FORT CAMPBELL, KENTUCKY

TECHNICAL DESIGN GUIDE

15 DEC 2021

Revision 05

See Appendix-B
Revision Status

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 Master Format (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.
For updated versions of the TDG document can be found at:
https://www.lrl.usace.army.mil/Missions/Engineering/guidepubftc.aspx

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.

See Appendix-B Revision Status.

FORT CAMPBELL Real Property Vision Plan Installation Planning Standards.

Installation Planning Standards (IPS) capture the Installation’s guidelines for development of sustainable and efficient facilities. The Standards provide a clear set of guidelines to ensure that the installation’s Vision and planning Objectives for development are achieved. The Standards are applicable to all installation tenants and includes Building Standards, Street Standards and Landscape Standards.

- The IPS supports the Regulating and Illustrative Plans in each Area Development Plan (ADP) by specifying building, landscape, and street standards.
- The IPS is developed to promote visual order, enhance the natural and manmade environments through consistent architectural themes and standards, and improve the functional aspects of the installation.
- The IPS provides common facility and infrastructure standards for the installation, provides guidance on cost-effective resource investments, ensures sustainability and efficiency of facilities, and improves the function and appearance of the installation, to include guidance on exterior and interior planning parameters, and landscaping.

For more on IPS go to: https://home.army.mil/campbell/index.php/download_file/view/795/762

Appendix D - Product list. A quick reference guide is provided in Appendix-D ‘Fort Campbell Preferred Equipment List, Exterior / Interior Finishes and Color Guidance’ for Contractors, Engineers, Designers, and Technicians. The Quick Reference Guide simplifies Design and Construction and provides uniformity in maintenance repair and replacement parts across the installation. This guidance is for New Construction, standard renovation, building resets, and equipment change out. Any changes to products on list must be approved by (EOR) Engineer of record and submitted during the submittal process.

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Technical Design Guide
CHAPTER 1
General Information and Administrative Requirements

PARAGRAPH

1-1 Purpose 05

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 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:
https://home.army.mil/campbell/index.php/about/Garrison/dpw/master-planning-division

1-1.6 A joint DPW and COE committee oversees maintenance, evaluation, and revision of the technical contents. Specific guidance and criteria contained within shall be developed through specialized sub-committees with representatives from engineering, construction, and maintenance personnel from Ft. Campbell and Louisville COE. It is the 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. Master Formatting is used in writing the TDG. (Construction Specifications Institute (CSI)) division categories, as implemented in the Unified Facilities Guide Specifications (UFGS), where possible. Additional information preceding the Division specific entries are added 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 ensure technical contents of this document are incorporated into design documents prior to submission for review.

1-5 Standardization

1-5.1 Fort Campbell's goal is to standardize equipment and systems as much as possible. Refer to Appendix-D for guidance.

1-5.2 Standardization allows improved reliability, better maintenance practices, reduce working capital, and minimize operating expense.

1-5.3 Fort Campbell's preferences, where they exist, shall be made available to the Contractor.

1-5.4 If the contractor elects to provide material/equipment that does not match the Fort Campbell preferred product list in Appendix D, the contractor shall submit required information showing their proposed material/equipment meets the required salient characteristics of the preferred product list and the other requirements of the contract.

1-5.5 Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer.

1-6 Passwords, Access Codes and Keys

1-6.1 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 Final acceptance.

-6.2 The Contractor shall provide the current, correct password(s)/codes to all installed equipment at the time of Final acceptance.

-6.3 DPW personnel shall verify the current, correct password(s)/codes to all installed equipment at the time of Final acceptance.

-6.4 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 Final acceptance.

-6.5 DPW personnel shall verify all keys are accounted for and function as required at the time of Final acceptance.

1-7 Document Improvements and Deviations

1-7.1 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 Engineer Design Branch (EDB) identified below:

EDB Division Chief: 270-798-7215 EDB Branch Chief: 270-798-7213

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: _____

Figure 1:

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TECHNICAL DESIGN GUIDE
CHAPTER 2
General Requirements

PARAGRAPH

2.0 General Design Provisions

2.1 Special Ft. Campbell Criteria

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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 of Work (SOW) / Performance Work Statement (PWS)** that is completed after a pre- design conference and site evaluation.

MILCON and OMA Projects

Fort Campbell's goal is to standardize equipment and systems as much as possible. This allows improved reliability, better maintenance practices and saves both personnel and financial resources. See **Appendix-D** for product list.

Water Conservation Program

To achieve the water reduction goals of section 2(c) of Executive Order (EO) 13423, Strengthening Federal Environmental, Energy, and Transportation Management (72 FR 3919; January 29, 2007) and the Instructions for Implementing Executive Order 13423, dated March 29, 2007. Beginning in 2008, Federal agencies must reduce water consumption intensity through life-cycle cost-effective measures, relative to the baseline of the agency's water consumption in fiscal year 2007 by 2 percent annually.

HVAC Equipment

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.

For New Construction or for complete building renovation, where practical, 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 systems are not permitted.

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 near 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.

Mechanical Equipment

Condensing type Boilers and Copper Fin Tube Boilers are preferred for all comfort-heating requirements, in lieu of cast iron sectional or fire tube boilers. Designers must take into account the mechanical room environment. i.e. area prone to flooding or humid condition.

Outdoor copper fin tube boilers shall be equipped with freeze protection. Primary/secondary piping with primary loop pump interlock as primary freeze protection is required. 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 and fuel containing equipment, design a containment curb under the equipment.

Do not install equipment in pits.

Plumbing Equipment

Condensing type Water Heaters and Copper Fin Tube Water Heaters are preferred for all domestic water heating requirements. Designers must take into account the mechanical room environment. i.e. area prone to flooding or humid condition. Total occupancy to size water heater BTU recovery rate and storage capacity.

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 truncated rubber mat detectable warning surfaces shall contrast visually with adjacent gutter or street, or pedestrian access route surface, either light-on-dark or dark-on-light. shall be placed at the end of a ramp in accordance with ADA requirements.

All entrances that are be used by trucks 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.

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

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

SIGNS

1. 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.

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

3. 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.

2.0.1 Deliverables

Drawing Standards

- All CADD drawings shall be done on Bentley Microstation V8i (SELECT series 4) DGN 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, DGN 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 Information Technology Laboratory.
https://www.wbdg.org/FFC/AECCAD/ERDC_ITL_TR-19-7_2019.pdf

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 Information Technology Laboratory.
https://www.wbdg.org/FFC/AECCAD/ERDC_ITL_TR-19-6_2019.pdf

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 will 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.
- Combined pdf files size shall be no more than 100MB each.
- Searchable DGN shall be provided for each final design drawing.
- All PDF raster's and references shall be locked as not to lose path.

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, UFC, 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. **See Appendix-L**
The installation of translucent panel shall comply with UFC 4-010-01. Color shall match existing building color unless noted by Engineer or Architect.

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 are 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

Equipment Location Verification

- Equipment Location Verification is required prior to AS-Built drawings.
- Geospatial location is required for both new and existing systems, sub-systems or equipment:
  - Installed on or under Fort Campbell property.
  - Abandoned-in-Place on Fort Campbell property.

Organization / Current Point(s) of Contact (POC)

- Directorate of Public Works, IGI&S Manager. 270-798-9571
- City Light & Power (CLP), System Owner, Building 5138, 1st Street & Wickham Avenue, 270-698-8970.
- Electrical Privatization Contracting Officer's Representative (COR), Directorate of Public Works, 270-798-2940.
- Clarksville Gas Privatization Contracting Officer representative (COR), Directorate of Public Works, 270-798-9719
- Directorate of Public Works, Engineering Design Branch, 270-798-0887
- Garrison Energy Manager, Directorate of public Works, Utilities Branch, 270-798-0367
- Directorate of Plans, Training, Mobilization & Security, GIS Coordinator, 270-956-1743

Requirements-Surveying and Mapping Requirements-Geospatial

a. Coordinate System
   i. The coordinate system used to maintain digital data would be the Tennessee State Plane Coordinate System (TN SPCS).
   ii. The datum used will be the North American Datum of 1983 (NAD83).
   iii. The mapping unit will be 'US Survey foot'.
   iv. The vertical datum used will be the North American Vertical Datum 1988 (NAVD1988).

b. Accuracy
   i. Mapped geographic data will have an accuracy of less than one (1) meter vertical and horizontal unless otherwise stated in the Scope of Work.
   ii. GPS - Surveyed data shall be within one (1) centimeter horizontal and two (2) centimeters vertical accuracy unless otherwise stated in the Scope of Work.

c. Topology
   i. Line segments will be 99% free of topological errors including, but not limited to: Dangling nodes, undershoots, overshoots, double-digitized lines.
   ii. Any feature with an area value must be represented as a polygon per Spatial Data Standards for facilities, Infrastructure, and Environment. (SDSFIE)
   iii. All topology rules stated in the feature's Quality Assurance Plan (QAP) must be adhered to.

Requirements- Surveying and Mapping –Geographic Information System (GIS)

a. Interoperability
   i. Fort Campbell uses and ESRI-based Enterprise GIS. All data must be compatible with ESRI software.
   ii. Fort Campbell's Geodatabase structure is in accordance with the current Spatial

Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) logical data model. To ensure compliance and interoperability, all geospatial data must be prepared and maintained in accordance with said model.

b. Completeness

i. All data shall comply with the Quality Assurance Plan (QAP) for the associated feature class.

ii. All attributes shall be considered required unless otherwise specified, in writing, by Fort Campbell.

iii. The contractor shall coordinate with the IGI&S Manager for any new layer or any additions/ corrections to and existing layer.

iv. Fort Campbell may maintain additional attributes for featureclasses mot specified in the QAP.

v. Fort Campbell has identification numbering convention is used to assign numbers to all electrical transmission, distribution and facility service equipment in the GIS. The contractor shall work with the Engineer Design Branch to formulate appropriate equipment numbers for all equipment such as poles, transformers, and switches not present or numbered in their associated GIS featureclasses.

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 (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.

- Rogers Group, Louisville, KY.
- Ingram Materials Nashville TN.
- Vulcan Materials Co. Clarksville TN.

Listed Below are natural fine aggregate sources for concrete, asphalt, stone base, subbase and DGA.

- Rogers Group, Louisville, KY.
- Ingram Materials Nashville TN.

POC for further information at the Louisville District contact:

Louisville District
P.O. Box 59
Louisville, KY 40201-0059
Contracting Review
(502) 315-6436 (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 Second Generations Micro-Computer Aided Cost Estimating System (MII-MCACES) software.
- Cost estimates for OMA projects shall be provided to DPW at the time of submittal for bid issue.
- Official government cost estimates (IGE) shall not 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. The draft version of the DD Form 1354, is generally used for the Acquisition by Construction and Capital Improvement to Existing Facilities acquisition methods. It is often initiated to enable effective capture of information during the design or Request for Proposal (RFP) preparation stage. This information may be updated upon any of the following:

- Changes in scope
- Changes in cost estimates
- Addition or deletion of RPUID

This requirement applies to both MILCON and OMA program projects.
See UFC 1-300-08 Unified Facilities Criteria (UFC) for further guidance.
https://wbdg.org/FFC/DOD/UFC/ufc_1_300_08_2009_c2.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 with Change 4, date: 12-Jan-2016 Revised 10-Jan-2019.

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? Are procedures in place to ensure that all new purchases of equipment are an Energy Star or FEMP designated product?

(c) 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?

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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.

Korean era buildings: when remodeling Korean era buildings i.e. Hammer Heads, administrative etc. The IPS standard shall be anodized dark brown window trim, insulated metal window panels, gutters, downspouts, and fascia trim. Window and insulated metal window panel configuration shall match existing design. All windows shall be 35% (translucent window panels are not to be used)

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 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

The Directorate of Public Works, Environmental Division, Petroleum Storage Tank Program Manager, shall not permit aboveground and underground petroleum storage tanks at new construction projects without design review and approval.

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 60% (by weight) of all construction, renovation, and demolition debris from the Woodlawn C/D landfill. Landfills on or off post shall not receive recyclable waste materials. 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 60% 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 Storm water Management Plan. Best Management Practices (BMPs) shall follow the design criteria in the 2012 Tennessee Erosion Prevention and Sediment Control Handbook. https://tnepsc.org/handbook.asp

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 storm water 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

Borrow area entry will be obtained by the COR for any DPW projects and the QA or Project Engineer for USACE projects by contacting the Environmental Division Pollution Prevention Branch at 270-798-9771 /9786 / 9767:

- 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. A proctor test will be provided when available.
- Contractor shall provide copy of permit to the COR.

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 Management Plan Checklist and Deliverables.

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 DPW:

Microstation, V8i Series 4

Microsoft Office 2016

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”.

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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. POC (502) 315-6437 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 been placed to isolate each building from the main service (water and gas), and to allow only for minimal main shut down when tying into 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, shall apply to all MILCON projects and OMA projects issues by the Fort Campbell Mission and Installation Contracting Command (MICC).

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.
3. FAR 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

    - General Requirements.

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.

- Warranty.

The contractor shall provide a bond thru the warranty period and if the contractor does not respond the bonding company will be contacted to address.

- 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 back charge the Contractor for the cost of such repairs. Such back charges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

- 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.

- 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.

- 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.

- 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.

• 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.

• 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.

• 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, manufacturers, or supplier's warranty.

• 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.

• 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.

• 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.

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

(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.

- 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.

- 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.

- **Equipment Warranty Identification Tags:**

- The Contractor shall provide warranty identification tags on all Contractor and Government furnished Equipment that were installed or replaced.

(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. (See Fig 1)

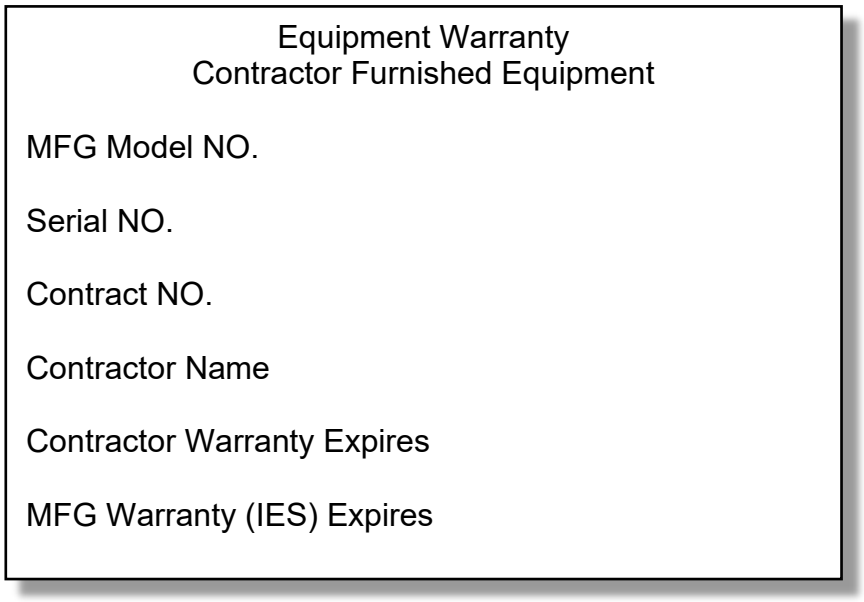

Fig. 1 Warranty Tag

(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.

(e) <u>Roof Warranty Placard:</u>

For each roof installation, furnish a "Date of Installation Placard", 0.032 inch thick [aluminum], 21.6 cm 8-1/2 inches high by 28 cm 11 inches wide, Secure placard to building exterior by Mechanical Room at corners using drive pins with waterproof sealing washers and stainless steel nail inserts, photoengraved to include the following information: (See Fig. 2)

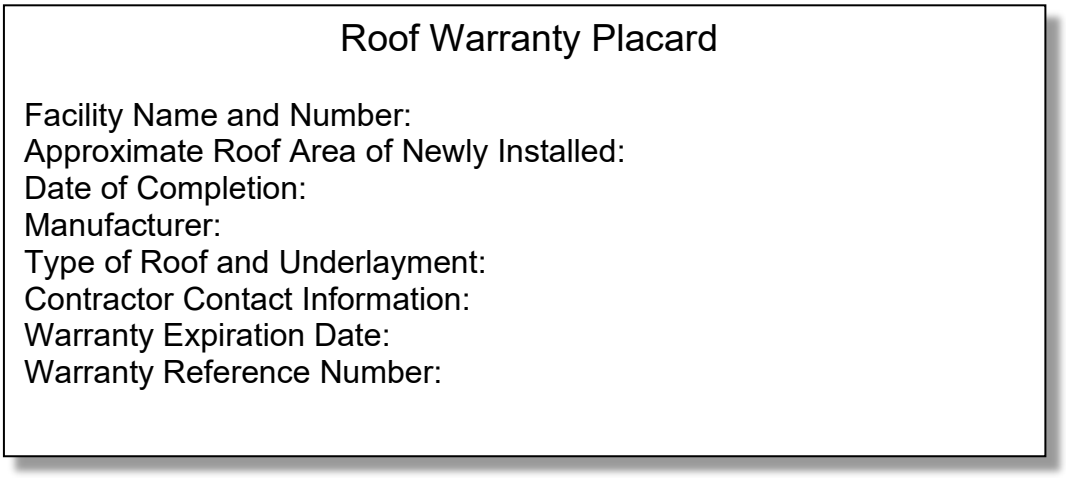

Fig. 2 Warranty Tag

Install placard as directed by the Contracting Officer.

• 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.

• 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.

• 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.

• Contractor's Response to Warranty Service Requirements.

• 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. The Contractor shall submit a report on any warranty item that has been repaired during

the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established under paragraph 20.1.1.1.

(1) First Priority Code 1 (Emergency) Perform on-site inspection to evaluate situation, determine course of action, initiate work within 24 hours and work continuously to completion or relief.

(2) Second Priority Code 2 (Urgent) Perform on-site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

(3) Third Priority Code 3 (Routine) All other work to be initiated within (5) five work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

Code 1 Air Traffic Control and Air Navigation Systems and Equipment.

Code 1 Air Conditioning System

a. Hospital.
b. Buildings with computer equipment.
c. Commissary, Clubs and Main PX.
d. Army Reserve Projects, Training Bldg. & OMS Administrative Areas of Bldg.
e. Air Force Reserve Projects, Training Bldg., OMS Administrative Areas of Bldg., and Indoor Ranges.
f. Barracks, mess halls, BOQ/BEQ (entire building down).
g. Troop medical and dental.

Code 2 Air Conditioning Systems

a. Recreational support.
b. Air conditioning leak in part of building, if causing damage.
c. Air conditioning system not cooling properly
d. Admin buildings with ADP equipment not on priority list.

Code 1 Doors
Overhead doors not operational.
Code 1 Electrical

a. Power failure (entire area or any building operational after 1600 hours).
b. Traffic control devices.
c. Security lights
d. Smoke detectors and fire alarm systems Code 2 Electrical
e. Power failure (no power to a room or part of building).
f. Receptacle and lights.

Code 3 Electrical
Street, parking area lights

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

Code 1 Heat
a. Hospital/Medical facilities.
b. Commissary, Clubs and Main PX.
c. Army Reserve Projects, Training Bldg. & OMS Administrative Areas of Bldg.
d. Area power failure affecting heat.

Code 2 Heat
a. Medical storage.
b. Barracks.
c. Army Reserve Projects, Training Bldg & OMS Administrative Areas of Bldg.

Code 3 Interior
a. Floor damage
b. Paint chipping or peeling

Code 1 Intrusion Detection Systems
Finance, PX and Commissary, and high security areas.

Code 2 Intrusion Detection Systems
Systems other than those listed under Code 1.

Code 1 Kitchen Equipment
a. Dishwasher.
b. All other equipment hampering preparation of a meal.

Code 2 Kitchen Equipment
All other equipment not listed under Code 1.

Code 2 Plumbing
a. Flush valves not operating properly
b. Fixture drain, supply line commode, or water pipe leaking.
c. Commode leaking at base.

Code 3 Plumbing
Leaking faucets

Code 1 Refrigeration
a. Commissary.
b. Mess Hall, Army Reserve Projects.
c. Cold Storage.
d. Hospital.
e. Medical storage.

Code 2 Refrigeration
Mess hall - other than walk-in refrigerators and freezers. 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 1 Sprinkler System
All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.

Code 1 Swimming Pools
Chlorine leaks or broken pumps.

Code 1 Tank Wash Racks (Bird Baths)
All systems which prevent tank wash. Code 1 Water (Exterior)
Normal operation of water pump station. Code 2 Water (Exterior)
No water to facility.

Code 1 Water, Hot (and Steam)
Hospitals and Mess Halls.
Army Reserve Projects, Training Bldg & OMS Bldg.
BOQ, BEQ, barracks (entire building).
Medical and dental.

Code 2 Water, Hot
No hot water in portion of building listed under Code 1 (items a through c)

- 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 Contractors 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.

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TECHNICAL DESIGN GUIDE
CHAPTER 3
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Division 01
General Requirements

Section

SECTION 01 14 00
Work Restrictions

Ft. Campbell Requirements:

No Smoking Policy

Smoking is prohibited within and outside of all buildings on installations under the cognizance of NAVFAC except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

Working Hours

Regular working hours shall consist of an [8 1/2 hour] \ between [7 a.m. and 4:30 p.m.,] Monday through Friday, [and 7 a.m. to 4:30 p.m. on Saturday], excluding Government holidays.

Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15

calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer. [Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.]

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 OSHA 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, 17731-147th Street SE Monroe, WA 98272 (Phone 855-301-4575).

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.

Utilities and their distribution lines shall follow existing road corridors and shall not exceed 15' from edge of pavement until a point of embarkation to a facility, unless otherwise stated in

contract requirements. Master Planning and /or Engineer Design Branch Site approval is required prior to deviating.

Instructions to Designers:

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

Ft. Campbell Requirements

Electricity

City Light & Power (CLP) are System Owner under Contract #SP0600-17-C-8325, Award date: 09/29/2017. POC Bldg. 5138 1st Street & Wickham Ave. (#270-698-8970).

Electrical Privatization Contracting Officer Representative (COR), Directorate of Public Works, (#270-798-0819).

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 Garrison Energy Manager, DPW Utilities Branch, Bldg. 865, or Utilities Energy Engineer, Bldg. 865 (# 270-798-0367).

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 (CLP). Read and understand UFGS Section 26-27-13.10-30 – Electric Meters

City Light & Power will provide the meter after approval of electrical equipment by (CLP)

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 (CLP) 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 and Sewer

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

Natural Gas

Fort Campbell Natural Gas distribution. The owner of the system is Clarksville Gas. Contact (931-542-9620) regarding requirements and costs associated with providing gas connections and service.

Water/ Waste-Water/ Natural Gas Privatization Utilities Service Contracting Officer representative (COR), directorate of Public Works, # 270-798-9719

Communications

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

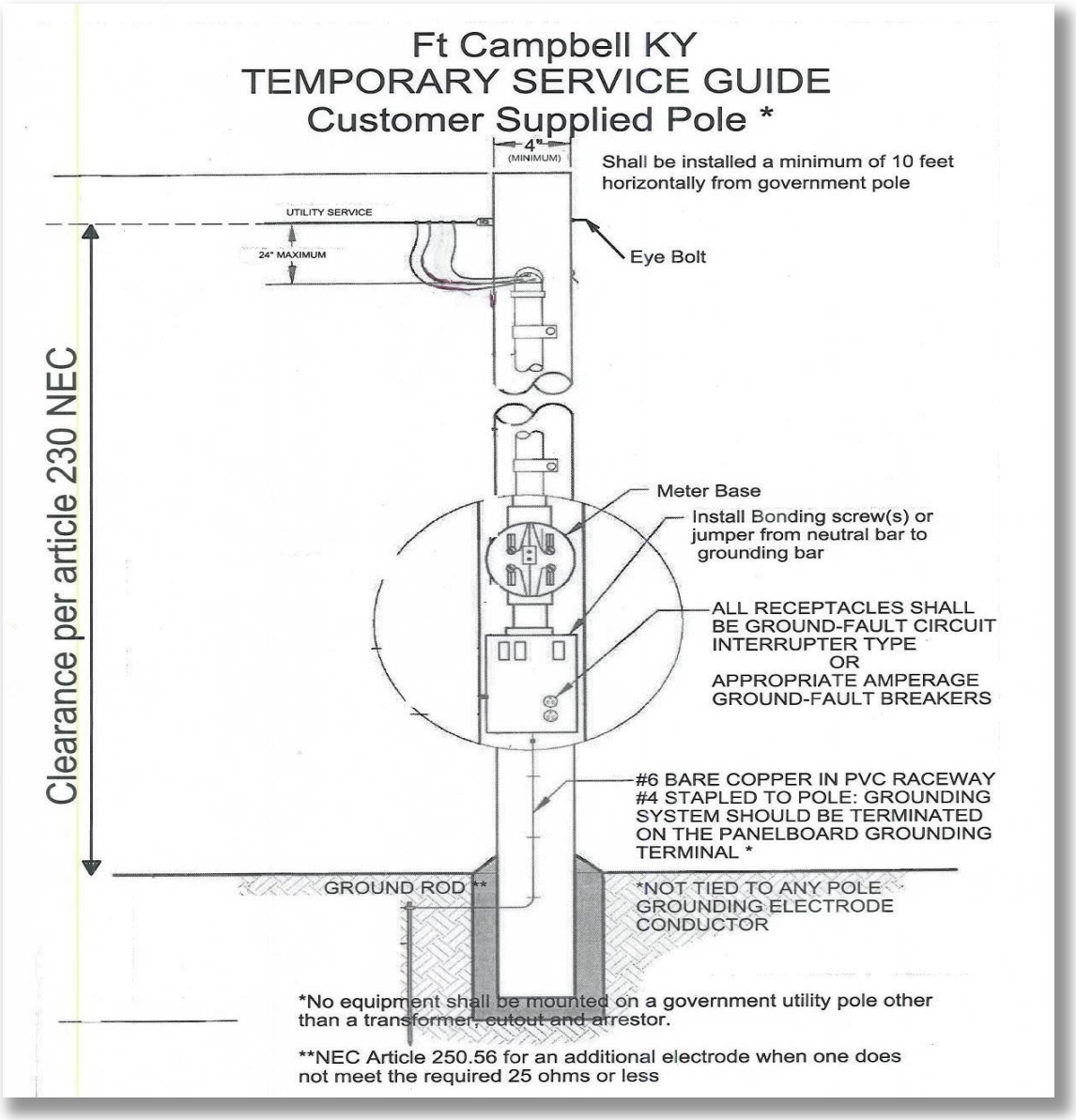

Fig 1-50

---- 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:

Hazardous materials (HM) to be brought onto the post

a. 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 , as an enclose with each Project Package. 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.**

Hazardous waste (HW) generated

b. The Environmental Protection Plan must list, any HW generated during the project. Disposal of hazardous waste generated will be coordinated with the Hazardous Waste Program Manager in the Environmental Division-Pollution Prevention Branch for proper disposal.

