky.
- Delta Materials, Cairo, Illinois Manufactured fine aggregates for concrete:
- Hopkinsville Stone Company, Hopkinsville, Kentucky.

POC for further information at the Louisville District contact:

Mr. David Black (502) 315-6436
Mr. David Kiefer (502) 315-6445

2.0.7 Cost Engineering

- Both MILCON and OMA projects require a construction cost estimate.
- For MILCON projects the estimate shall be prepared using M-CACES software.
- Cost estimates for OMA projects shall be provided to the DPW at the time of submittal for bid issue.
- Official government cost estimates are not to be made public. They remain the property of the Government, and classified FOR OFFICIAL USE ONLY.

2.0.8 Engineering Considerations and Instructions for Field Personnel

This documentation is required for all MILCON projects, and is normally a part of the Design Analysis. It offers the designers an opportunity to provide a written document providing important design facts to the construction field personnel. An example format of the [Engineering Instructions](#) is provided, which shall be revised and reflect project specific information.

2.0.9 Transfer and Acceptance

Completion of the Transfer and Acceptance of Military Real Property, DD Form 1354 is required for all projects. A draft copy of this information must be submitted with the Final Design submittal. This requirement applies to both MILCON and OMA program projects. DA Pam 415-28 is used to determine Cat Code for facility being transferred (http://www.apd.army.mil/pdf/p415_28.pdf)

2.1 Special Ft. Campbell Criteria

2.1.1 Army Energy Program

Refer to [UFC 1-200-02](#), High Performance and Sustainable Building Requirements, 1 March 2013 Table 1-1, page 2.

Consider the following questions during project design:

- A. Is the garrison meeting annual federal energy and water reduction goals as compared to baseline usage?
- B. Does the garrison use an energy design guide/checklist for all project designs to ensure that all cost-effective energy measures are incorporated into the design?

- C. Are procedures in place to ensure that all new purchases of equipment are an Energy Star or FEMP designated product?
- D. Is the garrison implementing other renewable thermal energy technologies (biomass, geothermal, solar water heating? Etc.) to meet the goal of 25% renewable energy consumed by 2025?

2.1.2 Historic District

The “Clarksville Base” portion of Ft. Campbell cantonment area is eligible for the National Register of Historic Places as a significant Cold War historic district. Designers are required to consult with the State Historic Preservation Office (SHPO) and the federal Advisory Council on Historic Preservation for any projects that are sited at the Clarksville Base. POC is DPW Environmental Division Cultural Resource Manager at 270-798-7437.

2.1.3 Environmental

The Environmental Division is under the guidance of the Directorate of Public Works at Fort Campbell. The [Environmental Division](#) Internet address will provide added information and points of contact.

Environmental Compliance is mandatory for all projects.

- **Designers shall NOT contact Kentucky or Tennessee regulators** regarding environmental issues. Contact the Ft. Campbell Environmental Div.
- 24-hour "Environmental Quality Officer" course is available bi-monthly on post by Ft. Campbell's Environmental Division. Designers are encouraged to attend.
- Designs shall take into consideration wetlands and endangered species on the installation.
- Several environmental topics contained in this document include the following:

APPENDIX A:

[Occupational Health Considerations](#)

[Clean Air Act](#)

[Clean Water Act](#)

[Safe Drinking Water Act](#)

[Toxic Substance Control Act \(Lead Based Paint and Radon\)](#)

[FIFRA \(Pesticides\)](#)

[Solid Waste Disposal/Diversion Practices](#)

[Hazardous Waste Disposal Practices](#)

[Emergency Planning and Community Right to Know](#)

2.1.4 Underground and Aboveground Storage Tanks

Aboveground and underground petroleum product storage tanks shall not be permitted at new construction projects without design review and approval by the Directorate of Public Works, Environmental Division, Petroleum Storage Tank Program Manager.

Underground Storage Tanks (USTs) shall not be installed without approval from the DPW Environmental Division. USTs shall be double walled steel fiberglass coated with interstitial monitoring and automatic tank gauging. The monitoring system shall be compatible with the systems already in use and capable of being remotely monitored by the Environmental Division. No used oil USTs shall be installed.

Above Ground Storage Tanks (ASTs) shall not be installed without approval from the DPW Environmental Division. ASTs shall follow requirements outlined in the Ft. Campbell Technical Design Guide, [Section 33 56 10](#) Factory-Fabricated Fuel Storage Tanks.

Design for used petroleum products holding and storage shall not include tanks. Only 55-gallon drum containers shall be used that are placed on approved pavement materials properly designed for hazardous spill containment and be secondarily contained.

2.1.5 Solid Waste Disposal / Recycling Diversion Practices

In the interest of reducing waste, Fort Campbell is actively recycling and reducing waste in all on-post operations. Contractors are required to participate in on-post programs. They are encouraged to find ways of reducing waste. Recycling shall be practiced to the maximum extent possible. Refuse materials shall be separated in accordance with installation policies and practices.

It is the intent of the installation to divert at least 50% (by weight) of all construction, renovation, and demolition debris from the Woodlawn C/D landfill. Recyclable waste materials shall not be landfilled on or off post. Recyclable materials shall be transported to designated locations for recycling or reuse.

Contractors must evaluate all diversion options and make good-faith effort to achieve the highest diversion rate within the project schedule and budget.

Contract specifications shall require at least a 50% diversion of construction and demolition (C & D) waste materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, HVAC equipment, and scrap metals be diverted from the landfill. Diversion can be accomplished by deconstructing the wood buildings and components per instructions below or by moving the structure off-post. Construction specifications shall require a C&D Waste Management Diversion Plan to be submitted and approved by DPW.

All material disposal and diversion shall be handled in accordance with [Appendix A-7, Solid Waste Disposal/Diversion Practices](#). Salvageable materials shall be disposed of as per the contract specifications. If salvageable materials are transported off the installation, the

contractor shall provide the project COR with the following information, type of material, method of disposal, and weights of material.

2.1.6 Erosion and Sedimentation Control

Erosion prevention and sedimentation control practices are required for activities that disturb soil, including construction sites and associated borrow pits, on the Fort Campbell Military Reservation.

Project plans and specifications shall include requirements contained in CAM REG 200-1 and the Fort Campbell Stormwater Management Plan. Best Management Practices (BMPs) shall follow the design criteria in the 2012 [Tennessee Erosion Prevention and Sediment Control Handbook](#).

The requirements shall apply at Fort Campbell, KY to its military units, construction contractors, Garrison activities and all authorized subcontractors.

The Tennessee Erosion Prevention and Sediment Control Handbook provides criteria for the permitting, design, installation, and maintenance of erosion prevention/sediment control practices and stormwater management to prevent water pollution. Those responsible for design of these practices shall evaluate the existing site conditions and determine if the minimum criteria contained in these standards are adequate or if more stringent criteria should be used.

2.1.7 Permits

2.1.7.a Local permits are required for construction activities at Ft. Campbell.

2.1.7.b Permits must be Contractor completed and submitted prior to beginning any construction effort.

2.1.7.c Contract documents must identify and contain permits that will apply to the contract.

2.1.7.d Among permits required included those for the following activities,

- confined space
- demolition,
- excavation,
- compaction,
- electrical,
- fuel tank installation, and
- environment.

2.1.7.e Specific Permit Information

Borrow Permit

A borrow area permit shall be obtained by contractor/sub-contractor:

- If the scope of work requires soil material to be brought in from Fort Campbell-designated borrow areas or,
- spoil material is to be transported away from the construction limits of the project to Fort Campbell-designated borrow areas.

Storm Water Pollution Prevention Permit

The contractor shall follow the guidelines and permitting process set forth in Section C1.10.6 and the Fort Campbell Policy for Storm Water Erosion and Sediment Control at Construction Projects document.

Electrical Permit

No electric equipment shall be installed within or on any Fort Campbell building, structure, or premises, nor shall any alteration or addition be made in any such existing equipment without first securing an Electrical Permit from the Fort Campbell Electrical Inspector in accordance with CAM Regulation 420-4 (Quality Assurance “Electrical” Inspection Standards) latest edition.

Landfill Access Permit

The contractor shall obtain a “landfill access permit” to gain access to Woodlawn C&D landfill.

2.1.8 Mold and Moisture Control:

Design features identified in [Appendix G](#) are critical to long term building environmental quality. They shall be incorporated into all projects.

2.1.9 Fort Campbell DPW Computer Software Capabilities:

2.1.9.a Software capabilities may vary within the DPW. To assure that electronic files can be accessed, the following versions of software are commonly utilized in the DPW:

Microstation, V8i
or later

Microsoft Office 2013
2007 or later

2.1.9.b Digital files being transferred to Fort Campbell shall be saved to allow accessibility with the above software.

2.1.9.c Files shall not be “write protected” or “view only”.

2.1.10 Installation Internet Addresses

[Ft. Campbell](#)

[The Directorate of Public Works](#)

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GENERIC SCOPE DEFINITION DOCUMENT

The following 2 pages contain a generic example of standardized "Scope Definition Document" which is required for each military O&M task order.

Items in black are part of the standard format.

Items in red are project task order specific, and should be changed for each customer request.

Items in blue are options to be considered.

DEPARTMENT OF THE ARMY U. S. ARMY ENGINEER DISTRICT, LOUISVILLE CORPS OF ENGINEERS

SCOPE DEFINITION DOCUMENT

For

PROJECT NAME

At

LOCATION

Date

1. **BACKGROUND:** Public Works Center, Detroit Arsenal defined a need for roof replacement on Buildings 229 & 231 at the Warren, MI facility (Site Map - see Enclosure 1), due to leaks and the age of the existing roofing material. There is also work slated to repair & replace air-handling units on these roofs under a separate contract prior to this replacement. Nick Ballard (ED-D-A) attend the meetings, surveyed the structures and obtained photographs and drawings for COE Louisville. This is a year-end funded design Project and must be finalized by mid-September 2000.

Information for this Scope of Work was acquired during a site visit to Detroit Arsenal on June 27, 2000 with the following personnel in attendance at meetings or the site. Kirk Dailey & Nick Ballard COE – Louisville; Jim Park (DPW Director), Bob Novak (Chief of Engineering Plans and Services) & Nabil Tominna (Project PE/A) of PWC Detroit Arsenal.

2. DESCRIPTION OF WORK: Each building is approximately 42,000 S.F. with 5400 S.F. of Penthouse roof and 36,600 S.F. of main roof with typical rooftop equipment. (Bldg. Photos - see Enclosure 2). All building equipment and problems were surveyed during the site visit and noted for review and plan preparation. (Field Notes - see Enclosure 3). PWC Detroit Arsenal provided 11 existing drawings pertinent to this roof project. (Reference Drawings - see Enclosure 4) They will also provide information as to equipment to be abandoned, capped off, removed and utility line rerouting. The customer has requested informal reviews when construction contract documents are approximately 50% complete, and a final review when 100% complete.

Initial discussions derived at the site visit and discussions indicated that the customer preferred replacement be a Modified Bitumen Roof. Existing built-up roofing is approximately 20 years old, and although in very good condition, will soon need replacement. No major environmental hazardous conditions exist. (Asbestos Reports – see Enclosure 5).

The customer also stated that he would like to receive contractor furnished an Operations and Maintenance Manual, including the manufacturers' cut-sheets showing recommended future roof penetration methods.

- Special Environmental Concerns or Requirements and Responses:
- Lead Based Paint Removal: **None**
- Asbestos Abatement: **(4) Roof samples being taken contained no asbestos.**
- Other: **None**
- Fire Protection or Life Safety Concerns or Requirements: **None**



Special work sequencing or Optional items: **None**

1. SCOPE OF DELIVERABLES TO BE PROVIDED:

Design: **[Simplified Design Method Plans and Specs]**

Review: **?? sets ½ full size CAD prints & Specs – hard copy**

Contract: **(1) Electronic CD/Hard disc to DOC**

Post Award: All final records, and (1) electronic version Microstation drawings & specs

4. TYPE OF CONSTRUCTION CONTRACT: **Job Order Contractor (JOC)**

5. DESIGN TEAM & DPW REVIEWERS:

- COE Louisville: **N. Ballard, J. Jagers, G. Minter (QC) / M. Mirzaian (PE/A)**
- DPW: Engineering:
 - Master Planning:
 - Environmental
 - Maintenance Shops:
 - Safety:
 - Fire Department:
 - ITBC:
 - End User:

6. DESIGN COST ESTIMATE: \$15,000 (See Attachment 1)

7. DESIGN SCHEDULE: 10 July to 10-12 September 2000

8. CONSTRUCTION COST ESTIMATE: Base Bid: \$480,000
Option 1: \$518,000

9. QUALITY EXPECTATIONS: Minimum QCP w/ one A/E reviewer. When signed by all parties, this document becomes the contract with the ED customer.

This package has been completed and assembled by the PE/A: Nicholas M. Ballard

This assembled complete package has been checked for completeness and compliance with the Engineering Division Quality Operating System.

Any change in any one of the items above will require a modification of this contract.

ED PE/A Name: <u>Nicholas M. Ballard</u>	Customer Name: <u>Kirk P. Dailey</u>
ED Unit Name: <u>ED-D-A</u>	Customer Office Symbol: <u>PM – M</u>
Signature: _____	Signature: _____
Date Signed: <u>11 August 2000</u>	Date Accepted: <u>11 August 2000</u>

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EXAMPLE

Engineering Considerations and Instructions for Field Personnel

B-1 General

B-1.1 Contractor's construction trailers on site must be wired per NEC, meet separation clearances, have electric meters but no water meters. COE is to coordinate with DPW Master Plans and utility personnel.

B-2 Civil

B-2.1 Notification of road closures during construction shall be given to the following agencies:

- Provost Marshall Office, Traffic Section (270) 798-6812.
- Directorate of Public Works, Master Plans, (270) 798-5643.

B-3 Geotechnical

B-3.1 During stripping and rough grading, positive surface drainage should be maintained to prevent the accumulation of water. The exposed subgrade materials are likely to be soft in some locations. Also, if conditions are encountered which are different from those described in the plans, the geotechnical engineer should be notified. Once subgrades are established, concentrated loads from construction equipment could cause pumping of the subgrade and require re-compaction.

B-3.2 Foundation designs are based on the subsurface investigation program. To verify that the foundation designs are appropriate for the structures, inspection by Corps of Engineers of the footings and undercutting is very important. Linda Davis (502) 315-6437 or Steve Durrett should be notified of the contractor schedule for performing earthwork and foundations so that inspections of the materials can be performed.

B-4 Utilities / Landscaping

B-4.1 Care should be taken in placement of underground utilities so as not to cause interference with landscaping trees.

B-4.2 Railroad crossings for gas and water piping are to be included in the drawings. The portion of the AREA-03 (the reference from which the details are taken) dealing with railroad crossings is included with these instructions.

B-4.3 Where gas and water piping are shown to be valved and capped for future expansion, the valve should be a gate valve. These are installed to prevent the need to shut down a section of the main and interrupt service in order to connect a new service line.

B-4.4 Valves should be placed to isolate each building from the main service (water and gas), and to allow only for minimal main shut down when tying to existing main lines.

B-5 Architectural

B-5.1 Hold metal roofing pre-submittal meeting, with construction, supplier, and contractor to discuss standing seam metal roof system specifications.

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----- END OF SECTION -----

TECHNICAL DESIGN GUIDE CHAPTER 3 Technical Requirements and Instructions Division 00 Procurement and Contracting Requirements

SECTION 00 22 13 Supplementary Instructions to Bidders

Ft. Campbell Requirements

Ft. Campbell Specification [Section 00 22 13, Supplementary Instructions to Bidders](#), shall apply to all MILCON projects and OMA projects issues by the Fort Campbell Directorate of Contracting (DOC) or COE.

Instructions to Designers

1. Modify the project specifications paragraphs as necessary to include all applicable portions of the Ft. Campbell Technical Design Guide:
2. For electronic copies of the document, contact the PE/A for MILCON and OMA projects by the COE. A-E's directly serving the installation should contact the PM.

Section 00 22 13: Supplementary Instructions to Bidders

20. WARRANTY OF CONSTRUCTION (MAR 1984) ALTERNATE 1 (APR 1984) FAR 52.246-211.

20.1 General Requirements.

20.1.1 In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 20.1.10 of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

20.1.1.1 Warranty Payment.

Warranty work is a subsidiary portion of the contract work, and has a value to the Government approximating 1% of the contract award amount. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: Payments Under Fixed-Price Construction Contracts. If the Contractor fails to respond to warranty items as provided in paragraph 20.5, the Government may elect to acquire warranty repairs through other sources and, if so, shall backcharge the Contractor for the cost of such repairs. Such backcharges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

20.1.1.2 Since the warranty period will extend beyond the construction completion date, this contract shall remain open until the warranty period expires.

20.1.2 This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(a) As a part of the one year warranty inspection, the Contracting Officer will conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for the Location of Wet Insulation in Roofing Systems Using Infrared Imaging". In accordance with paragraph 20.1.3 and 20.1.4, the Contractor shall be required to replace all damaged materials and to locate and repair sources of moisture penetration, at no additional cost to the Government.

20.1.3 The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

- (a) The Contractor's failure to conform to contract requirements; or
- (b) Any defect of equipment, material, workmanship, or design furnishes.

20.1.4 The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

20.1.5 The Contracting Officer shall notify the Contractor, in writing, (see para. 20.2.3 and 20.5) within a reasonable time after the discovery of any failure, defect, or damage.

20.1.6 If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, (see para. 20.5) the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

20.1.7 With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(a) Obtain all warranties that would be given in normal commercial practice;

(b) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(c) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers with specific designation of their area of responsibilities if they are to be contacted directly on warranty corrections; and

(d) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

20.1.8 In the event the Contractor's warranty under paragraph 20.1.2 of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

20.1.9 Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

20.1.10 This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

20.1.11 Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

20.2 Performance Bond.

20.2.1 The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions.

20.2.2

(a) In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have the work performed by others, and after completion of the work, will charge the remaining warranty funds established by paragraph 20.1.1.1 of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(b) In the event sufficient funds are not available to cover the warranty work performed by the Government at the Contractor's expense, the Contracting officer shall have the right to recoup expenses from the bonding company.

20.2.3 Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 20.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor as outlined in the paragraph 20.2.2 above.

20.3 Pre-Warranty Conference.

Prior to contract completion and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

20.4 Equipment Warranty Identification Tags.

20.4.1 The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

(a) The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or

most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

(b) Sample tags shall be submitted for Government review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

(c) Tags for Warranted Equipment: The tag for this equipment shall be similar to the following. Exact format and size will be as approved.

EQUIPMENT WARRANTY
CONTRACTOR FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

EQUIPMENT WARRANTY
GOVERNMENT FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty

expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by para. 20.1.

20.4.2 Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

20.4.3 Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS.

20.4.4 Equipment Warranty Tag Replacement. As stated in para. 20.1.4, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

20.5 Contractor's Response to Warranty Service Requirements.

20.5.1 Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below. If the Contractor does not perform the warranty within the timeframe specified, the Government will perform the work and backcharge the warranty payment item established under paragraph 20.1.1.1.

First Priority Code 1 Perform on site inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

Second Priority Code 2 Perform on site inspection to evaluate situation and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

Third Priority Code 3 All other work to be initiated within 3 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

- Code 1 Air Conditioning Systems
 - a. Recreational support.
 - b. Air conditioning leak in part of building, if causing damage.
 - c. Not cooling unit

- Code 3 Doors
 - a. Overhead doors not operational.
 - b. Interior/Exterior personnel doors or hardware not functioning properly.

- Code 1 Electrical
 - a. Power failure (entire area or any building operational after 1600 hours).
 - b. Security lights.
 - c. Smoke Detectors.

- Code 2 Electrical
 - a. Power failure (no power to a room or part of building).
 - b. Receptacle and lights (in a room or part of building).

- Code 3 Electrical
 - a. Street Lights.

- Code 1 Gas
 - a. Leaks and breaks.
 - b. No gas to family housing unit or cantonment area.

- Code 1 Heat
 - a. Area power failure affecting heat.
 - b. Heater in unit not working.

- Code 1 Hot Water heater Failure

- Code 2 Kitchen Equipment
 - a. Dishwasher.
 - b. All other equipment hampering preparation of a meal.

- Code 3 Plumbing
 - a. Leaky faucets.

- Code 2 Plumbing
 - a. Flush valves.
 - b. Fixture drain, supply line commode, or any water pipe leaking.
 - c. Commode leaking at base.

- Code 3 Interior
 - a. Floors
 - b. Paint chipping or peeling
 - c. Casework

- Code 1 Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2 Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2 Water (Exterior)

No water to facility.

Code 2 Water, Hot

No hot water in portion of building listed

Code 3 All other work not listed above.

20.5.2 Should parts be required to complete the work and the parts are not immediately available the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractor's proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

All roadway design shall comply with the AASHTO Green Book (A Policy on Geometric Design of Highways and Streets) and [SDDCTEA Pamphlet 55-17](#). Radii for entrances must consider the vehicles that are planned to determine the distance.

No speed bumps are allowed by Army Regulations on Army installations.

----- END OF SECTION -----

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Division 01
General Requirements

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01 57 23	<u>Storm Water Pollution Protection</u>
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SECTION 01 14 00
Work Restrictions

Ft. Campbell Requirements:

Roadway Construction

All roadways shall be designed in accordance with the AASHTO Green Book.

Pipes shall have low profile headwalls or flared end sections. Pipes under roadways will have a minimum diameter of 15 inches or have an equivalent capacity with an elliptical pipe. Pipes under driveways must have a minimum of 12 inches in diameter. All pipe under roadways must be reinforced concrete pipe unless approved DPW.

Sidewalks and parking lots must meet ADA requirements. A red truncated rubber mat will be placed at the end of a ramp in accordance with ADA requirements.

All entrances that may now or later be used by truck or buses shall have a minimum 45 foot radius. Entrances that will only be used by cars shall have a minimum of ___ foot radius.

New roadways and bridges shall be designed for MLC 40 loadings unless otherwise specified or approved by DPW.

No temporary construction equipment or facilities including fence shall be placed closer than 10 feet to the edge of pavement. The clear zone must be kept clear of obstacles.

Temporary Traffic Control (TTC) will be the contractor's responsibility. A TTC plan must be submitted to DPW for its review. All TTC shall be in conformance with Chapter 6 of the MUTCD. Signs, pavement marking and barricades shall be inspected on a daily basis and a

log showing the inspection, the deficiencies and the corrections must be submitted to the engineer on a weekly basis. Signs shall be cleaned as necessary to keep the message visible.

No work shall be done within ___ feet of the center of the railroad track and any work done on or near the railroad will need coordination with the DOL Transportation Office before work commences.

SIGNS

Signs shall comply with the 2009 MUTCD and SDDCTEA Pam 55-14. The size and shape shall comply with the MUTCD and the placement shall be as prescribed in the MUTCD. The signs must meet the minimum reflectivity as required by the MUTCD. In the Fort Campbell cantonment area, all signs shall be treated as urban standard and signs in the training area shall comply with the rural standard.

Reflectivity shall be tested and results submitted to DPW and the engineer.

All signs that were in place prior to construction shall be removed and new signs placed as shown. Other signs such as school zones and railroad crossings shall comply with the MUTCD.

SECTION 01 35 26 Government Safety Requirements

Ft. Campbell Requirements:

1. Fall Protection

All new and/or roof replacement projects (sloped roofs only) will incorporate the installation of a permanent fall protection system which meets the requirements of ASHA Guideline 1926:502 (d) (16) (ii-iii-iv). This system shall be similar or equal to a Super Anchor system as manufactured by Super Anchor Safety, 8522 216th Street SE, Woodinville, WA 98072-8009 (Phone 425-488-8868).

2. Utilities

Ft. Campbell requires contractors have buried utilities marked prior to starting any excavation/digging. Fort Campbell has stopped using dig permits. Instead, Tennessee One Call is now being used to locate buried utilities prior to digging/excavation (800-351-1111). See [Appendix C](#) for further information. If contractor cuts utility lines after being marked or does not get them marked he should be responsible for making **immediate** repairs (to be coordinated with the appropriate Government maintenance entity or be billed for repairs if the Government makes the repairs).

Ft. Campbell will allow a 4-8 hour utility outage if the utility is not a critical customer need and is properly coordinated and public notification is made to impacted customers. Outages shall be limited to not more than 3-4 to a customer for the contract duration. For a major outage, Ft. Campbell would advertise for at least 2 weeks prior to outage occurrence.

Avoid locating new utility lines under pavement where possible. When utilities are required to cross under roads/streets, boring is required (no cutting of pavement is to be done). Exceptions can be granted with written approval of the Director of Public Works. When underground utilities are sleeved under roadways, sleeves shall be extended a minimum of 10 feet beyond the roadway on both sides to protect lines from penetration by new road signs, poles, etc.

Instructions to Designers:

Fort Campbell has a great deal of underground utility lines (both active and abandoned) that are no shown on Base utility maps. Therefore, prior to starting any digging, utilities are to be marked.

Accessibility Standard for Federal Facilities. By memo on 31 October 2008 DOD adopted ABA Chapters 1 and 2 and Chapters 3 through 10 as its [standards](#) (the "DoD standards") under the ABA and also under Section 504 of the Rehabilitation Act. Subject to the special provisions specified in the attachment provided on DoD facilities, which is also part of the DoD standards, you are directed to meet the requirements of ABA Chapters 1 and 2 and Chapters 3 through 10, and to require recipients of financial assistance from your organization to do the same". See [Appendix N](#) for more information.

----- END OF SECTION -----

SECTION 01 50 00

Temporary Construction Facilities and Controls

Electricity

Temporary electric service – temporary electric service on a cost reimbursable basis is available for construction office trailers, powers tools, etc. Contractors are responsible for all temporary electric service poles, panels, wiring, conduit, etc. Coordination for meter service shall be with Rick McCoy Garrison Energy Manager, DPW Utilities Branch, Bldg. 865, e-mail james.r.mccoy76.civ@mail.mil or Karen Kopp-Voshel, Utilities Energy Engineer, Bldg. 865, phone 798-9724, e-mail karen.y.kopp-voshel.civ@mail.mil.

A 200 amp meter base shall be provided by the contractor. The meter bases shall be rated for 120/240 volts; container four meter jaws and one connection point for the neutral conductor; be at least 4-1/4 inches deep, 11 inches wide and 14' high; accept 2-1/2 inch rigid steel conduit; and have lugs (electrical connectors) that are marked to accept 4/0 aluminum conductors (See

proper installation of temporary meter in **Fig 1-50** at end of this section). Services larger than 200 amp shall be coordinated with the DPW Utilities Branch.

DPW Utilities Branch will provide the meter after approval of electrical equipment by the Fort Campbell Electrical Inspector. A representative for the Contractor shall be present for the setting/removal of the electric meter to witness and sign off acknowledging the serial number, starting/ending reading, and billing information for the electric meter. After the meter is installed, the contractor will contact the DPW Electric Distribution Shop for energizing of the electric service. No part of the electric service shall be energized until the meter is installed.

The prime contractor for the temporary electric service will submit monthly meter readings and payment for electric service no later than the 5th of each month to:

DPW Utilities Branch
P.O. Box 1172
Fort Campbell, KY 42223

Meter reading documentation format shall be provided by the COR or other Corps of Engineers personnel. Meter reading reports shall be signed by a prime contractor representative and a Corps of Engineer representative.

Water

The Fort Campbell water distribution was privatized in 2003. The owner of the system is CH2MHill. Contact Chris Semler (CH2MHill), 931-431-2015/5677) regarding requirements and costs associated with providing temporary water service.

Sewer

The Fort Campbell water distribution was privatized in 2003. The owner of the system is CH2MHill. Contact Chris Semler (CH2MHill), 931-431-2015/5677) regarding requirements and costs associated with providing temporary sewer service.

Communications

Contact ATT (1-866-620-6000) for temporary phone, FAX, internet connections.

Ft Campbell KY TEMPORARY SERVICE GUIDE Customer Supplied Pole *

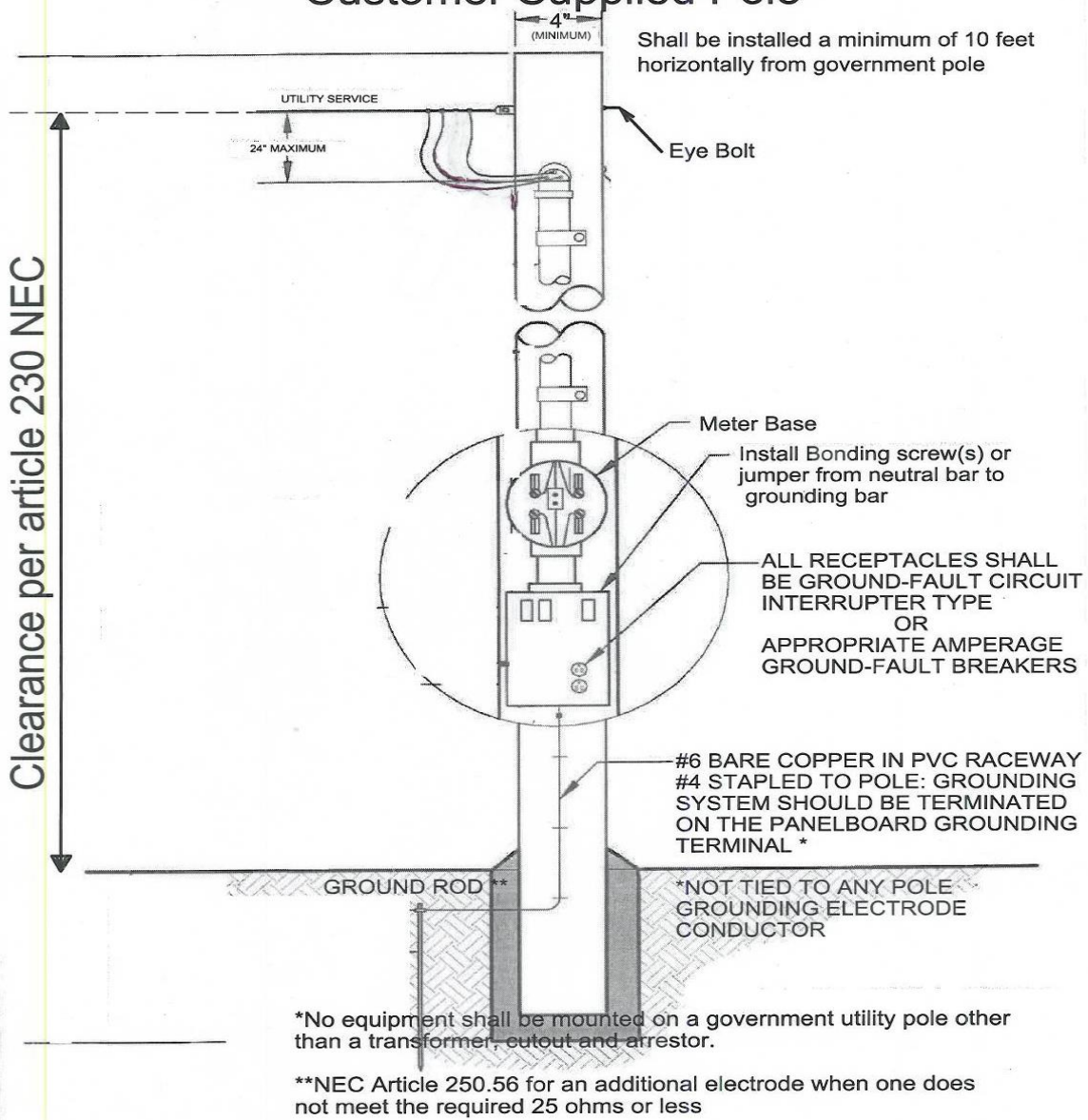


Fig 1-50
----- END OF SECTION -----

SECTION 01 57 20.00 10 Environmental Protection

Ft. Campbell Requirements:

Ft. Campbell specification Section 01 57 20.00 10, Environment Protection shall be used in all COE and DPW prepared projects.

Instructions to Designers:

Additional required guidance is found in [Appendix A](#).

For electronic copies of the document, contact the PE/A for MILCON and OMA projects by the COE. A-E's directly serving the installation should contact the PM.

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section C-01300 SUBMITTAL PROCEDURES:

1.2.1 SD-8, Statements

Work Plans; GA.

1.2.1.1 Environment Protection

Prior to commencement of work at the site, the Contractor will submit within 10 calendar days after Notice to Proceed, his written detailed proposal for implementing the requirements for environmental pollution control specified herein. The contractor will then meet the representatives of the Contracting Officer upon their completion of review of his proposal as needed for compliance with the environmental pollution control program.

1.2.1.2 Preconstruction Survey

Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey, after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs, and grassed areas immediately adjacent to the site of the work and adjacent to his assigned storage area and access routes(s) as applicable. This report will be signed by both the Contracting Officer and Contractor upon mutual agreement as to its accuracy and completeness.

1.2.1.3 Waste Disposal Scheme

As part of his proposed implementation under Paragraph 3.2, and prior to onsite construction, the Contractor shall submit a description of his scheme for disposing of waste materials resulting from the work under this contract. If any waste material is dumped in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, contaminated ground shall be excavated, disposed of as approved, and replaced with suitable fill material, all at the expense of the Contractor.

PART 2 POLLUTION PREVENTION PLANS

2.1 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with all Federal, State, and local regulations.

2.1.1 Environmental Protection Plan

The contractor will develop a site specific Environmental Protection Plan which will address in detail the following:

a. Hazardous materials (HM) to be brought onto the post

Any hazardous materials planned or used on the post by the contractor will be managed with the same intent and purpose as the Hazardous Materials Management Program (HMMP) maintained by the DPW Environmental Division Pollution Prevention Branch. Ft. Campbell's HMMP was established to maintain effective and regulatory compliant management of hazardous materials used on the post. The HMMP provides establishment of source reduction methods, recycling and reuse opportunities, modifications of processes and procedures, shelf life management, authorized HM use list, full visibility of all HM at any given time, the least toxic and least amount of HM acquired, stored, or used, and proper handling, storage, and disposal of all HM. A hazardous material as per 29 CFR 1910.1200 will be included. A hazardous material as per 29 CFR 1910.1200 is any material which is a physical or health hazard. The Contractor shall complete [the FTCKY HAZMAT INVENTORY FORM](#), which appears as an appendix to this section. The inventory form requires a list (including quantities) of HM to be brought to the post and copies of the corresponding material safety sheets (MSDS). The completed form shall be submitted to the Contracting Office representative and to Fort Campbell Environmental Division - Pollution Prevention Branch. In the event the usage of additional Hazardous Materials are found necessary during the project, they will be included into the MSDS package of the Environmental

Protection Plan. At project completion, any hazardous material brought onto the post shall be removed from the site by the Contractor. Ft. Campbell is required by Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements", to comply with the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA requires Ft. Campbell to identify the amounts of chemicals present on, or released from its facilities, understand the potential problems that hazardous materials pose to the surrounding communities and environment, and provide information to the public and local emergency planning organizations. To comply with EPCRA requirements, Ft. Campbell must track and be accountable for hazardous materials (HM) used throughout the post. As required by the Emergency Planning and Community Right - to - Know Act (EPCRA), the Contractor will account for the quantity of HM brought to the post, the quantity used or expended during the job, and the leftover quantity which (1) may have additional useful life as HM and shall be removed by the Contractor, or (2) may be hazardous waste, which shall then be removed as specified herein. [This information will be provided to the Environmental Division Pollution Prevention Branch on a calendar year basis or project basis if less than a single calendar year, and must be submitted by the end of January following the year reported.](#)

b. Hazardous waste (HW) generated

The Environmental Protection Plan must list, quantify explain how any HW generated during the project will be disposed. Disposal of hazardous waste generated by the contractor shall be disposed off site according to applicable regulations at the contractor's expense. A report must be submitted annually of the generation of hazardous waste on post and must be provided to the Contracting Officer representative and to Environmental Division - Pollution Prevention Branch.

c. Storage of hazardous waste

In accordance with post regulations and 40 CFR 262, hazardous waste shall be stored near the point of generation up to a total quantity of (one quart) 1 L of acutely hazardous waste or (55 gallons) 200 L of hazardous waste (Satellite Accumulation Point). Any volume exceeding these quantities shall be moved to a HW permitted area within 3 days. Locations of hazardous waste storage areas must be approved by DPW-ED-PP. Containers must be labeled in accordance with 40 CFR 262 and must contain the words Hazardous Waste and other words which identify the contents of the container. Prior to shipment of hazardous waste on site or off, the waste must be placed into good condition Department of Transportation (DOT) specification containers for hazardous waste (49 CFR 172.101). Containers must be labeled with required labels for HW and for DOT shipping. The area selected for the storage of hazardous wastes must minimize the threat to human health or the environment in the event of a release.

d. Minimization of hazardous waste

In accordance with post regulations, the Contractor should substitute materials as necessary to reduce the generation of HW and include a statement to that effect in the Environmental Plan.

e. Environmental conditions likely to be encountered during this project

Contact the Contracting officer for conditions in the area of the project which may be subject to special environmental procedures. Include this information in the Preconstruction Survey. Describe in the Environmental Plan any permits required prior to working the area, and contingency plans in case an unexpected environmental condition is discovered.

f. Any Hazardous Waste removal or disposal must be manifested through Environmental Division's Pollution Prevention Branch, Hazardous Waste Program Manager and must be signed and numbered. Permitting plans for any transportation and disposal, excavation, or construction of hazardous waste that will require an environmental permit from an issuing agency

The Contractor is responsible for generating the permits and delivering the completed documents to the Contracting Officer. The Contracting Officer will review the permits and the Contractor shall file the documents with the appropriate agency and complete disposal with the approval of the Contracting Officer. The Contracting Officer shall advise Environmental Plan of any Hazardous Waste generated and shall send contractor to Environmental Pollution Protection Branch. Correspondence with the State concerning the environmental permits and completed permits shall be delivered to the Contracting Officer.

g. Radon mitigation design and testing: See [Section 31 21 13, Radon Mitigation](#).

2.1.1.1 Environmental Protection Plan Format

The Environmental Protection Plan shall follow the following format:

1. Hazardous materials to be brought onto the post
2. MSDS package
3. Employee training documentation
4. Hazardous materials/waste storage plan
5. Hazardous waste to be generated
6. Pre-construction survey results
7. Permitting requirements identified
8. Waste Disposal Plan
9. Site Specific Spill Contingency Plan

2.1.1.2 Environmental Plan Review

Fourteen days after the environmental protection meeting, submit to the Contracting Officer the proposed environmental plan for further discussion, review, and approval.

2.1.1.3 Commencement of the Work

As directed by the Contracting Officer, following approval.

2.1.2 Storm Water Pollution Prevention Plan (SWPPP)

2.1.2.1. The SWPPP must be designed to meet the requirements of the [Tennessee Erosion and Sediment Control Handbook](#).

Notice of Intent, along with the SWPPP, must be submitted to the appropriate state regulatory agency for approval and Notice of Coverage.

SWPPP designers must consult the applicable state NPDES General Permit for Construction Activities for complete SWPPP requirements.

2.1.2.2. Contracting Officer shall provide SWPPP for review to Environmental Division, Stormwater Program. Once Fort Campbell review is complete, and the SWPPP, along with the Notice of Intent (NOI) are submitted to the state, allow 30 days for review by the Tennessee Division of Water Resources and 7 days for review of the Kentucky Division of Water.

2.2 ANTICIPATED SEQUENCE OF ACTIVITY:

Place erosion control measures in locations in close proximity to those shown on the drawings. Additional erosion control measures may be required to comply with the NPDES permit once demolition and construction begins. Projects smaller than five acres require initial and final Erosion Prevention/Sediment Control (EPSC) drawings. Projects five acres and larger require initial, intermediate, and final EPSC drawings.

Surface water flowing toward the construction area will be diverted around the construction area to reduce its erosion potential. Silt fence, sediment traps or rock check dams shall be properly constructed to detain runoff and trap sediment.

Construct new site amenities including utilities, buildings, parking areas, and sidewalks after completing the necessary demolition.

Landscape and grade remaining areas according to the drawings.

Upon completion, remove any temporary measures not necessary for future phases of the project after stabilization of the area. Any sediment removed from these measures shall be disposed of at a time and location designated by the Contracting Officer. Any other areas disturbed during the removal of the sediment control structures shall be seeded and mulched within 24 hours.

NOTE: The Contractor controls the actual sequence, however, the sediment control measures must be established prior to initiation of work in any area. Contractors for Phased projects will be required to coordinate this work and interface Storm Water Pollution Prevention Plans to ensure compliance with the intent of the NPDES General Permit and to maintain continuous pollution prevention. Construction should be staged or phased for this project. Describe phasing in detail. Areas of one phase should be stabilized before other phases are initiated. Stabilization shall be accomplished by temporarily or permanently protecting the disturbed soil surface from rain fall impacts and runoff.

2.3 DEMONSTRATION OF COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

All activities constructed under this contract will be performed in accordance with Federal, State and Installation regulations. The construction contractor's specifications require compliance with all applicable regulations.

2.4 POLLUTION PREVENTION PLAN AND NOTICE OF INTENT

The Contractor will implement the SWPPP as shown on the plans and directed in these specifications. This plan must be implemented in accordance with the NPDES permit. A Notice of Intent (NOI) will be prepared by the U.S. Army Corps of Engineers and submitted to the state of Tennessee (KENTUCKY) **thirty (30) days** prior to the notice to proceed being issued. The Contractor will sign the NOI and SWPPP and certify as an operator. The Contractor shall maintain a copy of the SWPPP in their construction trailer. Any changes made to the plan must be documented and approved by the Contracting Officer. For construction projects managed by Garrison activities the proponent shall prepare the SWPPP and NOI and submit to the Stormwater Program for review. Complete permit applications will require Garrison Commander signature before submittal to the state. Non-garrison and privatized activities shall obtain their own NPDES permit coverage for construction.

2.5 INVENTORY FOR POLLUTION PREVENTION PLAN

The materials or substances listed below are expected to be present onsite during construction:

These are examples of materials that could be Hazardous Materials and an inventory must be kept using Ft. Campbell's Hazardous Material Form attached. This list is not comprehensive but for illustration only. The Contractor must maintain and update a Hazardous Material list and inventory forms.

Concrete	Fertilizer	Detergents	Paints (Enamel and Latex)
Cleaning Solvents	Wood	Sealants	Metal Rebar/Structural Steel
Concrete Additives	Tar	Asphalt	Petroleum Based Products

2.6 SPILL PREVENTION

The following are the material management practices to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

2.6.1 Good Housekeeping

a. An effort will be made to store only enough product required to perform the task. Secondary containment shall hold 110 % of the bulk amount stored over 55 gallons.

b. All materials stored onsite will be stored in a neat and orderly manner in their appropriate containers and properly labeled. When possible, material should be stored under a roof or in an enclosed area. If this is not possible, material will be covered with a tarpaulin or suitable replacement to prevent direct contact between storm water and the materials. All runoff from the storage area will be routed through a control structure.

c. Products will be kept in their original containers with the original manufacturer's label.

d. Substances will not be mixed with one another unless recommended by the manufacturer.

e. Whenever possible, all of the product will be used up before disposing of container.

f. Manufacturer's recommendations for proper use and disposal will be dictated by Federal, State and Local regulations. Manufacturer's recommendations may be followed if as stringent or more than Federal, State and Local.

g. The contractor will conduct daily inspections to ensure proper use and disposal of materials onsite.

2.6.2 Hazardous Products

These practices are used to reduce the risks associated with hazardous materials and must be incorporated into the Pollution Prevention Plan:

a. Products will be kept in their original containers unless they are not resealable.

b. Original labels and material safety data will be retained they contain important product information.

c. All containers will have the Diamond label affixed per the National Fire Prevention Associations Publication 704.

d. Disposal of surplus product will be performed as recommended by the manufacturer or as required by State and Local regulations.

2.7 SPILL PREVENTION PRACTICES

In addition to good housekeeping and material management practices discussed in the previous sections of this plan, a Site Specific Spill Contingency Plan (SSSCP) must be prepared by the Contractor and submitted to Fort Campbell Environmental Division. Guidance and instructions for preparation of the SSSCP are included at the end of this section. In addition to the requirements of the SSSCP, the following practices must be followed by the Contractor for spill prevention and clean up:

- a. Materials and equipment necessary for cleanup will be kept in the material storage area. Fort Campbell's Environmental Handbook, Environmental Protocol Sheet SPILL KIT REQUIREMENTS, Page A-72 provides spill response materials minimum requirements. Equipment and materials may include but not be limited to: brooms, dust pans, mops, rags, gloves, goggles, absorbing compound, and plastic and metal trash containers specifically for this purpose. Spill response equipment is a critical component of an effective response to an unexpected release of hazardous materials. Making an inventory of potential spots for emergency releases and having appropriate and sufficient spill response equipment to deal with those potential releases is required for each unit.
- b. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of information and cleanup supplies.
- c. All spills will be cleaned up immediately after discovery. Disposal of the waste from the spill shall be at the Contractor's expense and shall be coordinated with the Pollution Prevention Branch before removal or disposal.
- d. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- e. All spills of toxic or hazardous materials will be reported to Fort Campbell Emergency Dispatch (911) or to Range Control (if in the Training Area) at 798-3001. The Contracting Officers Representative should also be contacted. The DPW Environmental at 798-9641/9601 will report to the appropriate State or Local government agency if necessary.
- f. Once a spill has occurred, the spill prevention plan will be adjusted to include measures to prevent this type of spill from recurring with a discussion of the appropriate cleanup for that type of spill. Also, a description of the spill, what cleaned it, and the cleanup measures will be included.
- g. The prime Contractor will be responsible for the day-to-day site operations, including spill prevention and will designate an employee, by name, to be the primary cleanup coordinator. Each subcontractor bringing more than 75 liters or 68 kilograms of a spillable substance shall also designate a cleanup coordinator.

h. Everyone will be trained in spill prevention and cleanup and shall know the primary cleanup coordinator and any additional site personnel to contact. Fort Campbell's Environmental Handbook, Environmental Protocol Sheet FUEL/POL SPILLS, Page A-36 will be the basis for spill prevention training.

(TAKEN FROM)

FORT CAMPBELL ENVIRONMENTAL HANDBOOK
Guidance and Instruction
SPILL PLANNING AND RESPONSE

Spill response equipment is a critical component of an effective response to an unexpected release of hazardous materials. Making an inventory of potential spots for emergency releases and having appropriate and sufficient spill response equipment to deal with those potential releases is required for each unit. Attachment 1 provides spill response materials minimum requirements.

SPILL PLANNING AND RESPONSE TRAINING REQUIREMENTS:

1) All personnel involved with the management and handling of oil and hazardous materials must be periodically trained in spill prevention and response. The training will be similar to the Hazardous Communication Program - Worker Right to Know and will include the following key features:

- a) Health effects of exposure to oil or hazardous materials;
- b) Applicable first aid procedures to be used following exposure;
- c) Personal Protective Equipment requirements and procedures for using equipment;
- d) Evacuation procedures;
- e) Spill material combustibility and potential for flash-back along vapor trails;
- f) Fire fighting procedures and special hazards of combustible products;
- g) Reactivity of spill material with common materials including water;
- h) Use and maintenance of all alarms and monitoring equipment associated with spill prevention or response;
- i) Initial Notification procedures;
- j) Site specific contingency plans;

- k) Location of posted Site Specific Spill Contingency Plan;
- l) Immediate spill response actions including location of pump controls and valves to stop spill flow; location and use of fire extinguishers, absorbents, neutralizing agents and other immediate spill response procedures;
- m) Visual inspections requirements of the particular areas; and
- n) Purpose and requirements of good housekeeping.

2) Spill response training exercises will be conducted once per year for personnel working at oil and hazardous material sites. Personnel entering one of these positions will be trained within two weeks after starting work and after any significant changes to the spill plan or training program. Records of the type, extent, and frequency of each individual's training will be maintained until closure of the applicable area or until three years after the date the individual last worked in the area. Refresher training shall be given with the Toolbox Safety Meetings and documented on the Quality Control Reports. Training shall cover what to do, and who to contact in case of a spill and what emergency action must be taken if any.

SPILL RESPONSE IS HANDLED BY FOUR DISTINCT OPERATIONS:

a. SPILL REPORTING

The first action to be taken in the event of a spill is to report the spill. If you observe a release of a hazardous material, report it to your supervisor and Fort Campbell Emergency Dispatch (911) or to Range Control (If in the Training Area) at 798-3001. Fort Campbell Emergency Dispatch (911) or Range Control will notify DPW Environmental Division and if required, Installation Safety, Emergency Medical, and Preventative Medicine. The DPW Environmental Division does all reporting to State/Federal Agencies.

Fort Campbell Emergency Dispatch (911) (or Range Control) must be promptly notified of any of the following spills:

(1) Any uncontrolled quantity of a hazardous substance, or if assistance is needed by Fire Department or Environmental Division, or as instructed by the MSDS or supervisor's discretion.

(2) Oil and other petroleum products with quantity exceeding 10 gallons or area of spill greater than three feet in any direction or any amount that has spilled into a stream or body of water.

b. STOP OR CONTAIN THE SPILL

Assess the situation before attempting to contain any hazardous material spilled and proceed only if it is safe to do so. You must have knowledge of the spilled substance and don any

required personal protective equipment. If necessary, make the spill scene off limits to any unauthorized personnel. If situation warrants, evacuate the area.

c. CLEAN UP THE SPILL

Under no circumstances should untrained and/or ill-equipped persons attempt to perform cleanup. In some instances, spill cleanup may require respiratory protection and other personal protective equipment. If it is within the capability of the unit that caused the spill, then that unit is responsible for its cleanup. Environmental Division will make the decision to obtain assistance and coordinate with other units as required. If you handle/work with the hazardous material as part of your job, you are to be trained and qualified to participate in the cleanup of the spill. All contractors must have an OSHA 1910.120 qualified spill response contractor available to respond to spills in 4 to 6 hours that require heavy equipment to remove contaminated soils/absorbents. Spill that cannot be removed because of response delays may need to be covered with heavy plastic and or secured to prevent further spread of contamination.

d. DISPOSE OF SPILLED HAZARDOUS MATERIAL.

All spilled material and other contaminated material (soil, gravel, absorbents, etc.) must be properly disposed. It is the responsibility of the contractor that created the spill to properly package, dispose of the waste, and ensure the site is properly cleaned at no cost to the government. Some spill incidents may require cleanup, disposal, soil testing and a site closure report by an approved licensed environmental contractor approved by Fort Campbell. Environmental Division will determine the required cleanup and disposal method.

2.8 PRODUCT SPECIFIC PRACTICES

The following product specific practices will be followed on-site:

- a. Petroleum Products - All vehicles will be periodically inspected for leaks and shall receive regular preventative maintenance to reduce the chance of leaks occurring. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Bulk storage areas will be equipped with secondary containment appropriate for risk of loss from the primary container (s). Storage shall meet Federal, State and Local regulations. Secondary containment shall hold 110% of the bulk amount stored over 55 gallons.
- b. Fertilizer - Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. The contents of any partially used bags of fertilizer will be transferred to a sealable container to avoid spills.
- c. Paints, Solvents, and Sealants - All containers will be tightly sealed and kept in the storage area when not in use. Any excesses of these materials will not be discharged into

the storm sewer system, but will be properly disposed of according to manufacturer's instructions or State and Local regulations.

d. Concrete Trucks - Concrete trucks will be allowed to wash out, discharge surplus concrete and drum wash water only in a designated area. All wash water from the concrete trucks must be retained on-site and treated according to Federal, State and Local regulations. Upon completion of the job, all discharges of surplus concrete and any soil contaminated by the concrete wash water will be removed from the site and taken to an approved disposal area. Water with the potential of entering sink holes or storm sewers will not be allowed to be discharged.

2.9 INSTALLATION/CONSTRUCTION

2.9.1 Stormwater Best Management Practices must be designed and installed according to the [TDEC Erosion and Sediment Control Handbook](#).

2.9.2 Seeding

- a. Test soil to determine its nutrient level or apply a 12-12-12 fertilizer at a rate of 75 to 110 kilograms per hectare.
- b. Work fertilizer into the soil 50 mm - 100 mm deep with a disk or rake operated across the slope.
- c. Select a seed mixture and application rate that best suits the soil type and climate. Also, consult the county soil, water conservation office for assistance.
- d. Apply seed uniformly with a drill or cultipacker seeder, or by broadcasting, and cover to recommended depth.
- e. If drilling or broadcasting, firm the seedbed with a roller or cultipacker.
- f. Mulch seeded area to increase seeding success.

2.9.3 Mulching

- a. Apply at the recommended rate based on the material being used.
- b. Spread uniformly with no more than 25% of the ground surface visible.
- c. If straw or hay is used, it must be anchored immediately.

2.10 INSPECTION AND MAINTENANCE

All measures that are being utilized will be inspected at least twice each week, 72 hours apart, and after each storm event. An inspection report shall be written after each inspection and submitted to the Contracting Office representative within 24 hours. Once a problem is found or

sediment has reached the clean-out elevation, corrective action shall commence within 24 hours. Inspections shall continue until the controls are removed or the vegetative cover is firmly established. Construction projects shall obtain 95 percent vegetation coverage.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall perform all work in such manner as to minimize the pollution of air, water, or land, and shall, within reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants. Information contained in the following specifications should also be referenced:

3.2 IMPLEMENTATION

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall meet the representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

3.3 PROTECTION OF LAND AREAS

Except for any work on storage areas and access routes specifically assigned for the use of the Contractor under this contract, the land areas outside the limits of permanent work performed under this contract shall, in accordance with CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURE, UTILITIES AND IMPROVEMENTS, be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work on the plans or specifically assigned for his use. In accordance with CONTRACT CLAUSE: OPERATIONS AND STORAGE AREAS, storage and related areas and access routes required temporarily by the Contractor in the performance of the work will be assigned by the Contracting Officer. No other areas on Government premises shall be used by the Contractor without written consent of the Contracting Officer.

3.4 PROTECTION OF TREES AND SHRUBS

CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES AND IMPROVEMENTS, is hereby supplemented as follows: The Contractor shall not deface, injure or destroy trees or shrubs, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage.

3.4.1 Tree Protective Structures

Where, in the opinion of the Contracting Officer, trees may possibly be defaced, bruised, injured or otherwise damaged by the Contractor's equipment or by his other operations, he may direct

the Contractor to provide temporary protection of such trees by placing boards, plans, or poles around them.

3.4.2 Restoration of Damaged Trees

Any tree scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. All scars made on trees not designated on the plan to be removed by construction operations shall be coated as soon as possible with an approved tree wound dressing. Trees that are to remain, either within or outside established clearing limits, that are damaged by the Contractor so as to be beyond saving in the opinion of the Contracting Officer, shall be immediately removed, if so directed, and replaced with a nursery-grown tree of the same species and size.

3.5 PROTECTION OF WATER RESOURCES

The Contractor shall control the disposal of fuels, oils, bitumen, calcium chloride, acids, or harmful materials, both on and off the Government premises, and shall comply with applicable Federal, State, County and Municipal laws concerning pollution of rivers and streams while performing work under this contract. The contractor should note that the entire cantonment area is within the delineated Well Head Protection Area for Fort Campbell. This means any release in this area has the potential, due to the installations geological features to impact their drinking water source. For this reason special measures need to be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides and insecticides from entering public waters or potentially migrating via sinkholes or other karst related geologic features to drinking water sources. Special measures will include the generation of a site-specific Spill Prevention Control and Countermeasures Plan. Water used in onsite material processing, concrete curing, foundation and concrete cleanup, paint cleanup and other waste waters shall not be discharged to the environment.

3.6 BURNING

Air pollution restrictions applicable to this project are as follows. Materials shall not be burned on the Government premises. If the Contractor elects to dispose of waste materials off the Government premises, by burning, he shall make his own arrangements for such burning area and shall, as specified in CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES, conform to all local regulations.

3.7 DUST CONTROL

The Contractor shall maintain all excavations, stockpiles, access roads, waste areas, and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to the Using Service or to others. Approved temporary methods consisting of sprinkling, chemical treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

3.8 EROSION CONTROL

Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall be graded to control erosion within acceptable limits. Temporary control measures shall be provided and maintained until permanent drainage facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum.

3.9 CORRECTIVE ACTION

The Contractor shall, upon receipt of a notice in writing of any noncompliance with the foregoing provisions, take immediate corrective action. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs of damages by the Contractor unless it was later determined that the Contractor was in compliance.

3.10 POST-CONSTRUCTION CLEANUP OR OBLITERATION

In accordance with CONTRACT CLAUSE: CLEANING UP, the Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed areas shall be graded and filled and the entire area seeded.

3.11 PAYMENT

No separate payment or direct payment will be made for the cost of the work covered under this section, and such work will be considered as a subsidiary obligation of the Contractor.

FTCKY HAZMAT INVENTORY FORM

Date: ____/____/____

Ft. Campbell Environmental Division/Pollution Prevention Branch/ 798-3105

Page ____ of ____

Unit (Bde, Bn, Co.): _____ Bldg #: _____ State: _____ POC Name: _____
 _____ Phone #: _____

Bldg Description: _____ HazMat Storage
 Location: _____

(i.e. motor pool, aviation hangar, supply room, etc.)

(i.e. flammable wall locker, supply closet, etc.)

Updated 3/25/98

NSN (If unknown, attach MSDS)	Manufacturer	Material Name	Material Use	Expiry Date	Disposal Procedure	Containers On Hand	Weight or Volume Per Container	Amount Used Per Month (Approximate)
<i>Example:</i> 6810-00-281-2785	<i>CSD Inc.</i>	<i>MEK</i>	<i>Degreaser</i>	<i>12-99</i>	<i>Hazardous Waste Disposal</i>	<i>1 Can</i>	<i>1 Gal.</i>	<i>1 Gal.</i>



Contractor Site Specific Spill Contingency Plan

Contractor Name	Contract Number	
General Description	Location	Start Date

Primary Person (Required)

Name/Title	Primary Phone	Secondary Phone	
Address	City	State	Zip Code

Secondary Person (Required)

Name/Title	Primary Phone	Secondary Phone	
Address	City	State	Zip Code

Primary Contractor Information (Required if subcontractor)

Name/Title	Home Phone	Work Phone	
Address	City	State	Zip Code

Hazardous Material and Quantity (If not applicable, write "N/A")

1	Substance	Quantity	Location
2	Substance	Quantity	Location
3	Substance	Quantity	Location
4	Substance	Quantity	Location
5	Substance	Quantity	Location

Material Safety Data Sheet(s) (Required)

Material Safety Data Sheet(s) are readily available in the following locations:	Location
---	----------

Aboveground Storage Tank(s) (Required)

Will aboveground tank(s) be onsite?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, contact the following to schedule mandatory monthly compliance inspections.	Russell Godsave, SPCC/Storage Tank Program Manager (270) 798-9637, Russ.Godsave@us.army.mil
-------------------------------------	---	---	--

Emergency Spill Equipment (Required)

Mark all emergency spill equipment that will be stored and maintained onsite (* Recommended)

- | | | | |
|---|--|---|--|
| <input type="checkbox"/> Peat* | <input type="checkbox"/> Drain Blocker | <input type="checkbox"/> Containment Unit | <input type="checkbox"/> Disposal Bags* |
| <input type="checkbox"/> Dry Sweep | <input type="checkbox"/> Spill Putty | <input type="checkbox"/> Baking Soda | <input type="checkbox"/> Rubber Gloves* |
| <input type="checkbox"/> Absorbent Pads* | <input type="checkbox"/> Overpak | <input type="checkbox"/> Broom* | <input type="checkbox"/> Respiratory Masks |
| <input type="checkbox"/> Absorbent Socks* | <input type="checkbox"/> Drip Pan | <input type="checkbox"/> Dust Pan | <input type="checkbox"/> Safety Goggles |
| <input type="checkbox"/> Absorbent Pillow | <input type="checkbox"/> Spill Pool | <input type="checkbox"/> Non-Sparking Shovel* | <input type="checkbox"/> Tyvek Suit |
| <input type="checkbox"/> Other (Please Explain) _____ | | | |

Spill Response Procedure

1. Be Prepared <ul style="list-style-type: none"> Know response material locations Know response procedures 	2. Be Safe <ul style="list-style-type: none"> Identify spilled substance / Read MSDS Use personal protective equipment 	3. Stop the Source <ul style="list-style-type: none"> Plug, roll, or right drums Use emergency shut-off devices 	4. Protect Water <ul style="list-style-type: none"> Confine spills with sandbags or booms Block access to stormwater grates
5. Notify <ul style="list-style-type: none"> Know response material locations Call Environmental Division or 911 	6. Clean Up <ul style="list-style-type: none"> Neutralize hazardous substances Pump or sweep into a safe container 	7. Dispose <ul style="list-style-type: none"> Contain waste water or sweepings Call PPOC for proper disposal 	8. Restock <ul style="list-style-type: none"> Replace materials and equipment Review the incident for lessons learned

Notification Procedure

1. Who to Call <ul style="list-style-type: none"> Fort Campbell Emergency Dispatch 911 Range Control (if in training area) 798.3001 SPCC/Storage Tank Program 798.9637/9601 	2. When to Call <ul style="list-style-type: none"> Greater than 10 gallons Three (3) square feet Enters any water source 	3. What to Report <ul style="list-style-type: none"> Location and address of release Name and phone number of POC Date and time of release Type and quantity of release Cause and source of release
--	---	--

Training

Oil Handling Personnel (OHP) training is required regulatory training for any installation personnel including garrison activities, tenants, tenant organizations, and contracted operations that are responsible for the transfer, transport, or handling of Petroleum, Oil, and Lubricant (POL) products in bulk quantities **greater than or equal to 55 gallons**. This training can be scheduled through the SPCC/Storage Tank Program, (270) 798.9637. Records must be maintained for three years as required by regulation 40 CFR 264.16.

Spill Awareness training is a best management practice for any installation personnel that may or may not be responsible for the transfer, transport, or handling of POL products. This training provides awareness of the proper procedures for reporting, responding, and preventing POL discharges by becoming familiar with the Spill Prevention Response and Notification Procedure (SPRNP) sign. This training must be complete within two weeks after starting work.

Signature (Required)

Failure to mark all three boxes will result in form being disapproved.

- I certify that all information provided in this document is true to the best of my knowledge.
- I have read and agree to follow the Spill Notification Procedure as described in this document.
- In the event of a discharge, I understand and agree to notify Fort Campbell Environmental Division who will report spill activities to State/Federal agencies as appropriate.

Responsible Person Signature _____ Date _____

For Official Use Only
Initials _____
Date _____
<input type="checkbox"/> Approve
<input type="checkbox"/> Disapprove

September 2009 v.3

-- END OF SECTION --

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[Return to Chapter 2, Para 2.7](#)

SECTION 01 57 23 Temporary Storm Water Pollution Control

Ft. Campbell Requirements:

Temporary stormwater pollution control requirements apply to all construction projects on Fort Campbell.

Instructions to Designers:

Project plans and specifications shall include guidance and requirements contained in CAM REG 200-1 and the Fort Campbell Stormwater Management Plan. Contact Dan Etson, Stormwater Program Manager, at 270-798-9784, for specific requirements and questions.

Additional required guidance is found in the 2012 [Tennessee Erosion Prevention and Sediment Control Handbook](#).

For electronic copies of the document, contact the PE/A for MILCON and OMA projects by the COE. A-E' directly serving the installation should contact the PM.

----- END OF SECTION -----

SECTION 01 58 00 Project Identification

Ft. Campbell Requirements:

PROJECT CONSTRUCTION SIGN

Part 1 GENERAL

1.1 For COE projects, the project construction sign shall be provided per contract requirements.

1.2 For locally funded (SRM/OMA) projects the project construction sign shall be constructed in accordance with the enclosed drawings and specifications.

1.2.1 The construction sign is for the identification of the Fort Campbell project and will be installed prior to commencement of construction at a location which is near the project site,

amenable to public viewing, and as determined by the Contracting Officer's Representative (COR).

1.2.2 . The sign will be adequately supported with regard to site conditions and will be at an adequate distance above prevailing grade to permit good visibility.

Part 2 PRODUCT

2.1 The sign shall be constructed of a 4.0 feet by 6.0 feet piece of exterior grade high density overlaid plywood or other sign material of equivalent quality and attached to nominal 4"X4" treated wood posts of a suitable grade as indicated on the following drawings. Additional support framing of nominal 2"X4" treated wood may be used as needed to adequately support the sign.

2.2. The sign background will be a light beige color. The IMCOM and DPW logos will be reproduced in strict proportions and matching colors shown in the attached details.

2.3. Lettering will be of professional quality and in accordance with the attached drawing: All lettering will be in proportion to the sizes shown and located as shown on attached sketches/drawings.

2.4. Information specified on the attached details will be displayed on the sign. A draft sign will be rendered and reviewed by the COR prior to production.

PART 3 MISCELLANEOUS

3.1. The sign posts and additional framing will be painted with one (1) coat of primer and two (2) coats of exterior grade paint. Color is to be light beige.

3.2. The sign will be maintained in good condition by the contractor until completion of the project.

3.3. The sign will be removed and appropriately disposed of when the project is complete and accepted by the COR.

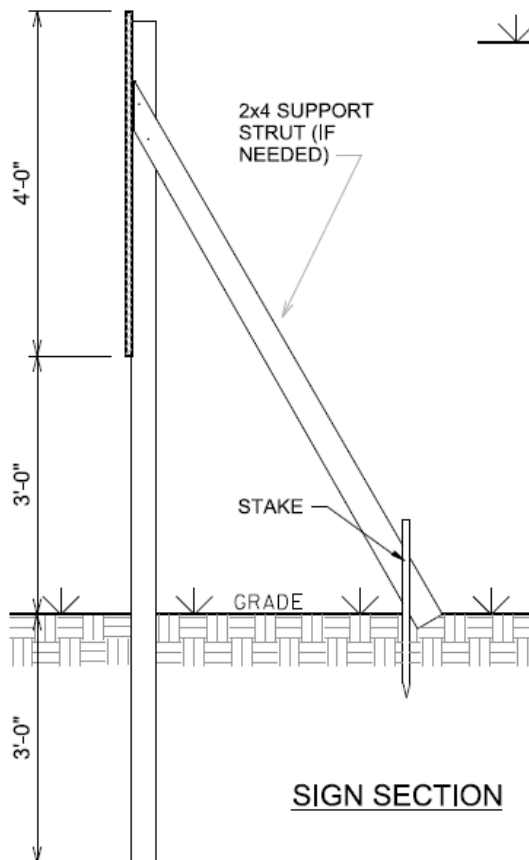
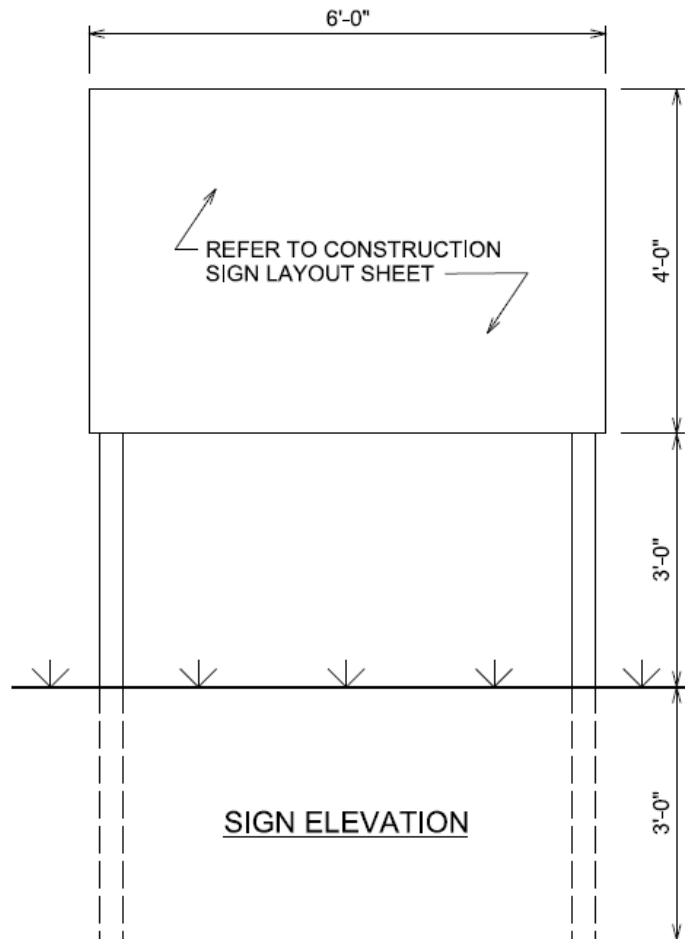
3.4. Refer to the following sign sketches/drawings for additional information.

GENERAL INFORMATION

Sign panel shall be of 3/4" thick High Density Overlay (H.D.O.) plywood.

Sign background and posts are to be painted with one (1) coat of primer and two (2) coats of paint. Color to be light beige.

All lettering is to be Helvetica (black).



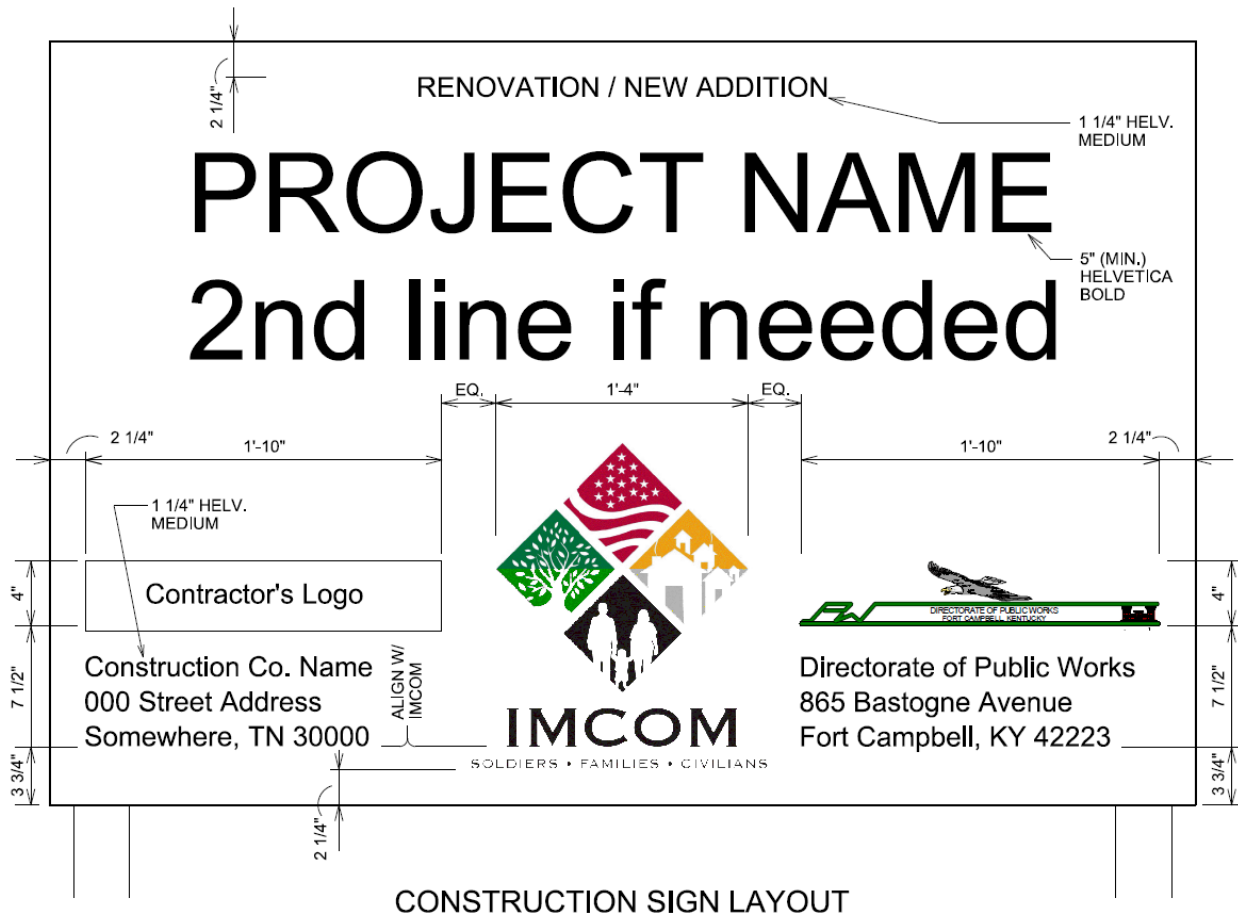
SIGN ASSEMBLY INFORMATION

Drill and Insert six (6) 3/8" T-nuts from the front face of the HDO sign panel. Position holes as shown. Flange of T-nut to be flush with sign face. Apply graphic panel to prepared HDO plywood panel as per manufacturers recommendations. Sign posts to be structural grade 4" x 4" treated Douglas Fir or Southern Yellow Pine, No.1 or better. Post to be 10 feet long. Drill six (6) 3/8" mounting holes in uprights to align with T-nuts in sign panel. Countersink (1/2") back of hole to accept socket head cap screw (4" x 3/8").

Anchor assembled sign as shown with posts placed 3'-0" deep into ground.

Additional 2" X 4" struts bolted to the inside face of posts (as shown) may be required to reinforce sign board and/or the assembly.

CONSTRUCTION SIGN DETAILS



CONSTRUCTION SIGN LAYOUT

----- END OF SECTION -----

**SECTION 01 74 19
Construction and Demolition Waste Management**

Ft. Campbell Requirements:

Requirements in this section and Appendix A-7. [Solid Waste Disposal/Diversion Practices](#) shall apply to all construction and demolition activities at Fort Campbell. Contract specifications shall require at least a 50% diversion of demolished building materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, HVAC equipment, and scrap metals be diverted from the landfill. See Chapter 2, Paragraph 2.1.4 (Click here). Diversion can be accomplished by deconstructing the wood buildings and components per instructions below or by moving the structure off-post.

Demolition materials shall not be salvaged by the contractor and shall not be removed from the installation. Non salvageable demolition materials shall not to be transported off the installation.

Notify the DPW Environmental Division if unknown waste is discovered during site investigations. Waste could be explosive, hazardous or toxic waste.

Dumpster service for new construction and for demolition is not provided by the installation. The contractor shall arrange for dumpster service at the Contractor's own expense. All waste containers (dumpsters, etc.), that are provided by the project contractor shall be placed within the construction limits of the project. It shall be the contractor's responsibility to remove any non-compatible materials that are placed in the waste containers provided for the project.

In general, utilities are not to be abandoned in place; all abandoned utilities are to be removed. There are circumstances where this requirement does not apply. Abandonment of utilities and removal shall be a topic of discussion at design conferences.

Instructions to Designers:

- 1 Modify UFGS 01 74 19 paragraphs to include the building demolition/diversion requirements above and modify contract specifications.
- 2 Construction specifications shall require a Building Materials Diversion Plan to be submitted and approved by DPW.
- 3 When a project requires removal/disposal of environmentally hazardous waste generated at Fort Campbell, the DPW Environmental Division must be involved in the permitting process. Modify project drawings and specifications paragraphs to include each of the above features as they apply to the project. Additional guidance on Environmental Requirements and Hazardous Waste Disposal Practices is contained in [Appendix A](#), and project specifications shall be modified to indicate these requirements.
- 4 For mercury containing light bulb disposal, insert the [Mercury Light Bulb](#) paragraph.

----- END OF SECTION -----

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CHAPTER 3 Technical Requirements and Instructions Division 02 Existing Conditions

[Section 02 41 00](#)

Demolition and Deconstruction

Section 02 82 14.00 10
Section 02 82 16.00 20
[Section 02 83 13.00 20](#)

Asbestos Hazard Control Activities
Engineering Control of Asbestos Containing Materials
Removal/Control and Disposal of Paint with Lead

SECTION 02 41 00 Demolition and Deconstruction

Ft. Campbell Requirements:

Requirements in this section and Appendix A-7. [Solid Waste Disposal/Diversion Practices](#) shall apply to all construction and demolition activities at Fort Campbell. Contract specifications shall require at least a 50% diversion (by weight) of demolished building materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, HVAC equipment, and scrap metals be diverted from the landfill (See Chapter 2, para 2.1.4 ([Click here](#))). Diversion can be accomplished by deconstructing the wood buildings and components per instructions below or by moving the structure off-post.

National Emission Standards for Hazardous Air Pollutants (NESHAP) regulatory requirements for demolition apply .

Demolition materials shall not be salvaged by the contractor and shall not be removed from the installation. Non-salvageable demolition materials shall not be transported off the installation. . Asbestos containing materials will, **at all times**, remain on Fort Campbell and be disposed of only in the asbestos cell at the Woodlawn Construction and Demolition (C&D) landfill located on Fort Campbell.

Notify the DPW Environmental Division if unknown waste is discovered during site investigations. Waste could be explosive, hazardous or toxic waste.

Dumpster service for new construction and for demolition is not provided by the installation. The contractor shall arrange for dumpster service at the Contractor's own expense.

In general, utilities are not to be abandoned in place; all abandoned utilities are to be removed. There are circumstances where this requirement does not apply. Abandonment of utilities and removal shall be a topic of discussion at design conferences.

When demolition includes more than 20 cubic yards of concrete, asphalt and/or masonry the material must be ground per requirements in [Appendix L, Grinding of Concrete, Asphalt and Masonry Materials](#).

Instructions to Designers:

- 1 Modify UFGS 02220 paragraphs to include the building demolition/diversion requirements above and modify contract specifications.
- 2 Construction specifications shall be modified to require a Building Materials Diversion Plan to be submitted and approved by DPW.
- 3 When a project requires removal/disposal of environmentally hazardous waste generated at Fort Campbell, the DPW Environmental Division must be involved in the permitting process. Modify project drawings and specifications paragraphs to include each of the above features as they apply to the project. Additional guidance on Environmental Requirements and Hazardous Waste Disposal Practices is contained in [Appendix A](#), and project specifications shall be modified to indicate these requirements.
- 4 National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulatory requirements for demolition apply for asbestos abatement. In addition [NESHAP](#) notification is also required even if the operation involves removal of "non-regulated" ACM in any amount, or even if the operation involves no asbestos removal whatsoever. When planning building demolition or renovation, as defined by the appropriate state, the NESHAP (10 day notification) will be filed for cases of no asbestos removal and/or any asbestos removal in any amounts, RACM or non-RACM.
- 5
- 6 For mercury containing light bulb disposal, insert the [Mercury Light Bulb](#) paragraph.

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----- END OF SECTION -----

SECTION 02 42 91 Removal and Salvage of Historic Building Materials

Ft. Campbell Requirements:

Historic District:

The "Clarksville Base" portion of Ft. Campbell cantonment area is eligible for the National Register of Historic Places as a significant Cold War historic district. Designers are required to consult with the State Historic Preservation Office (SHPO) and the federal Advisory Council on Historic Preservation for any projects that are sited at the Clarksville Base. POC is DPW Environmental Division Cultural Resource Manager at 270-798-7437.

Instructions to Designers:

1. Complete the requirements as they apply to specific projects.

----- END OF SECTION -----

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SECTIONS 02 82 14.00 10, Asbestos Hazard Control Activities and 02 82 16.00 20, Engineering Control of Asbestos Containing Materials

Ft. Campbell Requirements:

Removal and disposal of asbestos containing materials shall be conducted in accordance with United Facilities Guide (UFGS) Division 02 specifications, [Section 02 82 14.00 10, Asbestos Hazard Control Activities](#) and [Section 02 82 16.00 20, Engineering Control of Asbestos Materials](#). The provisions of these two guides shall be incorporated into all projects containing or possibly containing asbestos materials. In addition, all requirements of Ft. Campbell and the appropriate state(s) shall be complied with.

All friable and non-friable asbestos containing materials are to be removed from buildings before demolition. In addition, all materials containing asbestos in amounts of 1% or less will be removed by an abatement contractor using approved asbestos abatement methods unless it can be clearly demonstrated and documented that OSHA Worker Protection Rules are being fully complied with.

Abatement contractors are to notify the TSCA program in writing at least two working days prior to beginning asbestos removal. In addition, copies of all NESHAP (10 Day Notice) compliance documents provided to the states of Kentucky and/or Tennessee will be provided with the written notification. The point of contact for this notification is the TSCA Program Manager at (270) 798-9604.

Unless specifically approved in writing by the Hazardous Waste Program Manager, asbestos waste may not be disposed of anywhere except the Ft. Campbell Construction and Demolition Landfill, named the Woodlawn Landfill, which is physically located on the installation. Waste may not be disposed of in drums or containers, only bags or individually wrapped items are accepted; minimum 6 mil double bagged/wrapped. Asbestos waste is not permitted to be transported off of the installation.

Contractors must abide with the asbestos regulations in order for the asbestos to be accepted at the Woodlawn Landfill. These procedures include proper notification to the landfill, use of the [Ft. Campbell Asbestos Manifest](#) form for manifesting, documentation of NESHAP compliance (10 state notice), vehicle marking, unloading and PPE. All documentation will be required with **each** load delivered to the landfill; dump ticket issued to the primary contractor, copy(ies) of NESHAP 10 day notice for the appropriate state(s), Ft. Campbell Asbestos Waste Manifest.

Many contractors depend on refuse contractors to transport the asbestos waste, and their personnel accompanying the asbestos do not normally have asbestos knowledge or training. Therefore, those delivering the materials to the landfill must have proof of medical surveillance and proper PPE.

Asbestos studies have been completed for numerous existing buildings and facilities at Fort Campbell. These studies were performed to meet OSHA building occupant notification requirements and were non-destructive in nature. Regulations require that a thorough pre-demolition asbestos inspection be performed before demolition or renovation. Only reports specifically stating that they have been performed and prepared to meet the pre-demolition or renovation requirement truly meet this requirement. Designers shall investigate and review the data as required to insure proper identification and notification of asbestos presence at planned OMA and MILCON projects. These studies are available for inspection on the serserver at DPW/Env_Div/ASB-Lead-Radon/PDF_Reports or at the DPW Environmental Division. POC is the TSCA Program Manager at (270) 798-9604

All projects containing or possibly containing asbestos products shall incorporate all applicable parts of [UFGS 02 82 14.00 10 Asbestos Hazard Control Activities](#) and UFGS [02 82 16.00 20, Engineering Control of Asbestos Containing Materials](#).

----- END OF SECTION -----

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SECTION 02 83 13.00 20 Lead in Construction

Ft. Campbell Requirements:

Removal and disposal of lead-based paint materials shall be conducted in accordance with Ft. Campbell specification section 02 83 13.00 20, Lead in Construction, which shall be included in all projects containing or possibly containing lead-based products.

Instruction to Designers:

PART 1 GENERAL

1.1 Intent

The intention of this specification is to summarize the requirements of the contractor to protect his workers in accordance with the OSHA Lead Construction Standard detailed in 29 CFR 1926.62. This standard is intended to reduce the occupational health hazard of lead exposure and must be applied to all occupational exposures to lead in construction work in any amount. The intent of this specification is also to summarize requirements for segregation and disposal of lead containing waste resulting from the demolition.

The contractor is required by 29 CFR 1926.62 to perform an exposure assessment to determine if any employee may be exposed to lead at or above the action level of 30 µg/m³ as an 8-hour TWA. As per the standard the contractor must perform initial air monitoring or present objective data, demonstrating that under any conditions or activity involving lead at or above the action level does not exist. During initial air monitoring activities, or until a negative exposure assessment has been achieved all employees must wear the appropriate respiratory protection when performing certain listed high exposure □trigger tasks as defined by the standard.

This document only summarizes requirements of the OSHA standard for convenience purposes and is not all-inclusive. All requirements of 29 CFR 1926.62 are to be strictly followed along with all other applicable Federal, State and local regulations.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.2 - 1979 Fundamentals Governing the Design and Operation of Local Exhaust Systems

ANSI Z88.2 - 1980 Respiratory Protection

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134 - Respiratory Protection

29 CFR 1910.1025 - Lead Standard for General Industry

29 CFR 1910.1200 - Hazard Communication

29 CFR 1926.55 - Gases, Vapors, Fumes, Dusts, and Mists

29 CFR 1926.57 - Ventilation

29 CFR 1926.62 - Lead Standard for General Industry

40 CFR 260 - Hazardous Waste Management Systems: General

40 CFR 261 - Identification and Listing of Hazardous Waste

40 CFR 262 - Generators of Hazardous Waste

40 CFR 263 - Transporters of Hazardous Waste

40 CFR 264 - Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 - Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 268 - Land Disposal Restrictions

49 CFR 172 - Hazardous Materials Tables and Hazardous Materials Communications Regulations

49 CFR 178 - Shipping Container Specification

UNDERWRITERS LABORATORIES INC. (UL)

UL 586 - 1990 High-Efficiency, Particulate, Air Filter Units

1.3 DEFINITIONS

1.3.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of air averaged over an 8-hour period. As used in this section, "30 micrograms per cubic meter of air" refers to the action level.

1.3.2 Area Monitoring

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.

1.3.3 Physical Boundary

Area physically roped or partitioned off around a lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" will mean the same as "inside lead control area."

1.3.4 Certified Industrial Hygienist (CIH)

As used in this section, refers to an Industrial Hygienist employed by the Contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.