Storage of hazardous waste

c. 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.

g. 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.

h. 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

Note: If a project requires a Storm Water Pollution Prevention Plan (SWPPP) that document is a separate, stand-alone document.

2.1.1.2 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.

Post Construction Best Management practices shall meet the Tennessee Stormwater Management Manual for meeting water quality treatment and runoff reduction standards. All Projects shall be designed to meet Karst requirements of the Tennessee Stormwater Management Manual, Appendix B. All system designed to promote infiltration and utilization of sinkholes shall be reviewed and classified as Class V Underground Injection Control as required (chamber systems, infiltration trenches, increased runoff to sinkholes). Permitting for these Best Management Practices will be permitted with the Tennessee UIC program or

the USEPA Region IV UIC program for Kentucky.

Notice of Intent, along with the SWPPP, must be submitted to the appropriate state regulatory agency for approval and Notice of Coverage. This be accomplished after the Environmental Division has reviewed and approved the NOI, SWPPP, and Hydrology submittals. The projects under the Garrison will have the NOI signed by the Garrison Commander. Projects under the US Army Corps of Engineers will be signed by the District Resident Engineer, US COE plans and submittals will be provide for the installation Municipal Stormwater Program during the design phase and prior to any regulatory submission.

SWPPP designers must consult the applicable state NPDES General Permit for Construction Activities for complete SWPPP requirements based upon which state the project is located in Kentucky or Tennessee.

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 and plan that is submitted under the NOI to the regulatory agency. A Notice of Intent (NOI) will be prepared by the U.S. Army Corps of Engineers and submitted to the state of Tennessee or 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 or at approved location such as mail box posted outside the trailer. Any changes made to the plan must be documented and approved by the Environmental Division (under the installation Municipal Stormwater Permit) in coordination with 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. Manufacture'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 reseal able.

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-73 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. Spill kits should be inspected monthly and inventoried every 6 months. Spill materials for cleanup and to restock spill kits must be purchased with unit funds.

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 798-9637/9601 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 spill able 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) Firefighting 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 SDS 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. See Fort Campbell Environmental (Contractor Site Specific Spill Contingency Plan) Fig. 1 page 1 and 2.

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?	☐ Yes ☐ 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

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Figure 1 page 1

Emergency Spill Equipment (Required)

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

☐ Peat*	☐ Drain Blocker	☐ Containment Unit	☐ Disposal Bags*
☐ Dry Sweep	☐ Spill Putty	☐ Baking Soda	☐ Rubber Gloves*
☐ Absorbent Pads*	☐ Overpak	☐ Broom*	☐ Respiratory Masks
☐ Absorbent Socks*	☐ Drip Pan	☐ Dust Pan	☐ Safety Goggles
☐ Absorbent Pillow	☐ Spill Pool	☐ Non-Sparking Shovel*	☐ Tyvek Suit
☐ Other (Please Explain)			

Spill Response Procedure

1. Be Prepared	2. Be Safe	3. Stop the Source	4. Protect Water
• Know response material locations • Know response procedures	• Identify spilled substance / Read MSDS • Use personal protective equipment	• Plug, roll, or right drums • Use emergency shut-off devices	• Confine spills with sandbags or booms • Block access to stormwater grates
5. Notify	**6. Clean Up**	**7. Dispose**	**8. Restock**
• Know response material locations • Call Environmental Division or 911	• Neutralize hazardous substances • Pump or sweep into a safe container	• Contain waste water or sweepings • Call PPOC for proper disposal	• Replace materials and equipment • Review the incident for lessons learned

Notification Procedure

1. Who to Call		2. When to Call	3. What to Report
• Fort Campbell Emergency Dispatch	911	• Greater than 10 gallons	• Location and address of release
• Range Control (if in training area)	798.3001	• Three (3) square feet	• Name and phone number of POC
• SPCC/Storage Tank Program	798.9637/9601	• Enters any water source	• 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, resonding, 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 NotificationProcedure 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 _____

☐ **Approve**

☐ **Disapprove**

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Figure 1 page 2

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 Wash shall be containerized and disposed of accordantly. 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 Storm water 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 broadcast 16-lb. 12-12-12 per 1,000 sq. ft. (700 lbs. per acre).

b. Work fertilizer into the soil 2"- 4" (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, and 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 (DPW Forestry personal or a REC). No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless part of a tree maintenance project by a tree care professional.

During construction activities, trees need to be protected, both above and below the surface of the ground. Commonly seen injuries during construction activities on Fort Campbell have been improper pruning from non-arborists, trunk damage from equipment, and most commonly root damage. The majority of a trees roots are not that deep in the soil, often within the first several inches of soil. Root damage can be done by soil compaction or direct root injury. Soil compaction can result from heavy machinery sitting on the root system, repeated foot or car traffic during construction, storage of materials like lumber, rebar, gravel, dirt, and other equipment. Direct root damage can occur when digging too close to the tree and destroying and damaging those roots. Excavation or trenching can sever, rip, or tear roots. Ideally, if a root needs to be severed, it will be at a reasonable distance from the tree (outside of the drip crown radius) and it will be severed cleanly with a chainsaw or handsaw. Often times excavators are used and the root are ripped out or shattered. This causes significantly more damage than merely severing it cleanly.

1.5. Tree Protection Zone (TPZ)

The Tree Protection Zone is the area around a tree that should not be disturbed or entered during construction to ensure the health and survivability of the tree after the construction has completed. In general, the TPZ is determined by the size of the tree. An easy rule of thumb is to use the ‘Drip Crown Radius’ of the tree to determine the TPZ. This is an area around the tree that is the width of the widest spread of the tree’s crown (Figure 1).

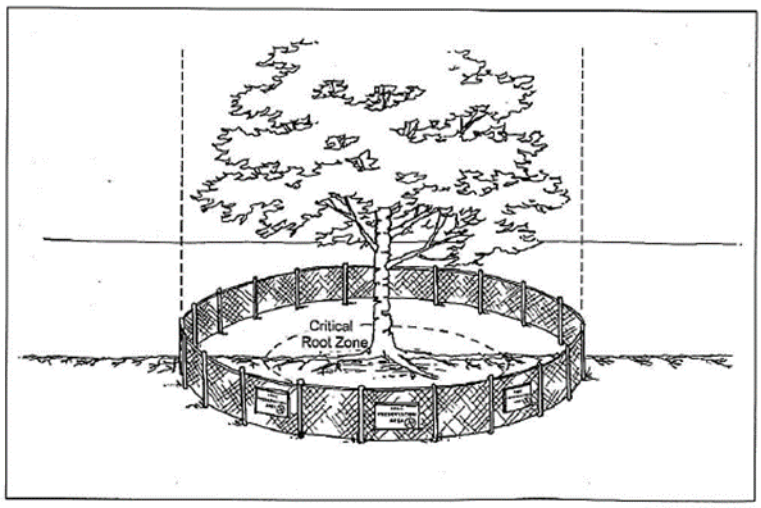

Figure 1. Drip line method for defining a TPZ.

3.6 Tree Protective Structures

To ensure the survivability of trees and proactively avoid creating a hazardous tree, the tree should either be removed with construction or a Tree Protection Zone should be established. At minimum the TPZ should consist of t-posts and 4 foot tall orange safety fencing that completely encircles the tree or trees. Signage that clearly marks it has a 'Tree Protection Zone' and to 'Keep Out' needs to be included. Where, in the opinion of the DPW Forestry personal, 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.

3.7 Root Pruning of Trees

In some construction activities roots are in the way and will need to be removed. Roads, sidewalks, and underground utilities are common examples. These may even pass within the Tree Protection Zone (TPZ) (as described in 3.1.1) of a tree. Ideally one would never disturb the root systems, but often times this is inevitable. So when a project requires digging into an area that has tree roots, there needs to do be a reasonable effort to make clean cuts on the roots. There are a few methods to do this, an excavator shovel is a poor method to this because it will smash, rip, and tear the roots. Using and air spade to excavate the roots, and the pruning them with pruners or saw may be the best, but is time consuming. A recommended method is to use a root pruning tool like those produced by Dosko or Vermeer. These are gas powered machines similar to a stump grinder with a large spinning wheel with bits that will cut a straight line about one foot deep and two inches wide. Less desirable, but acceptable for now would be a landscape trencher. Either the root pruning machines or landscape trencher machines should be used to cleanly sever roots before digging if digging is to take place within ten feet of the tree's dripline.

3.8 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 inspected by DPW Forestry personal as soon as possible. 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 DPW forestry personal, shall be immediately removed, if so directed, and replaced with a nursery-grown tree of a site acceptable species and reasonable size.

3.9 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.

3.10 BURNING

Air pollution restrictions applicable to this project are as follows. Materials shall not be burned on the Government premises.

3.11 DUST CONTROL

The Contractor shall maintain all excavations, stockpiles, access roads, waste areas, concrete and asphalt grinding 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. If chemical treatment is used, the DPW Environmental Division, Air Quality Program will need to review any Safety Data Sheet (SDS) for that chemical treatment.

3.12 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.

3.13 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.

3.14 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.

3.15 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.

-- 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.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass Tennessee Tower,
312 Rosa L. Parks Avenue, 11th Floor, Nashville, Tennessee 37243
1-888-891-8332 (TDEC)

Tennessee Municipal Construction Stormwater Project Review Checklist			
QLP/Municipality:		Reviewer:	Review Date:
Site Name:		Date Received:	TNQ/TNR:
Site Location:		Disturbed acreage:	
Owner/Developer Name:		Secretary of State Control Number:	
Stream and/or Wetland determination report included: YES☐ NO☐ NA☐		Exceptional Tennessee Waters: YES☐ NO☐ NA☐	
TDEC DWR HD/Wetland concurrence letter provided: YES☐ NO☐ NA☐		Siltation impaired drainage or water body (https://tdeconline.tn.gov/dwrcgp/): YES☐ NO☐ NA☐	
ARAP required: YES☐ NO☐ NA☐		T&E species present: YES☐ NO☐ NA☐	
COMPONENTS OF THE SWPPP			
Permit Section		Comments	Acceptable
5.5.2.	SWPPP and EPSC plans		☐
5.5.3.	Erosion Prevention and Sediment Controls		☐
5.5.3.1.	General criteria and requirements		☐
5.5.3.2.	Construction phasing		☐
5.5.3.3.	Projects Exceeding 50 acres of Disturbance		☐
5.5.3.4.	Stabilization practices (14 or 7 days)		☐
5.5.3.5.	Structural practices (2yr 24hr design storm, basin for 10 ac drainage area)		☐
5.5.3.6.	Stormwater management		☐
5.5.3.7.	Other items needing control		☐
5.5.3.8.	Site Assessments		☐
5.5.3.9.	Inspections (2/week)		☐
5.5.3.10.	Inspector qualifications		☐
5.5.3.11.	Schedule of inspections		☐
5.5.3.12.	Pollution prevention measures for non-stormwater discharges		☐
4.1.2.	Water Quality Riparian Buffers 30ft		☐
4.1.3.	Dewatering		☐
Discharges into Waters with Unavailable Parameters or Exceptional Tennessee Waters			
6.4.1.	SWPPP/BMP Requirements (5yr-24hr design storm, basins for 5 ac drainage area)		☐
6.4.2.	Water Quality Riparian Buffers 60ft		☐

CN-1440 (Rev 12-21) RDA 1663

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 Stormwater Program Manager, at 270-798-9858, 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 4X treated wood posts of a suitable grade as indicated on the following drawings. Additional support framing of nominal 2X4 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.

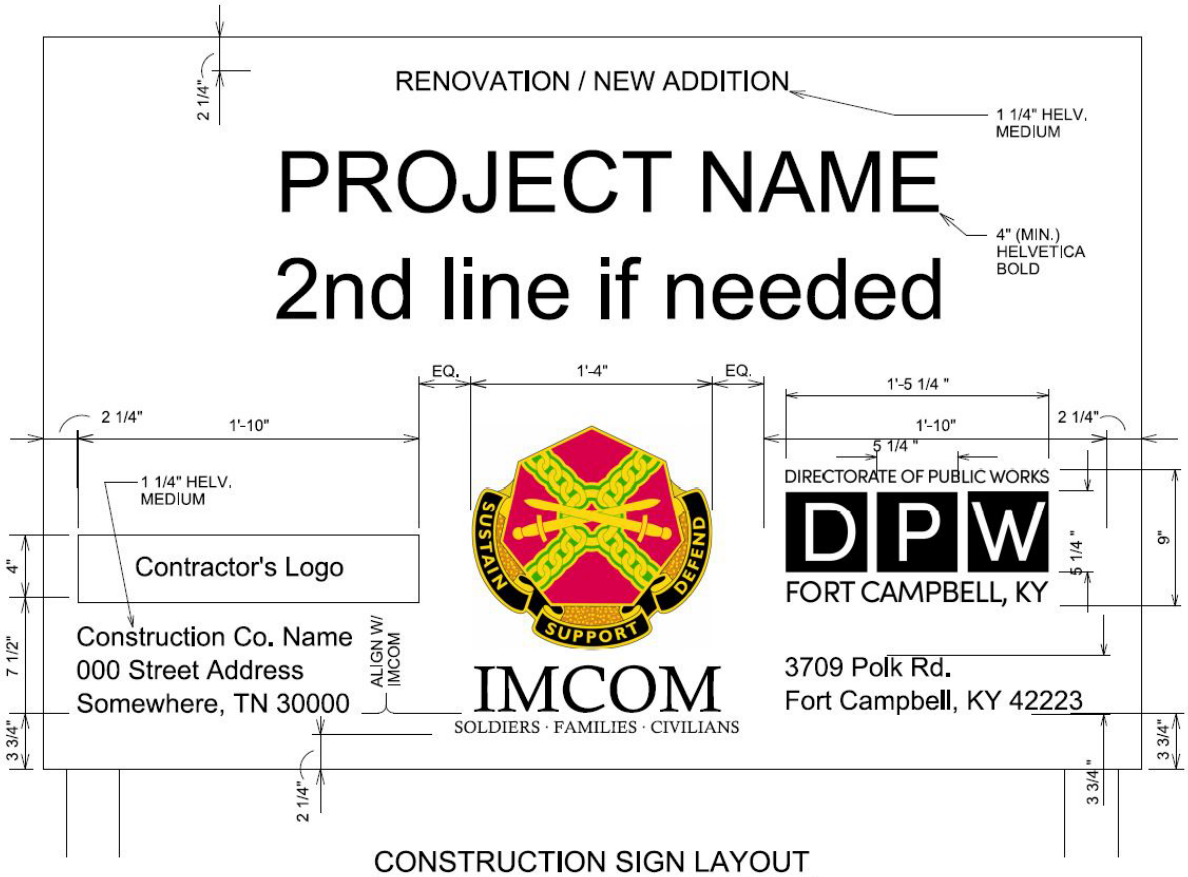
PART 3 MISCELLANEOUS

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.



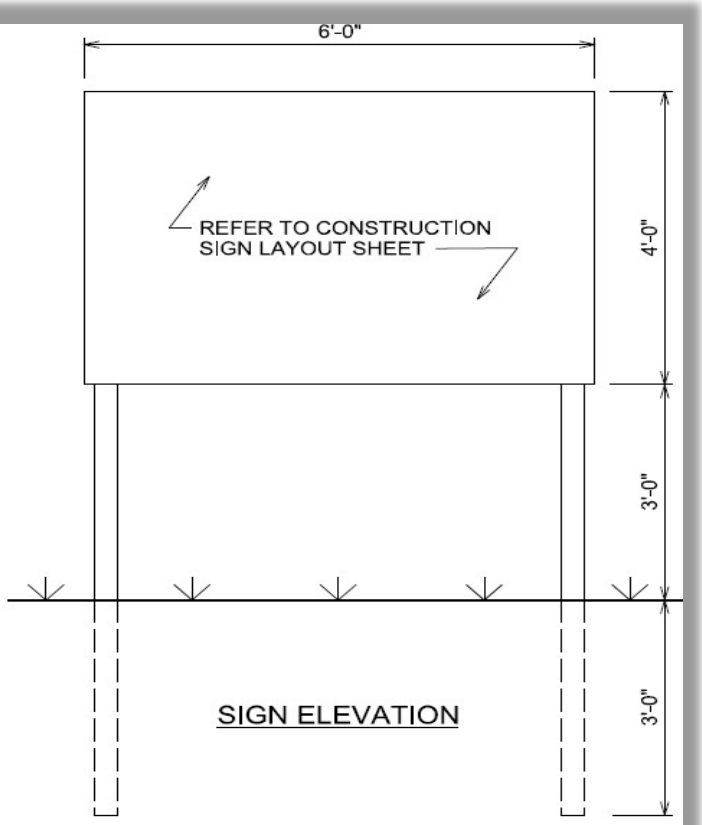
CONSTRUCTION SIGN LAYOUT

GENERAL INFORMATION

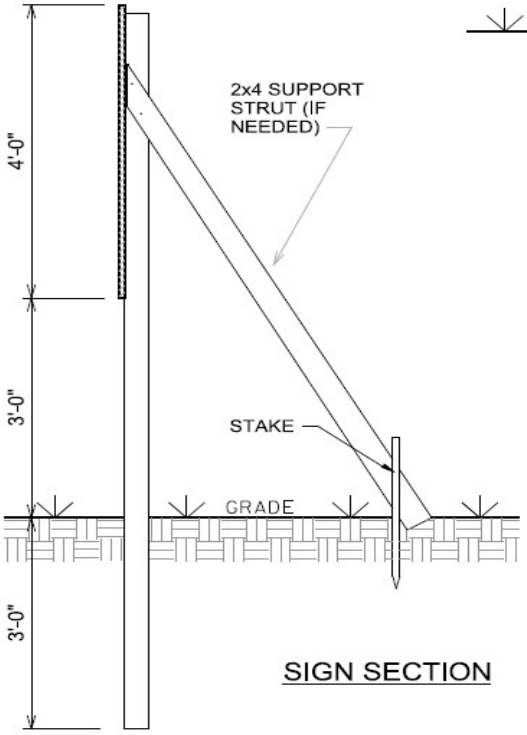
Sign panel shall be of 3/4" thick High Density Overlay (H.D.O.) plywood.

Sign background and posts are to 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 ELEVATION



SIGN SECTION

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

-----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 60% 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. 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 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

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 60% 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. 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 Containing, mixed, coated or covered with asbestos 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.

Follow requirements in Section 01 57 20.00 10 Environmental Protection Part 3.4 Protection of Trees and shrubs where trees or shrubs are present in or near (300 feet) the project area.

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 K, 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 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:

Complete the requirements as they apply to specific projects.

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

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Sections 02 82 00

Asbestos Remediation

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 00. The provisions of this guide shall be incorporated into all projects containing or possibly containing asbestos materials. In addition, all requirements of Ft. Campbell and the appropriate state(s) (KY/TN) shall be complied with.

Remove all RACM from a facility being demolished or renovated before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. This includes any material to be made or become friable (RACM) by any process or activity from first disturbance through disposal. And, remove all materials that would subsequently become contaminates to concrete, masonry or other materials to be ground, such as doors, window, piping, PVC items, toilet partitions, plumbing fixtures, excess dirt, floor tile, mastics containing asbestos, etc.

If materials containing some amount of asbestos that is less than or equal to 1% are to be removed, the contractor must observe the asbestos PELs and 29 CFR 1926.1101(g)(1)[except (g)(1)],g(2) and (g)(3).
NOTE: source Standard Interpretations, Standard Number: 1926.1101(b) ; 1926.110(f) ; 1926.1101(g).

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 day 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(s) 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 (40 CFR 61.145) require that a thorough pre- demolition asbestos inspection be performed before demolition or renovation. Only reports specifically stating the report has been performed and prepared to meet the pre-demolition or pre-renovation requirement truly meet this requirement. The Standard for these reports fan be found in ASTM E2356, Paragraph 8, and Pre-Construction Surveys. Designers shall investigate and review the data as required to insure proper identification and notification of asbestos presence at planned OMA and MILCON projects. Studies are available for inspection on the sanserver 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 00, Asbestos Remediation.**

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

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SECTION 02 83 00
Lead Remediation

Ft. Campbell Requirements:

Removal and disposal of lead-based paint materials shall be conducted in accordance with United Facilities Guide (UFGS) Division 02 Specifications section 02 83 00 Lead Remediation, which shall be included in all projects containing or possibly containing lead-based products. In addition, all requirements of Ft Campbell and the appropriate state(s) shall be complied with.

Instruction to Designers:

Section 02 83 00 Lead Remediation specification covers the requirements for protection of workers, disposal of lead, cadmium and chromium painted material, abatement of lead based paint hazards in target housing and child occupied facilities and limiting occupational and environmental exposure to lead-based paint or paint with lead (LBP/PWL). Carefully read all notes at the beginning of the specification for additional applicable applications, to include compliance with state (KY/TN) and local requirements.

Fort Campbell OMA LBP inspections for pre-1980 non-residential buildings are available on request through the project COR.

Disposal of LBP waste will be coordinated through the Environmental Division, Pollution Prevention (P2) Branch, Hazardous Waste Manager, 270-798-9786.

Lead containing materials resulting from demolition work, except those classified as hazardous waste, will become the property of the Contractor and will be disposed of as follows:

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 CFR172. 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.

d. 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.

e. 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.

f. Demolition debris which has LBP components, it would treat as C&D and it can go to the Woodlawn land fill as regular C&D waste.

g. Bagged LBP chip as a result of LBP Abatement, with manifest as required must be

disposed as a RCRA hazardous waste through the Environmental Division, Pollution Prevention (P2) Branch, Hazardous Waste Manager, 270-798-9786.

h. 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.

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

Back to Paragraph 3.1.11

Return to Section

Section 02 84 16
Handling of Lighting Ballasts and Lamps Containing PCB's and Mercury

Ft. Campbell Requirements:

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

a. 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 universal waste for recycle. The COR / Contractor shall contact the Hazardous Waste Program Manager for containers and location of the bulbs being removed. All lighting ballasts shall also be handled and universal waste for recycle and shall have to be removed from the lighting fixture for disposal. The COR / Contractor shall contact the Hazardous Waste Program Manager for containers and location of the ballasts being removed.

b. UFGS-02 84 16 specification covers the requirements for removal and disposal of polychlorinated biphenyl (PCB) containing lighting ballasts and mercury containing lamps, and the handling of resulting wastes. See above for local requirements.

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

Return to Designer Instructions

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

SECTION 03 30 00
Cast-In-Place Concrete

Ft. Campbell Requirements:

1.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M.Test compression test specimens in accordance with ASTM C39/C39M.Take samples for strength tests not less than once each shift in which concrete is produced from each strength of concrete required. Provide a minimum of five specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, two will be tested at 7 days for information and one held in reserve.

1.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used).The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, but not more than 20 percent, and no individual acceptance test result falls below f'c by more than 500 psi.

1.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in ACI 117.

1.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f'c is 4,000 psi at 28 days (90 days if pozzolan is used).The maximum nominal size coarse aggregate is 1 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water-cementitious material ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

2.2 **MATERIALS:**

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.2.1.1 Portland Cement

ASTM C150/C150M, Type I, II, low alkali with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali content of 0.80 percent Na2Oe (sodium oxide) equivalent.

2.2.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F, including requirements of Tables 1A

and 2A.

2.2.2 Aggregates

For fine and coarse aggregates meet the quality and grading requirements of ASTM C33/C33M and test and evaluate for alkali-aggregate reactivity in accordance with ASTM C1260. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. All results of the separate and combination testing must have a measured expansion less than 0.08 percent at 28 days after casting. If the test data indicates an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C1260 and ASTM C1567. Perform the additional testing using ASTM C1260 and ASTM C1567 using the low alkali Portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. Use GGBF slag in the range of 40 to 50 percent of the total cementitious material by mass. Use Class F fly ash in the range of 25 to 40 percent of the total cementitious material by mass. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.2.3.2 Accelerating Admixture

Provide calcium chloride meeting the requirements of ASTM D98. Other accelerators must meet the requirements of ASTM C494/C494M, Type C or E.

2.2.3.3 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; potable, and free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66.

2.2.6 Joint Sealants - Field Molded Sealants

Conform to ASTM C920, Type M, Grade NS, and Class 25, use NT for vertical joints and Type M, Grade P, Class 25, and use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, non-shrink, nonreactive with the sealant, and a non-absorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.2.7 Vapor Retarder

ASTM E1745 Class B polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum perm rating of 0.04 perms per ASTM E96/E96M.

Polyethylene sheeting is not a radon barrier except when used in conjunction with a passive or active radon mitigation system to remove the radon before it can pass through the polyethylene (diffusion).

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.2.8 Curing Materials

Provide curing materials in accordance with ACI 301, Section 5.

2.3 READY-MIX CONCRETE:

Provide ready-mix concrete with mix design data conforming to ACI 301 Part 2
Submit delivery tickets in accordance with ASTM C94/C94M for each
Ready-mix concrete delivery, include the following additional information.

a. Type and brand cement

b. Cement content in 94-pound bags per cubic yard of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixture

e. Total water content expressed by water cementitious material ratio

2.4 ACCESSORIES:

2.4.1 Curing Compound

Provide curing compound conforming to ASTM C309. Submit manufactures instructions for placing curing compound.

2.5 **Footings, Foundations, Slabs on Grade:**

a. All footings to bear on undisturbed existing soil, unless otherwise shown in the plans or calculations. All organic and deleterious material beneath the footings, foundations and slabs to be removed and replaced with granular fill compacted to 95% relative compaction. Bottom of footings to be below locally prescribed frost zone, not less than 18" for Tennessee and 24" for Kentucky. For Slabs, Foundations and Footings replace all over-excavated areas with granular material compacted in 8" maximum lifts to 95% Relative Compaction (RC). All footings are designed for 1,500 psf allowable soil bearing pressure.

b. Slabs on Grade. Subgrade below slabs shall be similar to the above. A layer of free draining material and a suitable vapor barrier (designed by others) are required for all exterior slabs. Slab thickness shall be no less than 6" thick, footing @ (H) 24" and (W) 12" turn down. Above ground exposer no less than 4" above grade. Any utilities / Piping etc. shall be inside footprint of slab. All pad edges shall have ½" chamfer.

   i. Contraction Joints (aka "Control Joints") Contraction joints shall be provided in all slabs per working drawings or if not indicated at a maximum of 15 feet on center in each orthogonal direction. Contractor may use tooled joints or 'zip strips'. Light gage metal-keyed joints are not recommended in slabs subject to vehicular traffic. Slab reinforcement shall be continuous across all contraction joints.
   ii. Expansion (isolation) joints. Expansion (isolation) joints are required where new concrete slabs are poured against existing concrete or masonry, and where shown on the plans. Expansion joint material shall be asphalt impregnated fiberboard or similar, ½ inch thick.
   iii. Construction (cold) joints. Where used, the previously placed concrete surface shall be clean and free of laitance. Reinforcing shall be continuous across the joint. Cold joints in slabs should be full depth, vertical face, and form a straight-tooled edge. Cold joints constructed in this manner may also function as contraction joints.

c. Existing Concrete pad modification shall be extended IAW manufacturer's recommendations. New portion shall be pinned with #4 dowel rods to existing pad every 12" on center and epoxied in place. Top of new work shall be flush with existing and match thickness and finish. All pad edges shall have ½" chamfer.

d. Standard Concrete:
   i. 4,000 PSI MIN MIX: Strength, Mix, Placing. All concrete, unless otherwise specified in the Plans or Calculations, shall attain a 28 day strength of f'c = 4,000 psi min.
   ii. WATER TO CEMENT RATIO 0.45: Maximum water/cement ratio shall be 0.45, and maximum slump = 4".
   iii. ADMIXTURE 01 CEMENT SHALL BE 15% to 20% fly ash by weight.
   iv. ADMIXTURE 02 Provide 5% air entraining in all concrete exposed to the

earth or weather.

v. ADMIXTURE 03 Additional concrete admixtures, are entirely at the discretion of the contractor and / or concrete batch plant such that they do not affect the minimum requirements herein nor reduce the longevity of the concrete.

e. ALKALI-SILICA REACTION (ASR) shall be limited as follows:
   i. Either pass (SUBMIT 3RD PARTY TESTING) ASTM C-1038 accelerated mortar bar expansion test or provide mill cert. alkali mtl content in cement is less than 0.75.
   ii. Concrete plant must be a state approved facility.
   iii. Concrete shall have a light broom finish.
   iv. Reinforced with either flat sheet 6x6-W2.9xW2.9 or #4 deformed reinforcing steel at 24” O.C. each way. Maintain edge distances for steel reinforcing to conc. (WW must be flat sht, no rolled stock permitted.
   v. MAX AGGREGATE SIZE: Max. Aggregate size = 7/8"
   vi. MIX/PLACEMENT: Mixing and placing of all concrete and selection of material to be in accordance with IBC and ACI 304 (latest editions).
   vii. When job-site conditions are present or anticipated that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80 degrees F or higher, and an evaporation rate that exceeds 0.2 lb/ft, conform concrete work to all requirements of ACI 305.1.

f. Concrete Reinforcing:
   i. Strength, Splicing, Bending. Reinforcing bars (rebar) shall be per drawings and sketches attached, and shall be grade 40 (Fy = 40 ksi), unless noted otherwise. All reinforcing shall be detailed, bolstered and supported in accordance with applicable ACI code. Bars shall be bent with minimum 6 bar diameter radius for sizes up to and including No. 8, and 8 bar diameter radius for bars larger than No.8.
   ii. Ties. For reinforced concrete beams, walls, columns, pilasters, and any other element wherein the main reinforcement bars are enveloped with tie bars (a.k.a. stirrups), the ties shall be bent with the least radius of bend so as to envelop the main rebars without the tie bars cracking or breaking. The tie bar ends shall overlap the main bars at least one bar diameter. The dia. of bend shall not be smaller than the diameter of the main bars in contact.
   iii. Slabs. Slabs on grade that will be subjected to Vehicular Traffic shall have 9” minimum (thickness) and thickened edges as described below, unless designed and specified by others. Reinforcement shall be #4 centered in the slab, at 16” O.C. each way. Such slabs shall have thickened edges consisting of a (H) 24” x (W) 12” minimum monolithic footing with 2 ea. #4 continuous at the top and bottom of the footing.
   iv. Reinforcement for slabs which will not be subjected to vehicular traffic shall be 6x6- W2.9xW2.9 or #4 at 24” O.C. each way, centered in a 6” slab. The contractor must install construction joints or saw-cuts per specs above or per Fort Campbell requirements within 12 hours of concrete placement (sooner if possible).

v. Welded Wire Fabric. Welded wire fabric (WWF) shall be ASTM A-185. Splice by lapping one mesh plus 4" all sides. Factory Fabricated FLAT!!! Sheet stock only. NO ROLLED WWF MATERIAL OF ANY KIND PERMITTED.

vi. Hooks. For 180 degree hooks, provide a minimum of 2-1/2 inches or 4 bar diameters extending beyond the bend. For 90 degree hooks, provide a minimum of 12 inches extending beyond the bend.

vii. Cover. Provide the following minimum cover:

- Footings and other unformed surfaces, distance from the bar to earth face...3"
- Formed surfaces in direct contact with earth .....2"
- Surfaces exposed to weather.....1-1/2”
- Surfaces exposed to salt water.....3"

2.6 For Airfield Pavement Design refer to most current UFC 3-260-02 See Sec. 32 13 11.

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

Section 04 20 00

Masonry

Ft. Campbell Requirements:

2.1 SYSTEM DESCRIPTION

2.1.1 Design - Specified Compressive Strength of Masonry

The specified compressive strength of masonry, f'm, is as indicated for each type of masonry.

2.1.2 Performance - Verify Masonry Compressive Strength

Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS MSJC. Submit calculations and certifications of unit and mortar strength.

Verify specified compressive strength of masonry using the "Prism Test Method" of TMS MSJC when the "Unit Strength Method" cannot be used. Submit test results.

2.2 MANUFACTURED UNITS

2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2.2 Concrete Units

2.2.2.1 Concrete Masonry Units (CMU)

2.2.2.1.1 Cement

Use only cement that has a low alkali content and is of one brand.

2.2.2.1.2 Recycled Content

Provide units with a minimum of 10 percent post-consumer recycled content, or a minimum of 40 percent post-industrial recycled content, based on mass, cost, or volume. Units may contain post-consumer or post-industrial recycled content.

2.2.2.1.3 Size

Provide units with specified dimension of 7-5/8 inches wide, 7-5/8 inches high, and 15-5/8 inches

long.

2.2.2.1.4 Surfaces

Provide units with exposed surfaces that are smooth and of uniform texture.

2.2.2.1.5 Weather Exposure

1. Provide concrete masonry units with water-repellant admixture added during manufacture where units will be exposed to weather. or
2. Apply lithium compound Sealer HLQ-125 that remains in solution, penetrates and reacts with mineral compounds and siliceous materials in concrete above or below grade.

2.2.2.1.6 Unit Types

a. Hollow Load-Bearing Units:
ASTM C90, lightweight or normal weight. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units:
ASTM C129, lightweight. Load-bearing units may be provided in lieu of non-load-bearing units.

c. Solid Load-Bearing Units:
ASTM C90, lightweight units. Provide solid units as indicated.

2.2.2.1.7 Jamb Units

Provide jamb units of the shapes and sizes to conform to wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

Provide sash jamb units with a 3/4 by 3/4 inch groove near the center at end of each unit.

2.2.2.2 Fire-Rated Concrete Masonry Units

For indicated fire-rated construction, provide concrete masonry units of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated by linear interpolation based on the percent by dry-rodded volume of each aggregate used in manufacturing the units.

TABLE I FIRE-RATED CONCRETE MASONRY UNITS	
Aggregate Type	Minimum Equivalent Thickness for Fire-Resistance Rating, inch

	1/2 hour	3/4 hour	1 hour	1-1/2 hour	2 hours	3 hours	4 hours
Calcareous or siliceous gravel (other than limestone)	2.0	2.4	2.8	3.6	4.2	5.3	6.2
Limestone, cinders, or air-cooled slag	1.9	2.3	2.7	3.4	4.0	5.0	5.9
Expanded clay, expanded shale, or expanded slate	1.8	2.2	2.6	3.3	3.6	4.4	5.1
Expanded slag or pumice	1.5	1.9	2.1	2.7	3.2	4.0	4.7

Determine equivalent thickness in accordance with ACI 216.1. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; include the thickness of plaster or brick or other material in the assembly in determining the equivalent thickness. Submit calculation results.

2.2.3 Precast Concrete Units

2.2.3.1 General

a. Provide precast concrete trim, lintels, copings, splash blocks and sills that are factory-made units in a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, provide precast concrete with minimum 3000 psi compressive strength, conforming to Section 03 30 00 CAST-IN-PLACE CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and with reinforcement required for handling of the units. Maintain minimum clearance of 3/4 inch between reinforcement and faces of units.

b. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, either damp-cure for 24 hours or steam-cure and then age under cover for 28 days or longer. In precast concrete members weighing over 80 pounds provide built-in loops of galvanized wire or other approved provisions for lifting and anchoring.

c. Fabricate units with beds and joints at right angles to the face, with sharp true arises and with drip grooves on the underside where units overhang walls. Form exposed-to-view surfaces free of surface voids, spalls, cracks, and chipped or broken edges and with uniform appearance and color. Unless otherwise specified, provide units with a smooth dense finish.

d. Prior to installation, wet and inspect each unit for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

e. Submit specified factory certificates.

2.2.3.2 Precast Concrete Lintels (non-pre-stressed)

Provide precast concrete lintels, unless otherwise shown, of a thickness equal to the wall and reinforced with minimum two No. 4 bars for the full length. Provide top and bottom bars for lintels over 36 inches in length. Provide at least 8 inches bearing at each end. Label the top of lintels and clearly mark each lintel to show location in the structure. Design reinforced lintels in conformance with ACI 318 for flexural and shear strength, using concrete with a minimum 28 day compressive strength of 3,500 psi. Limit lintel deflection due to dead plus live load to L/600 or 0.3 inches.

2.3 EQUIPMENT

2.3.1 Vibrators

Maintain at least one spare vibrator on site at all times.

2.3.2 Grout Pumps

Pumping through aluminum tubes is not permitted.

2.4 MATERIALS

2.4.1 Mortar Materials

2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270.

2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with Portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

2.4.1.3 Admixtures for Masonry Mortar

In cold weather, use a non-chloride based accelerating admixture that conforms to ASTM C1384, unless Type III Portland cement is used in the mortar.

In showers and kitchens, use mortar that contains a water-repellent admixture that conforms to ASTM C1384. Provide a water-repellent admixture, conforming to ASTM C1384 and of the same brand and manufacturer as the block's integral water-repellent, in the mortar used to place concrete masonry units that have an integral water-repellent admixture.

2.4.1.4 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by ASTM C270.

2.4.2 Grout and Ready-Mix Grout Materials

2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by ASTM C476.

2.4.2.2 Admixtures for Grout

Water-reducing admixtures that conform to ASTM C494/C494M Type F or G and viscosity-modifying admixtures that conform to ASTM C494/C494M Type S are permitted for use in grout. Other admixtures require approval by the Contracting Officer.

In cold weather, a non-chloride based accelerating admixture may be used subject to approval by the Contracting Officer; use accelerating admixture that is non-corrosive and conforms to ASTM C494/C494M, Type C.

2.4.2.3 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by ASTM C476.

2.5 MORTAR AND GROUT MIXES

2.5.1 Mortar Mix

a. Provide mortar Type N unless specified otherwise herein.

b. Use ASTM C270 Type M cement-lime mortar or mortar cement mortar for seismic-force-resisting elements indicated.

c. Provide mortar that conforms to ASTM C270. Use Type M mortar for foundation walls and in piers.

d. Provide Type N or S mortar for non-load-bearing, non-shear- wall interior masonry.

e. For field-batched mortar, measure component materials by volume. Use measuring boxes for materials that do not come in packages, such as sand, for consistent batching.

Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar unless approved by the Contracting Officer. Maintain workability of mortar by remixing or retempering. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

f. For preblended mortar, follow manufacturer's mixing instructions.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476, fine. Use conventional grout with a slump between 8 and 11 inches. Use self-consolidating grout with slump flow of 24 to 30 inches and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of 2000 psi in 28 days, as tested in accordance with ASTM C1019. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

2.6 ACCESSORIES

2.6.1 Grout Barriers

Grout barriers for vertical cores that consist of fine mesh wire, fiberglass, or expanded metal.

2.6.2 Anchors, Ties, and Bar Positioners

2.6.2.1 General

a. Fabricate anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of 5/8 inch mortar cover from each face of masonry.

b. Fabricate steel wire anchors and ties shall from wire conforming to ASTM A1064/A1064M and hot-dip galvanize in accordance with ASTM A153/A153M.

c. Fabricate joint reinforcement in conformance with ASTM A951/A951M. Hot dip galvanize joint reinforcement in exterior walls and in interior walls exposed to moist environment in conformance with ASTM A153/A153M. Galvanize joint reinforcement in other interior walls in conformance with ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below.

d. Fabricate sheet metal anchors and ties in conformance with ASTM A1008/A1008M. Hot dip galvanize sheet metal anchors and ties in exterior walls and in interior walls exposed to moist environment in compliance with ASTM A153/A153M Class B. Galvanize sheet metal anchors and ties in other interior walls in compliance with ASTM A653/A653M, Coating Designation G60.

e. Submit two anchors, ties and bar positioners of each type used, as samples.

2.6.2.2 Wire Mesh Anchors

Provide wire mesh anchors of 1/4 inch mesh galvanized hardware cloth, conforming to ASTM A185/A185M, with length not less than 12 inches, at intersections of interior non-bearing

masonry walls.

2.6.2.3 Wall Ties for Multi-Wythe Masonry Construction

Provide rectangular-shaped wall ties, fabricated of hot-dipped galvanized W1.7 diameter steel wire. Provide rectangular wall ties no less than 4 inches wide.

Provide adjustable type wall ties, if approved for use, that consist of two essentially U-shaped elements fabricated of minimum W2.8 diameter steel wire or pintle type ties that are inserted to eyes of horizontal joint reinforcement, hot-dip galvanized. Provide adjustable ties with double pintle legs and allows a maximum offset of 1-1/4 inch between each element of the tie and maximum distance between connecting parts no more than 1/16 inch. Form the pintle and eye elements shall be formed so that both can be in the same plane. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT.

2.6.2.4 Dovetail Anchors

Provide dovetail anchors of 3/16 inch diameter steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. Use these anchors to connect the exterior masonry Wythe as it passes over the face of concrete columns, beams, or walls. Fill cells immediately above and below these anchors unless solid units are used. Furnish dovetail slots, which are specified to be installed by others, in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.6.2.5 Adjustable Anchors

2.6.2.5.1 Anchorage to Structural Steel

Provide hot-dip galvanized adjustable anchors for connecting masonry walls to the structural steel frame as detailed on the drawings. Provide zinc-rich paint for touching up paint after welding galvanized anchors to structural steel.

2.6.2.5.2 Anchorage of Veneer to Light Gauge Steel or Concrete Backing

Use one of the following types of adjustable anchors to connect veneer to light gauge steel or concrete backing:

a. sheet metal at least 7/8 inch wide, 0.06 inch thick, and with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch or bent, notched or punched to provide equivalent performance;

b. wire anchors of minimum size W1.7 with ends bent to form a minimum 2 inches extension and without drips;

c. or wire pintle anchors used in conjunction with joint reinforcement.

Do not exceed 1/16 inch clearance between connecting parts of the tie. Assemble adjustable anchors to prevent disengagement. Provide pintle anchors with one or more pintle legs of wire size W2.8 and an offset not exceeding 1-1/4 inch.

2.6.2.6 Bar Positioners

Factory-fabricate bar positioners, used to prevent displacement of reinforcing bars during the course of construction, from 9 gauge steel wire or equivalent, and hot-dip galvanized.

2.6.3 Joint Reinforcement

Factory fabricate joint reinforcement in conformance with ASTM A951/A951M, welded construction. Provide ladder type joint reinforcement, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units and with all wires a minimum of 9 gauge. Size joint reinforcement to provide a minimum of 5/8 inch cover from each face. Space cross-wires not more than 16 inches. Provide joint reinforcement for straight runs in flat sections not less than 10 feet long. Provide joint reinforcement with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

2.6.4 Reinforcing Steel Bars

Reinforcing steel bars and rods shall conform to ASTM A615/A615M or ASTM A996/A996M, Grade 60.

2.6.5 Concrete Masonry Control Joint Keys

Provide control joint keys of a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D2000 M2AA-805 with a minimum durometer hardness of 80 or polyvinyl chloride conforming to ASTM D2287 Type PVC 654-4 with a minimum durometer hardness of 85. Form the control joint key with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch, to fit neatly, but without forcing, in masonry unit jamb sash grooves.

2.6.6 Through Wall Flashing and Weeps

2.6.6.1 General

Provide coated copper, copper or stainless steel sheet, self-adhesive rubberized sheet, or reinforced membrane sheet flashing except that flashing indicated to terminate in reglets shall be metal or coated-metal flashing and except that the material shall be one which is not adversely affected by damp-proofing material.

2.6.6.2 Coated-Copper Flashing

Provide 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acid-proof, alkali-proof, and asphalt impregnated Kraft paper or polyethylene sheets.

2.6.6.3 Copper or Stainless Steel Flashing

Provide copper sheet, complying with ASTM B370, minimum 16 ounce weight; or stainless steel, ASTM A167, Type 304 or 316, 0.015 inch thick, and No. 2D finish. Where indicated, provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions, where deformations consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

2.6.6.4 Reinforced Membrane Flashing

Provide polyester film core with a reinforcing fiberglass scrim bonded to one side. Provide membrane that is impervious to moisture, flexible, is not affected by caustic alkalis, and after being exposed for not less than 1/2 hour to a temperature of 32 degrees F, shows no cracking when, at that temperature, it is bent 180 degrees over a 1/16 inch diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

2.6.6.5 Rubberized Flashing

Provide self-adhesive rubberized asphalt sheet flashing consisting of 32-mil thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 8-mil thick, high density, cross-laminated polyethylene film to produce an overall thickness of 40 mils. Provide rubberized, asphalt-based mastic and surface conditioner that are each approved by flashing manufacturer for use with flashing material.

2.6.6.6 Metal Drip Edge

Provide stainless steel drip edge, 15-mil thick, hemmed edges, with down-turned drip at the outside edge and upturned dam at the inside edge for use with membrane flashings.

See Appendix D: Exterior Finishes.

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Technical Requirements and Instructions Division 05 Metals

Section 05 50 13
Miscellaneous Metal Fabrications

Ft. Campbell Requirements:

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

Roof access hatches (Scuttles) Provide zinc-coated steel sheets not less than 14 gauge with 3 inch beaded flange, welded and ground at corners. Provide a minimum clear opening of 30 by 36 inches. Insulate cover and curb with one inch thick rigid fiberboard insulation, covered and protected by zinc-coated steel liner of not less than 26 gage. Provide with 12 inches high curb, formed with 3 inch mounting flanges with holes for securing to the roof deck. 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

Ft. Campbell Requirements:

Railings

Welding Procedures shall be in accordance to Section 05-05-23.16 Structural Welding.

Aluminum Railing Fabrication in accordance to sub-section 2.1.1.

Steel Railing Fabrication in accordance to sub-section 2.1.2.

Avoid metal railing that require priming and painting for exterior use. 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:

Countertops fabricated with lumber core of exterior plywood, glued and screwed to for an integral unit. Bond laminated plastic using adhesive as recommended by plastic manufacturer.

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

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:

Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting CSA B45.5-11/IAPMO Z124 requirements.

Prefer using solid surfacing on counter tops, vanity sinks, kitchen sinks and windowsills (stool) for more scratch, stain resistance and moister control.

See **Appendix-D** for color guidance.

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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.

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS must be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations. Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

See **Appendix-D** for color guidance

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

SECTION 07 31 13
Asphalt Shingles

Ft. Campbell Requirements:

In keeping with Installation Planning Standards, (IPS) for Fort Campbell all roofing shall be standing seam metal unless approved by the Garrison Commander. Any proposed deviation would be for flat membrane type roofs. However, they are only allowed where pitched standing seam cannot be accomplished. Asphalt shingles are not allowed unless approved by Authority Having Jurisdiction (AHJ). In the event approval has been submitted for Asphalt Shingle Replacement Contractor shall install Architectural Design Shingles with Synthetic Guard Underlayment, and maximum life quality.

Flat built-up roofs are not to be utilized in new roof system designs. Minimum low slope for roofs shall be 2-12.

Modified bitumen is the preferred membrane on low slope less than 2-12 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.

Manufacturer's Warranty
Furnish the asphalt shingle manufacturer's standard [30-year] warranty for the asphalt shingles. The warranty shall run directly to the Government.
See Sec. 00 22 13 Supplementary Instructions to Binder, Roof Warranty Placards.

Contractor's Warranty
The Contractor shall warrant for 5 years asphalt shingle roofing system, as installed, is free from defects in workmanship. When repairs due to defective workmanship are required during the Contractor's warranty period, the Contractor shall make such repairs within 72 hours of notification. When repairs are not performed within the specified time, *emergency repairs performed by others will not void the warranty*.

See **Appendix-D** for color guidance

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

Section 07 42 13
Metal Wall panels

Ft. Campbell Requirements:

Furnish manufacturer's no-dollar-limit warranty for the metal wall panel system. The warranty period is to be no less than twenty (20) years from the date of Government acceptance of the work. The warranty is to be issued directly to the Government.

All panels are to receive a factory-applied Polyviylidene fluoride Kynar 500 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat.

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

See **Appendix-D** for color guidance

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

SECTION 07 51 13
Built-up Asphalt Roofing

Ft. Campbell Requirements:

Warranty

Manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.
See Sec. 00 22 13 Supplementary Instructions to Binder, Roof Warranty Placards.
See UFGS 07 51 13 Sec. 1.8 Warranty

Provide polyester reinforced roof walk pads, granule-surfaced modified bitumen membrane material, ASTM D6162/D6162M or ASTM D6164/D6164M, minimum 200 mils thick, compatible with the roof membrane and as recommended by the roof membrane manufacturer. Do not exceed 1.2 meters 4 feet in length for each panel.

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" 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:

Warranty

Manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.
See Sec. 00 22 13 Supplementary Instructions to Binder, Roof Warranty Placards.
See UFGS 07 52 00, 1.9 Warranty.

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

Provide roof walk pads that are polyester reinforced, granule-surfaced modified bitumen membrane material, minimum 197 mils thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Panels must not exceed 1.219 meters 4 foot in length.

Minimum low slope for new roofs shall be ¼" 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:

Warranty

Manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.
See Sec. 00 22 13 Supplementary Instructions to Binder, Roof Warranty Placards.
See UFGS Sec. 07 53 23, 1.8 Warranty.

Approval of Flat no-slope built-up roof systems by exception in new facility designs.

Minimum low slope for new roofs shall be ¼" 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:

Warranty

Manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.
See Sec. 00 22 13 Supplementary Instructions to Binder, Roof Warranty Placards.
See UFGS Sec. 07 61 14.00 20, 1.7 Warranty
When repairs are not performed within a specified time. Emergency repairs performed by others shall not void the warranty.