1.3.5 Change Rooms and Shower Facilities

Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.

1.3.6 Decontamination Room

Room for removal of contaminated personal protective equipment (PPE).

1.3.7 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.

1.3.8 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

1.3.9 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

1.3.10 Lead Control Area

An area isolated by physical boundaries to prevent unauthorized entry of personnel. It may consist of an enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead-containing paint removal/demolition operations or in those cases, when an enclosed lead control area is not practical, restriction of access into the area may be accomplished by roping off the area or by providing some other form of physical boundary constraint.

1.3.11 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1910.1025. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

1.3.12 Personal Monitoring

Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and the center at the nose or mouth of an employee.

1.4 QUALITY ASSURANCE

1.4.1 Medical Examinations

Before exposure to lead-contaminated dust, provide workers with a comprehensive medical examination as required by 29 CFR 1926.62 and 29 CFR 1910.1200. The examination will not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62 within the last year.

1.4.1.1 Medical Records

Maintain complete and accurate medical records of employees for a period of at least 40 years or for the duration of employment plus 20 years, whichever is longer.

1.4.2 CIH or Their Designated Representative Responsibilities:

- a. Certify training.
- b. Review and approve lead-containing paint demolition plan for conformance to the applicable referenced standards.
- c. Inspect the demolition work for conformance with the approved plan.
- d. Direct monitoring.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Ensure hazardous exposure to personnel and to the environment are adequately controlled at all times.

1.4.3 Training

Train each employee performing paint demolition, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62.

1.4.3.1 Training Certification

Submit certificates signed and dated by the CIH and by each employee stating that the employee has received training.

1.4.4 Respiratory Protection Program

- a. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 6 months thereafter as required by 29 CFR 1926.62.
- b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1910.134, 29 CFR 1910.1025, CFR 1926.62, and 29 CFR 1926.55.

1.4.5 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.

1.4.6 NOT USED

1.4.7 Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling,

storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62.

1.4.8 Pre-Construction Conference

Along with the CIH, meet with the Contracting Officer to discuss in detail the lead-containing paint demolition work plan, including work procedures and precautions for the work plan.

1.5 SUBMITTALS

Submit the following in accordance with Section C-01300, "Submittals." The testing laboratory qualifications and lead-containing demolition plan shall be approved by the government. All other submittals will be for informational purposes only.

1.5.1 Manufacturer's Catalog Data

- a. Vacuum filters
- b. Respirators

1.5.2 NOT USED

1.5.3 Statements

- a. Qualifications of CIH
- b. Exposure assessment documentation
- c. Testing laboratory qualifications
- d. Lead-containing paint demolition plan
- e. Rental equipment notification
- f. CIH approval of work plan (signature, date, and certification number)
- g. Respiratory protection program
- h. Hazard communication program

1.5.3.1 CIH Qualifications

Submit name, address, and telephone number of the CIH selected to perform responsibilities in paragraph entitled "CIH Responsibilities." Provide previous experience of the CIH. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification.

1.5.3.2 Testing Laboratory

The contractor will provide documentation which includes the name, address and telephone number of the laboratories to be providing services. In addition, the documentation will indicate that each laboratory is an EPA National Lead Laboratory accreditation Program (NLLAP) accredited laboratory that each is rated proficient in the NIOSH/ EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT) and will document the date of current

accreditation. Certification will include accreditation for heavy metal analyses, list of experience relevant to analyses of lead in air, and a Quality Assurance and Quality Control Program.

1.5.3.3 Written Compliance Plan

In accordance with 29 CFR 1926.62 (e)(2)(I), the contractor shall submit a detailed job-specific plan of the work procedures to be used in the demolition of the buildings. The written compliance plan should include but is not limited to:

- a. Details of the planned exposure assessment or a discussion of the objective data utilized from a previous project.
- b. A description of equipment and materials, controls, crew size, job responsibilities, and operations and maintenance procedures for each activity in which lead is emitted.
- c. A description of specific control methods (e.g., abatement process selection, wet methods). For engineering controls, include supporting engineering plans and studies used to select methods.
- d. Technology considered in meeting the PEL.
- e. Air monitoring data documenting sources of lead emissions.
- f. A detailed implementation schedule for the compliance plan, including the schedule for inspections by a competent person.
- g. A description of the lead work practice program that will be used to control worker exposures. (This includes the use of protective work clothing and equipment, hygiene facilities and practices, and housekeeping practices.
- h. A description of arrangements made among contractors on multi-contractor work sites to inform affected employees (including bystanders) of potential lead exposures, and to clarify responsibilities with regard to control of those exposures.

1.5.4 Air Monitoring

Submit monitoring results to the Contracting Officer within 3 working days, signed by the testing laboratory employee performing the air monitoring, the employee that analyzed the sample, and the CIH.

1.5.5 NOT USED

1.5.6 SD-18, Records

- a. Certification of medical examinations

b. Employee Training certification

1.5.7 Within 48 hours prior to beginning lead-based paint (LBP) disturbance (excluding building demolitions), the contractor will submit to the Contracting Officer Representative (COR) and Environmental Division / Compliance Branch written notification which shall include: Such notification shall include the following:

- Building number
- Anticipated start and end dates
- Description of surface being disturbed or abated
- Quantity of surface being disturbed or abated including units (e.g. SF, LF, number of components, etc.)
- Description of approximate location of work (e.g. latrines, NW corner of building, 2nd floor, etc.)
- Type of removal activity (e.g. surface preparation, stripping, etc.)

If needed, a copy of the LBP survey may be obtained at the DPW Environmental Division. Within 48 hours of being received, the COR will in-turn forward a copy of the survey annotation to the Fort Campbell / Directorate of Public Works / Environmental Division / Compliance Branch / TSCA Program Manager, IMSE-CAM-PWE, Building 2182, 13 ½ Street, Fort Campbell, Kentucky 42223-5130. Within 48 hours after LBP removal, the contractor will provide the CA a written description of the surfaces that were abated and the type of removal action (surface preparation, stripping of paint from the surface, component removal). The CA will forward a copy of the survey annotation to the DPW Environmental Division.

1.6 REMOVAL

1.6.1 Title to Materials

Lead containing materials resulting from demolition work, except those classified as hazardous waste, will become the property of the Contractor and will be disposed in accordance with section 3.5 of this specification.

1.7 EQUIPMENT

The contractor shall furnish the Contracting Officer with one complete set of personal protective equipment daily, as required by the CIH, for entry into and inspection of the demolition work within the lead controlled area. Required personal protective equipment may include, but is not limited to fitted respirators and whole body covering including appropriate foot, head, and hand protection. PPE shall be provided by the contractor and will remain the property of the contractor.

1.7.1 Respirators

Respirators will comply with the requirements of 29 CFR 1910.134. Furnish appropriate respirators approved by the NIOSH, Department of Health and Human Services, for use in atmospheres containing lead dust.

1.7.2 Special Protective Clothing

Special protective clothing will be worn as per the Lead Protection Plan (sec 1.5.3.3) and in accordance with OSHA 29 CFR 1910 .132. Reduction of levels of protective clothing can only be performed after approval from the CIH.

1.7.2.1 Furnished Clothing

Protective clothing shall be provided in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to use of a respirator are over 200 $\mu\text{g}/\text{m}^3$ of lead as an 8-hour TWA. The contractor shall provide for the cleaning, laundering, and disposal of protective clothing and equipment as needed.

1.7.2.2 Protective Clothing Handling

The contractor shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change area which prevents dispersion of lead outside the container.

The container shall be labeled as follows:

"CAUTION: Clothing contaminated with lead. Do not remove dust by blowing or shaking. Dispose of lead contaminated wash water in accordance with applicable local, state, or federal regulations."

1.7.3 Rental Equipment Notification

If rental equipment is to be used during lead-containing paint handling, removal, or demolition, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the Contracting Officer.

1.7.4 Vacuum Filters

UL 586 labeled HEPA filter must be used.

PART 2 NOT USED

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Notification

Notify the Contracting Officer 20 days prior to the start of any demolition work where elements with lead containing coatings or paint are present.

3.1.2 NOT USED

3.1.3 Protection of Existing Work to Remain

Perform demolition work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.

3.1.4 Boundary Requirements

Establish a lead control area to prevent the spread of lead dust, paint chips, or debris of lead-containing paint and restrict access to the area. Provide physical boundaries around the lead control area by roping off the area or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.

3.1.5 NOT USED

3.1.6 NOT USED

3.1.7 Change Room and Shower Facilities

Item 3.1.7 will only be required in case of a positive exposure assessment according to Section 3.1.11 of this specification. Provide clean change rooms and shower facilities (if feasible), within the physical boundary around the designated lead control area in accordance with requirements of 29 CFR 1926.62.

3.1.8 Mechanical Ventilation System

Item 3.1.8 will only be required in case of a positive initial determination according to Section 3.1.11 of this specification. If exposure is in excess of the PEL, the following control devices may be implemented:

- a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57.
- b. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the certified industrial hygienist. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.
- c. If air from exhaust ventilation is recirculated into the workplace, the system shall have a high efficiency filter with reliable back-up filter and controls to monitor the

concentration of lead in the return air and to bypass the recirculation system automatically if it fails. Air may be recirculated only where exhaust to the outside is not feasible.

3.1.9 Personnel Protection

Item 3.1.9 will only be required in case of a positive initial determination according to Section 3.1.11 of this specification. Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been given appropriate training and protective equipment.

3.1.10 Warning Signs

Item 3.1.10 will only be required in case of a positive initial determination, according to Section 3.1.11 of this specification. Provide warning signs at approaches to lead control areas, if the exposure will be above the PEL. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.1.11 Exposure Assessment

The contractor shall comply with all provisions of 29 CFR 1926.62 (d). Until the contractor performs an employee exposure assessment, the contractor shall implement appropriate protective measures in accordance with 29 CFR 1926.62. See [table-1](#), which lists applicable paragraphs of the standard that must be addressed during the exposure assessment. It also lists requirements for when exposures are above the action level, the permissible exposure level and at any level.

The personal protective clothing and controls shall be used as long as employee exposure is greater than the PEL. The CIH will be responsible for determining the exposure level and appropriate personal protective equipment.

3.1.12 Exposure Assessment Requirements

Until an exposure assessment has been performed, the contractor shall provide the employees with the interim protection outlined in 29 CFR 1926.62.

The personal protective clothing, controls, and hygiene facilities shall be used as long as employee exposure is greater than the PEL.

3.1.13 Additional Exposure Assessment

After the initial exposure assessment, additional assessments shall be conducted whenever there has been a change of equipment, process, control, personnel, or a new task has been initiated.

3.2 WORK PROCEDURES

The contractor shall perform demolition in accordance to the demolition plan (sec 02050), and the written compliance plan (sec 1.5.3.3). Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-containing paint material is removed in accordance with 29 CFR 1926.62. Dispose of paint chips, demolition debris, and associated waste in compliance with federal, state, and local requirements.

3.2.1 Personnel Exiting Procedures

Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

- a. Vacuum themselves off using the HEPA vacuum.
- b. Remove protective clothing in the decontamination room, and place them in an approved container.
- c. Shower(if required by CIH).
- d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated job site.

3.2.2 Monitoring

Monitoring of airborne concentrations of lead shall be in accordance with 29 CFR 1926.62 and as specified herein. Air monitoring, testing, and reporting shall be performed by a CIH or an Industrial Hygiene (IH) Technician who is under the direction of the CIH.

- a. The CIH or the IH Technician under the direction of the CIH shall be on the job site directing the monitoring, and inspecting the work to ensure that the requirements of the Contract have been satisfied during the entire demolition operation.
- b. Take personal air monitoring samples on employees who are anticipated to have the greatest risk of exposure as determined by the CIH. In addition, take air monitoring samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air monitoring samples, signed by the CIH, within 72 hours after the air samples are taken. Notify the Contracting Officer within 2 hours of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area. Contractor must notify each employee in writing of the results which represent the employee's exposure as per 29 CFR 1926.62.

3.2.2.1 Monitoring During Paint Disturbance

Perform personal and area monitoring during demolition activities as required by 29 CFR 1926.62. Sufficient area monitoring shall be conducted at the physical boundary to ensure unprotected personnel are not exposed above 30 micrograms per cubic meter of air at all times. If the outside boundary lead levels are at or exceed 30 micrograms per cubic meter of air, work shall be stopped and the CIH shall immediately correct the condition(s) causing the increased levels and notify the Contracting Officer immediately. The CIH shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Work shall resume when approval is given by the CIH. The Contractor shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. At least one sample on each shift shall be taken on the downwind side of the lead control area. If adjacent areas are contaminated, clean and visually inspect contaminated areas. The CIH shall certify that the area has been cleaned of lead contamination.

3.3 NOT USED

3.4 NOT USED

3.5 CLEANUP AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area.

3.5.2 Certification

The CIH shall certify the following in writing: air monitoring results are less than 30 micrograms per cubic meter inside and outside the lead control area, the respiratory protection for the employees was adequate, the work procedures were performed in accordance with 29 CFR 1926.62, and that there were no visible accumulations of lead-contaminated paint and dust at the worksite. Do not remove the lead control area or roped-off boundary and warning signs prior to the Contracting Officer's receipt of the CIH's certification. Reclean areas showing dust or residual paint chips.

3.5.3 Testing of Lead-Containing Paint Debris

Waste Products shall be separated into the following categories:

- a. Old woodwork, walls, roofing, plaster, windows, doors, concrete block debris, (all the debris associated with the demolition of the building).
- b. Rags, sponges, mops, HEPA filters, air monitoring cartridges, scrapers, and other materials used for testing, and cleanup

c. Disposable work clothes and respirator filters

The waste produced by demolition (only aforementioned point a) has been determined to be non hazardous waste; therefore, testing is not required and may be disposed at the Woodlawn Landfill. The Contractor must evaluate, in accordance with 40 CFR 261 for hazardous waste, the waste described on points b. and c. to determine if they are hazardous. For initial pricing purposes, it will be assumed that the items described in b. and c. above are non-hazardous, lead containing waste. If the Toxic Characteristic Leaching Procedure (TCLP) as required by 40 CFR 261 reveals that any items in b. or c. above as hazardous, an appropriate price adjustment will be negotiated in accordance with the Changes Clause.

Prior to initiation of the work and subsequent to final demolition and cleanup of the work site, soil testing will be performed to determine if the demolition project has contaminated the surface soils with lead. Remediation of contaminated soil resulting from the demolition is the sole responsibility of the contractor.

3.5.4 Disposal of Lead Contaminated Hazardous Waste

- a. Collect lead-contaminated hazardous waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 49 CFR 172. Dispose of lead-contaminated waste material at an EPA permitted hazardous waste treatment, storage, or disposal facility off Government property **after first coordinating with and having HW manifest signed by P2 Branch.**
- b. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- c. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

3.5.4.1 Disposal Documentation

Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. **Manifest must be signed by the HW manager as well as transporter before leaving the installation.**

3.5.5 Disposal of Lead Contaminated Non-Hazardous Waste

Any portion of the segregated waste products which does not test as hazardous by the testing requirements stated above, may be disposed at the Woodlawn Landfill.

3.5.6 Payment for Hazardous Waste Disposal

Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Government.

Table 1: Lead Contamination Levels

OSHA Instruction CPL 2-2.58
 DEC 13 1993
 Office of Health Compliance Assistance

**APPENDIX C
 APPLICABLE PARAGRAPHS OF 1926.62**

For Specific Air Lead Levels					During Assessment of Trigger Tasks
Regardless of Level	≥ AL		> PEL	> 4 X PEL	
	1 - 30 Days	> 30 Days			
1926.62(d) - Exposure Assessment and Interim Protection 1926.62(h) - Housekeeping 1926.82(j)(5) - Handwashing Facilities 1926.62(l)(1)(i) - Hazcom Training (and/or 1926.21 - Safety Training and Education)	1926.62(d)(4) - Monitoring Representative of Exposure for Each Exposed Employee 1926.62(j)(1)(i) - Initial Medical Surveillance 1926.62(j)(2)(ii) - Follow-up Blood Sampling 1926.62(k) - Temporary Removal Due to Elevated Blood Lead 1926.62(l)(1)(ii)-(iv) - Information and Training	1926.62(j)(1)(ii) - Medical Surveillance Program 1926.62(j)(3) - Medical Exams and Consultation (if required)	1926.82(e) - Engineering and Work Practice Controls 1926.62(f) - Respiratory Protection 1926.62(g) - Protective Clothing and Equipment 1926.62(i) - Hygiene Facilities and Practices 1926.62(m) - Signs	1926.62(g)(2) - Clean Protective Clothing Daily	1926.62(f) - Appropriate Respiratory Protection 1926.62(g) - Protective Clothing and Equipment 1926.62(i)(2) - Change Areas 1926.62(i)(5) - Handwashing Facilities 1926.62(j)(1)(i) - Biological Monitoring 1926.62(l)(1)(i) - Hazcom Training 1926.62(j)(2)(iii) - Respirator Training 1926.21 - Safety Training and Education

Table 1

----- END OF SECTION -----

[Back to Paragraph 3.1.11](#)

[Return to Section](#)

Section 02 84 16 Handling of Lighting Ballasts and Lamps Containing

The following Mercury Containing Bulbs paragraph shall be included in Spec Section 01 74 19, Construction and Demolition Waste Management in all projects:

"3.4.? Mercury Containing Light Bulbs: Mercury containing light bulbs such as mercury vapor, metal halide, high pressure sodium, and fluorescent light bulbs, or any other mercury-containing light bulbs shall be considered and handled as hazardous waste for recycle. The contractor shall collect these old/used bulbs or tubes and very carefully deliver them to the DPW-PPOC yard before the time of demolition of old buildings or a section of a building. For disposal and recycling of these bulbs, have the Contracting Officer's representative contact the DPW-PPOC yard hazardous waste supervisor before delivery to the yard so that packaging requirements for transport of the bulbs can be determined."

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE CHAPTER 3 Technical Requirements and Instructions Division 03 Concrete

SECTION 03 30 00 Cast-In-Place Concrete

Ft. Campbell Requirements:

Concrete used in masonry bond beams should be 9/11 slump and contain plastiziser.

Concrete shall use Class F fly ash as the pozzolanic cement replacement.

To accommodate environmental Radon protection, all specification items identified as "vapor barrier" shall be modified to read "vapor/radon barrier"

----- END OF SECTION -----

TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 04
Masonry

Section 04 20 00
Masonry

Ft. Campbell Requirements:

All exterior split faced units shall be fabricated with integral water repellent and shall be integrally colored during manufacture. Water repellent primer and stain shall also be applied to all exterior split faced CMU after completion of exterior work and split face is not subject to damage by construction activities.

Block filler shall be used on all exposed CMU.

For new construction, pre-engineered metal structural frames/buildings shall not be structurally tied to masonry. If tied, frame deflection must be limited to L/600, which increases steel frame cost to the point which it exceeds the cost of a designed structure.

This fact has been verified by metal building manufacturers, and precludes perceived advantages of pre-engineered structural systems.

Modify specifications section 04200, Masonry, to incorporate the following paragraphs, specifically including all items highlighted in red:

See [Appendix D: Exterior Finishes](#).

2.4.2.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be [fluted] [vertical scored] [split ribbed] [_____]. All exterior architectural units shall be fabricated with integral water repellent and shall be integrally colored during manufacture. Water repellent primer and stain shall also be applied to all exterior architectural CMU walls after completion of exterior work and when the masonry is not subject to damage by construction activities.

Color shall be [_____]. Patterned face shell shall be properly aligned in the completed wall.

2.10 MORTAR

Mortar shall be Type [S] [N] in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; Type N cement-lime mortar proportions shall be 1 part cement, 1 part lime and 6 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the 2.36 mm No. 8 sieve and 95 percent passing the 1.18 mm No. 16 sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source. Efflorescence testing of mortar shall be in accordance with ASTM C 67. Any component causing efflorescence shall be rejected.

2.11 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 200 and 250 mm. 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Efflorescence testing of mortar shall be in accordance with ASTM C 67. Any component causing efflorescence shall be rejected.

3.26.3 Efflorescence Test

Brick, split faced and scored CMU which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subject to rejection.

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE

CHAPTER 3
Technical Requirements and Instructions
Division 05
Metals

Section 05 50 13
Miscellaneous Metal Fabrications

Ft. Campbell Requirements:

Roof access hatches are to be provided for those buildings two stories and above. Provide access doors with a minimum of 14 by 20 inches and of not lighter than 14 gage steel, with stiffened edges and welded attachments. Provide access doors hinged to frame and with a flush-face, turn-screw-operated latch. Latch shall have locking capability.

Section 05 52 00
Metal Railings

Ft. Campbell Requirements:

Avoid painted handrailings and guardrails. Use unpainted galvanized (exterior), stainless steel or aluminum railings (interior).

----- END OF SECTION -----

TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 06
Wood, Plastics, and Composites

SECTION 06 20 00
Finish Carpentry

Ft. Campbell Requirements:

Use finished or painted wood trim instead of plastic for chair rails, and other decorative locations.

DPW is using wood veneer casework instead of plastic laminate on O&M projects.
Hollow metal interior doors shall be used in barracks buildings.

----- END OF SECTION -----

SECTION 06 61 16
Solid Polymer (Solid Surfacing) Fabrications

Ft. Campbell Requirements:

Prefer using solid surfacing on counter tops and possibly on windowsills for more scratch and stain resistance.

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 07
Thermal and Moisture Protection

SECTION 07 24 00
Exterior Insulation and Finish Systems

Ft. Campbell Requirements:

Exterior Insulating Finish Systems (EIFS): EIFS may be used as an exterior finish material only in limited applications. Building envelope finishes shall be predominantly brick, split-face block or metal panels (in industrial or otherwise approved land use areas). Unless otherwise approved, EIFS applications shall not exceed 20% of the total exterior building surface, and shall not be applied at grade or in other locations where the material is subject to damage from lawn mowing activities or is easily accessible to vandalism.

----- END OF SECTION -----

SECTION 07 31 13
Asphalt Shingles

Ft. Campbell Requirements:

Shingles shall be of simple seal-down 3-tap design. Use only light colors, and maximum life quality. Minimum slope for shingles shall conform to manufacturer recommendations.

Flat built-up roofs are not to be utilized in new roof system designs. Minimum low slope for roofs shall be ½ inch per foot.

Modified bitumen is the preferred membrane on low slope roof conditions for recover, replacement, and new installations.

The roof specification shall require the contractor to test new roofing systems by flooding roofs with interior gutters and to fire hose-spray exterior gutter roofs to insure water tightness.

----- END OF SECTION -----

Section 07 42 13 Metal Wall Panels

Ft. Campbell Requirements:

Metal panel siding may be used in industrial land use areas. Use of metal panel siding in other land use areas must be approved.

----- END OF SECTION -----

SECTION 07 51 13 Built-up Asphalt Roofing

Ft. Campbell Requirements:

Flat no-slope built-up roof systems are to be utilized in new facility designs by approved exception only.

Minimum low slope for new roofs shall be ½ inch per foot.

Modified bitumen is the preferred membrane on low slope roof conditions for recover, replacement, and new installations.

The roof specification shall require the contractor to test new roofing systems by flooding roofs with interior gutters and to fire hose-spray exterior gutter roofs to insure water tightness.

----- END OF SECTION -----

SECTION 07 52 00 Modified Bituminous Membrane Roofing

Ft. Campbell Requirements:

Flat no-slope built-up roof systems are to be utilized in new facility designs by approved exception only.

Minimum low slope for new roofs shall be ½ inch per foot.

Modified bitumen is the preferred membrane on low slope roof conditions for recover, replacement, and new installations.

The roof specification shall require the contractor to test new roofing systems by flooding roofs with interior gutters and to fire hose-spray exterior gutter roofs to insure water tightness.

----- END OF SECTION -----

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SECTION 07 53 23 Elastomeric Roofing (EPDM)

Ft. Campbell Requirements:

Flat no-slope built-up roof systems are to be utilized in new facility designs by approved exception only.

Minimum low slope for new roofs shall be ½ inch per foot.

Modified bitumen is the preferred membrane on low slope roof conditions for recover, replacement, and new installations.

The roof specification shall require the contractor to test new roofing systems by flooding roofs with interior gutters and to fire hose-spray exterior gutter roofs to insure water tightness.

----- END OF SECTION -----

SECTION 07 61 14.00 20 Steel Standing Seam Roofing

Structural:

Ft. Campbell Requirements:

Metal roofing shall be vertical seam with ASTM E 1592 uplift approval.

Color shall conform to Ft. Campbell approved standard schemes. See Appendix D

The roof specification shall require the contractor to test new roofing systems by flooding roofs with interior gutters and to fire hose-spray exterior gutter roofs to insure water tightness.

Non-Structural:

Ft. Campbell Requirements:

Metal roofing shall be vertical seam and meet UL class 90 uplift approval.

Color shall conform to Ft. Campbell approved standard schemes. See Appendix D

The roof specification shall require the contractor to test new roofing systems by flooding roofs with interior gutters and to fire hose-spray exterior gutter roofs to insure water tightness.

----- END OF SECTION -----

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**TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 08
Openings**

**Section 08 33 23
Overhead Coiling Doors**

Ft. Campbell Requirements:

Door manufacturer representative shall conduct a final inspection of the door installation(s) and certify the installation is complete and correct, and meets all requirements for the full warranty.

Instructions to Designers:

1. Modify UFGS 08331 paragraphs to include the on-site visit and verification requirement.
1. Modify the UFGS 08331 paragraphs to include a certification of inspection by the door manufacturer representative.

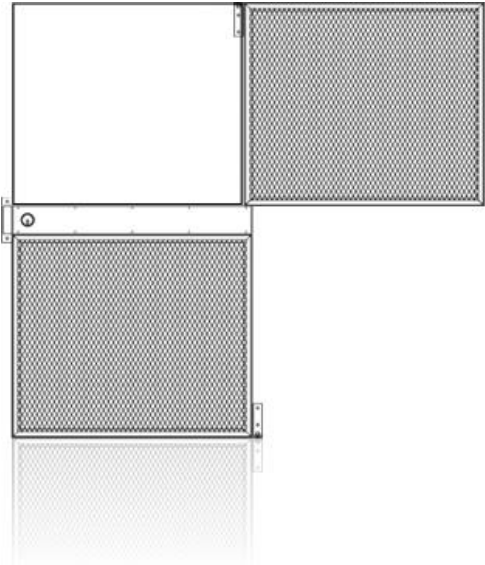
----- END OF SECTION -----

**Section 08 34 59
Vault Doors and Day Gates**

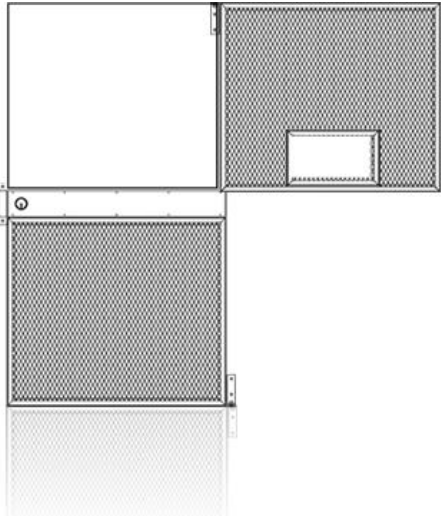
Ft. Campbell Requirements:

Following are examples of an Arms Room Dutch Door Day Gate and Weapons Rack Anchors to be used in arms rooms:

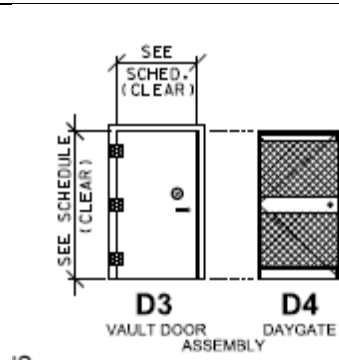
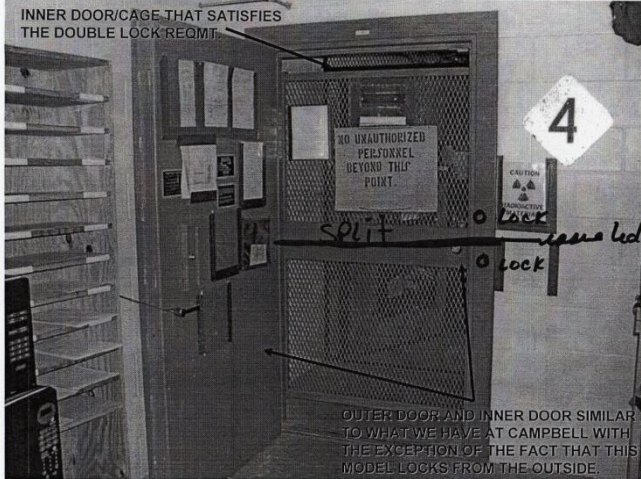
Reference: <http://www.vanguardii.com/products.php>

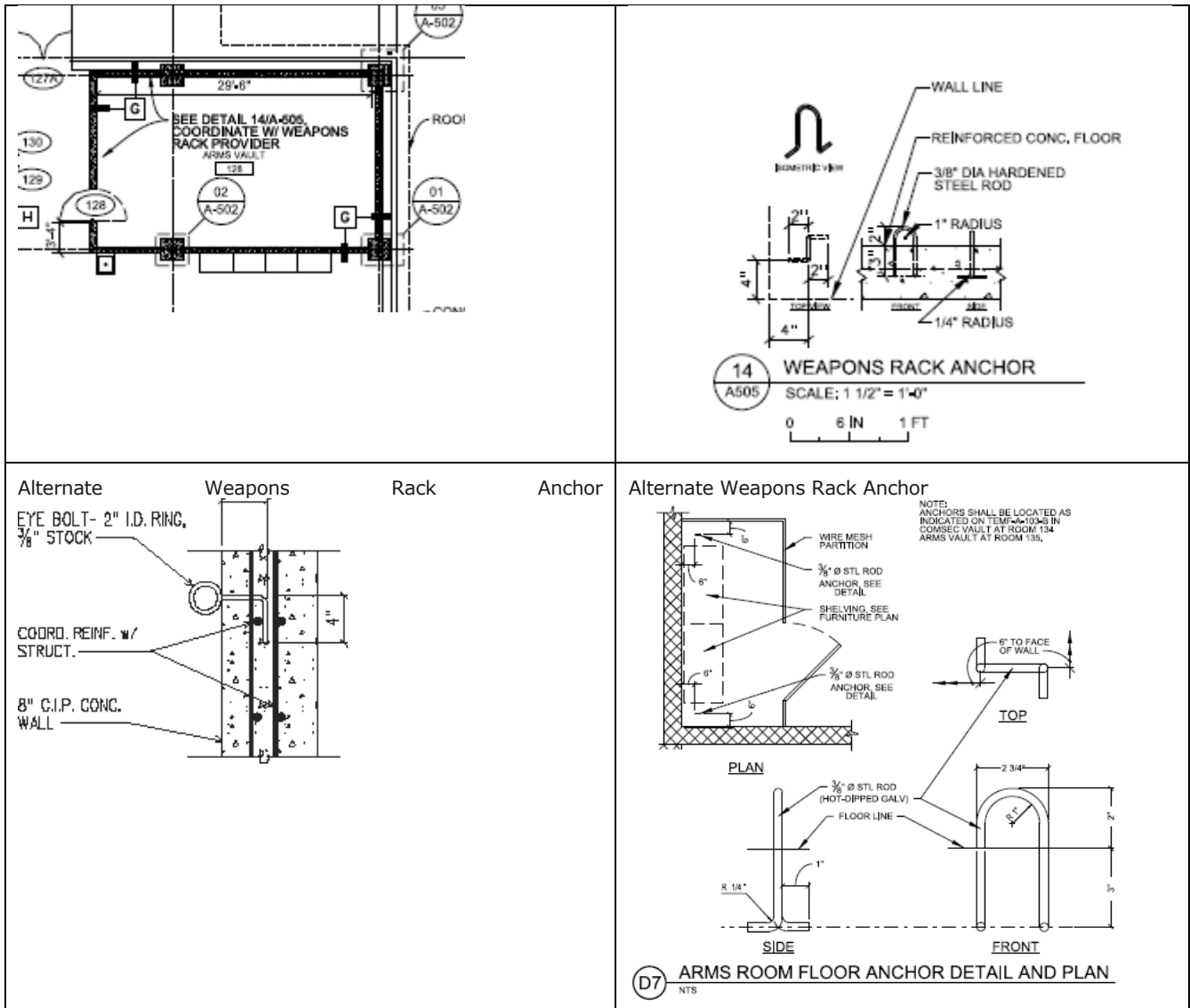
<p>Dutch Door Day Gate</p> 	<table border="1"> <tr> <td>Style:</td> <td>Dutch Door Day Gate</td> </tr> <tr> <td>Lock</td> <td>Deadbolt, keyed outside / thumb latch inside</td> </tr> <tr> <td>Options:</td> <td>Door Closure, Self Latching Lock</td> </tr> <tr> <td>Clear Opening:</td> <td>40" x 78" (Matches Class 5 Vault Door)</td> </tr> <tr> <td>Masonry Opening:</td> <td>Mounted on Class 5 Door Frame</td> </tr> <tr> <td>Weight:</td> <td>130 lbs.</td> </tr> <tr> <td>Available Swing:</td> <td>Left Swing / Right Swing</td> </tr> <tr> <td>Paint Color</td> <td>Gray</td> </tr> <tr> <td>Price:</td> <td>Please <u>contact us</u> for pricing</td> </tr> <tr> <td>Description</td> <td>11 ga. steel mesh with heavy duty hinges. The dutch door day gate consists of both a top and bottom leaf, which swing independently of each other. The top half locks to the bottom half when shut.</td> </tr> </table>	Style:	Dutch Door Day Gate	Lock	Deadbolt, keyed outside / thumb latch inside	Options:	Door Closure, Self Latching Lock	Clear Opening:	40" x 78" (Matches Class 5 Vault Door)	Masonry Opening:	Mounted on Class 5 Door Frame	Weight:	130 lbs.	Available Swing:	Left Swing / Right Swing	Paint Color	Gray	Price:	Please <u>contact us</u> for pricing	Description	11 ga. steel mesh with heavy duty hinges. The dutch door day gate consists of both a top and bottom leaf, which swing independently of each other. The top half locks to the bottom half when shut.
Style:	Dutch Door Day Gate																				
Lock	Deadbolt, keyed outside / thumb latch inside																				
Options:	Door Closure, Self Latching Lock																				
Clear Opening:	40" x 78" (Matches Class 5 Vault Door)																				
Masonry Opening:	Mounted on Class 5 Door Frame																				
Weight:	130 lbs.																				
Available Swing:	Left Swing / Right Swing																				
Paint Color	Gray																				
Price:	Please <u>contact us</u> for pricing																				
Description	11 ga. steel mesh with heavy duty hinges. The dutch door day gate consists of both a top and bottom leaf, which swing independently of each other. The top half locks to the bottom half when shut.																				

Dutch Door with Issue Port Day Gate



Style:	Dutch Door Day Gate with Issue Port
Lock	Deadbolt, keyed outside / thumb latch inside
Options:	Door Closure, Self Latching Lock
Clear Opening:	40" x 78" (Matches Class 5 Vault Door)
Masonry Opening:	Mounted on Class 5 Door Frame
Weight:	130 lbs.
Available Swing:	Left Swing / Right Swing
Paint Color	Gray
Price:	Please <u>contact us</u> for pricing
Description	11 ga. steel mesh with heavy duty hinges. The dutch door day gate consists of both a top and bottom leaf, which swing independently of each other. The top half locks to the bottom half when shut. The top leaf has an 8" x 12" issue port and has a stainless steel shelf that folds up and locks with 2 barrel bolts over the issue port.





----- END OF SECTION -----

SECTION 08 36 13
Sectional Overhead Doors

Ft. Campbell Requirements:

Door manufacturer representative shall conduct a final inspection of the door installation(s) and certify the installation is complete and correct, and meets all requirements for the full warranty.

Instructions to Designers:

1. Modify UFGS 08360 paragraphs to include the on-site visit and verification requirement.

2. Modify the UFGS 08360 paragraphs to include a certification of inspection by the door manufacturer representative.

----- END OF SECTION -----

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SECTION 08 71 00 Hardware

Section Revision Date: 4/14/2015

Instructions to Designers:

1. The Designer of Record (DOR) shall include each of the following requirements as they apply to the project.
2. Current installation POC for keys and locks is Mr. Bob Ayers (270) 798-3581, robert.b.ayers.civ@mail.mil.

Ft. Campbell Requirements:

1. Contractor's Notification Requirement

Contractor's noting "door hardware by others" need to inform the "others" of these Technical Design Guide (TDG) requirements.

2. Fort Campbell Master System

- Fort Campbell Master System is a 7 pin, small format interchangeable core (SFIC) by "Insta-Key".
- SFIC provided shall be compatible with the existing 7 pin "Insta-Key" system.
- This is the standard for all building types.
- Developed keying schedules shall include 4 change keys per set number and 4 blanks per change key.

3. Lock Grades:

All locks are to be a grade 1 and 7 pin SFIC prepped for "Insta-Key" cores, this includes electric lock key overrides, electric switches and vault room security inner doors.

4. Exit Device Standards:

- Panic device hardware shall be pad type.

- Avoid concealed and surface mounted vertical rods.
- Shall use mortise or Rim exit devices and removable mullions for double doors where applicable.
- Stile size of doors must be medium or wide depending on door devices being installed.
- Conflicts of stile sizes and locks, blast doors/frames must be announced to CORPS/COR immediately during design discovery time frame.

5. Electric Exit Devices:

- Electric exit devices need to follow door and hinge prep requirements of Electrical Power Transfer as listed in Allegion EPT 4 or EPT 10.
- Fort Campbell does not utilize MAG lock type locking mechanisms.
- During a renovation or new build careful preparations' towards conduit openings for lock wiring on left, right and top of door frames shall be made.

6. Specialty Rooms/Entrance/Exits:

- Mechanical rooms, roof entrances and crawl spaces are keyed to "Insta-Key" 5DPW.1 cores and Communication Rooms are keyed to "Insta-Key" 1FZ.1 cores as keying standards.
- SIPR/SCIF/secure rooms are secured LKM 7000 series hardware or Sargent and Greenleaf Model 2890B and utilizes S&G 2740 or KABA X-10 combination locks.
 - Should either brand use key override then they must be prepped for 7 pin SFIC and use Insta Key as stated above.
- "Technician Only" type SIPR rooms, can use a PDL2890 or CDX-10.
- Arms/Commo Vault inner gate like doors are to be prepped to use 7 pin SFIC Insta Key cores as stated above.
- Arms rooms vaults shall have S&G 2937 locks.
- NIPR rooms receive a "Basis G" electronic locks with key override and the "Insta-Key" core 1FZ.1.

7. Electronic Locks/Access Control:

Types of buildings requiring FIPS201 certification for electronic access control include:

- Category 1: Sleeping/Living Quarters, such a UEPH Barracks or BOQ:
- Category 2: any buildings not listed in Category 1 including: TEMF's, Co/Bn/Bde OPS, and DFAC.

8. Category 1 Buildings Require Best Basis G Locks In Three Series:

- Cylindrical or 9KG7DV15MS series Track 3
- Mortise or 45HG7TV15MS series Track 3

- Exit device trim EXG7EV15MS series Track 3
9. FIPS201-2 certification shall meet the following requirements:
- All new construction shall meet the requirements below. Tenant organizations may **apply for exception to these requirements prior to construction through the installation locksmith.**
 - Fort Campbell utilizes FIPS 201 qualified Allegion AD series locks, electric strikes, QEL series exit devices as needed (keeping with non-vertical rods/cable systems as earlier mentioned) with needed wall mounted readers for hardware.
 - Electric exit devices need to follow door and hinge prep requirements of Electric Power Transfer as listed in Allegion EPT 4 or EPT 10.
 - Out-buildings and interior doors may receive AD-201 & CO-100 series Allegion locks to complement FIPS 201-2 products.
 - Fort Campbell does not utilize MAG lock type locking mechanisms.
 - The FIPS 201-2 certified access control company used by Fort Campbell is Gallagher Access for software, programming, card encoder, and all equipment w/wiring as needed to obtain functioning system in support of above AD Series Locks or other electronic strikes.

----- END OF SECTION -----

SECTION 08 81 00

Glazing

Ft. Campbell Requirements:

Low Emissivity Coating: Insulating units shall be provided with anti-reflective low-emissivity coating. Color shall be bronze .

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 09
Finishes

SECTION 09 06 90
Color Schedule

Ft. Campbell Requirements:

Exterior and interior finish colors shall conform to [Appendix D](#).

----- END OF SECTION -----

SECTION 09 90 00
Paints and Coatings

Ft. Campbell Requirements:

Use of semi-gloss, eggshell, and other enamelled paint finishes shall be maximized. Use of flat paints shall be minimized.

----- END OF SECTION -----

TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 10
Specialities

SECTION 10 14 01
Exterior Signage

Ft. Campbell Requirements:

Exterior signage shall be fabricated and installed per [CAM Reg 420-6](#). For exterior unit signs, the contractor shall provide and install the sign frame and aluminum sign blank. The government will provide the covering and lettering to go on the sign.

All traffic signs shall comply with the most recent Manual on Uniform Traffic Control Devices ([MUTCD](#)) and [SDDCTEA Pam 55-14](#). The contractor shall test the reflectivity of the new signs and provide GPS location, sign designation, date and reflectivity data. Placement of the signs shall comply with MUTCD. The materials used shall conform to the Kentucky Transportation Cabinet's specification for reflectivity (ASTM D 4956, Types III, IV, VIII, IX, and XI). The aluminum sheeting used in fabricating the signs shall also conform to the Kentucky Transportation Cabinet's specifications. The sign post shall be break away 1 3/4 inch square galvanized steel tubing in a 2 inch square galvanized steel socket. Do not place concrete around the socket in the ground. Treat all signs in the cantonement area as Urban Standard and all signs in the range/training area as Rural Standard.

All signs that were in place prior to construction shall be removed and new signs placed as shown. Other signs such as school zones and railroad crossings shall comply with the MUTCD.

Projects that include new roads, shall also include street signage in the construction contract.

No construction fence or bollards shall be placed within the clear zone. If work is to be done on the roadway or within the clear zone, appropriate Temporary Traffic Control (Chapter 6, MUTCD) shall be implemented. Temporary Traffic Control measures must be inspected by the contractor at a minimum of once per day and more frequently as needed. Signs shall be cleaned as needed in order to promote safe travel through the work area. The contractor shall keep a log of the inspections and cleaning of signs. If the signs are to be used overnight, night time inspections will also be required.

Pavement Marking

All pavement markings shall be in conformance with the 2009 MUTCD and SDDCTEA Pam 55-14. The size and shape shall comply with the 2009 MUTCD. All traffic arrows, stop bars, yield bars, pedestrian crossings and gore areas must be marked with thermoplastic. The markings that are painted shall have a minimum of 100 mil thickness. All marking shall be reflectorized as required by the MUTCD. Reflectorized markings shall be tested to show compliance.

Other marking such as school zones and railroad crossings shall comply with the MUTCD.

Handicap parking spaces shall be marked with white lines and the handicap symbol shall be white with blue back ground and white border around the background. The handicap isles next to the parking spaces shall comply with the ADA guidelines. The placement of the handicap symbol shall be at the rear of the parking space and centered on the space.

Parking lot markings are not required to meet the reflectivity test unless otherwise specified.

The only pavement marking to be used at Fort Campbell will be white, yellow and blue for the background of the handicap symbol.

All stop bars shall be 24 inches in width. All pedestrian crossing and school crossing pavement marking shall be 18 inches in width. The outline border at gore areas shall be 8 inches in width.

FEV, LEV, and HOV Signs

Contractors/AEs will not be allowed to use pavement marking or signs for Fuel Efficient Vehicles, Low Emission Vehicles or High Occupancy Vehicles, etc. for LEEDs points. No signs or pavement marking will be used for such parking. Instead, the contractors/AEs are encouraged to find other LEEDs points that will be more beneficial for Fort Campbell.

Instructions to Designers:

1. Incorporate the above Fort Campbell requirements into the project specifications.

----- END OF SECTION -----

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SECTION 10 14 02 Interior Signage

Ft. Campbell Requirements:

If "addressable" fire alarm system is not used for a building, provide a building map identifying fire alarm zones and mount on wall next to fire alarm system panel.

Interior Designer shall (re)number building spaces for "wayfinding" and provide the information to signage subcontractor on construction drawings.

When interior signage is renumbered from the construction drawing room numbering sequence to accommodate "wayfinding", provide original construction drawing room number in metal slot mounted above door of each room for fire and maintenance purposes when construction drawings typically would be referenced. This confusing problem can be overcome by having "wayfinding" numbering from the beginning of design.

----- END OF SECTION -----

SECTION 10 21 13 Toilet Compartments

Ft. Campbell Requirements:

Use of solid phenolic partitions is encouraged.

----- END OF SECTION -----

**SECTION 10 28 13
Toilet Accessories**

Ft. Campbell Requirements:

Accessories shall not have keyed locking devices.

Toilet tissue dispensers shall be a simple design similar to Bobrick Washroom Equipment, Inc. number B-685 and B-686 series accessories.

Trash receptacles provided in restrooms shall have lids.

Sanitary napkin and tampon dispensers shall not be provided.

----- END OF SECTION -----

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**TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 11
Equipment**

**Section 11 44 00
Food Cooking Equipment**

Ft. Campbell Requirements:

Kitchen facilities that use deep fat frying equipment should have equipment for extracting and storing the used cooking oil.

----- END OF SECTION -----

TECHNICAL DESIGN GUIDE

CHAPTER 3
Technical Requirements and Instructions
Division 13
Special Construction

Section 13 34 19
Metal Buildings

Ft. Campbell Requirements:

For new construction, pre-engineered metal structural frames/buildings shall not be structurally tied to masonry. If tied, frame deflection must be limited to L/600, which increases steel frame cost to the point which it exceeds the cost of a designed structure.

This fact has been verified by metal building manufacturers, and precludes perceived advantages of pre-engineered structural systems.

See [Appendix D](#) for colors.

See: [TI 809-30](#), Metal Building Systems

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 22
Plumbing

Section 22 00 00
Plumbing, General Purpose

Ft. Campbell Requirements:

Gravity flow, tank type, water closets, 12-inch rough-in and 1.28 gallon per flush or less, are preferred and shall meet or exceed American Society of Mechanical Engineers (ASME) A112.19.6M for hydraulic performance and ASME A112.19.2M for fixture dimensions.

Waterless urinals are not acceptable

Schedule 40 PVC or cast iron soil pipe shall be used for all drain, waste, and vent (DWV) applications. Approved couplings or fittings shall be used when transitioning from one material pipe to the other, such as for fire break applications through floor slabs. A relieving arch or pipe sleeve shall be used when piping is routed under foundations.

Type L copper pipe shall be used for water supplies above grade. Type K copper shall be used for water supply under floor slabs. Sleeve all concrete slab penetrations and center copper piping with foam or fiberglass insulation to ensure copper does not contact concrete.

Water lines and gas lines shall not be used for electrical grounding.

Conduct sterilization/flushing of new water lines. Perform bacteriological testing of new water lines. See [Ft. Campbell Water Distribution System](#).

Provide access for grease traps (i.e. a way for a pumper truck to drive right up to the trap) for maintenance and periodic pump out.

Backflow Preventers:

Locate in a visible location with full access to the device for component removal and service no more than than 4 feet above the floor.

Devices must be installed far enough away from walls and other equipment to allow service and repair (nominally 1 foot clearance on either side and 3 feet of clearance top and bottom) such that testing or repair can be performed without interference from adjacent equipment or building structure.

Reduced Pressure Backflow Preventer (RPBP) and Double Check Backflow Preventer (DCBP) devices should be equipped with test cocks.

Testable RPBP and DCBP devices should be equipped with strainers except in fire suppression systems.

All backflow devices must be installed horizontally unless the device is specifically designed for vertical installation.

RPBP relief valves must be vented to a drain of sufficient capacity to handle the full discharge flow of the relief valve.

Large RPBP devices (3"D or greater are best vented to the outside unless a large floor drain with sufficient capacity is available.

Preferred devices include: Watts Regulator Inc., Zurn-Wilkins Inc., or Ames Corporation

RPBP devices must not be installed underground where they are susceptible to flooding. If an outdoor location is required, install the backflow preventer in an insulated box with a heat plate for freeze protection.

Point of Contact for backflow prevention is Chris Semler, CH2MHill at 270-980-7223.

ALL personnel involved with "backflow devices" shall be Tennessee/Kentucky certified in backflow devices. Contractors shall be required to qualify as a licensed Tennessee/Kentucky "Master Plumbers" Contractor. DPW personnel installing, maintaining, or inspecting will also need to obtain and maintain the Tennessee certification (Master Plumber is optional). Tennessee offers training at no cost at it's training center in Murfreesboro several times a year. Initial training is 4 days, renewal training is 2 days.

Atmospheric Vacuum Breaker Devices (AVB) should be installed with no valves downstream. A minimum of 6 inches must be provided above all downstream piping and flood level rim of receptor (hose bib, sink faucet, etc.).

Consider parallel devices where shutdown for inspection and maintenance is not feasible.

Devices shall have individual serial numbers. Numbers are needed to track a device to ensure it is not relocated or another type of device is installed. This is verified on the annual inspections/testing.

The following are backflow applications and recommended devices:

Building Feed	RPBP	High Hazard
Building Bypass	RPBP	High Hazard
Boiler Make up water	RPBP	High Hazard
Chiller Make up Water	RPBP	High Hazard
Wash Water Systems	RPBP	High Hazard
Dynamometers	RPBP	High Hazard
Film Developers	RPBP	High Hazard
Fire Systems w/ chemicals	RPBP	High Hazard
Water Conditioners	RPBP	High Hazard
Chemical Feed Tanks	RPBP	High Hazard
Pump Seal Flush	RPBP	High Hazard
Sewage Plant Connections	RPBP	High Hazard
Compressor Cooling Water	RPBP	High Hazard
Building Feed	DCBP	Intermediate Hazard
Building Bypass	DCBP	Intermediate Hazard
Garbage Disposal	DCBP	Intermediate Hazard
Irrigation Systems	DCBP or PVB	Intermediate Hazard
Ice Machines	DCBP	Intermediate Hazard

Steam Cookers	DCBP	Intermediate Hazard
Drink Machines	DCBP	Intermediate Hazard
Dental Utility Boxes	DCBP	Intermediate Hazard
Mop Sink	AVB	Intermediate Hazard
Hose Bibs	AVB	Intermediate & Low Haz.
Laboratory Sinks	AVB	Intermediate Hazard
Dishwashers	AVB	Intermediate & Low Haz.
Kitchen Wash Sink	AVB	Intermediate Hazard

Abbreviation:	Type of Device:
RPBP	Reduced Pressure Backflow Preventer
DCBP	Double Check Backflow Preventer
PVB	Pressure Vacuum Breaker
AVB	Atmospheric Vacuum Breaker

Vehicle Maintenance Facility Lubrication Systems

1. No compression fittings, valves or screw joints above a 6' working height. Joints above 6' should be welded or soldered to prevent leaks. Joints should be pressure tested for leaks.
2. When a piston pump is installed in a drum, install "drybreak" quick disconnect fittings on air and supply hoses.
3. Ensure all lines are properly labeled with product.
4. Air filters and lubricators should be installed in the supply line coming from the air compressor at a working height not greater than six feet.
5. Ensure only 120lb grease pump packages are installed.

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE CHAPTER 3 Technical Requirements and Instructions Division 23 Heating, Ventilation, and Air Conditioning

Section 23 00 00

Air Supply, Distribution, Ventilation, and Exhaust Systems

Ft. Campbell Requirements:

Ventilation for indoor air quality should follow the American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE) standards. Carbon dioxide sensor operated outdoor air supply dampers shall be used on commercial space heating and cooling systems above 1200 CFM.

Solvent cleaning in Arms Rooms - adequate ventilation a concern. Ventilate arms vaults at a rate of 0.1 CFM / Sq.Ft. minimum at all times. Provide separate manually operated ventilation at the rate of 0.5 CFM / Sq.Ft. during solvent cleaning.

Provide balancing dampers in all branch ducts feeding diffusers. Do not use volume dampers at diffusers for balancing because the noise created by a throttled damper at the diffuser is not attenuated.

Avoid over estimating cooling loads and cooling air flow to spaces. Doing so causes high space humidity, especially at part load cooling conditions. Refer to the appendix titled Mold and Humidity for air system considerations with regard to achieving good space humidity conditions.

Size cooling coils handling outdoor air for the design dry bulb temperature day, or the design humidity day which ever gives the greater coil capacity.

Provide dial type thermometers at air handlers to indicate the temperature of the supply air, return air, outdoor air, and mixed air.

Provide pressure gauges at air handlers to measure the supply duct pressure, the filter differential pressure, and the fan differential pressure.

Preferences: Air conditioners – Trane.

----- END OF SECTION -----

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Section 23 05 93 Testing, Adjusting, and Balancing for HVAC

Ft. Campbell Requirements:

Require the technician to measure, balance, and report the building pressure relative to atmosphere.

Where VAV systems are employed, require measurement of the building pressure at full air flow and at minimum air flow.

If a VAV system is used, the designer must carefully consider the mounting location of each VAV box. The VAV boxes must be easily accessible from a step ladder. They should be located so that moving furniture is not necessary. VAV boxes must not be located high above a suspended ceiling; this makes access nearly impossible. Designers must show the mounting height and insure access to all sides of the VAV boxes.

----- END OF SECTION -----

SECTION 23 07 00 Thermal Insulation for Mechanical Systems

Ft. Campbell Requirements:

Do not use all service jacket (ASJ) in humid or unconditioned spaces. The adhesive on this product does not hold in high humidity conditions.

Do not use fiberglass outdoors or anywhere insulation may get wet.

Provide metal or PVC covering over piping or equipment insulation in spaces that are not air conditioned (cooled); mechanical rooms and storage rooms are examples.

----- END OF SECTION -----

Section 23 08 00.00 10 Commissioning HVAC Systems

Ft. Campbell Requirements:

All projects, MILCON and OMA and other funding sources, shall be executed using commissioning procedures and processes per the COE specification.

Any special tools, computers, software, passwords, etc., required for operations and maintenance of the new equipment that will assist maintenance personnel maintain the facility shall be turned over to the contracting officer.

Specify training for DPW personnel. Training shall be given by factory authorized personnel.

----- END OF SECTION -----

Section 23 09 23.13 20

Lonworks Direct Digital Control for HVAC and Other Building Control Systems

Ft. Campbell Requirements:

General Requirements:

All new construction projects that install HVAC systems shall have open protocol, LONWorks certified, direct digital control (DDC) and shall include the ability to impose range limits to individual thermostats, night setback, equipment on/off, and energy monitoring within the software package.

All renovation, repair, maintenance, and service order projects within existing barracks rooms that replace existing stand-alone HVAC system thermostats shall install an adjustable or fixed style of limiting thermostat.

Barracks rooms shall have individual thermostats that can be manually adjusted within a temperature range consistent with current energy conservation directives.

Provide system control schematic diagrams for each system indicating all required sensors, actuators.

Locate laminated copies of as-built drawings and control schematics in mechanical rooms.

Indicate the valve coefficient, Cv for each control valve.

Locate Freeze stats downstream of the heating coil and be sure manufacturer approved mounting is specified. Locate reset for freeze stat in accessible location.

Electric actuators are to be oil immersed gear actuated or Belimo type. Do not use electro-hydraulic actuators.

Provide actuator position feedback to the DDC for monitoring the position of all valves and dampers.

Be sure conduit enters the control panel from the bottom only.

Specify that all wiring leaving the panel must be landed on a terminal strip separate from the control devices.

Provide control panel with hasp and pad lock in lieu of the panel lock. Pad lock shall be keyed same as the room door.

Do not use a personal computer (PC) as a router to convert from one protocol to another. PCs should be used as the interface to the system, not as a required component in the network.

Show the location of the control panels on the drawings.

Provide laminated control diagrams in the control panel.

EMCS Requirements

Include the following provisions in the specification, However do not include the notes to the designer in the specifications:

Connection to the Energy Management and Control System (EMCS)

See Section 25 10 10, Lonworks Utility Monitoring and Control System (UMCS)

The control inputs and outputs, the schedules, and the alarms to be transmitted shall be as shown on the drawings.

Note to the Designer: On the drawings, in addition to the system control schematics, and sequences of operation, provide a table showing for each system indicating the inputs, outputs, trends, schedules and alarms to be available at the EMCS. Refer to the section below titled EMCS Points for the minimum required points to be made available at the EMCS.

A personal computer (PC) type workstation shall be provided at the building if specified or shown on the drawings for use as a local interface to the building controls.

A personal computer (PC) shall not be used as the building interface to the EMCS, nor shall a PC be used to convert protocol used by the building controllers.

Notify the Contracting Officer 4 weeks in advance of the building connection to the post Ethernet and coordinate with the Directorate of Public Works (DPW) point of contact for Information Technology (IT) issues. The DPW contact is Tim Foe, phone 270-798-6716. DPW will provide IP addresses, install anti-virus software on any building workstations, and coordinate with Fort Campbell Information Technology Business Center (ITBC) concerning the connection to the post Ethernet.

EMCS Requirements on Design / Build Projects:

Include the following words in the Request for Proposal (RFP) in the section dealing with building controls. However do not include the notes to the RFP author in the RFP:

The HVAC control system shall be a direct digital control (DDC) system meeting the requirements of and installed in accordance with [Unified Facility Guide Specification UFGS-

15951 Direct Digital Controls][Specification Section 15951 Direct Digital Controls]. The equipment shall be limited to the options contained within the specification.

The connection shall provide the ability to do the following from the existing central workstations: monitor and control inputs and outputs, revise equipment schedules, override schedules, view trend data collected and stored at the building controllers, set up trends at the workstation, and receive alarms from the building controllers.

The connection shall use the existing post Ethernet network as the data transmission media.

The contractor shall be responsible to complete the connection and system integration of the building controls to the existing EMCS including all required programming of the building controls.

Note to the RFP author: Include a list or table showing typical inputs, outputs, schedules, and alarms to be transmitted to the EMCS, and trends to be maintained by the building controls and available to the EMCS. Include the position of all damper and valve actuators as an input available at the EMCS. Refer to the section below titled EMCS Points for the minimum required points to be made available at the EMCS.

A portable workstation / tester (lap top type computer) shall be provided with controls set up and diagnostic software installed. This device shall serve as a tool for the maintenance staff to access and modify the controls configuration.

Notify the Contracting Officer 4 weeks in advance of the building connection to the post Ethernet and coordinate with the Directorate of Public Works (PWC) point of contact for Information Technology. The DPW contact is Tim Foe, phone 270-798-6716. DPW will provide IP addresses, install anti-virus software on [any building workstations and on] the portable workstation / tester service tool and coordinate with Fort Campbell Information Technology Business Center (ITBC) concerning the connection to the post Ethernet and opening the communication port.

Inputs and outputs (points) to be connected to the Energy Monitoring and Control System are given below. The designer or author of the RFP should be sure that the procurement documents require that these points are available at the EMCS as a minimum.

Abbreviations that may be used in this section are as follows:

AI – analog input

AO – analog output

CSR – current sensing relay

DI – digital input

DO – digital output

dP – differential pressure

EMCS - Energy Monitoring and Control System

HVAC - Heating Ventilating and Air Conditioning

KW - Kilowatt

LAN – local area network

MZ – Multizone

SZ – Single Zone

VAV – Variable Air Volume

Ethernet Hub and Communication Cable

Verify that there will be an Ethernet hub within the building. This serves as the connection to the EMCS.

New instrumentation and controls such as sensors, control relays, and status indication will be connected to the EMCS. The following is a recommended summary of the minimum EMCS points to connect. Some of the listed equipment may not be used on this project. Some equipment may be missing. However, this list should give a feel for the types of points to connect. Note that some of the points such as damper or valve actuator position may not be needed by the building controls. Such points would be monitoring points.

Air Handler Units - Single Zone, VAV, and Multizone

Digital Outputs:

Start / Stop signal

Vent Delay signal. This is used to disable the outdoor air damper during morning warm up (or cool down) before the building occupants arrive. It is not required if the local controls are taking care of this function.

Analog Outputs: None

Digital Inputs:

Fan on / off status via dP switch is the preferred method. CSR is second preference.

Differential pressure switch across filters.

Economizer status.

Freeze stat status.

Duct Smoke detector status.

Analog Inputs:

Supply air temperature.

Hot deck temperature for MZ units.

Cold deck temperature for MZ units.

Return air temperature.

Mixed air temperature. Add the sensor if it is not part of the normal controls.

Damper positions.

Valve positions.

Space temperature.

Space humidity where sensors are installed for humidity control.

OA temperature sensors will not be added or connected. OA temperature is currently monitored by the EMCS at a central location.

Alarms:

AHU fan failure to start

AHU fan failure to stop

Return Temperature High

Return Temperature Low

Space Temperature High

Space Temperature Low

Mixed Air Temperature Low

Freeze stat Trip
Smoke condition
Trend: Data is stored at the building controller
Space temperature
Space humidity
Supply Air Temperature
VAV Boxes (applies to normal pressure independent VAV boxes)
Digital Outputs: None
Analog Outputs:
Space temperature set point adjustment.
Digital Inputs:
Fan Status, if the box is fan powered.
Analog Inputs:
Space Temperature
Air Flow through the primary air damper
Damper position
Valve position
Alarms: None
Trend: None
Hot Water Boiler
Digital Outputs:
Control Relay to disable the boiler.
Analog Outputs: None.
Digital Inputs:
Boiler (burner) status will be included.
Analog Inputs:
Hot water supply temperature to the building.
Hot water return temperature from the building.
Alarms:
Boiler trouble alarm from ignition controls
Hot leaving temperature high
Hot leaving temperature low
Trend: Data is stored at the building controller
Hot water supply temperature
Hot water return temperature
Steam to Hot Water Converter
Digital Outputs:
Control Relay to disable the steam valve.
Analog Outputs: None.
Digital Inputs: None.
Analog Inputs:
Converter entering water temperature.
Converter leaving water temperature.
Alarms:
Hot leaving temperature high
Hot leaving temperature low

Trend: Data is stored at the building controller

Hot water supply temperature

Hot water return temperature

Chillers

Digital Outputs:

Enable / Disable Signal.

Analog Outputs:

Chilled water set point adjustment.

Digital Inputs:

On / Off Status.

Chiller failure alarm: This is to indicate when there is a local chiller alarm. The specific condition causing the alarm need not be transmitted. The goal is to know when the chiller is in need of service.

Analog Inputs:

Chilled water supply temperature from the chiller to the building.

Chilled water return temperature from the building to the chiller.

Condenser water inlet temperature.

Condenser water outlet temperature.

Alarms:

Chiller failure signal from chiller packaged controls

Failure to stop after Disable command

Trend: Data is stored at the building controller

Chilled water supply temperature

Chilled water return temperature

Condensing Units

Digital Outputs:

Enable / Disable Signal. The signal serves to override the local automatic controls to force the condensing unit to stop.

Analog Outputs: None.

Digital Inputs:

On / Off Status via a CSR or interface to the on-board controls.

Analog Inputs: None.

Alarms:

Failure to stop after Disable command

Trend: None

Pumps

Digital Outputs:

Enable / Disable signal to override the local motor controls and force the pump to stop even if the motor starter is in the HAND position.

Analog Outputs: None.

Digital Inputs:

Pump on / off status; by a dP switch or by CSR.

Analog Inputs: None.

Alarms:

Failure to start.

Failure to stop.

Trend: None

Occupied Space

Digital Outputs: None

Analog Outputs: None.

Digital Inputs: None.

Analog Inputs:

Space temperature. Use VAV box sensors where possible. Use space sensors included for the control of air handlers where possible. In this case the space temperature may be shown as a point associated with the air handler. Additional space sensors may be added if necessary.

Alarms:

Space temperature high

Space temperature low

Trend: Data is stored at the building controller

Space temperature

Computer Room Units (such as Liebert units)

Digital Outputs: None.

Analog Outputs: None.

Digital Inputs: None.

Analog Inputs: None.

Alarms:

Trouble or failure signal from the packaged controls.

Trend: None

Make-up Air Units

As a rule, there is no EMCS control of the process exhaust equipment such as kitchen hoods. Likewise there will be no EMCS control of the associated make up air equipment serving kitchen hoods. However, where space sensors in the areas served by the makeup air units are connected to the DDC, these will be included and connected to the EMCS.

Digital Outputs: None

Analog Outputs: None.

Digital Inputs:

On / Off Status.

Analog Inputs:

Space Temperature where this sensor is interfaced to the DDC.

Trend: None

Infrared Gas Heaters

Digital Outputs: None.

Analog Outputs: None.

Digital Inputs: None

Analog Inputs:

Space Temperature.

Alarms: None

Trend: None

Preferences: Building Control Systems: Honeywell or Johnson Controls.

----- END OF SECTION -----

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Section 23 09 53.00 20 Space Temperature Control Systems

Ft. Campbell Requirements:

Provide a location for injecting chemical inhibitors into the system.

Provide a location for pulling water samples.

Provide strainers to remove solids from system.

Avoid using glycol systems. If a glycol system must be used, provide a means to flush the system and show it on the drawings.

All piping shall be installed to permit access without requiring removal of permanent walls, floor, or ceilings. All equipment, piping, etc. in mechanical rooms shall be arranged such that each piece of equipment can be removed without having to remove any other piece of equipment. Coil pull areas shall be included in the mechanical room layouts.

Floor mounted pumps are strongly preferred for sizes above 1 horsepower because of the difficulty maintaining or changing out.

Isolation valves and unions shall be installed on supply and return piping to all mechanical equipment. Provide isolation valves in all supply and return distribution piping at all laterals, wings, floors, and as necessary to limit affected areas during maintenance and repair outages.

Make sure unions are located so that they can be turned with a wrench.

The use of butterfly valves is not acceptable. Depending on the application, full port ball valves or gate valves are preferred.

Avoid the use of Dual Temperature piping systems.

Install expansion tank valves and unions so the tank can be isolated from the system for maintenance. Valves are to be locked out/tagged out so they cannot be inadvertently closed. Provide a drain line and valve connected to the piping between the isolation valve and the expansion tank for draining the expansion tank in order to check the air pre-charge.

Show the required air pre-charge pressure on the drawings.

Install valves and unions to isolate individual equipment. Install valves to isolate individual buildings on central systems servicing several buildings..

Size balance valves to have about 1 psi pressure drop wide open so that they will not operate nearly closed to achieve the necessary flow restriction in the system.

Remove triple duty type valves from the specifications. These triple duty type valves compromise each function and are unnecessary if variable frequency drives are provided on the pump motors. Provide separate valves.

Specify gate valves or ball valves in lieu of butterfly valves.

Avoid valves that function as a combination check, balance, and isolation valve all in one. These triple duty type valves compromise each function. Provide separate valves. Remove triple duty type valves from the specifications.

Detail and specify vents at all trapped high points in the piping.

Detail and specify drains at all trapped low points in the piping.

Use dial type thermometers installed in thermo wells.

Provide spare thermo wells at each temperature sensor.

Use oil filled dial type pressure gauges.

Where domestic water is used for system make-up, use a reduced pressure backflow preventer in the make-up line.

Use separate backflow preventers on the make-up lines to the chilled water and the hot water systems. Otherwise cross flow between the systems can occur (even if check valves are used).

----- END OF SECTION -----

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Section 23 35 00.00 10

Overhead Vehicle Tailpipe (and Welding Fume) Exhaust Removal Systems

Ft. Campbell Requirements:

The designer must verify the type of vehicles being serviced. Large diesel engine driven vehicles can require an exhaust volume much higher than the typical 400 to 600 CFM vehicle exhaust system can handle.

Before sizing the exhaust system components, determine the engine displacement, the engine speed while being run on the exhaust system, whether or not the engine is turbocharged, and whether the engine is operated loaded or unloaded at high idle speed.

----- END OF SECTION -----

Section 23 52 00 Heating Boilers

Ft. Campbell Requirements:

Environmental Air Quality requirements apply. See [Appendix A, Environmental Topics](#).

Copper-fin-tube hot water boilers, non-condensing type, are preferred for all comfort heating and large domestic hot water requirements, in lieu of cast iron sectional or fire tube boilers.

Outdoor copper fin tube boilers shall be equipped with freeze protection. Primary/secondary piping with primary loop pump interlock as primary freeze protection is preferred. Freeze valve or solenoid that flows water through the boiler on power failure is acceptable.

Install emergency boiler shutoff (push button) switches just inside mechanical room door.

In converters, use stainless steel converter tubes instead of copper.

Include manufacturer approved devices installed for testing samples of water and steam in the system (both in the mechanical room and at the ends of the system).

At the steam entrance into a building, install a double-block-and-bleed valve arrangement for positive isolation and venting of the steam during maintenance of the downstream system components.

For oil containing equipment, design a containment curb under the equipment.

Do not install equipment in pits.

----- END OF SECTION -----

Section 23 64 10 Packaged Water Chillers, Vapor Compression Type

Ft. Campbell Requirements:

Chillers shall include as a minimum the following features:

- Scroll or screw type compressors with 5 year parts and labor warranties.
- Microprocessor controllers with self-diagnostic capabilities.
- Open protocol, LONWorks certified, direct digital control (DDC) compatible.
- Tube and bundle type heat exchanger.
- Low ambient controls to 0 degrees F for air cooled package chillers.

Locate equipment to minimize piping runs.

Do not install roof-top equipment on metal or sloping roof systems.

Where direct expansion units are employed, use only manufacturer standard sized package units.

Install only manufacturer standard sized package chillers.

On outdoor package chillers, provide a circulating pump and bypass to allow flow through the chiller during the heating season (trying to keep from draining the system).

Design for the chiller to have control of the pumps for chiller freeze protection.

Install strainers upstream of chiller barrels and condenser barrels.

Install a single pressure gauge on the chiller barrel piped to read the inlet and outlet pressure.

Install a single pressure gauge on the condenser barrel piped to read the inlet and outlet pressure.

Refer to Section 23 09 23.13 20, Lonworks Direct Digital Control for HVAC and Other Building Control Systems for the points required to be monitored and controls from the Energy Monitoring and Control System. Specify that the chiller have the capability to communicate this data.

----- END OF SECTION -----

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Section 23 81 00.00 10 Unitary Air Conditioning Equipment

Ft. Campbell Requirements:

Do not install roof-top equipment on metal or sloping roof systems.

Locate equipment to minimize piping runs.

Use only manufacturer standard sized package.

----- END OF SECTION -----

SECTION 23 81 23.00 20 Computer Room Air Conditioning Units

Ft. Campbell Requirements:

Unless it is required in the specifications for the specific computer equipment going in the space, control temperature/humidity to 70 degrees F/50% RH.

Provide soft water for make-up.

Provide automatic blow down for humidifiers.

Consider multiple CRAC units to split the cooling load; if one unit fails, the other can keep the space at a reasonable temperature.

If multiple CRAC units are used, reheat may not be necessary for installation in all the units, but should always be installed in at least 50% of the units. Do NOT rely on the heat generated by the computer racks in the event of changes in the rack loads or a requirement to get room to design conditions prior to energizing the computer equipment.

Size computer room units to accommodate the actual heat released from the computer equipment; airflows will be decreased, the supply temperatures will be lower for a longer period of time, and the reheat will operate far less frequently.

Space humidity may not be a problem only because the CRAC unit has reheat capability. The CRAC unit adds enough heat to make up for the excess in airflow.

----- END OF SECTION -----

**Section 23 82 01.00 10
Warm Air Heating Systems**

Ft. Campbell Requirements:

Preferences: Furnaces – Trane/Carrier.

----- END OF SECTION -----

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**TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 25
Integretated Automation**

**Section 25 10 10
Lonworks Utility Monitoring and Control System (UMCS)**

Ft. Campbell Requirements:

Although this section says Lonworks, the UMCS system will be based on the Niagra Framework AX version developed by Tridium.

Refer to Sections 23 09 23.13 20 Lonworks Digital Control for HVAC and Other Building Control Systems and Section 26 27 13.10 30 Electric Meters.

Connect all new building controls to the UMCS unless directed otherwise.

Refer to [Section 23 09 23.13 20](#) for connection requirements.

SPECIFICATION FOR BUILDING INTEGRATION INTO FORT CAMPBELL'S EMCS

Building Integration

Note: The terms EMCS, BAS, UMCS and FMCS shall be used interchangeably. Facilities under this contract will be integrated to an FMCS as defined.

The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to Fort Campbell's wide area network. Access to the system, either locally in each building, or remotely from a

central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk (IDC) controllers and other open systems/devices provided. The Facility Management and Control System (FMCS) as provided will be based on the Niagara Framework AX VERSION (or “Niagara”), a Java-based framework developed by Tridium. Niagara provides an open automation infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed.

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE

CHAPTER 3

Technical Requirements and Instructions

Division 26

Electrical

Section Revision Date: 4/14/2015

Instructions to Designers:

- Include all Division 26 features into project design and contract documents specifications as they apply.
- See Appendix M for further electrical requirements.

Ft. Campbell Requirements:

1. Division 26 - Technical Requirements and Instructions

2. General Requirements

- 2.1.** Requirements of the Fort Campbell Technical Design Guide (TDG) apply to contractors, sub-contractors, Government entities, 3rd parties and tenants regardless of the organization.
- 2.2.** System Engineers/Managers, Design Engineers, Design Technicians and Managers may review and comment on design submittals from all parties.

- 2.3. The contractor shall submit designs for review starting not later than the fifty-percent (50%) design.
- 2.4. Manufacturer equipment cut sheets shall be provided not later than the 50% design review.
- 2.5. The contractor shall submit designs for final review at least at the ninety-five percent (95%) design.
- 2.6. Directorate of Public Works (DPW) reserves the right to approve or reject design submittals at any stage in the design process.
- 2.7. DPW review includes that by the DPW System Engineers/Managers.
- 2.8. Rejected designs, once corrected, shall be resubmitted by the contractor for further review by DPW.
- 2.9. Data in the following sections further refine requirements in the Unified Facilities Guide Specifications (UFGS), Unified Facility Codes (UFC), industry Codes, Standards and Regulations.
- 2.10. All parent Codes, Standards and Regulations apply and are incorporated by reference now and throughout this document.
- 2.11. The parent Codes, Standards and Regulations are not duplicated in this Technical Design Guide and all still apply in all design and construction taking place at Fort Campbell, KY.
- 2.12. Grayed out items simply means Fort Campbell has no further input besides the parent Codes, Standards and Regulations or the sections are covered elsewhere within this Technical Design Guide.
- 2.13. References may be given throughout this document contained within a Reference Box.
- 2.14. Errors or Omissions in this section of the Technical Design Guide should be brought to the attention of the Directorate of Public Works, Engineering Division, Engineering Design Branch at Fort Campbell, KY.

3. GENERAL REQUIREMENTS AND CONDITIONS

3.1. CONTENTS

- Permit Requirement
- Inclusion of Codes, Guidelines, Regulations, Specifications and Standards
- Exterior Distribution Operating Parameters

- Outages (Electrical Power Interruptions) And Operational Considerations
- Standardization

- Passwords, Access Codes And Keys
- Equipment Locks
- Special Tools Or Peripheral Equipment
- Specialized Training
- Vehicle Access Requirements

- Geospatial Location of Underground & Overhead Equipment
- Vegetation Management Program
- Reliability, Availability, And Maintainability (RAM)
- Equipment Removal List
- Appendix M

3.2. REQUIREMENTS AND CONDITIONS APPLY TO ALL ELECTRICAL WORK

3.3. Permit Requirement

3.3.1. No electric equipment shall be installed within or on any Fort Campbell building, structure, or premises, nor shall any alteration or addition be made in any existing equipment without first securing an Electrical Permit from the Fort Campbell Electrical Inspector in accordance with CAM Regulation 420-4 (Quality Assurance “Electrical” Inspection Standards).

3.3.2. An Electrical Inspection is required for any electrical work, modifications, additions or upgrades to existing electrical systems in any Fort Campbell real property, temporary building or other structures, including:

- mobile homes,
- temporary office trailers,
- recreational vehicles,
- floating buildings; and

- other premises such as:
 - yards,
 - parking,
 - storage,
 - carnival, and
 - other lots and industrial substations.

3.4. Inclusion by Reference of Codes, Guidelines, Regulations, Specifications and Standards

- Data in these sections further refine requirements in the Unified Facilities Guide Specifications (UFGS), Unified Facility Codes (UFC), industry Codes, Standards and Regulations.
- All parent Codes, Standards and Regulations apply to all projects, regardless if they are directly referenced.
- Include all features listed below into project design and contract documents specifications as they apply.
- See the Codes Specifications Regulations and Guidelines Attachment.
- See Appendix M for further electrical requirements

3.5. Exterior Distribution Operating Parameters

- Fort Campbell maintains real and operational ownership of all equipment under its jurisdiction.
- Any action of connecting (closing) to or disconnecting (opening) from the Fort Campbell electrical system equipment to Contractor equipment installed on Fort Campbell electrical property shall be performed by Fort Campbell Government employees, unless express, written permission is given as described below.
- Fort Campbell electrical system equipment includes, but is not limited to, any installed Government exterior electrical equipment (e.g. jacks, switches, etc.).
- The Director of the Directorate of Public Works or his designee may give express, written consent for non-Fort Campbell personnel to connect to or disconnect Fort Campbell electrical system equipment on a case-by-case basis. The Contractor shall maintain any consent document at the jobsite closest to the connect/disconnect point for inspection by Fort Campbell government personnel or their designees.
- Contractor's Temporary Construction Facilities shall not be installed on Fort Campbell equipment (i.e. utility poles) but shall have power run from Fort Campbell equipment to Contractor installed equipment (i.e. contractor installed utility pole upon which the Contractor has installed his equipment (e.g. transformers)).
- An inspection shall be made by a Fort Campbell's electrical inspector prior to any connecting to the Fort Campbell electrical system equipment.
 - The inspector shall give both verbal and written notification of either a passed or failed inspection.
 - Any deficiencies to the installation identified in the Inspection shall be corrected prior to an connection activity.
 - Another inspection shall be made after all corrections have been accomplished.
 - No connection activity shall be made prior to the installation passing the inspection.
- On projects with electrical distribution equipment which will turned over to Fort Campbell when the project is completed (DD Form 1354, Transfer and Acceptance of DoD Real

Property), the inspection process shall be the same as outlined above. Liability for damage to current Fort Campbell equipment caused by connecting to the ongoing project connecting should be discussed with all parties.

3.6. Outages (Electrical Power Interruptions) And Operational Considerations

3.6.1. Granting Outages

- Electrical outage may be granted where:
 - necessary to perform work safely,
 - the mission need is not compromised,
 - properly coordinated, and
 - timely public notification is given to impacted units/customers.
 - Fort Campbell reserved the right to deny electrical outages for operational reasons.
 - if initially denied, the requester shall work with DPW to arrive at a different, approved time for the outage.

3.6.2. Outage Time Limits

- Planned electrical outages shall be generally limited to four to eight (4-8) hours.

3.6.3. Outage Notification

- For major outages, Fort Campbell requires sufficient time to advertise the outage for at least 2 weeks prior to outage occurrence.

3.6.4. Sub-Transmission and Distribution Operational Configuration Changes

- Where the contractor needs a portion of the sub-transmission and/or distribution system reconfigured for construction or testing activities, they shall:
 - give the Fort Campbell Exterior Electrical (ED) shop at least a forty-eight (48) hour notice of the changes,
 - provide the Fort Campbell Exterior Electrical (ED) shop with a detailed list of changes or configurations needed,
 - require a pre-configuration change briefing for contractor personnel and the Fort Campbell Exterior Electrical (ED) shop personnel,
 - remember, connecting to or disconnecting from the Fort Campbell electrical system equipment to Contractor equipment installed on Fort Campbell electrical property shall be performed exclusively by Fort Campbell Government employees unless otherwise authorized.

3.6.5. Outage Coordination

- Contractor shall coordinate with the Fort Campbell Exterior Electrical (ED) shop and the Fort Campbell Housing office to schedule all outages necessary to perform work safely. See below for outage requirements in the housing areas.
- The contractor(s) shall meet with the Fort Campbell Exterior Electrical (ED) shop personnel to coordinate all outages and to discuss outage purpose and length.
- The contractor shall give Fort Campbell Exterior Electrical (ED) shop at least a twenty-four (24) hour notice of outage requirements.

3.6.6. Outages In Housing Areas

- Fort Campbell Housing office requires a minimum three (3) day notice prior to any scheduled outage.
- Scheduled outages effecting housing areas shall commence not earlier than 9:00 A.M. Contractor should stage work accordingly.

3.7. Standardization

- Fort Campbell's goal is to standardize equipment and systems as much as possible.
- Standardization allows improved reliability, better maintenance practices and saves both personnel and financial resources.
- Fort Campbell's preferences, where they exist, shall be made available to the Contractor.
- In each category where the designer's choice is not one of Fort Campbell's preferences, the design shall show why the standardization requirements cannot be met before DPW-EDB will approve other manufacturers.
- Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer.

3.8. Passwords, Access Codes And Keys

- All passwords and access codes changed or reset by the contractor during construction shall be cleared to factory defaults and verified by DPW personnel at acceptance.
- The Contractor shall provide the current, correct password(s)/codes to all installed equipment at the time of acceptance.
- DPW personnel shall verify the current, correct password(s)/codes to all installed equipment at the time of acceptance.
- All keys required for access to areas or equipment which does or shall belong to Fort Campbell upon acceptance, and used by the contractor during construction, shall become the exclusive property of Fort Campbell at acceptance.
- DPW personnel shall verify all keys are accounted for and function as required at the time of acceptance.

3.9. Equipment Locks

- Enclosures outside substations which have the potential for medium voltage exposure shall be lockable using an approved padlock.

3.10. Special Tools Or Peripheral Equipment

- The contractor shall provide and turn over to the contracting officer any special tools, computer-based interfaces, relay interface terminals, software, etc., required for operations and maintenance of the new equipment that will assist maintenance personnel maintain the facility.

- When special tools or peripheral equipment to repair, operate, maintain, or program they shall be provided to DPW at the time of transfer. This applies to all equipment, sub-systems and systems including fire alarm equipment and fiber optic systems. Contract language shall state that:
 - necessary tools or equipment shall be provided to the DPW, and shall be new at the time of transfer.
 - necessary interface devices (e.g. computer-based interfaces) shall be provided to the DPW, and shall be new at the time of transfer.
 - necessary software shall be provided to the DPW, and shall be the latest version at the time of transfer.

3.11. Specialized Training

- The contractor shall provide and schedule all appropriate and necessary specialized training required for the use computer-based interfaces, relay interface terminals, equipment, tools, or software to maintain any equipment, sub-systems and systems including fire alarm equipment and fiber optic systems for DPW personnel.
- Training shall be given by factory authorized personnel.

3.12. Vehicle Access Requirements

- Designs must allow for free and easy access and movement of the exterior electrical shop bucket and line trucks.
- Contractors should take DPW shop vehicle weights and physical size into consideration when designing access to poles, transformers, switches, or other electrical equipment, especially across sod/soil areas.
- All driving areas must be properly prepared to prevent vehicles sinking under wet conditions.
- Sidewalks, across which service trucks travel, should be of sufficient strength to support the truck loads without damage.
- Access through fenced areas should be anticipated and gates of sufficient size should be provided.

- Specifications for the current largest (100' reach) bucket truck are:
 - International Freightliner
 - Model: 7400 SBA
 - Date: 9 Oct 2006
 - Drive: 6x4
 - Wheelbase: 675cm - 22.15 feet
 - GVWR: 58,000 Lbs.
 - Front Axle: 18,000 lbs
 - Rear Axle: 40,000 lbs
 - Overhang: ~9 feet
 - Turning Radius: ~40 feet

3.13. Geospatial Location of Underground & Overhead Equipment

3.13.1. Equipment Identification System

- Fort Campbell maintains equipment numbering convention is used to assign numbers to all sub-transmission and distribution equipment, sub-systems and systems in the Global Information System (GIS) system.

3.13.2. Identification Assignment

- The assignment of numbers is performed by Fort Campbell personnel.
- The Contractor shall ask for guidance from the Electrical Engineering Section should a class of equipment not have a naming/numbering convention.

3.13.3. Global Information System (GIS)

- The Contractor shall document the underground and above ground geospatial location of all conduits, conductors and equipment for incorporation into the Fort Campbell Global Information System (GIS) layers (sub-meter accuracy).
- Requirements are further defined in Global Information System (GIS) Documentation Requirements (Electrical).
- The form used to fulfill the documenting requirements is the GIS Documentation Verification Spreadsheet.
- The contractor shall coordinate with the IGI&S Manager for all new layers, additions or corrections of the required GIS layer. Digital Data shall be prepared and maintained according to the following specifications:
 - All digital data and associated geospatial data, at a minimum, must comply with the latest version of Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) available at <http://www.sdsfieonline.org/> with additions and corrections developed by Fort Campbell. All Attributes in the SDSFIE shall be considered as required until, and unless, otherwise specified in writing by Fort Campbell.
 - The coordinate system used to maintain digital data will be the Tennessee State Plane Coordinate System (TN SPCS). The datum used will be the North American Datum of 1983 (NAD83). The mapping unit will be 'US foot'. The vertical datum used will be the North American Vertical Datum 1988

(NAVD1988).