New Construction or Roofing System Renovations shall have at a minimum 12" soffit incorporated into design.

Zinc-coated steel conforming to ASTM A653/A653M, Z275 G90 coating designation or aluminum-zinc alloy coated steel conforming to ASTM A792/A792M, AZ 165 AZ 55 coating. Provide material with a minimum thickness of (24 gage) minimum except when mid field of roof is subject to design wind uplift pressures of 3 kPa 60 psf or greater.

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

All panels are to receive a factory-applied Polyviylidene Fluoride Kynar 500 finish consisting of a baked-on topcoat with a manufacturer's recommended prime coat.

See **Appendix-D** for color guidance

Non-Structural:

Ft. Campbell Requirements:

Warranty

Manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.
See Sec. 00 22 13 Supplementary Instructions to Binder, Roof Warranty Placards.

New Construction or Roofing System Renovations shall have at a minimum 12" soffit incorporated into design.

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

The system is to resist positive and negative loads specified in accordance with the AISI SG03-3. Panels must support walking loads without permanent distortion or telegraphing of the structural supports.

See **Appendix-D** for color guidance

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

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

Section 08 11 13
Standard Steel Doors and Frames

Ft. Campbell Requirements:

1. SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

1.1 Classification - Level, Performance, Model

1.1.1 Heavy Duty Doors

SDI/DOOR A250.8, Level 2, physical performance Level B, Model 1, with core construction as required by the manufacturer for interior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

1.1.2 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for exterior doors and interior and exterior doors in Buildings 4029, 4062, and 4068. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

1.1.3 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish.

Doors shall have been tested in accordance with SDI/DOOR A250.4 and shall have met the requirements for Level C. Prepare doors to receive specified hardware. Doors shall be 1-3/4 inch thick.

Provide insulated steel doors and frames where shown, at all exterior doors, and doors between.

1.2 ACCESSORIES

1.2.1. Interior Louvers

SDI/DOOR 111, Louvers shall be stationary sight proof and lightproof type where scheduled. Detachable moldings on room or non-security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 20 gage steel and louver blades of a minimum 24 gage. Sight proof louvers to be inverted "V" blade design with minimum 55 percent net-free opening.

1.2.2 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies.

1.2.3 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide no removable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide Snap-On moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

1.3 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or

b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or

c. Mineral board: ASTM C612, Type I.

1.4 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 1, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, and interior glazed panels, unless otherwise indicated. Use knock-down in GWB partitions only.

1.4.2 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

1.4.3 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

1.4.4 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

1.4.5 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

1.4.6 Terminated Stops

Where indicated, terminate interior door frame stops 6 inch above floor.

1.4.7 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

1.4.8 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

1.4.8.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

1.4.8.1.1 Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;

1.4.8.1.2 Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel
Studs with sheet metal screws, and to open steel studs by wiring or welding;

1.4.8.1.3 Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111.

1.4.8.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member.Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.6 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.6.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and

construction to a door which has been tested and meets the requirements for the class indicated.

2.6.3 Astragal on Fire Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.

2.7 WEATHER-STRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

2.7.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Air leakage of weather-stripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of

SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weather-stripping to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.9 FINISHES

2.9.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8.

2.9.2 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A879/A879M, Commercial Quality, and Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. On Wrap-around frames for masonry partitions, provide a throat opening 1/8 inch larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

Section 08 33 23
Overhead Coiling

Ft. Campbell Requirements:

Doors

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:

- Modify UFGS 08-33-23.3.3.2 paragraphs to include the on-site visit and verification requirement.
- Modify the UFGS 08-33-23.3.3.2 paragraphs to include a certification of inspection by the door manufacturer representative.

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

Section 08 34 59
Vault Doors and Day Gates

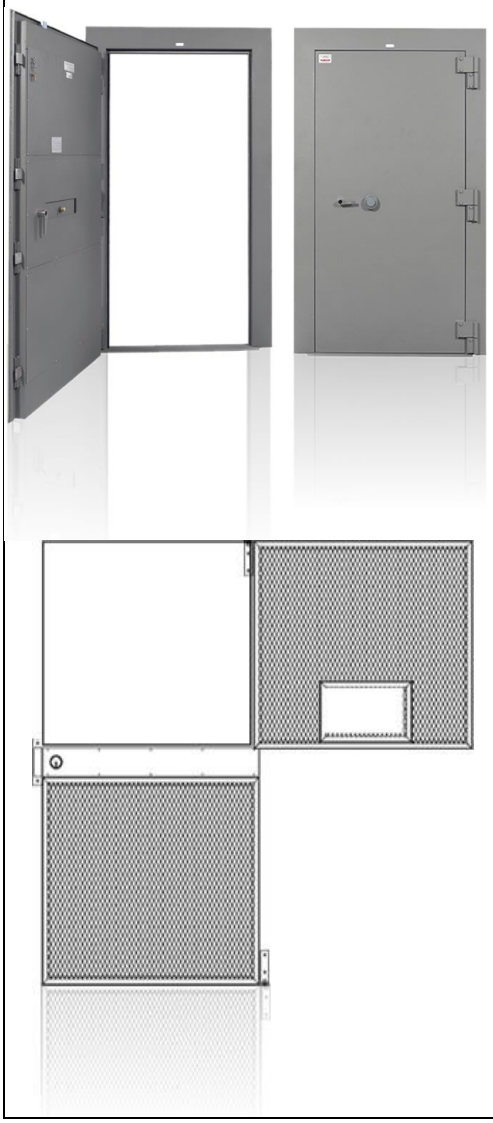
Ft. Campbell Requirements:

Door and frame assembly shall conform to FS AA-D-600. Provide a door which is Class 5, Type. Armory Vault Door (Class 5-A) utilizing a (Sargent and Greenleaf) 2937 Lock that meets Federal Specification FF-L-2937.

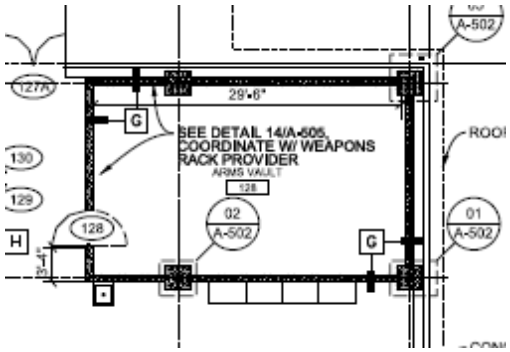
Following are examples of an Arms Room Dutch Door Day Gate and Weapons Rack Anchors to be used in arms rooms:

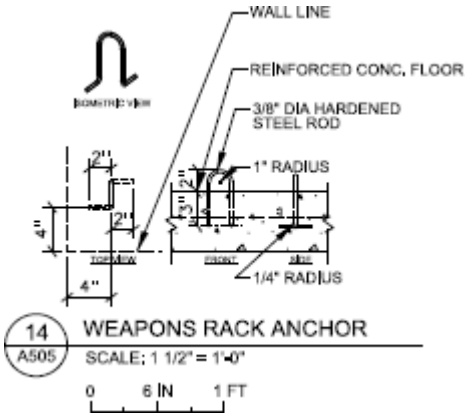
Reference: http://www.vanguardii.com/products.php

Dutch Door with Issue Port Day Gate

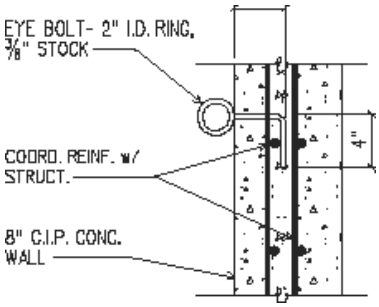


Style:	**Dutch Door Day Gate with Issue Port**
Lock	**Deadbolt, keyed outside / thumb latch inside**
Options:	**Door Closure, Self-Latching Lock**
Clear Opening:	**40" x 78" (Matches Class 5 Vault Door)**
Masonry Opening:	**Mounted on Class 5 Door Frame**
Weight:	**130 lbs.**
Available Swing:	**Left Swing / Right Swing**
Paint Color	**Gray**
Price:	**Please contact us 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.**

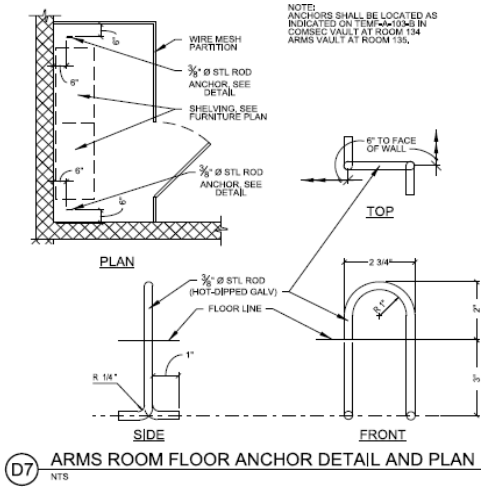




Alternate Weapons Rack Anchor



Alternate Weapons Rack Anchor



------ 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:

- Modify UFGS 08-36-13.3.3 paragraphs to include the on-site visit and verification requirement.
- Modify the UFGS 08-36-13.3.3 paragraphs to include a certification of inspection by the door manufacturer representative.

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

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SECTION 08 71 00
Hardware

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 (270) 798-3581.

Ft. Campbell Requirements:

At exterior locations provide locksets of full stainless steel type 302 or 304 construction including fronts, strike, escutcheons, knobs, bolts and all interior working parts. Marine Grade I, fully non-ferrous. Provide lever handles in accordance with ANSI/BHMA A156.3 for mortise locks of lever handles for exit devices.

1. Fort Campbell Master System

- Fort Campbell Master System is a 7 pin, small format interchangeable core (SFIC) by "InstaKey".
- SFIC provided shall be compatible with the existing 7 pin "InstaKey" 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.

2. Lock Grades:

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

3. 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.

4. 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.

5. Specialty Rooms/Entrance/Exits:

- Mechanical rooms, roof entrances and crawl spaces are keyed to "InstaKey" 5DPW.1 cores and Communication Rooms are keyed to "InstaKey" 1FZ.1 cores as keying standards.
- SIPR/SCIF/secure rooms are secured LKM 10K series hardware or Sargent and Greenleaf Model 2890B and utilizes KABA X-10 combination locks.
    - Should either brand use key override then they must be prepped for 7 pin SFIC and use InstaKey as stated above.

- "Technician Only" type SIPR rooms, can use a PDL2890 0r 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 room 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.

6. 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.

7. 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

8. 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.

See **Appendix-D** for color guidance

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

SECTION 08 81 00
Glazing

Ft. Campbell Requirements:

For glazing in exterior building elements such as storefronts, doors, windows, curtain walls, clerestories, and skylights provide no less than 1/4 in. (6 mm) nominal polycarbonate or laminated glass. The 1/4 in. (6 mm) laminated glass consists of two nominal 1/8 in. (3 mm) glass panes bonded together with a minimum of a 0.030 in. (0.75 mm) interlayer of a material \1\ that has typically been used in blast resistant window applications. For insulated glass units (IGU), use the polycarbonate or laminated glass for the innermost pane as a minimum. For polycarbonate, provide a glazing frame bite of no less than 1.5 times the polycarbonate thickness. For laminated glass, the laminated pane shall be adhered to its supporting frame using structural silicone sealant or adhesive glazing tape. The structural silicone sealant bite shall be equal to the larger of 3/8-in. (10-mm) or the thickness of the laminated glass to which it adheres. The minimum thickness of the structural silicone bead shall be 3/16-in. (5-mm). The glazing tape bite shall be equal to two times the thickness of the laminated glass to which it adheres. The structural silicone bead or glazing tape shall be applied to both sides of single pane laminated glass but need only be applied to the inboard (protected) side of an IGU. /1/ Monolithic glass or monolithic acrylic used as a single pane or as the inner pane of a multi-pane system is not allowed for the purposes of complying with this standard. Spandrel glass when backed by a structural wall or spandrel beam, translucent fiberglass panels, other lightweight translucent plastics, and glass unit masonry are not required to comply with this standard. Spandrel glass that is open to occupied space must \1\ comply /1/ with this standard.

Asbestos Window Panels.
Window panels containing asbestos fibers shall be replaced with insulated metal window panels. Metal trim for windows shall be anodized dark brown in color outlined in Appendix-D. Metal panels shall be anodized dark brown color in keeping with IPS standars or as outlined in Appendix-D.

Interior and exterior glass

Interior and Exterior galss panes for Low-E insulating units must be Type I annealed flat glass, Class [1-clear] [2-tinted] with anti-reflective low low-emissivity coating or heat-strengthened or fully tempered glass complying with ASTM C1048, Condition C on [No. 2 surface (inside surface of exterior pane)] [No. 3 surface (inside surface of interior pane)], Quality q3 - glazing select, conforming to ASTM C1036. Glass performance must be U value maximum of [Btu/hr-ft2-F], Solar Heat Gain Coefficient (SHGC) maximum of [_____]. Exterior window shall be 35% tint Color must be [bronze].

Bullet-Resisting Glass

Fabricated from Type I, Class 1, Quality q3 glass with polyvinyl butyral plastic interlayers between the layers of glass and listed by UL MEAPD as bullet resisting, with a rating Level of [N.I.J Level 7] in accordance with UL 752.

UL 752 Level 7: Provides protection against five shots of a 55-grain 5.56mm rifle full metal copper jacket with lead core (.223 caliber) at an fps between 3080 and 3383.

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

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

SECTION 09 06 00
Color Schedule

Ft. Campbell Requirements:

MPI Gloss and Sheen Standards

Gloss		@60 Sheen	@85
Gloss Level 1	a traditional matte finish-flat	max 5 units, and	max 10 units
Gloss Level 2	a high side sheen flat-a velvet-like	max 10 units, and	10-35 units
Gloss Level 3	a traditional “egg-shell like” finish	10-25 units, and	10-35 units
Gloss Level 4	a “satin-like” finish	20-35 units, and	min. 35 units
Gloss Level 5	a traditional semi-gloss	35-70 units	
Gloss Level 6	a traditional gloss	70-85 units	
Gloss Level 7	a high gloss	more than 85 units	

See **Appendix-D** for color guidance

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

SECTION 09 90 00
Paints and Coatings

Ft. Campbell Requirements:

MANUFACTURERS

Manufacturer’s trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer’s equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon submittal approval.

Use of MPI Level 3 eggshell, MPI Level 4 satin, and MPI Level 5 semi-gloss for interior and exterior paint finishes shall be maximized. Use of flat paints shall be minimized.

Instruction to Designers:

- Refer to Exterior and Interior Paint Tables sub-section 3.15.1 and 3.15.2 when designing paint colors and schedules.
- Include RGB color model numbers when specifying any color in SOW and Project Drawing Paint Schedule.
- MPI paint #54 is mildew resistant paint. Specify this paint in the Tables for Division 3 and 5 in high humidity locations or project locations with Environmental Severity Classifications (ESC) of C4 and C5. Humid locations are those in ASHRAE climate

zones 0A, 1A, 2A, 3A, 4C and 5C (as identified in ASHRAE 90.1).

See **Appendix-D** for color guidance

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

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

SECTION 10 14 01
Exterior Signage

Ft. Campbell Requirements:

Exterior signage shall be fabricated and installed per UFC 3-120-01 Signage and this TDG.

Will ensure compliance with:
http://www.campbell.army.mil/SiteAssets/DPW/FTC_TDG_24_Apr_17.pdf.

For exterior unit signs, the contractor shall provide and install the sign frame and aluminum sign blank. Unit will submit signage request thru their DPW CSR.

See **Appendix O** for Design specs and materials.

Applies to all military and civilian organizations assigned or providing a service to Fort Campbell or its facilities that require unit identification and facility signage and applies to the standardization of all new and/or replacement signage or the maintenance of existing signage.

The number of signs will be kept to a minimum to avoid visual clutter that can result in over-usage or bombardment of messages that have no relationship to each other. All signage will be organized into a coherent family of signs. Acronyms and abbreviations will be avoided.

(a) Siting and Approval to Construct.

Installation Site Approval and Approval to construct must be granted by the DPW prior to any Identification, wayfinding, informational or motivational signage project getting underway.

Placement of the signage must be parallel to the traffic flow, and set it back a minimum distance of 12 feet from the edge of the roadway. Signs may be placed in open areas free from other signs or obstructions. Clear of AT Antiterrorism unobstructed space and no create a situation of increased risk by labeling the facility a target

The dimensions shall not exceed 25 feet high x 20 feet wide for brigade-level motivational signage. The dimensions shall not exceed 10 feet high x 9 feet wide for battalion-level motivational signage.

5. Signage may show organizational emblems, mottos, and other elements related to unit morale. The design parameters of these signs may vary. The design and fabrication should reflect the overall design principles outlined within this regulation.

6. Wind Load Requirements: Exterior signage shall be designed to withstand 90 mph wind-load (follow American Society of Civil Engineers ((ASCE)) 7-98, latest edition, for wind speed and wind loads for signage).

7. Submit design analysis and supporting calculations performed in support of specified signage to DPW Engineering Division for review.

8. Exterior finishes shall be treated with a protective coating to prevent fading and corrosion to all sides appropriate to the material being used.

9. All signage shall be secured with concrete foundations as designed and approved by DPW Engineering Division.

(f) Materials.

1. Materials utilized should consider the life cycle cost of the sign. Sign stock and hardware should typically be aluminum, galvanized steel, or nonferrous materials to resist weathering and prevent rust streaking. Wood materials shall not be used.

2. Sign posts, foundations, and mountings shall be so constructed as to hold signs in a proper and permanent position and to resist swaying in the wind or displacement by vandalism. Avoid placement of non-breakaway signage in traffic or force protection clear zones.

(5) Temporary signs.
(a) DPW approval is required prior to the placement of signage supporting the advertisement of special activities and events.
(b) No signs of any kind will be affixed to utility or telephone poles.
(c) Once approved, temporary signs will be:
1. Installed no more than three working days prior to the event or activity.
2. Removed within three working days following the event or activity.
(6) Real Property and Real Estate Markers.
(a) Markers are designed for real estate and/or real property that is not a building or structure having a surface to which signage may be attached.
(b) Approved style and description is located in Appendix A.
(c) Placement shall be in a visible, readily accessible location.

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 cantonment 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

a. All pavement markings shall be in conformance with the 2009 MUTCD with Revision Numbers 1 and 2 dated May 2012 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.

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

c. 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.

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

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

f. All stop bars shall be 24 inches in width. All crosswalks (pedestrian and school crossings) shall be 24 inches (piano/sebra style) 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. Ft. Campbell CAM Regulations are located in the Project Templet Folders.

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

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SECTION 10 14 02
Interior Signage

Ft. Campbell Requirements:

Interior signage shall be fabricated and installed per. UFC 3-120-01 Chapter 4 Interior Sign Stabdards

https://wbdg.org/FFC/DOD/UFC/ufc_3_120_01_2014_c3.pdf

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 (HDPE) high density polyethylene for Toilet and Urinal Partitions is required with extruded aluminum cast alloy, chrome plated or Cast Stainless hardware.

See Appendix D for Color Guidance.

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

SECTION 10 28 13
Toilet Accessories

Ft. Campbell Requirements:

Accessories shall not have keyed locking devices.

1. Toilet tissue dispensers shall be a simple design similar to Bobrick Washroom Equipment, Inc. number B-685 and B-686 series accessories of type 304 stainless steel satin finish.
2. Grab Bars shall be 18-8S type 304 18 gauge stainless steel tubing with satin finish.
3. Trash receptacles provided in restrooms shall have lids.
4. Sanitary napkin and tampon dispensers shall not be provided.
5. Shower Curtain sized to suit conditions. Provide anti-bacterial nylon/vinyl fabric curtain (0.2mm) thick Opaque matte white. Curtain rod 18-8 type 304 18 gauge stainless steel.
6. Towel Bar shall be 18-8 type 304 22 stainless steel 22 gauge satin finish.

   Or approved Equal for items above. See Appendix D for Color Guidance.

------ 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:

Inspect equipment, fixtures, and material after installation for compliance with the applicable standards. Upon completion of inspection perform operational tests on each piece of equipment to determine that equipment and components, including controls, safety devices, and attachments, operate as specified and are properly installed and adjusted. Test all water, drain,

gas, steam, oil, refrigerant, and liquid carrying components for leaks. 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:

1. 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.

2. Metal building system manufacturer must have a minimum of five (5) years' experience as a qualified manufacturer [and a member of MBMA] of metal building systems and accessory products. Provide engineering services by an authorized currently licensed engineer in the geographical area where construction will take place, having a minimum of four years' experience as an engineer knowledgeable in building design analysis, protocols and procedures for the "Metal Building Systems Manual" (MBMA MBSM); SCE 7-10, [the building code in the geographic area where the construction will take place] and ASTM E 1592.

   Warranty:

3. Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than [20] years from the date of acceptance of the work and be issued directly to the Government. The warranty is to provide that if within the warranty period the roof panel system shows evidence of corrosion, perforation, rupture, loss of weather-tightness or excess weathering due to deterioration of the panel system resulting from defective materials and correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

See Appendix D for colors.
See UFC 3-320-04A

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, ABA height elongated 12-inch rough-in and 1.28 gallon per flush and Siphon jet urinals 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.

See Appendix D for preferred manufactures model list on plumbing related fixtures and ADA related fixtures.

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 rolled copper shall be used for water and compressed air supply under floor slabs. No fittings shall be used for under slab construction. Sleeve all concrete slab penetrations and center copper piping and drain 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 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 or 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, JACOBS 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 its 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 RPBP devices with each device capable of managing the buildings total water supply fixture unit (WSFU).

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 (Grater then 2”)	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 (Grater then 2”)	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 120 lb. 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 is 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. The normal static pressure on AHU shall be labeled for new construction and AHU renovation.

Provide Emergency Air Distribution Shutoff IAW UFC 4-010-01 DoD Minimum Antiterrorist Standards for Buildings. Sec. 3-19 Standard 18:

- Provide a minimum of one shutoff switch per floor. Locate the shutoff switch (or switches) to be easily accessible by building occupants by locating them adjacent to such locations as fire alarm pull stations, interior stairwell entrance doors such that the travel distance to the nearest shutoff switch on the same floor will not exceed 200 ft. (61 m). **/1/.**

- Ensure that the shutoff switches are well labeled, and of a different color than fire alarm pull stations. Shutoff to include a polycarbonate clear cover, red button, yellow background with black font. min. electrical requirement rating 1A @ 250v DC, 6A @ 600V AC, UL, cUL, ADA, Compliant.

Preferences: Air conditioners – Trane.
Concrete pad for equipment see 03 30 00 Cast in Place Sec. 2.5.

------ 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. VAV boxes must have access points on either side of duct work to allow access to clean coil if air flow is found to be restricted.

------ 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.

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.

Special Tools or Peripheral Equipment shall be provided and turned over to the contracting officer, any special tools, computer-based interfaces, relay interface terminals, software, etc. Required for operation and maintenance of the new equipment that will assist maintenance personnel in maintaining the facility.

When special tools or peripheral equipment to repair, operate, maintain, or program the Contractor shall provide to DPW at the time of transfer any said equipment. This applies to all equipment, sub-systems and systems including fire alarm equipment and fiber optic systems.

For Engineer or Designer, Contract language shall state that:

i. Necessary tools or equipment shall be provided to DPW, and shall be new at the time of transfer.
ii. Necessary interface devices (e.g. computer-based interfaces) shall be provided to DPW, and shall be new at the time of transfer.
iii. All software necessary to maintain the system, and fully licensed to the Government, shall be provided to DPW.
iv. All provided software shall be the latest version at the time of transfer.

1. **System Acceptance**
   - Systems may be partially accepted prior to seasonal testing if they comply with all construction contract and accepted design requirements that can be tested during initial Functional Performance Tests. All test procedure must be successful completed prior to full systems acceptance.
2. **Seasonal Tests**

- Perform Initial Functional Performance Tests as soon as all contract work is completed, but prior to facility turnover, regardless of the season. Opposed Season testing allows for testing of equipment that, due to extreme weather conditions, cannot be accurately tested at the time of the initial balance. If a project is balanced during the summer, the opposed season testing is performed during the winter months and vice-versa.
- During the opposed season testing, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space. At the time of opposite season testing, the designer and owner shall be given timely notification before any readings or adjustments are made so that he may participate.
- In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems during season of maximum [heating] and [cooling] as defined by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Schedule Seasonal Functional Performance Tests in coordination with the Contracting Officer. Submit Seasonal Test Report withing 14 days of test completion.
- Execute seasonal functional performance testing, witnessed by the Contacting Officer COR. Correct deficiencies and make adjustments to O&M manuals and as-built drawing for applicable issues identified in any seasonal testing.

3. **Full Load Tests**
   - Perform Initial Functional Performance Tests as soon as all contract work is completed, bit prior to facility turnover. In addition to the Initial Functional Performance Tests, perform Functional Performance Tests on HVAC systems under full-load conditions. [Develop and implement means of artificial loading to demonstrate the ability of the process cooling system to handle peak process loads.] Schedule Full-Load Functional Performance Tests in Coordination with the Contracting Officer COR. Submit Full-Load Test Report within 14 days of test completion.
   - Execute full-Load functional performance testing, witnessed by COR. Correct deficiencies and make adjustments to O&M manuals and as-built drawing for applicable issues identified in any full load testing.
4. **Training**
   - The Mechanical Systems Technical Commissioning Specialist must review the training plan required by Section 01 78 00 OPERATION AND MAINTENANCE DATA and identify any deficiencies to the COR and Contractor's Quality Control Personnel.
   - Coordinate, schedule, and document all required training. At a minimum, include the following items in the training report for commissioned systems:
     a. Complete commissioning documentation
     b. Complete O&M data
     c. Complete Training
     d. Purpose of equipment

e. Principle of how the equipment works
f. Important parts and assemblies
g. How the equipment achieves its purpose and necessary operation conditions
h. Most likely failure modes, causes and corrections
i. On site demonstration
j. Provide updates to O&M manuals based on field modification
k. Provide training of the post-occupancy operations and maintenance staff.

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

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Section 23 09 00
Instrumentation and Control for HVAC

Ft. Campbell Requirements:

1.0 Summary

System Architecture:

The Fort Campbell Utility Monitoring and Control System (FC-UMCS) System is comprised of 4 levels.

The FC-UMCS System Architecture is shown in Figure 1 below.

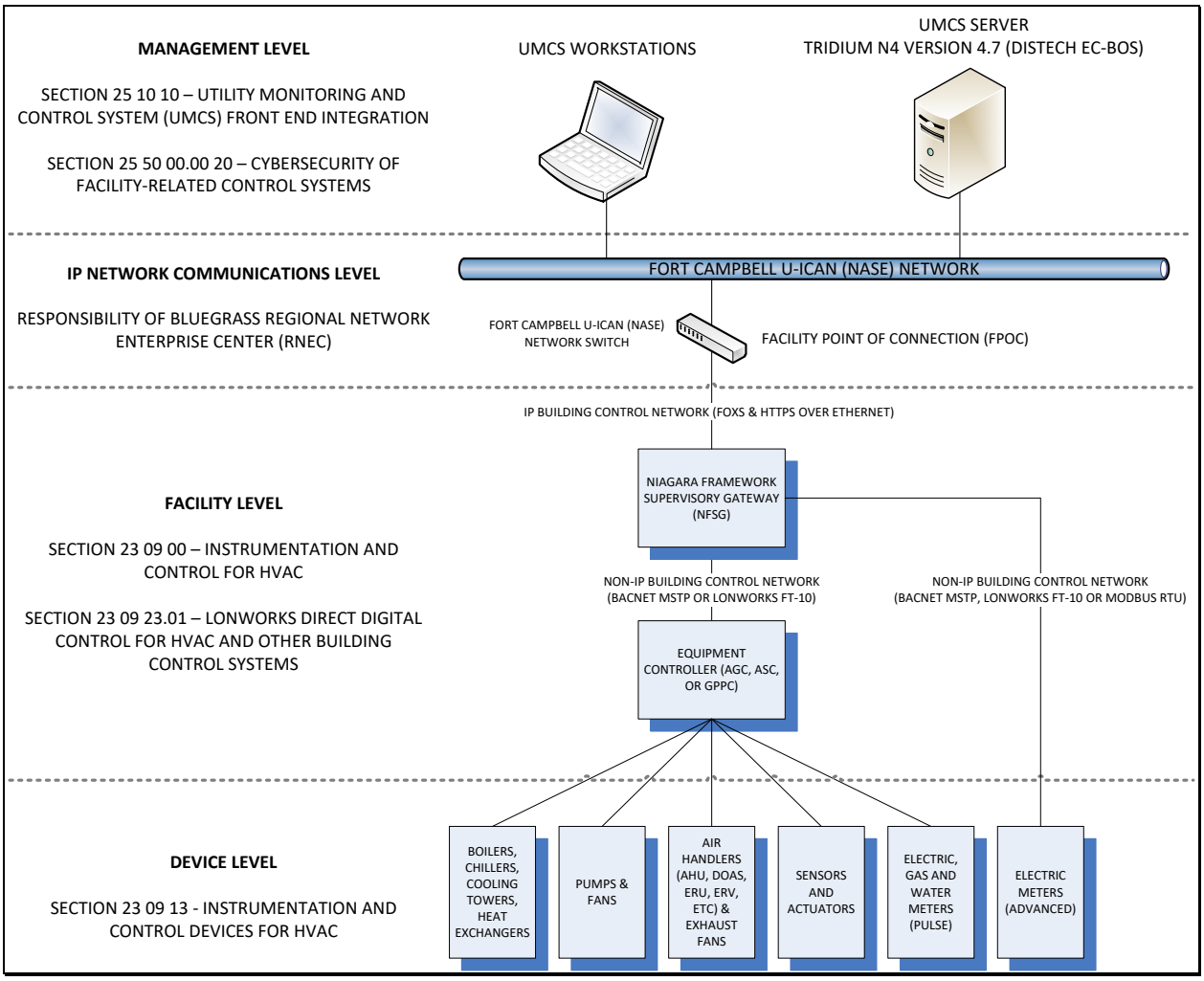


Figure 1 – FC-UMCS System Architecture

2.0 System Requirements

Provide a Direct Digital Control (DDC) system for HVAC systems as specified and indicated, and in accordance with the following characteristics.

All new construction projects that install HVAC systems shall provide a complete Direct Digital Control (DDC) system, except for the Front End which is specified in Section 25 10 10 UTILITY MONITORING AND CONTROL (UMCS) FRONT END AND INTEGRATION, suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as indicated and shown and in accordance with Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for LNS LonWorks systems or Niagara LonWorks systems, and other referenced Sections.

2.1 System Requirements

Provide systems meeting the requirements this Section and other Sections referenced by this Section, and which have the following characteristics:

a. The system implements the control sequences of operation shown in the Contract Drawings using DDC hardware to control mechanical and electrical equipment

b. The system meet the requirements of this specification as a stand-alone system and does not require connection to any other system.

c. Control sequences reside in DDC hardware in the building. The building control network is not dependent upon connection to a Utility Monitoring and Control System (UMCS) Front End, to the Niagara Framework Supervisory Gateway (NFSG) or to any other system for performance of control sequences. To the greatest extent practical, the hardware performs control sequences are implemented at the lowest possible level and without reliance on the building network.

d. The hardware is installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

e. All necessary documentation, configuration information, programming tools, programs, drivers, and other software are licensed to and otherwise remain with the Government such that the Government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor, Vendor or Manufacturer.

f. Sufficient documentation and data, including rights to documentation and data, are provided such that the Government or their agents can execute work to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor, Vendor or Manufacturer.

g. Hardware is installed and configured such that the Government or their agents are able to perform repair, replacement, and upgrades of individual hardware without further interaction with the Contractor, Vendor or Manufacturer.

h. All Niagara Framework components have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "ALL" for "Station Compatibility In", "Station Compatibility Out", "Tool Compatibility In" and "Tool Compatibility Out". Note that this will result in the following entries in the license file:
accept.station.in="*"
accept.station.out="*"
accept.wb.in="*"
accept.wb.out="*"

2.2 Submittal Requirements

DRAWINGS AND CALCULATIONS

Provide drawings in the form and arrangement indicated and shown. Use the same abbreviations, symbols, nomenclature and identifiers shown. Assign a unique identifier as shown to each control system element on a drawing. When packaging drawings, group schedules by system. When space allows, it is permissible to include multiple schedules for the same system on a single sheet. Except for drawings covering all systems, do not put information for different systems on the same sheet.

Submit hardcopy drawings on A3 17 by 11 inches sheets, and electronic drawings in PDF and in Microstation format. In addition, submit electronic drawings in editable Excel format for all drawings that are tabular, including but not limited to the Point Schedule and Equipment Schedule.

a. Submit DDC Contractor Design Drawings consisting of each drawing indicated with pre-construction information depicting the intended control system design and plans. Submit DDC Contractor Design Drawings as a single complete package: 3 hard copies and 3 copies on CD-ROM.

b. Submit Draft As-Built Drawings consisting of each drawing indicated updated with as-built data for the system prior to PVT. Submit Draft As-Built Drawings as a single complete package: 3 hard copies and 3 copies on CD-ROM.

c. Submit Final As-Built Drawings consisting of each drawing indicated updated with all final as-built data. Final As-Built Drawings as a single complete package: 3 hard copies and 3 copies on CD-ROM.

Drawings shall contain the following elements:

Drawing Index and Legend

Provide an HVAC Control System Drawing Index showing the name and number of the building, military site, State or other similar designation, and Country. In the Drawing Index, list all Contractor Design Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. In the Design Drawing Legend, show and describe all symbols, abbreviations and acronyms used on the Design Drawings. Provide a single Index and Legend for the entire drawing package.

Thermostat and Occupancy Sensor Schedule

Provide a thermostat and occupancy sensor schedule containing each thermostat's unique identifier, room identifier and control features and functions as shown. Provide a single thermostat and occupancy sensor schedule for the entire project.

Valve Schedule

Provide a valve schedule containing each valve's unique identifier, size, flow coefficient Kv (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure to torque data, dimensions, and access and clearance requirements data. In the valve schedule include actuator selection data supported by calculations of the force required to move and seal the valve, access and clearance requirements. Provide a single

valve schedule for the entire project.

Damper Schedule

Provide a damper schedule containing each damper's unique identifier, type (opposed or parallel blade), nominal and actual sizes, orientation of axis and frame, direction of blade rotation, actuator size and spring ranges, operation rate, positive positioner range, location of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. Include the AMCA 511 maximum leakage rate at the operating static-pressure differential for each damper in the Damper Schedule. Provide a single damper schedule for the entire project.

Occupancy Schedule

Provide an occupancy schedule drawing containing the same fields as the occupancy schedule Contract Drawing with Contractor updated information. Provide a single occupancy schedule for the entire project.

DDC Hardware Schedule

Provide a single DDC Hardware Schedule for the entire project and including following information for each device:

- DDC Hardware Identifier - The Unique DDC Hardware Identifier for the device.
- HVAC System - The system "name" used to identify a specific system (the name used on the system schematic drawing for that system).
- Network Address - The LonWorks Domain, Subnet and Node address for the device.
- Unique Node ID - The Unique 48-bit Node ID associated with the device. (Also referred to as the Neuron ID for some devices)
- Niagara Station ID - The Niagara Station ID for each Niagara Framework Supervisory Gateway

Points Schedule

Provide a Points Schedule in tabular form for each HVAC system, with the indicated columns and with each row representing a hardware point, network point or configuration point in the system.

Points Schedule Columns must include:

- Point Name - The abbreviated name for the point using the indicated naming convention.
- Description - A brief functional description of the point such as "Supply Air Temperature".

- DDC Hardware Identifier - The Unique DDC Hardware Identifier shown on the DDC Hardware Schedule and used across all drawings for the DDC Hardware containing the point.
- Settings - The value and units of any setpoints, configured setpoints, configuration parameters, and settings related to each point.

- Range - The range of values, including units, associated with the point, including but not limited to a zone temperature setpoint adjustment range, a sensor measurement range, occupancy values for an occupancy input, or the status of a safety.

- Input or Output (I/O) Type - The type of input or output signal associated with the point. Use the following abbreviations for entries in this column:

    a. AI: The value comes from a hardware (physical) Analog Input

    b. AO: The value is output as a hardware (physical) Analog Output

    c. BI: The value comes from a hardware (physical) Binary Input

    d. BO: The value is output as a hardware (physical) Binary Output

    e. PULSE: The value comes from a hardware (physical) Pulse Accumulator Input

    f. NET-IN: The value is provided from the network (generally from another device). Use this entry only when the value is received from another device as part of scheduling or as part of a sequence of operation, not when the value is received on the network for supervisory functions such as trending, alarming, override or display at a user interface.

    g. NET-OUT: The value is provided to another controller over the network. Use this entry only when the value is transmitted to another device as part of scheduling or as part of a sequence of operation, not when the value is transmitted on the network for supervisory functions such as trending, alarming, override or display at a user interface.

- Primary Point Information: SNVT Name - The name of the SNVT used for the point. Any point that is displayed at the front end or on an LDP, is trended, is used by another device on the network, or has an alarm condition must be documented here.

- Primary Point Information: SNVT Type - The SNVT type used by the point. Provide this information whenever SNVT Name is required.

- Niagara Station ID - The Niagara Station ID of the Niagara Framework Supervisory Gateway the point is mapped into.

- Override Information (SNVT Name and Type) - For each point requiring an Override and not residing in a Niagara Framework Supervisory Gateway, indicate the SNVT Name and SNVT Type of the network variable used for the override.

- Configuration Information - Indicate the means of configuration associated with each point. For points in a Niagara Framework Supervisory Gateway, indicate the point within the Niagara Framework Supervisory Gateway used to configure the value. For other points:

    a. Indicate "Niagara Framework Wizard" if the point is configurable via a Niagara Framework Wizard.

    b. If the point is not configurable through a Niagara Framework Wizard, indicate the network variable or configuration property used to configure the value.

Riser Diagram

The Riser Diagram of the Building Control Network may be in tabular form, and must show all DDC Hardware and all Network Hardware, including network terminators. For each item, provide the unique identifier, common descriptive name, physical sequential order (previous and next device on the network), room identifier and location within room. A single riser diagram must be submitted for the entire system.

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

Section 23 09 23.13 20
Lonworks Direct Digital Control for HVAC and Other Building Control Systems

Ft. Campbell Requirements:

1.0 Summary

System Architecture:

The Fort Campbell Utility Monitoring and Control System (FC-UMCS) System is comprised of 4 levels.

The FC-UMCS System Architecture is shown in Figure 1 below.

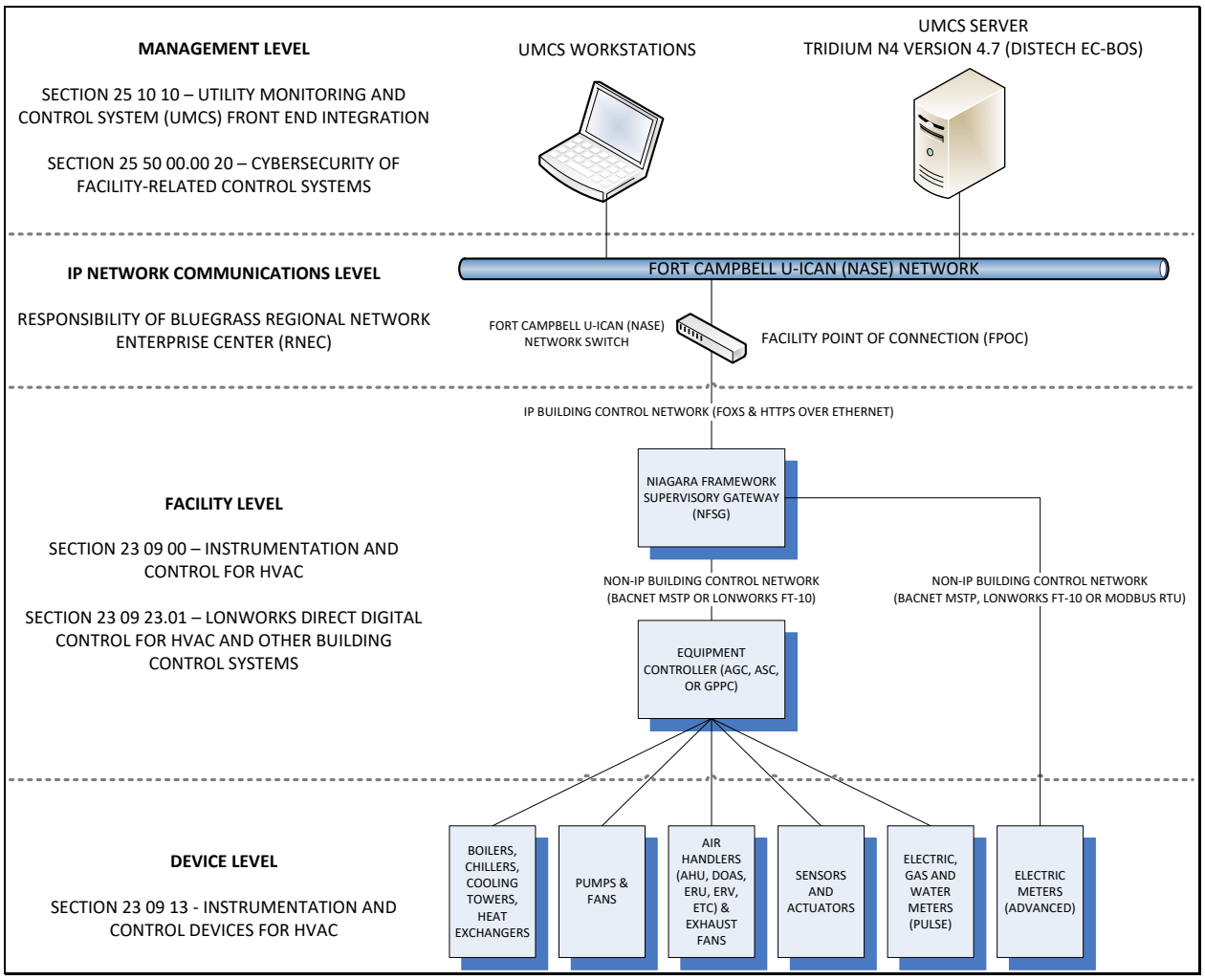


Figure 2 – FC-UMCS System Architecture

2.0 System Requirements

Provide a Direct Digital Control (DDC) system for HVAC systems as specified and indicated, and in accordance with the following characteristics.

All new construction projects that install HVAC systems shall provide a complete Direct Digital Control (DDC) system, except for the Front End which is specified in Section 25 10 10 UTILITY MONITORING AND CONROL (UMCS) FRONT END AND INTEGRATION, suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and shown and in accordance with Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC

2.1 General System Requirements

a. All new buildings, all major renovation projects, and all projects that install HVAC systems shall provide a complete Direct Digital Control (DDC) system and include connection of the DDC systems to the FC-UMCS unless directed otherwise.

b. All DDC systems shall be provided with one or more Niagara Framework Supervisory Gateways (NFSG). No more than 100 equipment controllers shall be connected to one NFSG.
c. Provide, install and configure DDC Hardware and Building Control Networks per the following requirements.
d. Provide configuration of one or more Niagara Framework Supervisory Gateway (NFSG) per the following requirements.

2.2 Control Network Wiring

a. Provide TP/FT-10 control wiring in accordance with CEA-709.3.

2.3 Direct Digital Control (DDC) Hardware Requirements

All DDC Hardware must meet the following general requirements:

a. Except for Niagara Framework Supervisory Gateways, it must incorporate a physical "service pin" which, when pressed will cause the DDC Hardware to broadcast its 48-bit NodeID and its ProgramID over the network. The service pin must be distinguishable and accessible. Niagara Framework Supervisory Gateways must incorporate a “service pin” function accessible in software.

b. It must incorporate a light to indicate the device is receiving power.

c. Except for Niagara Framework Supervisory Gateways, it must incorporate a TP/FT-10 transceiver in accordance with CEA-709.3 and connections for TP/FT-10 control network wiring. Niagara Framework Supervisory Gateways must incorporate two IP connections and at least one TP/FT-10 transceiver in accordance with CEA-709.3 and LonMark Interoperability Guide. Niagara Framework Supervisory gateways must have connection of the appropriate type for each transceiver.

d. It must communicate on the network using only the CEA-709.1-D protocol or the Fox protocol.

e. It must be capable of having network communications configured via the Niagara Framework.

f. It must be locally powered; link powered devices are not acceptable.

g. LonMark external interface files (XIF files), as defined in the LonMark XIF Guide, must be submitted for each type of DDC Hardware except Niagara Framework Supervisory Gateways.

h. Application programs and configuration settings must be stored in a manner such that a loss of power does not result in a loss of the application program or configuration settings:

(1) Loss of power must never result in the loss of application programs, regardless of the length of time power is lost.

(2) Loss of power for less than 2,500 hours must not result in the loss of configured settings.

i. It must have all functionality specified and required to support the application (Sequence of Operation or portion thereof) in which it is used, including but not limited to:

(1) It must provide input and output SNVTs or Niagara Framework Points as specified, as indicated on the Points Schedule, and as otherwise required to support the sequence and application in which it is used. All SNVTs and Niagara Framework Points must have meaningful names identifying the value represented by the SNVT or Niagara Framework Points. Unless a standard network variable type of an appropriate engineering type is not available, all network variables must be of a standard network variable type with engineering units appropriate to the value the variable represents.

(2) All settings and parameters used by the application in which the DDC hardware is used must be configurable via one of the following: standard configuration properties (SCPTs) as defined in the LonMark SCPT List, user-defined configuration properties (UCPTs), network configuration inputs (ncis) of a SNVT type as defined in the LonMark SNVT List, network configuration inputs (ncis) of a user defined network variable type, or hardware settings on the controller itself. Niagara Framework Supervisory Gateways may instead be configurable via the Niagara Framework.

j. It must meet FCC Part 15 requirements and have UL 916 or equivalent safety listing.

k. In addition to these general requirements and the DDC Hardware Input-Output (I/O) Function requirements, all DDC Hardware must also meet the requirements of a Niagara Framework Supervisory Gateway, a Local Display Panel (LDP), Application Specific Controller (ASC), General Purpose Programmable Controller (GPPC), or an Application Generic Controller (AGC). All pieces of DDC Hardware must have their DDC Hardware Type identified as part of the Manufacturer's Product Data submittal as specified in Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC. Except for Local Display

Panels provided as part of another controller, where a single device meets the requirements of multiple types, select a single type for that specific device based on it's use.

Where a Local Display Panel is provided as part of another device, indicate both the controller type and local display panel. One model of DDC hardware may be submitted as different DDC Hardware types when used in multiple applications.

l. The user interface on all DDC Hardware with a user interface which allows for modification of a value must be password protected.

m. Clocks in DDC Hardware incorporating a Clock must continue to function for 120 hours upon loss of power to the DDC Hardware.

n. Hardware Input-Output (I/O) Functions

DDC Hardware incorporating hardware input-output (I/O) functions must meet the following requirements:

Analog Inputs: DDC Hardware analog inputs (AIs) must perform analog to digital (A-to-D) conversion with a minimum resolution of 8 bits plus sign or better as needed to meet the accuracy requirements specified in Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC. Signal conditioning including transient rejection must be provided for each analog input. Analog inputs must be capable of being individually calibrated for zero and span. Calibration via software scaling performed as part of point configuration is acceptable. The AI must incorporate common mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10,000 ohms.

Analog Outputs: DDC Hardware analog outputs (AOs) must perform digital to analog (D-to-A) conversion with a minimum resolution of 8 bits plus sign, and output a signal with a range of 4-20 mAdc or 0-10 Vdc. Analog outputs must be capable of being individually calibrated for zero and span. Calibration via software scaling performed as part of point configuration is acceptable. DDC Hardware with Hand-Off-Auto (H-O-A) switches for analog outputs must provide for overriding the output through the range of 0 percent to 100 percent.

Binary Inputs: DDC Hardware binary inputs (BIs) must accept contact closures and must ignore transients of less than 5 milli-second duration. Protection against a transient of 50 Vac must be provided.

Relay Contact Closures: Closures must have a minimum duration of 0.1 second. Relays must provide at least 180V of isolation. Electromagnetic interference suppression must be provided on all output lines to limit transients to 50 Vac. Minimum contact rating must be 0.5 amperes at 24 Vac.

Triac Outputs: Triac outputs must provide at least 180 V of isolation. Minimum contact rating must be 0.5 amperes at 24 Vac.

Pulse Accumulator: DDC Hardware pulse accumulators must have the same characteristics as the BI. In addition, a buffer must be provided to totalize pulses. The pulse accumulator must accept rates of at least 20 pulses per second. The totalized value must be resettable via a configurable parameter.

2.3.1 Local Display Panel (LDP)

The Local Display Panels (LDPs) must be DDC Hardware with a display and navigation buttons or a touch screen display, and must provide display and adjustment of Niagara Framework points or network variables as indicated on the Points Schedule and as specified. LDPs must be as an integral part of another piece of DDC Hardware. LDPs must come factory installed with all applications necessary for the device to function as an LDP.

The adjustment of values using display and navigation buttons must be password protected.

2.3.2 Application Specific Controller (ASC)

Application Specific Controllers (ASCs) have a fixed factory-installed application program (i.e. ProgramID) with configurable settings and do not have the ability to be programmed for custom applications. ASCs must meet the following requirements in addition to the General DDC Hardware and DDC Hardware Input-Output (I/O) Function requirements:

a. ASCs must be LonMark Certified.

b. Unless otherwise approved, all necessary Configuration Properties and network configuration inputs (ncis) for the sequence and application in which the ASC is used must be fully configurable through the Niagara Framework. Application Specific Controller configurable via a Niagara Framework Wizard is preferred. Wizards must be submitted for each type (manufacturer and model) of Application Specific Controller which has a Wizard available for configuration. Wizards distributed under a license must be licensed to the project site. (Note: configuration accomplished via hardware settings does not require configuration via Niagara Framework Wizard.)

c. ASCs may include an integral or tethered Local Display Panel

2.3.3 General Purpose Programmable Controller (GPPC)

A General Purpose Programmable Controller (GPPC) must be programmed for the application. GPPCs must meet the following requirements in addition to the general DDC Hardware requirements and Hardware Input-Output (I/O) Functions:

a. The programmed GPPC must conform to the LonMark Interoperability Guide.

b. All programming software required to program the GPPC must be delivered to and licensed to the project site in accordance with Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC. Submit the most recent version of the Programming software for each type (manufacturer and model) of General Purpose Programmable Controller (GPPC).

c. Submit copies of the installed GPPC application programs (all software that is not common to every controller of the same manufacturer and model) as source code compatible with the supplied programming software in accordance with Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC. The submitted GPPC application program must be the complete application necessary for the GPPC to function as installed and be sufficient to allow replacement of the installed controller with a GPPC of the same type.

e. GPPCs must include an integral Local Display Panel.