- The digital geospatial data will be 99% free of topological errors including, but not limited to: the absence of dangling nodes, undershoots, overshoots, and snapped nodes for line segments; the existence of features that have area (square footage) will have polygon representations (per SDSFIE).

3.13.4. Reports

- Reports associated with the GIS identification numbering shall be in a tabular format, referenced to the Fort Campbell identification numbering convention and the SDSFIE in Microsoft Excel format.

3.14. Vegetation Management Program

- To “Ensure that the landscaping provided does not interfere with overhead power lines when it reaches maturity”, Fort Campbell authored the Vegetation Management Program as listed in APPENDIX M, Electrical Requirements.
- The contractor shall not install equipment, sub-systems or systems where the existing vegetation does not meet the requirements of the Vegetation Management Program.
- The contractor shall not plant vegetation which will violate the letter and spirit of the Vegetation Management Program.

3.15. PHOTOGRAPHS

3.15.1. TAKING PHOTOGRAPHS

- All persons must have signed approval to take video, still or digital photos (including a cell phone) on any part of Fort Campbell.
- For each individual seeking permission, the Contractor must provide written request(s) to the Contracting Officer for approval.
- If the request is granted, the government representative will leverage internal resources to provide the contractor with the needed documentation.

3.15.2. JOBSITE PHOTOGRAPHS

- As required by DPW, the contractor shall provide a photographic record of specific work accomplished and certain equipment attributes with the following characteristics:
 - Format: Digital photographs of the final installation in electronic .jpeg format.
 - The digital camera used must be capable of taking photographs with at least 5 megapixels.
 - All photographs shall free of glare or reflections and correctly focused.
 - Each photograph file size should be at least 2 megapixels.
 - A Microsoft Excel document shall be furnished to include the Service Order/CLIN contractor’s photograph file name, and any information necessary to identify the photograph.

- New installations shall be photographed from at least three sides (compass orientations).
- The photographs shall be sufficient for a third party to determine all equipment necessary to replicate the installation.
- Photographs shall show the overall installation and details installation.
- If multiple pieces of equipment are installed under an individual Service Order/CLIN, each piece of equipment, and its associated hardware, shall require a complete set of pictures as if it were a project in and of itself.
- Nameplate Data – the contractor shall supply photographs of complete nameplate(s) data for all equipment with nameplates. The format shall be both photographic and in Microsoft Word or Microsoft Excel format.
- Underground Installation - all underground installations shall be photographically documented prior to burial.

3.16. Reliability, Availability, And Maintainability (RAM)

- Fort Campbell must be able to maintain minimal Mission and Non-Mission capabilities in most buildings even when the partial loss or reduction in off-site power supply or the loss of one or more installation substations greatly reduces total electrical power availability.
- Non-Mission facilities
- Building/facility electric loads should be split into Life/Health/Safety and non-Life/Health/Safety loads.
- Separate busses should be installed for each load category.
- A separate transformer should feed each load category buss.
- Mission & C4ISR facilities
 - Contractors shall consult TM 5-691 – (UTILITY SYSTEMS DESIGN C4ISR FACILITIES) for command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR) facilities.
 - For non-C4ISR facilities, building/facility electric loads should be split into Technical, Emergency and Nonessential loads categories as described in TM 5-691.
 - External and internal electrical designs should conform to TM 5-691 (RELIABILITY/AVAILABILITY OF ELECTRICAL & MECHANICAL SYSTEMS FOR COMMAND, CONTROL, COMMUNICATIONS, COMPUTER, INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE (C4ISR) FACILITIES).

3.17. EQUIPMENT REMOVAL LIST

- When currently installed equipment is removed, or is to be removed, as a result of a project or maintenance action, the contractor shall compile a report using the associated equipment GIS identification numbering (see Reports) of all equipment.

- This report shall be forwarded to the appropriate System Engineer.

3.18. APPENDIX M

- See APPENDIX M, Electrical Requirements for further electrical requirements.

4. DIVISION 26 – ELECTRICAL

4.1. GENERAL REQUIREMENTS AND CONDITIONS - CONTINUED

4.2. SUB-TRANSMISSION AND DISTRIBUTION VOLTAGES

- Fort Campbell's sub-transmission voltage is 69kV, delta.
- Fort Campbell's distribution voltage is 12.47/7.2 kV, wye.

4.3. GROUNDING

- A minimum of two (2) grounding conductors shall be supplied to each of the major equipment (i.e. transformers, voltage regulators, circuit breakers) pads and connected to the equipment.
- All conductor to conductor (wire-type) grounding connections shall be connected using exothermically welding or with range-taking compression tap connector.
- All connections to Driven Ground Rods shall be exothermically welded or use compression connector.

- All grounding connections to structural metal frames of buildings or structures shall be bolted, riveted, welded or compression (i.e. range-taking compression tap connector).
- Equipment pad grounding conductors shall be a minimum 4/0 CU.
- Ground rods are required.
- Grounding shall not be accomplished at water lines.

- Split-bolts, or any reversible type connector, shall not be used on any substation grounded or grounding connections, including above ground.
- Split-bolts, or any reversible type connector, shall not be used on any exterior grounding system.
- Steel poles shall be supplied with factory, bolted, grounding connections.

4.4. Voltage Classifications

- For purposes this Technical Design Guide, voltage levels are defined as:
 - Low Voltage < 1,000V
 - Medium Voltage $\geq 1,000V$ and $\leq 63,000V$
 - High Voltage > 63,000V and < 230,000V

----- END OF SECTION -----

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Section 26 00 00.00 20 Basic Electrical Materials and Methods

Ft. Campbell Requirements:

4.5. New Equipment

- All equipment installed on Fort Campbell shall be new (within three years of manufacture) unless authorized in writing by the DPW Authority Having Jurisdiction.
- Rebuilt or reconditioned parts, equipment, sub-systems or systems shall be not installed unless required due to the age or availability of repair/replacement parts.
- If the use of rebuilt or reconditioned parts, equipment, sub-systems or systems is authorized, all such items shall have never contained, or shall not now contain, Polychlorinated biphenyl (PCB).
 - Contractors shall check with the DPW Environmental Division to determine any specific reporting requirements regarding PCB content.

4.6. Workmanship

- In addition to the mandatory and advisory provisions of NFPA 70, NESC and other Codes, Guidelines, Regulations, Specifications and Standards, workmanship requirements in on Fort Campbell shall be in compliance with the Standards and Recommendations of the National Electrical Contractors Association (NECA). APPENDIX M - Criteria, Specifications, Codes, Regulations and Related Electrical Engineering Requirements, contains a partial list of the NECA standards and recommendations.
- Contractors shall:
 - Lay out work in advance.
 - Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work.
 - Repair damage to buildings, piping, and equipment using skilled craftsmen of the required trade.

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Section 26 05 00.00 40 Common Work Results For Electrical

Ft. Campbell Requirements:

4.7. DESIGN AND SHOP DRAWINGS

4.7.1. Arrangement:

- Arrange the Electrical Drawings in accordance with the National CAD standards.

4.7.2. Grids

- All design drawings less than ninety-five percent (95%) shall have grids placed on the x and y axes to assist in identification of areas of the drawings on which comments are being made

4.7.3. General Criteria:

- All CAD drawings shall be submitted in electronic in a Microstation release V8, V8i, or a compatible, approved equal.
- A graphic scale shall be shown on each sheet of the drawings or annotated as 'none'.
- Drawing scale units shall be in the English system.
- Cardinal North shall be oriented either to the top or to the left of the drawing. (CHANGE)
- Cardinal North shall be oriented either to the top in the upper right quadrant of the drawing.

4.7.4. Numbering:

- All drawings shall be uniquely numbered and the initial drawing sheet of any part, system or plan shall include the drawing title, original drawing date, facility identification, and the initial revision number in the appropriate blocks.
- Drawings bearing the same number as another within a design, but having different scope, equipment, subsystem or system; and/or which have no revision dates and explanations will be rejected.

4.7.5. Revisions:

- Revision dates, initials and the reason for the revision shall be used whenever any published change is made to any specific drawing.
- Revision numbers on the drawings shall be updated as they are changed.

4.7.6. Title Blocks:

- Title Blocks shall reflect the content of the drawing.
- Title blocks shall be descriptive of the part of the project the drawing represents.
- Title block shall not be changed substantially from the original. Should significant changes in the scope of the drawing need to be made such that the title block also needs changing, a new drawing with a new number shall be created.

4.7.7. Content:

- Drawings shall include wiring diagrams and installation details of equipment indicating other items that must be shown to ensure a coordinated installation and

maintenance.

- Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.

4.8. FINAL, AS-BUILT DRAWINGS

- The As-Built drawings shall show any deviations from the original drawings, including any modifications/change-orders which were issued by the Government during the Contract.
- Final, As-Built, drawings shall be stamped by either a Professional Engineer (PE) or a Registered Architect (RA) unless otherwise designated in the contract.
- Final, As-Built, drawings are a valid revision and should be listed as such in the revision block as such.
- Final, As-Built, drawings shall be furnished without the designer's Proprietary and Confidential statement.
- Final design drawings shall be on 24" x 36" sheets or as required in the Statement of Work.

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SECTION 26 05 13.00 40 MEDIUM-VOLTAGE CABLES

Ft. Campbell Requirements:

4.9. NORMAL REPAIR

- Reserved

4.10. EMERGENCY REPAIR

- Reserved

4.11. UNDERGROUND MEDIUM VOLTAGE CABLES

- Modification to: UFC 3-550-01, February 3, 2010

4.11.1. All underground, medium-voltage cables shall be full concentric neutral, 133% insulation.

4.11.2. Existing Type MV-105 15kV (or 25kV) Shielded Power Cable or similar shielded cable installed within conduit shall be replaced with full concentric neutral (133% insulation) unless the following conditions are met:

- the existing conduit fill percentage would be violated, or
- DPW determines it is not economically feasible to replace the conduit with a

larger size to meet the requirements of the full concentric neutral, 133% insulation.

- 4.11.3. If the above conditions are met, DPW shall allow the replacement cable to be Type MV-105 15kV (or 25kV) Shielded Power Cable or similar shielded cable.

4.12. UNDERGROUND STRUCTURES - MANHOLES

- 4.12.1. Manholes shall be used for all medium voltage applications.
- All in-line splices must be in underground structures.
 - Manholes must allow enough space so that personnel are able to enter and work within its confines.
 - Manholes must allow enough space so that all phases of all medium voltage conductors may be “looped” around the insider perimeter of the manhole.
 - Cables shall be routed around the interior walls and securely supported from walls on cables racks.
 - Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables and maintain cable separation in accordance with IEEE C2 (UFGS SECTION 33 70 02.00 10)
 - Medium voltage conductors installed in/through a manhole shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.

4.13. MANHOLES – REQUIREMENTS

- The minimum size for a manhole is six feet by eight feet by seven feet (6'x8'x7')
- Manhole design shall include a racking package.
- The top shall be marked “ELECTRIC”.
- Installation shall include a drain field beneath vault per manufacturers requirements or at least 12” deep aggregate drain field beneath vault, whichever is the stricter requirement.

4.14. Underground Structures – Handholes

- Do not use handholes for splicing shielded power cables.
- Handholes can only be used for airfield lighting circuits and for low-voltage and communication lines.

**References: <http://ecmweb.com/content/sizing-manholes>
<http://forums.mikeholt.com/showthread.php?t=145034&page=2>**

4.15. Underground Structures – Prohibitions

4.15.1. The following equipment is PROHIBITED inside underground structures:

- Load junctions.
- Power distribution equipment, including transformers and switches.
- Separable splices (bolt-T or split-bolt connections) including bonding shielding or concentric neutral(s).
- T-splices and Y-splices on medium voltage systems of any rated voltage.

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SECTION 26 05 70.00 40 HIGH VOLTAGE OVERCURRENT PROTECTIVE DEVICES

Ft. Campbell Requirements:

4.16. SUBSTATION PROTECTIVE RELAYING

- The relaying and control scheme shall make possible the clearing and isolation of faults and the separation of loads during faults or abnormal operating conditions.
- A short circuit protection and coordination study shall be made by the design agency.
- The coordination study shall demonstrate that protective devices in the primary substation switchgear shall properly coordinate with each other, with relaying used by the commercial power company, and with relays to be installed in the site's low- and medium-voltage switchgear assemblies.
- The design shall include exact settings for all protective relays.

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SECTION 26 08 00 APPARATUS INSPECTION AND TESTING

Ft. Campbell Requirements:

4.17. Testing Standards

- Testing shall be performed in accordance with (IAW) the current revision of:
 - ATS - Standard For Acceptance Testing Specifications for Electrical Power Equipment and Systems - NETA Standards
 - ANSI/NETA ETT - Standard for Certification of Electrical Testing Technicians

4.18. Project Execution

- All projects, MILCON and OMA and other funding sources, shall be executed using commissioning procedures and processes per the USACE specification.

4.19. Test Plan And Commissioning Plan

- For projects not covered by the United States Army Corps of Engineers (USACE) commissioning procedures:
 - The Contractor shall provide a detailed, written procedure test plan and commissioning plan.
 - The plan shall indicate in detail how testing and commissioning are to be conducted.
 - A statement of the tests/procedures that are to be performed without indicating how the tests/procedures are to be performed is not acceptable.
- The sequence of testing shall be as specified in both the testing and commissioning plans.
- The purposes of these inspections, tests, calibrations and commissioning are to prove the integrity of a piece of equipment at the time of acceptance, and to assure that the installed electrical systems and equipment are:
 - Installed in accordance with design specifications and manufacturer's instructions,
 - Ready to be energized,
 - Operational and within industry and manufacturer's tolerances,
 - Function as a complete and useable whole.

4.20. Reports and Records

- The contractor shall submit documents in Microsoft Word or Microsoft Excel format.
- Contractor shall work with the Fort Campbell Electrical Engineering Section to develop a standardized format for reports & data.

- The final test report shall include:
 - Summary of the project
 - Description of the equipment tested
 - Visual inspection report
 - Description of the tests
 - Test results for each system and equipment item
 - single-line diagram of the portion of the power system included within the scope of the study
 - Conclusions and recommendations
 - Appendix including appropriate test forms
 - Identification of the test equipment used and calibration date
 - Signature of test engineer

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26 11 13.00 20
PRIMARY UNIT SUBSTATION

Ft. Campbell Requirements:

4.21. GENERAL SUBSTATION DESIGN

- Substations designs may vary from the General Substation Design criteria with specific, written DPW approval.

4.22. STANDARDIZATION

- Fort Campbell's goal is to standardize equipment and systems as much as possible.
- Standardization allows improved reliability, better maintenance practices and saves both personnel and financial resources.
- Fort Campbell's preferences, where they exist, shall be made available to the Contractor.
- In each category where the designer's choice is not one of Fort Campbell's preferences, the design shall show why the standardization requirements cannot be met before DPW-EDB will approve other manufacturers.
- Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer.

4.23. GROUNDING

- A minimum of two (2) grounding conductors shall be supplied to each of the major equipment (i.e. transformers, voltage regulators, circuit breakers) pads and connected to the equipment.
- All conductor to conductor (wire-type) grounding connections shall be connected using exothermically welding or with range-taking compression tap connector.
- All connections to Driven Ground Rods shall be exothermically welded or use compression connector.

- All grounding connections to structural metal frames of buildings or structures shall be bolted, riveted, welded or compression (i.e. range-taking compression tap connector).
- Equipment pad grounding conductors shall be a minimum 4/0 CU.
- Ground rods are required.
- Grounding shall not be accomplished at water lines.

- Split-bolts, or any reversible type connector, shall not be used on any substation grounded or grounding connections, including above ground.
- Split-bolts, or any reversible type connector, shall not be used on any exterior grounding system.
- Steel poles shall be supplied with factory, bolted, grounding connections.

4.24. APPROVAL OF DESIGNS, EQUIPMENT AND MATERIAL

- The Contractors choices of the all designs, material and equipment shall be submitted to for approval as required by the Statement of Work.

4.25. MATERIAL

- Copper (CU) shall be used for all flexible conductors and transformer windings.
- Rigid bus conductors may be either copper (CU) or aluminum (AL).

4.26. SUBSTATION PROTECTIVE RELAYING

- The relaying and control scheme shall make possible the clearing and isolation of faults and the separation of loads during faults or abnormal operating conditions.
- A short circuit protection and coordination study shall be made by the design agency.
- The coordination study shall demonstrate that protective devices in the primary substation switchgear shall properly coordinate with each other, with relaying used by the commercial power company, and with relays to be installed in the site's low- and medium-voltage switchgear assemblies.
- The design shall include exact settings for all protective relays.

4.27. SUBSTATION ELECTRICAL CHARACTERISTICS

4.27.1. Station Power

- Each substation shall have a 25kVA, 7200/240/120 VAC station power transformer installed within the substation and power from the main transformer low-side (12470/7200V) bus.

- An outside NEMA 3R distribution panel, complete with appropriate circuit breakers, shall be mounted within the substation and 240/120 VAC delivered to all equipment through underground, non-metallic conduit as necessary.

4.27.2. Substation Capacity

- An outside NEMA 3R distribution panel, complete with appropriate circuit breakers, shall be mounted within the substation and 240/120 VAC delivered to all equipment through underground, non-metallic conduit as necessary.
- The standard substation design shall be a combined capacity of 25MVA (nominal).
- The voltage rating shall be consistent with the nominal voltage rating of the commercial power line and with the nominal voltage rating of the site power distribution system.
- The kilovolt ampere rating shall be sufficient to supply the peak demands of the facilities continuously without exceeding the 65°C (149°F) thermal rating in an ambient temperature typical to the site of installation.

4.27.3. Cross-Tie Capability

- All substations shall be able to be cross-fed from/to adjacent substations.
- Consideration shall be given to a feeder circuit breaker dedicated as a cross-tie.

4.27.4. Feeder Circuit Breakers

- All substations shall have a minimum of eight (8) feeder breakers.

4.27.5. Acceptable Equipment - Protective Relay

- The following manufacturers' protective relay(s) are acceptable to Fort Campbell:
 - ABB
 - Schweitzer

4.27.6. Main Power Circuit Breaker

- Main Power Circuit Breakers shall be 72.5kV (nominal), 1200A, SF6.
- Phase: three (3)
- Voltage: 69kV
- Ampacity: 1200A
- Coolant: SF6

4.27.7. Local & Remote Control

- Designs must allow for both local and remote breaker control.

4.27.8. Acceptable Equipment – Main Power Circuit Breaker

- The following manufacturers' Main Power Circuit Breaker(s) are acceptable to Fort Campbell:
 - ABB
 - Siemens

4.27.9. Main Transformers

- The design shall use three (3), single (1-Φ) phase transformers.
- The design may include a fourth (hot spare) transformer.

- Phase: single (1)
- Primary Voltage 69kV
- Secondary Voltage 12.47kV
- Dielectric : oil-cooled or air-cooled are acceptable. Air-cooled not be noisier than oil-cooled.
- Rating (typical): 8.333 (ONAN - 55°C) / 9.333 (ONAN - 65°C) / 11.666 (ONAF - 65°C) MVA
- Cooling: ONAN/ONAN/ONAF, Transformer shall be equipped minimally with one stage of fans, with provisions for the future addition of a second stage of fans.
- Average Winding Temperature Rise: 55°C / 65°C
- Manual Tap Changing: either No-Load Tap or On-Load Tap changes are acceptable – five (5) minimum taps.

4.27.10. Acceptable Equipment – Main Transformer

- The following manufacturers' main transformers are acceptable to Fort Campbell:
 - ABB
 - General Electric.

4.27.11. Voltage Regulation

- Substation feeding sensitive loads should be designed with Feeder Regulation and/or Harmonic

- The regulation design shall be Bus Regulation with the exception of 59th Street and CAAF substations.

- 59th Street and CAAF substations shall have two (2) feeders with Feeder Regulation and six (6) feeders with Bus Regulation. The Feeder Regulated circuits shall feed facilities determined to have the most overall voltage sensitive equipment.

- Voltage regulators shall be:
 - Type: 1-phase
 - Quantity: 3
 - Steps: 32 steps of 5/8% (0.625%).

4.27.12. Acceptable Equipment – Voltage Regulator

- The following manufacturers' voltage regulators are acceptable to Fort Campbell:
 - Cooper Power Systems
 - GE

4.27.13. Station Batteries & D.C. Operation

- Fort Campbell does not, and shall not, maintain station batteries. Fort Campbell shall not accept any configuration which requires station batteries.
- Equipment requiring DC voltages for operation must be designed with an internally mounted method to convert the incoming 120VAC station voltage to the appropriate VDC working (trip & close) working voltage.
- The VDC must be available anytime there is station voltage available.

4.27.14. Feeder Circuit Breakers

- The substation shall have at least eight (8) feeder breakers, one of which shall be a spare feeder circuit breaker.
- Service: Outdoor
- Phase: three (3)
- Mounting: Pad mount
- Voltage: 12.47kV (15kV class)
- Ampacity: 1200A
- Type: vacuum
- Surge Arresters: metal oxide type

4.27.15. Low Voltage Compartment

- The low voltage compartment shall house all of the control components and the operating mechanism.
- Instruments, relays, and control devices shall be mounted on the front of the associated breaker or auxiliary units.

4.27.16. Acceptable Equipment – Feeder Circuit Breaker

- The following manufacturers' feeder circuit breakers are acceptable to Fort Campbell:
 - ABB
 - S&C

4.27.17. Feeder Breaker Protective Relaying

- Solid-state, protective relaying (Distribution Protection) including overcurrent, reclosing and monitoring options shall be mounted within the circuit breaker cabinet.
- Protective relaying controls shall be mounted internally for easy access.
- The relaying and control scheme shall make possible the clearing and isolation of faults and the separation of loads during faults or abnormal operating conditions. Solid-state, protective relaying (Distribution Protection) including overcurrent, reclosing and monitoring options shall be mounted within the circuit breaker cabinet.
- Protective relaying controls shall be mounted internally on a hinged front panel for easy access.
- The contractor shall ensure each protective device works in conjunction with and is properly coordinated with the rest of the substation protective relaying.

4.27.18. Acceptable Equipment – Feeder Breaker Protective Relay

- The following manufacturers' protective relay(s) are acceptable to Fort Campbell:
 - ABB
 - Schweitzer

4.27.19. Terminal Blocks

- Terminal blocks shall be mounted on side panels internal to the low voltage compartment.

4.27.20. Anti-condensation heaters

- Anti-condensation heaters shall be provided in the low voltage compartment.

4.27.21. Local Controls

- Local open/close and service selection switches shall be mounted, and its operation plainly marked, on the hinged front panel.
- A selection switch shall be installed to allow switching between 600A and 1200A service.
- Local controls shall be mounted internally on a hinged front panel for easy access.

4.27.22. Software, Cables or Hardware

- The contractor shall provide all manufacturer's software (one for each device), cables (one for each device) necessary and any other hardware necessary, including relay interface terminals, to interface with all equipment interfaces.
- Software shall be provided on individual manufacturer's CDs or DVDs.
- The contractor shall provide to the Government any new, corrected, or enhanced version of software needed to operate, control, monitor, and status any of the electrical system equipment.
- Such enhancement shall include all modifications to the software which increase the speed, efficiency, or ease of use of the software, or add additional capabilities or functionality to the software.

4.27.23. Communications Protocol/System Interface

- Regardless of other options available on the devices, all solid state protection devices shall be able to communicate with DNP-3.

4.28. SUBSTATION STRUCTURE

4.28.1. Bus Configuration (Topology)

- Bus topology shall be a main and transfer bus configuration.

4.28.2. Main Switch Tower

- The following tower structures are acceptable to Fort Campbell:
 - lattice

- standard (AISC)
- tapered tubular

4.28.3. Distribution Towers

- The following tower structures are acceptable to Fort Campbell:
 - lattice
 - standard (AISC)
 - tapered tubular

4.28.4. Towers Configuration

- The following tower structures are acceptable to Fort Campbell:
 - H-Frame
 - Frame

4.28.5. Control House

- There shall be no control house built substations.
- Controls may be placed within the Communications building.

4.28.6. Communication Building

- A 10'x12' (nominal) , precast concrete building for metering shall be provided and installed outside the boundary fence.
- Exterior stone and trim shall match existing substation communication buildings.
- Exterior stone shall exposed aggregate sizes 1/2 or 3/8-.
- Exterior stone color shall be H&C concrete stain color chart cedarwood brown HC103 or approved equivalent.
- Door color selection shall be Sherwin Williams Industrial & Marine Coating - Mason Brick SW 4048 or approved equivalent.
- Two (2) conduits shall be run parallel and directly (home run), underground between the individual, major electrical component (e.g. transformers, circuit breakers, voltage regulators) equipment location (pad) then underground to the communications building located approximately ten feet (10') outside the boundary fence.
- All conduit shall be Schedule 40, electrical, PVC, one inch (1") diameter. There shall be no daisy-chaining between equipment locations.
- The Contractor shall install two (2) separate pull strings in each conduit run. Each pull string shall have a sufficient length at each end to allow use in future wire installation.

- At the equipment end, one of the conduits at each location shall be installed into the individual electrical equipment's cabinet, sealed from environmental and vermin damage, then capped.
- The second conduit shall at each location be installed in a location in the equipment pad area to prevent tripping and damage to the conduit and to allow its future use. Once installed with its pull string, the second conduit shall be sealed from environmental and vermin damage, and then capped.
- The conduits shall enter the communications building by one of two options: 1) through an outside wall; 2) underground to a vaulted area under the communications building, then up through the floor of the communications building. All conduit entrances shall be positively sealed from environmental and vermin damage.
- Once the conduit(s) are in place, the contractor shall install copper, solid conductor, 18/2, shielded twisted pair cables between the equipment cabinet and the communications building. The contractor shall leave enough cable at each end to allow termination to any equipment terminals within the cabinet and the communications building. At least ten (10) feet at the cabinet and thirty (30) feet at the communications building.

4.28.7. Cathodic Protection System

- At this time, no cathodic protection system is being required.

4.28.8. Feeder Breaker Isolation and Transfer Bus Switching

- Each phase of a feeder circuit breaker shall have an individual, hook-stick disconnect switch.
- A three-phase gang-operated disconnect switch shall be used to connect the breaker output from the main to transfer bus.

4.28.9. Circuit Connections

- Circuit connections shall be overhead.

4.28.10. Electrical Clearances

- To provide ample spacing of phase conductors and grounded overhead static wires, the distribution class of aerial lines, bus conductors and switch spacing shall be designed as though rated at 35kV.

4.28.11. Rigid Bus Conductor

- The following Rigid Bus Conductor types are acceptable to Fort Campbell:
 - "L" shaped conductors
 - circular (tubing) conductors

4.28.12. Oil Containment Pits

- All transformer and voltage regulators shall have individual oil containment pits.
- The oil containment pits shall be equipped with a heavy rain event drainage system.

4.29. PROTECTION SYSTEMS

4.29.1. Direct Stroke Shielding

- The contractor shall design, provide and install a new Direct Stroke Protection system robust and capable of protecting all equipment within the boundary fence of the substation.

4.29.2. Fire Protection

- The contractor shall provide and install a modular firewall system between major equipment in the substation (voltage regulators, transformers).
- The modular design shall allow for non-destructive removable and reassembly with use equipment generally found on Fort Campbell (bucket and line trucks).
- Fire walls must have a proven history of resistance to missile intrusion into adjoining compartments.

4.29.3. Small Animal/Rodent Deterrent System

- The substation requires a non-electric, non-lethal small mammal/rodent deterrent system on all incoming and outgoing, overhead conductors.
- The following Small Animal/Rodent Deterrent System is acceptable to Fort Campbell:
 - Critter Guard

4.30. SUBSTATION YARD

4.30.1. Expansion

- The Contractor shall design the new substation in such a manner that at least two (2) more feeder breakers can be added within the boundary fence at a later date.

4.30.2. Physical Orientation

- The contractor must accommodate the transfer bus topology in conjunction with existing sub-transmission and distribution conductors.

4.30.3. Access

- The substation equipment layout must allow for free and easy access and movement of the exterior electrical shop bucket and line trucks.

- The contractor should take DPW shop vehicle weights and physical size into consideration when designing access to poles, transformers, switches, or other electrical equipment, especially across sod/soil areas.
- All driving areas must be properly prepared to prevent vehicles sinking under wet conditions.
- Sidewalks, across which service trucks travel, should be of sufficient strength to support the truck loads without damage.
- Access through fenced areas should be anticipated and gates of sufficient size should be provided.
- Specifications for the current largest bucket truck are:
- Specifications for the current largest (100' reach) bucket truck are:
 - International Freightliner
 - Model: 7400 SBA
 - Date: 9 Oct 2006
 - Drive: 6x4
 - Wheelbase: 675cm - 22.15 feet
 - GVWR: 58,000 Lbs.
 - Front Axle: 18,000 lbs
 - Rear Axle: 40,000 lbs
 - Overhang: ~9 feet
 - Turning Radius: ~40 feet

4.30.4. Lighting

- The contractor shall provide and install complete a minimum of four (4), LED (400W equivalent), full cutoff luminaires, fixtures mounted on the superstructures approximately at the four (4) corners of the substation.
- Lighting fixtures should be mounted at the minimum elevation required to provide coverage dictated by the required vertical and horizontal light levels and uniformity.

4.30.5. Emergency Lighting

- None at this time.

4.30.6. Low Voltage AC System

- The contractor shall provide and install a outdoor distribution panel within the yard.
- The panel shall provide power for substation lighting and convenience outlets.
- The contractor shall provide and install at least one duplex outlet at each of the main switch, transformer, voltage regulator and feeder breaker location.

4.30.7. CCTV Camera Towers

- The design shall contain provisions for CCTV towers.

4.31. CLIMATOLOGIAL

- The following information is preliminary information only.
- Contractors shall verify all climatological information.

4.31.1. General Information

- Approximate Center of Substation (Tennessee State Plane) To Be Given
- Altitude Above Mean Sea Level: To Be Given
- Seismic Risk Zone: (II) 0.15 - 0.2g
- Safety factor: 1.2

4.31.2. Weather

- Average annual temperatures
- Maximum 69.67°F
- Minimum 46.00°F
- Average 57.9°F

- Record temperatures:
- Highest recorded temperature: 110°F
- Lowest recorded temperature: -17°F

- Wind
- Wind gust have been reported up to 53 mph – WSW.

- Precipitation
- Average Annual Precipitation: 51.78”

- Humidity
- Average humidity 75%

----- END OF SECTION -----

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Section 26 12 19.10 Three-Phase Pad-Mounted Transformers

Ft. Campbell Requirements:

4.32. SERVICE TRANSFORMERS

- Service transformers, for all 15kV, and below, 3-phase underground fed installations, shall be of the pad-mounted type.
- The nameplate rating for the transformer shall not be less than 90 percent of the KVA demand load calculated for the transformer.

4.33. TRANSFORMER CONFIGURATION

- Delta banks shall not be provided for transformer stations.

4.34. DEAD FRONT

- For new construction, the high-voltage compartment shall be dead-front construction
- When replacing an existing transformer, dead-front construction should be used unless specifically authorized by DPW.

4.35. ADJUSTABLE TAPS

- Provide a minimum of five (5) adjustable taps on transformers.
- Taps may be either No-Load Tap or On-Load Tap changes.

4.36. ENCLOSURES

- Enclosures shall be lockable using a padlock.

4.37. OIL-FILLED EQUIPMENT

- Fort Campbell prefers Envirotemp™ FR3™ fluid
- Mineral oil may be used as a coolant in oil-filled equipment

4.38. MATERIAL

- Copper (CU) shall be used for all transformer windings.

4.39. TRANSFORMER CAGE ACCESS

- Where Anti-Terrorism/Force Protection (ATFP) or other requirements necessitate a cage over a pad-mount transformer enclosure area, the contractor shall design and construct a system by which Fort Campbell personnel may quick and full access for transformer replacement.

4.40. PLACING PAD-MOUNT TRANSFORMER WITHIN ENCLOSURES

- Contractor shall not place a pad-mount transformer serving any building or facility within a single enclosure which contains another heat-generating equipment, sub-system or system (e.g. HVAC systems) without providing engineering calculations, design and construction constraints which insure:
 - the efficiency of any equipment, sub-system or system is not compromised,
 - the design life of any equipment, sub-system or system is not shortened.
- This includes a transformer mounted within a brick-walled, secure, lockable enclosure.

4.41. PAD-MOUNTED TRANSFORMERS AND SWITCHGEAR VAULT (BOX)

- To provide working space length for all medium voltage conductors:
 - the use of a vault (box), instead of a manhole, shall be allowed only under Pad-

- Mounted Transformers (service transformer) and Switchgear
- pad-mounted transformers and switchgear shall have a vault (box) installed below them large enough to allow all phases of all medium voltage conductors may be “looped” around the insider perimeter of the vault.
 - medium voltage conductors installed the vault (box) shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.
 - the vault (box) shall be large enough to accommodate easy entry, exit and working of at least two (2) electrical personnel.
 - the vault (box) shall meet all confined space requirement, ventilation, extraction requirements.

----- END OF SECTION -----

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26 12 19.20

SINGLE-PHASE PAD-MOUNTED TRANSFORMERS

Ft. Campbell Requirements:

4.42. MOUNTING CHOICE

- Single phase installations for O&M projects shall be coordinated with user as to whether a pole mount or a pad mount transformer should be used.

4.43. ENCLOSURES

- Enclosures shall be lockable using a padlock.

4.44. OIL-FILLED EQUIPMENT

- Fort Campbell prefers Envirotemp™ FR3™ fluid
- Mineral oil may be used as a coolant in oil-filled equipment

4.45. MATERIAL

- Copper (CU) shall be used for all transformer windings.

4.46. DEAD FRONT

- For new construction, the high-voltage compartment shall be dead-front construction
- When replacing an existing transformer, dead-front construction should be used unless specifically authorized by DPW.

----- END OF SECTION -----

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26 13 00.00 20

SF6 INSULATED PAD-MOUNTED SWITCHGEAR

Ft. Campbell Requirements:

4.47. PAD-MOUNTED TRANSFORMERS AND SWITCHGEAR VAULT (BOX)

- To provide working space length for all medium voltage conductors:
 - the use of a vault (box), instead of a manhole, shall be allowed only under Pad-Mounted Transformers (service transformer) and Switchgear
 - pad-mounted transformers and switchgear shall have a vault (box) installed below them large enough to allow all phases of all medium voltage conductors may be “looped” around the insider perimeter of the vault.
 - medium voltage conductors installed the vault (box) shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.
 - the vault (box) shall be large enough to accommodate easy entry, exit and working of at least two (2) electrical personnel.
 - the vault (box) shall meet all confined space requirement, ventilation, extraction requirements.

----- END OF SECTION -----

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26 13 00.00 20

SF6 INSULATED PAD-MOUNTED SWITCHGEAR

Ft. Campbell Requirements:

4.48. PAD-MOUNTED TRANSFORMERS AND SWITCHGEAR VAULT (BOX)

- To provide working space length for all medium voltage conductors:
 - the use of a vault (box), instead of a manhole, shall be allowed only under Pad-Mounted Transformers (service transformer) and Switchgear
 - pad-mounted transformers and switchgear shall have a vault (box) installed below them large enough to allow all phases of all medium voltage conductors may be “looped” around the insider perimeter of the vault.
 - medium voltage conductors installed the vault (box) shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.

- the vault (box) shall be large enough to accommodate easy entry, exit and working of at least two (2) electrical personnel.
- the vault (box) shall meet all confined space requirement, ventilation, extraction requirements.

----- END OF SECTION -----

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Section 26 20 00 Interior Distribution System

Ft. Campbell Requirements:

4.49. COLOR CODING

- Provide for service, feeder, branch, control, and signaling circuit conductors.
- Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each.
- If MC cable assemblies are used for branch circuits, the ungrounded conductors shall be factory impregnated with the color to match the phase circuit to which it is connected.
- Color of ungrounded conductors in different voltage systems shall be as follows:
 - 208/120 volt, three-phase
 - Phase A - black
 - Phase B - red
 - Phase C - blue
 - 480/277 volt, three-phase
 - Phase A - brown
 - Phase B - orange
 - Phase C - yellow
 - 120/240 volt, single phase: Black and red
 - On three-phase, three-phase, four-wire delta system, high leg shall be orange, as required by NFPA 70.

4.50. GROUNDING

- All conductor to conductor (wire-type) grounding connections shall be connected using exothermically welding or with range-taking compression tap connector.
- All connections to Driven Ground Rods shall be exothermically welded or use compression connector.
- All grounding connections to structural metal frames of buildings or structures shall be bolted, riveted, welded or compression (i.e. range-taking compression tap connector).
- Ground rods are required.
- Grounding shall not be accomplished at water lines.

- Split-bolts, or any reversible type connector, shall not be used on any substation grounded or grounding connections, including above ground.
- Split-bolts, or any reversible type connector, shall not be used on any exterior grounding system.
- Steel poles shall be supplied with factory, bolted, grounding connections.

4.51. ACCESS - GENERAL

- Access to the electrical room shall be either directly from the outside of the building or through the mechanical room.

4.52. CLEARANCES

4.52.1. EQUIPMENT

- Coordinate plans so that lighting fixtures, smoke detectors, supply and return grilles, and other ceiling mounted equipment do not overlap or interfere with each other.

4.52.2. NETWORK ENTERPRISE COMMAND (NEC)

- Contractor shall coordinate with all disciplines, (electrical, mechanical and plumbing) to ensure that proper Network Enterprise Center (NEC) clearances are maintained around all equipment in electrical and mechanical rooms.

4.53. BATTERIES

- Wet cell batteries shall not be used. This includes both exit lights and emergency lights.

4.54. ELECTRICAL ROOM

- There shall be an electrical equipment room separate from the mechanical equipment room.
 - This protects electrical communications and fire alarm equipment from temperature and humidity normally encountered in a mechanical room.

4.55. ELECTRICAL/MECHANICAL ROOM LIGHTING

- Lighting levels for electrical, mechanical or electrical/mechanical room combinations shall not be less than 500 lux (46.50 fc).
- Lighting shall be controlled by manual means only.

- Lighting shall not be automatically be controlled by a timer or occupancy sensor (NEC Article 110.26 (D)).

4.56. PANEL BOARDS

- Install surface mounted panel boards in unfinished areas of buildings.
- Install flush or semi-flush panel boards in other areas.
- Panelboards shall have 25% spare capacity for future expansion.

4.57. TIMERS

- Timers shall not be installed to control lighting in latrines and showers.

4.58. SURGE ARRESTORS

- Secondary surge arrestors shall be provided on each new facility.

----- END OF SECTION -----

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SECTION 26 24 16.00 40 PANELBOARDS

Ft. Campbell Requirements:

1.1. BOLT ON CIRCUIT BREAKERS

- Circuit breakers for distribution panels/load centers shall be bolt-on style

----- END OF SECTION -----

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Section 26 27 13.10 30
Electric Meters

Ft. Campbell Requirements:

4.59. METERING

- Contractors shall address specific metering requirements with the Fort Campbell Energy/Utilities Branch, building 865.
- Generally, the contractor shall provide watt-hour meters on each new facility.
- Generally, meters shall be capable of receiving a device to allow future remote monitoring.

----- END OF SECTION -----

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Section 26 32 14.00 10
Diesel-Generator Set, Stationary, 15-2500 KW Standby Applications

Ft. Campbell Requirements:

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.11 (1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)

ANSI C39.1 (1981; R 1992) Requirements for Electrical Analog Indicating Instruments

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M (1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 106 (1999e1) Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A 135 (1997c) Electric-Resistance-Welded Steel Pipe

ASTM A 181/A 181M (2000) Carbon Steel Forgings for General-Purpose Piping

ASTM A 234M (2000) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM B 395 (1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger

ASTM B 395M (1995) U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes (Metric)

ASTM D 975 (1998b) Diesel Fuel Oils

ASME INTERNATIONAL (ASME)

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.5 (1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

ASME B16.11 (1996) Forged Fittings, Socket-Welding and Threaded

ASME B31.1 (1998) Power Piping

ASME BPVC SEC VIII D1 (1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5 (1994; CS5a-1995) Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV

AEIC CS6 (1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

ELECTRICAL GENERATING SYSTEMS ASSOCIATION (EGSA)

EGSA 101P (1995a) Engine Driven Generator Sets

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code IEEE Std 1 (1986; R 1992) General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation

IEEE Std 48 (1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV

IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

IEEE Std 100 (1997) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 120 (1989) Electrical Measurements in Power Circuits

IEEE Std 404 (1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V

IEEE Std 519 (1992) Harmonic Control in Electrical Power Systems
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports - Selection and Application

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches NEMA ICS 2 (1993) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA ICS 6 (1993) Industrial Control and Systems, Enclosures

NEMA WC 7 (1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NEMA WC 8 (1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NEMA MG 1 (1998) Motors and Generators

NEMA PB 1 (1995) Panel boards

NEMA SG 3 (1995) Power Switching Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (1996; Errata TIA 96-2) Flammable and Combustible Liquids Code

NFPA 37 (1998) Installation and Use of Stationary Combustion Engines and Gas Turbines

NFPA 70 (1999) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE ARP 892 (1965; R 1994) D-C Starter-Generator, Engine

SAE J 537 (1996) Storage Batteries

UNDERWRITERS LABORATORIES (UL)

UL 489 (1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 891 (1994; Rev thru Jan 1995) Dead-Front Switchboards

UL 1236 (1994; Rev thru Mar 1999) Battery Chargers for Charging Engine-Starter Batteries

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Layout; G

Drawings; G

a. Base-mounted equipment, complete with base and attachments including anchor bolt template and recommended clearances for maintenance and operation.

b. Starting system.

c. Fuel system.

d. Cooling system.

e. Exhaust system.

- f. Electric wiring of relays, breakers, programmable controllers, and switches including single line and wiring diagrams.
- g. Lubrication system, including piping, pumps, strainers, filters, heat exchangers for lube oil and turbocharger cooling, electric heater, controls and wiring.
- h. Location, type, and description of vibration isolation devices.
- i. The safety system, including wiring schematics.
- j. One-line schematic and wiring diagrams of the generator, exciter, regulator, governor, and all instrumentation.
- k. Panel layouts.
- l. Mounting and support for each panel and major piece of electrical equipment.
- m. Engine-generator set rigging points and lifting instructions.

Acceptance; G

Drawings, which accurately depict the as-built configuration of the installation, upon acceptance of the diesel-generator, set installation. Layout drawings shall be revised to reflect the as-built conditions and submitted with the as-built drawings.

SD-03 Product Data

Performance Tests; G

Calculations of the engine and generator output power capability, including efficiency and parasitic load data.

Sound Limitations; G

Sound power level data for the packaged unit operating at 100% load in a free field environment. The data should demonstrate compliance with the sound limitation requirements of this specification.

Generator; G

Each generator KW rating and short circuit capacity (both symmetric and asymmetric).

Day Tank; G

Calculations for the capacity of each day tank, including allowances for recirculated fuel, usable tank capacity, and duration of fuel supply.

Power Factor; G

Generator capability curve showing generator kVA output (kW vs. kvar) for both leading and lagging power factors ranging from 0 to 1.0.

Heat Rejected to Engine-Generator Space; G

Manufacturer's data to quantify heat rejected to the space with the engine generator set at rated capacity.

Time-Delay on Alarms; G

The magnitude of monitored values, which define alarm or action, set points, and the tolerance (plus and/or minus) at which the device activates the alarm or action.

Cooling System; G

- a. The maximum and minimum allowable inlet temperatures of the coolant fluid.
- b. The maximum allowable temperature rise in the coolant fluid.
- c. The minimum allowable inlet fuel temperature.

Manufacturer's Catalog; G

Manufacturer's standard catalog data describing and depicting each engine-generator set and all ancillary equipment in sufficient detail to demonstrate specification compliance.

Vibration Isolation; G

Vibration isolation system performance data for the range of frequencies generated by the engine-generator set during operation from no load to full load and the maximum vibration transmitted to the floor. Description of seismic zone C or equivalent qualification of the engine-generator mounting, base, and vibration isolation.

Instructions; G

Instructions including: the manufacturer's pre-start checklist and precautions; startup procedures for test mode, manual-start mode, and automatic-start mode, (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches). Instructions shall be weatherproof, laminated in plastic, framed, and posted where directed. Posted data shall include wiring and control diagrams showing the key mechanical and electrical control elements, and a diagrammatic layout of the system.

Experience; G

Statement and locations showing that each component manufacturer has a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary diesel-engine generator sets for commercial and industrial use of similar generator set size, location and function as that identified in the construction documents.

Field Engineer;

A letter listing the qualifications, schools, formal training, and experience of the field engineer.

Site Welding;

A letter listing the welder qualifying procedures for each welder, complete with supporting data such as test procedures used, what was tested to, and a list of the names of all welders and their qualifications symbols.

General Installation; G

A complete copy of the manufacturer's installation procedures. A detailed description of the manufacturer's recommended break-in procedure.

Site Visit;

A site visit letter stating the date the site was visited and listing discrepancies found.

SD-06 Test Reports

Onsite Inspection and Tests; G,

- a. A letter giving notice of the proposed dates of all onsite inspections and tests at least 14 days prior to beginning tests.
- b. A detailed description of the Contractor's proposed procedures for onsite tests including the test including the test plan and a listing of equipment necessary to perform the tests. Submission shall be at least 7 days prior to beginning tests.
- c. Six copies of the onsite test data described below in 216 x 279 mm (8-1/2 x 11 inch) 3-ring binders with a separate section for each test. Sections shall be separated by dividers with tabs. Data plots shall be full size 216 x 279 mm (8-1/2 x 11 inches) minimum), showing all grid lines, with full resolution.

- (1) A description of the procedures for onsite tests.
- (2) A list of equipment used, with calibration certifications.
- (3) A copy of measurements taken, with required plots and graphs.
- (4) The date of testing.
- (5) The parameters verified.
- (6) The condition specified for the parameter.
- (7) The test results, signed and dated.
- (8) A description of all adjustments made.

SD-07 Certificates

Vibration Isolation; G

Torsional analysis including prototype testing or calculations, which certify and demonstrate that no damaging or dangerous torsional vibrations will occur when the prime mover is connected to the generator, at synchronous speeds, plus/minus 10%.

Prototype Tests;

Manufacturer's standard certification that prototype tests were performed for the generator model proposed.

Design Prototype Tests.

- Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:
- Maximum power (kW).
- Maximum motor starting (kVA) at 35% instantaneous voltage dip.
- Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
- Governor speed regulation under steady-state and transient conditions.
- Voltage regulation and generator transient response.
- Harmonic analysis, voltage waveform deviation, and telephone influence factor.
- Three-phase short circuit tests
- Alternator cooling air flow.
- Torsional analysis to verify that the generator set is free of harmful torsional stresses.
- Endurance testing.

Final Production Tests

- Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
- Single-step load pickup
- Transient and steady-state governing
- Safety shutdown device testing
- Voltage regulation
- Rated Power @ 0.8 PF
- Maximum power

- A witness test or a certified test record sent prior to shipment.

Reliability and Durability; G

Documentation, which cites engines and generators in similar service to demonstrate compliance with the requirements of this specification. Certification does not exclude annual technological improvements made by a manufacturer in the basic standard model set on which experience was obtained, provided parts interchangeability has not been substantially affected and the current standard model meets all the performance requirements of this specification. For each different set, 2 like sets shall have performed satisfactorily in a stationary power application, independent and separate from the physical location of the manufacturer's and assembler's facilities, for a minimum of 2 consecutive years without any failure to start, including periodic exercise. The certification shall state that for the set proposed to meet this specification, there were no failures resulting in downtime for repairs in excess of 72 hours or any failure due to overheating during 2 consecutive years of service. Like sets are of the same model, speed, bore, stroke, number and configuration of cylinders, an output powers rating. Like generators are of the same model, speed, pitch, cooling, exciter, voltage regulator and output power rating. A list shall be provided with the name of the installations, completion dates, and name and telephone number of a point of contact.

Emissions; G

A certification from the engine manufacturer stating that the engine exhaust emissions meet federal, state, and local regulations and restrictions specified. At a minimum, this certification shall include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide, particulate matter, sulfur dioxide, non-methane hydrocarbon, and for hazardous air pollutants (HAPs).

Sound limitations; G

A certification from the manufacturer stating that the sound emissions meet the specification.

Flywheel Balance; G

Manufacturer's certification that the flywheel has been statically and dynamically balanced and is capable of being rotated at 125% of rated speed without vibration or damage.

Materials and Equipment; G

A letter stating that where materials or equipment are specified to comply with requirements of UL, or other standards, written proof of such compliance has been obtained. The label or listing of the specified agency, or a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency are acceptable as proof.

Factory Inspection and Tests; G

A certification that each engine generator set passed the factory tests and inspections and a list of the test and inspections.

Inspections; G

A letter certifying that all facilities are complete and functional, that each system is fully functional, and that each item of equipment is complete, free from damage, adjusted, and ready for beneficial use.

Cooling System; G

Certification that the engine-generator set and cooling system function properly in the ambient temperatures

1.3 SYSTEM DESCRIPTION

Each engine-generator set shall be provided and installed complete and totally functional, with all necessary ancillary equipment to include air filtration; starting system; generator controls, protection, and isolation; instrumentation; lubrication; fuel system; cooling system; and engine exhaust system. Each engine generator set shall satisfy the requirements specified in the Engine Generator Parameter Schedule.

1.3.1 Engine-Generator Parameter Schedule

- The generator set shall be a Kohler model _____ or an approved equal with a _____ alternator. It shall provide ____kW/____kVA when operating at ____volts, 60 Hz, .8 power factor. The generator set shall be capable of a Standby 130°C rating while operating in an ambient condition of less than or equal to 77° F and a maximum elevation of 7546 feet above sea level.
- Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying _____ LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.
- Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

Engine

- The _____-cubic-inch displacement engine shall deliver a minimum of ____ HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
- Electronic isochronous governor capable of 0.25% steady-state frequency

regulation.

- 12-volt positive-engagement solenoid shift-starting motor.
- 70-ampere automatic battery charging alternator with a solid-state voltage regulation.
- Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
- Dry-type replaceable air cleaner elements for normal applications.
- Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel.
- The turbocharged engine shall be fueled by diesel.
- The engine shall have a minimum of ___ cylinders and be liquid-cooled by Unit Mounted Radiator 122°F/50°C.
- The engine shall be EPA certified from the factory.

Alternator

- The alternator shall be salient-pole, brushless, 2/3-pitch, 12 lead, self-ventilated with drip-proof construction and amortisseur rotor windings and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to Standby 130°C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within $\pm 2.0\%$ at any constant load from 0% to 100% of rating. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
- The alternator shall have a single maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

- The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.

ENGINE GENERATOR PARAMETER SCHEDULE

Service Load [_____] [kVA] [kW]

Power Factor .08

Motor Starting kVA (maximum) [_____] kVA

Maximum Speed 1800 rpm

Engine-Generator Application stand-alone

Engine Cooling Type water/ethylene glycol

Heat Exchanger Type fin-tube

Governor Type Isochronous

Frequency Bandwidth + 0.4% (steady state)

Voltage Regulation + 2% (max.) (No load to full load) Voltage Bandwidth + 0.5 (steady state)

Frequency 60 Hz

Voltage [_____] volts

Phases [3 Phase, Wye] [3 Phase, Delta] [1 Phase]

Minimum Generator 12% percent Sub transient Reactance

Nonlinear Loads [_____] kVA

Max Step Load Increase 100% of Service

Load at 0.8 PF

Max Step Load Decrease 100 % of Service Load at (without shutdown) 0.8 PF

Max Time to Start to 10 seconds to Assume Load

Max Summer Outdoor Temp 49 degrees C (Ambient)

Min Winter Outdoor Temp -30 degrees C (Ambient)

Installation Elevation 150M above sea level

1.3.2 Output Capacity

Each generator set shall provide power equal to the sum of service load plus the machine's efficiency loss and associated ancillary equipment loads. Rated output capacity shall also consider engine and/or generator over-sizing required to meet requirements in paragraph Engine-Generator Parameter Schedule.

1.3.3 Power Rating

Standby ratings shall be in accordance with EGSA 101P.

1.4 GENERAL REQUIREMENTS

1.4.1 Engine-Generator Set

Each set shall consist of one engine, one generator, and one exciter, mounted, assembled, and aligned on one base; and all other necessary ancillary equipment, which may be mounted separately. Sets shall be assembled and attached to the base prior to shipping. Set components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard product offered in catalogs for commercial or industrial use. A generator strip heater shall be provided for moisture control when the generator is not operating.

1.4.2 Nameplates

Each major component of this specification shall have the manufacturer's name, type or style, model or serial number, and rating number on a plate secured to the equipment. As a minimum, nameplates shall be provided for: Engines; Relays; Generators; Day tanks; Transformers (CT & PT); Regulators; Pumps and pump motors; Governors; Generator Breaker; Economizers; Heat exchangers (other than base-mounted).

Engines Relays

Generators Day tanks

Transformers (CT & PT) Regulators

Pumps and pump motors Governors

Generator Breaker Economizers

Heat exchangers (other than base-mounted)

Where the following equipment is provided as a standard component by the diesel-engine generator set manufacturer, the nameplate information may be provided in the maintenance manual in lieu of nameplates.

Battery charger Heaters

Exhaust mufflers Exciters

Switchgear Silencers

Battery

1.4.3 Personnel Safety Device

Exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, and parts that may be a hazard to operating personnel during normal operation shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. The safety devices shall be installed so that proper operation of the equipment is not impaired.

1.4.4 Verification of Dimensions

Before performing work, the premises shall be visited and details of the work verified. The Contracting Officer shall be advised in writing of any discrepancies before performing any work.

1.4.5 Conformance to Codes and Standards

Where equipment is specified to conform to requirements of any code or standard such as UL, the design, fabrication and installation shall conform to the code.

1.4.6 Site Welding

Structural members shall be welded in accordance with Section 05090 WELDING, STRUCTURAL. For all other welding, procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.1. Welder qualification tests shall be performed for each welder whose qualifications are not in compliance with the referenced standards. The Contracting Officer shall be notified 24 hours in advance of qualification tests. The qualification tests shall be performed at the work site if practical. The welder or welding operator shall apply the assigned personal symbol near each weld made as a permanent record

1.4.7 Engine Generator Set Enclosure Weather Enclosure

- All enclosures are to be constructed from high strength, low alloy steel, aluminum or galvanized steel.
- The enclosure shall be finish coated with powder baked paint for superior finish, durability, and appearance. Enclosures will be finished in the manufacturer's standard color.
- The enclosures must allow the generator set to operate at full load in an ambient temperature of 40 - 45°C with no additional derating of the electrical output.
- Enclosures must be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code.
- Doors must be hinged with stainless steel hinges and hardware and be removable.

- Doors must be equipped with lockable latches. Locks must be keyed alike.
- The enclosure roof must be pitched to prevent accumulation of water
- A duct between the radiator and air outlet must be provided to prevent re-circulation of hot air.
- The complete exhaust system shall be internal to the enclosure or optional with external mounted silencer
- The critical silencer shall be insulated with a tailpipe and rain cap

SOUND LIMITATIONS.

1.4.8 Vibration Isolation

The maximum engine-generator set vibration in the horizontal, vertical and axial directions shall be limited to 0.15 mm (6 mils) peak-peak RMS with an overall velocity limit of 24 mm/seconds 0.95 inches/seconds RMS, for all speeds through 110% of rated speed. The engine-generator set shall be provided with vibration-isolation in accordance with the manufacturer's standard recommendation. Where the vibration-isolation system does not secure the base to the structure floor or unit foundation, seismic restraints shall be provided in accordance with the seismic parameters specified.

1.4.9 Experience

Each component manufacturer shall have a minimum of 3 years experience in the manufacture, assembly and sale of components used with stationary diesel engine-generator sets for commercial and industrial use. The engine-generator set manufacture/assembler shall have a minimum of 3 years experience in the manufacture, assembly and sale of stationary diesel engine-generator sets for commercial and industrial use.

1.4.10 Field Engineer

The engine-generator set manufacturer or assembler shall furnish a qualified field engineer to supervise the complete installation of the engine-generator set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment. The field engineer shall have attended the engine-generator manufacturer's training courses on installation and operation and maintenance for engine generator sets.

1.4.11 Seismic Requirements

Seismic requirements shall be in accordance with Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT, 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT and 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT [as shown on the drawings]. All emergency/standby generators shall be mounted on spring isolators rated for seismic zone "C".

1.5 STORAGE AND INSTALLATION

The Contractor shall properly protect material and equipment in procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.6 OPERATION AND MAINTENANCE MANUALS

The operation and maintenance manuals shall be submitted and approved prior to commencing onsite tests.

1.6.1 Operation Manual

Three copies of the manufacturer's standard maintenance manual. (All available manuals)

a. Procedures for each routine maintenance item. Procedures for troubleshooting. Factory-service, takedown overhaul, and repair service manuals, with parts lists.

b. The manufacturer's recommended maintenance schedule.

c. A component list, which includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components, listed in paragraph GENERAL REQUIREMENTS.

d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

e. One hard copy of each manual and 2 complete copies of CD's shall be permitted instead of 3 hard copies.

1.6.1 Deleted

1.6.2 Maintenance Manual

Three copies of the [manufacturers standard maintenance manual] [maintenance manual containing the information described below in 216 x 279 mm (8-1/2 x 11 inch) three-ring binders shall be provided. Each section shall be separated by a heavy plastic divider with tabs. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes].

a. Procedures for each routine maintenance item. Procedures for troubleshooting. Factory-service, overhaul, and repair service manuals, with parts lists.

b. The manufacturer's recommended maintenance schedule.

c. A component list, which includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components, listed in paragraph GENERAL REQUIREMENTS.

d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

1.7 SPECIAL TOOLS AND FILTERS

Two sets of special tools and two sets of filters required for maintenance shall be provided. Special tools are those that only the manufacturer provides, for special purposes, or to reach otherwise inaccessible parts this also includes, software, firmware, hardware, cables and connectors and an electronic device capable of programming, diagnostic trouble shooting, memory of not less than 80gb if required for re-programming of any component. One handset shall be provided for each electronic governor when required to indicate and/or change governor response settings. Two complete sets of filters shall be supplied in a suitable storage box. These filters shall be in addition to filters replaced after testing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified.

2.1.1 Circuit Breakers, Low Voltage

NEMA AB 1, UL 489, and NEMA SG 3.

2.1.2 Filter Elements (Fuel-oil, Lubricating-oil, and Combustion-air)

Manufacturer's standard.

2.1.3 Instrument Transformers

ANSI C12.11.

2.1.4 Pipe (Sleeves, Fuel/Lube-oil, Compressed-Air, Coolant and Exhaust) ASTM A 53/A 53M, ASTM A 106 or ASTM A 135, steel pipe. Pipe smaller than 50 mm (2 inches) shall be Schedule 80. Pipe 50 mm (2 inches) and larger shall be Schedule 40.

2.1.5 Pipe Flanges and Fittings

a. Pipe Flanges and Flanged Fittings: ASTM A 181/A 181M, Class 60, or ASME B16.5, Grade 1, Class 150.

b. Pipe Welding Fittings: ASTM A 234/A 234M, Grade WPB or WPC, Class 150, or ASME B16.11, 1360.7 kg. (3000 lb.)

c. Threaded Fittings: ASME B16.3, Class 150.

d. Valves: MSS SP-80, Class 150.

e. Gaskets: Manufacturers Standard.

2.1.6 Pipe Hangers

MSS SP-58 and MSS SP-69.

2.1.7 Electrical Enclosures

2.1.7.1 General
NEMA ICS 6.

2.1.7.2 Panel-boards
NEMA PB 1.

2.1.8 Electric Motors

Electric motors shall conform to the requirements of NEMA MG 1. Motors shall have sealed ball bearings, a maximum speed of 1800 rpm and integral automatic or manual reset thermal overload protectors. Motors used indoors shall have drip proof frames; those used outside shall be totally enclosed. AC motors larger than 373 W (1/2 Hp) (1/2 Hp) shall be of the squirrel cage induction type for standard voltage of 460 volts, 60 Hz three phase power. AC motors 373 W (1/2 Hp) (1/2 Hp) or smaller, shall be for standard voltage 115 volts, 60 Hz single-phase power.

2.1.9 Motor Controllers Motor controllers and starters shall conform to the requirements of NFPA 70 and NEMA ICS 2.

2.2 ENGINE

Each engine shall operate on No. 2-D diesel conforming to ASTM D 975, shall be designed for stationary applications and shall be complete with ancillaries. The engine shall be a standard production model described in the manufacturer's catalog. The engine shall, supercharged or turbocharged. The engine shall be four-stroke-cycle and compression-ignition type. The engine shall be vertical inline, V-, or opposed-piston type, with a solid cast block or individually cast cylinders. The engine shall have a minimum of two cylinders. Opposed-piston type engines shall have no less than four cylinders. Each block shall have a coolant drain port. Each engine shall be equipped with an over-speed sensor.

2.3 FUEL SYSTEM

The fuel system for each engine generator set shall conform to the requirements of NFPA 30 and NFPA 37 and contain the following elements.

2.3.1 Pumps

2.3.1.1 Main Pump

Each engine shall be provided with an engine driven pump. The pump shall supply fuel at a minimum rate sufficient to provide the amount of fuel required to meet the performance indicated within the parameter schedule. The fuel flow rate shall be based on meeting the load requirements and all necessary re-circulation.

2.3.1.2 Auxiliary Fuel Pump

Auxiliary fuel pumps shall be provided to maintain the required engine fuel pressure, either required by the installation or indicated on the drawings. The auxiliary pump shall be driven by

a dc electric motor powered by the starting/station batteries. The auxiliary pump shall be automatically actuated by a pressure-detecting device.

2.3.2 Filter

A minimum of one full flow fuel filter shall be provided for each engine. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.3.3 Relief/Bypass Valve

A relief/bypass valve shall be provided to regulate pressure in the fuel supply line, return excess fuel to a return line, and prevent the build-up of excessive pressure in the fuel system.

2.3.4 Day Tank

Each engine shall be provided with a separate self-supporting day tank if required. Each day tank shall be provided with connections for fuel supply line, fuel return line, fuel overflow line, local fuel fill port, gauge, vent line, drain line, and float switch assembly for control. A fuel return line cooler shall be provided as recommended by the manufacturer and assembler. The temperature of the fuel returning to the day tank shall be below the flash point of the fuel. A temperature-sensing device shall be installed in the fuel supply line.

2.3.4.1 Capacity

Each tank shall have capacity to supply fuel to the engine for an uninterrupted 2-hour period at 100% rated load without being refilled or 25 gallons, whichever is recommended or specified.

2.3.4.2 Local Fuel Fill

Each local fuel fill port on the day tank shall be provided with a screw-on cap.

2.3.4.3 Fuel Level Controls

a. Each tank shall have a float-switch assembly to perform the following functions:

(1) Activate the "Low Fuel Level" alarm at 70% of the rated tank capacity.

(2) Activate the "Overfill Fuel Level" alarm at 95% of the rated tank capacity.

2.3.4.4 Arrangement

Gravity flow tanks and any tank that allows a fuel level above the fuel injectors shall be provided with an internal or external factory installed valve located as near as possible to the shell of the tank. The valve shall close when the engine is not operating.

2.3.5.1 Capacity, Standby

Each day tank shall have capacity to supply fuel to the engine for an uninterrupted 2-hour period at 100% rated load without being refilled, plus any fuel, which may be returned to the main fuel storage tank. The calculation of the capacity of each day tank shall incorporate the requirement to stop the supply of fuel into the day tank at 90% of the ultimate volume of the tank.

2.3.5.2 Drain Line

Each day tank drain line shall be accessible and equipped with a shutoff valve. Self-supporting day tanks shall be arranged to allow drainage into a 305 mm (12 inch) tall bucket.

2.3.5.3 Local Fuel Fill

Each local fuel fill port on the day tank shall be provided with a screw-on cap.

2.3.5.4 Fuel Level Controls

- a. Each day tank shall have a float-switch-assembly to perform the following functions:
- (1) Activate the "Overfill Fuel Level" alarm at 95% of the rated tank volume.
 - (2) Activate the "Low Fuel Level" alarm at 70% of the rated tank Capacity.

2.3.5.5 Arrangement

Day tanks may allow gravity flow into the engine. Gravity flow tanks shall be provided with an internal or external valve located as near as possible to the shell of the tank. The valve shall close when the engine is not operating. Day tanks shall be provided with any necessary pumps to supply fuel to the engine as recommended by the generator set manufacturer. The fuel supply line from the day tank to the manufacturer's standard engine connection shall be threaded pipe.

2.3.6 Fuel Supply System

The fuel supply from the main storage of fuel to the day tank shall be as specified in Section 13202 FUEL STORAGE SYSTEMS.

Double Wall Secondary Containment Sub Base Fuel Tank

- A sub base fuel tank used in conjunction with a diesel powered generator set of ___kW will contain ___ gallons of fuel to support the generator set for a period of 48 hours at 100% of rated load and 72 hours at 75% of rated load.
- The sub base fuel system is listed under UL 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.
- The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
- Primary Tank. It will be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld. The Primary Tank shall not exceed 18 inches in height.
- Steel Channel Support System. Reinforced steel box channel for generator support, with a load rating of 5,000 lbs. per generator mounting hole location. Full height gussets at either end of channel and at generator mounting holes shall be utilized.

- Exterior Finish. The exterior coating has been tested to withstand continuous salt spray testing at 100 percent exposure for 244 hours to a 5 percent salt solution at 92-97° F. The coating has been subjected to full exposure humidity testing to 100 percent humidity at 100° F for 24 hours. Tests are to be conducted in accordance with The American Standard Testing Methods Society.
- Venting. Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.
- Emergency Venting. The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. The vent is spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. The emergency relief vent is sized to accommodate the total venting capacity of both normal and emergency vents.
- Fuel Fill. There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.
- Fuel Level. A direct reading, UL listed, magnetic fuel level gauge with a hermetically sealed vacuum tested dial shall be provided to eliminate fogging
- Low Fuel Level Switch. Consists of a 30 watt float switch for remote or local annunciation of a (50% standard) low fuel level condition.

2.4 LUBRICATION

Each engine shall have a separate lube-oil system conforming to NFPA 30 and NFPA 37. Each system shall be pressurized by engine-driven oil pumps. Each system shall be furnished with a relief valve for oil pressure regulation (for closed systems) and a dipstick for oil level indications. The crankcase shall be vented in accordance with the manufacturer's recommendation except that it shall not be vented to the engine exhaust system. Crankcase breathers, if provided on engines installed in buildings or enclosures, shall be piped to vent to the outside. The system shall be readily accessible for service such as draining, refilling, etc. Each system shall permit addition of oil and have oil-level indication with the set operating. The system shall utilize an oil cooler as recommended by the engine manufacturer.

2.4.1 Filter

One full-flow filter shall be provided for each pump. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall have inlet and outlet connections plainly marked.

2.4.2 Lube-Oil Sensors

Each engine shall be equipped with lube-oil pressure sensors. Pressure sensors shall be located downstream of the filters and provide signals for required indication and alarms.

2.5 COOLING SYSTEM

Each engine cooling system shall operate automatically while the engine is running. Each cooling system shall be sized for the maximum summer outdoor design temperature and site elevation. Water-cooled system coolant shall use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor temperature specified. The maximum temperature rise of the coolant across the engine shall be no more than that recommended and submitted in accordance with paragraph SUBMITTALS.

2.5.1 Coolant Pumps

Coolant pumps shall be the centrifugal type. Each engine shall have an engine-driven primary pump. Secondary pumps shall be electric motor driven and have automatic controllers.

2.5.2 Deleted

2.5.2.1 Fin-Tube-Type Heat Exchanger (Radiator)

Heat exchanger may be factory coated with corrosive resistant film providing that corrosion measures are taken to restore the heat rejection capability of the radiator to the initial design requirement via over-sizing, or other compensating methods. Internal surfaces shall be compatible with liquid fluid coolant used. Materials and coolant are subject to approval by the Contracting Officer. Heat exchangers shall be pressure type incorporating a pressure valve, vacuum valve and a cap. Caps shall be designed for pressure relief prior to removal. Each heat exchanger and the entire cooling system shall be capable of withstanding a minimum pressure of 48-kPa gauge (7 psi). (7 psi.) Each heat exchanger shall be protected with a strong grille or screen guard. Each heat exchanger shall have at least two tapped holes. One tapped hole in the heat exchanger shall be equipped with a drain cock, the rest shall be plugged.

2.5.3 Expansion Tank

The cooling system shall include an air expansion tank, which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The tank shall be suitable for an operating temperature of 121 degrees C (250 degrees F) and a working pressure of 0.86 MPa (125 psi). (125 psi.) The tank shall be constructed of welded steel, tested and stamped in accordance with ASME BPVC SEC VIII D1 for the stated working pressure. A bladder type tank shall not be used. Steel legs or bases for vertical installation shall support the tank.

2.5.5 Temperature Sensors

Each engine shall be equipped with coolant temperature sensors. Temperature sensors shall provide signals for pre-high and high indication and alarms.

2.6 SOUND LIMITATIONS The noise generated by the diesel generator set operating at 100 percent load shall not exceed the following sound pressure levels in any of the indicated

frequencies when measured in a free field at a radial distance of 7 meters (22.9 feet) at 45 degrees apart in all directions.

Frequency Band Maximum Acceptable

(Hz) Pressure Level

(Decibels)

31 [_81___]

63 [_77___]

125 [_71___]

250 [_64___]

500 [_58___]

1,000 [_55___]

2,000 [_54___]

4,000 [_54___]

8,000 [_56___]

2.7 AIR INTAKE EQUIPMENT

Filters and silencers shall be provided in locations that are convenient for servicing. The silencer shall be of the high-frequency filter type, located in the air intake system as recommended by the engine manufacturer. Silencer shall be capable of reducing the noise level at the air intake to a point below the maximum acceptable levels specified in paragraph SOUND LIMITATIONS. A combined filter-silencer unit meeting requirements for the separate filter and silencer items may be provided. Expansion elements in air-intake lines shall be rubber.

2.8 EXHAUST SYSTEM

The system shall be separate and complete for each engine. Piping shall be supported so as to minimize vibration. Where a V-type engine is provided, a V-type connector with necessary flexible sections and hardware shall connect the engine exhaust outlets.

2.8.1 Flexible Sections and Expansion Joints

A flexible section at each engine and an expansion joint at each muffler shall be provided. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

2.8.2 Exhaust Muffler

A chamber type exhaust muffler shall be provided. The muffler shall be constructed of welded steel and designed for [outside] [inside] [vertical] [horizontal] mounting. Eyebolts, lugs, flanges, or other items shall be provided as necessary for support in the location and position indicated. Pressure drop through the muffler shall not exceed the recommendations of the engine manufacturer. Outside mufflers shall be zinc coated or painted with high temperature 204

degrees C (400 degrees F) resisting paint. The muffler and exhaust piping together shall reduce the noise level to less than the maximum acceptable level listed for sound limitations in paragraph SOUND LIMITATIONS. The muffler shall have a drain valve, nipple, and cap at the low-point of the muffler.

2.8.3 Exhaust Piping

Exhaust muffler shall be provided for each engine, size and type as recommended by the generator set manufacturer. A chamber type exhaust muffler shall be provided. The muffler shall be constructed of welded steel and designed for outside horizontal mounting. Eyebolts, lugs, flanges, or other items shall be provided as necessary for support in the location and position indicated. Pressure drop through the muffler shall not exceed the recommendations of the engine manufacturer. Outside mufflers shall be zinc coated or painted with high temperature, 2040 C resisting paint. The muffler and exhaust piping together shall reduce the noise level to less than the maximum acceptable level listed for sound limitations. The muffler shall have a drain valve, nipple, and cap at the low-point of the muffler.

A flexible section at each engine and an expansion joint at each muffler shall be provided. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type.

Expansion and flexible elements shall be stainless steel suitable for diesel engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

Exhaust Piping: Horizontal sections of exhaust piping shall be sloped downward away from the engine to a condensate trap and drain valve. Changes in direction shall be long-radius. Exhaust piping shall be provide with a hinged gravity operated, self-closing rain cover.

2.9 EMISSIONS

The finished installation shall comply with Federal, state, and local regulations and restrictions regarding the limits of emissions.

2.10 STARTING SYSTEM

The starting system for standby engine generator sets used in emergency applications shall be in accordance with NFPA 99 and NFPA 110 and as follows

2.10.1 Controls

Generator Set Controller:

- The generator set controller shall be a microprocessor based control system that will provide automatic starting, system monitoring and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware and software.

- The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.

Controller Buttons, Display and Components

- The generator set controller shall include the following features and functions:
- Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:

Run Mode:	When in the run mode the generator set shall start as directed by the operator.
Off/Reset Mode:	When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown.
Auto Mode:	When in Auto the mode the generator set shall be te device.

- Push button Master Control buttons. The buttons shall be tactile-feel membrane with an indicator light to initiate the following functions:

Run Mode:	When in the run mode the generator set shall start as directed by the operator.
Off/Reset Mode:	When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown.
Auto Mode:	When in Auto the mode the generator set shall be ready to accept a signal from a remote device.

- Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
- Push Button/Rotary Selector dial. This dial shall be used for selection of all Menus and sub-menus. Rotating the dial moves you through the menus, pushing the dial selects the menu and function/features in that menu. Pushing the button selects the feature/function and sub-menus.
- Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 characters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running the display shall scroll all important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall asleep when the

generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.

- Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
- Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
- Alarm Silence/Lamp Test Button. When this button is depressed it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.
- USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
- Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2 wire star for transfer switch and auxiliary shutdown.
- The controller shall have auto resettable circuit protection integral on the circuit board.

System Controller Monitoring and Status Features and Functions

- The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller
- Overview menu
 1. Active shutdowns and warnings shall be displayed if present and without the need of operator interface.
 2. Engine runtime with total hours
 3. Average line to line voltage
 4. Coolant temperature
 5. Fuel level or pressure
 6. Oil pressure
 7. Battery voltage
 8. Software version
 9. Frequency

10 Average current

- Engine metering menu
 1. Engine speed
 2. Oil pressure
 3. Coolant temperature
 4. Battery voltage

- Generator metering menu
 1. Total power in VA
 2. Total power in W
 3. Rated power % used
 4. Voltage L-L and L-N for all phases
 5. Current L1, L2, L3
 6. Frequency

- Generator set information
 1. Generator set model number
 2. Generator set serial number
 3. Controller set number

- Generator set run time
 1. Engine run time total hours
 2. Engine loaded total hours
 3. Number of engine starts
 4. Total energy in kW

- Generator set system
 1. System voltage
 2. System frequency 50/60Hz
 3. System phase, single/three phase
 4. Power rating kW
 5. Amperage rating
 6. Power type standby/prime
 7. Measurement units, metric/English units adjustable
 8. Alarm silence, always or auto only

- Generator set Calibration; the following are adjustable at the controller
 1. Voltage L-L and L-N all phases
 2. Current L1, L2, L3
 3. Reset all calibrations

- Voltage regulation, +/-0.5% regulation, the following is adjustable at the controller
 1. Voltage Adjustable +/- 10%

- Digital and Analog Inputs and outputs
 1. Displays settings and status

- Event Log
 1. Stores event history, up to 1000 events

Controller Engine control features and functions

- Automatic restart - the controller has automatic restart feature which initiates the start routine and re-crank after a failed start attempt.
- Cyclic cranking - the controller shall have programmable cyclic cranking
- Engine starting aid - the controller shall have the capability of providing control for an optional engine starting aid.
- The control system shall include time delays for engine start and cool down.
- The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.
- The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring.

Controller Alternator control features and functions

- Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to

full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of nominal voltage.

- AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
- Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
- Power metering. The controller digitally displays power metering of kW and kVA.

Other control features and functions

- Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
- Historical data logging. The controllers' total number of generator set successful start shall be recorded and displayed.
- Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.

Generator Set Warning, Shutdown Alarm and Status

- The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns must exist as a minimum:
- Engine functions
 1. Critical high fuel level (alarm)
 2. ECM communication loss (shutdown)
 3. ECM diagnostics (alarm & shutdown)

4. Engine over speed (shutdown)
5. Engine start aid active
6. Engine under speed (shutdown)
7. Fuel tank leak (alarm & shutdown)
8. High DC battery voltage (alarm)
9. High coolant temperature (alarm & shutdown)
10. High fuel level (alarm)
11. Low DC battery voltage (alarm)
12. Low coolant level (shutdown)
13. Low coolant temperature (alarm)
14. Low cranking voltage (alarm)
15. Low engine oil level (alarm & shutdown)
16. Low fuel level (alarm & shutdown)
17. Low fuel pressure (alarm)
18. Low oil pressure (alarm & shutdown)
19. No coolant temperature signal (shutdown)
20. No oil pressure signal (shutdown)
21. Over crank (shutdown)
22. Speed sensor fault (alarm)

- Generator functions

1. AC sensing loss over & under current (alarm & shutdown)
2. Alternator protection (shutdown)
3. Ground fault input (alarm)
4. kW overload (shutdown)
5. Locked rotor (shutdown)
6. Over-frequency (shutdown)
7. Over AC voltage (shutdown)
8. Under-frequency (shutdown)
9. Under AC voltage (shutdown)
10. Emergency stop (shutdown)

- Other General functions

1. Battery charger fault (alarm)
2. Common fault (shutdown)
3. Common warning (alarm)
4. Master switch not in auto (alarm)
5. Generator running
6. Input/output fault (alarm)

- The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements which include several of the above along with; EPS

supplying load, Master switch not in auto and contacts for local and remote common alarm.

2.10.2 Capacity

The starting system shall be of sufficient capacity, at the maximum outdoor summer temperature specified to crank the engine without damage or overheating. The system shall be capable of providing a minimum of three cranking periods with 15-second intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds.

2.10.3 Functional Requirements

Starting system shall be manufacturers recommended dc system utilizing a negative circuit ground. Starting motors shall be in accordance with SAE ARP 892.

2.10.4 Battery

A starting battery system shall be provided and shall include the battery, battery rack, inter-cell connectors, and spacers. The battery shall be in accordance with SAE J 537. Critical system components (rack, protection, etc.) shall be sized to withstand the seismic acceleration forces specified. The battery shall be lead-acid non-maintenance type, with sufficient capacity, at the minimum outdoor winter temperature specified to provide the specified cranking periods. Valve-regulated lead-acid batteries are not acceptable.

2.10.5 Battery Charger

A 10-amp voltage regulated battery charger shall be provided for each engine generator set. Charger may be mounted in an automatic transfer switch if desired. Chargers shall not be mounted on the generator set. Charger shall be equipped with float, taper and equalize charge settings. Operations monitors shall provide visual output along with individual from C contacts rated at 4-amperes, 120 VAC, 30 VDC from remote indication of:

Loss of AC power - RED Light

Low battery voltage - RED Light

High battery voltage - RED Light

Power ON - GREEN Light (no relay contact)

2.10.6 Starting Aids

The manufacturer shall provide one or more of the following methods to assist engine starting.

2.10.6.1 Deleted

2.10.6.2 Jacket-Coolant Heaters

A thermostatically controlled electric heater shall be mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3 degrees of the control temperature. The heater shall operate independently of engine operation so that starting times are

minimized. The control temperature shall be the temperature recommended by the engine manufacturer to meet the starting time specified.

2.11 GOVERNOR

Each engine shall be provided with a governor, which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine generator set, without special tools, from 90 to 110 % of the rated speed/frequency, over a steady state load range of zero to 100% of rated capacity. Isochronous governors shall maintain the midpoint of the frequency bandwidth at the same value for steady-state loads over the range of zero to 100% of rated output capacity

2.12 GENERATOR

Each generator shall be of the synchronous type, one or two bearing, conforming to NEMA MG 1, equipped with winding terminal housings in accordance with NEMA MG 1, equipped with an amortisseur winding, and directly connected to the engine. Insulation shall be Class H standby rating at a minimum of 130 o C temperature rise. Generator design shall protect against mechanical, electrical and thermal damage due to vibration, 25 percent over-speeds, or voltages and temperatures at a rated output capacity of 100 percent. Generator ancillary equipment shall meet the short circuit requirements of NEMA MG 1. Frames shall be the drip-proof type.

2.12.1 Current Balance

At 100 percent rated load, and load impedance equal for each of the three phases, the permissible current difference between any two phases shall not exceed 2 percent of the largest current on either of the two phases.

2.12.2 Voltage Balance

At any balanced load between 75 and 100 percent of rated load, the difference in line-to-neutral voltage among the three phases shall not exceed 1 percent of the average line-to-neutral voltage. For a single-phase load condition, consisting of 25 percent load at unity power factor placed between any phase and neutral with no load on the other two phases, the maximum simultaneous difference in line-to-neutral voltage between the phases shall not exceed 3 percent of rated line to neutral voltage. The single-phase load requirement shall be valid utilizing normal exciter and regulator control. The interpretation of the 25 percent load for single-phase load conditions means 25 percent of rated current at rated phase voltage and unity power factor.

2.12.3 Waveform

The deviation factor of the line-to-line voltage at zero load and at balanced full rated load at 0.8 power factor shall not exceed 10%. The RMS of all harmonics shall be less than 5.0% and that of any one harmonic less than 3.0% at full rated load. Each engine-generator shall be designed and configured to meet the total harmonic distortion limits of IEEE Std 519.

2.13 EXCITER

The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 40 degrees C (104 degrees F) ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.

2.14 VOLTAGE REGULATOR

Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine generator voltage output without special tools, during operation from 90 to 110% of the rated voltage over the steady state load range of zero to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 20 degrees C. (36 degrees F.)

2.14.1 Steady State Performance (Regulation or Voltage Droop).

The voltage regulator shall have a maximum droop of 2% of rated voltage over a load range from 0 to 100% of rated output capacity and automatically maintain the generator output voltage within the specified operational bandwidth.

2.15 GENERATOR PROTECTION

Short circuit and overload protection for the generator shall be provided. The generator circuit breaker (IEEE Device 52) ratings shall be consistent with the generator rated voltage and frequency, with continuous, short circuit and interrupting current ratings to match the generator capacity. The manufacturer shall determine the short circuit current interrupting rating of the breaker. The breaker shall be engine generator base mounted by the engine-generator set manufacturer. UL listed molded case thermal magnetic type rated at [_____] amps, [_____] pole, and [_____] volts. Each breaker shall be provided with shunt trip and wired to the engine fault conditions. Field circuit breakers shall not be acceptable for generator over-current protection. Surge protection shall be provided for each phase of the generator, to be mounted at the generator terminals.

2.15.1 Panel-boards

Panel-boards shall be metal-enclosed, general purpose, [3-phase, 4-wire], [1-phase, 3-wire], [600][_____] volt rated, with neutral bus and continuous ground bus, conforming to NEMA PB 1 and UL 891. Neutral bus and ground bus capacity shall be [as shown][full capacity]. Enclosure designs, construction, materials and coatings shall be [as indicated][suitable for the application and environment]. Bus continuous current rating shall be [at least equal to the generator rating and correspond to UL listed current ratings specified for panel boards and switchboards][as indicated]. Current withstand rating (short circuit rating) shall match the generator capacity. Buses shall be copper.

2.15.2 Devices

Switches, circuit breakers, switchgear, fuses, relays, and other protective devices shall be as specified in Section 16475 COORDINATED POWER SYSTEM PROTECTION.

2.16 SAFETY SYSTEM

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions. The safety system shall be provided with a self-test method to verify its operability. Alarm signals shall have manual acknowledgement and reset devices. The alarm signal systems shall reactivate for new signals after acknowledgment is given to any signal. The systems shall be configured so that loss of any monitoring device shall be dealt with as an alarm on that system element.

2.16.1 Audible Signal

The audible alarm signal shall sound at a frequency of 70 Hz at a volume of 75 dB at 3.1 m (10 feet). The sound shall be continuously activated upon alarm and silenced upon acknowledgment. Signal devices shall be located as shown.

2.16.2 Visual Signal - Signal

The visual alarm signal shall be a panel light. The light shall be normally off, activated to be blinking upon alarm. The light shall change to continuously light upon acknowledgement. If automatic shutdown occurs, the display shall maintain activated status to indicate the cause of failure and shall not be reset until cause of alarm has been cleared and/or restored to normal condition. Shutdown alarms shall be red; all other alarms shall be amber.

2.16.3 Alarms and Action Logic

2.16.3.1 Shutdown

Simultaneous activation of the audible signal, activation of the visual signal, stopping the engine, and opening the generator main circuit breakers shall be accomplished.

2.16.3.2 Problem

Activation of the visual signal shall be accomplished.

2.16.4 Local Alarm Panel

Device/Condition/ Action/Location/ No. of Manufacturers

Function Offering

Low Coolant Level SD/CP VA 3

Overvoltage Protection SD/CP VA O 3

Shutdown

Under frequency SD/CP VA 1 Under voltage SD/CP VA 1

Magnetic Pickup Failure SD/CP VA 1

Over current SD/CP VA 1

Short Circuit SD/CP VA 1

Auxiliary Fault Alarm CP VA 1

Audible Alarm CP AA 1

Over current CP VA 1

Oil Pressure Sender Fault CP VA 1

Weak Battery CP VA 1

A local alarm panel shall be provided with the following shutdown and alarm functions [as indicated] [in accordance with NFPA 99 NFPA 110 level [1] [2]] and including the listed Corps of Engineers requirements, mounted either on or adjacent to the engine generator set.

Device/ What/Where/Size NFPA 99 NFPA 110 NFPA 110 Corps of
Condition/ Level 1 Level 2 Engrs Function Required

Shutdowns

W/Alarms

High engine Automatic/ SD/CP VA SD/CP VA SD/CP VA SD VA
temperature jacket water/
cylinder

Low lube-oil Automatic/ SD/CP VA SD/CP VA SD/CP VA SD VA
pressure/
level

Over speed (110% (+ 2%) SD/CP VA SD/CP VA SD/CP VA SD VA
shutdown \$ of rated
alarm speed

Over crank Automatic/ SD/CP VA SD/CP VA SD/CP VA
failure to
to start to start

Air shutdown When used SD/CP VA SD/CP VA
damper
(200-600kW)

Day tank Automatic/Day SD/OPA
overflow Tank/Level (Pump)
limit

indication &
transfer pump
shutdown
(95% volume)

Red emergency Manual Switch SD/CP VA SD/CP VA SD VA
stop switch

Failure to Corps of Engrs.
crank Required

[Day tank] Corps of Engrs.
[Integral Main Required
Fuel Tank]

low fuel
limit Device/
Condition/
indication
(70% volume
remaining)

Alarms

Low lube-oil Pressure/ CP VA CP VA CP VAO CP VA
pressure level

Low fuel Main tank, VA/AA CP VA CP VAO
 level 3 hours
 remaining
 High fuel Integral Main CP VA
 level Fuel Storage
 Tank
 95% Volume
 Low coolant Jacket water CP/VA CP VA CP VA
 Pre-high Jacket water/ CP VA CP VA CP VAO CP VA
 temperature cylinder
 Pre-low CP VA CP VA
 lube-oil
 pressure
 High battery CP VA CP VAO
 voltage
 Low battery CP VA CP VAO
 voltage
 Battery AC supply not CP VA CP VAO
 charger available
 AC failure
 Control CP VA CP VAO
 switch not
 in AUTO
 Low starting CP VA CP VAO
 air pressure
 Low starting CP VA CP VAO
 hydraulic pressure
 SD - Shut Down
 CP - On Control Panel
 VA - Visual Alarm
 AA - Audible Alarm
 O - Optional]

2.16.5 Time-Delay on Alarms

For startup of the engine-generator set, time-delay devices shall be installed bypassing the low lubricating oil pressure alarm during cranking, and the coolant-fluid outlet temperature alarm. The lube-oil time-delay device shall return its alarm to normal status after the engine starts. The coolant time-delay device shall return its alarm to normal status 5 minutes after the engine starts.

2.16.6 Remote Alarm Panel (If Required)

A remote alarm panel shall be provided as indicated. A remote alarm panel shall be provided in accordance with NFPA 99, NFPA 110 and as follows:

Device/Condition/ What/Where/Size NFPA 99 NFPA 110 NFPA 110

Function Level 1 Level 2

Remote annunciator panel Battery powered Alarms

Loads on genset VA
 Battery charger VA
 malfunction
 Low lube-oil Pressure/level VA/AA AA AAO
 Low Temperature Jacket water VA/AA AA AAO
 High Temperature Jacket water/ VA/AA AA AAO
 cylinder
 Low fuel level Main tank, 3 hr VA/AA AA AAO
 remaining
 Over crank Failure to start VA/AA AA AAO
 Over speed VA/AA AA AAO
 Pre-high temperature Jacket water/ AA
 cylinder
 Control switch not in AA
 AUTO
 Common alarm contacts X X
 for local & remote
 common alarm
 Audible alarm silencing X O
 switch
 Air shutdown damper When used AA AAO
 Common fault alarm AA
 X - Required
 SD - Shut Down
 CP - On Control Panel
 VA - Visual Alarm
 AA - Audible Alarm
 O - Optional]

2.17 ENGINE GENERATOR SET CONTROLS AND INSTRUMENTATION

Devices, wiring, remote panels, local panels, etc., shall be provided and installed as a complete system to automatically activate the appropriate signals and initiate the appropriate actions.

2.17.1 Controls

A local control panel shall be provided with controls [as indicated] [in accordance with NFPA 110 level [1] [2]] [and as follows] mounted on the engine generator set. A remote control panel shall be provided [with devices as indicated] [fully redundant to the local control panel] as required.

Device/Condition/ Corps Requirement NFPA 110 NFPA 110 MFG

Function Level 1 Level 2 Offering

Controls

Switch: run/start CP CP/STD

- off/set - auto

Emergency stop switch CP CP/STD

& alarm

Lamp test/indicator test CP CP VA CP VA CP/STD
 Common alarm contacts/ X X CP/O
 fault relay
 Panel lighting CP CP/STD
 Audible alarm & CP
 silencing/reset switch
 Voltage adjust for voltage CP/
 Regulator
 Pyrometer display CP
 w/selector switch
 Remote emergency stop switch CP VA CP VA
 Remote fuel shutoff switch
 Remote lube-oil shutoff switch

2.17.2 Engine Generator Set Metering and Status Indication

A local panel shall be provided with devices [as indicated] [in accordance with NFPA 110 level [1] [2]] [and as follows] mounted to the engine generator set as indicated. A remote control panel shall be provided [with devices as indicated] [fully redundant to the local control panel] as required.

Device/Condition/Corps Requirement NFPA 110 NFPA 110 MFG

Function Level 1 Level 2 Offering

Genset Status & Metering

Genset supplying load CP VA CP VAO CP VAO

System ready CP/STD

Engine oil pressure CP CP/STD

Engine coolant temperature CP CP/STD

Engine RPM (Tachometer) CP CP/STD

Engine run hours CP CP/STD

Pyrometer display CP

w/selector switch

AC volts (generator), CP CP/STD

3-phase

AC amps (generator), CP CP/STD

3-phase

Generator frequency CP CP/STD

Phase selector switches CP CP/STD

(amps & volts)

Watts/kW CP/VA-O

Voltage Regulator

Adjustment CP

CP - On Control Panel

VA - Visual Alarm

AA - Audible Alarm O - Optional

STD - Manufacturers Standard Offering

2.18 PANELS

Each panel shall be of the type necessary to provide specified functions. Panels shall be mounted on the engine generator set base by vibration/shock absorbing type mountings. Instruments shall be mounted flush or semi flush. Convenient access to the back of instruments shall be provided to facilitate maintenance. Instruments shall be calibrated using recognized industry calibration standards. Each panel shall be provided with a panel identification plate, which clearly identifies the panel function as indicated. Each instrument and device on the panel shall be provided with a plate that clearly identifies the device and its function as indicated. Panels except the remote alarm panel can be combined into a single panel.

2.18.1 Enclosures

Enclosures shall be designed for the application and environment, conforming to NEMA ICS 6, and provided with locking mechanisms, which are keyed alike.

2.18.2 Analog

Analog electrical indicating instruments shall be in accordance with ANSI C39.1 with semi flush mounting. Switchgear, and control-room panel-mounted instruments shall have 250-degree scales with an accuracy of not less than 1 percent. Unit-mounted instruments shall be the manufacturer's standard with an accuracy of not less than 2 percent. The instrument's operating temperature range shall be minus 20 to plus 65 degrees C. Distorted generator output voltage waveform of a crest factor less than 5 shall not affect metering accuracy for phase voltages, hertz and amps.

2.18.3 Electronic

Electronic indicating instruments shall be true RMS indicating, 100 percent solid state, microprocessor controlled to provide all specified functions. Control, logic, and function devices shall be compatible as a system, sealed, dust and water tight, and shall utilize modular components with metal housings and digital instrumentation. An interface module shall be provided to decode serial link data from the electronic panel and translate alarm, fault and status conditions to set of relay contacts. Instrument accuracy shall be not less than 2 percent for unit-mounted devices and 1 percent for control room, panel mounted devices, throughout a temperature range of minus 20 to plus 65 degrees C. Data display shall utilize LED or back lit LCD. Additionally, the display shall provide indication of cycle programming and diagnostic codes for troubleshooting. Numeral height shall be at the minimum height of ¼ inch or manufacturer specifications whichever is larger.

2.18.4 Parameter Display

Indication or readouts of the lubricating-oil pressure, ac voltmeter, ac ammeter, frequency meter, and coolant temperature.

2.18.5 Exerciser

The exerciser shall be in accordance with Section 16410 AUTOMATIC TRANSFER.

2.19 SURGE PROTECTION

Electrical and electronic components shall be protected from, or designed to withstand the effects of surges from switching and lightning.

2.20 AUTOMATIC ENGINE-GENERATOR-SET SYSTEM OPERATION

Fully automatic operation shall be provided for the following operations: engine-generator set starting and source transfer upon loss of normal source; retransfer upon restoration of the normal source; sequential starting; and stopping of each engine-generator set after cool down. Devices shall automatically reset after termination of their function.

2.20.1 Automatic Transfer Switch

- Furnish and install automatic transfer switches system(s) with ___ Pole [T], ___ Amps, ___ Volt-60Hz [C]. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

Codes and Standards - The automatic transfer switches and controls shall conform to the requirements of:

- UL 1008 - Standard for Transfer Switch Equipment
- IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
- NFPA 70 - National Electrical Code
- NFPA 99 - Essential Electrical Systems for Health Care Facilities
- NFPA 110 - Emergency and Standby Power Systems
- IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
- UL 508 Industrial Control Equipment
- CSA C22.2 No. 178 certification

Acceptable Manufacturers

- Automatic transfer switches shall be Kohler Specific Breaker Rated - Standard Transition (KSS)/KSSDCTA0 ___ S or an approved equal. Any alternate shall be submitted for approval to the consulting engineer and Local Authority Having Jurisdiction at least 10 days prior to bid date. Alternate bids shall include a line-by-line

clarification of the specification marked with "D" for deviation; "E" for exception, and "C" for comply.

Mechanically Held Transfer Switch

- The transfer switch shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism. Main operators shall include over current disconnect devices; linear motors or gears shall not be acceptable.
- All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
- The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
- All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
- Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
- Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources, are not acceptable.
- Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

Enclosure

- The ATS shall be furnished in a NEMA __ (A) enclosure.
- All standard door mounted switches and long life super bright type indicating LEDs described in section 3 shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The panel shall be capable of having manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be

mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.

Controller Display and Keypad

- A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the communications interface port. The following parameters shall only be adjustable via a password protected programming on the controller (dip switches shall not be acceptable):
 - Nominal line voltage and frequency
 - Single or three phase sensing
 - Operating parameter protection
 - Transfer operating mode configuration (Open transition, Closed transition, or Delayed transition)
- All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

Voltage, Frequency and Phase Rotation Sensing

- Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Dropout/Trip	Pickup/Reset
Under voltage	75 to 98%	85 to 100%
Over voltage	105 to 135%	95 to 100% of trip
Under frequency	85 to 99%	95 to 99%
Over frequency	105 to 120%	101 to 105%
Voltage unbalance	5 to 20%	3% to 18%

- Repetitive accuracy of all settings shall be within $\pm 0.5\%$ over an operating temperature range of -20°C to 70°C .
- An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.
- Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via the communications interface port.
- The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being defeated, if required.
- The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition shall be considered a failed source.
- Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

Time Delays

- An adjustable time delay of 0 to 10 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.
- A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
- A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
- A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
- A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up

to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal.

- The controller shall also include the following built-in time delays for the following operations:
 1. 0 to 60 minute time delay on failure to acquire the acceptable electrical parameters from the emergency source
 2. 0 to 60 minute time delay for a failure to synchronize on an in-phase operation.
 3. 60 minute time delay for the load disconnect position for delayed transition operation.
- All time delays shall be adjustable in 1 second increments.
- All time delays shall be adjustable by using the display and keypad or with a remote device connected to the communications interface port through a security-password system.
- All time delays shall be adjustable by using the display and keypad or with a remote device connected to the communications interface port through a security-password system.
- Each time delay shall be identified and a dynamic countdown shall be shown on the display.

Additional Features

- The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.
- Membrane-type switches shall be provided for the test functions and be maintained until the end test function is activated. The test function shall be allowed through password security. It shall be possible to defeat the password requirement by way of a circuit board mounted dip switch setting. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.
- A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the

generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

- Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.
- LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source.
- A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.
- Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
- Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or the communications interface port. A “not-in-auto” LED shall indicate anytime the controller is inhibiting transfer from occurring.
- An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled for the user interface.
- *Engine Exerciser* - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on a calendar mode. For each routine, the user shall be able to:
 1. Enable or disable the routine.
 2. Enable or disable transfer of the load during routine.
 3. Set the start time,
 - time of day
 - day of week
 - week of month (1st, 2nd, 3rd, 4th, alternate or every)
 4. Set the duration of the run.

5. At the end of the specified loaded exercise duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be display when the exercise is active. It shall be possible of ending the exercise event with a single button push.
- *Date and time* - The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.
 - *System Status* - The controller shall have a default display the following on:
 1. System status
 2. Date, time and type of the next exercise event
 3. Average voltage of the preferred and standby sources
 - Scrolling through the displays shall indicate the following:
 1. Line to line and line to neutral voltages for both sources
 2. Frequency of each source
 3. Load current for each phase
 4. Single or three phase operation
 5. Type of transition
 6. Preferred source
 7. Commit or no commit modes of operation
 8. Source/source mode (Utility/Gen; Gen/Gen; Utility/Utility)
 9. In phase monitor enable/disable
 10. Phase rotation
 11. Date and time
 - Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.
 - *Self Diagnostics* - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
 - *Communications Interface* - The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall

be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration), an Ethernet connectivity (over standard 10baseT Ethernet networks utilizing a RJ-45 port or remotely utilizing a dial-up modem). This module shall allow for seamless integration of existing or new communication transfer devices and generators. Monitoring software shall allow for the viewing, control and setup of parameters of the genset and transfer switch network through a standard personal computer utilizing current Microsoft operating systems. Separate and specific transfer switch software interfaces shall not be acceptable.

- The transfer switch shall also be able to interface to 3rd party applications using Modbus RTU and Modbus TCP/IP open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.
- The controller shall contain a USB port for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The file designator shall be the unique serial number of the transfer switch.
- *Data Logging* - The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be downloadable to be displayed on a computer.
 1. Event Logging
Data, date and time indication of any event.
 2. Statistical Data
Total number of transfers.*
Total number of fail to transfers.*
Total number of transfers due to preferred source failure.*
Total number of minutes of operation.*
Total number of minutes in the standby source.*
Total number of minutes not in the preferred source*
Normal to emergency transfer time
Emergency to normal transfer time
System start date
Last maintenance date
 - * The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.
- *External DC Power Supply* - An optional provision shall be available to connect up to two external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection.

Tests and Certification

- Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

Service Representation

- The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

Automatic transfer switches shall be in accordance with Section 16410 AUTOMATIC TRANSFER.

2.20.2 Monitoring and Transfer

Devices shall be provided to monitor voltage and frequency for the normal power source and each engine generator set, and control transfer from the normal source and retransfer upon restoration of the normal source. Functions, actuation, and time delays shall be as described in Section 16410 AUTOMATIC TRANSFER.

2.21 MANUAL ENGINE-GENERATOR SET SYSTEM OPERATION

Complete facilities shall be provided for manual starting and testing of each set without load, loading and unloading of each set.

2.22 BASE

The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of all rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment will be maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall be provided with suitable holes for foundation bolts. The base shall also withstand and mitigate the effects of synchronous vibration of the engine and generator, and shall be provided with suitable holes for anchor bolts and jacking screws for leveling. The base shall be mounted on spring isolators rated for Fort Campbell seismic conditions.

2.23 THERMAL INSULATION

Thermal insulation shall be as specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.24 PAINTING AND FINISHING

The engine-generator set shall be cleaned, primed and painted in accordance with the manufacturer's standard color and practice.

2.25 FACTORY INSPECTION AND TESTS

Factory inspection and tests shall be performed on each engine-generator set proposed to meet this specification section. Inspections shall be completed and necessary repairs made prior to testing. Inspectors shall look for leaks, looseness, defects in components, and proper assembly. Factory tests shall be NEMA MG 1 routine tests and the manufacturer's routine tests.

PART 3 EXECUTION 3.1 GENERAL INSTALLATION

Installation shall provide clear space for operation and maintenance in accordance with NFPA 70 and IEEE C2. Installation of pipe, duct, conduit, and ancillary equipment shall be configured to facilitate easy removal and replacement of major components and parts of the engine-generator set.

3.2 PIPING INSTALLATION

3.2.1 General

Piping shall be non-welded (threaded). Connections at valves shall be threaded. Connections at equipment shall be threaded to the diesel engine may be threaded if the diesel-engine manufacturer's standard connection is threaded. Except as otherwise specified, threaded fittings shall be utilized to allow for complete dismantling and removal of each piping system from the facility without disconnecting or removing any portion of any other system's equipment or piping. Connections to all equipment shall be made with flexible connectors. Pipes extending through the roof shall be properly flashed. Piping shall be installed clear of windows, doors, and openings to permit thermal expansion and contraction without damage to joints or hangers, and with a 15 mm (1/2 inch) drain valve at each low point.

3.2.2 Supports

Hangers, inserts, and supports shall be of sufficient size to accommodate any insulation and shall conform to MSS SP-58 and MSS SP-69. Supports shall be spaced not more than 2.1 m (6 feet) on center for pipes 50 mm (2 inches) in diameter or less, not more than 3.6 m (12 feet) on center for pipes larger than 50 mm (2 inches) (2 inches) but no larger than 100 mm, (4 inches,) and not more than 5.2 m (17 feet) on center for pipes larger than 100 mm (4 inches) in diameter. Supports shall be provided at pipe bends or change of direction.

3.2.3 Deleted

3.2.4 Cleaning

After fabrication and before assembly, piping interiors sh

3.2.5 Pipe Sleeves

Pipes passing through construction such as ceilings, floors, or walls shall be fitted with sleeves. Each sleeve shall extend through and be securely fastened in its respective structure and shall be cut flush with each surface. The structure shall be built tightly to the sleeve. The inside diameter of each sleeve shall be 15 mm, (1/2 inch,) and where pipes pass through combustible materials, 25 mm (1 inch) larger than the outside diameter of the passing pipe or pipe covering.

3.3 ELECTRICAL INSTALLATION

Electrical installation shall comply with NFPA 70, IEEE C2, and Section 16415 ELECTRICAL WORK, INTERIOR.

3.3.1 Vibration Isolation

Flexible fittings shall be provided for all conduit, cable trays, and raceways attached to engine-generator sets. Metallic conductor cables installed on the engine generator set and from the engine generator set to equipment not mounted on the engine generator set shall be flexible stranded conductor. Terminations of conductors on the engine generator set shall be crimp-type terminals or lugs.

3.4 FIELD PAINTING

Field painting shall be as specified in Section 09900 PAINTING, GENERAL.

ONSITE INSPECTION AND TESTS

NOTE: ALL ONSITE TESTING WILL BE AT NAME PLATE RATING OF THE GENERATOR SET

- Site Tests. The manufacturer's distribution representative shall perform an installation check, startup, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
- Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
- Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.
- Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
- Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer

switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

3.5.1 Test Conditions

3.5.1.1 Data

Measurements shall be made and recorded of parameters necessary to verify that each set meets specified parameters. If the results of any test step are not satisfactory, adjustments or replacements shall be made and the step repeated until satisfactory results are obtained. Unless otherwise indicated, data shall be taken during engine-generator set operation and recorded in 15 minute intervals and shall include: readings of engine-generator set meters and gauges for electrical and power parameters; oil pressure; ambient temperature; and engine temperatures available from meters and gauges supplied as permanent equipment on the engine-generator set. In the following tests where measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.), stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Electrical measurements shall be performed in accordance with IEEE Std 120. Definitions and terms are in accordance with IEEE Std 100. Temperature limits in the rating of electrical equipment and for the evaluation of electrical insulation shall be in accordance with IEEE Std 1.

3.5.1.2 Power Factor

Engine-generator set operating tests shall be made utilizing a load with 0.8-power factor for all 3-phase installations; a unity of 1.0 power factor shall be used on all single-phase installations.

3.5.1.3 Contractor Supplied Items

The Contractor shall provide all equipment and supplies required for inspections and tests including fuel, test instruments, cables, test leads, and load banks at the specified power factors.

3.5.1.4 Instruments

Readings of panel gauges, meters, displays, and instruments, provided under this specification shall be verified during test runs by test instruments of precision and accuracy greater than the tested items. Test instrument accuracy shall be at least as follows: current, 1.5%; voltage, 1.5%; real power, 1.5%; reactive power, 1.5%; power factor, 3%; frequency, 0.5%. Test instruments shall be calibrated by a recognized standards laboratory within 30 days prior to testing.

3.5.1.5 Sequence

The sequence of testing shall be as specified in the approved testing plan unless variance in authorized by the Contracting Officer and Local Authority Having Jurisdiction. Field-testing shall be performed in the presence of the Contracting Officer and Local Authority Having Jurisdiction. Tests may be scheduled and sequenced in order to optimize run-time periods; however the following general order of testing shall be followed: Construction Tests; Inspections; Safety run Tests; and Performance Tests and Final Inspection.

3.5.2 Construction Tests

Individual component and equipment functional tests for fuel piping, coolant piping, and lubricating-oil piping, electrical circuit continuity, insulation resistance, circuit protective devices, and equipment not provided by the engine-generator set manufacturer shall be performed prior to connection to the engine-generator set.

3.5.2.1 Piping Test

- a. Lube-oil and fuel-oil piping shall be flushed with the same type of fluid intended to flow through the piping, until the out flowing fluid has no obvious sediment or emulsion.
- b. Fuel piping which is external to the engine-generator set shall be tested in accordance with NFPA 30. All remaining piping, which is external to the engine generator set shall be pressure tested with air pressure at 150% of the maximum anticipated working pressure, but in no case less than 1 MPa, (150 psig,) for a period of 2 hours to prove the piping has no leaks. If piping is to be insulated, the test shall be performed before the insulation is applied.

3.5.2.2 Electrical Equipment Tests

- a. Low-voltage cable insulation integrity tests shall be performed for cables connecting the generator breaker to the [automatic transfer switch] [panel-board] [main disconnect switch] [distribution bus] [_____]. Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energizing. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

R in megohms = (rated voltage in kV + 1) x 304,800/(length of cable in meters). (R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

- a. Medium-voltage cable insulation integrity tests shall be performed for cables connecting the generator breaker to the [generator switchgear] [main disconnect switch] [distribution bus]. After insulation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shielding or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment.

- b. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or

because of improper installation of cable, cable joints, terminations, or other connections, the contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

c. Ground-Resistance Tests. The resistance of [each grounding electrode] [each grounding electrode system] [the ground mat] [the ground ring] shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- 1) Single rod electrode - [25] [_____] ohms.
- 2) Multiple rod electrodes - [_____] ohms.
- 3) Ground mat - [_____] ohms.

d. Circuit breakers and switchgear shall be examined and tested in accordance with manufacturer's published instructions for functional testing.

3.5.3 Inspections

The following inspections shall be performed jointly by the Contracting Officer the Contractor and Local Authority Having Jurisdiction, after complete installation of each engine-generator set and its associated equipment, and prior to startup of the engine-generator set. Checks applicable to the installation shall be performed. The results of those which are physical inspections (I) shall be documented by the Contractor and submitted in accordance with paragraph SUBMITTALS. The Contractor shall present manufacturer's data for the inspections designated (D) at the time of inspection. Inspections shall verify that equipment type; features, accessibility, installation and condition are in accordance with the contract specification. Manufacturer's statements shall certify provision of features, which cannot be verified visually.

1. Drive belts. (I)
2. Governor type and features. (I)
3. Engine timing mark. (I)
4. Starting motor. (I)
5. Starting aids. (I)
6. Coolant type and concentration. (D)
7. Radiator drains. (I)

8. Block coolant drains. (I)
9. Coolant fill level. (I)
10. Coolant line connections. (I)
11. Coolant hoses. (I)
12. Combustion air filter. (I)
13. Intake air silencer. (I)
14. Lube oil type. (D)
15. Lube oil drain. (I)
16. Lube-oil filter. (I)
17. Lube-oil-fill level. (I)
18. Lube-oil line connections. (I)
19. Lube-oil lines. (I)
20. Fuel type. (D)
21. Fuel-level. (I)
22. Fuel-line connections. (I)
23. Fuel lines. (I)
24. Fuel filter. (I)
25. Access for maintenance. (I)
26. Voltage regulator. (I)
27. Battery-charger connections. (I)
28. Wiring & terminations. (I)
29. Instrumentation. (I)
30. Hazards to personnel. (I)

- 31. Base. (I)
- 32. Nameplates. (I)
- 33. Paint. (I)
- 34. Exhaust system. (I)
- 35. Access provided to controls. (I)
- 36. Enclosure. (I)
- 37. Engine & generator mounting bolts (proper

3.5.4 Safety Run Tests

- a. Perform and record engine manufacturer's recommended pre-starting checks and inspections.
- b. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- c. Activate the manual emergency stop switch and verify that the engine stops.
- d. Remove the high and pre-high lubricating oil temperature sensing elements from the engine and temporarily install temperature gauge in their normal locations on the engine (required for safety, not for recorded data). Where necessary, provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.
- e. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize. Monitor the temporarily installed temperature gauges. If temperature reading exceeds the value for an alarm condition, activate the manual emergency stop switch.
- f. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.
- g. Remove the high and pre-high coolant temperature sensing elements from the engine and temporarily seal their normal location on the engine and temporarily install temperature gauges in their normal locations on the engine (required for safety, not for recorded data). Where necessary provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.

- h. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set at no load until the output voltage and frequency stabilize.
- i. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down.
Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.
- j. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- k. Operate the engine generator-set for at least 30 minutes at 100 percent of service load.
- l. Verify proper operation of the governor and voltage regulator.
- m. Verify proper operation and set points of gauges and instruments.
- n. Verify proper operation of ancillary equipment. o. Manually adjust the governor to increase engine speed past the over-speed limit. Record the RPM at which the engine shuts down.
- p. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of rated load.
- q. Manually fill the day tank to a level above the overfill limit. Record the level at which the overfill alarm sounds. Verify shutdown of the fuel transfer pump. Drain the day tank down below the overfill limit.
- r. Shut down the engine. Remove the time-delay low lube oil pressure alarm bypass and try to start the engine. Record the results.
- s. Attach a manifold to the engine oil system (at the oil sensor pressure port) that contains a shutoff valve in series with a connection for the engine's oil pressure sensor followed by an oil pressure gauge ending with a bleed valve. The engine's oil pressure sensor shall be moved from the engine to the manifold and its normal location on the engine temporarily sealed. The manifold shutoff valve shall be open and bleed valve closed.
- t. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of service load.
- u. Close the manifold shutoff valve. Slowly allow the pressure in the manifold to bleed off through the bleed valve while watching the pressure gauge. Record the pressure at which the engine shuts down. Catch oil spillage from the bleed valve in a container. Add the oil from the

container back to the engine, remove the manifold, and reinstall the engine's oil pressure sensor on the engine.

v. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 100% of service load. Record the maximum sound level in each frequency band at a distance of 22.9 m ((75 feet)) from the end of the exhaust and air intake piping directly along the path of intake and discharge horizontal piping; or at a radius of [_____] [22.9 m][10.7 m] ([75][35] feet) from the engine at 45 degrees apart in all directions for vertical piping. The measurements should comply with the paragraph SOUND LIMITATIONS. [If a sound limiting enclosure is provided, the enclosure, the muffler, and intake silencer shall be modified or replaced as required to meet the sound requirements contained within this specification.] [If a sound limiting enclosure is not provided, the muffler and air intake silencer shall be modified or replaced as required to meet the sound limitations of this specification. If the sound limitations cannot be obtained by modifying or replacing the muffler and air intact silencer, the contractor shall notify the Contracting Officer and provide a recommendation for meeting the sound limitations.]

w. Manually drain off fuel slowly from the day tank to empty it to below the low fuel level limit and record the level at which the audible alarm sounds. Add fuel back to the day tank to fill it above low-level alarm limits.

3.5.5 Performance Tests

3.5.5.1 Continuous Engine Load Run Test

The engine-generator set and ancillary systems shall be tested at service load to: demonstrate durability; verify that heat of extended operation does not adversely affect or cause failure in any part of the system; and check all parts of the system. If the engine load run test is interrupted for any reason, the entire test shall be repeated. The engine load run test shall be accomplished principally during daylight hours, with an average ambient temperature of 35 degrees C, during the month of July. After each change in load in the following test, measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the allowable range. Measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Data taken at 15 minutes intervals shall include the following:

- a. Electrical: Output amperes, voltage, real and reactive power, power factor, frequency.
- b. Pressure: Lube-oil.
- c. Temperature: Coolant.

Lube-oil.

Ambient.

- (1) Perform and record engine manufacturer's recommended pre-starting checks and inspections. Include as a minimum checking of coolant fluid, fuel, and lube-oil levels.
- (2) Start the engine; make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- (3) Operate the engine generator-set for at least 2 hours at 75 percent of service load.
- (4) Increase load to 100% of service load and operate the engine generator-set for at least 2 hours.
- (5) Remove load from the engine-generator set.

3.5.5.2 Load Acceptance Test

Engine manufacturer's recommended pre-starting checks and inspections shall be performed and recorded. The engine shall be started, and engine manufacturer's after-starting checks and inspections made and recorded during a reasonable warm-up period. For the following steps, the output line-line and line-neutral voltages and frequency shall be recorded after performing each step instruction (after stabilization of voltage and frequency). Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings.

- a. Apply load in steps no larger than the Maximum Step Load Increase to load the engine-generator set to 100 of Service Load.
- b. Verify that the engine-generator set responds to the load
- c. Verify that the engine-generator set responds to the load addition and that the output voltage returns to and stabilizes within the rated bandwidths.

3.5.6 Automatic Operation Tests for Stand-Alone Operation

The automatic loading system shall be tested to demonstrate automatic starting, and loading and unloading of each engine-generator set. The loads for this test shall utilize the actual loads to be served, and the loading sequence shall be the indicated sequence. Perform this test for a minimum of two successive, successful tests. This test shall be for a period of 2 hours. Data taken shall include the following:

- a. Ambient temperature (at 15 minute intervals).
- b. Generator output current (before and after load changes).
- c. Generator output voltage (before and after load changes).

d. Generator output frequency (before and after load changes.)

1. Initiate loss of the primary power source and verify automatic sequence of operation.
2. Restore the primary power source and verify sequence of operation.
3. Verify resetting of controls to normal.

3.6 FINAL INSPECTION AND TESTING

During final inspection and testing procedures, Fort Campbell Directorate of Public Works , Authority Having Jurisdiction shall be scheduled and in attendance. Approval shall not occur without this observation and participation. Testing procedures shall include the following:

- a. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.
- b. Increase the load in steps no greater than the maximum step load increase to 100% of service load, and operate the engine-generator set for at least 30 minutes. Measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the same range as previous measurements and is within the required range.
- c. Remove load and shut down the engine-generator set after the recommended cool down period. Perform the pre-test inspections and take necessary corrective actions.
- d. Remove the lube oil filter and have the oil and filter examined by the engine manufacturer for excessive metal, abrasive foreign particles, etc. Any corrective action shall be verified for effectiveness by running the engine for 4 hours at service load, then re-examining the oil and filter.
- e. Remove the fuel filter and examine the filter for trash, abrasive foreign particles, etc.
- f. Visually inspect and check engine and generator mounting bolts for tightness and visible damage.
- g. Replace air, oil, and fuel filters with new filters.

3.7 MANUFACTURER'S FIELD SERVICE

3.7.1 Onsite Training

The Contractor shall conduct training course for Fort Campbell Authority Having Jurisdiction and operating staff as designated by the Contracting Officer. The training period shall consist of a total 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance. The course instructions shall cover pertinent points involved in operating, starting, stopping, programming of all components, servicing the equipment, as well as all major elements of the operation and maintenance manuals.

Additionally, the course instructions shall demonstrate all routine maintenance operations such as oil change, oil filter change, and air filter change.

3.7.2 Manufacturer's Representative

The engine generator-set manufacturer shall furnish a factory certified, qualified representative to supervise the installation of the engine generator-set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment.

Warranty and Maintenance

- The generator set shall include a standard one year warranty to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of startup. Optional warranties shall be available upon request.
- The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and functional tests performed on all systems.

3.8 INSTRUCTIONS

Two sets of instructions shall be typed and framed under weatherproof laminated plastic, and posted side-by-side where directed before acceptance. First set of instructions shall include a one-line diagram, wiring and control diagrams and a complete layout of the system. Second set of instructions shall include the condensed operating instructions describing manufacturer's pre-start checklist and precautions; start procedures for test-mode, manual-start mode, and automatic-start mode (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Instructions shall include procedures for interrelated equipment and automatic transfer switches

3.9 ACCEPTANCE

Final acceptance of the engine-generator set will not be given until the Contractor has successfully completed all tests and after all defects in installation material or operation have been corrected.

----- END OF SECTION -----

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UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM ABOVE 15 KVA CAPACITY

Ft. Campbell Requirements:

4.60. UPS GENERAL REQUIREMENTS

- These requirements are for UPS which are part of the building infrastructure, not unit equipment and are hard-wired into the building electrical system (not plug-in).
- Other than those installed in Information Technology (IT) centers (i.e. server rooms), all UPS units shall be industrial (not commercial) grade, with a minimum life expectation of 15 years.
- All UPS units shall must be able to perform under both lagging and leading power factors without signification de-rating of the output.
- All UPS units shall be On-Line (Always On, Double-Conversion).

4.61. UPS RUNTIME REQUIREMENTS

- All UPS units running time shall be at least 10 minute running time.

4.62. UPS RUNTIME AIRFIELDS

- All UPS units running time shall be at least 25 (twenty-five) minute running time.

4.63. UPS COOLING REQUIREMENTS

- For proper HVAC sizing, manufacturer's shall provide the heat rejection specifications at 50% load.
- Designers must provide adequate cooling in UPS rooms based upon calculated normal load percentages and heat rejection specifications at that load.

----- END OF SECTION -----

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POWER FACTOR CORRECTION EQUIPMENT

Ft. Campbell Requirements:

4.64. BUILDING POWER FACTOR ANALYSIS AND CORRECTION

- Fort Campbell maintains a -.97 to .98 power factor across the installation.

- All building designs shall incorporate power factor correction at the building and/or equipment level to maintain a power factor not less than -.95.

4.65. BUILDING HARMONIC ANALYSIS AND CORRECTION

- All building designs shall include an analysis of the connected loads to ensure the Total Harmonic Distortion (THD) content being injected back onto the exterior distribution system is within specifications.
- **The DOR shall maintain overall building harmonics at such a level as they shall not be injected onto the distribution system.**
- All building designs shall incorporate active and/or passive devices to minimize Total Harmonic Distortion (THD) being injected back onto the exterior distribution system.

----- END OF SECTION -----

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Section 26 41 01.00 10 Lightning Protection System

Ft. Campbell Requirements:

4.66. FACILITIES REQUIRING LIGHTNING PROTECTION SYSTEMS

- Priority level 1. Must have lightning protection.
 - Any facility involved with children, example schools or child development structures
 - Communications facilities
 - Facilities which houses large amounts of computer processing equipment
 - Facilities which are in isolated areas away from other large structures or wooded areas.
- Priority level 2. These structures are to be evaluated on an as-needed basis with the recommendations from Ft. Campbell's fire marshal and DPW.
 - Barracks
 - Maintenance facilities
 - Family Housing
 - Administration buildings

4.67. LIGHTNING SYSTEM INSTALLATION METHODS

- Lightning protection equipment manufacturer's mechanical clamps/supports for air terminal base and roof conductor installation shall be the preferred method for all our projects.
- The use of adhesives in lieu of mechanical clamps/supports is an acceptable method for lightning protection equipment installation provided the following are met:
 - Roof design/construction does not allow or makes it physically impossible for the mechanical clamps to be utilized.
 - A variance from the original contract requirements is submitted by the Contractor indicating the type of adhesive and the reason for such variance. Corps must approve.
 - The proposed adhesive is listed as an approved compound by both the lightning system and roofing manufacturer.
 - All prep-work and application requirements are carefully followed in accordance with adhesive and roofing manufacturer instructions.

4.68. S-5 CLAMPS

- The use of the S-5 clamps (Cube) is an acceptable method for lightning protection equipment support provided the following are met:
 - A variance from the original contract requirements is submitted by the Contractor, with installation details, and the reason for such variance. Corps must approve.
 - The cube is used only as a means for support of the lightning protection equipment and does not compromise the "Lightning Protection System" requirements listed under NFPA 70, NFPA 780, UL 96, and UL 96A.
 - The cube does not void roofing manufacturer's warranty.

4.69. SNOW GUARDS

- Regardless of the manner or configuration of the mounting of a lightning protection system and equipment, the components are not intended to withstand the forces exerted by masses of ice and snow shifting on the roof.
- Snow guards or snow guard systems shall be installed in those instances where lightning protection systems will be exposed to such forces.

----- END OF SECTION -----

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Section 26 56 00 Exterior Lighting

Ft. Campbell Requirements:

4.70. DESIGN REQUIREMENTS

- Lighting system shall be established in accordance with NFPA 101, UFC 3-530-01, and the IES Handbook.

4.71. FULL CUTOFF

- All exterior light fixtures used must be full cutoff luminaries and meet LEED night sky initiatives.

4.72. EXTERIOR LIGHTING CATEGORIES

- lights including, but not limited to, those installed in or on:
 - street lights
 - parking lot
 - exterior of buildings, and shall include:
 - marques
 - lighted signs

4.73. ADAPTIVE LIGHTING

- Marques and lighted signs shall be designed to adjust to ambient light so as to dim to provide the appropriate amount of light for the time of day, time of year, and weather conditions.
- Designs should include both adaptive and Dark Sky considerations.

4.74. EXTERIOR LIGHTING PERMITTED LIGHT TYPES

- Exterior lighting shall be Light Emitting Diode (LED) when available. See EXTERIOR LIGHTING MASTER PLAN below.
- High-Pressure Sodium or mercury vapor lighting shall not be used.
- Use 1500-watt metal halide on athletic fields. Fixture is to be shielded to avoid glare and light pollution.

4.75. EXTERIOR LIGHTING ELECTRIC SOURCE

- Parking lot lighting shall be fed from the building it serves and from the service feeder to that structure.
- If the parking lights serve a complex of buildings they should be fed from the nearest building within the complex.
- Parking lot lights shall not be fed from the distribution system.

4.76. EXTERIOR LIGHTING MASTER PLAN

- Fort Campbell wants to save energy and present a visually consistent presentation across the installation.
- Fort Campbell has instituted an Oak Ridge National Laboratory Exterior Lighting Master Plan.
- Fort Campbell maintains a list of approved lights (listed lights) for most exterior uses.
- For listed lights with different lens selections, designers & contractors may choose the lens which fits the intended, installed application.

- Unless the specific, exterior application precludes the use of a light model found on the approved list (listed lights), designers & contractors shall confine themselves to the listed lights.
 - Any approved equal must meet both the form and function requirements given by the listed lights.
 - Any approved equal must maintain the same size, mounting, overall and specific dimensions, and internal replacement internal parts as the listed lights.

4.77. EXTERIOR LIGHTING LEVELS

- All exterior street, building and flood lights, shall meet the requirements of UFC 3-530-01, Chapter 8 to avoid conflict with night vision goggle use (Dark Sky).
- The intent is to minimize light pollution in the area and to minimize the chances of pilots looking directly into the beams of nearby lights.

4.78. EXTERIOR LIGHTING INSTALLATION AND SAFETY

- Lighting choice and installation should address maintenance personnel safety, especially when working on lights in inclement weather.

4.79. EXTERIOR LIGHTING VOLTAGE LEVELS

- All exterior lighting shall be either 120, 208, 277 or multi-volt units.
- The use of 480-volt lighting is not permitted.

4.80. EXTERIOR LIGHTING UNDERGROUND CONDUCTOR PLACEMENT

- Underground street light circuits should be installed in conduit and is the preferred method.
- Direct burial may be used when approved by DPW.

4.81. LIGHTING CONTROL - TIMERS

- Timers shall not be used for lighting control.

4.82. LIGHTING CONTROLS - MAINTENANCE OVERRIDE SWITCH

- All buildings using computer/PLC based controllers for exterior lighting, shall include at least one Maintenance Override Switch which will allow full control of all exterior lighting by maintenance personnel.

4.83. LIGHTING CONTROL - PHOTOCELLS

- Photocells shall be used for parking lot lighting control.
- Photocells shall be installed one photocell per fixture or one photocell per pole.
- One photocell per pole is acceptable (all lights are out if photocell fails) except for sensitive areas like hospitals, PX, and schools.
- For sensitive areas like hospitals, PX, and schools, provide one photocell per fixture.

4.84. LIGHTING POLE REQUIREMENTS

- Federal Highway Administration (FHWA) regulations apply for all poles that support luminaries along streets and roads.
- Federal Highway Administration (FHWA) adopted the American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide (Green Book) (4th Edition 2011) for clear zones.
- Lighting poles must be located outside the clear zone or be breakaway compliant.

4.85. PARKING LOT LIGHTS

- Parking lot and security lighting shall be LED type and provided at an average level of 0.5 to 1.0 foot-candles.
- Parking lot lighting shall be by pole mounted light fixtures.
- All exterior light fixtures used must cast 100% of the light downward and meet LEED night sky (Dark Sky) initiatives.
- Contractor shall submit photometric layout of exterior areas showing point-by-point light intensity levels for the designed lighting layout.
- Bi-level switching controls:
 - These controls are designed to be used with motion sensors for light reduction area when no one is present however, they are unnecessary when using LED fixtures and the dimming fixtures are a costly, man-power, maintenance item.
- Motion sensor controls:
 - These controls are designed for light reduction area when no one is present however, they are unnecessary when using LED fixtures and the dimming fixtures are a costly, man-power, maintenance item.

4.86. EXTERIOR BUILDING LIGHTING

- Provide a light fixture mounted at the exterior of all paths of emergency egress.
 - This fixture shall be on an emergency battery backup.
 - Provide exterior wall-packs around perimeter of each building for additional security.
- Surface mounted fixtures shall be provided on the ceiling of the covered hardstand.
- Fixtures shall be heavy duty, vandal resistant type.

- Provide lighting contactors with a single photocell for control of building mounted light fixtures.

4.87. FLOOD LIGHTS

- Flood lights shall be provided at the corners of each building to illuminate training area inside the fence.
- Flood lights should be a minimum of 250 watt no more than 400 watt.

4.88. CCTV (EXTERIOR) COVERAGE AREA LIGHTING

- Contractor shall submit photometric layout of exterior areas showing point-by-point light intensity levels for the designed lighting layout.
- Contractor shall coordinate lighting requirements with CCTV provider to insure lighting levels and quality meet the requirements of the CCTV system to be installed.

----- END OF SECTION -----

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Section 26 60 13.00 40 LOW-VOLTAGE MOTORS

Ft. Campbell Requirements:

4.89. VOLTAGE DIP

- Provide reduced voltage starting where motor starting kVA will result in more than a 30% transient voltage dip per DA technical guidance (Technical Manual 5-811-2).

4.90. SINGLE PHASE vs. THREE PHASE MOTORS

- Provide single-phase protection on all 3-phase motors.
- Generally, motors less than 1 HP are single phase. But single phase motors that start/stop frequently tend to wear out faster
- Use 3 phase motors to the maximum extent possible especially for integral (1/2, 3/4 HP) motors that start and stop frequently (i.e. pumps and air compressors).

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 27
Communications

Section 27 10 00
Building Telecommunications Cabling System

Ft. Campbell Requirements:

General:

The Director of the Network Enterprise Center, Fort Campbell (NEC) will enforce the following standards for the Fort Campbell *Information Technology (IT) Technical Design Guide*:

- N.E.C. will review and approve all proposed voice-data communications requirements for fiber, copper, and all requirements for connectivity into Fort Campbell's telecommunications infrastructure.
- N.E.C. requires all contracts performing telecommunications construction or deconstruction by a civilian contractor utilize the [Installation Information Infrastructure Architecture \(I3A\) Technical Criteria dated February 2010](#) standard requirements. Any and all requirements in these standards apply equally to on-site employees and to US Government contractors.
- N.E.C. requires designers to coordinate with tenant organizations and ensure that all communications requirements are being met in accordance with this standard.

Contractor Requirements:

- The Contractor is required to contact the N.E.C. as required in the I3A prior to connecting any facility on Fort Campbell to the telecommunications infrastructure.
- Plans and specification shall require Contractors to notify the Fort Campbell IT Technical Design Guide prior N.E.C. when renovating, modifying, or deconstructing communications materials in any existing structures on Fort Campbell, KY. This also applies to new facilities or any Military Construction Army (MCA) projects at Fort Campbell, KY.
- Secret Internet Protocol Router Network (SIPRNET) Technical Implementation Criteria, dated October 2010.
- Per DAIM-FD Memorandum dated 3 November 2000, Army-wide policy applies to individual subscriber communications (barracks Soldier rooms) infrastructure that supports MILCON barracks construction. Project funds are allowable to install the cabling from the individual Soldier room to a central telephone closet. Beyond that point, AAFES through their commercial phone service provider will make connection.

- All exterior communications infrastructure to the designated central closet is the responsibility of AAFES through their designated service provider. This includes all outside cable plant (cable, duct and manholes), equipment shelters, and switches.

Instructions to Designers:

Design Requirements:

1. All detailed requirements contained in the **Fort Campbell Information Technology (IT) Technical Design Guide (Appendix H)** document shall be incorporated into all design and construction documents. Any additional requirements not addressed in the document standards will conform to the ANSI/TIA/EIA Standard.
2. All Designs shall be coordinated with N.E.C. and submitted to N.E.C. for review and approval prior to start of construction to ensure that the requested or designed wiring is available in the existing system infrastructure.
3. All new data and voice communications lines shall be installed underground. If and when overhead service has been approved by the NEC Infrastructure Manager, use pinless construction. Should a need for cross arms arise, use fiberglass. Wooden poles with wooden cross arms are NOT to be utilized.
4. Pull boxes shall be used in accordance with TIA 569-B para 8.8.2.5.1 and 8.8.2.5.2
5. Pull boxes used in protective distribution system installation shall not have any punch-outs and the hinge must be on the inside of the pull box.
6. Pull box sizing shall be TIA-569-B, para 8.8.2.5, table 12 for conduit trade sizes 35 (1.24 in) and above. For trade size 27 (1 in) pull box shall be 4 and 11/16th in wide X 16 in long X 3 in deep. An outlet box of size 4 and 11/16 inches square and 2 and ¼ inches deep may be substituted if the EMT size installed is less than trade size 35 (1 and ¼ in).
7. Electric Metallic Tubing (EMT) installations shall be only constructed of ferrous metal material with the same material throughout.
8. Holocom secure raceway Protected Distribution System (PDS) that shall be installed by a Holocom certified installer, who has provided their Holocom certification number to the COR for verification
9. Building ground conductors shall not be installed in any manner whereas to coexist with signal (communication) lines inside any raceway, cable tray, cable ladder, EMT, or conduit.

Bonding of adjacent metallic components of raceway, cable tray, cable ladder, EMT or conduit will be IAW TIA/EIA-569-B and NECA/BICSI 568.

10. A minimum of 2 walls of the Telecommunication Rooms (TRs) will be covered with fire retardant certified, void-free plywood. The plywood will extend from 18 inches above finished floor to 114 inches above finished floor .

11. Telecommunication Room door frames shall have a minimum opening on 36 inches to accommodate installation of information processing system secure devices (safes). Channel bank (loop back carriers) shall be installed on the voice equipment rack and a quad power outlet shall be installed on the voice equipment rack to be used by the channel banks

12. Install card swipe readers on all telecommunication room doors for new construction and MCA projects. These card readers will be programmed by designated NEC personnel. The access cards will be controlled and assigned based on duties and responsibilities by written request to the NEC Security manager. Swipe locks and cards will meet existing NEC standards or will be specified by the Post locksmith and NEC Infrastructure Manager.

13. Newly installed Category 6 patch panel will be managed patch panels.

- a. Managed category 6 patch panels shall be [1U or 2U] high and provide [24 or 48] modular jack ports wired to [T568A or T568B]. Patch panels shall be configured with individually replaceable jacks.
- b. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination.
- c. The modular jacks may be contained separately from the patch panel in a ship along tray.
- d. Patch panels shall terminate the building cabling on 110-style insulation displacement connectors. Patch panels shall meet or exceed all ANSI/TIA-568-C.2 and ISO category 6/class E requirements.
- e. Each patch panel shall have an additional, separate network management connection used to communicate with a software suite used to correlate information about the panel and any cables connected to the panel.
- f. Each management connection will be contained in a separate plug-in management module.
- g. Each port on the panel shall have an LED that supports 7 states. The LED shall be controlled by software.

- h. Each panel shall be powered by either/or Power of Ethernet, PoE (IEEE 802.3af) or by an Auxiliary power input.
- i. Presence of power shall not affect data integrity through the panel.
- j. Each port of the panel shall be able to read details directly from cables inserted into the panel using a non-radiating method.
- k. Each port of the panel shall store and update the number of insertions on each port.
- l. Each port of the panel shall store and update the number of insertions a cable reports upon insertion.
- m. Each panel shall use out-of-band information from the cables inserted into the panel in order to perform the following with software (but not limited to):
 - 1) Circuit traces
 - 2) Polarity verification
 - 3) Service level verification
 - 4) Rating verification
 - 5) Color verification
 - 6) Media type
 - 7) Jacket type
 - 8) Length
 - 9) Date of manufacture
 - 10) Country of origin
- n. Each panel shall store name and location information internally and report that information to software via management network communication.
- o. Each panel shall be network addressable.
- p. Patch panels shall be TE Connectivity product part number(s) as listed below or equivalent as approved by NEC Plans Infrastructure Manager or NEC MCA Planner.

Description	Port Count	Rack Mount Units		Part Numbers
24 Port Network Panel WITH jacks, Category 6, UTP	24	1U	Loaded	QCPP-24MC6U
48 Port Network Panel WITH jacks, Category 6, UTP	48	2U	Loaded	QCPP-48MC6U

24-Port Network Panel without Jacks, Category 6, UTP	24	1U	N/A	QCPP-24NC6U
48-Port Network Panel without Jacks, Category 6, UTP	48	2U	N/A	QCPP-48NC6U
Panel Controller for Q2000 Network Panels	1	N/A	N/A	QCPU-MPPM

14. Fiber terminations shall be LC type. LC Fiber Connectors shall be TE Connectivity product part number(s) as listed below or equivalent as approved by NEC Plans Infrastructure Manager or NEC MCA Planner

- a. Backbone fiber optic cables shall be terminated with LC connectors in each Telecommunications Room (TR). Terminations shall be housed in rack-mount chassis providing protection for the terminated fibers. LC connector shall accept 900µm buffered [OM3 50um, OM4 50um, or single-mode] fiber.
- b. Simplex [OM3/OM4 50um or single-mode] LC connectors shall be no-epoxy/no-polish and terminate with 900um tight-buffered fiber. LC connectors shall meet the performance requirements of ANSI/TIA-568-C.3 standard.
- c. No-epoxy/no-polish LC connectors shall be compatible with TE Connectivity Termination Tool Kit part numbers [1278118-4, or 1754845-1].
- d. LC connectors in the TR shall be TE Connectivity product part number as listed below

LC Connector	No-Epoxy/No-Polish
Simplex, OM3/OM4 50/125um	6754483-4
Simplex, Single-mode	6754482-1

15. Install standard NEC approved locking manhole covers on new outside plant construction installations.

- a. The locking system shall be non-corrosive.
- b. The locking system shall be capable of accepting a General Field Service Padlock (GFSP). The contractor shall furnish and install the padlocks. The padlock is made by Abloy.
- c. The locking system shall be designed to be below ground level to avoid damage from vehicles, lawn care equipment, and other heavy machinery.

d. The locking system shall be consistent with existing communications manhole locking devices existing at Ft. Campbell, the Lockdown security system.

16. Install locking manhole devices on all “in place” manholes that have additional ducts, communication, copper, or FOC materiel installed.

17. Install standard NEC approved locking devices on/over patch panels and over telecom equipment faces in telecommunication rooms and equipment rooms that do not have swipe card locks and in rooms that have the potential for access by personnel other than NEC. These areas include current facilities with rooms where network equipment, facility electrical distribution equipment and/or HVAC equipment co-exist. This requirement is not intended to supersede any require specifying smart patch panels or smart cables.

18. Equipment racks that NEC must share with tenant users in shall include standard NEC approved equipment locking devices, sized for the planned equipment; typically 1 Rack Unit (RU) per data switch and a NEC approved locking device sized for the installed patch panel (1 RU or 4 RU).

19. Floor-mounted power and/or communication receptacles should be avoided whenever possible. The design/usage of floor-mounted (recessed or above-floor) receptacles must be reviewed and approved by NEC Plans Project Manager, Infrastructure Manager or Branch Chief.

20. Data outlets shall have unique identifying, machine generated labels IAW EIA/TIA 606-A. The labels for room/area outlets shall follow the following format:

- a. The room number will appear first in the format sequence. The Outlet-type ~~alpha~~ character will appear second. The Outlet-type ~~alpha~~ character will be ‘D’ for data, ‘V’ for Voice, ‘S’ for SIPR data, and ‘SV’ for SIPR Voice. The room port number will follow. The room port number will be sequenced, starting with ‘1’ and incremented clock-wise around the room, starting at the entry to the room.
- b. Room 118, Port-type, and outlet number. Ex: 118 D1, 118 D2, 118 D3.
- c. Each outlet will be labeled uniquely. In regards to rooms such as 118 and 118A, the full room designation for will be used.
Ex. 118 D1 and 118A D1.

21. All patch panel ports shall have a unique machine-generated label IAW EIA/TIA 606-A. The port number will have an identical label to the outlet it is servicing.

19. The use of hard inner duct is prohibited. Only fiber cell mesh shall be installed.

22. All Fiber cell mesh installed shall include and incorporated tracing wire. Or a separate tracer wire within the same duct as the fiber cell mesh

23. All newly installed communications duct shall include a centrally located tracer wire

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**TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 28
Electronic Safety and Security**

**Section 28 16 01.00 10
Small Intrusion Intrusion Detection System**

Ft. Campbell Requirements:

No electric equipment shall be installed within or on any Fort Campbell building, structure, or premises, nor shall any alteration or addition be made in any such existing equipment without first securing an Electrical Permit (FC Form 4183) from the Fort Campbell Electrical Inspector in accordance with [CAM Reg 420-4](#).

In addition to a phone jack inside the arms vault, place an additional phone jack outside the arms vault. The phone line in the arms vault shall be a single line only (no multiple lines on the same phone).

Instructions to Designers:

1. Installation of ICIDS Equipment in Arms Rooms and COMSEC vaults shall be in accordance with instructions found in [Appendix J](#).

----- END OF SECTION -----

**Section 28 31 76
Interior Fire Alarm System and Mass Notification System**

Ft. Campbell Requirements:

1. Vehicular Circulation
 - 1-1. Emergency Vehicle Access

a. Provide emergency access lanes with all-weather accessibility to accommodate the Fort Campbell Fire Trucks and Emergency Vehicles in accordance with NFPA, UFC, and AT/FP requirements.

b. Provide fire vehicle access as a minimum to two sides of each facility

1-2. Aerial Access

Provide aerial vehicle access as a minimum to two sides of each facility and a minimum of three sides of all sleeping quarters.

1-3. Apparatus Dimensions

Vehicle ID	GVW	Height	Length	Width	Turning Radius
ENGINE 1	40,000 lbs.	10'	31'3"	8'6"	
ENGINE 2	40,450 lbs	10'	29'9"	9'9"	
ENGINE 3	39,800 lbs	8'4"	32'5"	9'6"	
ENGINE 4	43,540 lbs	9'8"	30'6"	9'4"	
ENGINE 5	39,800 lbs	9'	30'9"	9'	
LADDER 1*	66,000 lbs	11'4"	42'	10'5"	39.2'
LADDER 5*	54,920 lbs	11'4"	40'2"	9'2"	39.2'
RESCUE 1	39,800 lbs	11'5"	38'8"	8'3"	
CRASH 2**	32,100 lbs	10'8"	27'	8'	87'
CRASH 3**	82,500 lbs	11'9"	38'7"	9'11"	117'
CRASH 33**	47,000 lbs	12'8"	31'1"	9'6"	87'
CRASH 4**	69,000 lbs	12'11"	36'3"	9'2"	117'
CRASH 5	43,540 lbs	10'5"	29'7"	8'6"	75"
HAZMAT 1	35,000 lbs	10'2"	30'3"	7'11"	
TANKER 1	43,000 lbs	9'10"	25'6"	8'5"	

* 16-feet with out-riggers extended

**ONLY for airfield operations

1-4. Fire Lanes Dimensions

Fire Lanes shall be a minimum width of 20 feet measured edge of roadway to edge of roadway not including storm gutters and curbs.

1-5. Alternative Fire Lane Surfaces

a. Alternative fire lanes shall meet the NFPA 1 Fire Code Handbook, Section 18. If approved and utilized, the site plan must indicate the type of alternative all-weather surface being utilized; examples are Tufftrack, grass-crete, grass-pave, ritter-rings, invisible structures, etc.

b. Fire apparatus access roads shall be designed and maintained to support the imposed live loads of fire apparatus (75,000 pounds) with outrigger point loads, maximum tandem axle load of 46,000 pounds and shall be surfaced so as to provide all weather driving capabilities.

c. Documentation shall include, but not be limited to the Following:

- (1) Sub-grade soil compaction report
- (2) Base material quality, thickness and compaction
- (3) Product information to include but not limited to installations instructions

d. The base must meet the current construction standards for a fire lane. A detail of the alternative fire lane surface material must be included within the site plan and the utility sheet of the civil plans.

e. Concrete reinforced curbing shall be installed on both sides of the alternative fire lane surface material to enhance lateral stability.

f. Dirt and sod shall not be allowed to be placed over alternative fire lane surface.

g. The site plan must reflect signage at the entry point of the fire lane utilizing any alternative fire lane surface in order to make responding fire crews aware of the entry points of these types of surfaces.

h. Approved edge boundary identification is also required. The curb shall be painted red or red reflectors shall be installed to define the width of the alternative surface fire apparatus access roads. The reflectors shall be imbedded into bordering curbing at intervals not exceeding 15 feet. A detail of the fire lane sign must be provided within the site plan detail sheet.

- i. The drive-on tests are the true test of how the paver will perform under vehicle load.
- (1) Once the pavers are installed and turf is established, the aerial apparatus will be maneuvered on the installed pavers.
 - (2) The aerial apparatus will set-up with outrigger extended and aerial raised.
 - (3) The pavers must not show any signs of movement.
 - (4) The pavers must not raise or tilt up in any way, the driving surface must not interfere with the ability of the vehicle to maneuver anywhere on the grass paved area.
 - (5) The fire departments will saturate the area with water, which ensures a true test of how the pavers will perform in an actual emergency situation and all weather situations.

1-6. Fire Lanes Marking

Marking of fire lanes may be required, at any time, if a need is identified by the fire department in the following manner:

- a. 90 degree curbs shall be identified by a 6 inch red (traffic grade paint) stripe on the top and side.
- b. Rolled curbs shall be identified by a 6 inch red (traffic grade paint) stripe to the top.
- c. Roads with no curbs shall be identified by a 6 inch red stripe (traffic grade paint).
- d. The words "NO PARKING – FIRE LANE" shall be 18 inches high white stenciled lettering with 3 inch stroke and placed 8 inches as measured perpendicular to the traffic grade red paint

stripe. Stenciling must be provided within 3 feet of each end of curbed areas and spaced a minimum of 100 feet apart thereafter. Paint must be traffic grade.

e. Diagonal red striping across the width of the Fire Lane (8 feet) shall be used when required by the fire department. It shall be used in conjunction with a 6 inch red stripe above. The stripes shall run at a 30 to 60 degree angle and shall be parallel with each other. The stripe shall be a minimum 6 inches in width and a minimum of 24 inches apart. Paint must be traffic grade.

f. A "NO PARKING – FIRE LANE" sign shall be posted at the beginning and end of each fire lane. Signs are to face on-coming vehicular traffic.

1-7. No Parking Signs

- a. Signs may be used instead of marking of fire lanes.
- b. Signs must be maintained and replaced when damaged.
- c. Signs shall read "NO PARKING FIRE LANE" or "NO PARKING FROM THIS POINT TO CORNER" and shall be 12" wide and 18" high.
- d. Signs shall be white background with letters and borders in red, using not less than 2" lettering.
- e. Signs shall be permanently affixed to a stationary post and the bottom of the sign shall be six feet, six inches (6'6") above finished grade.
- f. Signs shall be spaced not more than one hundred feet (100') apart.
- g. Signs may be installed on permanent buildings or walls or as approved by the Fire Chief.

1-8. Sidewalks dimensions that support emergency vehicle traffic

Sidewalks designed to support emergency vehicle traffic shall be a minimum of 20' wide (16' paved with 2' structural turf both sides). Coordinate with Fire Chief for location requirements. Reference Apparatuses Dimensions for Emergency Vehicle design loads.

2. Water Distribution System

2-1. Fire service mains, hydrants, and appurtenances

a. Install, test, and document fire service mains and their appurtenances in accordance with Unified Facilities Criteria (UFC), Unified Facilities Guide Specification (UFGS), National Fire Protection Association (NFPA), and applicable codes

b. Private and public water supply systems shall be installed, tested, and maintained in accordance with NFPA 24 and NFPA 25.

- c. Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets
- d. Fire hydrants shall be located a minimum of 40-feet from facility.
- e. Hydrants shall be located not less than 40-feet from building being protected
- f. Hydrant spacing shall not exceed 450-feet around facilities
- g. Hydrant spacing shall not exceed 600-feet in open air parking areas
- h. Hydrant spacing shall not exceed 1000-feet along undeveloped roadways

2-2. Existing Fire Hydrant

Existing fire hydrants shall not be relocated. New fire hydrants shall be installed when existing fire hydrants are required to be relocated.

2-3. Fire hydrant protection

All fire hydrants located in areas where subject to vehicular damage shall be protected with barriers.

2-4. Water flow test

The contractor shall perform a water flow test in accordance with NFPA 291.

2-5. Working Plans

Working plans and final as-built drawings shall comply with NFPA 24 paragraphs 4.1.3 and 4.1.4.

3. Interior Building Signage Requirements

3-1. Signage Review

Coordinate review of signage with Fire Prevention Division at the 100 % design phase. Fire Prevention shall review the correct placement, quantity of signage and the proposed path of egress that will be graphically illustrated on the sign.

4. Fire Protection

4-1. Sprinkler System

a. Install sprinkler systems in accordance with UFC 3-600-01, NFPA 13, and International Building Code (IBC) except as modified herein.

- b. Provide separate fire sprinkler service connection for each facility.

- c. Install vane type waterflow alarm switch with adjustable retard monitored by building fire alarm system. Set main riser waterflow switch retard adjustment for a delay between 50 and 60 seconds. Main riser waterflow switch is required on all Standpipe suppression systems.
- d. Install floor control valve assembly as illustrated in UFC 3-600-01, figure 4-1 for each riser on each floor. Set water flow switch retard adjustment for a delay between 30 and 40 seconds.
- e. Main riser and floor control valve assembly vane type water flow alarm switch with a maximum delay of 90 seconds, to include a minimum 20 second delay difference between main riser and floor control.
- f. All tampers and water flow switches shall be monitored by fire alarm system via the Signal Line Circuit (SLC). Set waterflow switch retard adjustment for a delay between 30 and 40 seconds.
- g. Install floor control valve assembly for each space separated by floors, partitions, and barriers regardless of separation orientation (vertical or horizontal)
- h. Install a remote inspector test valve on the end of the most remote branch line on each floor or space with control valve assembly. Locate inspector test valve in an accessible location not over 7-feet off the floor that is not exposed to freezing. The test drain shall terminate outdoors with appropriate splash guard protection as required. Refer to NFPA 13 figure A.8.16.4.2 (a).
- i. Install backflow preventer devices on the inlet (suction) side of water protection systems.
- j. Test backflow preventer to verify check valves are fully functional and operate in accordance with manufacturer specifications. Certified technician shall perform and post test results alone with certification certificate in waterproof enclosure on the backflow preventer.
- k. The backflow preventer shall be tested for full forward and test documented before sprinkler system can be accepted.
- l. Backflow preventer test connection shall terminate to the exterior of the building in a similar manner as the Fire Department Connection (FDC) located not less than 5-feet away from the FDC. Provide signage using the words "TEST HEADER" in similar manner as for FDC. The test header should be located near the sprinkler backflow preventer.
- m. Electrically supervise all sprinkler system water control valves to include sectional control and isolation valves and floor control valves. Electrically supervise backflow preventer test connection water control valves in the closed position.
- n. Locate fire department connection (FDC) at readily accessible location from the street or fire lane. FDC must be mounted directly to the facility.

o. Install the “KNOX” company stainless steel 2.5-inch male NST locking FDC caps on each fire department connection. The contractor shall submit “KNOX” FDC locking caps keys to post fire department the day the FDC caps are installed.

p. Install a Post Indicator Valve (PIV) with a tamper switch monitored by fire alarm system in accordance with NFPA 24 and NFPA 72. PIV shall be manually secured with fire department lock.

q. The use and installation of plastic pipe is prohibited.

4-2. Standpipe System

a. Install standpipe system in accordance with UFC 3-600-01, NFPA 14, NFPA 101, and IBC

b. Install combination standpipe and sprinkler system in building with four or more stories

c. Install combination standpipe and sprinkler system in any building regardless of height when the length or width of the building is 200-feet or more

1. Install Class 1 standpipe riser in every stairwell with cabinets of adequate size to accommodate 100-feet of (2 ½ inch, NST) fire hose.

2. Install waterflow switch on main riser and adjust retard delay between 50 and 60 seconds.

3. Provide FDC in accordance with NFPA 14 requirements based on number of standpipe risers.

4. Installing contractor shall provide all necessary equipment to properly test standpipe system in accordance with NFPA 14.

4-3. Fire Pumps

a. Install fire pumps when required by hydrostatic calculations in accordance with NFPA 20, NFPA 13, and UFC 3-600-01, all applicable codes, except as modified herein.

b. Permanently install necessary equipment to adequately test fire pump in accordance with NFPA 20, NFPA 25, and UFC 3-600-02.

c. Install backflow preventer devices on the inlet (suction) side of fire pump.

4-4. Kitchen Suppression System

a. All kitchenette and commercial cooking hood and suppression systems shall be installed in accordance with all applicable codes and standards to include NFPA 96, NFPA 17A, UFC 3-600-01, Mechanical Code, manufacturer recommendations and modifications herein.

- b. Provide a complete pre-engineer "Wet Chemical" suppression system to protect all grease vapors producing equipment.
- c. Wet automatic spray nozzle type suppression system is prohibited.
- d. De-energize all electrical receptacles within three feet of the hood.
- e. Connect the suppression system to the building fire alarm system and generate a general evacuation signal upon suppression system activation.
- f. Provide two means of manual activation where there are two or more means of egress from the area for each system.
- g. Provide minimum two-liter wet chemical portable fire extinguishers mounted in recess or semi-recess cabinets in all commercial and kitchenette cooking areas.
- h. Provide minimum ten pound Class ABC portable fire extinguishers mounted in recess or semi-recess cabinets in commercial and kitchenette cooking areas for fires other than cooking fires.
- i. Exhaust fans shall be accessible for cleaning and maintenance.
- j. Complete drawings of the system installation, including the hood(s), exhaust duct(s), and appliances, along with the interface of the fire-extinguishing system detectors, piping, nozzles, fuel shutoff devices, agent storage container(s), and manual actuation device(s), shall be submitted to Fort Campbell Fire Department Inspection Section, the authority having jurisdiction. The responsibility for their preparation shall be entrusted only to trained persons
- k. Drawing and plans shall be drawn to an indicated scale and shall be reproducible.
 - (1) 1/8 inch = 1-foot is the smallest drawing scale accepted
 - (2) Illustrate all appliances on drawing
 - (3) Illustrate all nozzles and lines such as plenum, duct, and appliance nozzles including supply and branch lines with dimensions
 - (4) Illustrate all access panels
 - (5) Illustrate all heat links and manual pull stations
 - (6) Illustrate all fuel shut-off valves and or electrical circuit breakers
 - (7) Illustrate reset button and system cylinders
 - (8) All symbols shall be in accordance with NFPA 170

4-5. Fire Alarm Systems

- a. The Fire Alarm Control Panel shall be fully compatible with the existing King-Fisher Industrial Radio Alarm Control System (IRACS) presently in use at Fort Campbell.
- b. The fire alarm system and the Mass Notification system shall be in separate cabinets.
- c. The fire alarm panel/system shall provide at least one set of dry contacts for future use.

- d. The fire alarm system shall be separate from and separable from the Mass Notification System.
- e. The operation of the fire alarm system and the Mass Notification System shall be completely separate and not dependent upon the other for proper operation.
- f. Fire Alarm Panels: The fire alarm panel/system shall be an industry-standard open protocol and supporting architecture that will not result in the use of proprietary (Government sole source procurement) systems or components for the expansion of the fire alarm system in that it is designed and installed such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without further dependence on the original Contractor or system manufacturer. This includes, but is not limited to the following:
 - 1. Hardware shall be installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.
 - 2. Necessary documentation (including rights to documentation and data), configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the Government.
 - 3. Any cable, adaptor or interface device that may be used to connect a laptop computer (required or not) to the alarm panel for programming, download or upload of system information, expansion of system (addition of devices) etc shall be provided in triplicate.
 - 4. Any configuration information, configuration tools, programs, drivers, and other software that may be used to program or reprogram alarm panels shall be provided in triplicate.
 - 5. All software required to manipulate the system shall be provided without any licensing agreements, signed documents or any requirements upon the Government to rely on any contractor or manufacturer for maintenance or manipulation of the system.
 - 6. There shall be no requirement for software locks, special tools and any other proprietary equipment to maintain, add devices to or delete devices from the system, or test the Fire Alarm system. Fire detection and alarm systems shall be able to be programmed from the control panel and the Government's laptop.
- a. All building designs which have a fire alarm system shall have an exterior strobe light alarm device mounted on the street side of the building's exterior. The strobe is to act as a visual indicator to responding fire crew. Response time is decreased since the crew does not need to find the actual building number.
- b. Provide a fire alarm system with Kingfisher transmitter.

c. All programming codes, passwords, equipment, cables, and plugs required to access, update, modify, and maintain the fire alarm system shall be provided to Fort Campbell with training no later than the date of final system acceptance.

d. Design and install the fire system in accordance with NFPA 72, 70, 101, and UFC 3-600-01, and Unified Facilities Guide Specification (UFGS) 28-31-76, and UL 864, except as modified herein.

(1) The components of system includes addressable control panel (FACP), autonomous control unit (ACU), notification appliance network (strobes and speakers), water flow switches, valve tamper switches, supervisory devices, monitor and control modules, duct detectors, heat detectors, smoke detectors, combination heat and smoke detectors, Kingfisher transceiver, and other equipment as required by code or Fort Campbell.

(2) Provide a complete addressable microprocessor-based fire alarm system.

(3) Provide remote annunciation panel when fire alarm panel and or associated panels are installed in remote area or closet.

(4) Provide manual pull stations at all exterior entrances/exits to include such rooms as mechanical, electrical, and communication rooms. Provide notification appliances network in such like rooms.

(5) All panel boxes shall be "red" in color.

(6) Whenever possible, all associated panel boxes shall be keyed alike.

(7) Detection devices that operate independent from fire alarm system are prohibited.

(8) The Signal Line Circuit (SLC) shall be Class A, Style 6 and the performance capabilities under abnormal conditions in accordance with NFPA 72 Section 6.

(9) The Notification Appliance Circuit (NAC) shall be Class A, Style Z and the performance capabilities under abnormal conditions in accordance with NFPA 72 Section 6.

(10) The Speaker Circuit shall be Class A, Style Z and the performance capabilities under abnormal conditions in accordance with NFPA 72 Section 6.

(11) Audio each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual amplifier trouble indicator on the control panel.

(12) All administrative areas shall have both strobes and speakers with a minimum audio level of 70-dba or 15-dba above the normal ambient sound level or 5-dba above the peak

sound level; whichever is greater; with a CIS score of 0.80. All measurements are collected with all doors closed.

(13) All sleeping rooms shall have both strobes and speakers will provide a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having duration of at least 60 seconds or a sound level of at least 75 dB, whichever is greater, measured at the pillow level in the occupy-able area, using the A-weighted scale (DBA).

(14) All components of the fire alarm shall be located near the facility main entrance. When the fire alarm panel and or panels associated with fire alarm system are installed in a remote area such as an electrical room, the system is required to have remote fire panel annunciation panel located near the facility main entrance and other entrances as deemed necessary by Fort Campbell Fire Department.

(15) All fire conductors shall be housed in "red" conduit. Junction (pull) boxes and covers shall be "red" in color.

(16) Vertical and horizontal conduit and cables separation shall be in accordance with NFPA 72-2002, paragraph A.6.4.2.2.2

(17) Conductors shall go from device to device and appliance to appliance without splices.

(18) Use terminal boards when wire splices are unavoidable, electrical wire nuts are prohibited.

(19) Only solid copper conductors are authorized for installation. Stranded conductors may be installed between fire alarm panel and Kingfisher transmitter.

(20) All panels and associated equipment shall operate on the secondary power source for 72-hours in (supervisory) state and 15-minutes in alarm. It is the contractor responsibility to coordinate battery test with Fort Campbell Fire Department Fire Prevention Section.

(21) Smoke detectors shall be 24 Vdc photoelectric analog/addressable smoke detectors which means they shall get their power through the FACP

(22) Locate smoke detectors a minimum of five feet away from air intake, diffusers, ceiling fans, and vapor and steam producing rooms or areas, such as bathrooms and kitchens.

(23) Smoke detectors shall be connected to the building fire alarm panel via the SLC loop.

(24) Sleeping Rooms, Dwelling Units, and Suite Rooms Smoke Detectors

a. Provide smoke detectors with a sounder base that produces a minimum sound pressure of 75-dba measured at the pillow.

b. Provide signals for sleeping areas, they shall have a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds or a sound level of at least 75 dB, whichever is greater, measured at the pillow level in the occupy-able area, using the A-weighted scale (DBA).

c. If any barrier, such as a door, curtain, or retractable partition, is located between the notification appliance and the pillow, the sound pressure level shall be measured with the barrier placed between the appliance and the pillow.

d. The alarm shall sound only within an individual sleeping area and shall not actuate the building fire alarm system notification appliances.

e. Alarm activation shall annunciate at the fire alarm panel and transmitted to the fire department via the Kingfisher transmitter.

f. Smoke detectors shall be connected to the building fire alarm notification system.

g. Smoke alarms that receive their operating power from the building electrical system are prohibited.

(25) When emergency back-up generators are provided for the facility and the fire alarm system with all its peripherals are connected to the back-up generator, the battery secondary power source maybe reduced to 24-hours in (supervisory) state and 60-minutes in alarm. It is the contractor responsibility to coordinate battery test with Fort Campbell Fire Department Fire Prevention Section.

(26) Maintenance Facilities, where practical, ceiling mount all notification appliances giving consideration for vehicle type and height.

4-6. Mass Notification System (MNS)

a. Fire alarm and MNS will be two separate systems which is authorized by UFC 4-021-01.

b. The two systems will work independent of each other except to override the fire alarm audible signal in mass notification emergencies.

c. The MNS shall provide the capability (either internally as a design feature, or with an approved or listed external controller) to temporarily deactivate the facility's fire alarm system audible and visual notification appliances. This is intended to allow the MNS to provide intelligible voice commands inside an individual building during simultaneous fire and terrorist events.

d. Combination fire alarm and mass notification System NOT authorized for installation.

e. The Mass Notification system shall be pre-programmed MNS (male voice) audible announcement messages shall be as follows and include the NFPA72 (2010) par 24.4.2.17 “this is a test” requirement:

- Severe Weather Warning: Attention, Attention. A Severe Weather Warning Has Been Issued For This Area. A Severe Weather Warning Has Been Issued For This Area. Tune To Local Radio Or Television Stations For More Information.
- Tornado Warning: Attention, Attention. A Tornado Warning Has Been Issued For This Area. A Tornado Warning Has Been Issued For This Area. Take Shelter According To The Building Emergency Action Plan.
- Shelter In Place: Attention, Attention. A Shelter In Place Order Has Been Issued. Stay Inside Buildings And Close Windows And Doors Unless Advised By Authorities To Evacuate Area. Stay Inside Buildings And Close Windows And Doors Unless Advised By Authorities To Evacuate Area.
- All Clear: Attention, Attention. All Clear, The Potential Emergency Situation Is Over. All Clear, The Potential Emergency Situation Is Over. Resume Your Normal Duties.
- Evacuation Warning: Attention, Attention. This Is An Emergency Evacuation Order. Remain Calm And Follow The Instructions Of The Emergency Officials. This Is An Emergency Evacuation Order. Remain Calm And Follow The Instructions Of The Emergency Officials.
- Bomb Threat Warning: Attention, Attention. A Bomb Threat Alert Has Been Issued For This Building. All Personnel Are To Evacuate Immediately Using The Nearest Exit. Further Instructions Will Be Issued Outside The Building By Emergency Officials.
- Lock Down: Attention, Attention. A Lock Down Order Has Been Issued For This Building. Follow Your Building Emergency Action Plan.
- Active Shooter Warning: Attention, Attention. An Active Shooter Threat Alert Has Been Issued For This Building. All Personnel Are To Take Appropriate Action.

4-7. Fire Alarm Transmitters

- e. Provide a fire alarm system with Kingfisher transmitter.
- f. The fire alarm AM transmitter shall be Government furnished, contractor installed and shall consist of the transmitter, antenna and batteries.

4-9. Installation Drawings of Record

As-built drawings, at a minimum shall include the following information

- a. Drawing shall be to an indicated scale 1:8 is the smallest acceptable scale
- b. All conduit runs
 - (1) All conduits shall be illustrated as installed overlaid on a floor plan to scale

(2) Identify all cable circuits within each conduit and direction of travel from “B” side (output) side of the circuit to “A” side (return) side of the circuit.

c. Device and Appliance Locations

- (1) Show all devices and detectors with addresses overlaid on a floor plan(s) to scale
- (2) Show all notification appliances (strobes and speakers) with addresses and labels overlaid on a floor plan(s) to scale
- (3) All floors plans shall be to scale with correct room numbers and nomenclatures.
- (4) Physically label each appliance (speaker and strobe) and devices as labeled on as-built drawings
- (5) Labeling shall be on clear or white tape with black letters
- (6) All symbols shall comply with NFPA 170

d. Wiring Drawing

- (1) Show all external wiring connections inside all panels to include fire alarm control panel, notification appliance panels, audio control unit, transmitter, and etc.
- (2) Show wiring connections illustration for each device, appliance, module, etc. installed in the system. Example: all incoming wiring connections on a smoke detector and or duct smoke detector, when a module is added to a panel it shall include all the wiring connections between the module and the panel.

e. Point to Point Wiring Diagram

- (1) The point to point wiring diagram illustrates the exact wiring connections between device to device, appliance to appliance, panel to device and appliance, panel to panel, and etc.
- (2) All drawings and diagrams shall illustrate exactly the structure and the installation of the system.
- (3) Each drawing shall have the signature and certification number of the Fire Protection Engineer or NICET level IV technician.

f. All symbols shall conform to NFPA 170 Standard Symbols

g. A complete accurate set of as-built drawings, preliminary test results, and installation, owner, and maintenance manuals are required to perform initial fire alarm and mass notification acceptance test. It is the contractor responsibility to coordinate and provide these documents to Fort Campbell Fire Department Fire Prevention Section seven days prior to test date.

4-10. Manuals and Information

- a. Installation manual
- b. Operation manual
- c. Maintenance manual
- d. Troubleshooting information
- e. Program instruction

- f. Battery calculations
- g. All drawings on CD
- h. One complete hard copy set of accurate as-built drawings
 - (1) All individuals involved in the design, installation, programming, and testing of the system shall certify all drawings, manuals, and test results are accurate.
- i. Preliminary test results
- j. Inspection and testing results document
- k. Copy of Certification of persons responsible in the design, installation, programming, and testing of the system
- l. Copy of Certificate of Calibration for each piece of test equipment
- m. Record of Completion

4-11. Preliminary Test

a. Perform and record all test results and what is required by all applicable codes and manufacturer to include but not limited to NFPA 72 Section 10, UFC 3-600-01, UFC 4-010-01, UFC 4-021-01, UFGS 28-31-76 (13859), and applicable codes and standards except as modified herein.

b. All as-built drawings, Manuals and Information, and Preliminary test results shall be provided to Fort Campbell Fire Department Prevention and Inspection Section seven days before Final Test and Inspection to be witnessed by this section.

4-12. Electromagnetic Door Holders

a. Where indicated on drawings, provide magnetic fire door hold open devices. The electromagnetic holding devices shall be designed to operate on 24-VDC and require not more than 3-watts of power to develop 25-psi of holding force.

b. Under normal conditions, the magnetic shall attract and hold the doors open.

c. The initiation of any fire alarm shall cause the release of the electromagnetic door holding device permitting the door to be closed by the door closer. Operation shall be failed safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure. The device shall be UL listed based on UL 228 tests.

5. Knox Box

5-1. Ordering Information

a. Provide 3200 series, dark bronze, hinged door recess or surface mounted, depending on the application, "Knox Box" manufactured by "The Knox Company".

b. The box can be purchased online at www.knoxbox.com.

5-2. Installation

- a. Be installed on the exterior of the building within 10 feet of the entrance door normally used by the Fire Department to access the building.
- b. The top of the box shall be installed no higher than 6 feet nor lower than 5 feet from the adjacent ground level.
- c. The box must be installed in such a manner as to be clearly visible and free from any obstruction (including trees, bushes, etc.)
- d. The box shall not be painted, as this hampers and in some cases, prohibits entry into the box. Boxes that have been painted must be replaced.

The red reflective [KNOX-BOX](#)® decal shall be placed on the entrance door of the site normally used by the Fire Department, 5 feet above the adjacent ground level.

- f. Variances to location, due to obstacles, may be approved by the Fire Prevention Office.

6. Portable Fire Extinguishers

- a. Install portable dry chemical (Class ABC) fire extinguishers in accordance with all applicable NFPA, UFC, and IBC code criteria including the manufacturer recommendations.
- b. Provide ten-pound portable dry chemical fire extinguishers with flush or semi-mounted approved cabinets in accordance with NFPA 10 and UFC 3-600-01.
- c. Fort Campbell **preference** for extinguishers is AMEREX or Badger.
- d. Fort Campbell color **preference** for fire extinguisher cabinets is red or white.
- e. Install fire extinguishers along the path of egress in clear view.
- f. Where visual obstructions cannot be avoided, provide signage to indicate the extinguisher location.
- g. Provide minimum two-liter size wet chemical portable fire extinguishers mounted in recess or semi-recess cabinets in all commercial and kitchenette cooking areas.
- h. Provide minimum ten pound Class ABC portable fire extinguishers mounted in recess or semi-recess cabinets in commercial and kitchenette cooking areas for fires other than cooking fires.
- i. Install all portable fire extinguishers with the top of the fire extinguisher 42-inches from the finish floor.

7. Heating, Ventilation, Air Conditioning (HVAC)

- a. Install smoke detectors, dampers, doors, and other equipment in accordance with NFPA 72, 90A, manufacturer recommendation and specification, and all other applicable codes and or standards, except as modified herein.
- b. Install smoke detectors listed for use in air distribution systems shall be located as follows:
 - (1) Downstream of the air filters and ahead of any branch connections in air supply systems having a capacity equal to or greater than 2000-CFM's.
 - (2) Prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air systems having a capacity equal to or greater than 15,000-CFM's.
 - (3) At each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air systems having a capacity equal to or greater than 15,000-CFM's and serving more than one story.
 - (4) Duct smoke detectors shall be furnished by the fire alarm company.
- c. Hardwire all duct smoke detectors to the air handler unit that the duct detector is monitoring.
- d. Where duct smoke detectors are installed in concealed locations, more than 10-feet above the finish floor or in arrangement where the detector's alarm or supervisory indicator is not visible to responding personnel, provide the detector with remote indicator and test switch in location acceptable to AHJ.
- e. Shut down all HVAC units on any fire alarm utilizing the hardwired duct smoke detector and the HVAC computer program.
- f. Shut down all HVAC units on any fire alarm or required manual shut down, regardless of size; and/or distributes outside air within a facility.
- g. Provide smoke detection in room(s) and or areas where air handler unit(s) less than 2000-cfm's are located. Smoke detection activation shall shut-down all air handler units located within that room or area. Detection activation shall not activate the building general evacuation notification appliances; however, it shall generate a special supervisory alarm that is transmitted to Central Station.
- h. "Emergency HVAC Shut Down" Switch
 - (1) Shut down all HVAC units that distributes outside air within a facility when "Emergency HVAC Shut Down" switch is activated.
 - (2) Close all required dampers in accordance with UFC 4-010-01 when "Emergency HVAC Shut Down" switch is activated.