2.3.4 Application Generic Controller (AGC)

An Application Generic Controller (AGC) has a fixed application program which includes the ability to be programmed for custom applications. AGCs must meet the following requirements in addition to the general DDC Hardware requirements and Hardware Input-Output (I/O) Functions:

a. The programmed AGC must conform to the LonMark Interoperability Guide.

b. The AGC must have a fixed ProgramID and fixed XIF file.

c. Unless otherwise approved, the ACG must be fully configurable and programmable for the application using one or more Niagara Framework Wizards, all of which must be submitted as specified for each type of AGC (manufacturer and model).

d. Submit copies of the installed AGC application programs as source code compatible with the supplied Niagara Framework Wizard used for programming the device in accordance with Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC. The submitted AGC application program must be the complete application program necessary for the AGC to function as installed and be sufficient to allow replacement of the installed controller with an AGC of the same type.

f. AGCs must include an integral Local Display Panel.

2.3.5 Niagara Framework Supervisory Gateway

Any device implementing the Niagara Framework is a Niagara Framework Supervisory Gateway and must meet these requirements. In addition to the general requirements for all DDC Hardware, Niagara Framework Supervisory Gateway Hardware must:

a. Be direct digital control hardware.

b. Have an unrestricted interoperability license and its Niagara Compatability Statement (NiCS) must follow the Tridium Open NiCS Specification.

c. Manage communications between a field control network and the Niagara Framework Monitoring and Control Software, and between itself and other Niagara Framework Supervisory Gateways. Niagara Framework Supervisory Gateway Hardware must use Fox protocol for communication with other Niagara Framework Components, regardless of the manufacturer of the other components.

d. Be fully programmable using the Niagara Framework Engineering Tool and must support the following:

(1) Time synchronization, Calendar, and Scheduling using Niagara Scheduling Objects

(2) Alarm generation and routing using the Niagara Alarm Service

(3) Trending using the Niagara History Service and Niagara Trend Log Objects

(4) Integration of field control networks using the Niagara Framework Engineering Tool

(5) Configuration of integrated field control system using the Niagara Framework Engineering Tool when supported by the field control system

e. Meet the following minimum hardware requirements:

(1) Two 10/100 Mbps Ethernet Ports

f. provide access to field control network data and supervisory functions via web interface and support a minimum of 16 simultaneous users.

g. Submit a backup of each Niagara Framework Supervisory Gateway as specified in Section 23 09 00 INTRUMENTATION AND CONTROL FOR HVAC. The backup must be sufficient to restore a Niagara Framework Supervisory Gateway to the final as-built condition such that a new Niagara Framework Supervisory Gateway loaded with the backup is indistinguishable in functionality from the original.

2.4 Control System Installation

2.4.1 Building Control Network (BCN)

Provide a Building Control Network (BCN) connecting all DDC hardware as specified. The Building Control Network (BCN) must consist of an IP Network, one or more Niagara Framework Supervisory Gateways, and one or more Non-IP Building Control Network Channels:

2.4.1.1 Building Control Network (BCN) Installation

Provide building control networks meeting the following requirements:

a. Provide a Building Control Network IP Network, Non-IP Building Control Network Channels and Niagara Framework Supervisory Gateways to a create a single building control network connecting all DDC Hardware.

b. When only a single Niagara Framework Supervisory Gateway is required, the IP network consists of only the Niagara Framework Supervisory Gateway. When multiple Niagara Framework Supervisory Gateways are required, provide an Ethernet connection per Niagara Framework Supervisory Gateway to the Facility Point of Connection in order to connect all Niagara Framework Supervisory Gateways. Connecting multiple Niagara Framework Supervisory Gateways via their secondary IP port is not acceptable. Contractor provided and installed network switches are not acceptable.

c. Install the network such that the peak expected bandwidth usage for each and every channel is less than 70 percent, including device-to-device traffic and traffic to the Utility Monitoring and Control System (UMCS) as indicated on the Points Schedule.

2.4.1.2 Non-IP Building Control Network (BCN) Channel

Provide Non-IP Building Control Network (BCN) Channel(s) meeting the following requirements:

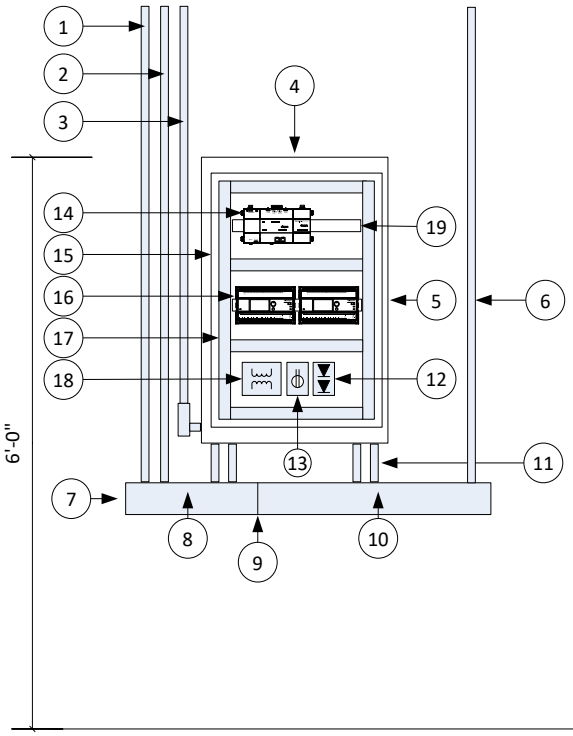
a. For each channel, provide a TP/FT-10 channel in doubly terminated bus (daisy chain) topology in accordance with CEA-709.3. The bus (daisy chain) topology is the only wiring topology that is acceptable. Both ends of the TP/FT-10 channel bus shall be located at the Niagara Framework Supervisory Gateway (NFSG).
b. Connect no more than 2/3 the maximum number of devices permitted by CEA-709.3 to each TP/FT-10 channel.
c. Connect no more than 2/3 the maximum number of devices permitted by the manufacturer of the device transceivers to each channel. When more than one type of transceiver is used on the same channel, use the transceiver with the lowest maximum number of devices to calculate the 2/3 limit.

2.4.1.3 Building Control Network (BCN) IP Network

Install IP Network Cabling in conduit. Install the Building Control Network (BCN) IP Network so that it is available at the Facility Point of Connection (FPOC) location as specified. When the FPOC location is a room number, provide sufficient additional media to ensure that the Building Control Network (BCN) IP Network can be extended to any location in the room.

2.4.1.4 DDC Hardware

Install Niagara Framework Supervisory Gateways in lockable enclosures. DDC hardware enclosures must meet the requirements detailed in **Figure 2** below. Install other DDC Hardware which is not is suspended ceilings in enclosures.



KEYNOTES

1. 120 VAC FOR CONTROLS. PROVIDE 1 DEDICATED 120 VOLT 20 AMP CIRCUIT.

2. CONDUIT(S) AS NEEDED FOR CONTROLS > 50 VAC.

3. NETWORK CONNECTION. PROVIDE 1" EMT RACEWAY TO COMMUNICATIONS ROOM. INSTALL 2 X CAT5 CABLES. TERMINATE CABLES AT PATCH PANEL IN COMMUNICATIONS ROOM AND PROVIDE JUMPERS TO ETHERNET SWITCH. PROVIDE 2 X CAT5 JACKS IN CONTROLS ENCLOSURE (SEE KEYNOTE #12).

4. CONTROLS ENCLOSURE. NEMA 12 HINGE COVER ENCLOSURE. MINIMUM DIMENSIONS TO BE 24" WIDE, 36" HIGH, 8" DEEP. NO CONDUITS ARE TO ENTER TOP OF THIS ENCLOSURE. TOP OF ENCLOSURE TO BE 6'0" A.F.F. PROVIDE LOCKING MEANS. PROVIDE DATA POCKET IN THE DOOR. PROVIDE LAMINATED AS BUILT CONTROLS SHOP DRAWINGS IN 11" X 17" RING BOUND FORMAT.

5. PROVIDE HEAVY DUTY HASP. DPW WILL PROVIDE PADLOCK (RED LOCK).

6. CONDUIT(S) AS NEEDED FOR CONTROLS < 50 VAC.

7. NEMA 1 WIREWAY, 4" X 4"MINIMUM SIZE. NO CONTROL DEVICES, RELAYS, ETC. ARE TO BE INSTALLED IN THE WIREWAY.

8. HIGH VOLTAGE (> 50 VAC) PORTION OF WIREWAY.

9. HIGH VOLTAGE / LOW VOLTAGE DIVIDER.

8. LOW VOLTAGE (< 50 VAC) PORTION OF WIREWAY.

11. CONDUITS BETWEEN CONTROL ENCLOSURE AND WIREWAY AS NEEDED. PROVIDE 4 X 1" CONDUITS MINIMUM.

12. 2 x CAT5 JACKS LOCATED IN CONTROLS ENCLOSURE

13. 1 x 120 VAC 20 AMP DUPLEX GFCI RECEPTACLE MOUNTED IN CONTROLS ENCLOSURE.

14. SPACE FOR NIAGARA FRAMEWORK SUPERVISORY GATEWAY (NSFG). PROVIDE 2" CLEARANCE ON TOP AND BOTTOM. MOUNT ON 35MM DIN RAIL.

15. BACK PLANE

16. SPACE FOR TWO 24 POINT GENERAL PURPOSE PROGRAMMABLE CONTROLLERS (GPPC). PROVIDE 2" CLEARANCE ON TOP AND BOTTOM. MOUNT ON 35MM DIN RAIL.

17. 1-½" X 1-½" PLASTIC WIREWAY AND COVER. FASTEN TO THE BACKPLANE WITH SHEET METAL SCREWS AT 6" INTERVALS.

18. 100 VA 120 VOLT TO 24 VOLT TRANSFORMER (MINIMUM OF ONE). PROVIDE ADDITIONAL TRANSFORMERS AS NEEDED BASED ON LOADS.

19. 35MM DIN RAIL (TYP).

Figure 3– DDC Control Panel Requirements

Configure and commission all DDC Hardware on the Building Control Network. Use Application Specific Controllers whenever an Application Specific Controller suitable for the application exists. When an Application Specific Controller suitable for the application does not exist use Application Generic Controllers or General Purpose Programmable Controllers.

Hand-Off-Auto (H-O-A) Switches

Provide Hand-Off-Auto (H-O-A) switches for all General Purpose Programmable Controller (GPPC) analog outputs and binary outputs used for control of systems other than terminal units, as specified and as indicated on the Points Schedule. H-O-A switches must be integral to the controller software and adjustable via the integral local display panel incorporated into the GPPC.

Graphics and Web Pages

Configure Niagara Framework Supervisory Gateways to use web pages to provide a graphical user interface including System Displays using the project site sample displays, including overrides, as indicated on the Points Schedule and as specified. Label all points on displays with the point name as indicated on the Points Schedule. Configure user permissions for access to and executions of action using graphic pages. Coordinate user permissions with the UMCS Account Manager. Configure the web server to use HTTPS based on the Transport Layer Security (TLS) protocol in accordance with IETF RFC 7465 using a Government furnished certificate.

Overrides for GPPCs and AGCs

Provide the capability to override points for all General Purpose Programmable Controllers and Application Generic Controllers as specified and as indicated on the Points Schedule using one of the following methods:

a. Override SNVT of Same SNVT Type method:

(1) Use this method for all setpoint overrides and for overrides of inputs and outputs whenever practical.

(2) Provide a SNVT input to the DDC hardware containing the point to be overridden of the same SNVT type as the point to be overridden.

(3) Program and configure the DDC hardware such that:

(a) If the value of the SNVT on the override input is the Invalid Value defined for that SNVT by the LonMark SNVT List, then the point is not overridden (its value is determined from the sequence).

(b) If the value of the SNVT on the override input is not the Invalid Value defined for that SNVT by the LonMark SNVT List then set the value of the point to be overridden to the value of the SNVT on the override input.

b. HVAC Override SNVT method:

(1) Use this method for override of inputs and outputs when the "Override SNVT Shares SNVT Type" method is impractical.

(2) Provide a SNVT input to the DDC hardware containing the point to be overridden of SNVT type SNVT_hvac_overid. Show on the Points Schedule how to perform the specified override using this SNVT.

Overrides for ASCs

Whenever possible use the methods specified for General Purpose Programmable Controllers and Application Generic Controllers to perform overrides for all Application Specific Controllers. If neither the "Override SNVT of Same SNVT Type" method or "HVAC Override SNVT" method are supported by the Application Specific Controller show this on the Points Schedule and perform overrides as follows:

a. Provide one or more SNVT input(s) to the DDC hardware containing the point to be overridden. Document the number and type of each SNVT provided on the Points Schedule.

b. Configure the Application Specific Controller such that:

(1) For some specific combination or combinations of values at the SNVT override input(s) the point is not overridden, and its value is determined from the sequence as usual. Show on the Points Schedule the values required at the SNVT override input(s) to not override the point.

(2) For other specific combinations of SNVT override input(s), the value of the point to be overridden is determined from the value of the override input(s). Show on the Points Schedule the correlation between the SNVT override input(s) and the resulting value of the overridden point.

2.4.1.5 Scheduling, Alarming, Trending and Overrides

Scheduling
Configure schedules in Niagara Framework Supervisory Gateway using Niagara Schedule Objects as indicated on the Points Schedule and as specified. When the schedule is controlling occupancy modes in DDC Hardware other than a Niagara Framework Supervisory Gateway use a network variable of type SNVT_Occupancy.

Schedule Groupings

Provide a separate schedule for each AHU including it's associated Terminal Units and for each stand-alone Terminal Unit (those not dependent upon AHU service) or group of stand-alone Terminal Units acting according to a common schedule as indicated.

Occupancy Mode Mapping to SNVT Values

Use the following mapping between SNVT_Occupancy enumerations and occupancy modes:

a. OCCUPIED mode: Enumeration value of OC_OCCUPIED
b. UNOCCUPIED mode: Enumeration value of OC_UNOCCUPIED
c. WARM-UP/COOL-DOWN (PRE-OCCUPANCY) mode: Enumeration value of OC_STANDBY

Alarming

For each point not in a Niagara Framework Supervisory Gateway which is shown on the

Points Schedule with an alarm condition, provide a SNVT output for the point to be used for alarm generation.

For each point which is shown on the Points Schedule with an alarm condition, configure alarms in Niagara Framework Supervisory Gateway using Niagara Alarm Extensions and Alarm Services.

Trending

For each point not in a Niagara Framework Supervisory Gateway which is shown on the Points Schedule as requiring a trend, provide a SNVT output for the point to be used for trending.

For each point which is shown on the Points Schedule as requiring a trend, configure a trend in Niagara Framework Supervisory Gateway using Niagara Framework History Service.

Overrides

Provide overrides for points as indicated on the Points Schedule. For overrides to points in Niagara Framework Supervisory Gateways, use the Niagara Framework. For overrides to other points, provide an override to a point in a Niagara Framework Supervisory Gateway via the Niagara Framework where the Niagara Framework Supervisory Gateway overrides the other point as specified in paragraphs "Overrides for GPPCs and AGCs" and "Overrides for ASCs"

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

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Section 23 09 53.00 20
Space Temperature Control Systems

Ft. Campbell Requirements:

1. Performance Requirements:
   a. Provide control systems to maintain the required heating, ventilation, and cooling (HVAC) conditions by performing the functions and sequences of operations indicated. Control systems shall be complete, including all equipment and appurtenances, and ready for operations. Control systems shall be furnished, installed, tested, calibrated, and started up by , or under the supervision of trained technicians certified by the Contractor as qualified and regularly employed in such work. Control system equipment, valves, panels and dampers shall bear the

manufacturer's nameplate.

2. Standard Products:
    a. Material and equipment shall be standard products of manufacturers regularly engaged in the manufacturing of such products, using similar materials, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid.
    b. The equipment items shall be supported by a service organization.
    c. 24 Volt Digital Heat/Cool Thermostats wall mounted non programmable hardwired to units with large easy to view screen. (Remote thermostats are prohibited).
3. Commissioning Procedures:
    a. Define procedures specific to each control system including instructions on how to set control parameters and set points, proportional, integral and derivative mode constants, contact output settings, positioner range adjustments and calibration checks of transmitters.

See UFGS Division 23 Heating, ventilation, and air conditions Sec. 23 09 53.00 20 Space Temperature control systems.

------ 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, 80% efficient non-condensing type, or 98% condensing type boilers 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/water 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.

Install two valve protection so the boiler can be isolated without having to drain the entire building.

Install a bypass loop/system so that the water can be recirculated while the boiler is secured during cooling season.

Install unions instead of straight pipe to the component and ensure that the correct unions i.e. die electric copper to black pipe and vice versa.

Do not install straight pipe directly to the boiler during installation incorporate unions for removal and installation of replacement boilers.

Do not install pumps in the overhead more than six feet, to allow for maintenance and repair on the pumps.

For oil containing equipment, design a containment curb under the equipment. Do not install equipment in pits.

Concrete pad for equipment see 03 30 00 Cast in Place Sec. 2.5.

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

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Section 23 64 10
Packaged Water Chillers, Vapor Compression Type

Ft. Campbell Requirements:

Chillers shall include as a minimum the following features:

- All Chillers shall be FEMP compliant for energy efficiency.
- Provide Lonworks card for all chillers, connect and integrated into UMCS.
- 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 (0° F) is required for very few applications here @ Fort Campbell, however it is required for all 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.

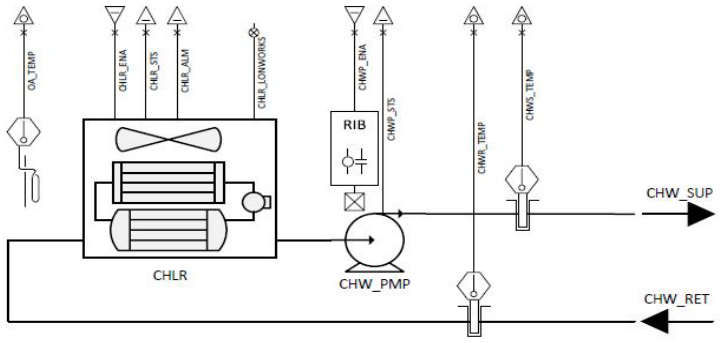
Install strainers upstream of chiller barrels and condenser barrels.

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.

Concrete pad for equipment see 03 30 00 Cast in Place Sec. 2.5.



CONSTANT VOLUME PRIMARY CHILLED WATER SYSTEM (1 CHLR, 1 CHWP)
SYSTEM SCHEMATIC

CONSTANT VOLUME PRIMARY CHILLED WATER SYSTEM (1 CHLR, 1 CHWP)
SEQUENCE OF OPERATIONS

1. CHILLED WATER SYSTEM ENABLE: THE CHILLED WATER SYSTEM SHALL BE ENABLED WHENEVER THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 55F (ADJUSTABLE FROM 45F TO 65F) SUBJECT TO A 2F DEADBAND. ADDITIONALLY THERE SHALL BE A SOFTWARE POINT TO MANUALLY OVERRIDE THE CHILLED WATER SYSTEM.

2. CHILLED WATER PUMP CONTROL: THE CHILLED WATER PUMP SHALL BE ENABLED WHENEVER THE CHILLED WATER SYSTEM IS ENABLED. THE CHLLED WATER PUMP SHALL CONTINUE TO OPERATE FOR 5 MINUTES (ADJUSTABLE FROM 0 MINUTES TO 1 HOUR) AFTER THE CHILLED WATER SYSTEM IS DISABLED. THE CONTROL SYSTEM SHALL MONITOR THE CHILLED WATER PUMP STATUS. AN ALARM SHALL BE INDICATED ANY TIME THE PUMP COMMAND AND PUMP STATUS DISAGREE FOR LONGER THAN 5 MINUTES (ADJUSTABLE FROM 2 MINUTES TO 15 MINUTES). IF THE PUMP IS ENABLED AND THE PUMP STATUS IS OFF A 'PUMP FAIL' ALARM SHALL BE INDICATED. IF THE PUMP IS DISABLED AND THE PUMP STATUS IS ON A 'PUMP IN HAND / MANUAL' ALARM SHALL BE INDICATED.

3. CHILLER CONTROL: THE CHILLER CHALL BE ENABLED WHENEVER THE CHILLED WATER SYSTEM IS ENABLED AND THE CHILLED WATER PUMP STATUS IS PROVEN AND THE CHILLED WATER PUMP HAS BEEN RUNNING FOR 5 MINUTES (ADJUSTABLE FROM 2 MINUTES TO 15 MINUTES). CHILLER STATUS SHALL BE MONITORED. CHILLER ALARM CONTACT SHALL BE MONITORED AND AN ALARM INDICATED UPON CONTACT CLOSURE.

4. CHILLED WATER TEMPERATURE SETPOINT: THE CHILLED WATER SETPOINT SHALL BE RESET VIA THE CHILLED WATER SETPOINT ACCESSED VIA THE LONWORKS COMMUNICATIONS INTERFACE. THE CHILLED WATER SETPOINT SHALL BE RESET BASED ON OUTDOOR AIR TEMPERATURE BASED UPON THE FOLLOWING SCHEDULE. WHEN OUTDOOR AIR TEMPERATURE IS EQUAL TO OR GREATER THAN 65F (ADJUSTABLE FROM 60F TO 70F) THE CHILLED WATER SETPOINT SHALL BE 44F (FIXED). WHEN THE OUTDOOR AIR TEMPERATURE IS EQUAL TO OR LESS THAN 55F (ADJUSTABLE FROM 50F TO 60F) THE CHILLED WATER SETPOINT SHALL BE 48F (FIXED). IF THE LONWORKS INTERFACE TO THE CHILLER BECOMES INOPERATIVE THE CHILLER SHALL DEFAUT TO ITS INTERNAL SETPOINT OF 44F. IF THE LONWORKS INTERFACE TO THE CHILLER BECOMES INOPERATIVE AN ALARM SHALL BE INDICATED.

5. CHILLED WATER SUPPLY & RETURN TEMPERATURE SHALL BE MONITORED. AN ALARM SHALL BE INDICATED IF THE CHILLED WATER SUPPLY TEMPERATURE IS 10F GREATER THAN SETPOINT AFTER THE CHILLED WATER SYSTEM HAS BEEN ENABLED FOR 30 MINUTES (ADJUSTABLE FROM 15 MINUTES TO 60 MINUTES).

Point Type	Controller Point	Point Name	Type	Default Value	Facets	Alarm	History	History Type	History Length
Hardware	UI-1	OA_TEMP	10K NTC Thermistor	0°F	Unit: degrees-Fahrenheit	NO	YES	Interval (15 Min)	500
Hardware	UI-2	CHWS_TEMP	10K NTC Thermistor	0°F	Unit: degrees-Fahrenheit	YES	YES	Interval (15 Min)	500
Hardware	UI-3	CHWR_TEMP	10K NTC Thermistor	0°F	Unit: degrees-Fahrenheit	NO	YES	Interval (15 Min)	500
Hardware	UI-4	MECH_RM_TEMP	10K NTC Thermistor	0°F	Unit: degrees-Fahrenheit	YES	YES	Interval (15 Min)	500
Hardware	UI-5	CHLR_STS	Current Sensor	OFF (0)	Boolean (ALARM; NORMAL)	NO	YES	Change of Value	100
Hardware	UI-6	CHLR_ALM	Contact Closure	NORMAL (0)	Boolean (ALARM; NORMAL)	YES	YES	Change of Value	100
Hardware	UI-7	CHWP_STS	Current Sensor	OFF (0)	Boolean (ON; OFF)	NO	YES	Change of Value	100
Hardware	UO-1	CHLR_ENA	RIB Relay	DISABLED (0)	Boolean (ENABLED; DISABLED)	NO	YES	Change of Value	100
Hardware	UO-2	CHWP_ENA	RIB Relay	DISABLED (0)	Boolean (ENABLED; DISABLED)	NO	YES	Change of Value	100
Software	nviSetpoint	EFF_CHW_STPT	Lonworks SNVT	44°F	Unit: degrees-Fahrenheit	NO	YES	Change of Value	100

CONSTANT VOLUME PRIMARY CHILLED WATER SYSTEM (1 CHLR, 1 CHWP)
POINTS LIST

FORT CAMPBELL MUSEUM CONTROLS CONCEPT SKETCHES			
TYPICAL CHW PLANT			
SIZE B	DATE 7/13/2023	DWG NO C-4	REV A
SCALE 1 : 1	DRAWN BY JAS	SHEET 4 OF 4	

Fig. 1 Constant Volume Primary Chiller System

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

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Section 23 81 00.00 10
Unitary Air Conditioning Equipment

Ft. Campbell Requirements:

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

2. Locate equipment to minimize piping runs.

3. Use only manufacturer standard sized package.

4. 24 Volt Digital Heat/Cool Thermostats wall mounted non programmable hardwired to units with large easy to view screen. (Remote thermostats are prohibited).

5. For PTAC, VTAC, Mini Splints etc., Provide a [vertical] [through-the-wall], [grade/floor mounted][wall mounted],[wall hung] [cassett] heavy-duty commercial grade, factory assembled and precharged [air conditioner] [heat pump] unit in accordance with [AHRI 390] [ANSI/AHRI/CSA 310/380] and UL 1995. Provide units listed in AHRI DCAACP.[Provide Units removable from inside the building for servicing without removing the outside cabinet.] Provide unit with a noise rating in accordance with AHRI 350 that does not exceed [85] dB while the entire unit is operating at any fan or compressor speed.[Heat pump units must contain a reversing valve to change unit to heating cycle.] Provide an outdoor coil temperature sensor to guard against coil freeze-up by either switching to supplemental heat only, or by cycling the compressor to defrost the coil. Provide [Air Conditioners][Heat pumps] with [a minimum [seasonal] energy efficiency ratio ([S]EER) of [_14_],] [a minimum Heating Seasonal Performance Factor (HSPF) of [__8.8_],] [a minimum Integrated Part Load Value (IPLV) of [_____],] and [a minimum COP of [_____].] [Provide units suitable for use with minimal ductwork having a total external static resistance up to 25 Pa 0.1 inch of water.]

------ 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.

24 Volt Digital Heat/Cool Thermostats wall mounted non programmable hardwired to units with large easy to view screen. (Remote thermostats are prohibited).

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

SECTION 23 81 29
Variable Refrigerant Flow HVAC Systems

Ft. Campbell Requirements:

For VRF (Variable Refrigerant Flow) Trane/Mitsubishi
Simultaneous heating and cooling system shall be 2-pipe throughout. Pipe size between the condenser and branch controller shall remain the same throughout. Branch Controller shall be provided with field installed full port ball valve and schrader port that will allow each air

handler to be individually serviced. All branch controllers to have bottom access for service. VRF system to actively monitor system operation and perform oil recovery only when necessary. Timed oil recovery is not allowed. In the event of power loss of one indoor unit the remainder of the system will keep running. In the event of power loss to any of the system it will auto reset when power is restored. Refrigerant piping temperature shall not exceed more than 200 ºF (Temperatures above 200 ºF require thicker insulation per IECC)

VRF System Contractor Design Drawings: The refrigerant piping system plans are required to be apart of the approval package by the manufacturer for complete system installations.

Instructions to Designers:

NOTE: VRF systems are manufactured with limited dehumidification and outside air ventilation capability. Selected systems must support an overall design that meets UFC 3-410-01 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS for dehumidification and ventilation requirements.

Section 23 82 01.00 10
Warm Air Heating Systems

Ft. Campbell Requirements:

Preferences: Furnaces – Trane/Carrier.

24 Volt Digital Heat/Cool Thermostats wall mounted non programmable hardwired to units with large easy to view screen. (Remote thermostats are prohibited).

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

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TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 25

Integrated Automation

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

Ft. Campbell Requirements:

1.0 Summary

The Fort Campbell Utility Monitoring and Control System (FC-UMCS) which performs supervisory monitoring and supervisory control of base-wide building control systems and utility control systems using the Niagara Framework with Fox protocol. Integrate field control systems installed per Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS or Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS to the UMCS via Niagara Framework Supervisory Gateways as specified.

System Architecture:

The Fort Campbell Utility Monitoring and Control System (FC-UMCS) System is comprised of 4 levels.

The FC-UMCS System Architecture is shown in Figure 1 below.

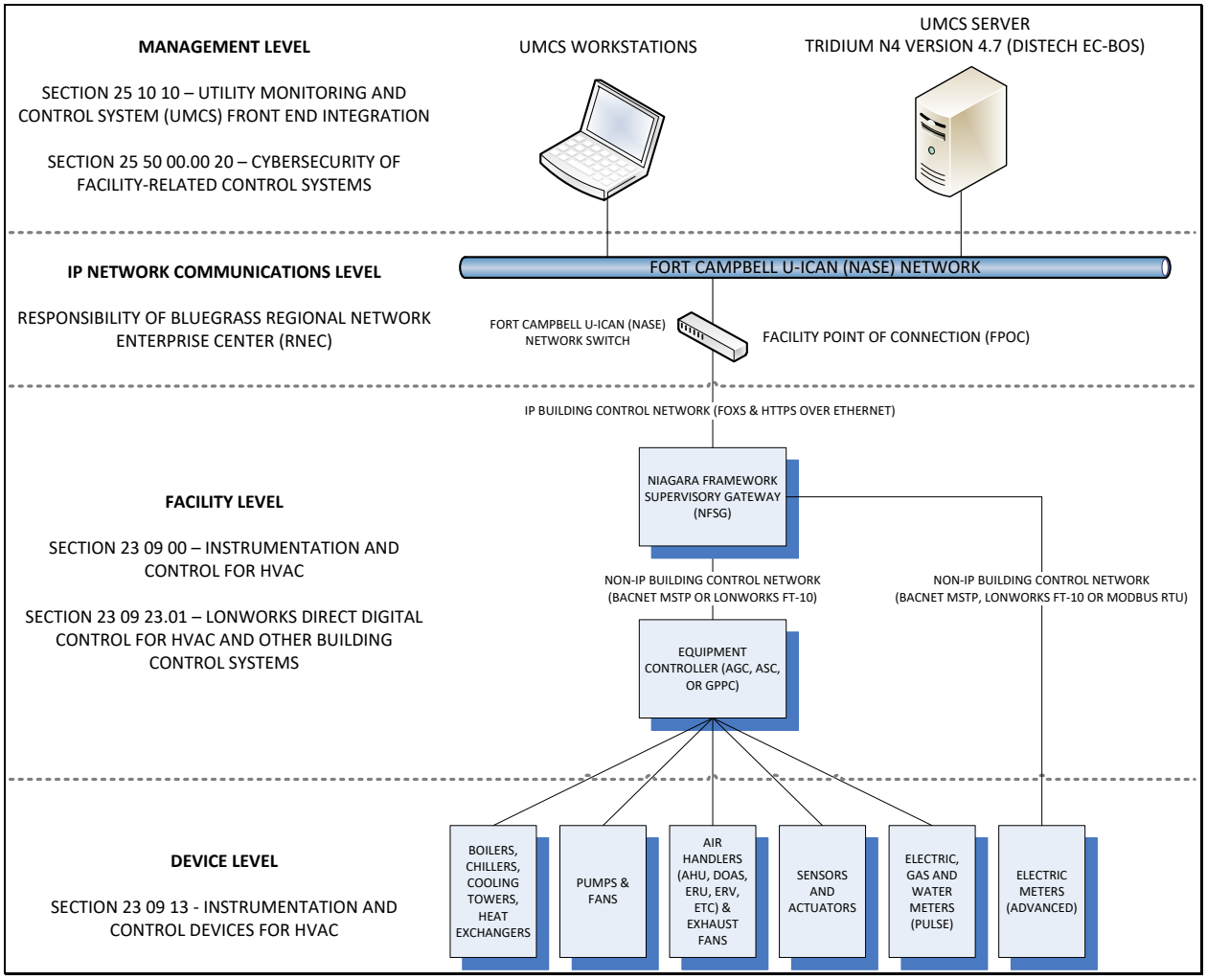

Figure 4 – FC-UMCS System Architecture

2.0 System Requirements

Provide Front End Integration for the existing FC-UMCS as specified and indicated, and in accordance with the following characteristics.

2.1 General System Requirements

a. All new building and major renovation projects shall include connection of HVAC control systems to the FC-UMCS unless directed otherwise.

b. The system performs supervisory monitoring and control functions including but not limited to Scheduling, Alarm Handling, Trending, Overrides, Report Generation, and Electrical Demand Limiting as specified.

c. The system includes a Graphical User Interface which allows for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, and access to all supervisory monitoring and control functions.

d. All software used by the FC-UMCS and all software used to install and configure the FC-UMCS is licensed to and delivered to the installation.

e. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software is licensed to and otherwise remains with the Government such that the Government or their agents are able to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor. Software licenses must not require periodic fees and must be valid in perpetuity.

f. Provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor.

g. The FC-UMCS interfaces directly to Niagara Framework field control systems as specified.

2.2 Niagara Framework Requirements

a. All Niagara Framework components have an unrestricted interoperability license with a Niagara Compatability Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "ALL" for "Station Compatibility In", "Station Compatability Out", "Tool Compatability In" and "Tool Compatability Out". Note that this will result in the following entries in the license.dat file:

```
accept.station.in="*"
accept.station.out="*"
accept.wb.in="*"
accept.wb.out="*"
```

b. The version of Niagara Framework used on this project must be N4 (Version 4.7.110.32) or later.

c. The UMCS must use the Niagara Framework and must communicate with Niagara Framework field control systems using the Secure Fox (FOXS) protocol and Secure HTTP (HTTPS) over the Government furnished IP network as indicated and specified..

d. The Contractor shall establish FOXS protocol communication link between the FC-UMCS front end server and the Niagara Framework Supervisory Gateway (NFSG) devices.

2.3 General Cybersecurity Requirements

Prior to initiating any work on site pertaining to the FC-UMCS each contractor employee who will work on programming or existing ICS infrastructure shall:

a. Apply for and obtain a Common Access Card (CAC).

b. Obtain an Fort Campbell Domain Account (FC-U-ICAN account) by completing and providing to Contracting Officer the following items:

- Form DD2875 – SAAR (FC-U-ICAN)
- Annual Department of Defense Information Assurance Awareness Training.
- Signed Acceptable Use Policy

c. Upon obtaining Fort Campbell domain account, obtain a Fort Campbell UMCS Account (FC-UMCS Account) by completing and providing to the Contracting Officer the following items:
- Form DD2875 – SAAR (FC-UMCS)
- Annual Department of Defense Information Assurance Awareness Training.
- Signed FC-UMCS Rules of Behavior
- Signed Acceptable Use Policy
- Proof of Tridium N4 Certification

Contractor should plan on the clearance activities listed above taking 12 weeks for personnel not already holding a Government security clearance. Clearance activities can take longer than 12 weeks for individuals found to have clearance issues during their background check.

Admin Rights: Contractors will not be granted full admin rights to any government-owned computer. Local accounts on government computers are not allowed; contractors whose personnel who have submitted their forms and have a proper background check or clearance will be granted FC-U-ICAN Domain accounts for their access needs for the duration of the project.

All types of removable media with the exception of writable CDs & DVDs are prohibited use with Government IT equipment (this includes USB “thumb” drives, USB hard drives, SD cards, etc).

The Contractor shall not connect contractor owned computer equipment to Fort Campbell Network (FC-U-ICAN), nor leave behind any telecommunication infrastructure (i.e., cellular modems) that allows remote access into installed equipment. Contractor owned laptops that are used to configure the Niagara Framework Supervisory Gateway (NFSG) devices shall be connected only to the secondary port of the NFSG. The secondary port of the NSFG shall have its IP settings configured to 192.168.1.140/24.

Provide secure password protection for each device/system. Password information shall be need-to-know, and the Contractor shall not disclose it to others. Password information shall be submitted via hard copy correspondence or CD to the Contracting Officer. Passwords shall not be conveyed by e-mail or 3rd party means.

If at any of the above security requirements are violated, the individual(s) will have (at a minimum) their Government computer access privileges revoked. All IT related possessions may be confiscated pending an investigation.

2.4 FC-UMCS Network

Upon request by the Contractor, the Government will provide IP addresses for each Niagara Framework Supervisory Gateway (NFSG) device. The Contractor shall first provide a spreadsheet with the MAC address, serial number, device nomenclature, firmware revision, planned port on switch to which it is connected, system function being served by each device installed, and a blank field for the IP address. The FC-UMCS ISO will provide a blank template spreadsheet for completion by the Contractor. The government will return the spreadsheet to the Contractor with IP addresses filled in. IP addresses will not be provided electronically.

2.5 FC-UMCS Programming Software

For software used for controllers below the supervisory controller and is not already existing on site, the Contractor shall provide 6 copies of the software.

For software used to program and create graphical content on the supervisory controller and is not already existing on site, the Contractor shall provide 3 copies of the software.

The installed version of the programming software for each device shall be licensed to Fort Campbell DPW. Software shall be submitted on CD or DVD, and one hard copy and one electronic copy of the software user manual shall be submitted for each piece of software provided.

2.6 Software Requirements

2.6.1 Graphical System Displays

Develop graphical system displays on both the FC-UMCS server and the Niagara Framework Supervisory Gateways.

Provide graphical displays consisting of building system (air handler units, boilers, chillers, cooling towers, dedicated outside air units, energy recovery ventilators, exhaust fans, fan coil units, pumps, VAV boxes, etc.) graphic displays. Data associated with an active display must be updated at least once every 5 seconds.

2.6.2 Navigation Scheme:

System graphic displays of building systems and points must be hierarchical displays using a building-to-equipment point-and-click navigation scheme which allows navigation from a garrison-wide display, through a building-wide display to the individual units. Each display must show the building name and number. Each display must show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

a. For each Building or Building Sub-Area display, show the building foot print and basic floor plan, and clearly show and distinguish between the individual zones and the equipment serving each zone and space. Show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. Show the locations of individual pieces of monitored and controlled equipment.

b. For each equipment display show a 3-dimensional representation of the individual pieces of equipment using the symbols and point data types as specified. Use different colors and textures to indicate various components and real time data. Use consistent color and texture meanings across all displays.

c. Provide displays which clearly distinguish between the following point data types and information:

- Real-time data.
- Other user-entered data.
- Devices in alarm (unacknowledged).
- Out-of-range, bad, or missing data.
- Points which are overridden.

2.6.3 Scheduling

The Contractor shall route required alarms from the NFSG devices to the appropriate master occupancy and master holiday schedules located on the UMCS front end server.

2.6.4 Alarms

The Contractor shall route required alarms from the NFSG devices to the appropriate alarm class on the UMCS front end server.

2.6.5 Trending

The Contractor shall configure automatic archiving of the historical trends from the NFSG devices to the UMCS front end server. Archiving shall occur at minimum once every 8 hours.

2.6.6 Electrical Power Demand Limiting

The Contractor shall obtain the electrical power demand limiting signal from the UMCS front end server. This signal shall be utilized to activate zone temperature set-point offsets. Upon receipt of a level 1 demand limiting signal all zone temperature set-points shall be raised by 2° F. Upon receipt of a level 2 demand limiting signal all zone temperature set-points shall be raised by 4° F. Upon receipt of a level 3 demand limiting signal all zone temperature set-points shall be raised by 6° F. Other electrical power demand limiting strategies may be required for specific projects as specified.

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

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TECHNICAL DESIGN GUIDE
CHAPTER 3
Technical Requirements and Instructions
Division 26
Electrical

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. The contractor shall submit designs for review starting not later than the fifty-percent (50%) design.

   2.3. Manufacturer equipment cut sheets shall be provided not later than the 50% design review.

   2.4. The contractor shall submit designs for final review at least at the ninety-five percent (95%) design.

   2.5. Directorate of Public Works (DPW) reserves the right to approve or reject design submittals at any stage in the design process.

   2.6. DPW review includes that by the DPW System Engineers/Managers.

2.7. Rejected designs, once corrected, shall be resubmitted by the contractor for further review by DPW.

2.8. All parent Codes, Standards and Regulations apply and are incorporated by reference now and throughout this document.

2.9. 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.

2.10. 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.

2.11. References may be given throughout this document contained within a Reference Box.

2.12. 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, and Engineering Design Branch at Fort Campbell, KY.

3. GENERAL REQUIREMENTS AND CONDITIONS

3.1. CONTENTS

a. Permit Requirement
b. Inclusion of Codes, Guidelines, Regulations, Specifications and Standards
c. Exterior Distribution Operating Parameters Outages (Electrical Power Interruptions)
d. And Operational Considerations
e. Standardization
f. Passwords, Access Codes And Keys
g. Equipment Locks
h. Special Tools Or Peripheral Equipment
i. Specialized Training
j. Vehicle Access Requirements
k. Geospatial Location of Underground & Overhead Equipment
l. Vegetation Management Program
m. Reliability, Availability, And Maintainability (RAM)
n. Equipment Removal List
o. 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,
  - 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

a. City Light & Power (CLP) are System Owner under Contract #SP0600-17-C-8325, Award date: 09/29/2017. POC Bldg. 5138 1st Street & Wickham Ave. #270-698-8970.

b. 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 (CLP) employees, unless express, written permission is given as described below.

c. Fort Campbell electrical system equipment includes, but is not limited to, any installed Government exterior electrical equipment (e.g. jacks, switches, etc.).

d. 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.

e. 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)).

f. An inspection shall be made by a Fort Campbell's electrical inspector prior to any connecting to the Fort Campbell electrical system equipment.

g. The inspector shall give both verbal and written notification of either a passed or failed inspection.

h. Any deficiencies to the installation identified in the Inspection shall be corrected prior to a connection activity.

i. Another inspection shall be made after all corrections have been accomplished.

j. No connection activity shall be made prior to the installation passing the inspection.

k. 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:

a. Necessary to perform work safely, the mission need is not compromised, properly coordinated, and timely public notification is given to impacted units/customers.
b. 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:

a. Give DPW-COR for CLP at least a forty-eight (48) hour notice of the changes,
b. Provide the DPW-COR with a detailed list of changes or configurations needed,
c. Require a pre-configuration change briefing for contractor personnel and DPW-COR.
d. 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 CLP unless otherwise authorized.

3.6.5. Outage Coordination

Contractor shall coordinate with the CLP and Fort Campbell Housing office to schedule all outages necessary to perform work safely. See below for outage requirements in the housing areas:

a. The contractor(s) shall meet with CLP personnel to coordinate all outages and to discuss outage purpose and length.

b. The contractor shall give CLP at least a twenty- four (24) hour notice of outage requirements.

3.6.6. Outages In Housing Areas

a. Fort Campbell Housing office requires a minimum three (3) day notice prior to any scheduled outage.
b. 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 PW-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:

a. Necessary tools or equipment shall be provided to the DPW, and shall be new at the time of transfer.
b. Necessary interface devices (e.g. computer-based interfaces) shall be provided to the DPW, and shall be new at the time of transfer.
c. 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:

i. International Freightliner
ii. Model: 7400 SBA
iii. Date: 9 Oct 2006
iv. Drive: 6x4
v. Wheelbase: 675cm - 22.15 feet
vi. GVWR: 58,000 Lbs.
vii. Front Axle: 18,000 lbs
viii. Rear Axle: 40,000 lbs
ix. Overhang: ~9 feet
x. Turning Radius: ~40 feet

3.12.1. 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.

3.12.2. 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.

3.12.3. 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.

3.13. Geospatial Location of Underground & Overhead Equipment

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:

a. 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.

b. 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 1988NAVD1988).

c. 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).

3.13.1. 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 powerlines 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.

- **All Persons must have verbal approval to take video, still or digital photos (including a cell phone) on any part of 160th SOAR Compound. The Regimental Engineer and or 160th Security S-2 will view any media before leaving the Compound.**

- 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.

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 ≥ 1,000V and ≤ 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.

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

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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 of 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.

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

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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 manufacturer’s 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.

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

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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.

4.23. Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer. 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 / 65ºC
- 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 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 120 VAC 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, and 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 luminaries, 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 an 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 guest 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 ether 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 enclosures 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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Section 26 20 00
Interior Distribution System

Ft. Campbell Requirements:

4.48. 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.

4.49. WIRING

NM cable (Romex) is prohibited from being used on Fort Campbell.
All conductors AWG10 and smaller shall be “solid” THHN type.

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.
- Minimum grounding shall be AWG 4.
- Ground rods 5/8” x 10’ shall be required.
- 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).
- Grounding shall 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:

BOLT ON CIRCUIT BREAKERS

- Circuit breakers for distribution panels/load centers shall be bolt-on style regardless of location.

Instructions to Designer:

UFC 3 520 01
Distribution and branch circuit panelboards should be of the wall-mounted, dead-front type, equipped with \1\bolt-on/1/ circuit breakers. \1\/1/Load center style panelboards, with **plug-in breakers** should be used only where eight or fewer circuits are supplied, and where **light duty** can be expected, except as authorized for military family housing. \1\Panelboards and load center style panelboards must be fed from a dedicated circuit and circuit breaker./1/.
Light duty requiments:

- Any equipment like Access Control Points (ACP) (Guard Shacks) that have been designed and manufactured with plug in breaker panels to run light duty HVAC or lighting can be used if equipment is connected to exterior sub-panel.

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

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Section 26 27 13.10 30
Electric Meters

Ft. Campbell Requirements:

METERING

City Light & Power (CLP) are System Owner under Contract #SP0600-17-C-8325,

Award date: 09/29/2017. POC Bldg. 5138 1st Street & Wickham Ave. (#270-698-8970).

Electrical Privatization Contracting Officer Representative (COR), Directorate of Public Works, (#270-798-0819).

- Contractors shall address specific metering requirements with the Fort Campbell Energy/Utilities Branch.
- 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 (1999el) 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 Cummins 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 ±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 operation, maintenance and shop/technical manuals shall be submitted and approved prior to commencing onsite tests. Copies of the manufacturers standard operation, maintenance and shop/technical manuals 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 plastic dividers with tabs and identified by a Table of Contents. Drawings shall be folded, with the title block visible, and placed in plastic pockets with reinforced holes.

Information Required

a. Basic procedures for each routine maintenance item, procedures for troubleshooting, factory services details, procedures for takedown/overhaul, and repair service manuals containing 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.

d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

e. Two (2) hard copies of all manuals and one (1) complete copy of all manuals on CD shall be permitted instead of 3 hard copies.

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.

- 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° C (400° 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, 204° 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 form 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 the 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 charters. 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:

    a) Active shutdowns and warnings shall be displayed if present and without the need of operator interface.

    b) Engine runtime with total hours.

    c) Average line to line voltage.

    d) Coolant temperature.

    e) Fuel level or pressure.

    f) Oil pressure.

    g) Battery Voltage.

    h) Software version.

    i) Frequency.

    j) 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-amps, 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 4O 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 drop 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] [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
overfill 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 Cummins 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 ± 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 shall be cleaned of dust and debris.

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 manufacturers 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 manufacturers 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 manufacturers 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 manufacturers 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 manufacturers 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 manufacturers 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 manufacturers 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 operating procedures will be followed. Engine pre-start checks and inspections shall be performed and recorded. The engine shall be started and after-starting checks and inspections shall be performed and recorded during a reasonable warm-up period. During engine run time, the output line to line and line to neutral voltage and frequency shall be recorded after stabilization of voltage and frequency. Note: Stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances for a minimum of four consecutive readings.

a. To load the engine-generator, apply load in steps no larger than the Maximum Step Load Increase per manufacturer’s recommendation not to exceed 80% of total rated load.

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 manufacturers 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.

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UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM ABOVE 15 KVA CAPACITY

Ft. Campbell Requirements:

1. 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).

2. UPS RUNTIME REQUIREMENTS
   - All UPS units running time shall be at least 10 minute running time.

3. UPS RUNTIME AIRFIELDS
   - All UPS units running time shall be at least 25 (twenty-five) minute running time.

4. UPS COOLING REQUIREMENTS
   - For proper HVAC sizing, manufacturers 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 -----

26 35 33.00 40
POWER FACTOR CORRECTION EQUIPMENT

Ft. Campbell Requirements:

1. 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.

2. 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.

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Section 26 41 01.00 10

Ft. Campbell Requirements:

Lightning Protection System

6. FACILITIES REQUIRING LIGHTNING PROTECTION SYSTEMS

- Priority level 1. Must have lighting protection.
- Any facility involved with children, example schools or child development structures
- Communications facilities
- Facilities which houses large amounts of computer processing equipment
- Faculties 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

7. 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.

8. 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.

9. 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.

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Section 26 51 00
Interior Lighting

Ft. Campbell Requirements:

1. Comply with National Energy Policy Act and Energy Star requirements for lighting products.
2. Prohibited lighting will include any LED bulb with Polycarbonate tube structure.

Section 26 56 00
Exterior Lighting

Ft. Campbell Requirements:

1. DESIGN REQUIREMENTS
- Lighting system shall be established in accordance with NFPA 101, UFC 3-530-01, and the IES Handbook.

2. FULL CUTOFF
- All exterior light fixtures used must be full cutoff luminaries and meet LEED night sky initiatives.

3. 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. 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.

5. 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.

6. 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.

7. 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.
- For listed lights with different lens selections, designers & contractors may choose the lens which fits the intended, installed application.
- 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.

8. 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.

9. EXTERIOR LIGHTING INSTALLATION AND SAFETY
- Lighting choice and installation should address maintenance personnel safety, especially when working on lights in inclement weather.

10. 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.

11. 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.

12. LIGHTING CONTROL - TIMERS

- Timers shall not be used for lighting control.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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.

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Section 26 60 13.00 40
LOW-VOLTAGE MOTORS

Ft. Campbell Requirements:

1. 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).

2. 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

Ft. Campbell Requirements:

General:

The Director of the Regional Network Enterprise Center (RNEC), Fort Campbell, will enforce the following standards for the Fort Campbell *Information Technology (IT) Technical Design Guide:*

- RNEC will review and approve all proposed communications requirements for Inside Plant (ISP), Outside Plant (OSP), fiber, copper, and all requirements for connectivity into Fort Campbell's telecommunications infrastructure.

- RNEC requires all contracts performing telecommunications construction or deconstruction by a civilian contractor to follow the Unified Facilities Criteria (UFC 3-580-01) dated JUNE 2016 for interior infrastructure (ISP) and the Installation Information Infrastructure Architecture (I3A) Chapter 3 dated February 2010 for exterior infrastructure (OSP) along with the guidelines detailed in this Fort Campbell Technical Design Guide document which

are specific to Fort Campbell. These shall be used as the technical telecommunications criteria for planning and design. Any and all requirements in these standards apply equally to on-site employees and to US Government contractors.