8. Elevator Hoist Ways and Machine Rooms

- a. Install all types of elevators in accordance with ASME A17-1, NFPA, UFC'S, UFGS, and all applicable codes and standards except as modified herein.
- b. All hoist ways and machine rooms will be 2-hour fire rated.
- c. When sprinklers are required to be installed in elevator machine room and hoist way in accordance with UFC 3-600-01, provide heat detector within 2-feet of sprinklers.
- d. Heat detector shall have both a lower temperature rating and a higher sensitivity as compared to sprinklers.
- e. Heat detectors shall activate prior to sprinkler activation and shut down elevator power.
- f. Program a time delay equal to the amount of time for the elevator to travel from the top of the hoist way to the lowest recall level before activation of the power shunt trip in conjunction with heat detector activation.
- g. Water flow or pressure switch shall shut down elevator power immediately upon activation. The use of devices with time delay switches or time delay capability shall not be permitted.

9. Emergency Lighting

- a. Install emergency lighting in accordance with NFPA 101, UFC 3-600-01, and all applicable codes except as modified herein.
- b. Provide emergency lighting in all windowless locations to include but not limited to restrooms, mechanical rooms, and elevator machine rooms.
- c. Provide exterior emergency/egress lighting, with backup power to illuminate the pathway to public way.
- d. Install emergency lighting in all facilities regardless of occupancy.

10. Exit Signage (Means of Egress)

- a. Provide Exit signs and Directional signs in accordance with NFPA 101, UFC 3-600-01, and all applicable codes and standards except as modified herein.
- b. Install Exit signs at main exterior exit doors that are readily visible from any direction of exit access.
- c. Install Exit signs at all exit access and exterior doors leading to public way.

- d. Provide Directional signs showing the direction of travel to main exterior exit doors where the direction of travel to reach the main exit is not apparent.

11. Attic Access

- a. Provide attic access in accordance with UFC 3-600-01 and International Building Code (IBC) and all applicable codes and standards except as modified herein.
- b. Must have 30" or more of head clearance at point of access into attic space.
- c. Access Hatch not less 20" by 30" in size.
- d. Access Hatch must be 2-hour fire rated, self closing and self latching with propped opening position and it can open up or down.

12. Roof Access

- a. Provide roof access in accordance with UFC 3-600-01 and International Building Code (IBC) and all applicable codes and standards except as modified herein.
- b. Stairways shall have handrails on at least one side. At least one handrail shall extend at least 34 inches above the roof surface. Such handrail may be attached to the underside of the operable hatch so that it is in the correct position for handrails when the hatch is in the open position, or it may be secured to the roof or other construction. Minor breaks in the continuity of the handrail are permitted; handrail sections must be generally aligned.
- c. The curb at the roof opening for the roof hatch on the side where the stairs emerge from the interior shall extend above the roof surface no more than nine inches, the curb at the roof hatch on other sides of the hatch shall not exceed 24 inches above the roof surface, and the maximum height of any portion of the hatch in a closed position shall not exceed 36 inches above the roof surface.
- d. The width of a stairway to a roof and the clear width of a roof hatch in its open position shall be not less than 32 inches. Handrails, lifting mechanisms and other equipment may encroach into the required width up to 1 1/2" when the roof hatch is in a fully open position.
- e. Stairways with roof hatches that do not meet these requirements must be labeled as "NO ROOF ACCESS".

13. Stairs

- a. Stairs and handrails shall comply with NFPA 101 Life Safety Code.

14. Doors

- a. Doors and self-closure appliances shall comply with NFPA 101, NFPA 80, UFC 3-600-01, and applicable codes and standards.

15. Fire Safety Symbols

- a. Symbols used on all shop and as-built drawings shall comply with NFPA 170.

16. Life Safety Plan

- a. Provide Life Safety Plan to scale to include:
 - (1) Means of egress
 - (2) EXIT and directional exit signs
 - (3) Fire extinguishers to include cabinets and extinguisher type and size.

17. Outdoor Storage, Parking, and Loading and Unloading Areas

- a. Provide fire hydrants spaced at 300 feet maximum intervals around the perimeter. Provide additional hydrants to protect facilities within the perimeter according to UFC 3-600-01.

----- END OF SECTION -----

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TECHNICAL DESIGN GUIDE CHAPTER 3 Technical Requirements and Instructions Division 31 Earthwork

Section 31 21 13 Radon Mitigation

Ft. Campbell Requirements:

All residential and non-residential construction performed at Fort Campbell must have passive radon mitigation features implemented into the design. The contractor will install preliminary features as per drawings. The contractor will hire an independent testing company to perform radon monitoring prior to inhabitation of the units. The testing firm must be EPA accredited and approved to perform work in the State of Tennessee (Kentucky). A list of accredited testing firms in the state of TN (KY) can be obtained through the state Radon Program Coordinator (615) 532-0733. In the event radon concentrations greater than 4 pCi/L (pico curies per liter of air) are revealed consult Fort Campbell DPW through the Contracting Officer's representative for guidance pertaining to retesting. If upon further testing, elevated (unacceptable) levels are present, additional mitigation features will be installed followed by

more testing. The buildings will not be inhabited until levels of less than 4 pCi/L have been achieved.

Extend the pipe of the passive radon mitigation system through the roof and leave it open (do not Cap).

Place electrical outlets near (e.g. within 6 feet) of the radon vent pipe riser in the attic.

The riser should be located in an area of the attic with at least 3-4 feet of clearance to allow for easy access to install and maintain the fan.

If at all possible, the aggregate bed under the slab should not be compacted in order to provide the maximum subslab vacuum coverage.

With respect to the number of risers, suggest an interval of 1 for every 3-5000 SF of slab.

----- END OF SECTION -----

Section 31 23 00.00 20 Excavation and Fill

Ft. Campbell Requirements:

Ft. Campbell requires contractors have buried utilities marked prior to starting any excavation/digging. Fort Campbell does not issue dig permits. Instead, Tennessee One Call is now being used to locate buried utilities prior to digging/excavation (800-351-1111). See [Appendix C](#) for further information.

If contractor cuts utility lines after being marked or does not get them marked, he is responsible for making **immediate** repairs (to be coordinated with the appropriate Government maintenance entity) or be billed for repairs if the Government makes the repairs. Repairs shall be made to the satisfaction of the appropriate government entity.

Ft. Campbell will allow a 4-8 hour utility outage if the utility is not a critical customer need and is properly coordinated and public notification is made to impacted customers. Outages shall be limited to not more than 3-4 to a customer for the contract duration. For a major outage, Ft. Campbell would advertise for at least 2 weeks prior to outage occurrence.

Avoid locating new utility lines under pavement where possible. When utilities are required to cross under roads/streets, bores shall be considered as the preferable option for installation of utilities under existing roads. Road cuts will only be allowed when sound engineering practices dictate that this is the only feasible method with which to install the utility lines. When underground utilities are sleeved under roadways, railways, runways, sleeves shall be extended a minimum of 10 feet beyond the roadway on both sides to protect lines from penetration by new road signs, poles, etc.

Instructions to Designers:

1. Meet with DPW utility people to get exact locations of utilities. Fort Campbell has a great deal of underground utility lines (both active and abandoned) that do not show up on Base utility maps. Therefore, any utilities to be installed underground must be coordinated with DPW as soon as possible during the design process. OMA projects shall include in the contract emergency phone numbers for each utility impacted.
2. Specifications Demolition section paragraphs shall incorporate the permit and demolition requirements at all construction projects.
3. Construction projects requiring soil borrow material should be coordinated with DPW Engineering Division at 270-798-0972.

----- END OF SECTION -----

Section 31 31 16

Soil Treatment for Subterranean Termite Control

Ft. Campbell Requirements:

Termite treatment measures shall be provided on ALL new construction projects.

Environmental quality shall be maintained in delivery, storage, application, and protection of chemicals in accordance with Ft. Campbell policies and procedures.

Instructions to Designers:

1. Point of Contact is Ed Legere at 270-798-3110.
2. See [Appendix A](#) for environmental requirements.
4. Specifications section UFGS 02364, paragraphs shall be included at all new construction (and additions) projects.

----- END OF SECTION -----

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CHAPTER 3
Technical Requirements and Instructions
Division 32
Exterior Improvements

SECTION 32 12 17
Hot Mix Bituminous Pavement

Ft. Campbell Requirements:

Corps of Engineers Guide Specifications shall be used and modified to reference "KDOT" for Asphalt pavement throughout the installation except for Airfield pavements.

All new facilities should include waste handling equipment, concrete pads and screens as necessary. The designer should have some idea of the volume of waste to be generated by the final permanent facility. If the facility will generate recyclable materials, capacity for recyclable bins should be included.

Instructions to Designers:

1. Design, contract drawings, and specifications paragraphs shall include each of the above features as they apply to the project.
2. Include any [digging/excavation permits](#).

----- END OF SECTION -----

SECTION 32 13 11
Concrete Pavement for Airfields and Other Heavy-Duty Pavements

Ft. Campbell Requirements:

Fort Campbell has experienced unsatisfactory life and performance in exterior concrete pavements due to alkali-silica reaction (ASR). ASR causes excessive expansion of concrete, leading to degraded load capacity, surface spalling, and eventual premature pavement failure. Secondary damage includes displacing adjoining vertical construction applying threatening lateral loads on adjacent embedded and pavement features.

Concrete for exterior pavements and hardstand areas shall specify and require only low alkali Portland cement with Class F fly ash as the pozzolanic cement replacement and Ground Granulated Blast-Furnace (GGBF) Slag in combination for the concrete mix design test proportioning. Specific concrete mixture proportions have been developed for concrete

pavement in an attempt to mitigate concrete expansion problems currently being experienced at the base.

A three foot asphalt pavement buffer around all utilities (storm water, sanitary sewer, water, electrical, communications, etc.) in the concrete paved area shall be provided. The width of the buffer around buildings shall be determined by the engineer of record and approved by DPW.

Instructions to Designers:

1. Design, contract drawings, and specifications paragraphs shall include each of the above features as they apply to the project.
2. Fort Campbell prefers that military vehicle and equipment parking/hardstand areas be concrete vice asphalt.
2. For new construction projects having concrete pavement for parking hardstand areas, roadways, airfield runways and aprons, one of the following Louisville District COE, Engineering Division technical elements -- ED-T, ED-TC and/or ED-TG -- shall be consulted. These elements will provide specific design instructions and review all site related concrete specifications.
- 3.

----- END OF SECTION -----

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Section 32 16 13 Concrete Sidewalks and Curbs and Gutters

Ft. Campbell Requirements:

Use of curbs and gutters is encouraged especially at road corners and radius. Use of parking blocks is not encouraged as this inhibits snow removal.

Handicapped curb ramps must meet ADA requirements.

Concrete for exterior pavements and hardstand areas shall use Class F fly ash as the pozzolanic cement replacement. Specific concrete mixture proportions have also been developed for these features in an attempt to mitigate concrete expansion problems currently being experienced at the base.

All new facilities shall include waste handling equipment, concrete pads and screens as necessary. The designer should have some idea of the volume of waste to be generated by the final permanent facility. If the facility will generate recyclable materials, capacity for recyclable bins should be included

Instructions to Designers:

1. Design, contract drawings, and specifications shall include each of the above features as they apply to the project.
3. For MILCON projects, COE in-house units ED-TC and ED-TS shall be consulted for review of all site related concrete specifications.

----- END OF SECTION -----

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Section 32 17 23.00 20 Pavement Markings

Ft. Campbell Requirements:

All pavement markings shall be in conformance with the latest version of [MUTCD](#) and [SDDCTEA Pam 55-14](#). The size and shape shall comply with the 2009 MUTCD. All traffic arrows, stop bars, yield bars, pedestrian crossings and gore areas must be marked with thermoplastic. The markings that are painted shall have a minimum of __ mil thickness. All marking shall be reflectorized as required by the MUTCD. Reflectorized markings shall be tested to show compliance.

Other marking such as school zones and railroad crossings shall comply with the MUTCD.

Handicap parking spaces shall be marked with white lines and the handicap symbol shall be white with blue back ground and white border around the background. The handicap isles next to the parking spaces shall comply with the ADA guidelines. The placement of the handicap symbol shall be __ feet from the front end of the parking space and centered on the space.

Parking lot markings are not required to meet the reflectivity test unless otherwise specified.

The only pavement marking to be used at Fort Campbell will be white, yellow and blue for the background of the handicap symbol.

All stop bars shall be 24 inches in width. All pedestrian crossing and school crossing pavement marking shall be 18 inches in width. The outline border at gore areas shall be 8 inches in width.

LEV or FEV parking spaces shall be marked on the pavement with white only. No signs shall be erected for the parking spaces. The space shall be marked LEV or FEV only (See Figure 32-1 below).

Pavement Marking
for
Low Emmission Vehicles
and
Fuel Efficiency Vehicles

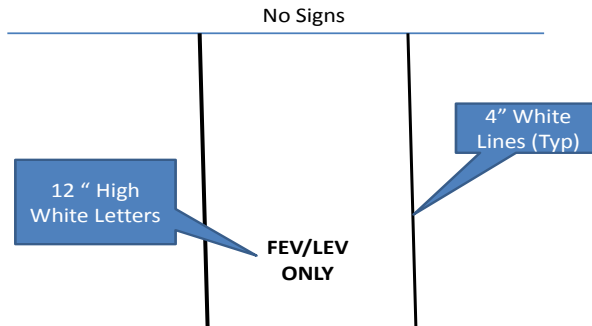


Figure 32-1

Handicap parking stalls shall be painted white. The handicap parking symbol shall be marked with the blue and white standard pavement marking with a white border. Handicap parking signs shall be as required in the MUTCD. At each curb cut for handicap accessible walks, the contractor shall install a reddish brown truncated rubber pad in accordance with the ADA guidelines.

----- END OF SECTION -----

Section 32 93 00 Exterior Plants

Ft. Campbell Requirements:

(1) Maintenance during Planting Operation.

Maintain installed plants in a healthy growing condition. Begin maintenance operations immediately after each plant is installed and continue until the plant establishment period commences.

(2) Plant Establishment Period.

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, the plant establishment periods shall be established for the work completed.

(3) Maintenance during Establishment Period.

The maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrap, protecting plant areas from erosion, maintaining erosion material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants. If used, irrigation systems shall be for plant establishment only. Remove at the end of this period. Ft Campbell will not furnish potable water for irrigation.

(4) Unhealthy Tree.

A tree shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit in accordance with the following warranty paragraph.

(5) Warranty.

Furnished plant material shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanting existing plants requires no guarantee.

Installation grounds keeping funding is limited. Maintenance free design around facilities and plant areas is required.

Ensure that the landscaping provided does not interfere with overhead power lines when it reaches maturity.

Fort Campbell maintains lists of suitable plant materials for use at the installation. These lists are subdivided into plant sizes. The following Ft. Campbell Landscape Plant Lists are in [Appendix E](#):

[Native Evergreens/Conifers](#)

[Native Deciduous](#)

[Introduced Evergreens](#)

[Introduced Deciduous](#)

[Parking Lot Plants](#)

[Bio-Retention Plants](#)

----- END OF SECTION -----

CHAPTER 3
Technical Requirements and Instructions
Division 33
Utilities

Section 33 11 00 Water Distribution

Ft. Campbell Requirements:

The Fort Campbell water distribution was privatized in 2003. The owner of the system is now CH2MHill. All additions/alterations to the system must be done in accordance with the CH2MHill Design Manual. Contact Chris Semler, CH2M HILL, csemler@ch2m.com or 931-431-2015 or -5677 to obtain current CH2M HILL Design and Construction Standards.

----- END OF SECTION -----

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Section 33 30 00 Sanitary Sewers

Ft. Campbell Requirements:

The Fort Campbell wastewater collection and treatment system was privatized in 2003. The owner of the system is now CH2MHill. All additions/alterations to the system must be done in accordance with the CH2MHill Design Manual. Contact Chris Semler, CH2M HILL, csemler@ch2m.com or 931-431-2015 or -5677 to obtain current CH2M HILL Design and Construction Standards.

----- END OF SECTION -----

Section 33 40 00 Storm Drainage Utilities

Ft. Campbell Requirements:

Verify capacity of existing infrastructure, and whether it is sized sufficiently to handle new construction.

Include provisions to maintain utilities when executing new work. Think about constructability and coordination of demo with installation of new. Goal is not to leave an occupant or customer without service (gas, water, heat, sewer, etc.).

Avoid use of odd pipe sizes (i.e. 3").

Trenching through roadways shall be avoided to the maximum extent possible. Whenever possible utilities shall be pressure-pumped below roadways.

All utility lines installed underground shall be marked with magnetic tape.

Include in contract requirements stating that the contractor is responsible for **IMMEDIATE** repair of existing project site utility lines broken during construction. Repairs shall be made to the satisfaction of the appropriate government entity.

OMA projects shall include in the contract phone numbers for each utility that contractor is to use in case of an emergency.

Policy

It is the policy of Fort Campbell that storm drainage systems in non-airfield areas convey the 10-yr storm event, storm drainage systems in airfield areas convey the 2-yr storm event, and that post-construction peak runoff rates do not exceed pre-construction peak runoff rates in new construction areas. Pre-construction rates are defined herein as the peak rate of runoff that would be produced by the design storm events from the area prior to the currently proposed construction.

No deviation from or waiver of this policy will be allowed without approval of DPW Engineering Design Branch and Environmental Storm Water Program Manager.

DESIGN CRITERIA:

The following standards are site specific for Fort Campbell and are designed to work in conjunction with all UFC and Army Technical Manuals.

Hydrology

Fort Campbell has selected the NRCS Unit Hydrograph Method or NRCS TR-55 as the standard for calculating runoff. Basic data required for these methods are: drainage area rainfall frequency, runoff factor, and time of concentration. Details of the methodology can be found in the *SCS National Engineering Handbook, Section 4 and TR-55 NRCS Manual for Urban Hydrology for Small Watersheds*. The use of alternate hydrograph methods to compute runoff must be approved by the DPW Engineering Design Branch.

Design Storm Events

Storm drainage systems in non-airfield areas shall be designed to convey the 10-yr, 24-hr Type II storm event and storm drainage systems in airfield areas shall be designed to convey the 2-yr, 24-hr Type II storm event. In depth discussion of these criteria can be found in: Paragraph 3 Section b of *TM 5-820-1*, and Chapter 2 Section 2-2 of *TM 5-820-4*. Pre-construction and post-construction peak runoff rates shall be evaluated for the 2-yr, 10-yr, and 100-yr storm events to verify that construction does not increase peak runoff rates. The following table includes the rainfall data that shall be used to determine storm drainage system capacities and peak runoff rates:

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr
2	0.45	0.72	0.90	1.25	1.56	1.85	2.01	2.47	3.00	3.64
10	0.57	0.91	1.15	1.67	2.17	2.57	2.80	3.46	4.22	5.17
100	0.73	1.16	1.47	2.25	3.11	3.71	4.09	5.18	6.34	7.80

**These precipitation frequency estimates are based on frequency analysis of partial duration series. ARI is the Average Recurrence Interval.*

NOAA 2013

Complete rainfall records can be found at <http://hdsc.nws.noaa.gov/hdsc/pfds/>.

Underground Injection Wells (Sinkholes)

In order to protect the groundwater resources of the region, Fort Campbell has adopted a policy of discouraging discharge and disposal of storm water runoff to sinkholes wherever practical. Storm water runoff is to be diverted around or prevented from flowing into sinkholes whenever possible. Existing sinkholes and Class V Underground Injection Control (UIC) wells shall be closed when surface runoff can be discharged through the storm drainage system. Small sinkholes and surface collapses shall be filled in as soon as practical. Procedures for closure of Class V UICs are outlined in the Fort Campbell Class V UIC Management Plan.

Sediment and Erosion Control Measures

In order to comply with the provisions of the Kentucky and Tennessee NPDES permits, the Environmental Division of DPW implements procedures and requirements through Fort Campbell Regulation (CAM REG) 200-1. All storm drainage system construction projects must comply with the provisions of this regulation. These provisions include preparation of a project specific Storm Water Pollution Prevention Plan (SWPPP), permit coverage, and enforcement of the plan components. Contact the Fort Campbell Storm water Program for specific requirements on permitting and meeting compliance.

Low Impact Development Strategies and other IMPs

Low Impact Development (LID) is a storm water management strategy designed to maintain site hydrology and mitigate the adverse impacts of storm water runoff and nonpoint source pollution. LID actively manages storm water runoff by mimicking pre-development hydrology using design techniques that infiltrate, store, and evaporate runoff close to its source of origin. LID strategies provide decentralized hydrologic source control for storm water runoff. In short, LID seeks to manage the rain, beginning at the point where it falls. This is done through a series of techniques that are referred to as LID Integrated Management Practices (LID-IMPs).

The LID-IMPs are distributed small scale controls that closely mimic hydrological behavior of the pre-project sites for a design storm event.

LID-IMPs can be categorized in four main categories:

- **Bioretention.** Natural type depression storage, infiltration, and evapotranspiration. This design option is typically the least costly and easiest to accomplish if site availability, soils, water table, etc. are conducive. Other site treatments such as swales, rain gardens, open space, filter strips, vegetated buffers, constructed wetlands, tree filter boxes, wet ponds etc. fall under this general category and are advisable due to lower initial costs.
- **Permeable Pavements.** Provide infiltration and prevent concentrated flow. Permeable pavements (including pavers) are the next most cost effective method of meeting the design goals. Limitations on the use of these design options are wheel loading, traffic, ability to maintain, etc.
- **Cisterns/Recycling.** Re-use systems that store and re-use storm water. This design option is preferable if adequate demands for reuse water exist. Many facilities do not have the potential for reuse to make this option cost effective.
- **Green Roofs.** Limit peak discharges and seasonal evapotranspiration. Green roofs are a design option where the site is constrained by space limitations and other design options do not meet the design goals. Green roofs should be assessed with consideration of other benefits such as lower energy costs.

All projects must comply with Section 438 of the Energy Independence and Security Act of 2007. It states” The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow.

IMP Operation and Maintenance

Development of Operation and Maintenance Support Information (OMSI) documentation is critical to ensure LID-IMPs are properly maintained in order to function properly. LID-IMPs should be viewed as environmental systems that have specific maintenance requirements. O&M procedures for each of the LID practices implemented in the site plan should be developed as part of the OMSI documents. Different types of LID-IMPs will have different maintenance requirements, but some general principles will apply:

- Keep LID-IMPs and flow paths clear of debris.
- Regular trash pickup shall be required.
- Use native, drought-tolerant plantings that can tolerate periods of saturation. If required, water vegetation regularly during dry periods.
- Consider impact on plants by road salts.
- Plantings should be pruned as needed.

Water Quality

Bioretention IMPs, permeable pavements, and green roofs effectively improve water quality. For water quality control purposes, the Fort Campbell requirement is to treat the water quality volume for the first 1.1 inches of a rain event.

LID-IMP References

The following is a listing of sources of publications describing various LID strategies and IMPs. Other control measures are described in professional journals and accepted design manuals of state and federal agencies. The designer is encouraged to select those measures that will work best within the constraints of their development and still meet the objectives of Fort Campbell.

- UFC 3-210-10 (Unified Facilities Criteria Design: Low Impact Development Manual) Nov. 2010
- Low-impact Development Design Strategies: An integrated design approach. Prepared by Prince George's County, MD. June 1999
- Low Impact Development-Technical Guidance Manual for Puget Sound. Publication No. PSP 2012-3. December 2012.
- Greening EPA , Storm water Management Best Practices Website: http://www.epa.gov/oaintrnt/stormwater/best_practices.htm
- Low Impact Development Center Website: <http://www.lowimpactdevelopment.org>

Storm Drainage System

The storm drainage system at Fort Campbell consists of all manmade and natural structures that convey storm water runoff including: streets, storm drains, piping, detention areas, retention areas, and open channels. To provide for future growth the system must be planned and properly designed to convey the 2-yr design storm event in airfield areas and 10-yr event in non-airfield areas. This section provides requirements for evaluating and designing the system.

Storm Drainage System Operation and Maintenance

In order to ensure storm water runoff goals are met and maintained, Fort Campbell has implemented specific procedures for storm drainage system design. Any structure that will require periodic maintenance to function properly must be approved by the DPW Operations and Maintenance Division prior to construction. Designers are instructed to develop an operation and maintenance plan for each structure and submit it to the DPW for approval. The plan must include a maintenance schedule, and a required materials/equipment list.

Pavement Drainage

Good roadway drainage practice requires extensive use of roadside ditches and curb and gutter sections in combination with spillways, chutes or storm water inlets for adequate control of surface runoff. Storm inlets or drainage ditches shall be designed and located to convey the excess runoff during design storm events. A Manning's "n" value of 0.013 shall be used to calculate runoff from paved areas.

In non-airfield areas flow in the gutter must never exceed 5 inches or overtop curbs, whichever is less. Whenever possible flow across intersections and roadway entrances shall be avoided.

In airfield areas shallow, structurally adequate paved gutters adjacent to airfield pavements are frequently required. A sufficient number of inlets must be provided to prevent depth of flow from exceeding 2 ½ inches.

Roadside Ditches

Roadside ditches must be designed to convey the runoff from the design storm without overflowing. Proper slope must be maintained to prevent the ponding of water or erosion of the channel. The ditches should be stabilized using vegetation, or other suitable materials. Erosion protection shall be provided around culverts and storm drain entrances. The channel side slopes shall not be steeper than 3:1 and preferably not steeper than 4:1 for easy maintenance and mowing. Ditches shall be constructed a minimum of 5 feet from the edge of the road shoulder.

Storm Water Inlet Structures

The primary aim of storm water inlets is to limit the amount of water flowing along gutters or ponding at profile sags to quantities that will not interfere with the passage of traffic. Drainage inlets shall be located to prevent concentrated or heavy sheet flow from crossing traffic lanes during the design storm event. Inlets shall be located just upgrade of pedestrian crossings and locations where pavement slope reverses. Grates and inlets shall be designed to safely accommodate pedestrian and bicycle traffic where applicable.

Curb Inlets: Shall be placed and designed in accordance with standards found in: Chapter 3 Section 3-7 of *TM 5-820-3*, and Chapter 3 Section 3-7 of *TM 5-820-4*.

Grate/Drop Inlets: Shall be placed and designed in accordance with standards found in: Chapter 3 of *TM 5-820-3*, and Chapter 3 Section 3-7 of *TM 5-820-4*.

Storm Drain Piping

After the location and size of inlets has been determined, the rate of discharge to be carried by each drainpipe during the design storm event shall be computed. The rate of discharge shall be used to determine size and gradient for each pipe section. Drainpipes shall be sized on the assumption that they will flow full or nearly full under the design storm discharge, but will not be placed under pressure head. All drainpipes shall be designed such that velocities of flow will not be less than 2.5 feet per second when one-third or more full. Pipe sizing must be adequate to convey the runoff from the design storm within the barrel of the conduit. The Manning Equation shall be used for capacity calculations. Storm drain piping shall be a minimum 12 inches diameter, refer to, Chapter 2 of *TM 5-820-3* and Chapter 3 Section 3-6 of *TM 5-820-4* for sizing requirements.

The storm drains must be designed to accommodate the storm discharge without causing flooding, or allowing flows to exit the system at unacceptable locations. The Hydraulic Gradient shall be determined for the storm drain system. The following design criteria shall be followed when determining the elevation along the hydraulic grade line.

- The hydraulic grade shall be 0.75 feet below the intake lip of any affected inlet, manhole cover, or any entering non-pressurized system.
- The energy grade line shall not rise above the intake lip of any affected inlet, manhole, or any entering non-pressurized system.

Pipe Materials: Storm drainpipe and culverts must serve under varying loading and flow conditions including heavy abrasion, erosion, and sedimentation. A variety of materials are available for use. Only reinforced concrete storm drain pipe or monolithic cast-in-place concrete shall be used at Fort Campbell, unless otherwise approved by DPW Engineering Design Branch and Operations and Maintenance Division. Joints shall be formed with approved rubber gaskets and shall be soil tight.

Alternative flexible conduits, including plastic (polyethylene HDPE) materials and corrugated metal pipe (steel or aluminum CMP), may be approved for special applications. Since these flexible materials obtain their strength by the interaction of the pipe and the surrounding backfill material, select haunching and pipe embedment materials shall be utilized with these alternative pipe materials. Jointing methods for alternative materials shall provide a soil-tight or watertight joint. DPW Engineering Design Branch may require additional pipe loading, structural, and geotechnical calculations for approval.

Manholes: Manholes shall be installed at the upper end of all storm drain lines and at all changes in grade, size, alignment and intermediate joints. Points of entry shall not be spaced more 300 feet for conduits with a minimum nominal diameter of 30 inches or less. Inside dimensions shall not be less than 2.5 feet with round covers. Construction materials, sizing, access, and spacing shall be in accordance with Chapter 4 Section 4-1 of *TM 5-820-4*.

Pipe Connections: Including pipe diameter increases and lateral inputs shall match pipe crown elevations and be designed to minimize the hydraulic loss of the system.

Depth of Cover: Storm Drain depths should be held to a minimum consistent with limits imposed by cover requirements, other structures and utilities. Location, depth of cover, materials, and outlets shall be designed to acceptable Post standards found in, Chapter 2 of *TM 5-820-3* and Appendix C of *TM 5-820-4*.

Drain Pipe Abandonment

- Storm drain piping that is no longer used shall be removed or abandoned in place.
- Open or cutoff ends of abandoned pipe shall be plugged with concrete.
- The DPW Engineering Design Branch may require that abandoned pipe be filled with sand or flowable fill where necessary to assure the structural integrity and support of the pipe.
- The location of all abandoned pipe shall be recorded in “as-constructed” records that document the location and provide the elevation of all know sections of abandoned pipe.

Open Channel Conveyance

Many different types of channels may be used to convey storm water runoff as part of the drainage system. All existing natural drainage patterns should be retained if possible. Natural channels, wetlands, streams, floodplains and ponds should be preserved wherever possible. The main classifications of channels are: natural, bio-technical, vegetated grass-lined, rock-lined, and concrete. Manning's equation shall be used to calculate flow velocities. Flows at or near critical depth should be avoided when possible. Side slopes for unlined earthen channels should not exceed 3:1 (Horizontal:Vertical). Freeboard must be incorporated in the design of open channels to allow for future development on Post. All channels must conform to standards found in Chapter 6 of *TM 5-820-3*, and Chapter 3 Section 3-2 of *TM 5-820-4*.

The design of open channels usually requires the additional design of an assortment of associated structures to dissipate energy and help minimize erosion or control sediment in the channels. They include: Drop Structures, Check Dams, and Energy Dissipaters.

Storage and Storage Facilities

Temporary storage or ponding may be necessary when post-construction runoff rates exceed that of pre-construction levels or exceed the capacity of downstream drain system. Storage may be concentrated in large basin-wide facilities or distributed throughout the drainage system. Storage may be developed in parking lots, parks, recreational areas, and small lakes, ponds, and other depressions within the Post area. However, ponding shall not be permitted on the primary runway under any condition.

Storage volume shall be adequate to attenuate the post-construction peak discharge rates to pre-construction discharge rates for the 2-year or 10-year design storm event depending on site location within the watershed. Routing calculations must be presented to demonstrate storage volume is adequate. Storage volume shall allow for the sediment load anticipated from the contributing areas. For storage facilities, all temporarily stored runoff shall be drained within 72 hours.

Dams shall be designed using latest local practices and standards. Outlet works selected for storage facilities shall include a principal spillway and emergency overflow, and must be able to accomplish the design functions of the facility. Principal spillway discharge must be released in a non-erosive manner.

Detention: Areas above the normal high water elevations of storage facilities shall slope a minimum of 2% toward the facilities to allow drainage and to prevent standing water. Careful finished grading is required to avoid upland surface depressions that may retain runoff. The bottom of a storage area shall be sloped towards the outlet to prevent standing water. A minimum 2% bottom slope is required on unpaved areas. A low flow channel can be constructed across the facility bottom from the inlet to the outlet to convey low flows and prevent standing water.

Retention: Retention facilities are conducive to establishing wetlands and open water habitats. Site-specific criteria such as depth, habitat, and bottom and shoreline geometry shall be

selected to encourage establishment of the desired habitat. Plant and wildlife experts should be contacted for site-specific guidance.

Because the downstream storm sewer systems shall be designed assuming storage upstream, a storage facility in the storm sewer system shall be maintained and remain functional as a storage facility site permanently.

Instructions to Designers

- 1) See *TDG Chapter 2, General Design Provisions, 2.0.1 Deliverables* for as-built and construction drawing requirements.
- 2) See *TDG Chapter 2, General Design Provisions, 2.0.5 for Surveying and Mapping Requirements*.

Additional Requirements are found in [Appendix A-3, Clean Water](#).

Instructions to Designers:

1. Point of Contact is Maintenance Chief at 270-798-5082 or 270-412-4804.
2. At the design meeting, obtain a current list of points of contact for utilities.
3. Design, contract drawings, and specifications section UFGS 02630 paragraphs shall include each of the above features as they apply to the project.

----- END OF SECTION -----

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Section 33 51 15 Natural Gas/Liquid Petroleum Gas Distribution

Ft. Campbell Requirements:

Gas lines shall not be used for electrical grounding.

Refer to [Appendix F](#) Utility Procedures for outside service lines

Section 33 56 10

Factory-Fabricated Fuel Storage Tanks

This S.O.P. has incorporated the National Electrical Code (NEC), National Fire Protection Association (NFPA Code), Underwriters Laboratories (UL), and industry standards.

1.0 General:

- 1.1 Aboveground petroleum/fuel tanks (ASTs) shall conform to all Federal, State, Local regulations and guidelines, and with these design requirements. This includes tanks for permanent placement as part of new construction, as replacement of existing storage systems, and tanks used for temporary storage by construction Contractors and military units.
- 1.2 ASTs shall be double-walled type tanks. Provide means to establish the integrity of the secondary containment. Secondary containment (a tank having an inner and an outer wall with an interstitial space between the walls) provides a means for monitoring the interstitial space for a leak.
- 1.3 When there is a discrepancy between any or all of these guidelines, these requirements will be the final authority over all others except NFPA.
- 1.4 The Directorate of Public Works , Environmental Division, Petroleum Storage Tank Manager is the Installation Local Authority Having Jurisdiction (AHJ) who must approve any design proposal and construction before any installation of an AST.

2.0 Definitions:

Fuel tank: is any vessel containing more than 60 U.S. gallons of Class I or Class II flammable liquids.

Emergency Vent: An opening, construction method, or device that will automatically relieve excessive internal pressure due to an exposure fire.

Normal Vent: as a minimum size, all vents shall be at least 1-¼ inches in inside diameter. It must have a bug proof, rain cap secured on top of the vent. The vent must be at least 3 feet higher than the highest point within a 10-foot radius of the ATS.

Anti-siphon valve: a device to prevent any siphoning due to damaged fuel lines, broken pumps, leaky or leaking fuel pumps. This device is not a check valve.

Overfill protection device: a device to serve as a catch basin to prevent any and all overfill spillage. Minimum size shall be 5 gallons.

Fuel Level Gauge: a device that is easily readable that automatically indicates the actual fuel level in the AST. A standard float type gauge is acceptable.

3.0 Location of AST:

- 3.1 All proposed installation sites of ASTs must have written prior approval by the AHJ.
- 3.2 Clearance distances:
 - 3.2.1 No AST shall be installed closer than 5-feet from any type of an electrical disconnect device.
 - 3.2.2 All ASTs between the size of 60 U.S. gallons and 2,000 U.S. gallons shall be located no closer than 10-feet from any building, lean-to, or property line.
 - 3.2.3 ASTs shall have at the minimum of 5 ft of unobstructed clearance on all sides to facilitate refueling, maintenance and serviceability.
 - 3.2.4 No AST shall be installed without having at least a 15-foot aerial clearance from overhead or underground electrical lines, which includes but not limited to weather heads, transformers, and fuses.
 - 3.2.5 The minimum distance between any two ASTs shall be 3-feet.
 - 3.2.6 The minimum distance between an AST with Gasoline or Diesel fuel and a LP tank shall be 20-feet.
- 3.3 ASTs shall rest on the ground or on foundations made of concrete, masonry, piling, or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

4.0 Aboveground Fuel Lines:

- 4.1 Below ground fuel lines shall not be permitted for use with an AST.
- 4.2 Aboveground supply and return lines.
 - 4.2.1 Fuel lines shall be suspended a minimum of 6 inches off the ground and be supported every 3-feet with some type of approved support.
 - 4.2.2 AST fuel lines shall be protected against corrosion.
 - 4.2.3 ASTs shall have some type of protective features that prohibit any collision from motor vehicles, i.e., bollards.
 - 4.2.4 All above ground fuel lines shall be insulated, heat traced, and protected with a covering equal to vinyl.
 - 4.2.5 The fuel lines shall be separated by a minimum distances of 6 inches.
 - 4.2.6 AST aboveground fuel lines shall be of black carbon type steel.
 - 4.2.7 AST aboveground supply fuel lines shall have a shut off valve located as close as possible to the AST.
 - 4.2.8 There shall be no traps or check valves in the return fuel line to the AST.
 - 4.2.9 All pipe joints shall be of the threaded type, no welding of pipes or of the joints shall be permitted.

- 4.2.10 Joints shall be made liquid tight and shall be threaded, except that listed flexible connectors shall be permitted where installed with prior written approval of the Local Authority Having Jurisdiction.
- 4.2.11 All threaded joints shall be made up tight with a suitable thread sealant or lubricant. Joints in piping systems handling Class I liquids shall be welded when located in concealed spaces within buildings.

5.0 Normal Venting for aboveground Tanks:

- 5.1 Venting requirements shall be in accordance with current Unified Facilities Guide Specifications, Section 13202, Fuel Storage Systems requirements. Stage I vapor recovery is the process of recovering vapors when a storage tank is filled. Stage I vapor recovery is mandatory on all Army Facilities. Stage II vapor recovery is the process of recovering vapors during vehicle fueling operations. Stage II vapor recovery is optional and will be included if required by state and local clean air regulations.
- 5.2 Prevent the development of vacuum or pressure sufficient to exceed the design pressure due to filling or emptying and the atmospheric temperature changes.
- 5.3 If any tank has more than one fill or withdrawal connection and simultaneous filling or withdrawal can be made, the vent size shall be based on the maximum anticipated simultaneous flow.
- 5.4 The outlet of all vents and vent drains on tanks equipped with venting to permit pressures exceeding 2.5 psig shall be arranged to discharge in such a way as to prevent localized overheating of, or flame impingement on, and part of the tank, in the event vapors from such vents are ignited.
- 5.5 Where vent pipe outlets for tanks storing Class I liquids are adjacent to building or public ways, they shall be located so that the vapors are released at a safe point outside of buildings and not less than 12 ft. above the adjacent ground level. In order to aid their dispersion vapors shall be discharged upward or horizontally away from closely adjacent walls. Vent outlets shall be located so eaves will not trap the flammable vapors or other obstructions and shall be at least 5 ft from building openings.

6.0 Emergency Venting for Fire Exposure for Aboveground Tanks.

- 6.1 Every aboveground tank shall have some form of construction or device that will relieve excessive internal pressure caused by exposure fires. This requirement shall also apply to each compartment of a compartmented tank, the interstitial space of a secondary containment type tank, and the enclosed space of tanks of closed top dike construction.

6.2 The outlet of all vents and vent drains on tanks, equipped with emergency venting to permit pressures exceeding 2.5 psig shall be arranged to discharge in such a way as to prevent localized overheating of or flame impingement on any part of the tank, in the event vapors from such vents are ignited.

7.0 Miscellaneous Requirements:

7.1 ASTs permanently installed shall have a device(s) for fuel leak detection, fuel level, and all other monitoring requirements.

7.2 ASTs shall be marked in accordance with N.F.P.A. 704.

7.3 ASTs shall be grounded, and wired in accordance with NEC 70.

7.4 ASTs shall have some type of spill containment that will hold 110% of the AST capacity.

7.5 ASTs that have filling and emptying connections for any Class I or Class II, flammable liquids shall be closed and liquid tight when not in use and shall be properly identified.

7.6 ASTs fill caps shall have an AHJ approved means of locking when not being refueled.

7.7 ASTs shall have some device of firefighting equipment in the immediate area. (Contact Fort Campbell Fire Prevention Section for further details).

7.8 Means shall be provided for determining the level of liquid in the tank. This means shall be accessible to the delivery operator.

7.9 Steps shall be installed as needed for providing access to tank components, i.e., fill port.

7.10 Precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to:

- a. Open Flames
- b. Lightning
- c. Hot surfaces
- d. Radiant heat
- e. Smoking
- f. Cutting and welding
- g. Spontaneous ignition
- h. Frictional heat or sparks
- i. Static electricity
- j. Electrical sparks
- k. Stray currents
- l. Ovens, furnaces, and heating equipment.

----- END OF SECTION -----

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SECTION 33 61 00 Pre-Engineered Underground Heating/Cooling Distribution System

Ft. Campbell Requirements:

Include spec provisions to maintain utilities when executing new work. Think about constructability and coordination of demo with installation of new. Goal is not to leave an occupant or customer without service (gas, water, heat, sewer, etc.).

At design meetings, discuss what outages will be needed and for how long. Generally, Ft. Campbell will allow a 4-8 hour utility outage if the utility is not a critical customer need and is properly coordinated and public notification is made to impacted customers. Outages shall be limited to not more than 3-4 to a customer for the contract duration.

At design meetings, discuss notification schedule for outages. For a major outage, Ft. Campbell would advertise for at least 2 weeks prior to outage occurrence.

All utility lines installed underground shall be marked with magnetic tape.

Fort Campbell has a great deal of underground utility lines (both active and abandoned) that do not show up on Base utility maps. Therefore, any utilities to be installed underground must be coordinated with DPW as soon as possible during the design process.

Utility lines are not to be abandoned in place. Remove abandoned lines.

Trenching through roadways shall be avoided to the maximum extent possible. Whenever possible utilities shall be pressure-pumped below roadways.

Ft. Campbell no longer requires dig permits. See [Appendix C](#) for procedure for marking underground utilities.

OMA projects shall include in the contract phone numbers for each utility that contractor is to use in case of an emergency.

Instructions to Designers:

1. Point of Contact is Chief of Maintenance Division at 270-798-9704.
5. Include Discussions of any digging /excavation being considered at the design Meeting.
6. At the design meeting, obtain a current list of points of contact for utilities.

7. Design, contract drawings, and specifications section UFGS 02770 paragraphs shall include each of the above features as they apply to the project.

----- END OF SECTION -----

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**TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 33 70 & Division 33 71
Utilities – Electrical Distribution System**

Section Revision Date: 4/14/2015

Instructions to Designers:

- Include all Division 26 features into project design and contract documents specifications as they apply.
- See Appendix M for further electrical requirements.

Ft. Campbell Requirements:

- 1. Division 33 70 and Division 33 71 - Technical Requirements and Instructions**
- 2. General Requirements**
 - 2.1.** Requirements of the Fort Campbell Technical Design Guide (TDG) apply to contractors, sub-contractors, Government entities, 3rd parties and tenants regardless of the organization.
 - 2.2.** System Engineers/Managers, Design Engineers, Design Technicians and Managers may review and comment on design submittals from all parties.

- 2.3. The contractor shall submit designs for review starting not later than the fifty-percent (50%) design.
- 2.4. Manufacturer equipment cut sheets shall be provided not later than the 50% design review.
- 2.5. The contractor shall submit designs for final review at least at the ninety-five percent (95%) design.
- 2.6. Directorate of Public Works (DPW) reserves the right to approve or reject design submittals at any stage in the design process.
- 2.7. DPW review includes that by the DPW System Engineers/Managers.
- 2.8. Rejected designs, once corrected, shall be resubmitted by the contractor for further review by DPW.
- 2.9. Data in the following sections further refine requirements in the Unified Facilities Guide Specifications (UFGS), Unified Facility Codes (UFC), industry Codes, Standards and Regulations.
- 2.10. All parent Codes, Standards and Regulations apply and are incorporated by reference now and throughout this document.
- 2.11. The parent Codes, Standards and Regulations are not duplicated in this Technical Design Guide and all still apply in all design and construction taking place at Fort Campbell, KY.
- 2.12. Grayed out items simply means Fort Campbell has no further input besides the parent Codes, Standards and Regulations or the sections are covered elsewhere within this Technical Design Guide.
- 2.13. References may be given throughout this document contained within a Reference Box.
- 2.14. Errors or Omissions in this section of the Technical Design Guide should be brought to the attention of the Directorate of Public Works, Engineering Division, Engineering Design Branch at Fort Campbell, KY.

3. GENERAL REQUIREMENTS AND CONDITIONS

3.1. CONTENTS

- Permit Requirement
- Inclusion of Codes, Guidelines, Regulations, Specifications and Standards
- Exterior Distribution Operating Parameters

- Outages (Electrical Power Interruptions) And Operational Considerations
- Standardization

- Passwords, Access Codes And Keys
- Equipment Locks
- Special Tools Or Peripheral Equipment
- Specialized Training
- Vehicle Access Requirements

- Geospatial Location of Underground & Overhead Equipment
- Vegetation Management Program
- Reliability, Availability, And Maintainability (RAM)
- Equipment Removal List
- Appendix M

3.2. REQUIREMENTS AND CONDITIONS APPLY TO ALL ELECTRICAL WORK

3.3. Permit Requirement

3.3.1. No electric equipment shall be installed within or on any Fort Campbell building, structure, or premises, nor shall any alteration or addition be made in any existing equipment without first securing an Electrical Permit from the Fort Campbell Electrical Inspector in accordance with CAM Regulation 420-4 (Quality Assurance “Electrical” Inspection Standards).

3.3.2. An Electrical Inspection is required for any electrical work, modifications, additions or upgrades to existing electrical systems in any Fort Campbell real property, temporary building or other structures, including:

- mobile homes,
- temporary office trailers,
- recreational vehicles,
- floating buildings; and

- other premises such as:
 - yards,
 - parking,
 - storage,
 - carnival, and
 - other lots and industrial substations.

3.4. Inclusion by Reference of Codes, Guidelines, Regulations, Specifications and Standards

- Data in these sections further refine requirements in the Unified Facilities Guide Specifications (UFGS), Unified Facility Codes (UFC), industry Codes, Standards and Regulations.
- All parent Codes, Standards and Regulations apply to all projects, regardless if they are directly referenced.
- Include all features listed below into project design and contract documents specifications as they apply.
- See the Codes Specifications Regulations and Guidelines Attachment.
- See Appendix M for further electrical requirements

3.5. Exterior Distribution Operating Parameters

- Fort Campbell maintains real and operational ownership of all equipment under its jurisdiction.
- Any action of connecting (closing) to or disconnecting (opening) from the Fort Campbell electrical system equipment to Contractor equipment installed on Fort Campbell electrical property shall be performed by Fort Campbell Government employees, unless express, written permission is given as described below.
- Fort Campbell electrical system equipment includes, but is not limited to, any installed Government exterior electrical equipment (e.g. jacks, switches, etc.).
- The Director of the Directorate of Public Works or his designee may give express, written consent for non-Fort Campbell personnel to connect to or disconnect Fort Campbell electrical system equipment on a case-by-case basis. The Contractor shall maintain any consent document at the jobsite closest to the connect/disconnect point for inspection by Fort Campbell government personnel or their designees.
- Contractor's Temporary Construction Facilities shall not be installed on Fort Campbell equipment (i.e. utility poles) but shall have power run from Fort Campbell equipment to Contractor installed equipment (i.e. contractor installed utility pole upon which the Contractor has installed his equipment (e.g. transformers)).
- An inspection shall be made by a Fort Campbell's electrical inspector prior to any connecting to the Fort Campbell electrical system equipment.
 - The inspector shall give both verbal and written notification of either a passed or failed inspection.
 - Any deficiencies to the installation identified in the Inspection shall be corrected prior to an connection activity.
 - Another inspection shall be made after all corrections have been accomplished.
 - No connection activity shall be made prior to the installation passing the inspection.

- On projects with electrical distribution equipment which will be turned over to Fort Campbell when the project is completed (DD Form 1354, Transfer and Acceptance of DoD Real Property), the inspection process shall be the same as outlined above. Liability for damage to current Fort Campbell equipment caused by connecting to the ongoing project connecting should be discussed with all parties.

3.6. Outages (Electrical Power Interruptions) And Operational Considerations

3.6.1. Granting Outages

- Electrical outage may be granted where:
 - necessary to perform work safely,
 - the mission need is not compromised,
 - properly coordinated, and
 - timely public notification is given to impacted units/customers.
 - Fort Campbell reserved the right to deny electrical outages for operational reasons.
 - if initially denied, the requester shall work with DPW to arrive at a different, approved time for the outage.

3.6.2. Outage Time Limits

- Planned electrical outages shall be generally limited to four to eight (4-8) hours.

3.6.3. Outage Notification

- For major outages, Fort Campbell requires sufficient time to advertise the outage for at least 2 weeks prior to outage occurrence.

3.6.4. Sub-Transmission and Distribution Operational Configuration Changes

- Where the contractor needs a portion of the sub-transmission and/or distribution system reconfigured for construction or testing activities, they shall:
 - give the Fort Campbell Exterior Electrical (ED) shop at least a forty-eight (48) hour notice of the changes,
 - provide the Fort Campbell Exterior Electrical (ED) shop with a detailed list of changes or configurations needed,
 - require a pre-configuration change briefing for contractor personnel and the Fort Campbell Exterior Electrical (ED) shop personnel,
 - remember, connecting to or disconnecting from the Fort Campbell electrical system equipment to Contractor equipment installed on Fort Campbell electrical property shall be performed exclusively by Fort Campbell Government employees unless otherwise authorized.

3.6.5. Outage Coordination

- Contractor shall coordinate with the Fort Campbell Exterior Electrical (ED) shop and the Fort Campbell Housing office to schedule all outages necessary to perform work safely. See below for outage requirements in the housing areas.
- The contractor(s) shall meet with the Fort Campbell Exterior Electrical (ED) shop

personnel to coordinate all outages and to discuss outage purpose and length.

- The contractor shall give Fort Campbell Exterior Electrical (ED) shop at least a twenty-four (24) hour notice of outage requirements.

3.6.6. Outages In Housing Areas

- Fort Campbell Housing office requires a minimum three (3) day notice prior to any scheduled outage.
- Scheduled outages effecting housing areas shall commence not earlier than 9:00 A.M. Contractor should stage work accordingly.

3.7. Standardization

- Fort Campbell's goal is to standardize equipment and systems as much as possible.
- Standardization allows improved reliability, better maintenance practices and saves both personnel and financial resources.
- Fort Campbell's preferences, where they exist, shall be made available to the Contractor.
- In each category where the designer's choice is not one of Fort Campbell's preferences, the design shall show why the standardization requirements cannot be met before DPW-EDB will approve other manufacturers.
- Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer.

3.8. Passwords, Access Codes And Keys

- All passwords and access codes changed or reset by the contractor during construction shall be cleared to factory defaults and verified by DPW personnel at acceptance.
- The Contractor shall provide the current, correct password(s)/codes to all installed equipment at the time of acceptance.
- DPW personnel shall verify the current, correct password(s)/codes to all installed equipment at the time of acceptance.
- All keys required for access to areas or equipment which does or shall belong to Fort Campbell upon acceptance, and used by the contractor during construction, shall become the exclusive property of Fort Campbell at acceptance.
- DPW personnel shall verify all keys are accounted for and function as required at the time of acceptance.

3.9. Equipment Locks

- Enclosures outside substations which have the potential for medium voltage exposure shall be lockable using an approved padlock.

3.10. Special Tools Or Peripheral Equipment

- The contractor shall provide and turn over to the contracting officer any special tools, computer-based interfaces, relay interface terminals, software, etc., required for operations and maintenance of the new equipment that will assist maintenance personnel maintain the facility.

- When special tools or peripheral equipment to repair, operate, maintain, or program they shall be provided to DPW at the time of transfer. This applies to all equipment, sub-systems and systems including fire alarm equipment and fiber optic systems. Contract language shall state that:
 - necessary tools or equipment shall be provided to the DPW, and shall be new at the time of transfer.
 - necessary interface devices (e.g. computer-based interfaces) shall be provided to the DPW, and shall be new at the time of transfer.
 - necessary software shall be provided to the DPW, and shall be the latest version at the time of transfer.

3.11. Specialized Training

- The contractor shall provide and schedule all appropriate and necessary specialized training required for the use computer-based interfaces, relay interface terminals, equipment, tools, or software to maintain any equipment, sub-systems and systems including fire alarm equipment and fiber optic systems for DPW personnel.
- Training shall be given by factory authorized personnel.

3.12. Vehicle Access Requirements

- Designs must allow for free and easy access and movement of the exterior electrical shop bucket and line trucks.
- Contractors should take DPW shop vehicle weights and physical size into consideration when designing access to poles, transformers, switches, or other electrical equipment, especially across sod/soil areas.
- All driving areas must be properly prepared to prevent vehicles sinking under wet conditions.
- Sidewalks, across which service trucks travel, should be of sufficient strength to support the truck loads without damage.
- Access through fenced areas should be anticipated and gates of sufficient size should be provided.

- Specifications for the current largest (100' reach) bucket truck are:
 - International Freightliner
 - Model: 7400 SBA
 - Date: 9 Oct 2006
 - Drive: 6x4
 - Wheelbase: 675cm - 22.15 feet
 - GVWR: 58,000 Lbs.
 - Front Axle: 18,000 lbs
 - Rear Axle: 40,000 lbs
 - Overhang: ~9 feet
 - Turning Radius: ~40 feet

3.13. Geospatial Location of Underground & Overhead Equipment

3.13.1. Equipment Identification System

- Fort Campbell maintains equipment numbering convention is used to assign numbers to all sub-transmission and distribution equipment, sub-systems and systems in the Global Information System (GIS) system.

3.13.2. Identification Assignment

- The assignment of numbers is performed by Fort Campbell personnel.
- The Contractor shall ask for guidance from the Electrical Engineering Section should a class of equipment not have a naming/numbering convention.

3.13.3. Global Information System (GIS)

- The Contractor shall document the underground and above ground geospatial location of all conduits, conductors and equipment for incorporation into the Fort Campbell Global Information System (GIS) layers (sub-meter accuracy).
- Requirements are further defined in Global Information System (GIS) Documentation Requirements (Electrical).
- The form used to fulfill the documenting requirements is the GIS Documentation Verification Spreadsheet.

- The contractor shall coordinate with the IGI&S Manager for all new layers, additions or corrections of the required GIS layer. Digital Data shall be prepared and maintained according to the following specifications:
 - All digital data and associated geospatial data, at a minimum, must comply with the latest version of Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) available at <http://www.sdsfieonline.org/> with additions and corrections developed by Fort Campbell. All Attributes in the SDSFIE shall be considered as required until, and unless, otherwise specified in writing by Fort Campbell.
 - The coordinate system used to maintain digital data will be the Tennessee State Plane Coordinate System (TN SPCS). The datum used will be the North American Datum of 1983 (NAD83). The mapping unit will be 'US foot'. The vertical datum used will be the North American Vertical Datum 1988 (NAVD1988).
 - The digital geospatial data will be 99% free of topological errors including, but not limited to: the absence of dangling nodes, undershoots, overshoots, and snapped nodes for line segments; the existence of features that have area (square footage) will have polygon representations (per SDSFIE).

3.13.4. Reports

- Reports associated with the GIS identification numbering shall be in a tabular format, referenced to the Fort Campbell identification numbering convention and the SDSFIE in Microsoft Excel format.

3.14. Vegetation Management Program

- To “Ensure that the landscaping provided does not interfere with overhead power lines when it reaches maturity”, Fort Campbell authored the Vegetation Management Program as listed in APPENDIX M, Electrical Requirements.
- The contractor shall not install equipment, sub-systems or systems where the existing vegetation does not meet the requirements of the Vegetation Management Program.
- The contractor shall not plant vegetation which will violate the letter and spirit of the Vegetation Management Program.

3.15. PHOTOGRAPHS

3.15.1. TAKING PHOTOGRAPHS

- All persons must have signed approval to take video, still or digital photos (including a cell phone) on any part of Fort Campbell.
- For each individual seeking permission, the Contractor must provide written request(s) to the Contracting Officer for approval.
- If the request is granted, the government representative will leverage internal resources to provide the contractor with the needed documentation.

3.15.2. JOBSITE PHOTOGRAPHS

- As required by DPW, the contractor shall provide a photographic record of specific work accomplished and certain equipment attributes with the following characteristics:
 - Format: Digital photographs of the final installation in electronic .jpeg format.
 - The digital camera used must be capable of taking photographs with at least 5 megapixels.
 - All photographs shall free of glare or reflections and correctly focused.
 - Each photograph file size should be at least 2 megapixels.
 - A Microsoft Excel document shall be furnished to include the Service Order/CLIN contractor's photograph file name, and any information necessary to identify the photograph.

- New installations shall be photographed from at least three sides (compass orientations).
- The photographs shall be sufficient for a third party to determine all equipment necessary to replicate the installation.
- Photographs shall show the overall installation and details installation.
- If multiple pieces of equipment are installed under an individual Service Order/CLIN, each piece of equipment, and its associated hardware, shall require a complete set of pictures as if it were a project in and of itself.
- Nameplate Data – the contractor shall supply photographs of complete nameplate(s) data for all equipment with nameplates. The format shall be both photographic and in Microsoft Word or Microsoft Excel format.

- Underground Installation - all underground installations shall be photographically documented prior to burial.

3.16. Reliability, Availability, And Maintainability (RAM)

- Fort Campbell must be able to maintain minimal Mission and Non-Mission capabilities in most buildings even when the partial loss or reduction in off-site power supply or the loss of one or more installation substations greatly reduces total electrical power availability.

- Non-Mission facilities
- Building/facility electric loads should be split into Life/Health/Safety and non-Life/Health/Safety loads.
- Separate busses should be installed for each load category.
- A separate transformer should feed each load category buss.

- Mission & C4ISR facilities
 - Contractors shall consult TM 5-691 – (UTILITY SYSTEMS DESIGN C4ISR FACILITIES) for command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR) facilities.
 - For non-C4ISR facilities, building/facility electric loads should be split into Technical, Emergency and Nonessential loads categories as described in TM 5-691.
 - External and internal electrical designs should conform to TM 5-691 (RELIABILITY/AVAILABILITY OF ELECTRICAL & MECHANICAL SYSTEMS FOR COMMAND, CONTROL, COMMUNICATIONS, COMPUTER, INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE (C4ISR) FACILITIES).

3.17. EQUIPMENT REMOVAL LIST

- When currently installed equipment is removed, or is to be removed, as a result of a project or maintenance action, the contractor shall compile a report using the associated equipment GIS identification numbering (see Reports) of all equipment.
- This report shall be forwarded to the appropriate System Engineer.

3.18. APPENDIX M

- See APPENDIX M, Electrical Requirements for further electrical requirements.

3.19. GENERAL REQUIREMENTS AND CONDITIONS

3.20. USDA – RURAL UTILITY SYSTEM

- Were possible, Fort Campbell uses the UNITED STATES DEPARTMENT OF AGRICULTURE, Rural Development Utilities Programs, BULLETINS and Associated Documents for all exterior electric utilities.

3.21. SUB-TRANSMISSION AND DISTRIBUTION VOLTAGES

- Fort Campbell's sub-transmission voltage is 69kV, delta.
- Fort Campbell's distribution voltage is 12.47/7.2 kV, wye.

3.22. VOLTAGE CLASSIFICATIONS

- For purposes this Technical Design Guide, voltage levels are defined as:
 - Low Voltage < 1,000V
 - Medium Voltage $\geq 1,000V$ and $\leq 63,000V$
 - High Voltage > 63,000V and < 230,000V

3.23. GROUNDING

- A minimum of two (2) grounding conductors shall be supplied to each of the major equipment (i.e. transformers, voltage regulators, circuit breakers) pads and connected to the equipment.

- All conductor to conductor (wire-type) grounding connections shall be connected using exothermically welding or with range-taking compression tap connector.
- All connections to Driven Ground Rods shall be exothermically welded or use compression connector.
- All grounding connections to structural metal frames of buildings or structures shall be bolted, riveted, welded or compression (i.e. range-taking compression tap connector).
- Equipment pad grounding conductors shall be a minimum 4/0 CU.
- Ground rods are required.
- Grounding shall not be accomplished at water lines.
- Split-bolts, or any reversible type connector, shall not be used on any substation grounded or grounding connections, including above ground.
- Split-bolts, or any reversible type connector, shall not be used on any exterior grounding system.
- Steel poles shall be supplied with factory, bolted, grounding connections.

3.24. COLOR CODING

- Provide for service, feeder, branch, control, and signaling circuit conductors.
- Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each.
- If MC cable assemblies are used for branch circuits, the ungrounded conductors shall be factory impregnated with the color to match the phase circuit to which it is connected.
- Color of ungrounded conductors in different voltage systems shall be as follows:
 - 208/120 volt, three-phase
 - Phase A - black
 - Phase B - red
 - Phase C - blue
 - 480/277 volt, three-phase
 - Phase A - brown
 - Phase B - orange
 - Phase C - yellow
 - 120/240 volt, single phase: Black and red
 - On three-phase, three-phase, four-wire delta system, high leg shall be orange, as required by NFPA 70.

3.25. New Equipment

- All equipment installed on Fort Campbell shall be new (within three years of manufacture) unless authorized in writing by the DPW Authority Having Jurisdiction.

- Rebuilt or reconditioned parts, equipment, sub-systems or systems shall be not installed unless required due to the age or availability of repair/replacement parts.
- If the use of rebuilt or reconditioned parts, equipment, sub-systems or systems is authorized, all such items shall have never contained, or shall not now contain, Polychlorinated biphenyl (PCB).

3.26. Workmanship

- In addition to the mandatory and advisory provisions of NFPA 70, NESC and other Codes, Guidelines, Regulations, Specifications and Standards, workmanship requirements in on Fort Campbell shall be in compliance with the Standards and Recommendations of the National Electrical Contractors Association (NECA). APPENDIX N - Criteria, Specifications, Codes, Regulations and Related Electrical Engineering Requirements, contains a partial list of the NECA standards and recommendations.
- Contractors shall:
 - Lay out work in advance.
 - Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work.
 - Repair damage to buildings, piping, and equipment using skilled craftsmen of the required trade.

----- END OF SECTION -----

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Section 33 70 02.00 10 Electrical Distribution System, Underground

Ft. Campbell Requirements:

3.27. NORMAL REPAIR

- Reserved

3.28. EMERGENCY REPAIR

- Reserved

3.29. Underground Structures - Manholes

- 3.29.1. Manholes shall be used for all medium voltage applications.
 - All in-line splices must be in underground structures.

- Manholes must allow enough space so that personnel are able to enter and work within its confines.
- Manholes must allow enough space so that all phases of all medium voltage conductors may be “looped” around the insider perimeter of the manhole.
- Cables shall be routed around the interior walls and securely supported from walls on cables racks.
- Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables and maintain cable separation in accordance with IEEE C2 (UFGS SECTION 33 70 02.00 10)
- Medium voltage conductors installed in/through a manhole shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.

3.30. Underground Structures – Handholes

- Do not use handholes for splicing shielded power cables.
- Handholes can only be used for airfield lighting circuits and for low-voltage and communication lines.

3.31. Underground Structures – Prohibitions

3.31.1. The following equipment is PROHIBITED inside underground structures:

- Load junctions.
- Power distribution equipment, including transformers and switches.
- Separable splices (bolt-T or split-bolt connections) including bonding shielding or concentric neutral(s).
- T-splices and Y-splices on medium voltage systems of any rated voltage.

----- END OF SECTION -----

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**Section 33 71 01.00 40
Overhead Transmission and Distribution**

Ft. Campbell Requirements:

3.32. NORMAL REPAIR

- Reserved

3.33. EMERGENCY REPAIR

- Reserved

3.34. UNDERGROUND vs. OVERHEAD

- Where possible, feasible and practicable new electrical distribution lines shall be installed underground.

3.35. OIL-FILLED EQUIPMENT

- Fort Campbell prefers Envirotemp™ FR3™ fluid
- Mineral oil may be used as a coolant in oil-filled equipment

3.36. DISTRIBUTION SYSTEM CONFIGURATION

- Distribution lines shall be designed for maximum system flexibility.
- Use loop feed where practicable to create redundancy.
- In housing areas utilizing underground distribution, run separate feeds from transformer to each apartment.
- The contractor shall attempt to keep all exterior distribution on one side any given street.

3.37. UTILITY POLE SPACING

- Contractor shall design for the minimal number of utility poles reasonable within the design.
- Contractor shall not place additional poles between two existing poles if possible.

3.38. ORPHANED UTILITY POLES

- An utility pole from which all exterior distribution or service conductors have been removed is classified as an orphan pole.
- This classification does not include stub poles designed for guying.
- This classification exists even if other non-distribution system conductors remain on the pole (non-bare).
- The COR/Contractor shall contact the owner of conductors remaining on the orphan (non-bare) pole to have the utilities removed.
- Removal can be placing them on another non-orphaned pole, or removing them completely.
- All orphan poles shall be removed.

3.39. UTILITY POLE PROFILE

- Reserved

3.40. WOODEN UTILITY POLES

- Contractors shall specify wooden poles with 20 year minimum life span.
- Contractors shall specify class 2 wooden poles when transformers or capacitor banks are installed on them.
- For wooden poles class 2 or less, contractors shall specify either class 2 or class 4. Class 5 or below wooden poles are not permitted.

3.41. UTILITY POLE HARDWARE

- Use eye bolts, bolt eyes, eye nuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises wherever required to support and to protect poles, brackets, crossarms, guy wires, and insulators.

3.42. STEEL POLE & SWITCH PLATES

- Steel poles shall be supplied with factory, bolted, grounding connections.
- All steel poles shall be installed with a separate ground rod and conductor.
- All guys to all steel poles shall have fiberglass guy strain insulators installed on all guys.
- Switch plates shall be properly grounded and flexible cable used as required by code.
- During construction all equipment, including steel poles, shall be properly stored (i.e. cribbing) per manufacturer's requirements.

3.43. CROSS ARMS

- All new and replacement cross arms shall be fiberglass.
- The current cross arms in use are 2000 & 3000 from GEOTEK (<http://www.pupicrossarms.com/>)
- All new and replacement cross arms shall be at least eight (8) feet long.
- Wooden cross arms shall not be used.

3.44. GUYING

- Calculations shall be performed using appropriate software for all guy placements (NESC)
- Guy strands shall be either 3/8" or 1/2" in diameter
- Standard and street guys shall meet all NESC requirements
- Guy guards shall be placed on every guy wire
- Fiberglass-reinforced plastic guy strain insulators (minimum 36") and extension links shall be used for all connections to the pole above the neutral position.

3.45. GUY WIRE PROTECTION

- Guys placed in traffic areas (e.g. parking lots) or in areas where the risk of vehicular impact might be anticipated (i.e. within one foot (1') of a paved surface) shall be protected by a physical barrier (e.g. bollards, un-mountable curb).

3.46. MOUNTING HARDWARE

- All equipment mounting brackets shall be aluminum.

3.47. SINGLE PHASE OVERHEAD RECLOSERS

- Single phase, overhead reclosers shall be oil-less and fit into existing fuse cutouts.
- TripSaver® II Cutout-Mounted type (S&C Electric Company) meet this requirement

3.48. OVERHEAD SWITCHES AND CUT-OUTS

- All overhead switches and cut-outs shall be of the load break type
- Insulators shall be polymer

3.49. OVERHEAD LINES

- Overhead lines shall be ACSR
- Copper (CU) shall not be used as overhead distribution conductors

3.50. POLE MOUNTED METERS AND DISCONNECTS

- Conductors from meter base to service equipment inside shall be copper (CU).
- Conductors from the transformer(s) down to the meter base shall be copper (CU).
- Conductors from the transformer(s) down to the disconnect shall be copper (CU).

3.51. SERVICE DROPS

- Copper conductors are preferred for overhead service drops.
- Aluminum conductors may be used with approval from DPW.
- If overhead service has been approved by the installation, use pinless construction.

3.52. UTILITY POLE IDENTIFICATION PLACARD/TAG

- In conjunction with DPW engineers and the Equipment Identification System, contractors shall install an utility pole identification placard/tag on every utility pole installed/replaced under the project.
- The placard/tag shall be of sufficient contrast and letter height to be clearly visible and seen easily by service personnel from the seat of a service truck driving on the nearest roadway.
- The placard/tag shall be approximately six feet (6') above finished grade at the bottom measured from the bottom of the pole, or six feet (6') above the nearest roadway elevation, whichever is higher.
- The placard/tag shall be oriented to face closest point of the nearest roadway.

3.53. MEDIUM VOLTAGE UNGROUNDED CONDUCTOR PHASE INDICATOR PLACARD/TAG

- The contractor shall determine the correct phase of every installed/replaced ungrounded conductor installed under the project.
- The contractor may use either Edgoten or Screaming Eagle Substation as a reference.
- The contractor shall install a placard/tag on every pole/cross arm/structure on which the medium voltage conductor(s) is/are mounted indicating the correct phase of every ungrounded conductor installed under the project.
- The placard/tag may be placed on either side of the pole/cross arm/structure but shall match the existing orientation if one exists.
- The placard/tag shall be of sufficient contrast and letter height to be clearly visible and seen easily by service personnel from the seat of a service truck driving on the nearest roadway.

3.54. SIGN AND PLACARD REQUIREMENTS

3.54.1. Security Sign Requirements

- Material shall be No. 16 US gauge sheet steel with fused porcelain finish 3/32-inch thick with black center and glossy finish white surfaces both sides. Background shall be white and all text shall be black.
- Test style shall be medium Helvetica block type except where bold is specified.
- The centerline of mounting holes shall be located 1-inch from each edge and shall be fitted with brass eyelets. The finished holes shall be suitable for a ¼-inch bolt. Provide 1/8x1x6 inch galvanized strap or other suitable hardware to fasten signs on gates.

3.54.2. Equipment Identification Sign Requirements

- Material shall be No. 18 US gauge sheet steel with fused porcelain finish 3/32-inch thick with black center and glossy finish white surfaces both sides. Background to be white with black letters for all signs except background to be red with white letters for all ground switch signs, or red, white or blue for phase identification signs.
- The small characters shall be 5/8-inch high, 3/32-inch stroke, the large numerals 1 ¾-inch high, 1/4 inch stroke on the equipment identification signs. The large letter on the phase designation sign shall be 4-inches high and ¼-inch stroke.
- The number of 5/8-inch high characters plus the number of places between words for the first and third lines of equipment identification signs shall not exceed 21. Use abbreviations and/or acronyms as necessary to stay within this limit.
- The designation at the bottom of the equipment identification sign is the design designation appearing on control wiring and cable tags.
- Mounting holes shall be located ½ inch from each edge. Mounting holes in porcelain finish signs shall be fitted with brass eyelets. The finished holes shall be suitable for a ¼-inch bolt.
- The 1/8x1x6 bars are not normally required for mounting identification signs.
- Sign length will vary from 8 to 12 inches depending on the number of letters and numbers.

----- END OF SECTION -----

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Section 33 71 02.00 20 UNDERGROUND ELECTRICAL Distribution

Ft. Campbell Requirements:

3.55. NORMAL REPAIR

- Reserved

3.56. EMERGENCY REPAIR

- Reserved

3.57. EXISTING CONDITIONS

- Fort Campbell has a great deal of underground utility lines (both active and abandoned) that do not show up on Installation utility maps.
- Contractors shall coordinate with DPW as soon as possible when designing utilities to be installed underground.

3.58. CONCRETE ENCASEMENT

- All underground, medium voltage conductors shall be installed in conduit (duct).
- All underground, medium voltage conduits (duct) shall be concrete encased.
- All conduit (duct) runs shall include spares in the number of the used conduit(s).

3.59. CABLE TAGS

- Cables shall be tagged IAW the UFGS.

3.60. UNDERGROUND MARKING

- All Electric Lines, Cables And Conduit Installed Underground Shall Be Marked With Magnetic Tape.

3.61. SERVICE ENTRANCE

- Underground service entrance conductors shall be copper installed in conduits.

3.62. CUTTING AND TRENCHING ROADWAYS

- Cutting or trenching through roadways shall be avoided if possible.
- Distribution lines installed under pavement shall be minimized.
- Prior to cutting or trenching through roadways, the contractor shall receive written permission from DPW.
- Patches to cuts or trenches shall extend at least one cut/trench width on either side of the original cut/trench.
- Whenever possible utilities shall be pressure-pumped below roadways.

- When underground utilities are sleeved under roadways, conduit sleeves shall be extended a minimum of 10 feet beyond the roadway on both sides to protect conductors from penetration by new road signs, poles, etc. (Note: this narrows the UFC 3-550-01 requirement of 5 feet).

3.63. DISTANCE BETWEEN MANHOLES AND PULLING TENSION

- The UFGS discusses pulling tension.
- Where the calculated and measured pulling tension can be kept within limits, the contractor may extend the distance between manholes up to six-hundred (600') feet.

3.64. DISTANCE BETWEEN SPLICES OR JOINTS IN MEDIUM VOLTAGE CABLE

- Cables shall have no more than one (1) splice per manhole.

3.65. CONDUIT SIZE – UNDERGROUND INSTALLATIONS

- Minimum conduit sizes shall conform to UFC 3-550-01 EXTERIOR ELECTRICAL POWER DISTRIBUTION.
- Where UFC 3-550-01 is not specific, and to facilitate maintenance and replacement, for all medium voltage underground installations:
 - the contractor shall increase the minimum, code-required, conduit size by at least one and one-half inches (1 ½") above the point where they enter the ground.
 - Example: a pole-mounted 2 inch (2") down-riser shall be increased to four inches (4") before it enters the ground.

----- END OF SECTION -----

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Section 33 73 00.00 40 UTILITY TRANSFORMERS

Ft. Campbell Requirements:

3.66. OIL-FILLED EQUIPMENT

- Fort Campbell prefers Envirotemp™ FR3™ fluid
- Mineral oil may be used as a coolant in oil-filled equipment

3.67. MATERIAL

- Transformer windings shall be copper.
- Aluminum windings shall not be used.

3.68. DEAD FRONT CONSTRUCTION

- Transformers with a medium-voltage compartment shall be dead-front construction.

3.69. kVA RATING

- The nameplate rating for the transformer shall not be less than 90 percent of the KVA demand load calculated for the transformer.

3.70. DELTA

- Delta transformer banks shall not be provided for transformer stations.

3.71. TRANSFORMER FEEDS

3.71.1. Overhead Secondary Feeds

- The Designer shall coordinate with the DPW as to whether a new or replacement feed is to be run overhead or underground.
- Transformers (single and three phase) whose secondary feeds run overhead into a building or facility may be pole or pad-mount type.

3.71.2. Underground Secondary Feeds

- Transformers (single and three phase) whose secondary feeds run underground into a building or facility shall be pad-mount type.

3.72. PAD-MOUNTED TRANSFORMERS AND SWITCHGEAR VAULT (BOX)

- To provide working space length for all medium voltage conductors:
 - the use of a vault (box), instead of a manhole, shall be allowed only under Pad-Mounted Transformers (service transformer) and Switchgear
 - pad-mounted transformers and switchgear shall have a vault (box) installed below them large enough to allow all phases of all medium voltage conductors may be “looped” around the insider perimeter of the vault.
 - medium voltage conductors installed the vault (box) shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.
 - the vault (box) shall be large enough to accommodate easy entry, exit and working of at least two (2) electrical personnel.
 - the vault (box) shall meet all confined space requirement, ventilation, extraction requirements.

----- END OF SECTION -----

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Section 33 75 00.00 40 SWITCHGEAR AND PROTECTIVE DEVICES

Ft. Campbell Requirements:

3.73. GENERAL CONDITIONS

- Medium-voltage switchgear compartments shall be dead-front construction.
- Switchgear with a medium-voltage compartment(s) shall be dead-front construction.
- Primary switching and protective devices shall include:
 - load break switching,
 - fuse protection,
 - medium-voltage separable load break connectors,
 - universal bushing wells and,
 - inserts or integral one piece bushings and surge arresters.

3.74. PAD-MOUNTED TRANSFORMERS AND SWITCHGEAR VAULT (BOX)

- To provide working space length for all medium voltage conductors:
 - the use of a vault (box), instead of a manhole, shall be allowed only under Pad-Mounted Transformers (service transformer) and Switchgear
 - pad-mounted transformers and switchgear shall have a vault (box) installed below them large enough to allow all phases of all medium voltage conductors may be “looped” around the insider perimeter of the vault.
 - medium voltage conductors installed the vault (box) shall have at least one (1) 360° “loop” around the inside perimeter of the manhole.
 - the vault (box) shall be large enough to accommodate easy entry, exit and working of at least two (2) electrical personnel.
 - the vault (box) shall meet all confined space requirement, ventilation, extraction requirements.

Section 33 75 00.00 40 MEDIUM-VOLTAGE UTILITY FUSES

Ft. Campbell Requirements:

3.75. FUSE SIZE/TYPE PLACARD

- The contractor shall install a placard on the pole/structure on which the medium voltage cutout(s) is mounted indicating the fuse size and type calculated by the DOR/EOR to be the correct size.

- The placard shall be of sufficient contrast and letter height to be clearly visible and seen easily by service personnel from the ground around the pole.
- The placard shall be oriented to face the point on the ground where service personnel would be standing when changing the fuse.

----- END OF SECTION -----

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Section 33 82 00 Telecommunications Outside Plant (OSP)

Ft. Campbell Requirements:

See [Section 27 10 00 \(Building Telecommunication Cabling System\)](#) and [Appendix H](#) for further information on outside plant requirements.

----- END OF SECTION -----

CHAPTER 3 Technical Requirements and Instructions Division 43 Process Gas and Liquid Handling, Purification, and Storage Equipment

Section 43 15 00.00 20 Low Pressure Compressed Air Piping (Non-Breathing Air Type)

Ft. Campbell Requirements:

Preferences: Air compressor – Quincy.

----- END OF SECTION -----

Appendix A

Environmental Requirements

PARAGRAPH

- A-1 [Occupational Health Considerations](#)
- A-2 [Clean Air Act](#)
- A-3 [Clean Water Act](#)
- A-4 [Safe Drinking Water Act](#)
- A-5 [TSCA](#)
- A-6 [FIFRA](#)
- A-7 [Solid Waste Disposal Practices](#)
- A-8 [Hazardous Waste Disposal Practices](#)
- A-9 [Emergency Planning and Community Right-To-Know Act](#)
- A-10 [National emission standards for hazardous air pollutants \(NESHAP\)](#)

A-1. Occupational Health Considerations

Ft. Campbell has design Standard Operating Procedures for the following items and they shall be used in preparation of a design:

Confined Spaces:

Contractor shall observe OSHA Regulation 29 CFR Part 1910.146 regarding permitting, entry and working within confined spaces. Contractor is required to submit a work plan to the Contracting Officer's representative prior to entering any confined space.

Hazard Communication Program:

Contractor shall observe OSHA Regulation 29 CFR Part 1910.1200 regarding a written hazard communication program for describing how requirements for labels and other forms of warning, material safety data sheets, and employee information and training will be met. The program will also include a list of the hazardous chemicals known to be present and the methods used to inform employees of the hazards of non-routine tasks.

Lock Out, Tag Out Procedures:

Contractor shall observe OSHA Regulation 29 CFR Part 1910.147 regarding the control of hazardous energy (lock-out/tag-out).

Lock-out/Tag-out for Safety: The Contractor shall use a locking device that secures a valve or lever in the "off" position when a repair, inspection, or construction or new installation is required and also to clean or move any equipment. Making any exception to this rule could result in serious injury and death.

Lock-out: Blocking the flow of energy from the power source to the equipment - and keeping it blocked out - is called a lock-out system. A locking device is usually a key or combination lock arrangement.

Tag-out: Tag-out means placing a tag on the power source to warn co-workers or others not to turn the power on. The information on the tag shall include the name of personnel who put it there, the date, time the work begins, and type of work to be performed.

Basic Rules: Before shut down, the Contractor shall ensure that authorized employees know the type, magnitude, and hazards of the energy to be controlled; and shall verify the method or means of the system. He shall inform all affected employees of the lockout. The equipment shall be turned off, and the Contractor shall lockout energy sources and tag-out at the disconnect point. Any stored or residual energy may be released at that time so the equipment can be tested. The Contractor shall restore energy safely.

----- END OF SECTION -----

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[Return to Appendix A](#)

A-2 Clean Air Act:

A-2.1 Fort Campbell has specific Environmental points of contact, and requirements. These are available at the following Internet site: <http://www.campbell.army.mil/envdiv/cleanairact.html>

A-2.2 Ft. Campbell is a major source for criteria air pollutants and has an Operating permit for both Kentucky and Tennessee. Permitted air sources include boilers, spray booths, aggregate storage piles, etc. Air permit information is to be provided by designers to Ft. Campbell Environmental Division, Air Quality, prior to construction start. If required, construction and operating permits will be obtained by the Air Quality office. Construction permits are based on design while Operating permits are based on actual installation. Data needed for the permit application are on the checklists for **Non-Process Source** and **Vent/Stack** that are included at the end of this Appendix (Figure A-2-1) for designers' use. If required, permits can take 3-6 months to obtain so as much of a lead time will be necessary.

A-2.3 Class 1 ozone depleting substances (CFC's, Halon) shall not be used on any project. Class 2 refrigerants (HCFC's) are close to being phased out of production so Class III refrigerants (HFC's) are preferred.

A-2.4 Emergency generator data must be obtained to determine compliance with new regulations. Please contact the Air Quality office if a new emergency generator is going to be installed.

A-2.5 Ft. Campbell has been designated as an "Attainment - Maintenance" area for ozone. A General Conformity Rule (GCR) analysis will be required for all projects that have the potential to impede the continuation of the attainment status for ozone and to ensure that the action does not hinder air pollution control efforts in the ozone "maintenance" area. The contractor performing the work on a project must provide information as requested on the General Conformity Rule Checklist included at the end of this Appendix and turned into the Air Quality office prior to commencement of construction.

A-2.6 Ft. Campbell Air Quality POC is Patty Lockard, 270.798.9603

FORT CAMPBELL ENVIRONMENTAL DIVISION – AIR QUALITY PROGRAM VENT/STACK CHECKLIST

Date: _____

Organizational Owner/Operator: _____ Interviewer: _____

Facility: _____ Contact: _____ Phone: _____

Bldg. No.: _____ Room No.: _____ Source No.: _____

1. Description of emission (particulate matter, gaseous, mix, species name, etc.)

2. Identify source(s) served _____

3. Are criteria air pollutants emitted? (check one) Yes No

4. Are hazardous air pollutants emitted? (check one) Yes No

5. Does the source also have the potential for fugitive emissions? (check one)
(If yes, describe nature of fugitive emissions in the comment section.) Yes No

6. Has there been a stack test for this source? (check one)
(If yes, attach copy of stack test documents to this form) Yes No

7. Has there been a surrogate stack test for this source? (check one)
(If yes, attach copy of stack test documents to this form) Yes No

Pick-up Duct Data (Not applicable if spray booth exhaust panel(s) are part of design)

1. Hood Type _____

2. Hood Dimensions: Slot Length _____
Slot Width _____
Distance from Hood Face to Contaminant _____
Hood Face Area (Calculated) _____
Measured Air Flow at Hood _____
Measured Face Velocity _____
Hood Static Pressure _____
Duct ID _____
Duct Length to Bldg. Exit _____
Contaminant Capture Temp. _____

Vent Information

1. Inside diameter (ID) at exit _____ (inches; ft - check one)

2. Vent height: a. Above ground _____ (ft)
b. Above roof level _____ (ft)

3. Gas stream exhaust exit temp _____ (°F; °C - check one)

Figure 2-1-1 page 1

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4. Exit velocity _____ (ft/sec), at _____ ° F, _____ (air pressure - note measurement units) and standard conditions (68 ° F and 1 atm) _____ (ft/sec)
5. Exit flow at exit conditions _____ (ft³/min)
Obtained from (check one): calculations test data
Exit flow at standard conditions _____ (dscfm)
6. Stack gas moisture percent at exit conditions _____ % By Weight Volume (check one)
7. Exit plume direction (check one): Up Down Horizontal
8. Exhaust fan data: Horsepower _____ RPM _____ Volume Rate _____ (ft³/min)
9. Air pollution controls installed? (check one) yes no
(If yes, complete and attach Control Device/Technique Checklist)

If the stack/vent serves more than one piece of equipment, submit diagram and identify the units served. Complete the additional applicable process or non-process checklists.

COMMENTS: _____

Figure 2-1-1 Page 2
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**General Conformity Rule Checklist
General Information**

Name of Project: _____

Construction Company: _____

POC Name: _____

Phone Number/Email: _____

Anticipated Start Date: _____ Anticipated End Date: _____

Construction Equipment Listing

Equipment Type	Qty	Hours of Operation	Miles	Fuel Type
Bulldozer				
Grader				
Excavator				
Backhoe				
Dump Truck				
Fuel/Service Trucks				
Tractors				
Pug Mills (on site)				
Concrete Batch Plant (on site)				
Scraper				
Ready-Mix Truck				
Screed, Concrete				
Portable Paint Sprayer				
Air Compressor				
Lay Down Machines				
Rollers				
Compactors				
Water Trucks				
Pavement Stripping Machines				
Traffic Road Striping				
Loaders				

Figure A-2-2 Page 1

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Generators				
Compactors				
Curb and Gutter Pavers				
Other: _____				
Other: _____				

Emergency Generator Information

(This information will be needed for all stationary emergency generators associated with the project, attach a sheet if necessary)

Manufacturer: _____
 Model Number: _____
 Horsepower: _____
 Max. Fuel consumption (gal/hr): _____
 Fuel Type: _____
 Serial number if currently available: _____

Stationary Fuel Burning Equipment

(This information will be needed for all stationary sources such as boilers, hot water heaters, etc that will be installed attach a sheet if necessary)

Type: _____
 Manufacturer: _____
 Model Number: _____
 BTU Value: _____
 Fuel Type: _____
 Serial number if currently available: _____

Personal Occupancy Vehicle Information

Vehicle Type	Qty	Miles driven on Post	Fuel Type
Light Duty Truck			
Heavy Duty Truck			
Car/SUV/Van			

Submitted by: _____ Date: _____

FORT CAMPBELL ENVIRONMENTAL DIVISION – AIR QUALITY PROGRAM CONTROL DEVICE/TECHNIQUE CHECK LIST

Date: _____

Organizational Owner/Operator: _____

Interviewer: _____

Facility: _____ Contact: _____

Phone: _____

Bldg. No.: _____ Room No.: _____

Source No.: _____

1. Control(s) for (describe source): _____

2. Type of controls (check all that apply): equipment technique/strategy
(If technique only, describe in comments)

3. Control for: PM VOC HAP Other (describe) _____

4. Monitoring for: PM VOC HAP Other (describe) _____

5. Type of controls/monitors:

No.	Description	Pollutant	% Control Equip. Eff	Tested? (y/n)	Test date	Cost Equip.
_____	_____ for _____	_____	_____	_____	_____	_____
_____	_____ for _____	_____	_____	_____	_____	_____
_____	_____ for _____	_____	_____	_____	_____	_____
_____	_____ for _____	_____	_____	_____	_____	_____
_____	_____ for _____	_____	_____	_____	_____	_____

(If necessary, continue on additional sheets and attach.)

6. Control Equipment Information:

No.	Equipment Manufacturer	Model No.	Serial No.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

7. Obtain copy of technical specifications and attach (includes specifications for panel filter products)

8. Obtain copy of test results and attach

9. Complete applicable control equipment form(s) and attach

10. If answer to No. 9 is "yes", list the control devices for which capture efficiency tests have been completed _____

11. Tests for capture efficiency accomplished? (check one) Yes No
(If yes, obtain copy of procedures and results and attach)

Figure A-2-3 Page 1

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- 12. Estimated capture efficiency, if not tested _____%.
- 13. Installation/construction costs _____
- 14. Annual operating costs _____

COMMENTS: _____

FILTER UNIT (OTHER THAN PANEL DRY FILTERS)	
1. EMISSION POINT NUMBER OF FILTER UNIT:	
2. MANUFACTURER:	3. MODEL NAME AND NUMBER:
4. FILTERING MATERIAL:	5. FILTERING AREA:
6. CLEANING METHOD: <input type="checkbox"/> Shaker <input type="checkbox"/> Reverse Air <input type="checkbox"/> Pulse Air <input type="checkbox"/> Pulse Jet <input type="checkbox"/> Other (specify) _____	
7. GAS COOLING METHOD: <input type="checkbox"/> Ductwork: Length _____ ft; Diameter _____ inches <input type="checkbox"/> Heat Exchanger <input type="checkbox"/> Bleed-in Air <input type="checkbox"/> Water Spray <input type="checkbox"/> Other (specify) _____	
8. GAS FLOW RATE (from source) _ scfm (at 68°F)	9. COOLING GAS FLOW RATE: Bleed-in Air _____ scfm (at 68°F) water spray _____ GPM
10. INLET GAS CONDITION: Temperature ____ °F; Dewpoint ____ °F	11. EFFICIENCY OF FILTER UNIT:

SCRUBBER	
1. EMISSION POINT NUMBER OF SCRUBBER:	
2. MANUFACTURER:	3. MODEL NAME AND NUMBER:
4a. TYPE OF SCRUBBER: <input type="checkbox"/> Venturi <input type="checkbox"/> Wet Fan <input type="checkbox"/> Packed; Packing type _____, Size _____, Packed height _____ inches <input type="checkbox"/> Spray; Number of Nozzles _____, Nozzle Pressure _____ psig <input type="checkbox"/> Other (specify) _____ (Attach description and sketch with dimensions)	
4b. Pressure Drop Across the Scrubber _____ inches H ₂ O	
5. TYPE OF FLOW: <input type="checkbox"/> Co-current <input type="checkbox"/> Countercurrent <input type="checkbox"/> Cross-flow	
6. SCRUBBER GEOMETRY Length in direction of Gas Flow _____ ft; Cross-sectional area; _____ sq. ft.	
7. CHEMICAL COMPOSITION OF SCRUBBING LIQUID:	
8. SCRUBBING LIQUID FLOW RATE: _____ GPM	9. GAS FLOW RATE: _____ scfm (at 68°F)
10. INLET GAS TEMPERATURE: _____ °F	11. EFFICIENCY OF SCRUBBER: _____ %

Figure A-2-3 Page 3

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PANEL (DRY) FILTER SYSTEMS FOR PM	
1. EMISSION POINT NUMBER OF CONTROL EQUIPMENT:	
2. MANOMETER Circle YES NO:	3. MAXIMUM PRESSURE DROP ACROSS SYSEM: PSIA
4. FILTER MANUFACTURER:	5. FILTER MODEL NAME AND NUMBER:
6. CAPTURE EFFICIENCY % (from MSDS or system specifications): TPM: PM10: PM2.5	7. FLOW RATE TO CONTROL SYSTEM/EQUIP (cfm)
8. FILTERING MATERIAL (from MSDS or equipment specifications):	9. DIMENSIONS (length x width) OF FILTER PADS (provide units of measurement)
10. HEPA FILTERS INSTALLED? Circle YES NO	11. TOTAL NUMBER EXHAUST FILTER BANKS:
12. TOTAL NUMBER OF FILTERS PER BANK:	13. NUMBER OF STAGES PER FILTER CELL:
PROVIDE SKETCH OF EXHAUST FILTER SYSTEM BELOW IF VENDOR/MANUFACTURER DOCUMENTS DO NOT PROVIDE IMAGE	

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DESCRIPTION AND SKETCH, WITH DIMENSIONS, FLOW RATES AND EFFICIENCY OF "OTHER" CONTROL EQUIPMENT.

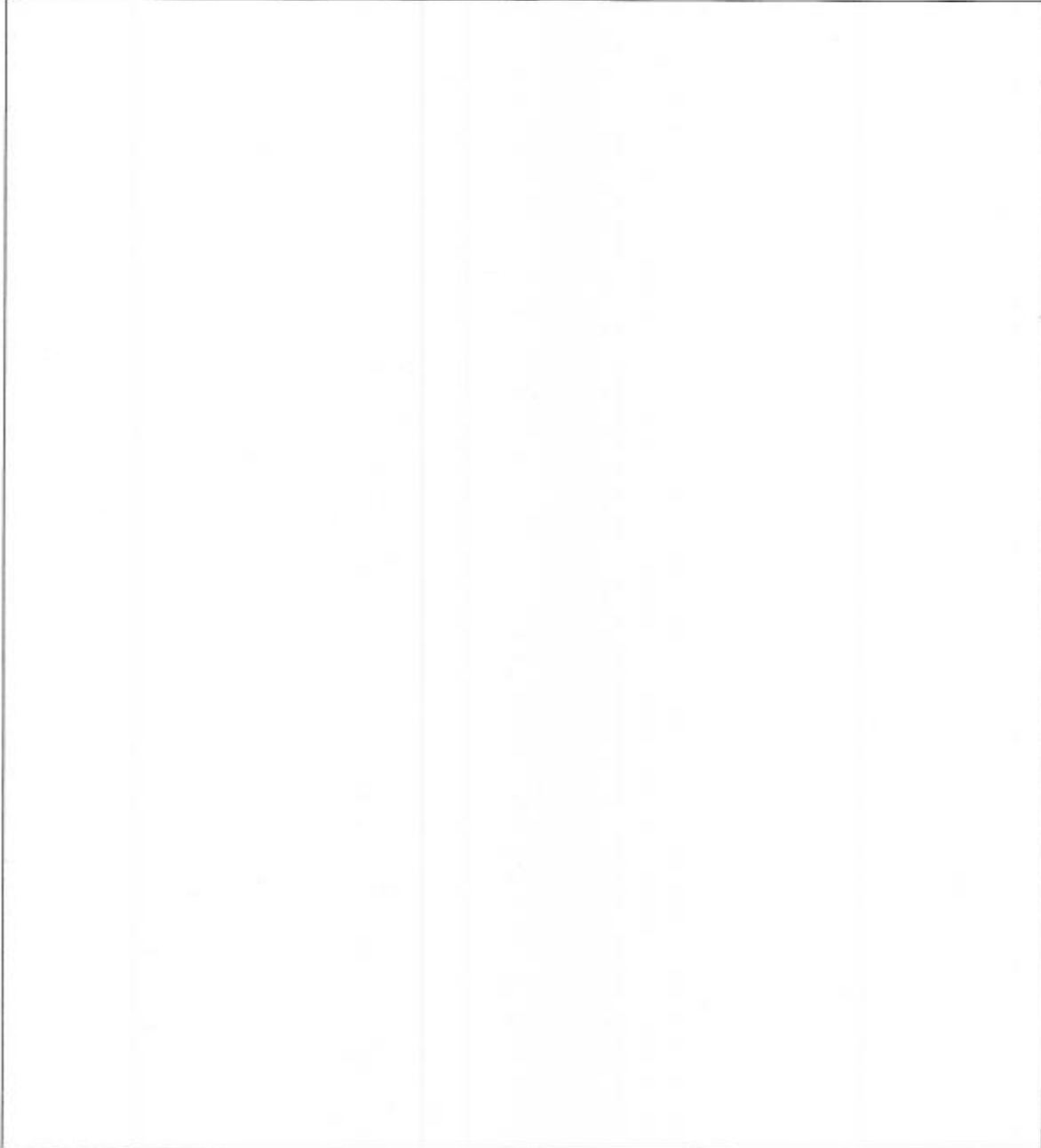


Figure A-2-3 Page 5

**AIR QUALITY ISSUES CONCERNING CONSTRUCTION PROJECTS
FORT CAMPBELL**

ISSUE	STATEMENT TO BE INCLUDED
GENERAL CONFORMITY RULE (GCR)	<p><u>OZONE:</u> The current status for Fort Campbell is that the installation has been designated an ozone "maintenance" area in 2005. The maintenance plan requirements will be designed to maintain the average ozone concentration levels at or below the maximum allowed to sustain compliance with the National Ambient Air Quality Standards. The redesignation as an "attainment maintenance area" will be in effect for 12 years. During this time Fort Campbell Air Quality will have to establish that all construction activities will not impede the continuation of the attainment status and ensure the action does not impede Kentucky or Tennessee air pollution control efforts in ozone "attainment maintenance areas". This is referred to as the General Conformity Rule (GCR). The rule requires that an analysis and other procedures (if required as a result of the analysis) be completed prior to the commencement of any of the project activities. In order to make the determination, the Air Quality Program will need to gather information from the contractor concerning equipment types, hours of operation, number of personnel, etc. and then do calculations for estimated emissions. This process needs to be started as soon as the contractor is known, because it is required to be completed prior to groundbreaking. Once awarded, please have the contractor contact the Air Quality office at (270) 798-9598 or (270) 798-9603.</p> <p><u>PM2.5:</u> Nonattainment designations for particulate matter (PM) are based on 3- year averages of either each years' annual average concentration (annual average) or on a 24 hour average basis (a rolling 24 hour avg.). Exceedance of either standard can result in an area being classified as nonattainment. Trends indicate that within the next few years Fort Campbell has a strong possibility of being designated nonattainment for PM2.5. If that should occur, PM2.5 will be considered and added to the GCR process as stated above.</p>
Fuel Burning Equipment (Natural Gas and/or Fuel Oil)	Boilers \geq 10 MBTU or any boiler that uses fuel oil, contact the Air Quality Program with specifications for boilers. Hot Water Heaters \geq 120 gallons, contact the Air Quality Program with specifications for hot water heaters. The Air Quality Program will submit the Boiler NESHAP Notification to EPA.
Concrete/ Asphalt	Recommend that document include requirements concerning whether operations of concrete batch plant/asphalt plant (including any use of a pug mill) will be on or off post. If on post, need capacity and other design data to determine if air permits would be required and to determine other CAA related compliance issues. Approximately 120 day lead time to obtain state operating permit.
Debris Burning	Recommend inserting the statement "air pollution restrictions applicable to this project do not allow materials to be burned on the Government premises."
Debris Disposal	Recommend that document include requirements concerning disposal of debris. If the debris is to be sent to a grinder for recycling, need to know if the grinding equipment will be on or off post and if on-post, will need to obtain grinder capacity (tons/hour) and design in order to determine if air permitting and other CAA related compliance issues apply. Approximately 120 day lead time to obtain state operating permit.
Dust	Recommend inserting the statement "maintain all excavations, stockpiles, access roads, waste areas, and all other work areas free from excess dust to such a reasonable degree as to avoid causing a hazard or nuisance".
Ozone Depleting Chemicals	Recommend inserting a statement requiring any refrigerants to have an ozone depleting potential (ODP) of 0.05 or less.

Figure A-2-4

----- END OF SECTION -----

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A-3 Clean Water Act:

A-3.1 Ft. Campbell POC is Dan Etson at 270-798-9784.

A-3.2 Ft. Campbell processes approximately 3 million gallons of potable water per day. The high has been 13 million gallons. The desire is to not exceed this. Fort Campbell water and wastewater has been privatized. Contact CH2MHill (Chris Semler 931-980-7223)

A-3.3 Water volume calculations need to be submitted. There is a two to three month review time by State. Can walk permit through. Storm water shall not discharge into sanitary sewer.

A-3.4 When sinkholes are encountered close them, and route water to natural storm drainage patterns. Must have permit from Tennessee to close sinkhole. Double sandbag or hay bales if sinkhole is part of the drainage pattern on a construction site.

A-3.5 If water is discharged into Kentucky, then Kentucky permit will be required.

A-3.6 If oil/water separators are used then design shall be the open top type. Contact CH2MHill (Chris Semler 931-980-7223) for design details.

A-3.7 Specifications and sizing data for construction of the grease interceptor are available to the design team. Designer will contact Gary Sewell for this information. State of Tennessee has sizing criteria. Grease interceptors shall be located for ease of access for cleaning by pumper truck.

A-3.8 Pollution prevention plan must be maintained during construction. Notice-of-intent is required prior to moving any earth.

A-3.9 See Specification [Section 01 57 20.00 10, Environment Protection](#). Specifications must address spill containment for contractor and should contain language for servicing of construction vehicles. Five copies of Spill Contingency Plans shall be specified. The Contractor shall be required to mail or submit one copy of a Spill Contingency Plan to:

Russ Godsave
Environmental Division, DPW
Building 871, Bastogne Ave
Ft. Campbell, KY 42223

And, four copies to the Contacting Officer. The Contractor shall not start work until the Spill Contingency Plan is approved by the Contracting Officer. If the contract does not require any plan for a specific project, he shall apply for an exception to the Contracting Officer with a copy to Mr. Etson, Environmental Division at address indicated above. For further information or guidelines in order to prepare Spill Plan contact Environmental Division, DPW at 270-798-9641.

A-3.10 Dumping of any liquids on the ground will be considered a release.

A-3.11 Floor drains are not to be provided except where required. They will be provided in a judicious manner, only where necessary. Old sewage system cannot take load. Shower drains are okay but wash-down drains are not acceptable. Mud Rooms must go to sanitary sewer. Discharge cannot adversely affect waste treatment. Biggest concern is volume. Ft. Campbell treatment facility almost maxed out. This is the reason shop wash down is not allowed. Must adhere to approved provisions for washing tents or vehicles. Washing must occur on grass areas.

A-3.12 Must pretreat boiler blow down before discharge due to base sewer toxicity levels being a noted problem.

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A-4 Safe Drinking Water Act (SDWA):

A-4.1 Dead end water lines shall not be installed. Lines must be looped and disinfected. POC CH2MHill (Chris Semler 931-980-7223).

A-4.2 Backflow prevention is required on domestic water only and must be approved by state of Tennessee CH2MHill.

A-4.3 The Reduction of Lead in Drinking Water Act will become effective on 4 January 2014. This law amends the Safe Drinking Water Act (SDWA) to reduce lead in new plumbing materials and establish a formula to calculate the weighted average lead content of a pipe, plumbing fitting or fixture. The revisions to the SDWA require that pipe, pipe fittings, plumbing fittings, and fixtures must meet a weighted average lead content of 0.25%. The law applies only to new construction/installation and future repairs. A summary of the changes is presented in the table below. The full text of the amendment is located at <https://www.govtrack.us/congress/bills/111/s3874/text>.

Summary of Changes – Effective January 2014

Component	Before January 2014	January 2014 and After
------------------	----------------------------	-------------------------------

Solder and Flux	Lead free = 0.2% lead	Lead Free = 0.2% lead
Wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures	Lead free = 8.0% lead	Lead Free = 0.25% lead
Lead pipes, plumbing fixtures, solder, and flux	Prohibited in the installation or repair of any public water system, residential, or nonresidential building	Allowed if used for nonpotable applications; or if they are used for toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are two inches in diameter or larger

DoD employees responsible for oversight of new construction and/or repairs of plumbing systems or components should ensure certified low lead plumbing components are used in these projects. These components have been third party certified to contain equal to or less than 0.25 percent lead by weight. There are two test protocols used to certify low lead plumbing components – NSF/American National Standards Institute (ANSI) Standard 372 and NSF/ANSI Standard 61, Annex G. Both test protocols evaluate the lead content of the plumbing components.

Plumbing products certified to meet the low lead requirement will have certification marks on the product packaging. Low lead plumbing products can also be found on the NSF product and service listings website: http://www.nsf.org/business/search_listings/.

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A-5 Toxic Substances Control Act (TSCA):

A-5.1 Lead paint:

A-5.1.1 Lead-based paint and lead containing paint protection required for working personnel in accordance with OSHA requirements. Lead exposure for air quality will be tested by an exposure assessment for the first building demolished; this data can then be used for the remainder of buildings. If test results indicate that airborne lead levels have not exceeded standards as established by the Clean Air Act, additional testing is not required.

A-5.1.2 Lead-Based Paint Notification Requirements for Work in Family Housing:

A-5.1.2.1 There is a new Federal requirement to notify family housing occupants when work in their quarters will disturb known or suspected lead-based paint (LBP). This requirement became effective 1 June 1999 and will affect all Army Family housing built prior to 1978. This

final rule is issued under the authority of section 406(b) of the Toxic Substance Control Act (TSCA), 15 U.S.C. 2686(b) as amended by the Residential Lead-Based Paint Hazard Reduction Act of 1992 to add Title IV, entitled Lead Exposure Reduction. The Residential Lead-Based Paint Hazard Reduction Act is also referred to as Title X of the Housing and Community Development Act of 1992, Public Law 102-550. A copy of this requirement can be found in the Federal Register, 1 Jun 98, at <http://www.epa.gov/fedrgstr/EPA-TOX/1998/June/Day-01/t14437.htm>.

A-5.1.2.2 The requirement is that whenever maintenance, repair, or renovation is performed in or on an occupied unit and LBP is disturbed (resulting in flaking or dust) that the worker (both in-house and contractor) must provide the occupant a copy of the pamphlet, "Protect Your Family from Lead in Your Home". The Pamphlet can be obtained at <http://www.hud.gov/lea/leadhelp.html>. This is the same pamphlet that is required to be given to occupants by the housing office when they are assigned to quarters containing lead-based paint (per ACSIM Memo, Subject: Disclosure Requirements for Lead-Based Paint Hazards in Army Family Housing, dated 24 Jul 96). The worker must also attempt to obtain from the occupant a written acknowledgment that the occupant has received the pamphlet (sample language on the above web site). These records must be kept for three years. This requirement also applies when work is done in common areas of occupied multi-unit family housing. The Garrison commander (or designated representative, such as the housing manager), as the owner's representative, must also be notified.

A-5.1.2.3 Contractors working in occupied AFH are also required to issue this pamphlet and this should be verified by the Government inspector. Current contracts should be modified as necessary to comply with this new requirement. Pre-1978 AFH units that are certified as free of lead-based paint and units that are vacant due to major renovation or between occupancy are exempt from this requirement. This requirement does not apply to minor repair and maintenance activities (including minor electrical work and plumbing) that disrupt 2 square feet or less of painted surface per component.

A-5.1.2.4 PAINTER-L is a computerized tool currently available to help manage the presence of LBP and LBP hazards. For more information on this system contact Dr. Ashok Kumar, CERL, at 1-800-USA-CERL.

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A-5.2 Radon:

A-5.1.1 Building design must have Radon protection features. In the specifications, Contractor is to be required to test the building for radon after construction is complete.

Radon mitigation design and testing: All construction performed at Fort Campbell must have passive radon mitigation features implemented into the design. The contractor will install preliminary features as per drawings. The contractor will hire an independent testing company to perform radon monitoring prior to habitation of the building(s). The testing firm must be EPA accredited and approved to perform work in the State of Tennessee (Kentucky). A list of

accredited testing firms in the state of TN (KY) can be obtained through the state Radon Program Coordinator (TN 615-532-0733) (KY 502-564-4856). In the event radon concentrations greater than 4 pCi/l (pico curries per liter) are revealed, consult Fort Campbell DPW through the Contracting Officer's Representative for guidance pertaining to retesting. If upon further testing unacceptable levels are present, additional mitigation features will be installed followed by more testing. The buildings will not be inhabited until levels of less than 4 pCi/l have been achieved.

----- END OF SECTION -----

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A-6 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA):

A-6.1. Fort Campbell has an approved insecticide and pesticide list contained in the Installation Pest Management Plan (IPMP). The current IPMP's approved list of pesticides will be used in the preparation of the appropriate contract documents. All insecticide and pesticide work on Fort Campbell must comply with the IPMP.

A-6.2. Contractors will submit a report of the pesticides used, type and amounts, on Ft Campbell to the FIFRA program manager. Applicators of pesticides on Ft. Campbell must be licensed in Kentucky and Tennessee.

----- END OF SECTION -----

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A-7 Solid Waste Disposal/Diversion Practices:

A-7.1 In the interest of reducing waste, Fort Campbell is actively recycling and reducing waste in all operations to meet the installation's 25 year sustainability goals. Contractors are required to participate in on-post programs. They are encouraged to find ways of reducing waste. Recycling shall be practiced to the maximum extent possible. Refuse materials shall be separated in accordance with installation policies and practices.

A-7.2 Dumpster service is not provided by the installation. Contractors shall arrange for dumpster service at their own expense. All waste containers (dumpsters, etc.), that are provided by the project contractor shall be placed within the construction limits of the project. It shall be the contractor's responsibility to remove any non-compatible materials that are placed in the waste containers provided for the project.

A-7.3 Landfill:

A-7.3.1 Contract specifications shall include contract performance requirements for a 50% minimum diversion of construction and demolition (C&D) waste by weight, from landfill disposal. Contract specifications will include submission of a contractor's C&D Waste Management Plan to be submitted and approved by DPW, preferably prior to the start of a site clearance.

A-7.3.2 Point of contact for landfill issues is DPW Environmental Division at 270-798-9769.

A-7.3.3 Landfill Access:

- Upon award of a contract the name of the contractor, the contract number, project name and the completion date of the contract is furnished to the Directorate of Public Works Environmental Division, which will in turn furnish landfill access passes for the contractor's use in delivering C&D debris materials to the Woodlawn Rd. C&D landfill.
- All loads of debris will be weighed and recorded in the landfill data base. Scales are available at the landfill. Each month, tabulation (by contract number) will be furnished to contracting office indicating the amount of debris generated by that contract, if requested. Trucks and/or trailers shall be weighed coming in and going out of the landfill. The vehicle operator shall have a landfill access pass from the contractor to obtain entrance into the landfill. Other information that will be recorded includes whether the load contained asbestos or any other authorized special waste and whether the load contained recyclable materials.

A-7.4 Materials Handling:

A-7.4.1 Demolition and removal activities:

- Contract specifications shall require at least a 50% diversion (by weight) of C & D waste materials such as wood, plumbing fixtures, electrical materials (lights and panels), windows, doors, toilet partitions, HVAC equipment, and scrap metals be diverted from the landfill. Diversion can be accomplished by deconstructing the wood buildings and components per instructions below or by moving the structure off-post. Construction specifications shall require a C & D Waste Management Plan to be submitted and approved by DPW.

A-7.4.1 (a) Salvageable materials shall not to be transported off the installation. Government salvage requirements shall be evaluated on a project by project basis and salvage rights automatically apply for the following equipment:

- Transformers
- Cut-outs
- Capacitors
- Circuit Breakers
- Voltage Regulators
- Line hardware
- Utility Poles

Salvageable metals that are recovered as a result of grinding shall be separated for sale as scrap metal.

- All salvageable materials removed from the project site shall be delivered to DRMO for selling as scrap metal. The Contractor must properly complete the turn in document, DD Form 1348-1a and ensure Fort Campbell funding code (21F3875 1111 76 C S15056 AC 9921) is utilized when materials are turned into DRMO.

A-7.4.1. (b) Non-salvageable materials shall not be removed from the installation. They shall be taken to the Woodlawn landfill or diverted for recycle/reuse as recovered materials. Transporting of non-salvageable materials off the installation must be approved by DPW Environmental Division, Pollution Prevention Branch (NO EXCEPTIONS).

Street surfacing (asphalt/concrete), sidewalks, steps and landing, curbs, gutters, chimneys, etc., and building related concrete and masonry materials shall be ground up at the project site and reused, to the maximum extent possible, on the construction site. When the quantity of ground concrete/masonry materials exceeds the amount that can be used on the project site, the excess shall be transported to a location designated by the COR and approved by the DPW Environmental Division, Pollution Prevention Branch. Materials to be ground shall not be contaminated with other non-masonry/concrete/asphalt materials, such as doors, windows, piping, PVC items, toilet partitions, plumbing fixtures, excess dirt, etc. Reinforcing steel in the concrete is not considered a contaminant.

Whole pieces, no larger than 24" by 36" by 18", of concrete/masonry/asphalt materials generated at the project site may be transported to Woodlawn landfill if the total site quantity does not exceed _____ tons. These materials shall not be contaminated with other non-masonry/concrete/asphalt materials, such as doors, windows, piping, PVC items, toilet partitions, plumbing fixtures, etc. Reinforcing metals/steel in the concrete is not considered a contaminant. Reinforcing steel that is embedded in the concrete, brick, and masonry shall not protrude more than 4 inches beyond the size of the material. The authority to use the Woodlawn landfill for disposal of concrete/masonry/asphalt material shall be specifically stated in the contract documents.

Bricks may be delivered to Woodlawn landfill whole or in pieces, in uncontaminated loads, and recycled to meet diversion requirements unless specified otherwise.

Land clearing waste (trees, stumps, tree branches, bushes, etc.) shall not be delivered to the Woodlawn landfill. This material shall be mulched on the project site and used as soil stabilization, mulch, etc. or transported to Bi County landfill for mulching. Logs cannot exceed a maximum length of 12 feet and diameter of 20 inches. This material can be credited to recycling if used as stated.

A-7.4.2 New Construction Activities and Contracts:

• It is the contractor's responsibility to insure that all new construction C & D materials disposal meets the 50% diversion criteria. Waste recyclable materials, such as cardboard, paper, scrap metals, pallets, etc., shall be recycled and not landfilled. Evidence that this diversion criteria is met shall be maintained in a data log for the duration of the project by the contractor and provided to the project COR or the project engineer. Assistance in identifying recycler outlets can be obtained from DPW Environmental Division.

----- END OF SECTION -----

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A-8 Hazardous Waste Disposal Practices:

A-8.1 Mercury containing light bulbs such as fluorescent tubes, mercury vapor, metallic halide, and high-pressure sodium lamps shall be considered hazardous wastes and require special handling. Fluorescent, mercury vapor, metallic halide, and high pressure sodium light bulbs, while not a listed hazardous waste, may be a characteristic hazardous waste and therefore subject to testing and proper disposal as per RCRA. These lamps are a concern at Fort Campbell in regard to their disposal. Disposal of these materials resulting from demolition or other DPW related activities, shall be coordinated with the DPW Environmental Quality Officer for the policy contained in Section 11 of the EQP Handbook.

A-8.2 Low-pressure sodium lamps are not listed hazardous wastes but require special handling.

A-8.3 Refrigerant in air conditioning equipment being demolished must be recovered and transported to the Environmental Division Pollution Prevention Operations Center for reclaiming.

A-8.4 PCB's is a concern for HVAC/Electrical and capacitors. Capacitors in existing air conditioning equipment may contain polychlorinated biphenyl's (PCB's).

A-8.5 Fluorescent ballast in buildings to be demolished may contain PCB's.

A-8.6 Transformers as well as all fluorescent ballasts and HVAC/Electrical capacitors to be removed may contain PCB's. Transformers shall be turned over to DRMO.

A-8.7 Lighting ballast and capacitors are to be placed in 55-gallon drum and delivered to the Environmental Division Pollution Prevention Operations Center.

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A-9 Emergency Planning and Community Right-To-Know Act (EPCRA):

A-9.1 Ft. Campbell is required by Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements", to comply with the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA requires Ft. Campbell to identify the amounts of chemicals present on, or released from its facilities, understand the potential problems that hazardous materials pose to the surrounding communities and environment, and provide information to the public and local emergency planning organizations. To comply with EPCRA requirements, Ft. Campbell must track and be accountable for hazardous materials (HM) used throughout the installation. The Contractor must submit information describing hazardous materials (paint, solvents, adhesives, treated lumber, etc) on **FTCKY HAZMAT INVENTORY FORM** to the Environmental Division Pollution Prevention Branch. The Contractor will account for the quantity of HM brought to the post, the quantity used or expended during the job, and the leftover quantity to be removed from the installation. This information will be provided on a calendar year basis and must be submitted by the end of January following the year reported. Tracking of hazardous materials used by the Contractor shall be required by the contract.

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A-10. National Emission Standards for Hazardous Air Pollutants (NESHAP)

Ft. Campbell has design Standard Operating Procedures for the NESHAP items and they shall be used in preparation of a design:

State of Kentucky and Tennessee NESHAP Reporting Requirements for Demolition (Defined as the demolition of a building or demolition of a load supporting structure such as a load-bearing wall) shall be followed:

1. In the case of demolition only, the contractor will mail and be postmarked, fax and follow-up with a mailing, or deliver the NESHAP notice 10 working days before demolition begins even if the operation involves removal of "non-regulated" ACM only in any amount, OR even if the operation involves no ACM removal whatsoever!
2. In the case of demolition where asbestos abatement is also involved, the contractor will send in a separate notice for the abatement as required in paragraphs 2.a. through 2.d. below. The abatement notice may also be included on the demolition notice, so that only one notice may be sent. In this case, include the additional notice lead times as identified in paragraphs 2.a. through 2.d.

a. The Contractor is requested by the state to telephone at least 24 hours beforehand if the operation involves RACM that is below 260 LF, 160 SF, or 35 CF. This only applies in the contractor has sent a long-term NESHAP notification to the State.

b. The Contractor will mail and be postmarked, fax and follow-up with a mailing, or deliver the NESHAP notice 10 working days beforehand if the operation involves RACM that is below 260 LF, 160 SF, or 35 CF (and if the contractor has not sent a long-term NESHAP notification to the State).

c. The Contractor is requested (not a regulatory requirement) by the State to mail, fax, deliver a notice, or phone in the notice so that it is received at least 24 hours beforehand if the operation involves non-regulated ACM in any amount. (In any case, the government “project designer” may still specify that the contractor does a NESHAP notice for any asbestos removal actions. This would be advantages to the government.)

d. The Contractor will mail and be postmarked, fax and follow-up with a mailing, or deliver the NESHAP notice at least 10 working days before abatement begins if the operation involves RACM that is at least 260 LF, 160 SF, or 35 CF.

3. All Kentucky notifications are sent to:

Rebecca Bohannon
Kentucky Division for Air Quality
Asbestos Branch, Paducah Region
4500 Clarks River Road
Paducah, Kentucky 42003
(270) 898-8468 Office
(270) 898-8640 Fax

All Tennessee notifications are sent to:

Mr. Randal Harrison
Tennessee Division Air Pollution Control
9th Floor, L & C Annex, 401 Church St.
Nashville, Tennessee 37243-1531
(615) 532-0554 Office
(615) 532-0614 Fax

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APPENDIX B
State Water/Sewer Submittals

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APPENDIX C

Digging / Excavation Permits

This appendix establishes policies, procedures, and guidance for requesting utility locates associated with digging activities and excavation of soil to ensure protection of underground utilities (water/sewer, electric, gas, phone, steam/chill water, control cables, petroleum/POL, cable TV) and environmental/historical sensitive areas (archeological sites, former solid waste disposal sites).

Fort Campbell has stopped using dig permits. Tennessee One Call is being used to notify utility providers of the need to locate buried utilities prior to digging/excavation. One week prior to beginning digging/excavation, the contractor shall call 800-351-1111 with the following information:

- a. Address
- b. Phone number
- c. Start date – when digging/excavation to begin
- d. Start time – time digging/excavation to begin
- e. Town – Fort Campbell
- f. Dig Street & Number
- g. Nearest Intersecting Road

The proposed area of excavation shall be designated by the person responsible for the excavation by marking such area with safety white color coded stakes or white paint.

The underground utilities will be marked within 3 days as follows:

- a. Safety Red – electric power distribution and transmission facilities
- b. High Visibility Safety Yellow – gas and oil distribution and transmission facilities
- c. Safety Alert Orange – telephone, telegraph, cable, television, video and other telecommunications facilities
- d. Safety Precaution Blue – water system facilities
- e. Safety Green – sewer system facilities
- f. Safety Purple – reclaimed water, irrigation and slurry lines

If the start date and time arrives and one or more members have failed to mark the facilities, and there is clear evidence of the presence of an unmarked utility, you **MUST** call Tennessee One-Call with a Second Request.

If, during the course of excavation an underground facility has been damaged, notify the facility owner immediately of the location and nature of the damage. Do not try to repair the facility yourself or to cover up the damage.

A locate request has an expiration date. It is 15 calendar days from the date and time specified the dig is to begin.

The above information was taken from the "Tennessee Excavation Guide, April 2007" available from Tennessee One-Call System, Inc. (phone: 615-367-1110, email: tnocs@tnonecall.com).

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APPENDIX D

Finishes, Exterior and Interior

The following are Ft. Campbell's standard color schedule for **Exterior Finishes** and special items:

STANDING SEAM METAL ROOF AND FASCIA

Manufacturer: Varies

Color: Butler, Kyner 500, color "Terra Brown" or approved equal

METAL SIDING (When approved)

Manufacturer: Varies

Color: Butler, Kyner 500, color "Country Wheat" or approved equal

EXTERIOR DOORS, FRAMES, TRIM AND ANODIZED ALUMINUM WINDOWS

Manufacturer: Varies

Color: Match standing seam metal roof color

BRICK

Manufacturer: Palmetto Brick Company

Color: ".75 Greystone"

Manufacturer: Acme Brick

Color: "Ko-Ko Brown"

Manufacturer: Sioux City Brick

Color: Beige Grey Velour

ACCENT BRICK

Manufacturer: Acme Brick

Color: "Ko-Ko Plus Chocolate"

Manufacturer: Palmetto Brick Company

Color: "1.25 Greystone"

Manufacturer: Sioux City Brick

Color: Charcoal Grey Velour

SPLIT-FACE CONCRETE MASONRY UNITS

Manufacturer: Southland Supply style

Color: Goldenrod, 24H

MORTAR

Manufacturer: Quickrete

Color: Ochre 2

Manufacturer: Holcim Cement

Color: PCL S Buff

ROOF FIXTURES

Manufacturer: Varies

Color: Match standing seam metal roof

DOWNSPOUTS, GUTTERS, LOUVERS, FLASHING

Manufacturer: Varies

Color: Match standing seam metal roof

EXTERIOR SOFFITS AND CEILING

Manufacturer: Varies

Color: White (factory finish)

[The following are Ft. Campbell's standard color schedule for Interior Finishes and special items:](#)

Plastic Laminate, Vertical: **Wilsonart, "1500N-60, Grey"**
Wilsonart, "D432-60, Cashmere"

Plastic Laminate, Horizontal: **Wilsonart "4640-60, Dove Moraine"**
Wilsonart "4608-60, Caldera Beige"

Solid Surface Material: **Wilsonart "1521-MG, Light Beige Mirage"**
Wilsonart "D431-MG, Alabaster Mirage"

Vinyl Base: **Azrock, 4" Vinyl Base, "CB-66"**
Flexco, 4" Vinyl Base, "VCB-031 Zephyr"

VCT: **Azrock, 12"x12"x1/8" "V869, Tundra, Cortina Colors"**
Azrock, 12"x12"x1/8" "V787, Stratus"

Sheet Flooring: **Tarket, "18319"**

ACT: **USG "2110, 2'x2'x5/8" White, Radar"**

ACT Grid: **USG "Donn DX, 15/16", White"**

Window Blinds: **Valencia Deluxe, "0285, 1" Metal**
Valencia Deluxe, "0023, 1" Metal

Carpet: **Lees, 115 Mauve, Pebble Weave II**
Lees, 305 Cloisonne, Pebble Weave II
Lees, 204 Vienna Woods, Pebble Weave II

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APPENDIX E

Fort Campbell Landscape Plant List

Native Plant Material

(Native) Conifers/Evergreens:

Botanical Name	Common Name
(Native) Tall Trees – (trees over 50 ft. at maturity)	
<i>Pinus echinata</i>	Shortleaf Pine
<i>Tsuga canadensis</i>	Eastern Hemlock
<i>Taxodium distichum</i>	Bald Cypress
(Native) Medium Trees – (trees 25 to 50 ft. at maturity)	
<i>Pinus virginiana</i>	Virginia Pine
<i>Juniperus virginiana</i>	Eastern Red Cedar
(Native) Small Trees/Large Shrubs – (10 to 25 ft. at maturity)	
<i>Juniperus virginiana</i>	Eastern Red Cedar

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(Native) Deciduous:

Botanical Name	Common Name
(Native) Tall Trees– (trees over 50 ft. at maturity)	
<i>Liriodendron tulipifera</i>	Yellow or Tulip Poplar
<i>Sassafras albidum</i>	Sassafras
<i>Liquidambar styraciflua</i>	Sweetgum
<i>Ulmus thomasii</i>	Rock Elm
<i>Celtis occidentalis</i>	Hackberry
<i>Celtis laevigata</i>	Sugarberry
<i>Morus rubra</i>	Red Mulberry
<i>Juglans nigra</i>	Black Walnut
<i>Carya illinoensis</i>	Pecan
<i>Carya cordiformis</i>	Bitternut Hickory
<i>Carya tomentosa</i>	Mockernut Hickory
<i>Carya ovata</i>	Shagbark Hickory
<i>Carya glabra</i>	Pignut Hickory
<i>Fagus grandifolia</i>	American Beech

Botanical Name	Common Name	
(Native) Tall Trees-- (trees over 50 ft. at maturity) continued		
<i>Quercus alba</i>	White Oak	
<i>Quercus stellata</i>	Post Oak	
<i>Quercus bicolor</i>	Swamp White Oak	
<i>Quercus michauxii</i>	Swamp Chestnut Oak	
<i>Quercus prinus</i>	Chestnut Oak	
<i>Quercus muehlenbergii</i>	Chinkapin Oak	
<i>Quercus rubra</i>	Northern Red Oak	
<i>Quercus palustris</i>	Pin Oak	
<i>Quercus falcata</i>	Southern Red Oak	
<i>Quercus velutina</i>	Black Oak	
<i>Quercus shumardii</i>	Shumard Oak	
<i>Quercus coccinia</i>	Scarlet Oak	
<i>Quercus phellos</i>	Willow Oak	
<i>Tilia americana</i>	American Basswood	
<i>Populus deltoides</i>	Eastern Cottonwood	
<i>Salix nigra</i>	Black Willow	
<i>Diospyros virginiana</i>	Common Persimmon	
<i>Prunus serotina</i>	Black Cherry	
<i>Gleditsia tracanthos</i>	Honeylocust	
<i>Gymnocladus dioica</i>	Kentucky Coffeetree	
<i>Nyssa aquatica</i>	Water Tupelo	
<i>Nyssa sylvatica</i>	Black Tupelo	
<i>Aesculus octandra</i>	Yellow Buckeye	
<i>Acer rubrum</i>	Red Maple	
<i>Acer saccharinum</i>	Silver Maple	
<i>Acer negundo</i>	Box Elder	
<i>Fraxinus pennsylvanica</i>	Green Ash	
<i>Fraxinus americana</i>	White Ash	
(Native) Medium Trees – (trees 25 to 50 ft. at maturity)		
	<i>Magnolia tripetala</i>	Umbrella Magnolia
<i>Magnolia macrophylla</i>	Bigleaf Magnolia	
<i>Asimina triloba</i>	Pawpaw	
<i>Ulmus alata</i>	Winged Elm	
<i>Celtis occidentalis</i>	Hackberry	
<i>Quercus stellata</i>	Post Oak	
<i>Quercus marilandica</i>	Blackjack Oak	
<i>Ostrya virginiana</i>	Eastern Hop Hornbeam	
<i>Carpinus carolinia</i>	American Hornbeam	
<i>Betula lenta</i>	Sweet Birch	
<i>Betula nigra</i>	River Birch	
<i>Salix nigra</i>	Black Willow	
<i>Oxydendron arboreum</i>	Sourwood	
<i>Diospyros virginiana</i>	Common Persimmon	
<i>Halesia carolina</i>	Carolina Silverbell	

Botanical Name	Common Name
(Native) Medium Trees – (trees 25 to 50 ft. at maturity) continued	
<i>Amelanchier arborea</i>	Downey Serviceberry
<i>Ilex opaca</i>	American Holly
<i>Rhamnus caroliniana</i>	Carolina Buckthorn
<i>Aesculus glabra</i>	Ohio Buckeye
<i>Acer negundo</i>	Box Elder
(Native) Small Trees/Large Shrubs – (10 to 25 ft. at maturity)	
<i>Hamamelis virginiana</i>	Witch Hazel
<i>Carpinus carolinia</i>	American Hornbeam
<i>Kalmia latifolia</i>	Mountain Laurel
<i>Prunus americana</i>	American Plum
<i>Crataegus spp.</i>	Hawthorn
<i>Cercis canadensis</i>	Eastern Redbud
<i>Cornus florida</i>	Flowering Dogwood
<i>Euonymus atropurpurens</i>	Eastern Wahoo
<i>Cephalanthus occidentalis</i>	Buttonbush
<i>Sambucus canadensis</i>	American Elder

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Introduced Species (Kentucky Extension Service List)

(Introduced) Evergreen:

Botanical Name	Common Name
(Introduced) Tall Trees– (trees over 50 ft. at maturity)	
<i>Abies nordmanniana</i>	Nordmann Fir
<i>Cedrus libani</i> var. <i>stenocoma</i>	Hardy Cedar of Lebanon
<i>Picea abies</i>	Norway Spruce
<i>Picea glauca</i> 'Densata'	Black Hills Spruce
<i>Picea omorika</i>	Serbian Spruce
<i>Picea orientalis</i>	Oriental Spruce
<i>Picea pungens</i>	Colorado Spruce
<i>Pinus densiflora</i>	Japanese Red Pine
<i>Pinus flexilis</i>	Limber Pine
<i>Pinus resinosa</i>	Red Pine
<i>Pseudotsuga menziesii</i>	Douglas Fir
<i>Thuja occidentalis</i>	American Arborvitae
(Introduced) Medium Trees – (trees 25 to 50 ft. at maturity)	
<i>Abies concolor</i>	White Fir
<i>Chamaecyparis obtusa</i>	Hinoki Cypress
<i>Chamaecyparis pisifera</i>	Thread Cypress
<i>Ilex attenuata</i> 'Fosteri'	Foster No. 2 Holly
<i>Juniperus chinensis</i>	Chinese Juniper
<i>Osmanthus americanus</i>	Devil Wood

Botanical Name	Common Name
(Introduced) Medium Trees – (trees 25 to 50 ft. at maturity) continued	
<i>Pinus bungeana</i>	Lacebark Pine
<i>Pinus cembra</i>	Swiss Stone Pine
<i>Pinus densiflora</i> 'Oculus-draconis'	Japanese Red Pine
<i>Pinus strobus</i> 'Fastigiata'	Columnar White Pine
<i>Pinus strobus</i> 'Pendula'	Weeping White Pine
<i>Pinus sylvestris</i>	Scotch Pine
<i>Platycladus orientalis</i>	Oriental Arborvitae
<i>Taxus baccata</i>	English Yew
<i>Taxus cuspidata</i> 'Capitata'	Upright Japanese Yew
(Introduced) Small Trees/Large Shrubs – (10 to 25 ft. at maturity)	
	<i>Abies koreana</i> 'Prostrate Beauty' Prostrate Korean Fir
<i>Chamaecyparis obtusa</i> 'Torulosa'	Contorted Hinoki Cypress
<i>Ilex aquifolium</i>	English Holly
<i>Ilex crenata</i> 'Noble's Upright'	Noble's Upright Japanese Holly
<i>Ilex pedunculosa</i>	Longstock Holly
<i>Juniperus chinensis</i>	Chinese Juniper
<i>Juniperus scopulorum</i>	Rocky Mountain Juniper
<i>Picea glauca</i> 'Conica'	Dwarf Albert Spruce
<i>Pinus densiflora</i> 'Umbraculifera'	Tanyosho Pine
<i>Pinus mugo</i>	Mugho Pine
<i>Pinus strobus</i> 'Contorta'	Curly White Pine
<i>Pinus sylvestris</i> 'Wateri'	Waterer's Scotch Pine
<i>Rhododendron catawbiense</i>	Rhododendron
<i>Rhododendron azalea</i>	Azalea
<i>Rhododendron maximum</i>	Rosebay Rhododendron
<i>Sciadopitys verticillata</i>	Umbrella Pine
<i>Taxus cuspidata</i>	Japanese Yew
<i>Viburnum fragense</i>	Fragrant Viburnum
(Introduced) Medium Shrubs – (6 to 8 ft. at maturity)	
	<i>Chamaecyparis obtusa</i> 'Sanderi' Sanderi Hinoki False Cypress
<i>Chamaecyparis pisifera</i>	Sawara Cypress
<i>Ilex meserveae</i>	Blue Holly
<i>Juniperus chinensis</i> 'Sea Green'	Sea Green Chinese Juniper
<i>Mahonia aquifolium</i>	Oregon Holly Grape
<i>Pieris japonica</i>	Japanese Pieris
<i>Taxus cuspidata</i>	Japanese Yew
<i>Taxus media</i>	Spreading Yew
(Introduced) Small Shrubs – (4 to 5 ft. at maturity)	
	<i>Buxus microphylla</i> Boxwood
<i>Chamaecyparis pisifera</i>	Gold Thread Cypress
<i>Ilex glabra</i> 'Compacta'	Compact Inkberry
<i>Ilex opaca</i> 'Maryland Dwarf'	Maryland Dwarf American Holly
<i>Juniperus chinensis</i>	Chinese Juniper

Botanical Name	Common Name
(Introduced) Small Shrubs – (4 to 5 ft. at maturity) continued	
<i>Leucothoe fontanesiana</i>	Drooping Leucothoe
<i>Mahonia aquifolium</i>	Oregon Holly Grape
<i>Picea abies</i>	Norway Spruce
<i>Picea pungens</i>	Colorado Spruce
<i>Pinus mugo</i>	Mugho Pine
<i>Pinus strobus</i> 'Nana'	Dwarf White Pine
<i>Pinus sylvestris</i> 'Beuvronensis'	Dwarf Scotch Pine
<i>Rhododendron</i> 'Starry Night'	Starry Night Rhododendron
<i>Taxus baccata</i> 'Repandens'	Spreading English Yew
<i>Tsuga canadensis</i> 'Gentsch'	Gentsch White Canadian Hemlock
(Introduced) Low Shrubs – (2 to 3 ft. at maturity)	
<i>Abies balsamea</i> 'Nana'	Dwarf Balsam Fir
<i>Chamaecyparis obtusa</i> 'Pygmaea Aurescens'	Dwarf Hinoki False Cypress
<i>Chamaecyparis pisifera</i>	Moss Cypress
<i>Juniperus horizontalis</i>	Compact Juniper
<i>Juniperus sabina</i>	Savin Juniper
<i>Juniperus squamata</i> 'Blue Star'	Blue Star Juniper
<i>Leucothoe fontanesiana</i>	Drooping Leucothoe
<i>Mahonia aquifolium</i> 'Compactum'	Compact Oregon Holly Grape
<i>Picea abies</i>	Dwarf Norway Spruce
<i>Pieris japonica</i> 'Pygmaea'	Pygmy Andromeda
<i>Pinus sylvestris</i> 'Riverside Gem'	Riverside Gem Scotch Pine
<i>Rhododendron obtusum</i>	Azalea (several varieties)

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**(Introduced)
Deciduous:**

Botanical Name	Common Name
(Introduced) Tall Trees– (trees over 50 ft. at maturity)	
<i>Acer platanoides</i>	Norway Maple
<i>Alnus glutinosa</i>	European Alder
<i>Cercidiphyllum japonicum</i>	Katusra Tree
<i>Eucommia ulmoides</i>	Hardy Rubber Tree
<i>Fagus sylvatica</i>	European Beech
<i>Ginkgo biloba</i>	Ginkgo or Maidenhair Tree
<i>Larix kaempferi</i>	Japanese Larch
<i>Metasequoia glyptostroboides</i>	Dawn Redwood
<i>Platanus x acerfolia</i>	London Planetree
<i>Quercus acutissima</i>	Sawtooth Oak
<i>Quercus robur</i>	English Oak
<i>Tilia cordata</i>	European Linden

Botanical Name	Common Name
(Introduced) Tall Trees-- (trees over 50 ft. at maturity) continued	
<i>Tilia tomentosa</i>	Silver Linden
<i>Ulmus parvifolia</i>	Chinese Elm
<i>Ulmus x</i>	Hybrid Elms
<i>Zelkova serrata</i>	Japanese Zelkova
(Introduced) Medium Trees – (trees 25 to 50 ft. at maturity)	
<i>Acer campestre</i>	Hedge Maple
<i>Acer griseum</i>	Paperbark Maple
<i>Aesculus x carnea</i>	Red Horsechestnut
<i>Aesculus pavia</i>	Red Buckeye
<i>Amelanchier grandiflora</i>	Apple Serviceberry
<i>Amelanchier laevis</i>	Alleghany Serviceberry
<i>Betula populifolia</i>	Gray Birch
<i>Betula maximowicziana</i>	Monarch Birch
<i>Carpinus betulus</i>	European Hornbeam
<i>Castanea mollissima</i>	Chinese Chestnut
<i>Corylus colurna</i>	Turkish Filbert
<i>Franklinia alatamaha</i>	Franklin Tree
<i>Ilex decidua</i>	Possum Haw
<i>Koeireuteria paniculata</i>	Golden Raintree
<i>Larix decidua</i> 'Pendula'	Weeping European Larch
<i>Maackia amurensis</i>	Amur Maackia
<i>Magnolia virginiana</i>	Sweet Bay Magnolia
<i>Phellodendron amurense</i>	Cork Tree
<i>Prunus sargentii</i>	Sargent Cherry
<i>Prunus serrulata</i> 'Kwanzan'	Kwanzan Japanese Cherry
<i>Pyrus fauriei</i>	Korean Pear
<i>Stewartia pseudocamellia</i>	Japanese Stewartia
<i>Syringa pekinensis</i>	Pekin Lilac
<i>Syringa reticulata</i>	Japanese Tree Lilac
<i>Prunus x yedoensis</i>	Yoshino Cherry
<i>Pyrus calleryana</i>	Callery Pear
(Introduced) Small Trees/Large Shrubs – (10 to 25 ft. at maturity)	
<i>Acer buergeranum</i>	Trident Maple
<i>Acer ginnala</i>	Amur Maple
<i>Acer japonicum</i>	Fullmoon Maple
<i>Acer maximowiczianum</i>	Nikko Maple
<i>Acer palmatum</i>	Japanese Maple
<i>Acer tegmentosum</i>	Manchu Striped Maple
<i>Aesculus parviflora</i>	Bottlebrush Buckeye
<i>Buddleia alternifolia</i>	Fountain buddiela
<i>Cercidiphyllum japonicum</i>	Weeping Katsura Tree
<i>Chionanthus retusus</i>	Chinese Fringe Tree
<i>Chionanthus virginicus</i>	Fringe Tree
<i>Cornus alternifolia</i>	Pagoda Dogwood

Botanical Name	Common Name
(Introduced) Small Trees/Large Shrubs – (10 to 25 ft. at maturity) continued	
<i>Cornus kousa</i>	Kousa Dogwood
<i>Cornus mas</i>	Cornelian Cherry Dogwood
<i>Cornus officinalis</i>	Japanese Cornel Dogwood
<i>Cornus racemosa</i>	Gray Dogwood
<i>Corylus avellana</i> ‘Cortorta’	Curly European Filbert
<i>Corylus maxima</i> ‘Purpurea’	Purple Giant Filbert
<i>Cotoneaster multiflorus</i>	Many-flowered Cotoneaster
<i>Crataegus crus-galli</i>	Cockspur Hawthorn
<i>Crataegus lavalleyi</i>	Lavalle Hawthorn
<i>Crataegus phaenopyrum</i>	Washington Hawthorn
<i>Crataegus viridis</i> ‘Winter King’	Winter King Hawthorn
<i>Deutzia scabra</i> ‘Pride of Rochester’	Pride of Rochester Deutzia
<i>Enkianthus campanulatus</i>	Redvein Enkianthus
<i>Euonymus alata</i>	Burning Bush
<i>Forsythia intermedia</i>	Border Forsythia
<i>Fothergilla major</i>	Large Fothergilla
<i>Ilex verticillata</i>	Winterberry
<i>Kolkwitzia amabilis</i>	Beauty Bush
<i>Ligustrum ibolium</i>	Ibolium Privet
<i>Ligustrum ovalifolium</i>	California Privet
<i>Ligustrum vicaryl</i>	Vicary Golden Privet
<i>Lindera benzoin</i>	Spicebush
<i>Lonicera morrowii</i>	Fragrant Honeysuckle
<i>Lonicera tatarica</i>	Tatarian Honeysuckle
<i>Magnolia x</i>	Hybrid Magnolia (several varieties)
<i>Magnolia loebneri</i> ‘Merrill’	Dr. Merrill Magnolia
<i>Magnolia soulangiana</i>	Saucer Magnolia
<i>Magnolia stellata</i>	Star Magnolia
<i>Malus x spp.</i>	Crabapple
<i>Malus floribunda</i>	Flowering Crabapple
<i>Malus sieboldii</i> var. Zumi	Calocarpa Crabapple
<i>Philadelphus virginialis</i>	Mockorange
<i>Physocarpus opulifolius</i>	Eastern Ninebark
<i>Prunus x</i> ‘Hally Jolivet’	Hally Jolivet Cherry
<i>Prunus subhirtella</i>	Higan Cherry
<i>Rhamnus fragula</i> ‘Asplenifolia’	Cutleaf Buckthorn
<i>Syringa vulgaris</i>	Common Lilac
<i>Ulmus glabra</i> ‘Camperdownii’	Camperdown Elm
<i>Viburnum burkwoodii</i>	Burkwood Viburnum
<i>Viburnum carlcephalum</i>	Fragrant Viburnum
<i>Viburnum dentatum</i>	Arrowwood Viburnum
<i>Viburnum dilatatum</i> ‘Iroquois’	Iroquois Linden Viburnum
<i>Viburnum lantana</i>	Wayfaring Tree
<i>Viburnum lentago</i>	Nannyberry Viburnum
<i>Viburnum macrocephalum</i>	Chinese Snowball Viburnum

Botanical Name	Common Name
(Introduced) Small Trees/Large Shrubs – (10 to 25 ft. at maturity) continued	
<i>Viburnum opulus</i>	Cranberry Bush Viburnum
<i>Viburnum plicatum</i> var. <i>tomentosum</i> '	Doublefile Viburnum
<i>Viburnum prunifolium</i>	Blackhaw
<i>Viburnum rhytidophyloides</i>	Lantanaphyllum Viburnum
<i>Viburnum sargentii</i> 'Onondaga'	Onondaga Viburnum
<i>Viburnum sieboldii</i> 'Seneca'	Seneca Viburnum
<i>Viburnum setigerum</i>	Tea Viburnum
<i>Viburnum</i> 'Sesquehana'	Sesquehanna Viburnum
(Introduced) Medium Shrubs – (6 to 8 ft. at maturity)	
<i>Acanthopanax sieboldianus</i>	Five-leaved Aralia
<i>Acer palmatum</i>	Japanese Maple
<i>Aronia arbutifolia</i> 'Brilliantissima'	Brilliant Red Chokeberry
<i>Berberis mentorensis</i>	Mentor Barberry
<i>Berberis thunbergii</i>	Japanese Barberry
<i>Buddleia davidii</i>	Orange-eyed Butterfly Bush
<i>Clianthus florid us</i>	Carolina Allspice
<i>Cercis chinensis</i>	Chinese Redbud
<i>Chaenomeies speciosa</i>	Flowering Quince
<i>Clethra ainifloia</i>	Summer Sweet
<i>Cornus alba</i>	Tatarian Dogwood
<i>Cornus baileyi</i>	Bailey's Dogwood
<i>Cornus florida</i> 'Pygmaea'	Pygmy Dogwood
<i>Cornus sericea</i> 'Flaviramea'	Yellow-twig Dogwood
<i>Cotoneaster divaricata</i>	Spreading Cotoneaster
<i>Deutzia lemoinei</i>	Slender Deutzia
<i>Forsythia intermedia</i> 'Sunrise'	Border Forsythia
<i>Hamamelis vernalis</i>	Vernal Witchhazel
<i>Hibiscus syriacus</i>	Rose of Sharon
<i>Hydrangea quercifolia</i>	Oakleaf Hydrangea
<i>Ilex verticillata</i>	Winterberry
<i>Kerria japonica</i>	Japanese Kerria
<i>Ligustrum vulgare</i> 'Lodense'	Lodense Privet
<i>Lonicera xyldosteum</i> 'Claveyl'	Clavey's Honeysuckle
<i>Malus sargentii</i>	Sargent Crabapple
<i>Morus alba</i> 'Pendula'	Weeping Mulberry
<i>Myrica pensylvanica</i>	Northern Bayberry
<i>Prunus x cistena</i>	Purpleleaf Sand Cherry
<i>Pyracantha coccinea</i>	Scarlet Firethorn
<i>Rhus aromatica</i>	Fragrant Summac
<i>Ribes alpinum</i>	Alpine Currant
<i>Spiraea nipponica</i> 'Snowmound'	Snowmound Spirea
<i>Spiraea x vanhouttei</i>	Vanhoutte Spirea
<i>Viburnum acerfolium</i>	Mapleleaf Viburnum
<i>Viburnum carlesli</i>	Koreanspice
<i>Viburnum juddii</i>	Judd Viburnum

Botanical Name	Common Name
(Introduced) Medium Shrubs – (6 to 8 ft. at maturity) continued	
<i>Viburnum x 'Mohawk'</i>	Mohawk Viburnum
<i>Viburnum x pragense</i>	Prague Viburnum
<i>Weigela florida</i>	Weigela
(Introduced) Small Shrubs – (4 to 5 ft. at maturity)	
<i>Abelia grandiflora</i>	Glossy Abelia
<i>Berberis thunbergii 'Aurea'</i>	Golden Japanese Barberry
<i>Cotoneaster horizontalis</i>	Rockspray Cotoneaster
<i>Deutzia gracilis</i>	Slender Deutzia
<i>Divervilla sessilifolia</i>	Southern Bush Honeysuckle
<i>Hydrangea arborescens</i>	Hills-of-Snow
<i>Hypericum kalm</i>	Kalm St. Johnswort
<i>Ilex verticillata</i>	Winterberry
<i>Itea japonica 'Beppu'</i>	Beppu Sweetspire
<i>Malus sargentii 'Tina'</i>	Tina Crabapple
<i>Physocarpus opulifolius</i>	Eastern Ninebark
<i>Potentilla fruticosa</i>	Bush Cinquefoil
<i>Pyracantha coccinea</i>	Scarlet Firethorn
<i>Syringa meyeri 'Palibin'</i>	Meyer's Lilac
<i>Syringa patula 'Miss Kim'</i>	Littleleaf Lilac
<i>Viburnum opulus 'Nana'</i>	Dwarf Cranberrybush Viburnum
<i>Viburnum trilobum 'Compactum'</i>	Compact American Cranberry Bush
<i>Viburnum utile 'Eskimo'</i>	Eskimo Viburnum
(Introduced) Low Shrubs – (2 to 3 ft. at maturity)	
<i>Berberis thunbergii</i>	Japanese Barberry
<i>Caryopteris clandonensis 'Blue'</i>	Blue Mist Bluebeard
<i>Cornus sericea 'Kelseyi'</i>	Kelsey's Dwarf Dogwood
<i>Cotoneaster apiculatus</i>	Cranberry Cotoneaster
<i>Cotoneaster dammeri</i>	Bearberry Cotoneaster
<i>Cotoneaster horizontalis 'Perpusilla'</i>	Perpusilla Rock Cotoneaster
<i>Cotoneaster microphylla</i>	Small Leaf Cotoneaster
<i>Forsythia viridissima 'Bronxensis'</i>	Bronx Forsythia
<i>Forsythia 'Arnold's Dwarf'</i>	Arnold's Dwarf Forsythia
<i>Fothergilla gardenii</i>	Dwarf Fothergilla
<i>Hypericum 'Hidcote'</i>	Hidcote St. Johnswort
<i>Jasminum nudiflorum</i>	Winter Jasmine
<i>Kalmia cuseata 'White Wicky'</i>	White Wicky Mountain Laurel
<i>Kerria japonica 'Picta'</i>	Variegated Japanese Kerria
<i>Physocarpus opulifolius 'Nana'</i>	Dwarf Eastern Ninebark
<i>Rhus aromatica 'Gro-low'</i>	Gro-low Fragrant Summac
<i>Ribes alpinum 'Greenmound'</i>	Greenmound Alpine Currant
<i>Rosa wichuriana</i>	Memorial Rose
<i>Spiraea x bumalda</i>	Bumald Spirea
<i>Spiraea japonica 'Little Princess'</i>	Little Princess Japanese Spirea
<i>Symphoricarpos albus</i>	Snowberry
<i>var. laevigatus</i>	

Recommended Low Maintenance Plants for Bio-Retention Areas and Parking Lot Islands:

Bio-retention Plants:

Large Grasses 3-6 ft.

Small - Medium Grasses 1 ½ to 4 ft.

Scientific Name	Common Name
<i>Deschampsia caespitosa</i>	Tufted hairgrass
<i>Dichanthelium sphaerocarpon</i>	Roundseed panicgrass
<i>Elymus hystrix</i> var. <i>hystrix</i>	Eastern bottlebrush grass
<i>Panicum virgatum</i>	Switch grass
<i>Festuca arundinacea</i>	Kentucky 51 fescue

Note: Grass selection should be based on Bio-retention area size, user maintenance needs and limits.

Perennials/Ground Covers

Scientific Name	Common Name	Cultivars or Comments
<i>Hemerocallis middendorfii</i>	Middendorfii Daylily	
<i>Hemerocallis minor</i>	Minor Daylily	
<i>Sedum species</i>	Sedum	Select appropriate species for the site.
<i>Liriope species</i>	Lilyturf	Select appropriate species for the site.

Shrubs

Scientific Name	Common Name	Cultivars or Comments
<i>Ilex glabra</i>	Inkberry	Any appropriate cultivar for bio-retention size.
<i>Itea japonica</i> ‘Beppu’	Beppu sweetspire	If there is a better cultivars for the site it should be used.
<i>Juniperus communis</i> ‘Wiltonii’	Blue Rug juniper	
<i>Viburnum dentatum</i>	Arrowwood viburnum	Any appropriate cultivar for bio-retention size.
<i>Physocarpus opulifolius</i>	Ninebark	Any appropriate cultivar for bio-retention size.
<i>Buxus microphylla</i>	Littleleaf boxwood	

Small Trees

Scientific Name	Common Name	Cultivars or Comments
<i>Cercis canadensis</i>	Redbud	Cultivars should match conditions
<i>Amelanchier canadensis</i>	Serviceberry	Multiple stems

Medium / Large Trees

Scientific Name	Common Name	Cultivars or Comments
<i>Chionanthus virginicus</i>	Frindgetree	
<i>Acer rubrum</i>	Red maple	Has surface roots

<i>Quercus palustris</i>	Pin oak	
<i>Quercus phellos</i>	Willow oak	Has large surface roots
<i>Liquidambar styraciflua</i>	Sweetgum	Use fruitless varieties, has large surface roots Make sure site has appropriate soils.
<i>Nyassa sylvatica</i>	Black gum	Select appropriate cultivar for the site.
<i>Platanus occidentalis</i>	Sycamore	
<i>Fraxinus pennsylvanica</i>	Green ash	Select appropriate species for the site.
<i>Taxodium distichum</i>	Bald Cypress	
<i>Betula nigra</i>	River birch	Appropriate cultivar should be selected for the size of the bio-retention area

Note: Prior to selection please check information regarding inundation, drought, and salt tolerance. Also confirm mature height and spread limits, and cold and heat tolerance for the site.

Parking Lot Plants:

**Parking Lot Trees and Shrubs
Shrubs / Small (4 to 5 feet at maturity)**

Scientific Name	Common Name	Cultivars or Comments
<i>Ilex glabra</i> 'Chamzin'	Inkberry	When there is better cultivar for the site it should be used.
<i>Viburnum opulus</i> 'Compactum'	Cranberrybush Viburnum	If there is a better cultivar for the site it should be used.

Shrubs / Low growing (2 to 3 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
<i>Itea japonica</i> 'Beppu'	Beppu sweetspire	If there is a better cultivar for the site it should be used.
<i>Juniperus communis</i> 'Wiltonii'	Blue Rug juniper	If there is a better cultivar for the site it should be used.
<i>Physocarpus opulifolius</i> 'Nana'	Dwarf Eastern Ninebark	If there is a better cultivar for the site it should be used.
<i>Buxus microphylla</i>	Littleleaf boxwood	
<i>Spiraea x bumalda</i>	Bumald spirea	Chose the cultivar that is best for the site.

Large Trees (Over 50 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
<i>Fraxinus americana</i>	White ash	'Autumn Purple'
<i>Quercus bicolor</i>	Swamp White oak	
<i>Gleditsia triocanthos</i>	Honeylocust	Use thorn less variety/cultivar inermis 'Shademaster'

Medium Trees (25 to 40 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
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<i>Ginko biloba</i>	Ginko (Maiden Hair)	'Fastigiata', 'Princeton' 'Sentry', 'Shangri-la'
<i>Ostrya virginiana</i>	American hophornbeam	
<i>Zelkova serrata</i>	Japanese zelkova	'Village Green'

Small Trees (10 to 25 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
<i>Acer ginnala</i>	Amur maple	
<i>Crataegus crus-galli</i>	Washington hawthorn	Use thorn less variety inermis

Note: To protect newly planted trees from lawnmower and weed eater damage a trunk protector, that is adjustable to the growth of the tree, should be used.

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Appendix F

Utility Procedures

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- F-2 [Record Drawings](#)
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- F-4 [Distribution Lines](#)
- F-5 [Existing Lines to be Removed](#)
- F-6 [New Service Lines](#)
- F-7 [Plans and Specifications](#)
- F-8 [Utility Cost Estimate](#)
- F-9 [Utility Company Contracts](#)

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The natural gas distribution system, the water distribution system for domestic and fire, and the sewer systems at Fort Campbell are now privately owned and operated by utility companies.

This is an outline of the recommended procedures for dealing with the utility aspects of facility design projects. Variation from this procedure is expected, depending upon the project. However, revised procedures should be agreed upon during the early design stages of a project. Unless noted otherwise in the design scope of work, the utility companies will install new service lines to buildings.

The utility companies are active players in the planning, design, and construction process of each building project.

Utility company contacts are provided below.

F-2 RECORD DRAWINGS:

The utility companies maintain as-built record utility drawings for the installation. To obtain utility drawings, refer to UTILITY COMPANY CONTACTS below.

F-3 METERING:

Metering of gas, steam, heating hot water, electricity, fuel oil, etc. is required by UFC 3-400-01 Energy Conservation.

Metering of water is required for all buildings where potable water demand is estimated to exceed 100,000 gallons per year.

Connection of the meters to the Energy Monitoring and Control System (EMCS) is required.

The gas utility company will install a regulator and a meter with a pulse initiator for EMCS. Coordinate the location of this assembly with the utility company and show the location on the drawings and indicate that the installation is by the gas utility company.

Where required, a building domestic water meter will be provided inside the building mechanical room by the water company. Coordinate the location of this meter with the utility company and show the location on the drawings and indicate that the installation is by the water utility company.

The fire sprinkler water will not be metered.

F-4 DISTRIBUTION LINES:

The utility company will determine whether changes to the utility distribution systems will be required. The cost, schedule, and execution of the upgrade to the distribution system will be handled by Fort Campbell and the utility company as a contract action separate from the building project.

F-5 EXISTING LINES TO BE REMOVED:

Unused lines will be either removed or abandoned in place. If abandoned in place, the line will remain in GIS and be indicated as abandoned.

F-6 NEW SERVICE LINES:

The building designer determines the required capacity of each service line and the preferred location of the building service entrance.

The building designer determines the required gas pressure into the building (typically 14 inches water column).

The building designer obtains the installation utility record drawings (maps) from the utility company.

The building designer coordinates with the utility companies to determine and share the following information concerning the service lines:

- Flow
- Estimated consumption
- Line size
- Routing
- Tie-in points to the main distribution system
- Location of the utility service entrance to the building
- Location of the gas regulator / meter / emergency connection / seismic shutoff valve assembly
- Location of valves including the post indicator valve for the fire sprinkler system
- Location of the water meter
- The type of backflow preventer on the incoming domestic water service lines, usually a reduced pressure type
- The type of backflow preventer on the incoming fire sprinkler line, usually a double check type. However if there are additives such as antifreeze or foam in the system or if there is a second non-potable water source connected to the sprinkler system, a reduced pressure type is required.
- Location of existing utility lines to be removed

F-7 PLANS AND SPECIFICATIONS:

On the design drawings, the building designer shows:

- The routing of the new utility service lines, noted to be installed by others
- The location of building meters and regulator assemblies, noted to be installed by others
- The location of fire hydrants, noted to be installed by others
- The location of water line valves in the service lines, noted to be installed by others
- The location of post indicator valves, noted to be installed by others
- The location of utility lines to be removed, noted to be removed by others
- The main gas pressure
- The required building gas pressure
- The available static and residual water pressure and associated flow

Utility installation details are not shown.

Fire department connections are included in the contract as part of the sprinkler work.

The backflow preventers for domestic water and for fire sprinkler service are to be located inside the building and will be included in the building construction contract.

The building designer sends the design drawings to the utility companies. This should be done during concept design and during final design.

The utility company reviews the drawings and coordinates any required changes with the building designer.

The building designer includes a provision in the specifications that the building construction contractor must coordinate with the utility companies on the timing and sequence of work for the installation of the utilities. The utility contacts for utility work during construction below are to be included in the design documents.

The design documents must indicate that the utility company applies for all permits from the appropriate state authorities.

F-8 UTILITY COST ESTIMATE:

The building designer has no involvement in the gas and water utility cost estimate.

F-9 UTILITY COMPANY CONTACTS:

NATURAL GAS:

To obtain record drawings, to discuss gas service line capacity, size, routing, and tie-in points to the main distribution system and for coordination of gas utility work during construction or for inspection of contractor installed lines:

Clarksville Gas and Water Co.

Phone: 931-542-9620

Fax: 931-542-9601

WATER AND SEWER:

To obtain water and sewer record drawings, to discuss water and sewer service line capacity, size, routing, and tie-in points to the main distribution system, and for coordination of water and sewer utility work during construction or for inspection of contractor installed lines:

Chris Semler
CH2M Hill Co.
Phone: 931-980-7223

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APPENDIX G

Mold and Humidity Control

PARAGRAPH

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- G-2 [Building Envelope](#)
- G-3 [Tight Buildings](#)
- G-4 [Air Infiltration and Vapor Barriers](#)
- G-5 [Gypsum Board and Wall Finishes](#)
- G-6 [Attics](#)
- G-7 [Crawl Spaces](#)
- G-8 [System Selection / Space Humidity Considerations](#)
- G-9 [Condensate Leaks](#)
- G-10 [Barracks](#)

G-1 INTRODUCTION:

Mold grows where mold spores, nutrients, correct temperature, and ample moisture are combined. Controlling moisture is the best approach to avoiding mold. Eliminating mold spores is impractical, the organic materials in buildings offer potential mold nutrients, and the temperature in buildings is conducive to mold growth. Thus minimizing moisture by eliminating leaks, drips, and condensation in the wrong places must be addressed. Undesired water and moisture usually comes from problems in either the building envelope or the building mechanical systems or both. Wet materials and surfaces are not always required for mold to grow. Even high humidity conditions contribute to mold growth. Air conditioning systems must be designed to keep space humidity at reasonable levels.

G-2 BUILDING ENVELOPE

The design of the building envelope must consider removal of all air entry points, cold bridges, multiple vapor barriers and gaps in the insulation system. Attics (with exceptions) and crawl spaces should no longer be ventilated. Interior floor slabs should be separated from foundations by insulated expansion joint materials. Cavity wall insulation should extend down to the footings. Insulated windows should be aligned with cavity wall insulation to remove gaps in the insulation system. Window sills, foundation sills and other veneer wall features should

be isolated from the structural backup wall allowing cavity wall insulation to run continuously. Use only thermally insulated windows. When designing with metal stud backup wall, apply minimum 1 inch rigid insulation over exterior sheathing to improve thermal performance. Consider the use of new insulation products such as Polyisocyanurate which effectively eliminates air infiltration and vapor transmission.

G-3 TIGHT BUILDINGS:

Leaks of unconditioned outdoor air bring moisture into the building and lead to condensation on cold surfaces with subsequent wetting of building materials followed by deterioration of the materials and mold growth. Therefore, buildings that are relatively air tight must be the goal. A ventilated attic directly over an insulated lay-in ceiling, for example, does not represent tight building construction. Keep in mind that a slight pressure difference usually exists between inside and outside the building. Insulation batts alone will not stop air flow through the batt if a pressure difference exists from one side of the batt to the other and should therefore not be the only barrier to outdoor air. Mechanical air handling and exhaust systems are typically designed to bring in more air than they exhaust in an attempt to pressurize the building to prevent infiltration of outdoor air. This pressurization however is impossible if the building is full of holes. Pay close attention to the details of construction where walls meet roof to eliminate sources of air leaks. Note that building air tightness is not the same as vapor tightness. Buildings may be designed with or without vapor barriers depending on the indoor and outdoor conditions; however, air tightness must always be the goal.

G-4 AIR INFILTRATION AND VAPOR BARRIERS:

Recent studies have shown that air infiltration/exfiltration is a more significant source of moisture accumulation in walls than water vapor diffusion. Air infiltration barriers (such as Tyvek) resist entry of air in walls that can transport moisture and create condensation problems while allowing water vapor to escape. These barriers also resist wind blown rain and water while protecting wall sheathing.

The use of vapor barriers, vapor retarders, and perm ratings for construction materials in the building envelope must be carefully considered for use by the designer. Vinyl wall coverings, bituminous damproofing, certain paint systems all have properties which may create vapor retarders. If used, vapor barriers must be placed at a location where the temperature is above the dew point temperature in both the heating and the cooling seasons. It is critical to eliminate

multiple vapor retarders in wall systems which can trap moisture and create potential mold conditions.

G-5 GYPSUM BOARD AND WALL FINISHES:

Do not place paper covered gypsum board or other surfaces that may provide nutrients for mold behind wall mounted fan coil units. Condensate drips from the valves and cold piping inside the fan coil cabinet and a small splash occurs with each drip. Because manufacturers provide no rear panel to the fan coil cabinet, the splashed droplets dampen the wall surface behind the fan coil unit. Conventional gypsum board material at this location insures mold growth. Provide a wall liner made of plastic, metal, or other material that will not be a nutrient source for mold behind wall mounted fan coil units.

Do not use vinyl wall coverings on the interior surfaces of exterior walls or wall surfaces opposite kitchens or shower rooms. Moisture from these high humidity spaces will be trapped and condense behind the vinyl. Use of vinyl wall covering is not permitted in locations with predominant air conditioning loads rather than heating loads.

G-6 ATTICS:

Because mold is becoming more associated with the entry of moisture laden air in the building envelop, it is strongly recommended that ventilated attics be used only in limited applications. However, if an attic is ventilated, do not use a vapor barrier under the insulation installed on top of the ceiling. This is because in the cooling season, this puts the vapor barrier in a location made cold by air discharging from supply air diffusers.

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G-7 CRAWL SPACES:

Do not ventilate crawl spaces. Doing so introduces moisture to the crawl space which will migrate through floors and condense on the underside of floor coverings. The moisture can also condense on cold pipe surfaces within the crawl space; even the outer surface of the

insulation on a chilled water line can easily reach temperatures below the dew point of a ventilated crawl space.

Use a 10 mil vapor barrier on the ground surface to prevent moisture migration from the ground. Cover the vapor barrier with gravel.

G-8 SYSTEM SELECTION / SPACE HUMIDITY CONSIDERATIONS:

Direct humidity control using reheat is rarely necessary except in the most demanding climate control situations such as libraries or museums. Indirect humidity control can reasonably be achieved through thoughtful system design.

The paragraphs below are not meant to dictate equipment or system types. Rather, the goal is to point out the advantages and disadvantages of various systems with regard to space humidity for designer consideration.

Most systems are designed to do a good job of limiting humidity at full cooling load. The problem with high space humidity usually occurs at part load.

Oversized equipment essentially runs at part load all the time, so over sizing must be avoided.

Make sure the occupant's needs for temperature and humidity are known.

Design systems to limit space relative humidity to 45% instead of the usual 50% at full load. Use an indoor design condition of 78 deg F / 45% RH.

Design systems to limit space relative humidity to 60% at part load conditions.

Size cooling coils handling outdoor air for the design dry bulb temperature day, or the design humidity day which ever gives the greater coil capacity.

Single Zone Systems:

These systems modulate the supply air temperature in response to the space temperature.

Avoid adding safety factor to the cooling loads. Doing so increases the supply airflow, and with excess airflow comes high supply air temperature which leads to high space humidity.

A typical single zone air handling system serving a small office area is an example. Assess the cooling loads carefully and do not arbitrarily increase airflow or oversize the equipment.

Simple single zone systems serving a theater, an auditorium, or a gymnasium can be a problem, particularly if one air handler is used for the entire area. The wide fluctuation in load caused by the wide variation in the occupancy of these facilities leads to problems at part load conditions. In many cases, a single air handling unit sized for full occupancy can maintain space temperature setpoint with a supply air temperature that is within a degree or

two of the space temperature when the facility is at minimal occupancy. This insures part load humidity problems.

Get the airflow right and full load humidity problems are less likely. Always consider what will happen to the supply air temperature and the resulting space humidity at part load conditions. Consider the following possible solutions to part load humidity problems when using single zone equipment:

Colder Supply Air – Design for colder supply air. Then at part load the air will be colder than it would otherwise be, more moisture will be removed from the air stream, space humidity at part load will be lower. (Designing for lower space relative humidity will require colder supply air.)

Variable Air Volume Single Zone System – The single zone cooling coil provides constant discharge air temperature while the fan speed is modulated based on space temperature. After the fan reaches minimum speed the supply air temperature is modulated by decreasing.

Return Air Bypass Single Zone System – Using face and bypass dampers, bypass return air (not mixed air) around the cooling coil as the space cooling load is satisfied while the cooling coil operates with full flow.

Multiple Single Zone Systems – Use more than one air handling system. As the cooling load falls shut down one or more units. This causes the remaining units to supply colder air to maintain the space temperature setpoint.

Multizone Systems:

As with single zone, accurate determination of the cooling loads and zone airflow leads to good humidity control at full load conditions.

During warm weather, many multizone systems are operated without heating water to the heating coil because the boiler is turned off. Then at part load, mixed air is essentially

bypassed around the cooling coil through the hot deck. The moisture laden mixed air is then delivered to the space causing a rise in the space humidity.

Improved part load performance space humidity performance can be achieved by resetting the hot deck temperature upward during periods of high humidity. (Of course this requires operating the boiler during the warm weather months.)

A Texas multizone with individual heating coils in the individual zone ducts also offers a possible solution to the part load humidity problem by providing a means of reheat.

Carefully consider the part load space humidity before using a multizone system.

Dual Duct Systems:

These systems typically have a hot and a cold deck and are similar to multizone systems. Instead of zone dampers, modulating dual duct mixing boxes mounted near the space combine the hot and cold air streams from separate ducts then deliver the mixture to the space. The part load humidity problems are the same as with a multizone.

Improved part load space humidity performance can be achieved by resetting the hot deck temperature upward during periods of high humidity. Of course this requires operating the boiler during the warm weather months.

A modified arrangement known as a Dew Point Dual Duct system could be employed for good humidity control. All of the mixed air in the air handler passes through the cooling coil. Then a portion of this air is split off and passes through the hot coil then to the hot duct. Both hot and cold air streams have the same low dew point temperature giving this arrangement its name.

Carefully consider the part load space humidity before using a dual duct system. The system may be more expensive than other alternatives due to the requirement for two supply main ducts. As with a variable air volume system, terminal boxes are required, and these create additional maintenance.

Variable Air Volume Systems:

Because a VAV air handler maintains cold discharge air, it automatically maintains reasonable space humidity and should be considered where applicable and when budget permits.

However, VAV systems are not a panacea. The valve, heating coil, controls, and often filter and fan inside every VAV box represent additional maintenance. The maintenance aggravation is amplified when the VAV boxes are not easily accessible.

Computer Room Units:

Oversized computer room units are common. Determining the cooling load by summing all the nameplate amp ratings of all the computer equipment will surely result in an oversized unit and cause inefficient operation. Space humidity may not be a problem only because

the computer room unit has reheat capability. The unit adds enough heat to make up for the excess in airflow. Size computer room units to accommodate the estimated heat release from the computer equipment; airflows will be decreased, the supply temperatures will be lower for a longer period of time, and the reheat will operate far less frequently. Always consider multiple computer room units to split the cooling load.

Fan Coil Systems:

Fan coils usually handle sensible loads but often fall short on the latent load.

Do not design fan coil units to handle outdoor air because the cooling coils are usually not deep enough, because cycling the coil flow insures periods when no moisture removal occurs, and because local exhaust systems can cause bypass of outdoor air around the cooling coil directly into the space.

In lieu of specifying the total coil load for fan coil units, specify the entering and leaving air conditions, and specify that these conditions must be met at all fan speeds. Where multi-speed fan coil units are used, schedule the maximum airflow at the high fan speed setting.

Fan coil units represent a great maintenance burden. The multiple cooling coils with multiple filters, multiple condensate pans, multiple potential leak sources, and multiple potential locations for mold growth must be considered.

Fan coils shall be installed in a manner that will prevent water from dripping or splashing outside the drain pans. Require back splash panels to contain the splashing cause by drips from coil valves and uninsulated piping within the cabinet enclosure.

Direct Expansion (DX) Equipment

Avoid the use of DX coils in air handlers with constant running fans that handle outdoor air. When the sensible load is satisfied and the compressor turns off, unconditioned outdoor air is then delivered to the space and any water on the wet cooling coil is evaporated into the supply air and also delivered to the space. The result is poor part load humidity control.

G-9 CONDENSATE LEAKS:

Condensate drain pans and drain lines from air conditioning equipment must be designed to allow access for cleaning and flushing. Blockages in fan coil condensate lines are notorious for causing overflowing drain pans and wet floors, walls, and ceilings.

Improper trapping of condensate discharge in air handling units leads to water hold-up and overflow at the condensate drain pan.

Provide details of the condensate traps on the design drawings. Require adequate slope in two directions on condensate drain pans and drain lines (1/4 inch per foot). Make certain that

the equipment curb or equipment frame affords ample elevation of the pan outlet connection above the floor or roof to accommodate the required trap dimensions and drain line slope.

G-10 BARRACKS:

Barracks have historically had high humidity problems leading to mold growth in the living space.

In barracks, follow the design found in TI 800-01 Appendix B Unaccompanied Personnel Housing for the mechanical systems in barracks. This guidance requires that outside air be treated (heated / cooled) by a separate dedicated air handling unit to a neutral temperature, or as necessary to handle the latent load, and ducted to each living / sleeping room (Dedicated Outside Air System, DOAS).

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APPENDIX H
Fort Campbell, KY Technical Design Guide

Network Enterprise Center
Fort Campbell, KY
Requirements

Prepared By:
US Army Signal Network Enterprise Center (NEC)-Ft Campbell
856 North Carolina Avenue
Fort Campbell, KY 42223-5000

Revised
September 2014

MEMORANDUM FOR Directorate of Contracting**SUBJECT: Appendix H to the Fort Campbell, Kentucky Technical Design Guide**

- 1. Purpose.** To outline the associated reference documents and identify local enhancements/ clarification for all IT-related construction services provided on Fort Campbell, Kentucky. Based on varying environmental, infrastructure density and construction considerations unique to Fort Campbell, the NEC has identified the need to implement certain deviations from the references listed below as they pertain to IT construction efforts on the installation. These deviations are found at the enclosure and are listed by reference. Each deviation consists of: the Item Paragraph Number, Item Name, and verbiage as it appear in the reference; the deviation imposed by the NEC; followed by a justification for implementing that specific deviation.
- 2. References.** Below are the IT regulations/standards used by the Fort Campbell NEC to ensure compliance for all unclassified (NIPRNet) and classified (SIPRNet) and IT-related voice and data equipment/services and associated construction efforts:
 - a.** “Technical Guide for Installation Information Infrastructure Architecture (I3A), Department of the Army, U.S. Army Information Systems Engineering Command, Fort Huachuca, AZ”, dated, February 2010.
 - b.** “Technical Guide for the Integration of Secret Internet Protocol Router Network (SIPRNET), Version 7”, dated, September 2013.
 - c.** National Security Telecommunications and Information Systems Security (NSTISSI) No. 7003, “Protective Distribution Systems (PDS)”, dated, 13 December 1996.
 - d.** NSTISSAM TEMPEST/2-95, “Red/Black Installation Guidance”, dated, 12 December 1995.
 - e.** NSTISSAM TEMPEST/2-95A, Amendment to Tempest 2/95, 03 February 2000.
 - f.** ANSI/TIA 569, Standards Update, Pathways & Spaces for Telecommunications, current.
 - g.** Army Regulation 380-5, “Department of the Army Information Security Program”, Chapter 7, Section III, dated, 29 September 2000.
- 3. Applicability:** This policy applies to all persons who provide IT construction services to any facility located on Fort Campbell, Kentucky.
- 4.** This memorandum supersedes “Information Technology (IT) Technical Design Guide, dated, 05 January 2010.

5. Point of contact for this document is the, NEC Plans/Architecture Branch located at 856 North Carolina Ave., Fort Campbell, KY 42223, 270/798-6238.

Encl

EAYRE, TIMOTHY, EDWIN.1031025377

JAMES O. WEBB, JR., PHD
Director, Network Enterprise
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d.	NSTISSI TEMPEST/2-95, "Red/Black Installation Guidance", dated, 12 December 1995		H-25
e.	NSTISSAM TEMPEST/2-95A, Amendment to Tempest 2/95, 03 February 2000.		H-25
f.	ANSI/TIA 569, Standards Update, Pathways & Spaces for Telecommunications, current.		H-25
g.	Army Regulation 380-5, "Department of the Army Information Security Program", Chapter 7, Section III, dated, 29 September 2000.		H-25
Item: 7-3	Standards for Storage Equipment		H-25

Clarifications/Enhancements

a. Technical Guide for Installation Information Infrastructure Architecture (I3A), Department of the Army, U.S. Army Information Systems Engineering Command, Fort Huachuca, AZ”, dated, FEB 2010.

ITEM: 2.3.1 Outlet Box

Specify double gang electrical boxes of at least 2-1/8 inches (in) (54 millimeters [mm]) depth to provide dedicated space for current and possible future fiber optic cable (FOC) installation. For single connector outlets, such as voice-only; cable or community antenna television (CATV); or closed circuit television (CCTV), use a single gang, 2-in by 4-in by 2 ¼ -in (51-mm x 102-mm x 57-mm) electrical box, recess-mounted, with the faceplate flush with the wall surface. Locate a service power outlet within 6 inches (152 mm) of the CATV or CCTV outlet. Designers shall specify 4-11/16-in (119 mm) square by 2 ¼ -in (57 mm) boxes for 1-in (27 mm) conduit installations and outlet boxes that have or may require fiber optic cabling.

CLARIFICATION/ENHANCEMENT: Quad jacks will be used instead of a single jack use. Quad jack will be two voice and two data. NO single jacks will be installed without NEC approval in writing. ANSI/TIA-569-c states a power outlet should be within 3 ft of tel. outlet.

JUSTIFICATION: All jacks will contain two voice and two data, cat 6, so that each location will support two occupants. If an office needs more data than voice, jack usage can be adjusted at minimal cost. Also, see ANSI/TIA-569-C for power outlet install for each telecommunications outlet.

ITEM: 2.3.5 NIPRNET Outlet Types and Density

Table 1 lists the outlet types that are commonly used in military construction projects. Sketches of these outlets are included in Figure B-6 of Appendix B. The outlet types do not cover all possible user required configurations. The designer shall certify that all user-defined outlets have a corresponding valid requirement, such as fiber for various levels of classification. Outlet configurations shall comply with this TC and the current versions of TIA/EIA-568 and 569. Outlet densities are provided for planning purposes, when actual outlet locations are not known and cannot be determined with available information. The designer can develop reasonably accurate total outlet count estimates based on the size and dedicated usage of the space. Actual designs shall include outlets in work areas, office automation outlets, private office outlets, and wall or access phones as necessary. Private (fixed wall) offices or areas where it would prove difficult to add telecommunications outlets at a later date shall have a minimum of two (2) dual outlets on different walls to accommodate furniture layouts. These factors fall within the ranges given in TIA/EIA-569-B and are based on gross area (overall building footprint without deducting for equipment rooms, restrooms, etc.). Refer to Figure B-9 of Appendix B for a typical building floor plan.

Facility Space Category	Outlet Configuration	Planning Area (SF(SM)) per Outlet
Administrative space, to include classrooms, and medical/clinics	FOUR 8-pin modular (RJ45 type) outlet/connector in a QUAD gang outlet faceplate, TWO connectors labeled voice use and TWO labeled data use.	80(7.5) ONE QUAD OUTLET PER WALL

Headquarters and special users	Minimum of two 8-pin modular (RJ45 type) outlet/connector in a double gang outlet faceplate, one connector labeled voice use and one labeled data use, with additional 8-pin modular and/or fiber outlet/connectors as required.	80(7.5) ONE QUAD OUTLET PER WALL
Systems furniture	FOUR 8-pin modular (RJ45 type) outlet/connector in a modular furniture outlet faceplate with outlet box extender, TWO connectors labeled voice use, and TWO connectors labeled data use.	See Para. 2.3.5.3
Non-admin spaces (CDCs, Chapels, Recreation centers, etc.)	FOUR 8-pin modular (RJ45 type) outlet/connector in a QUAD gang outlet faceplate, TWO connectors labeled voice use and TWO labeled data use.	500(46.5)
Barracks space/bachelor officer's quarters (BOQ)	See below	See Para. 2.3.5.2
Warehouse space	FOUR 8-pin modular (RJ45 type) outlet/connector in a QUAD gang outlet faceplate, TWO connectors labeled voice and TWO labeled data use.	5000(465)
Wall and pay telephone outlet	One 8-pin modular (RJ45 type) connector in a single gang outlet faceplate with mounting lugs, labeled voice use.	As needed
Family housing units	See below	See below
Wireless access points	TWO 8-pin modular (RJ45 type) connectors in a DOUBLE gang outlet box labeled for data.	See below

Table 1 - Outlet Types

ITEM: 2.3.5.1 Family Housing Units

The designer **shall** determine the minimum outlet quantity for Army Family Housing (AFH) units based upon the number of rooms in the AFH unit. In general, provide one telephone outlet and one CATV outlet (as a minimum) in each of the following: kitchen, living room, dining room, family room/area, each bedroom, and any other logical location deemed appropriate. Copper outlet/connectors shall be TIA/EIA CAT6 for U.S. Army and U.S. Air Force projects.

ITEM: 2.3.5.2 Quarters

For U.S. Army barracks projects, provide one 8-pin modular (RJ45 type) connector in a single gang outlet faceplate, labeled voice use, and one CATV outlet per sleeping/living area. In Unaccompanied Enlisted Personnel Housing (UEPH), BOQ, Senior Enlisted Bachelor Quarters (SEBQ)/etc., provide one single RJ-45 outlet and one CATV outlet in each room of the suite; i.e., bedroom and living room, configured per TIA/EIA-570.

CLARIFICATION/ENHANCEMENT: For U.S. Army barracks projects, provide TWO 8-pin modular (RJ45 type) connector in a DOUBLE gang outlet faceplate, ONE labeled voice, ONE labeled data. In Bachelor Enlisted Quarters (BEQ), BOQ, Senior Enlisted Bachelor Quarters (SEBQ) etc., provide TWO 8-pin modular (RJ45 type) connector in

a DOUBLE gang outlet faceplate, ONE labeled voice, ONE labeled data on opposite walls for a total of two double gang outlets in each room of the suite; i.e., bedroom and living room, configured per TIA/EIA-570.

ITEM: 2.3.5.3 Systems Furniture Wiring

The designer shall specify a minimum of one systems furniture outlet per single occupancy cubicle. The designer shall specify a minimum of two systems furniture outlets per cubicle designated for servers, printers, copiers, or facsimile (FAX) machines. When systems furniture is installed as part of the construction contract, ensure that systems furniture specifications include the American National Standards Institute (ANSI)/TIA/EIA-568-C.0 and ANSI/TIA/EIA-569-B cabling and raceway standards. Multi-user telecommunication outlet assembly (MUTOA) may be used in lieu of fixed furniture outlets. However, the distribution of work area cables from the MUTOA to the desktop shall be addressed and accounted for in the telecommunications and the furniture designs.

ITEM: 2.3.5.4 Wireless Access Point (WAP) Cabling

Wireless access points may be required for wireless local area networks (WLANs) in some situations and are required for wireless intrusion detection systems (WIDS). If the project management for IT has approved the inclusion of wireless in the design, the recommendations herein shall be followed. For each wireless AP outlet, the designer shall specify one CAT6 unshielded twisted pair (UTP) cable terminated on a standard 8-pin modular connector. The CAT6 cable can be used in conjunction with Power over Ethernet (PoE) to provide both power and data to the AP.

The TIA Technical Committee TR-42 has published Technical Service Bulletin 162 (TSB-162), *Telecommunications Cabling Guidelines for Wireless Access Points*. The intent of this TSB is to provide a pre-cabled grid to support 802.11 WLANs. The current guidance is to place one WAP at the center of each 55 by 55-foot square grid for up to 20 users. For grid locations with over 20 users, provide two UTP cables. The TSB is based upon International Organization for Standardization (ISO)/International Engineering Consortium (IEC) Technical Report 24704, *Information Technology Customer Premises Cabling for Wireless Access Points*. Both the TIA and ISO utilize a 39-foot (12-meter [m])-diameter circle for WAP coverage. The designer shall note that a wireless survey will be required after the completion of construction to ensure proper wireless coverage. The WAP grid provides a foundation for implementing wireless but does not eliminate final wireless design. Provide WAP outlets at a minimum of one every 25,000 square feet within each building to support the WIDS installed by the Network Enterprise Center (NEC).

CLARIFICATION/ENHANCEMENT:

<u>Facility Space Category</u>	<u>(Area) Sq Ft per Outlet</u>
Classroom XXI, Administrative/Clerical/Technical	50
Warehouse/Motor Pool	200
Hangar	500

JUSTIFICATION: Because of the lack of work area and the number of personnel occupying that space, the increase in the amount of jacks per area help alleviate the connection to voice/data requirements that exist for activities/units.

ITEM: 2.4.1.1 Copper Voice and Data

For general projects, one CAT6, UTP cable shall be installed to each standard 8-pin modular connector provisioned at the outlet. For example, two 4-pair UTP cables shall be installed to a standard administrative outlet, or one 4-pair UTP cable to each single connector outlet. Copper cables shall not be split between multiple modular connectors. Only cable that has passed the Underwriters Laboratory (UL) LAN certification program and is labeled with UL-acceptable markings shall be used. Plenum cables shall be provided IAW National Fire Protection Association, Inc. (NFPA) 70, or as required by the facility safety officer or local building code. Terminations shall be provided IAW the paragraph entitled “Copper Termination” in this TG. The designer shall not use 150 ohm shielded twisted pair for new construction. CAT5-, CAT5e-, and CAT3-rated cable shall not be used in new construction or rehabilitation projects. A minimum of 3 m (10 feet) of cable slack shall be provided at the TR/TER and 1 m (3.28 feet) in the suspended ceiling for the telecommunications outlets. Service loops are not allowed for CAT6 cabling; slack shall be stored above the accessible ceiling in its natural lay, or in the cable tray, as shown in Figure 8.

a. Copper Termination: Terminations shall be performed using an 8-pin (RJ45 type) connector, rated for the category of the installed cable. In the standard Army cabling scheme, horizontal cables are arbitrarily designated “voice” and “data” to identify and differentiate their purpose. This designation in no way indicates a difference in the capability of the cable. Copper distribution cable shall be terminated at the TR on insulation displacement cabinet or rack-mounted patch panels compliant with CAT6 for general projects. Very small projects (i.e., fewer than ten users) may use a TIA/EIA category-qualified block or backboard-mounted patch panel. Cables from the same outlet shall be terminated in the same equipment rack to either the same or separate patch panels and shall be individually identified. All terminations shall be wired to the TIA/EIA T568A configuration. The T568B wiring configurations shall not be used unless they are specifically requested by the user and approved by the authority having jurisdiction. Copper cables shall not be split between multiple modular connectors.

b. Copper Patch Cables: Copper patch cables shall be 4-pair, 24 American Wire Gauge (AWG) stranded UTP cable, rated for CAT6, with 8-pin modular connectors at each end. Provide sufficient copper patch cables, of various appropriate lengths, to terminate all copper patch panel appearances.

c. Category 6 Augmented and Category 7: CAT6A and CAT7 have not been authorized for use in the I3A because of the following unresolved issues. The TIA/EIA is the United States’ trade organization and standards body that specifies structured cabling systems. The ISO/IEC is a network of the national standards institutes of 151 countries and is the international standards body responsible for specifying structured cabling systems. The TIA committee TR-42 has approved for publication the standard for 10G Base-T cabling, or augmented CAT6 (CAT6A): ANSI/TIA/EIA-568-B.2-10. The comparable ISO/IEC standard is ISO/IEC 11801 Addendum 1 Class EA. The ISO/IEC currently has a standard for a shielded-twisted pair (STP) cabling system, designated as Class F. The TIA/EIA has not yet formed a task group to explore the standardization of ISO/IEC 11801 Class F as Category 7. CAT6A cable is 15-20 percent larger in diameter than CAT6 and CAT5e cable. USAISEC, as of the publication of this TC, has not yet been able to evaluate the impact to cable tray fill and the cost increase associated with the use of CAT6A cable. Class F (CAT7) cabling also introduces the following issues: larger cable diameter, proper grounding of shields, and non-compatible connectors.

CLARIFICATION/ENHANCEMENT: Copper distribution cables (voice and data) will be terminated at the TR in rack-mounted patch panel, compliant with Cat 6. Cables from the same outlet shall be terminated on the same patch panel and individually identified. Standard installation on Cat 6 cable is now terminated to a Cat 6 patch panel Voice and Data alike, therefore the ports can be used for either. So the existing labeling and naming convention is not necessary, as long as the ports are identified by room, patch panel and port and is used in a pattern left to right or clockwise around a room and building. IE, (146A1) rm 146, patch A, port 1. It is set up to be used in a plug and play design.

Copper jacks will be EIA/TIA Category 6, 9-pin/8 position insulation displacement terminations wired to match existing system (T568A or T568B). If there is no existing wire, they will be wired per T568A (normal). All drops will conform to the following wire color scheme. Green – Voice and Unclassified data (NIPRNet); Red – Classified data (SIPRNet); and Orange JWICS (Top Secret) (Appendix A)

JUSTIFICATION: It saves space in the TRs and allows NEC to maintain a more efficient area. Some of the older facilities at Fort Campbell have a termination of T568B instead of T568A. If adding additional drops in those areas, continue with matching termination. Any NEW infrastructure with no present wiring will be T568A.

ITEM: 2.4.2.2 Copper Termination

Termination shall be performed using 110-type connectors, rated for the installed cable. All terminations shall be wired IAW TIA/EIA T568A. Twisted pair outside plant (OSP) cable is terminated on the Protected Entrance Terminal (PET); refer to Paragraph 3. Refer also to Figures B-5 and B-6 of Appendix B for details. Cross-connects can then be placed from the PET to the first set of 110-type terminal blocks as needed. The first set of terminal blocks provides connection for all backbones and for outlets served by the main TR. For main TRs that contain a telephone distribution frame, the horizontal main distribution frame (MDF) blocks shall serve as the main cross-connects. Refer to the MDF description in the section on Dial Central Offices (DCO) in the USAISEC *Technical Guide for Telephone Switching*, September 2006.

Post backbone communications nodes shall have an MDF for copper OSP cabling. For larger buildings with over 1200 pair copper, consider the use of an MDF frame. For example, in a three-floor building, one backbone cable shall be terminated on 110-type blocks on the same backboard as the PET; one backbone cable shall be terminated on 110-type blocks in the second floor TR; and one backbone cable shall be terminated on 110-type blocks in the third floor TR. A backbone cable connects a second set of 110-type blocks in each TR to a rack-mounted, 8-pin (RJ45 type) connector voice patch panel. This panel can be patched to the distribution patch panel which, in turn, terminates the CAT6 outlet wiring. Cross-connects can be installed by NEC/telephone personnel, and jumpers can be installed by the user/Information Mission Area (IMA) department, providing the desired connectivity between the OSP and the inside plant wiring. This design allows maximum flexibility for future moves, additions, and changes.

CLARIFICATION/ENHANCEMENT: Copper distribution cables (voice and data) will be terminated at the TR in rack-mounted patch panel, compliant with Cat 6. Cables from

the same outlet shall be terminated on the same patch panel and individually identified. Standard installation on Cat 6 cable is now terminated to a Cat 6 patch panel Voice and Data alike, therefore the ports can be used for either. So the existing labeling and naming convention is not necessary, as long as the ports are identified by room, patch panel and port and is used in a pattern left to right or clockwise around a room and building. IE, (146A1) rm 146, patch A, port 1. It is set up to be used in a plug and play design.

JUSTIFICATION: It saves space in the TRs and allows NEC to maintain a more efficient area.

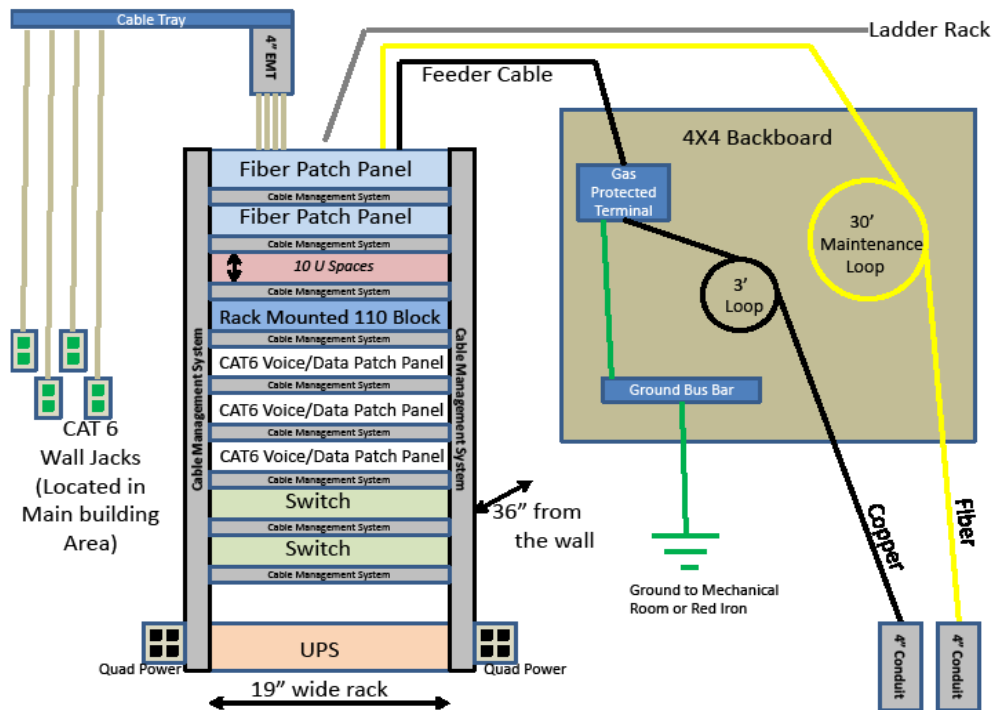
ITEM: 2.4.4.7 Small Facilities and Renovations

In new construction involving small, mixed-use (non-administrative) facilities, or in construction projects involving renovation of existing buildings, the use of “J” hooks, flexible cable trays, and alternative support systems specifically certified for CAT6 cable is permissible. All alternative telecommunications supporting structures shall be TIA/EIA-569-B-compliant and shall be designed and installed in accordance with TIA/EIA-569-B, NECA/BICSI 568, and the manufacturers’ specifications. Alternative support systems shall not exceed a 50 percent fill ratio. “J” hooks shall not exceed 20 cables or 50 percent of the fill capacity, whichever is less. Surface-mounted, non-metallic raceway may be used in renovation projects where access to the walls for installation of conduit and outlet boxes is not possible or where historical requirements prohibit the alteration of the building structure. Refer to Figure B-9 of Appendix B for details.

CLARIFICATION/ENHANCEMENT: “J” hooks will not be used.

JUSTIFICATION: These hooks do not supply enough support and cause points of stress on the cable.

ITEM: 2.5 Telecommunications Spaces



ITEM: 2.5.4 Room Door

The TR doors shall be a minimum of 36 in (1 m) wide, 80 in (2 m) tall, without doorsill or windows, hinged to open outward and shall be fitted with a lock to control access to the room. Doors shall open to the inside of the building served, except when strict controlled access is required (i.e., child development centers, youth centers, and dependent schools).

CLARIFICATION/ENHANCEMENT: Present buildings will have closet door(s) in Telecommunications rooms keyed separate from other locks in the building IAW DPW standards, with two copies of the key provided to the Supply Section of the NEC. On new construction or triaged buildings, closet doors will have a swipe card system installed.

JUSTIFICATION: Having a separate lock from others in the building provides for additional security and accountability of the expensive IT equipment. Swipe card access is the new standard for TRs as per ISEC.

ITEMS: 2.5.10 Fiber Optic Patch Panels (FOPPs)

Fiber optic patch panels shall be installed in, or adjacent to, the equipment racks or cabinets which will house LAN equipment. Patch panel connectors and couplers shall be the same type and configuration as those used elsewhere in the system. Utilize 568SC duplex connectors on 19-inch (475 mm) rack-mounted panels unless otherwise directed. Twenty-three-inch (580-mm) rack-mounted panels or minimum 12x10-in (300x250-mm) wall-mounted enclosures may be utilized when necessary, such as at small facilities in U.S. Army projects. A 3-foot (1-meter) slack

loop of fiber shall be provided within each panel, and panels shall provide strain relief for cables. Patch panels shall properly provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Provide a minimum spare capacity of 10 percent in the installed patch panels. Single-mode and multi-mode fiber optic cables shall be terminated on separate fiber optic patch panels.

CLARIFICATION/ENHANCEMENT: Fiber Optic patch panels WILL be installed in cabinets or racks that house the LAN equipment. No fiber optic patch panels will be installed on backboards unless specified by the NEC.

JUSTIFICATION: Patch panels need to be within a close proximity of the LAN equipment to make patching cables convenient and neat.

The Low Profile Fiber Optic Patch Panel is the preferred equipment due to it requiring less rack space.

ITEM: 2.5.15 Electrical Power

Provide a dedicated electrical panel for each TR with the following minimal requirements: 120/208 volt (V), 3-phase, 30-space panel with a minimum 100-Ampere (A) total capacity. All loads within the TR shall be fed from the dedicated TR panel and not from other branch circuits. Loads shall include, but are not limited to, receptacles, servers, UPS, data switches, and HVAC systems (including exterior units for split systems). A minimum of 30A spare capacity shall be reserved in each TR panel with a minimum of four unused spaces for future loads. In accordance with TIA/EIA-569-B, lighting fixtures should not be powered from the TR's electrical panel.

Additional 110V, 20A duplex convenience receptacles shall be provided at 6 feet (1800mm) intervals around the perimeter walls of the TR.

For all projects, provide a dedicated power circuit and receptacle for each 19 inch (480 mm) rack or cabinet. These receptacles shall be installed on the bottom of or immediately adjacent to racks or cabinets to avoid equipment power cords from being placed across the TR floor. The designer shall consult with the facilities engineer to determine the necessary power requirements since the rack or cabinet may contain devices requiring 110V and/or 220V circuits. Stackable type data switches serving smaller user populations users may only require 110V, 20A circuits, while blade servers, PoE switches, or larger network switches may require multiple 110V circuits or 220V circuits.

If there is a SIPRNET room adjacent to a TR, the TR's electrical panel shall also be used and sized for all circuit requirements for the operation of the SIPRNET room.

Design note for renovations: The designer shall specify a disconnecting means as defined in the National Electrical Code, Article 645.10, if the existing panel is not collocated or in close proximity to the branch-circuit power panel.

CLARIFICATION/ENHANCEMENT: A minimum of four dedicated 20 ampere, 110 volt AC outlets will be installed with each equipment rack or cabinet to provide power for

installed equipment. Each communication rack will have a 1000 CA UPS installed. Electrician will coordinate with appropriate contractor for location and type of outlet.

JUSTIFICATION: Having the outlets on the communication racks allows for ease of use, prevents the use of extension cords to connect switches and UPS and also keeps cords from trailing on the ground causing safety issues.

ITEM: 3.3.2.1 Copper

Calculate the number of OSP copper pairs by multiplying the number of users, outlets, or jumpers in the building by 1.5 pairs. For new construction or renovations, multiply the number of estimated outlets by 1.5. This factor shall add in some additional pairs for faxes, modems, and special circuits. Then, size the cable to the next largest industry standard cable size. For example, a building with 85 users would require a 200-pair cable ($85 \times 1.5 = 128 \approx 200$ pair).

CLARIFICATION/ENHANCEMENT: A minimum of 25 pair of dedicated physical copper is desired, if available. In those locations where available physical Cu is minimally available, the amount dedicated to a specific building may be reduced to 12 pr. or 6 pr., as recommended by the Infrastructure Manager, based on the function of activities in that particular building.

JUSTIFICATION: Current methodologies dictate the future direction of providing voice capability is to primarily be VoIP but, with minimal direct physical Cu backup. Also, direct physical Cu will be recycled for use as long as it is fully functional and, readily available. There are no plans to abandon use of fully functional Cu at this time.

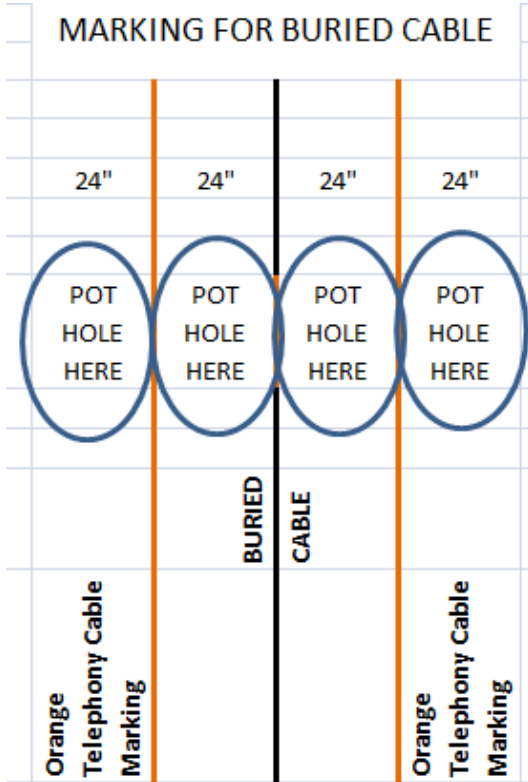
ITEM: 3.5.2 Utility Location

Unless otherwise stated in the design package, the NEC or DPW shall be responsible for the location and marking of utilities. The installer shall furnish a schedule of proposed excavation involving utility locations to the NEC/DPW in sufficient time to allow marking. Since each NEC/DPW has different operating requirements, the location's lead-time shall be stated in the design package. An acceptable utility mark shall be within 24 inches (600 mm) of the edge of the utility. After the utilities are located and marked, the installer is responsible for maintaining the marks until they are no longer required. The intent is that the utilities shall be located and marked only once and not after each rainfall.

CLARIFICATION/ENHANCEMENT: Cables for the NEC will be remarked upon justifiable request by the contractor. The Contractor will place a call to Tennessee One Call (811) or 1-800-351-1111 and locates will be done.

Always call 811 before you dig!

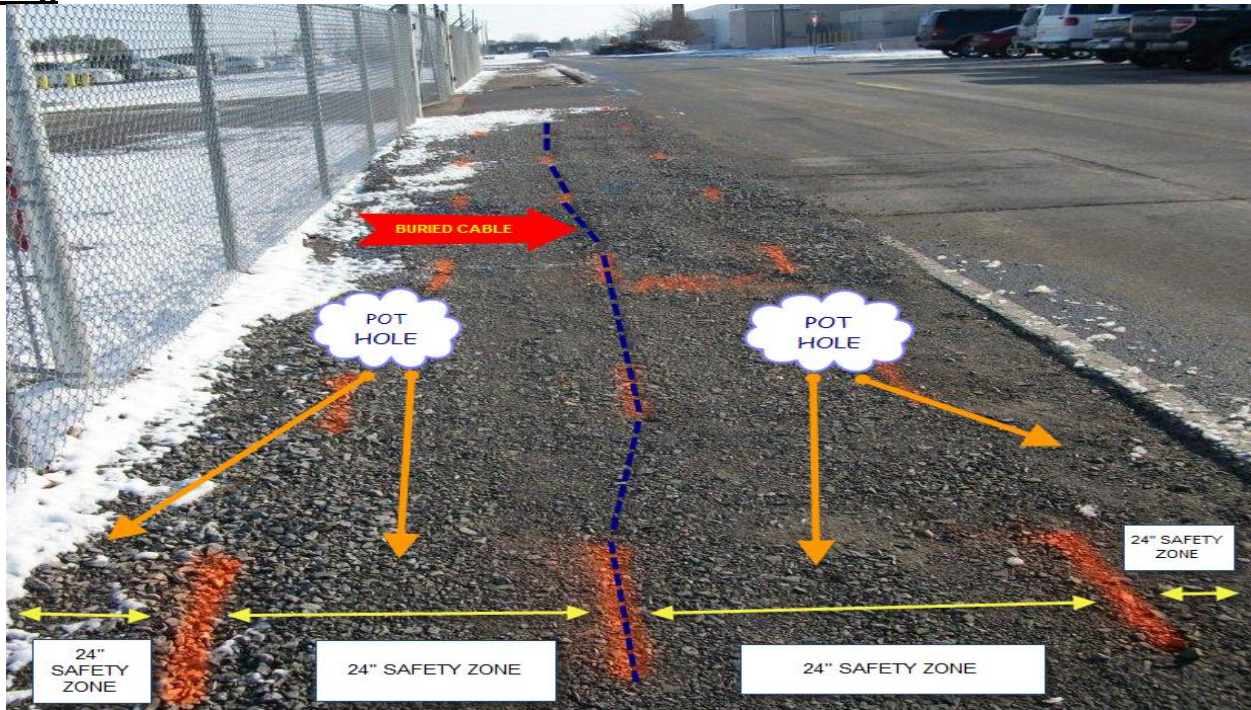
JUSTIFICATION: This practice is being done to cut down on the amount of cables and other utilities cut during the project.



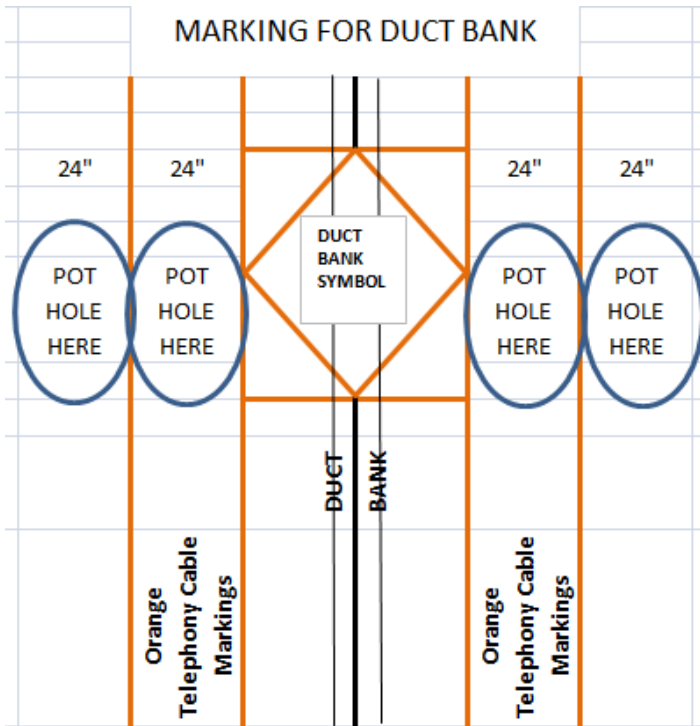
Orange paint shall be used to mark telephone copper and fiber optic cable. An excavator will exercise reasonable care to avoid damage caused by an excavation or demolition within the safety zone around the marked location of the underground utilities. The NEC IT Design Guide defines "SAFETY ZONE" as a strip of land at least eight feet (8') wide, but not wider than the width of the utility plus four feet (4') on either side of the utility.

The approximate location of underground utilities does not include a designation of location as to depth below the surface of the ground. Excavators shall use reasonable care to ascertain for themselves the exact depth of the underground utilities below the surface of the ground. The excavator, either U.S. Government or contractor, is responsible for positively determining the EXACT location and depth of all marked utilities suspected to be within 24 inches of the proposed excavation or directional drilling. The excavator

will make this determination by hand-digging and/or pot-holing to ensure the trenching or boring/drilling equipment does not damage the utilities. See I3A paragraph. 3.5.3 Pot Holing.



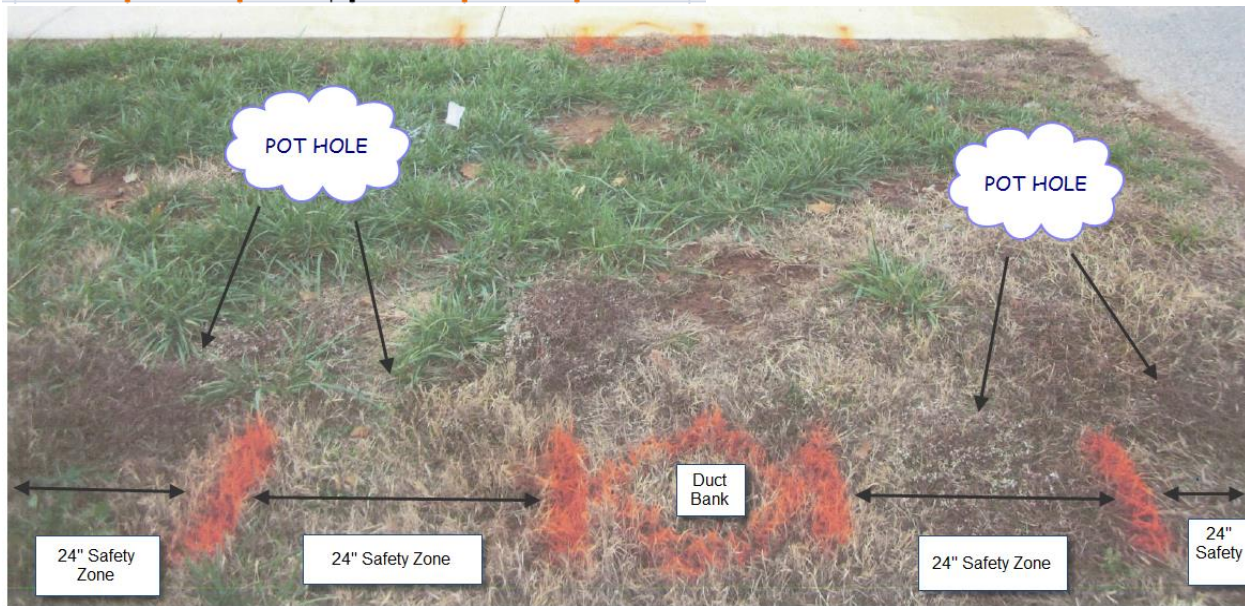
Actual NEC Utility Marking indicating a Buried Cable



PERMITS DO NOT RELIEVE LIABILITY.

CALL TENNESSEE ONE-CALL BEFORE YOU DIG. DIAL 811 OR 1-800-351-1111. IF PERMIT EXPIRES-CALL AGAIN.

NOTIFY NEC IMMEDIATELY IF A CABLE IS CUT OR DAMAGED OR IF AN UNMARKED CABLE IS UNEARTHED. DIAL NEC COR CELL AT 931-249-5561 OR NEC QAE CELL AT 931-561-1377 OR 931-619-5952.



Actual NEC Utility Marking indicating a Duct Bank.

The excavator, either U.S. Government or contractor, is responsible for positively determining the EXACT location and depth of all marked utilities suspected to be within 24 inches of the proposed excavation or directional drilling. The excavator will make this determination by hand-digging and/or pot-holing to ensure the trenching or boring/drilling equipment does not damage the utilities. See I3A paragraph. 3.5.3 Pot Holing.

ITEM: 3.5.9.2 Grass

All grass surfaces shall be leveled and reseeded unless stated otherwise (such as the placement of sod) in the design package. For grassy areas where the installer shall have to bring heavy equipment back onto the construction site, the areas shall be rough-graded and covered with protective matting to prevent erosion. For durations longer than two weeks between construction and final disturbance, the installer shall rough-seed the area to provide cover until final grading and seeding are accomplished.

CLARIFICATION/ENHANCEMENT: ALL grass areas will be leveled and either place new sod, use of a mesh ground cover or hydraspray will be used to prevent erosion of soil.

JUSTIFICATION: Due to the number of construction projects and the rainy weather in the area, this form of restoration will help keep erosion to a minimum.

ITEM: 3.6.3 Direct Buried

The DB cable plant system is the preferred method for placement in less congested areas (outside the cantonment area only).

Supporting documentation for buried cable installation is available in RUS Bulletins 1751F-640 (http://www.rurdev.usda.gov/SupportDocuments/UTP_Bulletins_1751F-640.pdf), 641 (<http://www.usda.gov/rus/telecom/publications/1751f641.pdf>), 642 (<http://www.usda.gov/rus/telecom/publications/1751f642.pdf>) and TIA/EIA-758, Customer Owned Outside Plant Telecommunications Cabling Standard.

Note: Above sites are located at the following URL under the BULLETINS Table (<http://www.usda.gov/rus/telecom/publications/publications.htm>)

CLARIFICATION/ENHANCEMENT: All cable splicing will be done either in manholes, hand holes, or pedestals. NO buried splices will be performed unless stated in writing by the NEC.

JUSTIFICATION: Buried splices do not protect the cable sufficiently, and are subject to freezing and thawing causing excessive unstable environmental conditions to the cable. This will allow ease of access for future maintenance requirements.

ITEM: 3.6.4 Aerial

Aerial cable plant systems are not a preferred solution but may be used as specified in the design package. Exceptions may include range cables or other long runs through undeveloped areas; locations where underground systems cannot be installed; or locations where compliance with local mandates is required. The desired or required reliability (i.e., "five nines" or 99.999% reliability) of some communications systems may preclude the use of aerial pathways. Aerial pathways and spaces may consist of poles, messenger wire, anchoring guy wires, splice closures, and terminals.

CLARIFICATION/ENHANCEMENT: Aerial cable will not be engineered.

JUSTIFICATION: Aerial cable is subject to thermal in the air and also has been torn down by heavy equipment and large vehicles.

ITEM: 3.7.1.3(b) Accessories (Locking Covers)

Each new maintenance hole shall be equipped with a lid, sump, pulling-in irons, ground rod, bonding ribbon, cable racks, and hooks. Accessories shall be designed for use in a telecommunications maintenance hole. Cable hooks shall be placed IAW RUS Bulletin 1751F-643, RUS Bulletin 1753F-151, and the Lucent Technologies Document 900-200-318, *Outside Plant Engineering Handbook*, October 1996, Practices 632-305-215 and 919-240-300, to support the weight of the cable and splice case.

b. Locking Covers: The first maintenance hole outside a DCO or wire node; maintenance holes at critical junctions; or maintenance holes equipped with carrier equipment will have a lockable cover. Additional maintenance holes requiring lockable covers may be identified as such in the Statement of Work (SOW)/Engineering Design Plan (EDP). The preferred lockable lid cover is one that utilizes a lever and clamp mechanism placed into a receiver that is installed into the cover. The mechanism will allow the cover to be replaced without indexing the cover to the frame. When locked, the mechanism will be flush with the frame surface, minimizing the potential for the cover to be dislodged. The bolt used to secure the cover is available in many configurations and can only be turned with a socket provided by the manufacturer. The U.S. Government will select the bolt configuration. A disposable tamper-evident plastic cap snaps into the lock body covering the recessed bolt head, keeping dirt and debris out of the bolt area. An alternative means of securing the maintenance hole utilizes an inner, water-resistant cover that can be locked by means of a General Services Administration (GSA)-approved, changeable combination lock. The U.S. Government will provide the locks.

CLARIFICATION/ENHANCEMENT: We do not utilize bolts or locking covers. The Ft. Campbell NEC standard is the LockDown Device™ with NEC specific ABLOY lock. The manhole will include a ladder from collar to floor of same.

JUSTIFICATION: The NEC standard Lock Down Device provides for easier access to the cable inside and also lockable to prevent access by unauthorized personnel.

ITEM: 3.7.1.5 Stenciling

All new maintenance holes shall be stenciled with a number designated by the NEC.

CLARIFICATION/ENHANCEMENT: Manhole name will be stenciled on the north side of the collar inside and also on the top of the lid.

JUSTIFICATION: This allows for ease of recognizing manholes and also the inside marking provides for recognition if the stenciling on the top of the lid wears off.

ITEM: 3.7.2 Hand Holes

Hand holes are reinforced concrete units provided with a lid that permits internal access to the housed components. Hand holes are typically used as pull points for small-diameter cables used

for building access. A hand hole shall not be used in place of a maintenance hole in lateral runs or in a main conduit system. Hand holes shall not be used in runs of more than three 4-inch conduits. Hand holes shall not be used for splicing cables without prior U.S. Government approval. Telecommunications hand holes shall not be shared with electrical installations. The acceptable hand hole size is 4 feet x 4 feet x 4 feet (1.2 m x 1.2 m x 1.2.m). Hand holes installed where vehicular traffic may be present shall be load-rated as H-20 and shall be equipped with round maintenance hole lids.

CLARIFICATION/ENHANCEMENT: Hand holes will be no less than 4ft. X 6ft. X 6ft. interior size unless otherwise stated in writing by the NEC. We do not utilize bolts or locking covers. The Ft. Campbell NEC standard is the Lock-Down Device™ with NEC specific ABLOY lock.

JUSTIFICATION: The larger hand hole allows more room for splice cases and ease of splicing. It also provides additional space for dark cable to be coiled up.

ITEM: 3.7.4.5(e) Minimum Duct Bank Sizing

e. Entrance conduits in minor buildings, as listed in the design package, shall be a minimum of one-way, 4-inch (100-mm) ducts if the entrance cables are less than one inch (25-mm) in diameter and if less than 40 percent of the duct area shall be used.

CLARIFICATION/ENHANCEMENT: Entrance conduits in ALL buildings, regardless of size, shall be a minimum of two- 4 inch ducts. All ducts installed will have, at a minimum, three cell and traceable fiber mesh (maxcell type) with an additional pull string outside the maxcell.

JUSTIFICATION: Due to the number of buildings that are being used in a capacity different than purpose intended we require two ducts so no additional digging would be required for additional infrastructure installation.

ITEM: 3.7.4.6(a) Duct Installation Guidelines

Depth of cover: At least 24 inches (600 mm) of cover are required above the top of the duct bank. At least 18 inches (457 mm) of cover are required under roads or sidewalks (if duct is concrete-encased). For ducts installed in solid rock, the cover shall consist of at least 150 mm (6 inches) of concrete. If rock is encountered below grade, the minimum cover above the concrete-encased duct shall be 12 inches (300 mm). Refer to Figure C-3 (Figure C-10 for Europe), Conduit Placement/Cut and Resurface, for details. The cover or fill shall be compacted IAW UFGS-02300.

CLARIFICATION/ENHANCEMENT: There will be 48” of cover required above the top of the duct or duct encasement. All ducts installed will have, at a minimum, three cell and traceable fiber mesh (maxcell type) with an additional pull string outside the maxcell.

JUSTIFICATION: Due to congestion of existing underground utilities.

ITEM: 3.8.3 Warning Signs

Buried cable warning signs or route markers shall be provided at intervals no greater than every 250 feet (76 m) or at each change in route direction, on both sides of street crossings, on pipelines, and on buried power cables. Color-coded warning signs or markers shall be orange in color.

CLARIFICATION/ENHANCEMENT: Wording:

**Underground Cable
Communications
Contact TN One Call at 811 OR 1-800-351-
1111 prior to digging**

In addition, the s

- **Sign mounted to steel PSP stake; orange in color preferred**
- **4ft. below ground in concrete; rising 5ft. above ground**
- **No more than 1ft. off the ditch line; perpendicular to the trench line**
- **If there is a change in direction, a sign should be positioned immediately at the turn showing the line**
- **Although I3A states every 250ft. for those areas that end up being less than 250ft. we request they be positioned accordingly, even if an additional sign needs to be added**

JUSTIFICATION: Orange PSP stake and height/depth is due to the height of the grass, especially in rear areas, and the bush hogs used to cut the grass. It will hopefully give us a fighting chance of not being hit/damaged or mowed over.

ITEM: 3.8.4 Plowing

Plowing shall be used in range environments or other areas where there are no significant obstacles and where cable runs typically exceed 1,000 feet (305 m) between splices. The design package shall identify areas in which plowing is deemed feasible.

CLARIFICATION/ENHANCEMENT: When trenching or excavating in the cantonment area, under no circumstances will rotary trenchers or plowing be allowed. The NEC prefers the method of open trenching, using bucket type equipment, i.e., backhoe and track hoe. It is however, acceptable to use plowing and rotary trenching equipment in the rear areas. The maximum width of the trench is in accordance with the type of equipment used to dig.

JUSTIFICATION: Due to congestion of existing underground utilities.

ITEM: 3.8.5 Trenching

3.8.5.1 Backhoe Trenching

Trenching with a backhoe shall be done only for short distances (i.e., from maintenance hole to building). The installer shall hand dig at all existing maintenance hole locations, building entrance points, utility crossings, through tree roots, under curbs, etc.

3.8.5.2 Trencher Trenching

A maximum trench width of 12 inches (300 mm) shall be used in DB applications done by a trencher. The installer shall hand dig at all existing maintenance hole locations, building entrance points, utility crossings, through tree roots, under curbs, etc.

CLARIFICATION/ENHANCEMENT: When trenching or excavating in the cantonment area, under no circumstances will rotary trenchers or plowing be allowed. The NEC prefers the method of open trenching, using bucket type equipment, i.e., backhoe and track hoe. It is however, acceptable to use plowing and rotary trenching equipment in the rear areas. The maximum width of the trench is in accordance with the type of equipment used to dig.

JUSTIFICATION: Due to congestion of existing underground utilities.

ITEM: 3.8.6 Depth of Placement

3.8.6.1 Copper Cable

The depth of placement for a DB copper cable shall provide a minimum top cover of 24 inches (600 mm) in soil, 36 inches (900 mm) at ditch crossings, and 6 inches (150 mm) in solid rock (RUS Bulletin 345-150/RUS Form 515A).

3.8.6.2 FOC

Direct-buried FOC shall be placed at a depth providing a minimum top cover of 42 inches (1070 mm). In solid rock, the minimum top cover shall be 6 inches (150 mm).

3.8.6.3 Frost Considerations

In areas where frost heaving can be expected, the cable or wire shall be buried below the frost line. Movement of OSP housings due to frost heaving can cause damage to the insulated copper conductors, optical fibers, or may result in loss of shield and/or armor continuity. In areas where movement of OSP housings by frost heaving is encountered, the OSP housings shall be installed on stub poles. The stub poles shall be set below the frost line and IAW the requirements of RUS Form 515.

3.8.6.4 Other Considerations

The NEC/DPW may stipulate special depth requirements for certain areas (i.e., tank tracks, ranges, etc.), which shall be provided in the design package.

CLARIFICATION/ENHANCEMENT: Depth of cover for all communication cables is 48” of cover. There will be NO new Direct Buried Fiber Optic Cable.

JUSTIFICATION: Due to congestion of existing underground utilities.

ITEM: 3.8.7 DB Cable Splicing

Buried splices shall be engineered and installed as identified in the design package. With U.S. Government approval, a buried splice may be used for the following conditions:

- Electrical or explosion hazard (i.e., ammunition areas).
- Vehicular hazard (i.e., motor pool areas).
- Security hazard (i.e., within a high security compound).

Only splice cases specifically designed for a buried application shall be used. All buried splices shall be encapsulated. All other splices in a DB run shall be placed in pedestals or maintenance holes. Encapsulation is not required in a pedestal.

CLARIFICATION/ENHANCEMENT: All cable splicing will be done either in manholes, hand holes, or pedestals. NO buried splices will be performed unless stated in writing by the NEC.

JUSTIFICATION: Buried splices do not protect the cable sufficiently, and the cables are subject to freezing and thawing causing excessive unstable environmental conditions to the cable. This will allow ease of access for future maintenance requirements.

ITEM: 3.11 Free Space Optics

Free Space Optics (FSO) can provide an alternative to FO connectivity for the “last mile” to EUBs and small enclaves. Typical FSO implementations result from one of the following factors that prohibit traditional infrastructure: rapid deployment, right-of-way permit issues, water, railroads, and rough terrain. The FSO is a line-of-sight (LOS), point-to-point, wireless optic technology that uses the transmission of modulated infrared beams through the atmosphere to obtain broadband communications. The FSO operates in the unlicensed near-infrared spectrum 750 nanometer (nm) to 1550 nm wavelength range. The FSO systems can function over distances of several kilometers (km), as long as there is a clear LOS between the source and the destination.

Design Note: For systems operating at 1.25 Gigabits per second (Gbps), the link distance shall be kept to approximately 1000 meters. If the FSO system is to operate in an environment of low visibility (fog), a backup system such as millimeter wave (MMW), symmetrical high-density digital subscriber line (SHDSL), or 802.11a shall be used.

A number of manufacturers are producing FSO equipment. The designer shall utilize an FSO device that has been tested, approved, and recommended by the USAISEC’s Technology Integration Center (TIC). The FSO equipment shall be designed to prevent data loss due to temporary blockages, such as birds, smoke, dust, rain, and light fog. The FSO devices shall be FDA- and IEC 60825-1 Class 1M-approved to ensure safety. Operational test reports on individual equipment, such as the Technical Report (TR) No. AMSEL-IE-TI 04-009, *Free Space Optics (FSO) Comparison Report*, November 2003; and TR No. AMSEL-IE-TI 05-066, *Grafenwoehr Free Space Optics (FSO) Demonstration Report*, June 2005, is available from USAISEC-TIC.

CLARIFICATION/ENHANCEMENT: FSO will not be implemented unless approved in writing by the NEC.

JUSTIFICATION: All non-wired transmission falls under Spectrum Management. This type of equipment operates on an unlicensed frequency.

ITEM: 3.15.2 Cable ID/Cable Tags

Cable ID/cable tags shall be installed at all termination points (terminals) and splices, including house cables. In maintenance holes, all new and existing cables that are part of the project shall be tagged/retagged between the splice and the wall and on both sides of a splice loop or maintenance loop. When a cable is re-homed to a new node, DCO, cross-connect box, etc., all existing cable tags and terminal labels on the re-homed cable shall be re-tagged and re-labeled to reflect the new information. One tag is required for a copper cable pull-through, and two tags are required for an FOC pull-through. Labels in maintenance holes and hand holes shall be machine-produced on a durable material suitable for the environment. Handwritten labels are not acceptable.

CLARIFICATION/ENHANCEMENT: NEC will provide necessary cable tags for all TRs, Manholes, Pedestals, and Hand holes; labeled with cable names and counts.

JUSTIFICATION: This allows the NEC to standardize cable tags and make sure exact verbiage, counts, and names are correct. It prevents errors made due to poor handwriting or incorrect tag types. (See Fort Campbell NEC Standard Cable Naming Convention below)

Ft. Campbell NEC Standard Cable Naming Convention

Please refer to the following standard cable naming convention when questions arise regarding infrastructure and, note that no infrastructure is to be dedicated or used without my approval.

Cable Tags

I3A compliant name/count

Tag, line 1

Field Size – 19 characters, TMS software package should have the ability to accept at least 20 characters.

Building of origin for the cable in question – 5 characters, digits only

Type of cable, Cu for copper, Fc for common SM fiber cable, Fw for DWDM fiber, (due to I3mp upgrades) – 2 characters, alpha only, first is upper case only, second is lower case only (I UNDERSTAND TMS WILL NOT ACCEPT LOWERCASE LETTERS)

Cable number – 3 characters, digits only, 101 – 999. to be used as a separator – 1 character (NOT PART OF THE CABLE NAME)

Pair/strand count: up to nine characters possible, four (digits only, beginning pr/strand), - (used as a separator), four (digits only, ending pr/strand)

Note: all field spaces up to pr/strand count shall be filled in

Cu Example: 00095Cu101.801-1200 would be a copper cable originating at building 95 (DCO) with the cable number 101, containing pairs 801 through 1200.

Fiber Example: 07030Fc112.49-60 would be a common fiber cable originating at building 7030 with the cable number 112 containing strands 49 thru 60.

The logical cross-check is when the tag on the cable inside the comms room matches exactly, the other end of the same cable in the manhole.

No cables shall be named otherwise.

ITEM: 3.15.3.3 Splices

- a. Copper and FOC splicing shall be performed IAW RUS Bulletin 1735F-401, *Standards for Splicing Copper and Fiber Optic Cable*, February 1995.
- b. Cable shall be spliced into one continuous length. All copper splices shall be of the fold-back type to facilitate future work in the splice. Fiber optic cable shall contain splice loops in trays IAW the manufacturer's recommendations.
- c. Completed splices shall meet similar performance and mechanical specifications of a single cable of the same overall length.
- d. Self-piercing, electrical, filled connectors shall be used when plastic-insulated conductors are spliced. The installer shall place and install connectors using a tool specifically designed to place those particular connectors. In North America, a 25-pair splicing module, 3M-type MS2 or equal shall be used. The same modules shall be used throughout the project and shall be consistent with previously-installed connectors to preclude a requirement for a variety of installation tools. B-wire connectors shall not be used. In Europe, a 10-pair splicing module system is used.
- e. Binder group integrity shall be maintained.
- f. All dead pairs in a copper cable shall be spliced through if the size of the continuing cable shall allow a clear and cap at the end. Only UL-listed material shall be used for capping cable pairs.
- g. All underground and buried splice cases shall use encapsulant-fillable closures and shall be filled with encapsulant upon completion of the splice IAW RUS Bulletin 345-72 (PE-74). To ensure sheath continuity, cable sheaths at all cable splices shall be bonded with bonding harnesses.
- h. Splice cases shall not be installed in such a manner that their weight is supported by the cables on the cable hooks in the maintenance hole. The use of non-encapsulated, re-enterable splice cases (for both copper and FOC) that are suitable for environmentally-sealed telephone splices in the aerial or underground non-pressurized network are acceptable for non-DB locations. The preferred method for installing splice cases is to hang them from an overhead support, such as a pipe supported by the set of cable hooks above the splice case.

CLARIFICATION/ENHANCEMENT: "Preform" stainless steel splice cases are Fort Campbell's preferred standard for all copper cable splices, or an equivalent which will be approved by the QAs or the infrastructure manager. NEC requires submittals for splice cases and splice modules prior to work beginning.

All splice cases shall be specified for the particular environment in which they will be placed and shall be sized to accommodate the cable count spliced. End plates shall be designed for the number and size of the cables served by the splice and shall be designed to seal around each cable individually. All splice cases shall be filled with re-enterable media to protect from corrosion and shall contain all necessary equipment to be installed properly, adhering to all appropriate electrical codes. Splices will be done

in 710 instead of MS2. Any changes to the splice case media will be approved by the NEC QAs or Infrastructure manager.

JUSTIFICATION: Specific splice cases are required in order to protect the cable infrastructure. They have been used on the installation for a number of years with no problems or unsolvable issues. Their durability and reliability has been proven over many years of use. Using 710 splicing is more compact and ease of troubleshooting.

3.17.3 Fiber Optic Patch Panels

ITEM: 3.17.3.1 Fiber Termination Device

All strands of FOC, both OSP and inside plant (ISP) will be properly terminated on FOPPs. The OSP plant FOC will be extended IAW the National Electrical Code standards into the main data closet/location of the building and terminated there. If the main data closet/location cannot be determined, the OSP FOC will be terminated on a lockable patch panel collocated with the copper PET. Inside plant FO riser cables between the main data room/location and any satellite data room(s)/location(s) will be terminated at both locations on the FOPPs. All FOPPs will be stenciled with the panel number and the cable count.

CLARIFICATION/ENHANCEMENT: Fiber optic cable (FOC) entering a facility will be terminated in a rack mounted Fiber Optic Patch Panel (FOPP). If lack of space for sufficient rack; FOPP will be mounted on backboard in coordination with written NEC approval. The Low Profile Fiber Optic Patch Panel is the preferred equipment due to it requiring less rack space.

JUSTIFICATION: Some of the older facilities at Ft. Campbell do not have sufficient space to provide a telecommunications room. In those instances a backboard mount is required.

ITEM: 3.17.3.2 Fiber Terminations

All terminations shall be made using subscriber connector (SC) or straight tip (ST) connectors (ST™-compatible) or as defined in the SOR/PWS. Per the ANSI, duplex SC is the recommended connector for OSP cable terminations. Use of the Physical Contact (PC) family of connectors may be required based on the performance requirements of the network or system to be installed, the interface of the terminal electronics, or planned upgrades to the system or network. Physical Contact connectors are also referred to as Polished Connectors. The PC family of connectors includes Ultra PC (UPC), Super PC (SPC), and Angle PC (APC). These connectors shall typically be used to support systems with 10-Gb or higher connection rates. All OSP fibers shall be fusion-spliced to factory-produced pigtails.

CLARIFICATION/ENHANCEMENT: All NEW terminations will be made using LC connectors. Any connectors already in place in triaged buildings or additional fiber connections in old buildings will be terminated with already present technology.

JUSTIFICATION: We are trying to standardize the connectors with the newest technology.

b. Technical Guide for the Integration of Secret Internet Protocol Router Network (SIPRNET), Version 7, dated, September 2013.

There are currently no deviations to this reference.

c. National Security Telecommunications and Information Systems Security (NSTISSI) No. 7003, Protective Distribution Systems (PDS), dated, 13 December 1996.

There are currently no deviations to this reference.

d. NSTISSI TEMPEST/2-95, "Red/Black Installation Guidance", dated, 12 December 1995.

There are currently no deviations to this reference.

e. NSTISSAM TEMPEST/2-95A, Amendment to Tempest 2/95, 03 February 2000.

There are currently no deviations to this reference.

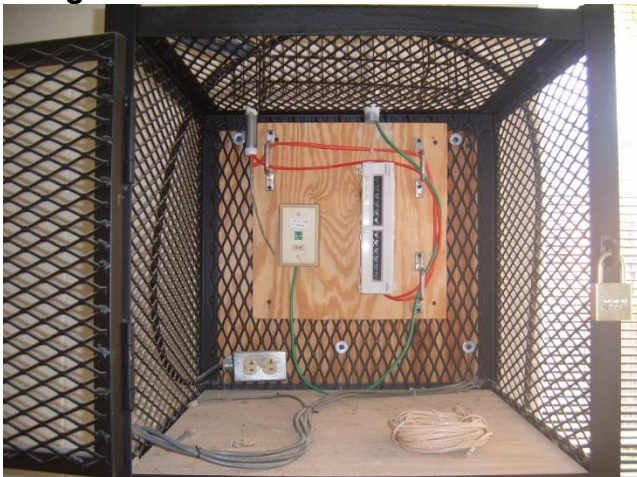
f. ANSI/TIA 569, Standards Update, Pathways & Spaces for Telecommunications, current.

There are currently no deviations to this reference.

g. Army Regulation 380-5, "Department of the Army Information Security Program", Chapter 7, Section III, dated, 29 September 2000.

7-3: Standards for Storage Equipment.

CLARIFICATION/ENHANCEMENT: All taclanes will be installed in a GSA Approved container/safe. Taclanes already installed in steel mesh cages as shown below will not be "grandfathered".



TACLANE CAGES, AS DEPICTED, ARE NO LONGER AUTHORIZED. TACLANE CAGES WILL BE REPLACED WITH GSA APPROVED CONTAINERS/SAFES.

JUSTIFICATION: See Secret Internet Protocol Router Network (SIPRNET) Technical Implementation Criteria, Version 7.0 dated September 2013.

----- END OF SECTION -----

Appendix I
IMCB-PWE
Borrow/Spoil Permit

Contract# _____

Contractor: _____

Vehicle Tag # _____

Material: Borrow Spoil

Material Type: Topsoil Fill

Dates of Excavation: _____

Quantity to be moved: _____

Authorized by _____

Date: _____

Signature _____

----- END OF SECTION -----

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APPENDIX I

Arms Room Requirements

Instructions for Contractors “Roughing-in for ICIDS-IV Equipment for Arm Rooms, COMSEC Vaults and RED SIPR Rooms”

First Priority in ICIDS installation is the contractor scheduling a meeting with the ICIDS Administrator, Mr. Anthony Saylor prior to commencement of work.

Second Priority The contractor will schedule, with the ACOE and ICIDS Administrator, an inspection of the reinforcing bars prior to pouring the cement for Arms Room and COMSEC Vaults.

Third Priority in ICIDS installation. The contractor schedules an inspection when ready to put the conduit and wiring up. The RADC(s) will be delivered at that time. After the rough-in is ready for inspection, notify ACOE and the ICIDS Administrator

NOTE: Type and placement of ICIDS sensors will be discussed at the meeting.

Contact information is: Office: (270) 412-5864 or (270) 798-1225, Cell Phone: (931) 624-1783, or email at: anthony.l.saylor.civ@mail.mil

- Contractor will run and tag all wires and provide all materials except as noted.

- Contractor will provide the ICIDS Administrator the As-Builts to the ICIDS protected area(s) during the inspection of the conduit and wiring.

1. Mount the Remote Area Data Collectors (RADCs and SubRADCs), in the ICIDS zones, on the same side as the interior door opens, approximately two feet to the left or right of the door and five feet up from the floor, (the exact location will be discussed during the first meeting with the contractor), See Picture #1. RADCs and SubRADC will be provided by ICIDS Administrator.

2. All foursquares, for sensors, will be flushed mounted and covered with a plate once the wire has been run. The exact location will be discussed during the first meeting with the contractor. ½” or ¾” EMT must run from each foursquare to the RADC and SubRADCs top, approximately six inches from the top right side, see picture # 1. A punch out will be needed. Wall mounted foursquares will be approximately eight - nine feet high and one foot from the wall. Arms rooms will have a minimum of six foursquares (one above the door, one for the duress switch, one or two in the center of the arms room and two wall-mounted. SIPR and COMSEC vaults will have a minimum of two foursquares.

4. If only one SubRADC, CAT 6, in ½ or ¾ inch EMT; will run from the SubRADC to the RADC, leaving six feet at each end. Each RADC can have up to two SubRADCs. If there is two SubRADCs, from the second SubRADC, CAT 6, in ½ or ¾ inch EMT will run from the SubRADC to the next SubRADC, leaving six feet at each. The last SubRADC, CAT 6, in ½ or ¾ inch EMT will run from the SubRADC to the RADC, leaving six feet at each end. The CAT 6 will be identified and labeled, at both ends, with the SubRADC room number.

5. From each RADC, single mode fiber and CAT 6, in ½ or ¾ inch EMT; will run from the RADC to the NIPR Room Patch Panel, leaving six feet at each end. The single mode fiber and CAT 6 will be identified and labeled, at both ends, with the RADC room number.

7. Dedicated 120 Volt AC power with minimum of a 20 AMP Breaker must run to the bottom left of the RADC and SubRADC cans through ½” or ¾” EMT see picture # 2 for exact location, to the closest electrical room. The 120 Volt AC power will be terminated in the power line filter, as indicated on Picture # 2. The Line must be labeled with the electrical room number and which breaker it is on.

8. Arms Rooms Doors: Interior and exterior lighting will be provided for all arms storage buildings, buildings in which arms storage rooms are located, and arms storage rooms. The lighting will be sufficient to allow guards (or individuals responsible for maintaining surveillance) to see illegal acts,

such as forced entry or the unauthorized removal of arms during hours of reduced visibility. Areas appropriate for lighting include entrances to buildings, corridors, and arms rooms. When an arms room is located inside a building, the entrance door to the arms room will be illuminated. Arms rooms that are located within another room (for example, a supply room); do not require security lighting over the arms room door. When an arms room is located inside another secured room, the exterior door to that room will be illuminated.

9. Secure storage rooms must meet secure room standards IAW AR 190-51:

Doors: Doors will be a minimum of 1 3/4-inch thick solid core wood or hollow steel. Hollow steel doors will be industrial type construction with at least 20-gauge skin plate thickness and will be internally reinforced with continuously spaced stiffeners. Door frames will be constructed of a minimum of 18-gauge steel. Doors with locking systems exposed to the outside will be kept to the absolute minimum number needed based on operational considerations. In addition, the doors will meet the following installation requirements:

- Door hinge mounting screws should not be exposed to the exterior of the facility. If screws are exposed, they will be spot welded, peened, covered, or filled with material in a way to prevent easy removal. Nails will not be used to mount hinges or any other door hardware.
- Door hinge pins should not be exposed to the exterior of the facility. If they are, they will be spot welded, covered, filled, or otherwise secured to prevent easy removal.
- Doors secured from the inside will be secured with a deadbolt locking device, crossbar, or similar locking device resistant to jimmying and manipulation from the outside. Latch style door locks will not be used. Locking devices will conform to U.S. Army Corps of Engineers guide specifications.
- Doors secured from the outside will have locking devices conforming to U.S. Army Corps of Engineers guide specifications for the type of structure or with U.S. Government approved tumbler-type, key-operated padlocks. The servicing facility engineer will verify lock conformance with the guide specification.

Windows: The following apply to all first floor openings, except doors, in excess of 96 square inches that are located less than 12 feet from the ground level and to similar openings above the first floor which can be reached from an elevated portion of the structure or an adjacent structure which provides ground level access. Long narrow openings with the shortest dimension measuring less than 6 inches are exempt from these requirements. If window air conditioning is used, bar, mesh, or fence fabric assemblies will completely enclose the air-conditioning unit protruding from the building or storage room exterior. If the window air conditioner is mounted through the wall, measures will be taken to ensure that it cannot be removed from the outside.

- Operable windows will have adequate individual locking devices. Windows will also be covered with 1/2-inch diameter diamond mesh/bars spaced at 6 inches on center each way, with 1/16-inch expanded metal mesh, or with 9-gauge chain link fabric.

Walls: Walls will be constructed of at least 1/2-inch plywood, 1-inch tongue-in-groove wall boards, or 26-gauge steel siding

Floors and Ceilings: The following requirements do not apply to slab on grade floors. No special requirements apply for such floors.

- Floors and ceilings will be constructed of at least 1/2-inch plywood, 1-inch tongue-in-groove wall boards, or 24-gauge steel deck.

NOTES:

#1: All conduits going into the RADCs & SubRADCs must be flushed on the inside of the can's top, approximately six inches from the top right side, picture one.

#2: All holes drilled into the RADCs & SubRADCs, to run wires/fiber, must be sealed off with no metal showing; there are marked areas in the RADCs & SubRADCs that can be used. If new holes are drilled they must be drilled in such a way that the inside parts of the RADC must be attached unhindered.

#3: For every wire/CAT 6/single mode fiber leave approximately six feet at both ends and all wires/CAT 6/single mode fiber will be labeled, at each end, tagged with the sensor number and one the foursquare plate covers.

#4: For new buildings with ICIDS requirements and rooms other than arms rooms, COMSEC Vaults and/or SIPR Rooms, the ICIDS Administrator will instruct the contractor where to run the wires and mount the foursquare boxes.

#5: All foursquare boxes must have covers.

#6: Measurements: RADC: Approximately 5 to 5 ½ feet above floor and two feet left of door.

#7: Wire Type: - West Penn 220 = 2 conductor 22 awg (product manufacture can be Substituted) All Wire must be Single Stranded solid copper.
- West Penn 240 = 4 conductor 22 awg (product manufacture can be Substituted) All Wire must be Single Stranded solid copper.

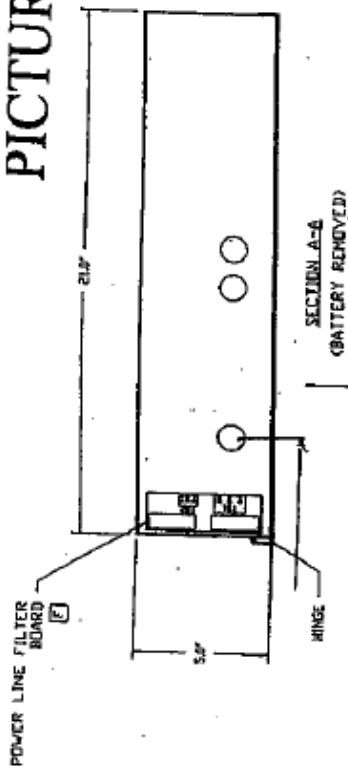
#8: Power: Black, Red, Green 12 AWG solid to RADC/SubRADCs.

#9: Arms Rooms Rough-in: All arms rooms will have one foursquare approximately eighteen inches above, and centered, of the arms room door, two ceiling mounted, and two wall mounted foursquares. If the arms room has a cage, there will be an additional wall mounted foursquare. Exact location will be discussed during the meeting with the contractor.

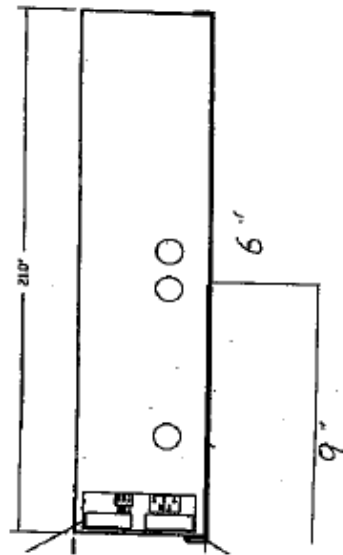
#10: SIPR/COMSEC/Open Storage: All SIPR, COMSEC, and Open storage zones will have one foursquare approximately eighteen inches above, and centered, of the arms room door and one ceiling mounted or wall mounted foursquare. Exact location will be discussed during the meeting with the contractor.

#11: **SCIFs:** ICIDS for SCIF Rough-Ins will be discussed during Master Plans Meetings to determine amount of foursquares, conduit, and wire needed. If a SCIF Remote Status Monitor (RSM), is needed, the requirements for the Uninterrupted Power Supply (UPS), will also be discussed during Master Plans Meetings to determine the contractor's requirements to install 120 Volt AC power, with minimum of a 30 AMP Breaker, to the UPS System. The UPS System is provided by the ICIDS Administrator.

PICTURE # ONE

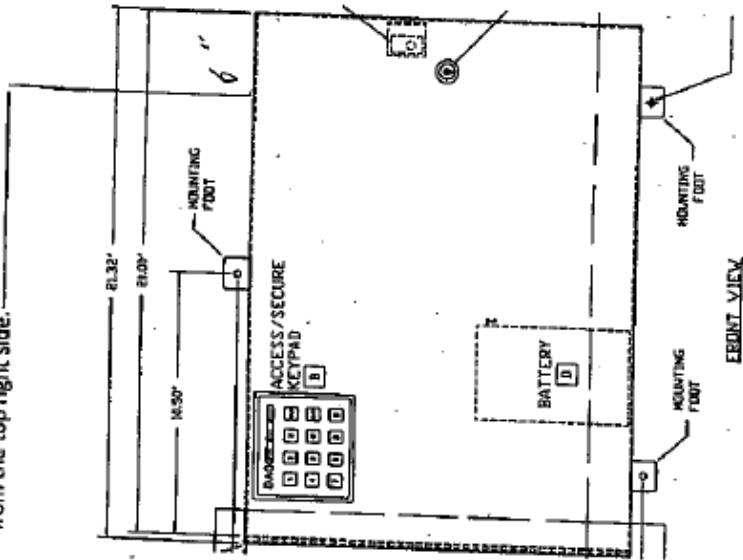


120 V Power: 1/4 or 1/2 inch EMT terminating the 120V Into the Power Line Filter Board

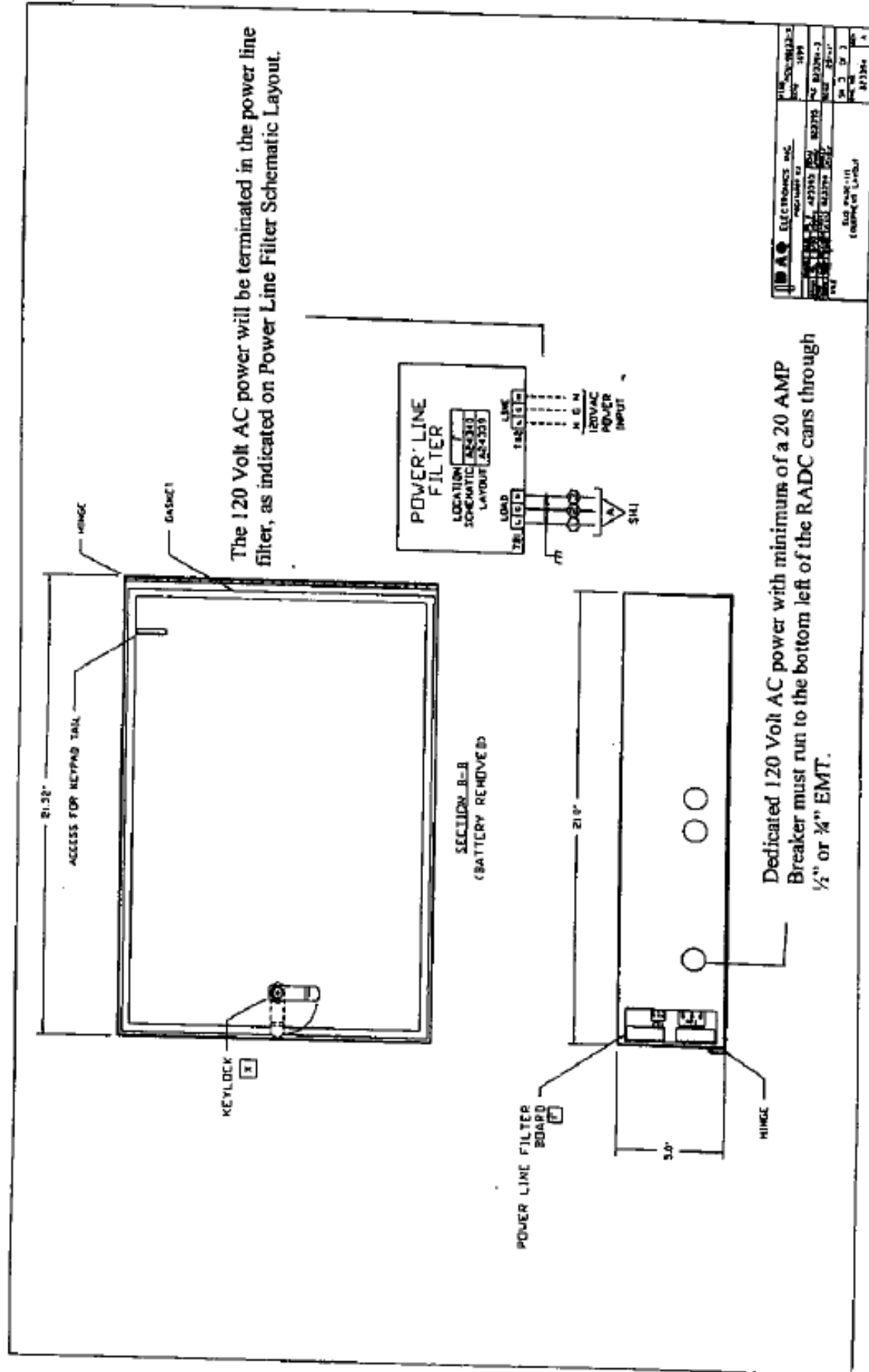


DURESS: 1/2 or 1/4 inch EMT from the bottom, centered, approximately six inches down, and 9 inches to the left side of the RADC/SubRADCS

Sensor Wires: 1/2 or 1/4 inch EMT will be mounted to the top of the RADC SubRADCS approximately six inches from the top right side.



PICTURE # TWO



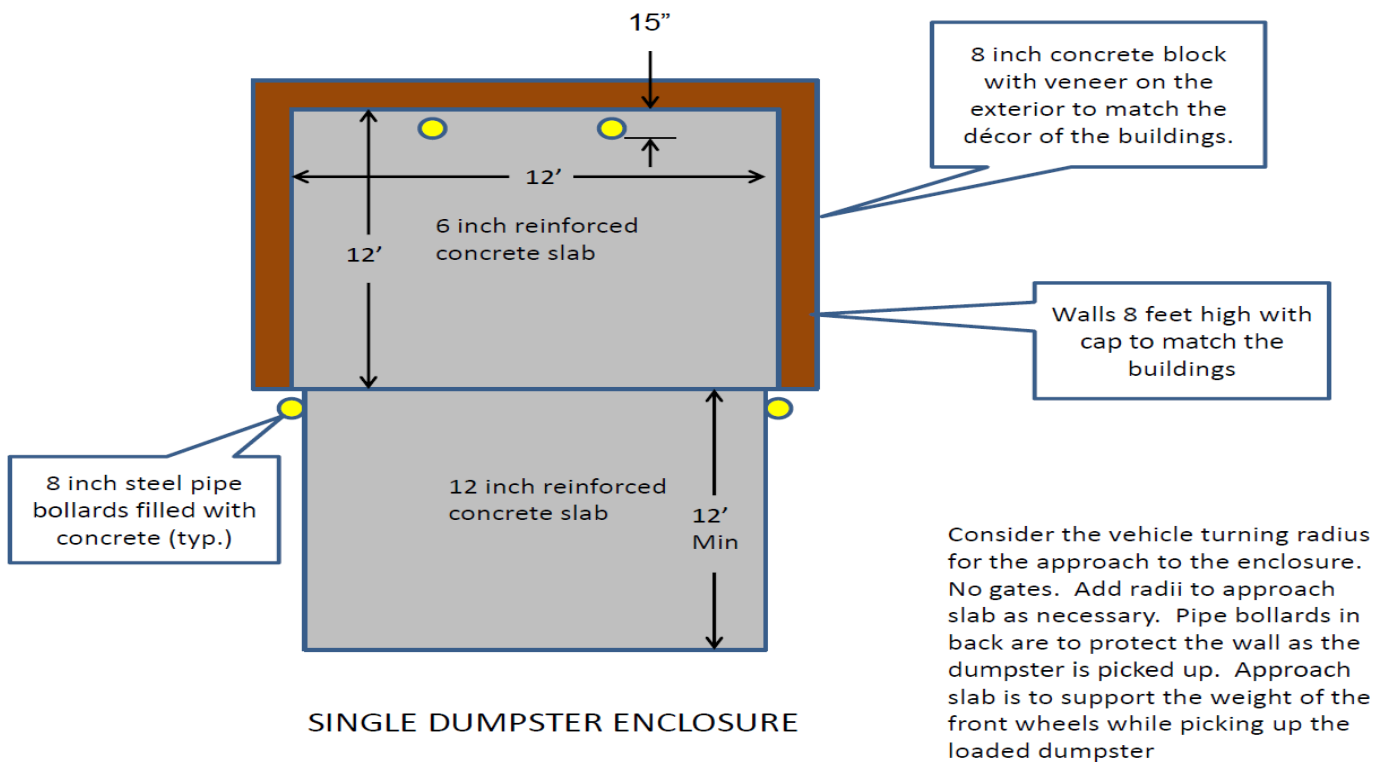
----- END OF SECTION -----

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APPENDIX J

Refuse Container Enclosures

The three figures show the approximate shape of the dumpster and compactor enclosures. For multiple dumpsters, add 10 feet of width for each additional dumpster. For compactors add 12 feet of width for each additional compactor. For additional dumpsters or compactors add two bollards in the rear of the enclosure. The slab should be designed for the weight of the vehicle (refuse collection truck or roll off container truck with the dumpster or compactor). There are no open top large refuse or recycle dumpsters used by the Fort Campbell Refuse



Contract other than at the convenience center. Pipe bollards must be yellow in color for safety. The interior of the enclosure should be painted to match the décor of the project. New dumpster enclosures shall be located within the fenced area of facilities that have a perimeter fence.

Figure K-1

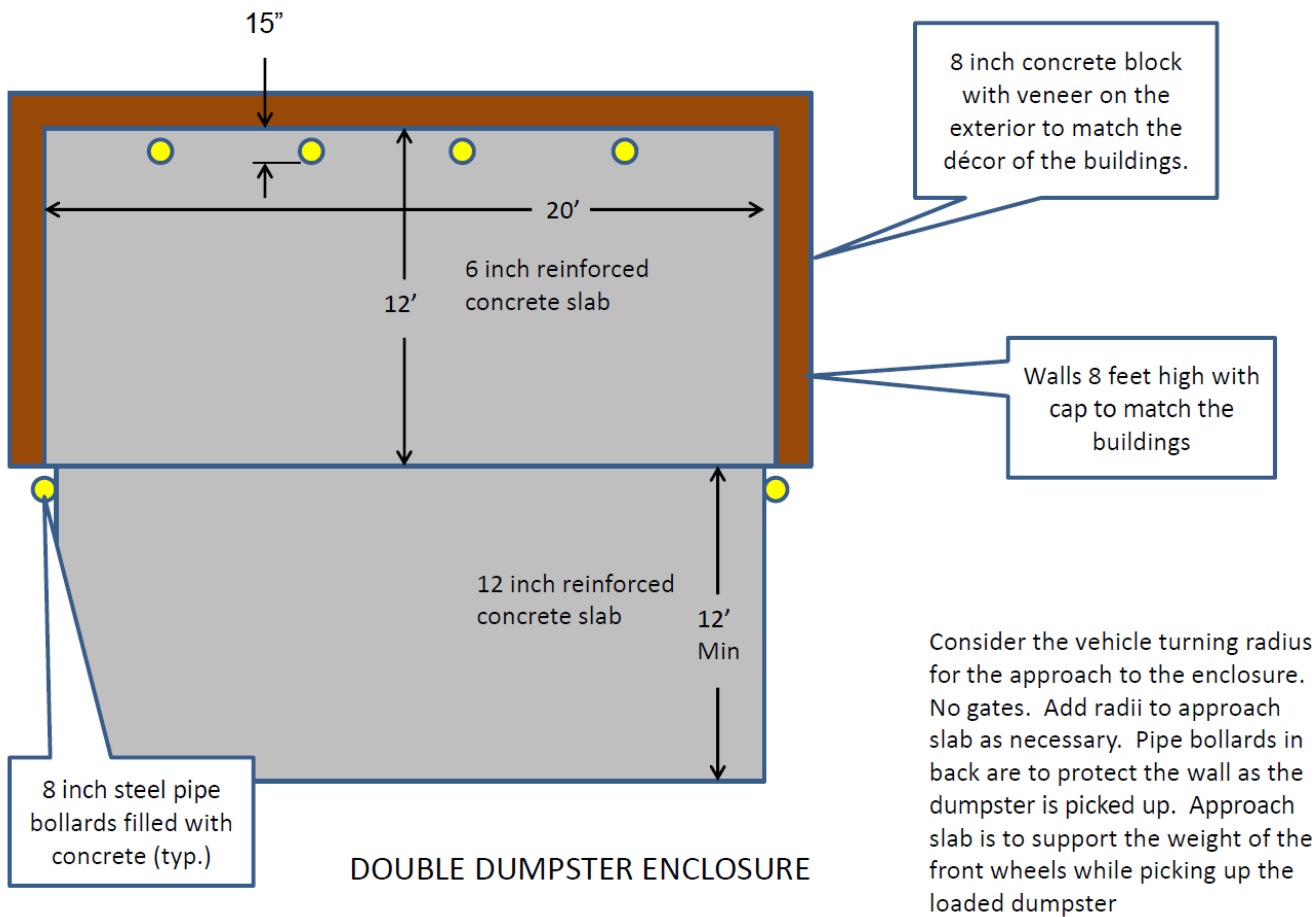
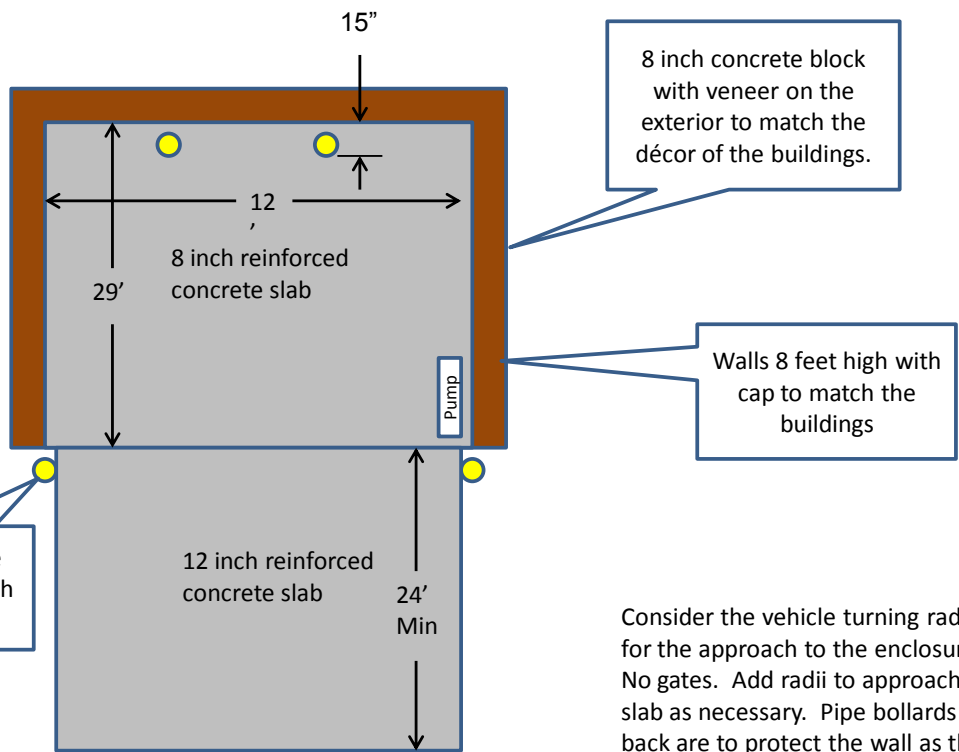


Figure K-1

Figure K-2

Compactors need hydraulic pumps and electrical connections . Normally placed on the right side.



8 inch steel pipe bollards filled with concrete (typ.)

8 inch concrete block with veneer on the exterior to match the décor of the buildings.

Walls 8 feet high with cap to match the buildings

Consider the vehicle turning radius for the approach to the enclosure. No gates. Add radii to approach slab as necessary. Pipe bollards in back are to protect the wall as the dumpster is picked up. Approach slab is to support the weight of the wheels while picking up the loaded dumpster

SINGLE COMPACTOR ENCLOSURE

Figure K-3

----- END OF SECTION -----

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Appendix K

Grinding of Concrete, Asphalt and Masonry Materials

The Contractor will be required to perform on-site grinding of one hundred percent (100 %) of any concrete, asphalt and masonry materials (hereafter “ground concrete”) generated at any project that produces greater than twenty (20) cubic yards of concrete. The Contractor must use as much ground concrete as possible on-site at the project location,* thereafter delivering any remaining ground concrete to a designated storage area located in the rear area of the installation. All ground concrete used on-site at the project location must be approved by the Contracting Officer for use at the project location.

The Contractor will be required to crush the concrete into 50% riprap and 50% #2 sizes and dump each load of ground concrete into the appropriate-sized pile.

Please note that all delivered ground concrete shall be placed in piles according to size of ground product – NO EXCEPTIONS.

At this time, the designated storage site will only be used for one construction/demolition project. The Contractor shall prepare the area selected for the ground concrete storage site and then construct a fence around the area to enable site management and stockpile maintenance. The fenced area shall also have a locking gate, and the Contractor and the Corps of Engineers will monitor quality control and quality assurance to ensure that, prior to the dumping of any loads of ground concrete:

1. Metals and steel rebar have been removed from the concrete;
2. The concrete has not been contaminated with trash or other materials prior to delivery;
3. The area is not used as a dumping ground for other wastes.

The Contractor COR and DPW Environmental Division, Pollution Prevention Branch, will require a QC signature of quality of ground concrete, to include the approximate amount of metals in the ground product and size (grade) of the ground product.

The Contractor will be responsible for removing and recycling any metals, including reinforcing steel, from the concrete. All metals will become the property of the Contractor for salvaging/recycling.

Weights of any metals recycled are to be reported to personnel at DPW Environmental Division, Pollution Prevention Branch.

Contractor is also to provide the size and quantity of ground concrete generated at the project location to personnel at DPW Environmental Division, Pollution Prevention Branch.

The stockpiled ground concrete shall be used within one year.

DPTMS Range Control, in conjunction with DPW Environmental, will select the storage location and will have use of any of the ground concrete located at the site. DPW Roads & Grounds will also have access to the ground concrete and the storage area. If it is found that the materials are not being utilized quickly enough to use up within one year's time, other contractors may be permitted to obtain materials from the storage area.

The Environmental Division will obtain any permits applicable to this requirement, including a Storm Water Pollution Prevention Plan, as well as ensure that any permits and environmental controls are monitored for compliance. The Environmental Division will furnish the specifications for grinding concrete.

The success of the project will determine if the storage site will be used for another project or be restored to its previous condition. If it is determined that it will be restored to its previous condition, this will be the responsibility of the Contractor to finalize. At the completion of the project, the fenced site and the fence shall become the property of Range Control.

* Please note that ground concrete may also be used on site as substrate placed under constructed Green Spaces following excavation at the project location, thereby reducing the quantity of stockpiled ground concrete, reusing the ground concrete, and enhancing soil drainage, subject to approval by the Contracting Officer.

----- END OF SECTION -----

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Appendix L

Antiterrorism (AT) Construction Standards

Ft. Campbell Requirements:

The Fort Campbell Installation Antiterrorism Office reviews construction plans for projects in order to ensure compliance with current AT standards and application of the Installation's specific Design Basis Threat.

Primary references for AT construction standards are:

- a. UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings (9 FEB 12).
- b. UFC 4-010-02, DoD Minimum Antiterrorism Standards Distance for Buildings (9 FEB 12).
- c. UFC 4-020-01, DoD Security Engineering Planning Manual (11 SEP 08).
- d. UFC 4-022-01, Security Engineering: Entry Control/Access Control Points (25 MAY 05).
- e. UFC 4-022-02, Selection and Application of Vehicle Barriers (8 JUN 09).
- f. UFC 4-022-02FA, Security Engineering - Concept Design (8 JUN 09).
- g. USACE PDC List: DoD Anti-Ram Vehicle Barriers (APR 12).
- h. PDC-TR 10-02 Blast Resistant Design Methodology for Window Systems Designed Statically and Dynamically (19 APR 12).
- i. Threat Assessment for Fort Campbell, KY (1 FEB 12).

Multiple disciplines are addressed for AT compliance during building projects. AT minimum standards are contained in the list of references above (a. thru i.) and will be met in the design and construction of new facilities. As a summary, the "Pre-Final Checklist – DoD Minimum Antiterrorism Construction Standards" is a supplement to published AT construction standards. This UFC based checklist should be used by all disciplines of design and construction personnel to document that AT compliances have been addressed and met during the design and build phases of projects. [The checklist can be found in Figure M-1.](#)

Various types of vehicle and pedestrian protective barriers are required for Installation Critical and Non-Critical Assets on Fort Campbell. Rationale for employing required protective barriers by type on Fort Campbell will be in accordance with the, "Decision Flow Chart for Protective Barriers." [The flow charts can be found in Figures M-2 and M-3.](#)

The designation of a facility as either a Critical Asset or Non-Critical Asset will be determined by the Installation AT Office through coordination with the Senior Commander's Office for approval.

For any facility that employs non-standard punched window systems (glass walls / storefronts), Blast Analysis will be conducted by the project contractor in coordination with the Installation AT Office and provided to DPW for AT Office review. Proposed non-standard window systems will comply with PDC-TR 10-02 Blast Resistant Design Methodology for Window Systems Designed Statically and Dynamically (19 APR 12).

Desires by any party to not conform to the UFC or to Fort Campbell Technical Design Guide AT standards will require that a formal waiver process be executed with approval required, at minimum, by the Senior Commander. If a waiver is requested, contact the DPW Master Plans Office for further information.

Antiterrorism issues or concerns should be addressed to the Installation Antiterrorism Office, Mann Operations Center, Bldg 5740, Screaming Eagle Blvd, Fort Campbell, KY, Ph# 270-798-5006/4178.

**Pre-Final Checklist - DoD Minimum Antiterrorism Construction Standards
Fort Campbell, KY (updated: 15 NOV 12)**

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD (AT&L) Memorandum dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. The standards below are minimums set for DoD.

Date:	Facility Name/Description:		Facility No. (if assigned)
Is This Facility New Construction?	Y	N	If No, which "trigger" requires compliance with these standards?
Is There a Controlled Perimeter?	Y	N	(See triggers below) An explanation of each can be found on the reverse of this checklist.

TRIGGERS

A MAJOR	B CONVERSION OF	C GLAZING	D BUILDING	E NEW/UPDATED	F TEMPORARY	G NATIONAL GUARD	H ON BASE TENANT
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MAJOR INVESTMENT: Implementation of these standards to bring an entire building into compliance is mandatory for all DoD building renovations, modifications, repairs, and restorations where those costs exceed 50% of the replacement cost of building except as otherwise stated in these standards. The 50% cost is exclusive of the costs identified to meet these standards. Where the 50% threshold is not met, compliance with these standards is recommended.

CONVERSION OF USE: Implementation of these standards is mandatory when any portion of a building is modified from its current use to that of an inhabited building, billeting, high occupancy family housing, or a primary gathering building for one year or more. Examples would include a warehouse (low occupancy) being converted to administrative (inhabited) use and an inhabited administrative building being converted to a primary gathering building or billeting.

GLAZING REPLACEMENT: Because of the significance of glazing hazards in blast environment, implementation of the glazing provisions of these standards is mandatory for existing inhabited buildings within any planned window or door glazing replacement project, regardless of whether that project meets the 50% cost trigger above. Such replacements may require window frame modification or replacement.

BUILDING ADDITIONS: Inhabited additions to existing inhabited buildings will comply with the minimum standards for new buildings. If the addition is 50% or more of the gross area of the existing building, the existing building will comply with the minimum standards for existing buildings in Appendix B.

LEASED BUILDINGS: DoD personnel occupying leased buildings deserve the same level of protection as those in DoD-owned buildings, implementation of these standards is therefore mandatory for all facilities leased for DoD use and for those buildings in which DoD receives a space assignment from another government agency except as established below. This requirement is intended to cover all situations, including General Services Administration space, privatized buildings, and host-nation and other foreign government buildings. This requirement is applicable for all new leases executed on or after 1 October 2005 and to renewal or extension of any existing lease on or after 1 October 2009. Leases executed prior to the above fiscal years will comply with these standards where possible.

Partial Occupancy: These standards only apply where DoD personnel occupy leased or assigned space constituting at least 25% of the net interior useable area or the area as defined in the lease, and they only apply to that portion of the building that is occupied by DoD personnel.

New Buildings: Buildings that are built to lease to DoD as the effective date established above will comply with the standards for new construction.

Existing Buildings: New leases or renewals of leases of existing buildings will trigger the minimum standards for existing buildings in accordance with the effective dates established above.

EXPEDITIONARY AND TEMPORARY STRUCTURES: Implementation of these standards is mandatory for all expeditionary and temporary structures that meet the occupancy criteria for inhabited or primary gathering buildings or billeting. See Appendix D for structure types that meet the expeditionary and temporary structures criteria.

New Structures: These standards apply to all new expeditionary sites effective immediately.

Existing Structures: These standards will apply to all existing expeditionary activities beginning in Fiscal Year 2004. Prior to that fiscal year, existing expeditionary structures should comply with these standards where possible.

Existing Structures: These standards will apply to all existing expeditionary activities beginning in Fiscal Year 2004. Prior to fiscal year, existing expeditionary structures should comply with these standards where possible.

NATIONAL GUARD BUILDINGS: Any National Guard Buildings built that uses Federal funding for new construction, renovations, modifications, repairs, restorations, or leasing and that meets the applicability provisions above, will comply with these standards.

TENANT BUILDINGS ON DoD INSTALLATIONS: Because buildings built by tenants on DoD installations may be taken over by DoD during their life cycles, memoranda of understanding or similar agreements between DoD components and tenants will require tenant-built buildings to comply with these standards, regardless of funding source. For purpose of the standards, tenant-built building occupants will be calculated assuming that building occupants are DoD personnel.

SITE PLANNING - Standards 1 - 4

STD	REQUIREMENT	YES	NO	N/A	COMMENTS/REMARKS/NOTES
1	STANDOFF DISTANCES				
	WITH A CONTROLLED PERIMETER				
1	Based on the building occupancy and construction type, is the conventional construction standoff distance (CCSD) from the controlled perimeter to the building met? Refer to Tables B-1 and B-2 in UFC 04-010-01.				
1	Based on the building occupancy and construction type, is the conventional construction standoff distance (CCSD _u) from uncontrolled parking (in parking lots or on roadways) met? Refer to Tables B-1 and B-2 in UFC 04-010-01.				

Figure M-1 (Page 1)

STD	REQUIREMENT	YES	NO	N/A	COMMENTS/REMARKS/NOTES
1	Is controlled parking prohibited within 12 feet of the building (the minimum standoff distance)? Refer to Table B-1 in UFC 04-010-01.				
WITHOUT A CONTROLLED PERIMETER					
1	Based on the building occupancy and construction type, is the conventional construction standoff distance (CCSD) from uncontrolled parking (in parking lots or on roadways) met? Refer to Tables B-1 and B-2 in UFC 04-010-01.				
1	Is controlled parking prohibited within 18 feet of the building (the minimum standoff distance)? Refer to Table B-1 in UFC 04-010-01.				
1	If there is controlled parking within the conventional construction standoff distance, has access control been established to limit the entry or parking of unauthorized personnel and vehicles? (Note: To mitigate the introduction of hand delivered explosives into the controlled parking areas, they must have some means to control pedestrian access as well as vehicular access, such as fencing or walls)				
REGARDLESS OF TYPE OF PERIMETER					
1	Based on the building occupancy and construction type, is the conventional construction standoff distance (CCSDII) from trash containers met? Refer to Tables B-1 and B-2 in UFC 04-010-01.				
1	If the conventional construction standoff distance from trash containers is not met, has the trash enclosure been hardened to mitigate direct blast effect and secondary fragment effects of the explosive on the building or the trash container secured to preclude the introduction of object 6-inches or greater in height or width?				
1	If the answer to any questions in F.9.1, F.9.2, or F.9.3 is "NO", has dynamic analysis of the building been completed?				
2	UNOBSTRUCTED SPACE				
2	Are there are obstructions that are 6 inches (150 mm) or greater in height within the unobstructed space that would allow for concealment from observation of explosive devices? The unobstructed space is the conventional construction standoff distance for Explosive Weight II, in accordance with Tables B-1 and B-2, or the standoff distance established through analysis, but not less than the minimum standoff distance.				
2	Are enclosures within the unobstructed space closed on all four sides and the top?				
2	Are enclosures within the unobstructed space secured?				

Figure M-1 (Page 2)

STD	REQUIREMENT	YES	NO	N/A	COMMENTS/REMARKS/NOTES
3 DRIVE-UP/DROP-OFF AREAS (VEHICLE RELATED STANDARDS)					
3	Are drive-up/drop-off areas properly marked?				
3	Are procedures in place to preclude the unmonitored presence of vehicles in the drive-up/drop-off area?				
3	Is the drive-up/drop-off area prohibited from being located under any inhabited portion of the facility?				
4 ACCESS ROADS					
4	Have controls been implemented to preclude unauthorized presence on access roads within the building standoff distance?				
STRUCTURAL DESIGN - Standards 5 - 9					
5 PARKING BENEATH BUILDINGS OR ON ROOFTOPS					
5	Has parking been precluded on the rooftops and under the facility?				
6 PROGRESSIVE COLLAPSE AVOIDANCE					
6	Does the building meet the requirements in UFC 4-023-03 Design of Buildings to Resist Progressive Collapse?				
6	Is there uncontrolled public access to the building? (Note: Refer to Para. B-2.1.2. For purposes of Std 6, positive access control will be considered to include (but not be limited to) electronic access control or personnel to control visitor access on exterior doors/entrances.)				
7 STRUCTURAL ISOLATION					
BUILDING ADDITIONS					
7	Are building additions structurally independent from adjacent existing buildings?				
7	If not, has analysis been completed which shows collapse of either the addition or the existing building will not result in collapse of the remainder of the building?				
PORTIONS OF BUILDINGS					
7	Are low occupancy areas of inhabited facilities designed structurally independent of the inhabited areas?				
8 BUILDING OVERHANGS					
8	Are restrictions in place to preclude parking or other vehicle travel under overhangs?				
8	Do all building elements adjacent to the overhang area provide the appropriate level of protection to explosive weight II?				
9 EXTERIOR MASONRY WALLS					
9	For buildings with unreinforced masonry walls, are conventional construction standoff distance for the building met? Refer to Tables B-1 and B-2 in UFC 04-010-01.				
9	If conventional construction standoff distance for the building is not met, have mitigating measures to provide the applicable level of protection been implemented?				

Figure M-1 (Page 3)

STD	REQUIREMENT	YES	NO	N/A	COMMENTS/REMARKS/NOTES
ARCHITECTURAL DESIGN - Standards 10 - 15					
10 WINDOWS AND SKYLIGHTS					
10	Do all exterior windows and/or skylights provide for effective hazard mitigation, to provide a low (or very low) level of protection, in accordance with UFC 4-010-01, Std 10.				
10	(Leased Facilities) Do window retrofits (e.g. fragment retention film or blast curtains) provide a low (or very low) level of protection? Also, the lease agreement stipulates the retrofits are maintained and replaced with manufacturer's recommendations.				
11 BUILDING ENTRANCE LAYOUT					
11	(New Bldgs) Does the main entrance to the facility face away from the perimeter or other uncontrolled vantage points with direct lines of sight?				
12 EXTERIOR DOORS					
12	Have exterior, unglazed, doors been tested to achieve the applicable level of protection (low or very low) in accordance with ASTM F 2247? (Tested doors may have this information stamped on a plate on the edge of the door.)				
12	Does glazing in doors meet the glazing and frame bite provisions of UFC 4-010-01, Standard 10?				
12	if the conditions in F.18.1 and F.18.2 are not met, then are the exterior doors positioned such that they will not be propelled into inhabited areas if they fail in response to a blast?				
13 & 17 MAIL ROOMS					
13	Is the mail room located on the perimeter, exterior wall, of the facility?				
13	Is the mail room located away from heavily populated portions of the facility?				
17	Does the mail room have a separate, dedicated air ventilation system?				
17	Does the mail room have a dedicated exhaust system?				
17	Does the mail room have ventilation system outside air intakes, relief air, and exhausts with low leakage isolation dampers?				
17	Can dampers be automatically closed to isolate the mail room?				
17	Do the low leakage dampers have a maximum leakage rate of 3 cfm/sq-ft with a differential pressure of 1in of water gage across the damper?				
14 ROOF ACCESS					
14	(New Buildings) Has roof access been limited to controlled internal access?				
14	(Existing Buildings) Has exterior roof access been secured with a locked cage or similar mechanism?				
15 OVERHEAD MOUNTED ARCHITECTURAL FEATURES					
15	Are overhead-mounted features weighing 31-lbs (14kg) or more mounted to resist forces of 0.5 times their weight in any horizontal direction and 1.5 times their weight in the downward direction?				

Figure M-1 (Page 4)

STD	REQUIREMENT	YES	NO	N/A	COMMENTS/REMARKS/NOTES
ELECTRICAL AND MECHANICAL DESIGN - Standards 16 - 22					
16 AIR INTAKES					
16	Are outside air intakes located at least 10-ft (3m) above the ground?				
16	Where air intakes that are designed to cool equipment may allow blast pressures to infiltrate equipment rooms, are equipment room interior walls designed to the same standards for blast resistance as the exterior walls of buildings based on the standoff distance provided and allowing for blast pressure reductions where they can be validated?				
18 EMERGENCY AIR DISTRIBUTION SHUTOFF					
18	Does the facility have an emergency shutoff switch in the HVAC control system that can immediately shut down the air distribution system throughout the building? Shutoff switch (or switches) must be easily accessible by building occupants and located similarly to manual fire alarm boxes with at least one shutoff switch per floor and so that the travel distance to the nearest shutoff switch will not be in excess of 200 feet (61 meters).				
18	Do all outside air intakes have relief air, and exhaust openings with low leakage dampers that are automatically closed when the emergency air distribution shutoff switch is activated?				
18	Do the low leakage dampers have a maximum leakage rate of 3 cfm/sq-ft with a differential pressure of 1in of water gage across the damper?				
18	Do critical area air handling units close with low leakage isolation dampers and recirculated air? (critical area examples: server rooms and other rooms with high heat loads).				
19 EQUIPMENT BRACING					
19	Are all overhead equipment mountings designed to resist forces 0.5 times the equipment weight in any horizontal direction and 1.5 times the equipment weight in the downward direction?				
20 UNDER BUILDING ACCESS					
20	Are crawl spaces, utility tunnels, and other means of under building access controlled?				
21 MASS NOTIFICATION					
21	Does the building have a mass notification system that is capable of providing real-time information to building occupants or personnel in the immediate vicinity of the building during emergency situations?				
21	Is the mass notification system capable of relaying information that is specific enough to determine the appropriate response actions?				
21	Can information be originated both locally at the building and from a remote location?				

Figure M-1 (Page 5)

ADDITIONAL NOTES	
Verification of these items has been made by me or under my supervision and they conform to the DoD minimum antiterrorism standards for buildings, except where noted herein or on other supporting documents.	Verification of these items has been made by me or under my supervision and they conform to the DoD minimum antiterrorism standards for buildings, except where noted herein or on other supporting documents.
Signature of Civil Engineer Representative:	Signature of Antiterrorism Representative:
Typed Name and Title:	Typed Name and Title:
RECOMMENDED ADDITIONAL ANTITERRORISM MEASURES FOR NEW AND EXISTING BUILDINGS (Ref; Appendix C, UFC 4-010-01)	
C-1 SITE PLANNING. The following additional measures, if implemented, will significantly enhance site security with little increase in cost and should be considered for all new and existing buildings required to comply with these standards.	
C-1.1 Recommendation 1. Vehicle Access Points. The first line of defense in limiting opportunities for aggressors to get vehicles close to DoD buildings is at vehicle access points at controlled perimeters, in parking areas, and at drive-up/drop-off points. The number of access points should be kept to the minimum necessary for operational or life safety purposes. This will limit the number of points at which access may have to be controlled with barriers and/or personnel at increased Force Protection Conditions or if the threat increases in the future.	
C-1.2 Recommendation 2. High-Speed Vehicle Approaches. The energy of a moving vehicle increases with the square of its velocity; therefore, minimizing a vehicle's speed allows vehicle barriers to be lighter and less expensive should vehicle barriers required to stop the energy of a moving vehicle ever become necessary. To facilitate reductions in vehicle speeds in the future, avoid unobstructed vehicle approaches perpendicular to buildings.	
C-1.2 Recommendation 2. High-Speed Vehicle Approaches. The energy of a moving vehicle increases with the square of its velocity; therefore, minimizing a vehicle's speed allows vehicle barriers to be lighter and less expensive should vehicle barriers required to stop the energy of a moving vehicle ever become necessary. To facilitate reductions in vehicle speeds in the future, avoid unobstructed vehicle approaches perpendicular to buildings.	
C-1.3 Recommendation 3. Vantage Points. Vantage points are natural or man-made positions from which potential aggressors can observe and target people or other assets in and around buildings. Vantage points outside the control of personnel in targeted buildings should be identified and either eliminated or means should be provided to avoid exposure to them. Means to avoid exposure may include actions such as reorienting buildings or shielding people or assets in and around them using such measures as reflective glazing, walls, privacy fencing, or vegetation.	
C-1.4 Recommendation 4. Drive-Up/Drop-Off Areas. Drive-up and drop-off areas should be located away from large glazed areas of buildings to minimize the potential for hazardous flying glass fragments in the event of an explosion. Consider locating the lanes at outside corners of buildings or otherwise away from main entrances or minimizing glazing in the proximity of drive-up and drop-off areas. Building geometries in the vicinity of drive-up and drop-off areas should be laid out to minimize the possibility that explosive blast forces could be increased due to being trapped or otherwise concentrated.	
C-1.5 Recommendation 5. Building Location. Activities with large visitor populations provide opportunities for potential aggressors to get near buildings with minimal controls and limit opportunities for early detection of aggressor activity. To limit opportunities for aggressors, separation distances should be maximized between buildings required to comply with these standards and areas with large visitor populations.	
C-1.7 Recommendation 7. Access Control for Family Housing. For new family housing areas, space should be provided at the perimeter of the housing area so that a controlled perimeter with an entry control facility/access control point can be established there if the need arises in the future in accordance with UFC 4-022-01.	
C-1.8 Recommendation 8. Standoff for Family Housing. For new low occupancy family housing construction, standoff distances should be maintained in accordance with the controlled perimeter standoff distance in Table B-1 from installation perimeters and roads, streets, or highways external to housing areas.	
C-1.9 Recommendation 9. Building Separation. This recommendation applies to new buildings and is established to minimize the possibility that an attack on one building causes injuries or fatalities in adjacent buildings. The separation distance is predicated on the potential use of indirect fire weapons such as those containing explosives equivalent to explosive weight III in Table D-1.	
C-1.9.1 Primary Gathering Buildings, Billeting, and High Occupancy Family Housing. For all new billeting, high occupancy family housing, and primary gathering buildings, all adjacent inhabited buildings should be separated from those buildings by at least 33 feet (10 meters). Where it is necessary to encroach on those building separations, buildings should be analyzed and provided with hardened building components as necessary to mitigate the effects of the indirect fire weapons equivalent to those identified as explosive weight III in Table D-1 to the low level of protection. Levels of protection are described in Table 2-1 and in UFC 4-020-01. The indirect fire weapon should be assumed to detonate at a distance from the target building of one-half of the separation distance. C-1.9.2 Inhabited Buildings. There are no minimum separation distances recommended for antiterrorism purposes for inhabited buildings other than billeting, high occupancy family housing, and primary gathering buildings.	

Figure M-1 (Page 6)

<p>C-2 STRUCTURAL AND ARCHITECTURAL DESIGN. The following additional measures, if implemented, will significantly enhance building occupants' safety and security with little increase in cost. Consider these measures for all new and existing buildings required to comply with these standards.</p>
<p>C-2.1 Recommendation 10. Internal Circulation. Circulation within buildings should be designed to facilitate visual detection and monitoring of unauthorized personnel approaching controlled areas or occupied spaces.</p>
<p>C-2.2 Recommendation 11. Visitor Control. Controlling visitor access maximizes the possibility of detecting potential threatening activities. Locations in buildings where visitor access is controlled should be kept away from sensitive or critical areas, areas where high-risk or mission-critical personnel are located, or other areas with large population densities of DoD personnel.</p>
<p>C-2.3 Recommendation 12. Asset Location. To minimize exposure to direct blast effects and potential impacts from hazardous glass fragments and other potential debris, critical assets and mission-critical or high-risk personnel should be located away from the building exterior.</p>
<p>C-2.4 Recommendation 13. Room Layout. In rooms adjacent to the exterior of the building, personnel and critical equipment should be positioned to minimize exposure to direct blast effects and potential impacts from hazardous glass fragments and other potential debris.</p>
<p>C-2.5 Recommendation 14. External Hallways. Because doors can become hazardous debris during explosive blast events and designing them to resist blast effects is expensive, avoid building configurations that have large numbers of exterior doors leading into inhabited areas in buildings required to comply with these standards. A common example is a barracks/dormitory with exterior doors into each room or suite. Internal hallways with interior entrances to rooms or suites are preferable.</p>

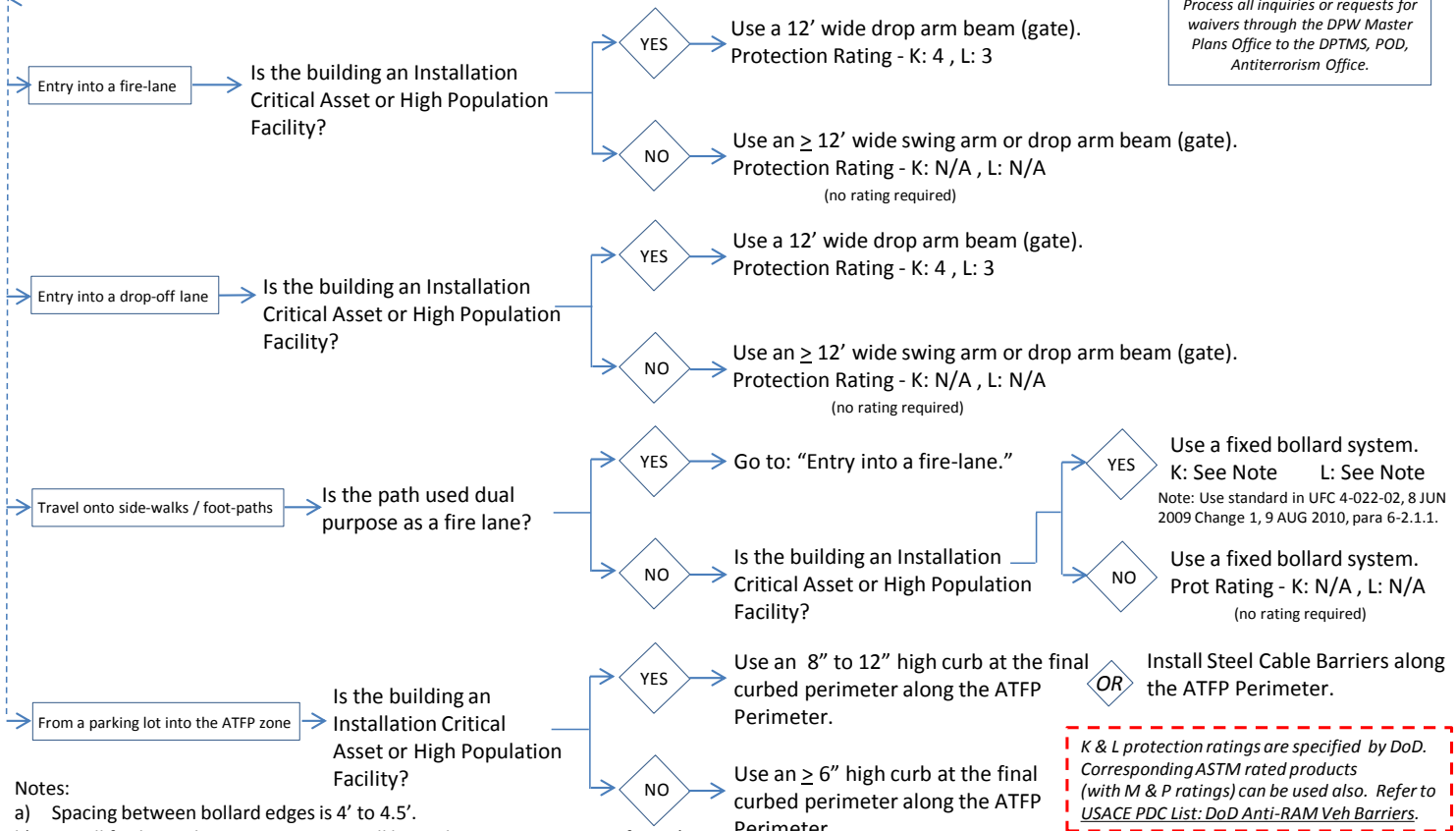
Figure M-1 (Page 7)

Decision Flow-Chart For Protective Barriers



For vehicles, is the barrier used to stop a) Entry into a fire-lane, b) Entry into a drop-off lane, c) Travel onto sidewalks / foot-paths, or d) From a parking lot into the AT/FP zone?

About this Flow Chart
Information herein is to be used so decisions to employ protective barriers on Fort Campbell are procedural.
Process all inquiries or requests for waivers through the DPW Master Plans Office to the DPTMS, POD, Antiterrorism Office.



- Notes:
- a) Spacing between bollard edges is 4' to 4.5'.
 - b) For all facilities, the ATFP perimeter will be tied-in to prevent gaps of > 4.5'.
 - c) If a protection rating is required, approved drop arm beam (gate) construct and design reference is: USACE PDC DoD Anti-Ram Vehicle Barriers, April 2012. Item will be lockable, have an "anti-drop" safety mechanism, and have "Knox Boxes" affixed for storing emergency use keys.
 - d) For curbs higher than 6", reference is: UFC 4-022-02FA, Security Engineering - Concept Design (8 JUN 2009), para 3.c.(1) titled, "Perimeter Barriers for the Stationary Vehicle Bomb Tactic."

Figure M-2

Using Protection Requirements for Selecting Protective Barrier Products

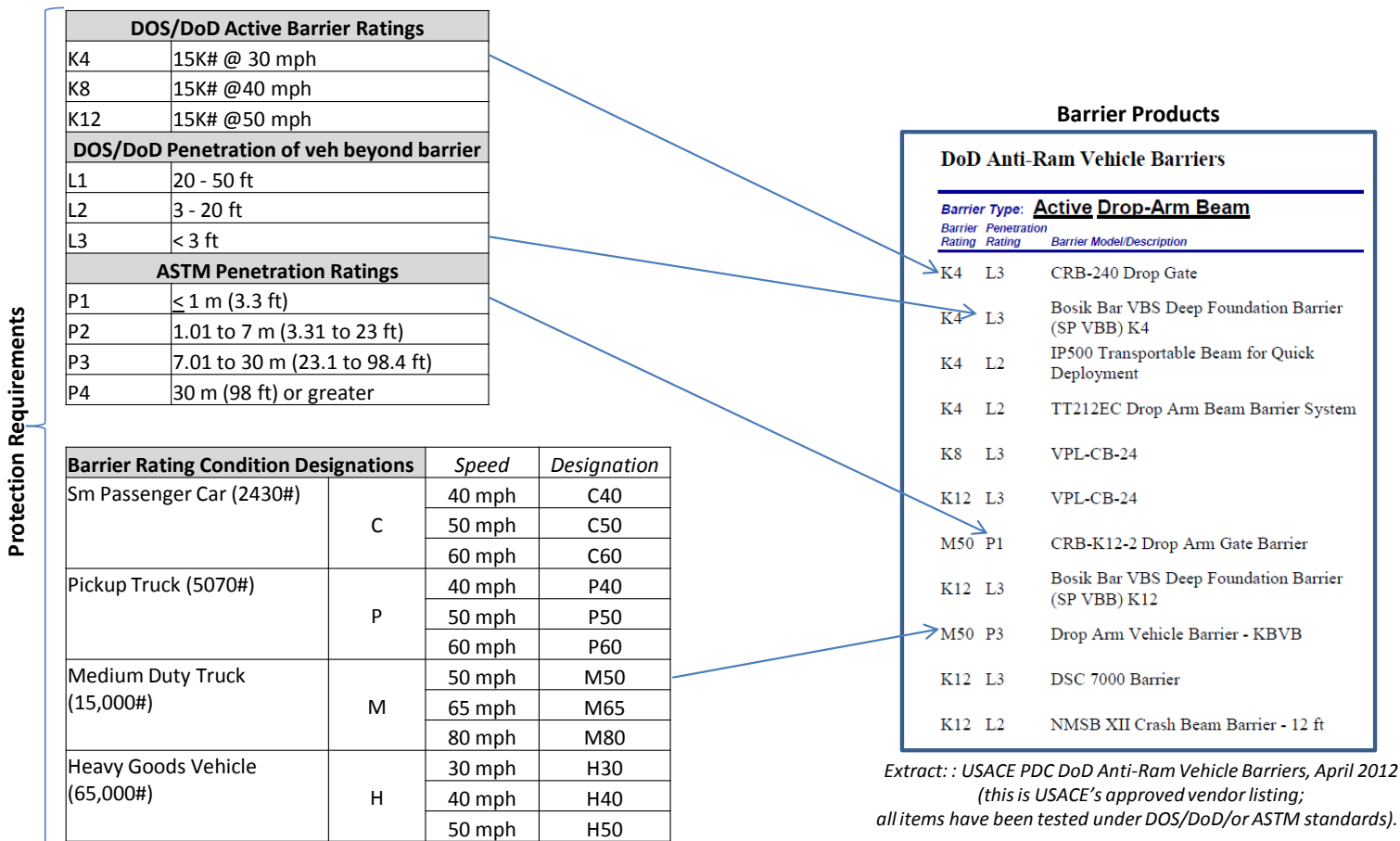


Table Summaries: UFC 4-022-02, Selection and Application of Vehicle Barriers, 8 June 2009.

Extract: : USACE PDC DoD Anti-Ram Vehicle Barriers, April 2012 (this is USACE's approved vendor listing; all items have been tested under DOS/DoD/or ASTM standards).

----- END OF SECTION -----

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APPENDIX M

Electrical Requirements

A. Design Review Checklist

1 Obtain a copy of the Project Scope: Major items of electrical equipment (e.g. generators, USB) and specials utilities (e.g. underground power lines) must be line items or they are not allowed.

2 Insure that the following criteria, where appropriate, have been incorporated in the design:

- ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings
- EPACT 2005 Energy Policy Act of 2005, Public Law 109-58.
- IBC International Building Code
- IEEE C2 National Electric Safety Code
- IESNA Illuminating Engineering Society of North America
- MIL HDBK 1190 Military Handbook for Facility Planning and Design Guide
- MIL HDBK 1191 Military Handbook for Medical and Dental Treatment Facilities, Design and
- Construction Criteria Guide
- NFPA 70 National Electric Code
- NFPA 72 National Fire Alarm and Signaling Code
- NFPA 101 Life Safety Code

- TI 800-01 Design Criteria
- TI 800-03 Technical Requirements for Design-Build
- TM 5-811-3 Electrical Design: Lightning and Static Electricity Protection

- UFC 1-200-01 Design: General Building Requirements
- UFC 3-501-01 Electrical Engineering
- UFC 3-510-01 Foreign Voltages and Frequencies Guide
- UFC 3-520-01 Interior Electrical Systems
- UFC 3-520-05 Stationary Battery Areas
- UFC 3-530-01 Design: Interior and Exterior Lighting and Controls
- UFC 3-535-01 Visual Air Navigation Facilities
- UFC 3-540-04N Diesel Electric Generating Plants
- UFC 3-550-01 Exterior Electrical Power Distribution
- UFC 3-555-01N 400 Hertz Medium Voltage Conversion/Distribution and Low Voltage Utilization Systems
- UFC 3-560-01 Electrical Safety, O&M
- UFC 3-570-02A Cathodic Protection
- UFC 3-570-02N Electrical Engineering Cathodic Protection

- UFC 3-570-06 O&M: Cathodic Protection Systems
- UFC 3-580-01 Telecommunications Building Cabling Systems Planning and Design
- UFC 3-600-01 Fire Protection Engineering for Facilities
- UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings
- UFC 4-020-04A Electronic Security Systems: Security Engineering
- UFC 4-021-01 Design and O&M: Mass Notification Systems
- UFC 4-021-02NF Security Engineering Electronic Security Systems
- UFC 4-030-01 Sustainable Development
- TI 800-01 Design Criteria
- TI 800-03 Technical Requirements for Design-Build

3 Check the power riser diagram.

- **Main transformer**
 - a. Insure the primary and secondary voltages/connections are shown.
 - b. Insure impedance(s) are shown or covered in the specifications.
- **Primary**
 - a. Insure the size and voltage ratings of the cable are shown.
 - b. Insure the size is adequate for the transformer size.
 - c. Insure fused cutouts or fused primary switch is shown.
- **Service**
 - a. Insure the service entrance conductors are sized for the demand or the transformer secondary current as a maximum
 - b. Insure the grounding electrode conductor is in accordance with NEC Article 250.
- **Service Equipment**
 - a. Insure the main breaker and interrupting ratings are shown:
 - i. verify the continuous current rating with demand load calculations.
 - ii. verify interrupting rating(s) with short circuit calculations
 - b. Insure the main bus rating is shown (size should agree with the demand load calculations as a minimum.

- c. Insure Ground Fault Protection is shown if required by the National Electrical Code. See also additional requirements from UFC 3-520-01.
 - d.
 - e. Insure the 15%-25% spare breakers are shown.
- **Subpanels**
 - a. Insure feeders are sized per the demand load calculations (as a minimum; can be sized to match the rating of the panel).
 - b. Insure the panel main breaker (if not MLO) is sized for the panel rating. Insure the interrupting rating is shown and verified by short circuit calculations.
 - c. Insure the panel trim (flush vs. surface) is shown.
 - d. Insure an oversized neutral is shown when required for nonlinear loads (ETL 1110-3-403).
 - e. Insure the 15%-25% spare breakers are shown.
- **208/120 Volt Panels**
 - a. Insure the required main breaker is shown.
 - b. Check to insure it is sized at the demand load as a minimum or the panel rating as a maximum.
 - c. Insure the interrupting rating is shown and verified by short circuit calculations.
 - d. Insure an oversized neutral is shown when required for nonlinear loads (ETL 1110-3-403).
 - e. Insure the 15%-25% spare breakers are shown.
- **480/277 Volt dry type transformers**
 - a. Insure transformers are sized by demand load calculations
 - b. Insure the grounding electrode conductor is in accordance with NEC
 - c. Article 250.
 - d. Insure the primary and secondary connections are shown.

4 Floor Plans

1. Compare the electrical plans (lighting, power and systems) with the architectural to insure these agree.
2. Compare these plans with the mechanical plans to insure the power is provided to mechanical equipment and it's the correct size as shown in the mechanical equipment schedule.

5 Lighting Plans

1. Coordinate the lighting fixture layout with the HVAC plans to insure fixtures and registers do not conflict in locations.
2. Insure lighting switches are shown on the correct side of the door swing and that they are not located in sidelights or other glass.
3. Insure a fixture schedule is included. Use the new 40-06-06 for details and EI 16E500 for the schedule.
4. Insure fixtures chosen are compatible with ceiling types specified on the architectural plans.
5. Insure boundaries of any hazardous classified location and identification of this location(s) are shown clearly.
6. If dimming ballasts are required, insure they are shown in the details and/or schedule.

6 Power Plans

1. Insure there is power to each piece of HVAC equipment (size for sizes shown in mechanical equipment schedules).
2. Insure Ground Fault Protection is shown if required by the National Electrical Code. See also additional requirements from UFC 3-520-01.
3. Insure the chiller circuit(s) is sized in accordance with the manufacturer's data and that the data is included in the design analysis.

4. Insure receptacles are located at the TBB, LAN backboard and DDC controls.
5. Insure there is at least one outlet on every wall.
6. Panel Schedules
 - a. Panel name
 - b. MLO or Main Breaker
 - c. AIC rating shown
 - d. Size of branch breaker and description shown
 - e. Oversize neutral shown where required
 - f. Surface or flush trim shown
 - g. Voltage rating and main bus rating is shown
 - h. Spare breakers shown
 - i. Insure standard sizes are shown (≤ 100 Amps use 30 poles; ≤ 225 Amps use 42 poles)
 - j. Indicate any 2 section panels (state if they are feed-through or double lugs).
7. Insure boundaries of any hazardous classified location and identification of this location(s) are shown clearly.

7 Fire Alarm Plans

- **Initiating Devices**
- **Manual pull stations**
 - a. Every egress
 - b. Every level
 - c. 200 foot maximum travel distance
- **Area detection**

- a. Protect all areas including area above ceiling if needed.
- b. Place all detection devices at least 12-18 inches from lights and 3 feet from HVAC registers.
- **Heat detectors**
 - a. Reduce spacing for ceilings above 10 feet.
 - b. Reduce spacing for other than smooth ceilings (joist, beam, etc.)
 - c. All points on ceiling shall be within .7 of the listed spacing after adjustments are made.
- **Smoke detectors**
 - a. Use 30 feet spacing as a guide
 - b. Adjust spacing for other than smooth ceilings (joist, beam, etc.)
 - c. All points on the ceiling shall be within .7 of the listed spacing after adjustments are made.
 - d. Consider the effects of stratification.
- **Special Applications**
 - a. Use smoke detectors under raised floors and above ceilings if this area is a return air plenum. Use detectors rated for the air velocity present.
 - b. See NFPA 72-5.7.5.2 for high rack storage areas.
 - c. See NFPA 72-5.7.5.3 for areas of high air movement.
 - d. See NFPA 72-6.15.3 for elevator recall.
 - e. See NFPA 72-6.15.5.2 for smoke door release.
- **Duct detectors**
 - a. Coordinate with the mechanical engineer.
 - b. Over 2000 CFM, provide on supply.
 - c. Over 15000 CFM and multistory building, provide on return.
 - d. Provide remote test station as required by NFPA 72.

- e. Show detectors on floor plans and in the rise.
- **Notification Appliances**
 - a. Audible Appliances
 - i. Locate to provide sufficient sound level
 1. 15 dB above ambient
 2. 5 dB above maximum 60 second sound level
 3. Double the distance loses 6 dBA
 4. Lose 25 dB through walls
 5. Lose 10 dB through doors
 6. UFGS states that bells/horns have 85 dBA at 10 feet
 7. Provide devices on every floor
 8. Provide devices in noisy areas (e.g. mechanical rooms, etc).
 9. Devices shall have a temporal sound pattern in accordance with NFPA 72.
 - b. Visual Appliances pace in accordance with NFPA 72 and ADAAG.
- **Control Panel**
 - a. Where connecting to an existing system, insure that the existing and new systems are compatible.
 - b. For conventional systems, use the following zones:
 - i. Fire suppression system
 - ii. Hazardous areas
 - iii. Flow switches
 - iv. Tamper switches
 - v. Other supervisory devices
 - vi. Fireman's elevator service
 - vii. Attic detectors
 - viii. Pull station
 - ix. Kitchen equipment
 - x. Notification appliances
 - xi. Automatic door release
 - xii. Power shutdown to data processing equipment
 - xiii. AHU shutdown
 - c. Provide manual override for AHU shutdown testing.
 - d. NFPA 72 lists maximum number of devices for a zone.
 - e. Annunciator: use a graphic annunciator if one is required.
 - f. Specify transceiver to be compatible with the base/post system.

g. Riser Diagram

- i. Show FACP
- ii. Show power supply
- iii. Show signaling method
- iv. Show annunciator
- v. Show all zones

h. Power Supply

- i. Provide primary source from light and power system (208/120 volts) per NFPA 72.
- ii. Secondary source is primary batteries. Size per NFPA 72 requirements. Provide a separate battery cabinet.
- iii. Power all devices from the FACP.

i. Wiring

- i. All wiring is to be Class A, Style D.
- ii. When connecting to an existing system, insure compatibility. Do not connect a 4-wire system to a 2-wire system.

j. Sprinkler System Supervision

- i. Coordinate with the Mechanical/Fire Protection engineer.
- ii. Flow switches
- iii. Tamper switches
- iv. Pressure switches (on all systems).

8 Telephone

1. Verify receptacles are located at the TBB.
2. Verify telephone outlets are located as desired by the user.
3. Provide telephone outlets at the DDC panel location.
4. Verify the telephone room complies with EIA/TIA standards.
5. Insure CAT 5 circuits have not exceeded the 90-meter limit in length.

9 Mass Notification System

1. Insure audible and visual devices are shown
2. Insure the system is shown interconnected with the FACP

3. Determine what the Mass Notification message are to be

10 Site Plan

1. Verify the electrical site plan agrees with the civil site plan
2. Coordinate with the landscaping plans to avoid conflicts between electrical equipment (transformers, lighting fixtures, etc.) and planting materials.
3. Coordinate with the mechanical plans to avoid conflicts in location between transformers and chillers, etc.
4. Verify the lighting layout meets design lighting levels prescribed in the IES and the TI; support with calculations.
5. Verify required details are show; these include pole details, pad details, manhole/handhole details, duct bank sections, etc.
6. Coordinate with other utilities (water, sewer, gas, storm sewer, etc.) to identify any conflicts and to insure that required code (IEEE C2 and NFPA 70) clearances are obtained.
7. Verify that manholes/handholes have been located in accordance with pulling calculations.
8. Verify that overhead line clearances meet IEEE C2 (verified with sag calculations where required).
9. Verified that guy leads and guy sizes are shown and supported by calculations.
10. Verify that cathodic protection is provided where required, that all appropriate details are shown and that the current specifications have been used.
11. Insure all circuits that are intended to remain and to be reconnected with new circuits are properly shown and all necessary work is identified.

11 Miscellaneous Drawings

1. Verify all symbols are included in the legend (use Tri-Service standard symbols).
2. Verify enlarged plans of electrical and/or mechanical rooms are included if necessary.
3. Insure the size of large items of equipment can be provided by at least three manufacturers.

12 Miscellaneous

1. Insure Customer Specifics Criteria has been incorporated.
2. Insure all design techniques for nonlinear loads have been incorporated.

13 Design Analysis

1. Calculations included
 - a. Demand load analysis
 - b. Lighting Calculations
 - i. Zonal cavity for interior
 - ii. Exterior
 - c. Short circuit calculations
 - d. Voltage drop calculations
2. Coordination study provided (as required in the design manual).
3. Arc Flash Hazard Analysis has been performed and results presented.
4. Design narrative
5. Interior, exterior narratives
6. Catalog cuts

14 Lessons Learned

1. Verify all applicable lessons learned from the district database have been incorporated (at each design/review submittal).
2. Lesson Learned certification is required before RTA.

FIRE ALARM CHECKLIST

1. Determine what Codes and standards must be followed.
2. Determine the type of system to be use.
3. Check NFPA 72 and ADA/ABA to see if there are any special requirements.
4. Initiating Devices
 - a. Manual pull stations
 - i. Every egress.
 - ii. Every level.

- iii. 200 feet maximum horizontal travel distance.
- b. Area detection
 - i. Protect all areas, including above ceiling if needed.
 - ii. Consider providing a catwalk for maintenance of detectors in inaccessible areas.
 - iii. Consider remote LED for detectors above ceiling.
 - iv. Place all detection devices at least 3 feet from HVAC diffusers on plans.
- c. Heat detectors
 - i. Reduce spacing if ceiling over 10 feet.
 - ii. Adjust spacing and mounting if ceiling is not smooth (interrupted by joists, beams).
 - iii. Adjust spacing if ceiling is not level (sloped).
 - iv. All points on ceiling shall be within 0.7 times the detector's listed spacing after all adjustments.
- d. Smoke detectors
 - i. Use 30 feet spacing as a guide.
 - ii. Adjust spacing and mounting if ceiling is not smooth (interrupted by joists, beams).
 - iii. Adjust spacing if ceiling is not level (sloped).
 - iv. All points on ceiling shall be within 0.7 times the detector's listed spacing after all adjustments.
 - v. Consider the stratification effects.
- e. Special Applications
 - i. Use smoke detectors under raised floors and above ceilings if this area(s) is used as a return air plenum.
 - ii. Insure detector is listed for the air velocities present.
- f. High air movement areas - See NFPA 72.
- g. High rack storage areas - See NFPA 72.
- h. Smoke door release - See NFPA 72.
- i. Elevator recall for firefighter's service - See NFPA 72 and ASME A17.1b.
- j. Flame detectors - - See NFPA 72.
- k. Duct Detectors

- i. Coordinate with the Mechanical Engineer.
- ii. From 2000-15000 CFM use detectors on supply
- iii. Above 15000 CFM use detectors on supply and return (multiple story).
- iv. Provide remote test station when detectors may be inaccessible.
- v. Show detectors on floor plans and on fire alarm riser diagram.

5. Notification Devices

a. Audible Alarms

- i. Locate devices to provide sufficient sound level
 - 1. 15 dB above ambient.
 - 2. 5 dB above maximum for 60 seconds.
 - 3. Insure losses are taken into consideration:
 - a. Doubling the distance loses 6 dB.
 - b. Lose 25 dB through walls.
 - c. Lose 10 dB through doors.
- ii. Provide device(s) on every floor.
- iii. Provide device(s) for noisy areas (e.g. Mechanical and Break rooms).
- iv. Provide device(s) in soundproof areas.
- v. Provide device(s) in hallways sufficient to be heard when all doors are closed.
- vi. Provide device(s) that have sounds distinct from the surrounding sounds.

b. Visual Alarms

c.

- i. Space in accordance with (IAW) Tables in NFPA 72 and ADA/ABA.
 - 1. There are 2 separate Tables for rooms, corridors (less than 20 feet side) and sleeping areas.
 - 2. There are separate Tables for ceiling-mounted and wall-mounted appliances (which are not specifically allowed by ADA).

6. Control Panel

- a. Where a design will tie into an existing system, be certain the new design will be compatible.
- b. Check existing wiring and FACP capacity.
- c. NFPA 72 lists the maximum number of devices for a zone.

- d. Consider maintenance when zoning detectors.
- e. For DC loop systems, put each of the following on an individual zone:
 - i. Fire Suppression System.
 - ii. Hazardous areas.
 - iii. Flow switches.
 - iv. Tamper switches for post indicator valves (PIVs).
 - v. Tamper switches for all control valves.
 - vi. Any other supervisory device.
 - vii. Fireman's service for elevators.
 - viii. Attic detectors.
 - ix. Pull stations.
 - x. Kitchen equipment.
 - xi. Notification appliances.
 - xii. Automatic door release.
 - xiii. Power shutdown to data processing equipment.
 - xiv. AHU shutdown.
- f. Provide manual override to AHU shutdown for testing purposes.
- g. Provide activation of fire alarms if kitchen equipment control panel is alarmed, where applicable.
- h. Annunciators
 - i. Avoid annunciators that only list the zones (these merely repeat information available from the fire alarm control panel).
 - ii. Use a graphic annunciator if an annunciator is needed.
 - iii. Show underfloor and above ceiling detectors.
- i. Signaling Equipment
 - i. Specify a transceiver with enough zones to transmit all facility information.
 - ii. Do not show conduit to TBB when radio is used.

7. Riser Diagram

- a. Show FACP.
- b. Power supply.
- c. Signaling method.
- d. Annunciator, if used.
- e. All zones

8. Power Supply

- a. Primary Source:
 - i. Connections to light and power service must be on a dedicated branch circuit, with disconnecting means accessible only to authorized personnel.
 - ii. Insure the disconnecting means is locked/lockable if necessary.
- b. Secondary Source: Batteries most commonly used.
- c. Trouble Source: Shall be independent of the primary power.
- d. Provide non-supervised power for door holders.
- e. All fire alarm devices should be powered from the FACP.
- f. Show fire pump power ahead of all disconnecting means.

9. Wiring

- a. Siring shall be Class A or B as required.
- b. Insure wiring compatibility when connecting to an existing system.
- c. Do not connect a 4-wire system to a 2-wire system.

10. Sprinkler System Electrical Supervision

- a. Coordinate with the Mechanical Engineer
- b. Flow switches
- c. Tamper switches on all control valves and PIVs.

- d. Pressure Tank:
 - i. Detect high and low pressure.
 - ii. Detect high and low water level.
- e. Dry-Pipe Pressure: Detect high and low pressure
- f. Steam Pressure: Detect low pressure.
- g. Water Temperature: detect and signal when below 40°F.
- h. Fire Pumps: Supervise according to NFPA 20.
- i. Show all supervising devices on floor plans and on fire alarm riser.
- j. Show air compressor used for the dry-pipe system on the power floor
- k. Plans with hard-wired power connection.

Abbreviations and Acronyms

ADA	Americans with disabilities Act
AR	Army Regulation
ASHRAE	American Society of Heating Refrigeration and Air-Conditioning Engineers
BCOE	Buildability, Constructability, Operability and Environmental issues
cd	Candela (unit of light intensity)
dB	Decibels, A-Weighted scale
ER	Engineering Regulation
ETL	Engineering Technical Letter
FACP	Fire Alarm Control Panel
fc	Footcandle
HVAC	Heating, Ventilation and Air Conditioning
IEEE	Institute of Electrical and Electronic Engineers
IESNA	Illuminating Engineers Society of North America
IFB	Invitation for Bid
ITR	Independent Technical Review
kVA	kilovolt-ampere
LAN	Local Area Network
Lume	Light intensity per area
MIL HDBK	Military Handbook
MLO	Mail Lugs Only
NEC	National Electrical Code
NFPA	National Fire Protection Association
PPTO	Price Performance Tradeoff
RFI	Request for Information

RFP details	Request for Proposal – graded on technical, experience, management, cost
RTA	Ready to Advertise (one of the Design Stages)
TBB	Telephone Backboard
TI	Technical Instruction
TM	Technical Manual
UFC	Unified Facilities Criteria
UFGS	Unified Facilities Guide Specifications
VE	Value Engineering

B. Underground Installation Location Verification Form

Fill out one (1) form each for each conduit/duct run where the conduit/duct is carrying different circuits. Where separate conduit/duct is run with one (1) each phase per conduit/duct, only one form need be filled out. Use additional pages as necessary.

CONDUCTOR INFORMATION	Number	Size	Insulation Type	Temp	Total Length	
Conductor (1):						
Conductor (2):						
Conductor (3):						
Conductor (4):						
Conductor (5):						

CONDUIT/DUCT INFORMATION	Average Burial Depth	Size	Material Type	Total Length
Conduit (1)				
Conduit (2)				
Conduit (3)				
Conduit (4)				
Conduit (5)				
Conduit (6)				

CONDUIT GPS LOCATION	GPS Location		Depth (ft)
From (start point):			
To (end):			
Deviation/Deflection (1):			
Deviation/Deflection (2):			
Deviation/Deflection (3):			
Deviation/Deflection (4):			
Deviation/Deflection (5):			
Deviation/Deflection (6):			

Form N-1

C. Vegetation Management Program

AUTHORITIES

- 7 CFR Agriculture; CHAPTER XVII—RURAL UTILITIES SERVICE, DEPARTMENT OF AGRICULTURE (parts 1700 to 1794)
- National Electrical Safety Code, C2-2007
- Fort Campbell Technical Design Guide

BACKGROUND

Fort Campbell Technical Design Guide states: “Ensure that the landscaping provided does not interfere with overhead power lines when it reaches maturity”.

DEFINITIONS and ACCROYMNS

Clearance: the clear distance between two objects measured surface to surface. [2]

Clearance Circle: is that distance around a conductor, set by the NESC, which must be maintained free of any object . Note: in the case of a 69kV conductor, that distance is three feet (3’).

Clear Zone: see Wire Zone.

Danger Tree: tree or large vegetation on either side of the Clear Zone which might fall-into, bend-into, grow-into or into which conductors might swing (Swing-Into). They may be trees that are dead, dying, diseased, damaged, leaning or otherwise structurally unsound. Sound trees will have to be evaluated on a case-by-case basis and may need to be removed if the impact of their fall, bend, grow or swing presents an unacceptable risk.

- Fall-Into – Danger Trees: a tree not within the ROW* which might fall into the Clearance Circle and cause a flashover. The Clearance Circle is that distance around a conductor, set by the NESC, which must be maintained free of any object . In the case of a 69kV conductor, that distance is three feet (3’). (Note: Fort Campbell refines this definition to include any tree which may Fall-Into the Clear Zone around an utility pole or conductors).
- Bend-Into – Danger Trees: a tree, or branch thereof, not within the ROW which, due to snow or ice load, wind, or other factors, might bend into the Safety Zone and cause a flashover. (Note: the Safety Zone (NESC) for 115kV or less is sixteen feet (16’) – horizontally).

- Grow-Into - Danger Trees: a tree not within the ROW which, due natural growth will have branches growing into the Safety Zone and cause a flashover. (Note: the Safety Zone (NESC) for 115kV or less is sixteen feet (16') horizontally and nine feet (9') vertically).
- Swing-Into – Danger Trees: a tree not within the ROW into which the wind might cause the conductors to blow (swing) into the trees and cause a flashover. (Note: the 'Swing Zone' (NESC) for 115kV or less is sixteen feet (16') around the tangent to the insulator and conductor assembly).

Danger Tree Zone: the three-dimensional space comprised of the area in which a Danger Tree might exist. Note: this zone is shown on drawings:

- EDB-2011-ROW1: Right-of-Way (ROW) Clearing Guide
- EDB-2011-ROW2: Right-of-Way (ROW) Clearing Guide
- EDB-2011-ROW3: Right-of-Way (ROW) Clearing Guide

Distribution: The movement or transfer of electric power from the low-side (load side) sub-station transformers to the end users. For purposes of this program, included are all 12.47 (12.5) kV and below aerial lines and hardware (poles, guys).

Electric Utility Transmission & Distribution Corridor: corresponds to the combination of the Clear Zone, Wire Zone and the Danger Tree Zone. This also includes the areas in and around sub-stations.

Neutral conductors: a system conductor(s) other than a phase conductor that provides a return path for current to the source.[2]

Phase conductors: supply conductors cables with voltages over 750V to 22kV. Note: the 69kV lines shall be considered phase conductors.

Primary conductors: (see Phase conductors)

ROW: land under and to either side of electric utility transmission and distribution poles and towers devoted to the safe delivery of electrical power to the installation.

Sag: the vertical distance between the point where the line is joined to the pole and the lowest point on the line.[

www.eng.uwi.tt/depts/elec/staff/alvin/ee35t/notes/Transmission-Line-Construction.html, 4-Jan-12].

Secondary conductors: supply cables with voltages 0 to 750V.

Transmission: The movement or transfer of electric power from generating power plants to electrical substations over conductors (lines). Note: for purposes of Fort Campbell, our transmission system begins at the 69kV output of the commercial switching stations currently owned by TVA, and includes all 69kV lines and hardware up to and including the high-side (line side) of the sub-station transformers.

Vegetation-to-Conductor Clearance: the minimum clearance required between an ungrounded conductor and vegetation. Also called the “Clearance Circle’.

Wire Zone [13, 16]: • Wire Zone: Area directly underneath the conductor(s). Vegetation in the wire zone comprises low-growing forbs and grasses. Note: this definition corresponds roughly to the ‘Clear Zone’ as shown on drawings:

- EDB-2011-ROW1: Right-of-Way (ROW) Clearing Guide
- EDB-2011-ROW2: Right-of-Way (ROW) Clearing Guide
- EDB-2011-ROW3: Right-of-Way (ROW) Clearing Guide

PROGRAM

This program contains four (4) elements:

- PLANNING,
- INSPECTIONS AND RE-INSPECTIONS
- INITIAL MOWING, CLEARING AND GRUBBING, TREE TRIMMING AND REMOVAL,
- MAINTENANCE.

PLANNING

All planning must ensure that all landscaping meets the following requirements:

- no trees and non-grass species are to be planted within the Clear Zone,
- only trees and non-grass vegetation meeting the *mature height* [18] restrictions are planted in the Danger Tree Zone,
- all plantings must remain outside the Danger Tree Zone when they reach maturity,
- Row crops – (e.g. corn, wheat, cotton, soybeans) – are permitted in rear-area ROW, but not tree farms, as long as the associated farming equipment does not violate the NESC specified clearances to conductors.
- All minimum conductor (SAG), Clearance Circle and Vegetation-to-Conductor Clearance are accounted for in designs.
- No projects are placed within the Clear Zone or within any NESC specified clearances to the conductors.
- No temporary or permanent structures, buildings, pools, playground equipment or other fixed improvements should be erected in the ROW.

- The specifications for the Grounds Maintenance Contracts (mowing, clearing and grubbing, grounds maintenance, tree trimming and tree removal) contracts in and around the Electric Utility Transmission & Distribution Corridor must include the requirements already stated for the perpetual maintenance of the corridor in the state necessary to affect system reliability and mission execution as stated herein, and should also include those extra requirements listed in the INITIAL MOWING, CLEARING AND GRUBBING, TREE TRIMMING AND REMOVAL section below.

INSPECTIONS AND RE-INSPECTIONS

- *Inspections should be performed by a certified arborist, urban or certified forester.* [18, 19]
- Re-inspection assumes the Grounds Maintenance contracts are in force and being performed correctly.
- Following initial inspection(s) and clearing, the Cantonment should be inspected annually for any vegetation which might evade the Clear Zone or Danger Tree Zone.
- Following initial inspection(s) and clearing, the rear-area should be divided into four, rotating yearly inspection cycles to be inspected for any vegetation which might evade the Clear Zone or Danger Tree Zone.
- Note: the Forestry Section can be used as a resource to inform DPW should an exceptionally fast-growing species begin to invade the Clear Zone or Danger Tree Zone.
- Areas outside the border zone must be patrolled for which may grow into danger trees.

INITIAL MOWING, CLEARING AND GRUBBING, TREE TRIMMING AND REMOVAL

- The Environmental Division should be contacted prior to work being performed. Any approved Fort Campbell Tree Removal process and all applicable regulations shall be followed.
- Clear Zones and Danger Tree Zones should be cleared as soon as possible.
- Danger trees that can reach power lines shall be removed or be subject to *height/limb reduction*[18].
- Vegetation management methods include clear cutting or total removal of trees and vegetation, trimming and herbicide spraying.
- DPW shall be permitted to cut trees and limbs outside the easement where trees or limbs may endanger the lines.

Grounds Maintenance Contracts

Potential losses of due to vegetation-based fire and power outages on Fort Campbell, and the associated costs require the Grounds Maintenance requirements be strictly enforced.

The specifications for the mowing, clearing and grubbing, grounds maintenance, tree trimming and tree removal contracts in and around the Electric Utility Transmission & Distribution Corridor must include the requirements already stated for the perpetual maintenance of the corridor in the state necessary to affect system reliability and mission execution as stated herein, and should also include:

- Electric utility poles shall be kept free of all underbrush and vines within the Clear Zone.
- Guy wires shall be treated as a electric utility poles shall have the same Clear Zone established around them as a electric utility pole.
- Aggressive enforcement of the mowing contract should alleviate any extra costs in removing unwanted future growth in the Clear Zone.

Stumps [19]

The area around a removed tree must be maintained, to include mowing. Therefore, stumps must either be removed or otherwise cut and/or treated to allow maintenance.

The preferred method is either to pull them completely from the ground or to grind them below-grade. In either case, the area in and around the hole must be leveled, repaired and reseeded to allow mowing.

In the event neither pulling nor grinding is possible due to the contour of the landscape, or some here unforeseen reason, stumps must be cut off and left no more than 2" above ground level.

Where stumps (2") have been left in place , a certified arborist, urban or certified forester must be consulted to prescribe a mechanical or chemical method to prevent regrowth.

Substation Grounds Clearing Criteria

It is important, therefore, to be intentional about the selection, placement, and maintenance of vegetation around substation yards. A qualified electrical engineer or Substation Grounding Engineer may have to provide guidance for the correct distances to be maintained. The following criteria are the basis for the procedures outlined below:

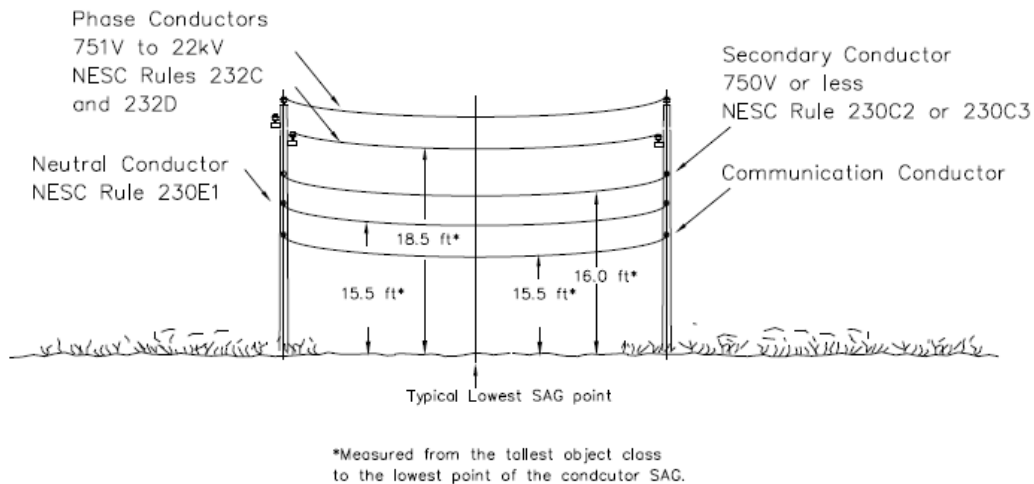
- Vegetation touching the fence must not extend beyond the perimeter grid wire.
- Green, vining vegetation must not encroach on the area of steepest potential rise gradient or grow up through substation surfacing rock.
- When the perimeter grid wire is inside the boundaries of the perimeter fence and perimeter vegetation is touching the fence, the side of the shrub or bush away from the fence should be pruned back as closely as possible to the fence or should be removed manually or chemically.
- No new ornamental trees, bushes or shrubbery should be planted within 10 feet of the substation perimeter fence or building.
- Substation surfacing rock must be free of all vegetative matter.

MAINTENANCE

Once the initial mowing, clearing and grubbing, tree trimming and removal has been performed, re-inspections and the Grounds Maintenance contracts should be sufficient to maintain the Electric Utility Transmission & Distribution Corridor.

Reference documents used to develop this program are available. Contact the Electrical System Engineer listed above.

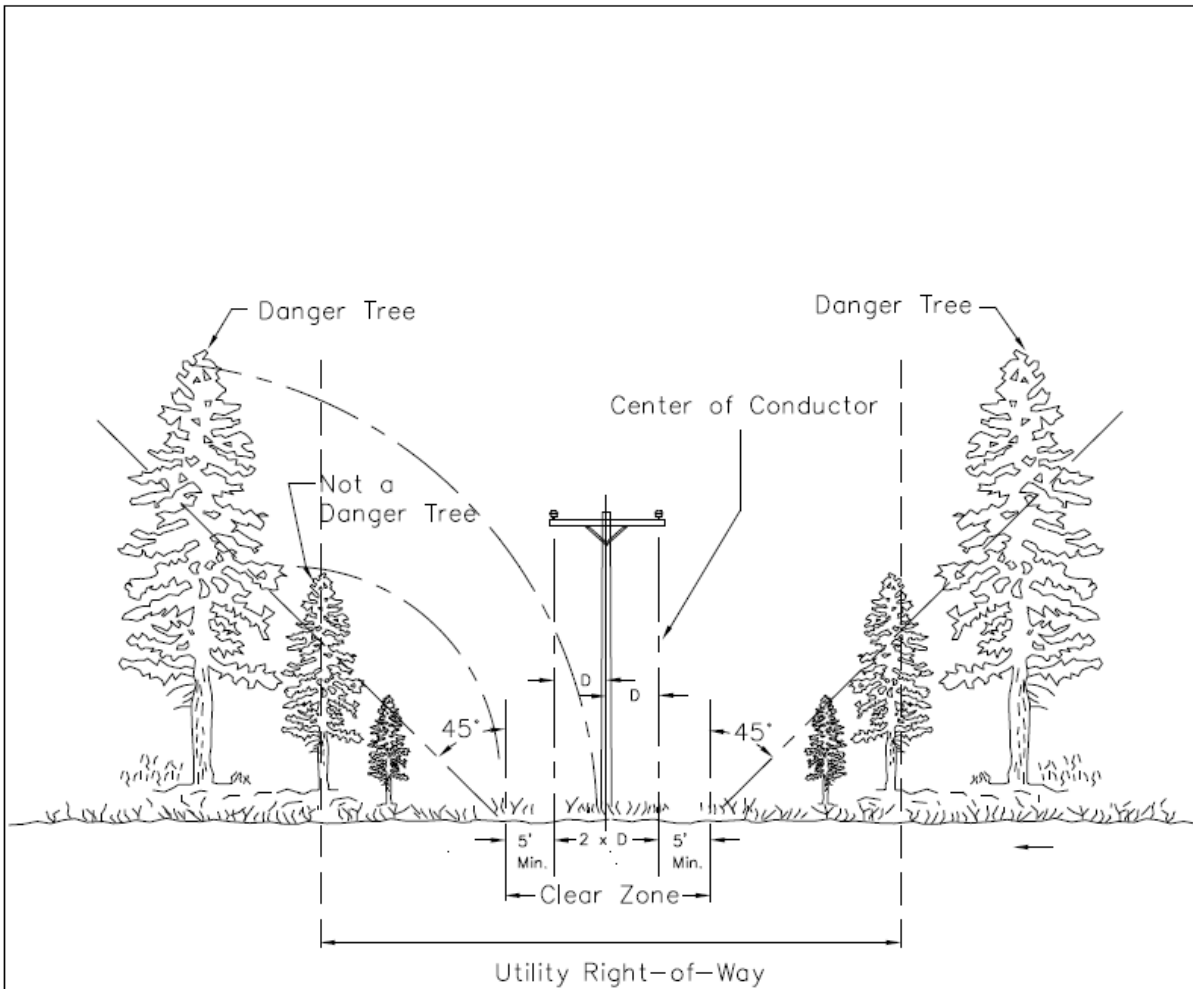
See Right-of-Way Clearing Guide figures that follow:



NOTES:

1. These are minimum clearance distances and are measured, and must be kept, from the top of the tallest class object (e.g. road, trees ...) to the lowest SAG point.
2. Vegetation growth under all conductors (if any) must be planned so that the mature growth does not encroach upon these minimum clearances.
3. Further requirements for both Transmission and Distribution conductors are contained in the National Electrical Safety Code Including Part 2. Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communication Lines
4. Further requirements for both Transmission and Distribution conductors are contained in several United States Department of Agriculture, Rural Utilities Service (RUS) bulletins including 1724E-154: Distribution Conductor Clearances and Span Limitations.
5. Contact the DPW engineer/technician, or a qualified engineer under DPW direction, for further guidance if the requirements are in question.

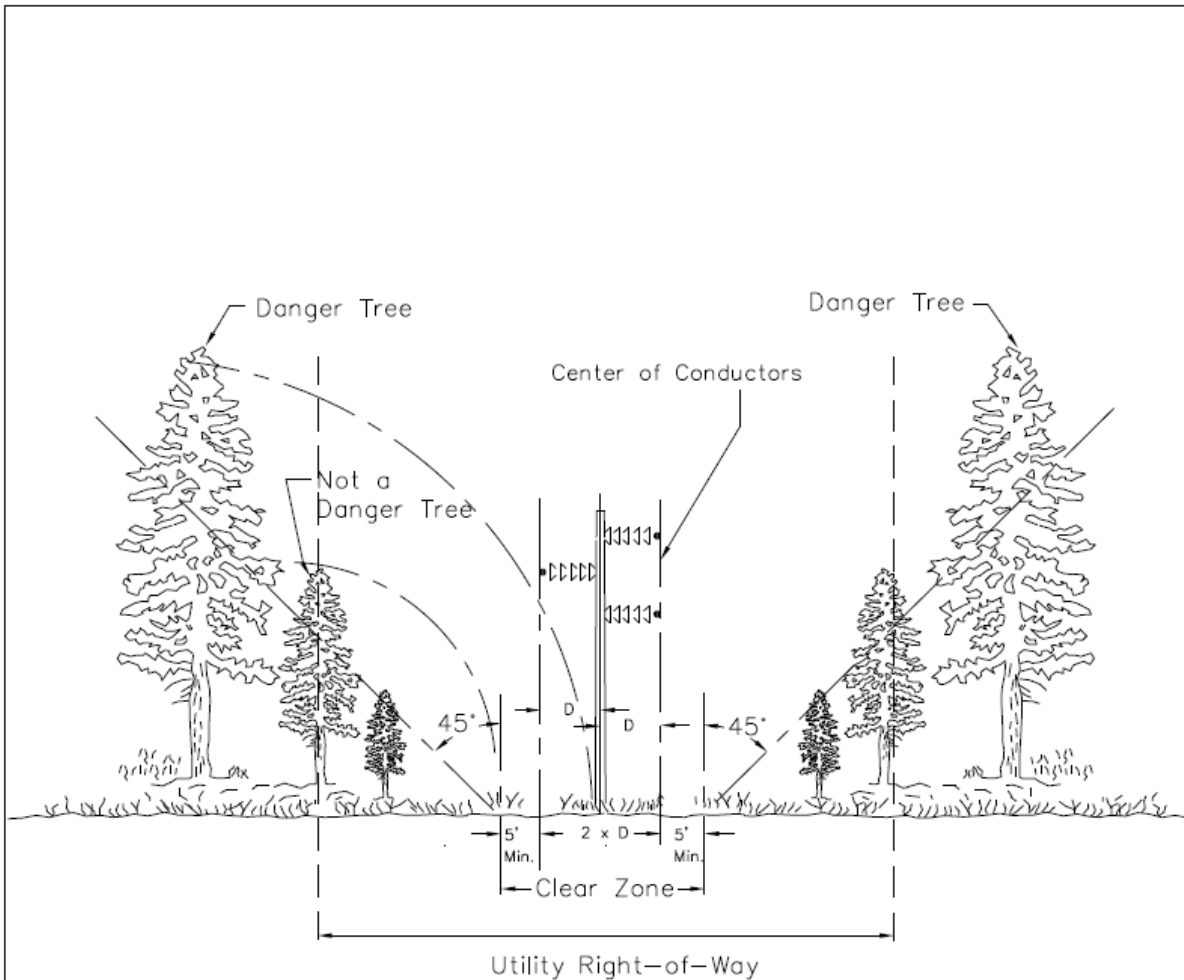
Figure N-1



NOTES:

1. DPW will designate all danger trees which shall be removed or topped. Danger trees include Fall-Into, Bend-Into, Grow-Into and Swing-Into trees.
2. As directed by DPW, portions of the right-of-way (ROW) must be cut so that stumps will not prevent the passage of tractors and trucks or mowing in and along the ROW.
3. The Clear Zone shall be clear of all live growth above 12". Stumps shall be removed or ground below-grade.
4. The Clear Zone shall extend on either side of the utility pole centerline the distance (D), center of the pole to the centerline of the free-hanging conductor, plus at least 5 feet (5').

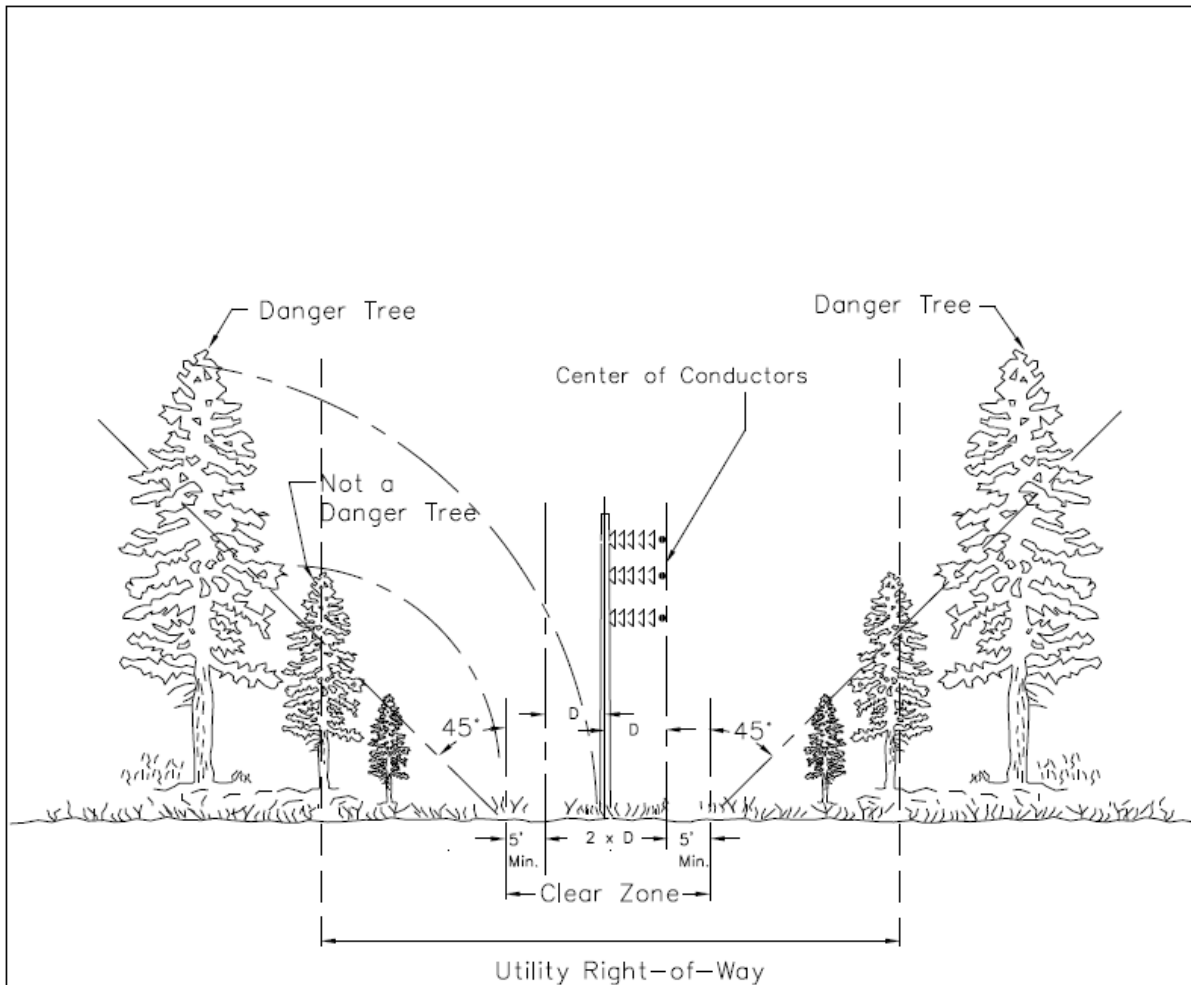
Figure N-2



NOTES:

1. DPW will designate all danger trees which shall be removed or topped. Danger trees include Fall-Into, Bend-Into, Grow-Into and Swing-Into trees.
2. As directed by DPW, portions of the right-of-way (ROW) must be cut so that stumps will not prevent the passage of tractors and trucks or mowing in and along the ROW.
3. The Clear Zone shall be clear of all live growth above 12". Stumps shall be removed or ground below-grade.
4. The Clear Zone shall extend on either side of the utility pole centerline the distance (D), center of the pole to the centerline of the free-hanging conductor, plus at least 5 feet (5').

Figure N-3



NOTES:

1. DPW will designate all danger trees which shall be removed or topped. Danger trees include Fall-Into, Bend-Into, Grow-Into and Swing-Into trees.
2. As directed by DPW, portions of the right-of-way (ROW) must be cut so that stumps will not prevent the passage of tractors and trucks or mowing in and along the ROW.
3. The Clear Zone shall be clear of all live growth above 12". Stumps shall be removed or ground below-grade.
4. The Clear Zone shall extend on either side of the utility pole centerline the distance (D), center of the pole to the centerline of the free-hanging conductor, plus at least 5 feet (5').

Figure N-4

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APPENDIX N

Assessibility for Disabled Persons

Per the October 31, 2008 Deputy Secretary of Defense (DepSECDEF) Memo, Subject: Access for People with Disabilities, the DoD accessibility standards are based on the 2004 “Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines” ([ADA-ABA Guidelines](#)) developed by the U.S. Access Board. Specifically, DoD’s adopted standards are included in ABA Chapters 1 and 2, and Chapters 3 through 10 of the guidelines, which specify what has to be accessible and how to achieve access. Although ADA-ABA are written as guidelines, the October 31, 2008 DepSECDEF Memo states that the ADA-ABA Guidelines are adopted by the DoD. Therefore, since DoD adopted the guidelines, they are now standards with which DoD must comply.

The ADA applies to state and local government and private sector facilities, while the ABA applies to Federal facilities.

Accessibility requirements are also addressed in the Manual on Uniform Traffic Control Devices ([MUTCD](#)), FHWA/US DOT, 2009. Military installations must comply with the standards presented in the MUTCD in accordance with Multi-Service Regulation (AR 55-80, OPNAVINST 1210.2, AFMAN 32-1017, MCO 11210.2D and DLAR 4500.19): DoD Transportation Engineering Program.

----- END OF SECTION -----

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