- RNEC requires designers and contractors to coordinate with a RNEC Planner and tenant organizations to ensure that all communications requirements are being met in accordance with this standard.

- Utilities and their distribution lines shall follow existing road corridors and shall not exceed 15' from edge of pavement until a point of embarkation to a facility, unless otherwise stated in contract requirements. Master Planning and /or Engineer Design Branch Site approval is required prior to deviating.

Contractor Requirements:

- The Contractor is required to contact the RNEC as per the UFC 3-580-01 prior to connecting any facility on Fort Campbell to the telecommunications infrastructure.

- All Contractors are required to contact the RNEC before 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.

References

- The publications listed below form a part of these Division 27 UFGS specifications to the extent referenced. The publications are referred to within the text by the basic designation only.

- **Telecommunications Industry Association (TIA)**

    - TIA-455-21
        - *FOTP-21 – Mating Durability of Fiber Optic Interconnecting Devices*
    - TIA-455-33
        - *Optical Fiber Cable Tensile Loading and Bending Test*
    - TIA-568.1-E
        - *Commercial Building Telecommunications Cabling Standard*
    - TIA-568.2-D
        - *Balanced Twisted-Pair Telecommunications Cabling and Components Standards*
    - TIA-568.3-D
        - *Optical Fiber Cabling Components Standard*
    - TIA 569
        - *Commercial Building Standard for Telecommunications Pathways and Spaces*
    - TIA-598
        - *Optical Fiber Cable Color Coding*
    - TIA-604-2
        - *Fiber Optic Connector Intermateability Standard*
    - TIA-604-3
        - *Fiber Optic Connector Intermateability Standard (FOCIS), Type SC and SC-APC, FOCIS-3*
    - TIA-604-10
        - *FOCIS 10 Fiber Optic Connector Intermateability Standard - Type LC*
    - TIA-604-12
        - *FOCIS 12 Fiber Optic Connector Intermateability Standard Type MT-RJ*
    - TIA-606

        - *Administration Standard for the Telecommunications Infrastructure*
    - TIA-607
        - *Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises*
    - TIA-758-B
        - *Customer-Owned Outside Plant Telecommunications Infrastructure Standard*
    - TIA-4750000-C
        - *Generic Specification for Fiber Optic Connectors*

- **AMERICAN SOCIETY FOR TESTING AND MATERIALS**

    - ASTM D4976
        - *Standard Specification for Polyethylene Plastics Molding and Extrusion Materials*

- **UNDERWRITER LABORATORIES (UL)**

    - UL 444
        - *Communications Cables*
    - UL 467
        - *UL Standard for Safety Grounding and Bonding Equipment*
    - UL 1666
        - *Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*
    - UL 1863
        - *UL Standard for Safety Communication Circuit Accessories*

- **NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

    - NFPA 70
        - *National Electrical Code*

- **INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)**

- ICEA S-83-596
  - *Indoor Optical Fiber Cables*
- ICEA S-90-661
  - *Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables for Use in General Purpose and LAN Communications Wiring Systems Technical Requirements*
- ICEA S-166-732-2019
  - *Defines minimum electrical performance and allowable conductor sizes, stranding and shielding for premise wiring cables for voice and data applications for 100 ohm shielded and unshielded twisted pair cables*

- **ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)**
  - ECIA EIA/ECA 310-E
    - *Cabinets, Racks, Panels, and Associated Equipment*
- **U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)**
  - FCC Part 68
    - *Connection of Terminal Equipment to the Telephone Network (47 CFR 68)*
- **UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS) SPECIFICATIONS**
  - Section 26 20 00
    - *Interior distribution system*
  - Section 07 84 00
    - *Fire-stopping*
- A complete listing of Unified Facilities Guide Specifications (UFGS) Division 27 specifications can be found within the Whole Building Design Guide at: https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs

- UFGS 27 05 13.43 (Television Distribution System)
- UFGS 27 05 28.36 40 (Cable Trays For Communications System)
- UFGS 27 05 29.00 10 (Protective Distribution System (PDS) For SIPRNET Communications Systems)
- UFGS 27 10 00 (Building Telecommunications Cabling Systems)
- UFGS 27 13 23.00 40 (Communications Optical Backbone Cabling)
- UFGS 27 21 00.00 20 (Intercommunicatoin System)
- UFGS 27 21 00.00 40 (Intercommunicatoin System)
- UFGS 27 21 10.00 40 (Fiber Optic Data Transmission System)
- UFGS 27 51 16 (Public Address Systems)
- UFGS 27 51 23.10 (Intercommunicatoin System)
- UFGS 27 52 24 (Nurse Call System)
- UFGS 27 53 19.13 (First Responder Distributed Antennae Systems (DAS))

Section 27 10 00
Building Telecommunications Cabling System

Ft. Campbell Requirements:

General:

- Telecommunications Contractor:
    - The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment.
- Key Personnel
    - Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems

and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems

- Test Plan
    - Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified prior to the proposed test date. Include procedures for certification, validation, and testing.
- Standard Products
    - Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship.

Common Products and Components:

- Telecommunications pathway:
    - Provide telecommunications pathways in accordance with TIA-569 and as specified in UFGS Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide system furniture pathways in accordance with UL 1286.
- Backbone Copper
    - Copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, minimum 25-pair, Category 3, UTP, in accordance with ICEA S-90-661, TIA-568.1-E, TIA-568.2-D and UL 444, formed into 25 pair binder groups covered with a gray thermoplastic jacket [and overall metallic shield]. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular length marking intervals in accordance with ICEA S-90-661. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70.

- Backbone Optical Fiber

    - Provide in accordance with ICEA S-83-596, TIA-568.3-D, UL 1666 and NFPA 70. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 1 meter 40 inches.

    - Provide the number of strands indicated, (but not less than 12 strands between the main telecommunication room and each of the other telecommunication rooms), of single-mode (OS1) fiber optic cable.

    - Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be in accordance with TIA-598.

- Horizontal Copper

    - Provide horizontal copper cable, UTP, 100 ohm in accordance with TIA-568.2-D, UL 444, ANSI/NEMA WC 66, ICEA S-90-661, and ICEA S-166-732-2019. Provide four each individually twisted pair, minimum size 24 AWG conductors, Category 6, with a green thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling in accordance with NFPA70.

- Horizontal Optical Fiber

    - Provide optical fiber horizontal cable in accordance with ICEA S-83-596 and TIA-568.3-D. Cable shall be tight buffered, single-mode, 8/125-um diameter, OS1. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 1 meter 40 inches.

    - Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70.Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA

70. The cable jacket shall be of single jacket construction with color coding of cordage jacket, fiber, unit, and group in accordance with TIA-598.

- Equipment Support Frame
    - Racks:
        - Floor mounted modular type, 16 gauge steel or 11 gauge aluminum construction, minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and a surge protected power strip with 6 duplex 20 amp receptacles. Rack shall be compatible with 482.6 mm (19 inches) 584 mm (23 inches) panel mounting.
    - Cabinets
        - Freestanding modular type, 16 gauge steel or 11 gauge aluminum construction, minimum, treated to resist corrosion. Cabinet shall have removable and lockable side panels, front and rear doors, and have adjustable feet for leveling.
          Cabinet shall be vented in the roof and rear door. Cabinet shall have cable access in the roof and base and be compatible with 482.6 mm (19 inches), 584 mm (23 inches) panel mounting. Provide cabinet with grounding bar, rack or roof mounted 15 cu. m 550 CFM fan with filter, and a surge protected power strip with 6 duplex 20 amp receptacles. All cabinets shall be keyed alike.
        - Wall-mounted modular type, 16 gauge steel or 11 gauge aluminum construction, minimum, treated to resist corrosion. Cabinet shall have lockable front and rear door[s], louvered side panels, 7 cu. m 250 CFM roof or rack mounted fan, ground lug, and top and bottom cable access. Cabinet shall be compatible with 482.6 mm (19 inches), 584 mm (23 inches) panel mounting. All cabinets shall be keyed alike. A duplex AC outlet & surge protected power strip with 6 duplex 20 amp receptacles shall be provided within the cabinet.
- Connector Blocks
    - Type 66 blocks are not permitted for new construction. Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare.
- Cable Guides

- NOTE: This paragraph does not apply for single family residential installations.

- Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 482.6 mm (19 inches), 584 mm (23 inches) equipment racks, cabinets and telecommunications backboards. Cable guides of ring or bracket type devices mounted on rack, cabinet, panels, and backboard for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws and/or nuts and lock washers.

- Patch Panels

  - Provide ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized optical fiber and copper patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified. Provide fiber optic patch cables with crossover orientation in accordance with TIA-568.3-D. Patch cords shall meet minimum performance requirements specified in TIA-568.1-E, TIA-568.2-D and TIA-568.3-D for cables, cable length and hardware specified.

- Modular to 110 Block Patch Panel

  - Provide in accordance with TIA-568.1-E and TIA-568.2-D. Panels shall be third party verified and shall comply with TIA Category 6 requirements. Panel shall be constructed of 2.2 mm (0.09 inches) minimum aluminum and shall be cabinet, rack, and/or wall mounted and compatible with an ECIA EIA/ECA 310-E 482.6 mm (19 inches), 584 mm 23 inches) equipment cabinet or rack. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568A. Patch panels shall terminate the building cabling on Type 110 (Insulation Displacement Contact) IDC and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

- Fiber Optic Patch Panel

  - Panel shall be constructed of 16 or 18 gauge steel or 11 gauge aluminum minimum and shall be cabinet, rack or wall mounted and compatible with a ECIA EIA/ECA 310-E 482.6 mm (19 inches), 584 mm (23 inches) equipment rack. Each panel shall provide a minimum of 12 single-mode adapters as duplex LC in accordance with TIA-604-10 with zirconia ceramic alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of 203 mm (8 inches) deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have

each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

- Optical Fiber Distribution Panel

    - Cabinet, rack, and/or wall mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with ECIA EIA/ECA 310-E utilizing 16 or 18 gauge steel or 11 gauge aluminum minimum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides, splice tray and shall be lockable, user section shall have a cover for patch cord protection. Each panel shall provide 12 single-mode pigtails and adapters. Provide adapters as duplex LC with zirconia ceramic alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS.

- Outlet/Connector Copper

    - Outlet/connectors shall comply with FCC Part 68, TIA-568.1-E, and TIA-568.2-D. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568.2-D Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements and match the color for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired in accordance with T568A as indicated. UTP outlet/connectors shall comply with TIA-568.2-D for 200 mating cycles. UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.

- Optical Fiber Adapters(Couplers)

    - NOTE: LC style adapters and connectors are the default standard for new construction.

    - Provide optical fiber adapters suitable for duplex LC in accordance with TIA-604-10 with zirconia ceramic alignment sleeves, duplex SC in Accordance with TIA-604-3 with zirconia ceramic alignment sleeves, MT-RJ in accordance with TIA-604-12 with thermoplastic alignment sleeves, and ST in accordance with TIA-604-2 with metallic alignment sleeves] as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with TIA-455-21 for 500 mating cycles.

- Optical Fiber Connectors

- NOTE: Do not use ST style connectors for new construction unless specifically required for interface with existing equipment reused on installations.

- Provide in accordance with TIA-455-21. Optical fiber connectors shall be duplex LC in accordance with TIA-604-10 with zirconia ceramic alignment sleeves, duplex SC in accordance with TIA-604-3 with zirconia ceramic, MT-RJ in accordance with TIA-604-12 with thermoplastic, or ST in accordance with TIA-604-2 with metallic ferrule, non-epoxy crimp style compatible with 62.5/125 and 50/125 multimode, and 8/125 single-mode fiber. The connectors shall provide a maximum attenuation of 0.3 dB at 850, 1300, 1310, and 1550 nm with less than a 0.2 dB change after 500 mating cycles.

- Cover Plates

  - Telecommunications cover plates shall comply with UL 514C, and TIA-568.1-E, TIA-568.2-D, TIA-568.3-D. Cover plates shall be flush mounted, single gang, constructed of high impact thermoplastic material ivory in color and have a minimum of 4 ports for outlet/connector connection. Provide labeling in accordance with TIA-606.

- Grounding and Bonding Products

  - NOTE: Indicate grounding and bonding components and conductor sizes on drawings. Use Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

  - Provide in accordance with UL 467, TIA-607, and NFPA 70. Components shall be identified as required by TIA-606. Provide ground rods, bonding conductors, and grounding bus-bars as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

- Fire-Stopping Material

  - NOTE: Fire-stopping material requirements are specified in Section 07 84 00 FIRESTOPPING.

  - Provide as specified in Section 07 84 00 FIRESTOPPING.

The Items listed in this Section 27 10 00 Building Telecommunications Cabling System are commonly used products and components requirements specific to Fort Campbell. Consult the Fort Campbell Technical Design Guide Appendix H, the complete UFGS 27 10 00, project PWS, and Fort Campbell Regional Enterprise Center (RNEC) for clarification on products and

components not listed in this document. Any deviations for products and components listed in this Section 27 10 00 shall require approval from Fort Campbell RNEC.

The Complete UFGS 27 10 00 and all other Division 27 UFGS section specifications may found at the following link: https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs

Section 27 13 23.00 40
Communications Optical Backbone Cabling

Ft Campbell Requirements:

- Single Mode Fiber Media
    - Provide FO single mode media with outer sheath jacket, strength member, ripcords, water blocking material, steel shield, core tube, and core fibers as installed in a permanent underground pathway system as shown on the construction drawings. Provide media with all glass, dual window, graded index material with a core diameter of 8.7 microns. Coat fiber with a cladding material which is concentric with the core. Ensure fiber cladding diameter is a nominal 125 microns, and media has a transmission window centered at 1300 and 1550 nanometer wavelengths. Attenuation at 1550 nanometers is less than 0.5 dB per kilometer. Verify FO media complies with TIA-758-B.

- Fiber Optic Cable Construction
    - Inner Jacket
        - Locate buffer tubes concentrically around the cable central core member and covered with a polyethylene inner jacket. Ensure inner jacket is high or medium density polyethylene in accordance with ASTM D4976. Fill space between the buffer tubes and inner jacket with a gel compound to prevent air, moisture, or water intrusion in the inner jacket.

- Pulling Strength Member
    - Use aramid type material as pulling strength members in the cable to provide pulling strength of at least 1800 newton (400 pounds) for the cable during installation.
- Cable Outer Jacket
    - Apply black high/medium density, high-molecular weight, polyethylene materials in accordance with ASTM D4976 longitudinally over all the inner jacket and sheathing strength member to form the cable outer jacket. Ensure outer jacket is smooth, concentric, non-nutrient to fungus, and free from holes, splits, blisters, or other imperfections.
- Metallic Armor
    - Provide a metallic armor shield for direct buried cable for additional tensile strength, rodent protection, and high crush and moisture resistance. Provide metallic armoring of metallic tube or steel corrugation-coated with anti-corrosion material, sealed at the longitudinal overlap.

- Pre-Connected Cable Assembly
    - Provide factory assembled pre-connectorized cable assembly to interface with the patch panel bulkhead feed-through receptacle. Provide dust caps for all terminated fibers. Ensure single fiber optic cable assembly is comprised of a single fiber connector terminated on the three (3) meter length of single fiber, single mode cable. Single fiber cable contains a buffered optical fiber, the same as that provided in the multi-fiber cable.
- Optical Patch Panel Assemblies
    - Provide all cable terminations in optical patch panel assemblies, with patch panel assemblies of the pre-assembled chassis type with associated rack-mounting hardware. To facilitate the transition between outside plant cable and the preconnectorized cable assemblies, ensure the fibers are fusion spliced and housed in a splice tray. Position splice tray in the optical patch panel assembly as indicated. Cover splice with a protective sleeve.
- Fiber Optic Enclosures

- Provide metallic enclosures for fiber optic data transmission equipment. Use NEMA 250, type 4, enclosure in non-climate controlled and outdoor areas. Protect the spliced fibers from moisture and physical damage. Splice closure provides strain relief for the cable and the fibers at splice points. Provide full documentation citing conformance to structural parameters.

- Fiber Optic Terminations And Connectors

  - FO connectors to comply with TIA/EIA-4750000-C and TIA-604-3.

- Central Core Member

  - Include a central core member to serve as a cable core foundation to reduce strain on the fibers but not to serve as a pulling strength member. Ensure material of the central core member is non-metallic.

- Optical Fibers

  - Provide single-mode fiber within the cable as follows:

    - Provide Single-Mode (SM) fiber with a fiber core diameter of approximately 8.7 micrometer. Cladding diameter is 125 plus or minus 3 micrometer with core cladding offset less than 1 micrometer. Ensure minimum tensile strength of the fiber after primary protective coating is greater than 350,000 kilopascal 50,000 psi.
    - Loose Tube Buffering

    - Surround color-code coated fibers with a loose tube buffering for protection from external mechanical and environmental influences. Fill interior of the tube with a suitable gel-fitting compound to prevent water migration. Color code loose tube buffering for the tube identification.

- Minimum Bend Radius

  - Provide cable which withstands bending to a minimum radius of 10 times the cable outer diameter without tensile load applied, and of 20 times the cable outer diameter with maximum tensile load applied (during installation), without damage to cable components or degradation of the optical fiber performance at room temperature.

- Tensile Strength

    - Provide fiber optical cable which withstands a pull force of at least 1800 newtons (400 pounds) to be applied to the pulling strength member during the installation, and a tensile load of at least 300 newtons during operation without incurring any damage or detriment to fiber optical cable and optical performance. Ensure tensile strength test is in accordance with TIA-455-33.

The Items listed in this Section 27 13 23.00 40 Communications Optical Backbone Cabling are commonly used products and components requirements specific to Fort Campbell. Consult the Fort Campbell Technical Design Guide Appendix H, the complete UFGS 27 13 23.00 40, project PWS, and Fort Campbell Regional Enterprise Center (RNEC) for clarification on products and components not listed in this document. Any deviations for products and components listed in this Section 27 13 23.00 40 shall require approval from Fort Campbell RNEC.

The Complete UFGS 27 13 23.00 40 and all other Division 27 UFGS section specifications may found at the following link: https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs

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

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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 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**.

Instructions to Designers:

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).

Installation of ICIDS Equipment in Arms Rooms and COMSEC vaults shall be in Accordance with instructions found in Appendix I.

------ 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. All Facilities greater than 5,000 sq.ft. or more than two stories in height, must have at least one means of all-weather ground access to allow emergency vehicles unimpeded

access to the Facility. All-weather ground access must be paved, start from the road, and terminate no farther than 33 feet from an exterior door accessible for fire department ingress (i.e. a stair door or some other exterior door that provides access to the Facility interior). The route between the access surface and exterior door must be able to be traversed without the use of a ladder. Additional access may be required based on location, size, or use of the facility if determined by AHJ.

c. All force protection equipment, such as bollards, or gates, must not require more than one person to remove or open. Access may require fire apparatus to drive over a curb. Any locking device controlling vehicle access must be under control of the fire department or 24-hour security personnel located at the specific Facility. Dimensions of fire land and turnarounds must comply with NFPA 1. Vehicle access must be coordinated with the Installation Fire Department.
d. Facilities with fire department connections for fire suppression systems must be provided with suitable all-weather ground access surface for any apparatus within 150 feet of such fire department connections.

1-2. Aerial Access

a. New facilities four stories or more in height and all new warehouses must be provided with suitable all-weather ground access for aerial apparatus on a minimum of two sides of the perimeter of the structure.
b. The access for buildings four stories or more in height must be parallel to at least one entire side of the Facility with windows or other openings to allow aerial access for fire department ingress to the entire side. The distance between the aerial apparatus access and the Facility must be based on the responding aerial apparatus and Facility height and be approved by the DFPE. Additional access may be required based on location, size, or use of the facility if determined by AHJ.

Note: The intent of this paragraph is to provide aerial apparatus access to two sides of the building for all buildings four stories or more in height and for all warehouses. It is also the intent to provide aerial access on one side along the entire side of the building with window or other opening access for buildings four stories or more in height so that the aerial apparatus has multiple locations to set up operations and accommodate aerial rescue operations. Consideration should be given to providing roof access locations for warehouse facilities to accommodate aerial suppression operations.

1-3. Apparatus Dimensions

Vehicle ID	GVW	Height	Length	Width	Turning Radius
ENGINE--10	40,000 lbs.	10’	30’5”	8’6”	
ENGINE--20	42,700 lbs.	10’9”	30’5”	8’6”	
ENGINE--30	46,000 lbs.	10’	29’9”	9’9”	
ENGINE--40	40,540 lbs.	9’8”	30’6”	9’4”	
ENGINE--50	39,800 lbs.	10’	31’3”	8’6”	
LADDER--11*	66,000 lbs.	11’4”	42’	10’5”	39.2’
LADDER--51*	54,920 lbs.	11’4”	40’2”	9’2”	39.2’

RESCUE--1	39,800 lbs.	11’5”	38’8”	8’3”	
CRASH--21**	47,000 lbs.	12’8’’	31’1”	9’6”	87’
CRASH--31	82,500 lbs.	11’9’’	38’7’’	9’11’’	117’
CRASH--33**	93,000 lbs.	13’	40’	10’	78’
CRASH--41**	69,000 lbs.	12’11”	36’3”	9’2”	117’
CRASH--32	93,000 lbs.	13’	40’	10’	78’
HAZMAT--1	35,000 lbs.	10’2”	30’3”	7’11”	
TANKER--1	46,720 lbs.	10’	31’	8’3”	

* 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, curbs, or area allocated for parking.

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.

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 Department

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. Fire Suppression Systems

a. Design and install fire suppression systems (including but not limited to: automatic sprinkler systems; water spray systems; foam systems; standpipe systems; dry chemical extinguishing systems; wet chemical extinguishing systems; clean agent fire extinguishing systems; water mist systems; carbon dioxide systems; and holon 1301 systems) in accordance with applicable NFPA standards, UFC 3-600-01, and International Building Code.

b. Provide separate fire sprinkler service connection for each facility.

c. Control valves, tampers, and water flow switches shall be installed and tested in accordance with applicable NFPA and UFC criteria.

d. 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.

e. Install backflow preventer devices on the inlet (suction) side of water protection systems.

f. 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.

g. The backflow preventer shall be tested for full forward and test documented before sprinkler system can be accepted.

h. 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.

i. 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.

j. Locate fire department connection (FDC) at readily accessible location from the street or fire lane. FDC must be mounted directly to the facility.

k. Facilities with fire department connections for fire suppression systems must be provided with suitable all-weather ground access surface for any apparatus within 150 feet of such fire department connections.

l. Provide stainless steel 2.5-inch male NST FDC caps/plugs on each fire department connection.

m. Install a Post Indictor Valve (PIV) for each facility in accordance with NFPA 13, and NFPA 24. PIV shall be manually secured with DPW Red Lock. PIV’s shall not be required to be equipped with an electronic tamper switch, so long as they have the capability to be physically locked. Wall Indicating Valves are prohibited for installation.

n. The use and installation of plastic pipe is prohibited in commercial structures. Plastic pipe is only permitted under applicable NFPA 13D or 13R criteria. The use of flexible sprinkler hose with fittings intended for direct connection to sprinklers is prohibited without prior approval from AHJ.

4-2. Standpipe System

a. Install standpipe system in accordance with UFC 3-600-01, NFPA 14, NFPA 101, and IBC. Class II and III standpipes as defined in NFPA 14 are not permitted.

b. Residual pressure for facilities under 150 feet in height may be met by fire department apparatus when hydraulic calculations demonstrate that fire department apparatus can provide the required pressure via the building fire department connections.

c. A Class I standpipe system must be provided in all required exit stairs of facilities four stories or more in height.

d. For facilities less than four stories in height, provide a Class I standpipe system where all portions of the building (on any floor) cannot be reached from an exterior door in less than 450 feet.

e. Standpipe and hose valves must not encroach into the means of egress especially on stair landings.

f. Provide FDC in accordance with NFPA 14 requirements based on number of standpipe risers.

g. 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.

d. Install waterproof drawing or engineered diagrams on system layout in same location of pump.

4-4. Kitchen Suppression System

a. All kitchenette and commercial cooking hood and suppression systems shall be designed and 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. Range hood fire extinguishing systems must be wet chemical or water assisted wet chemical designed and installed in accordance with NFPA 96.

c. De-energize all electrical receptacles within three feet of the hood.

d. Connect the suppression system to the building fire alarm system and generate a general evacuation signal upon suppression system activation.

e. Provide minimum two-liter wet chemical portable fire extinguishers mounted in recess or semi-recess cabinets in all commercial and kitchenette cooking areas.

f. 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.

g. Exhaust fans shall be accessible for cleaning and maintenance.

h. 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, and DPW EDB through the COR. The responsibility for their preparation shall be entrusted only to trained persons.

i. 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

j. Exhaust Hood System Controls:

Exhaust Hood System Controls 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 that, when designed and installed as such. The Government or its agents are unable to perform repairs, component 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 control 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 control 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

4-5. Fire Alarm Systems

a. The Fire Alarm and Mass Notification System shall be fully compatible with the existing King-Fisher Radio Transmitter Interface systems (KFRTI), presently in use at Fort Campbell and STAR Interface Transmitters presently in use at Fort Campbell.
b. The fire alarm panel/system shall provide at least one set of dry contacts for future use. Typical Zone Points relayed to the Kingfisher shall be: Zone 1 General Alarm, Zone 2 Trouble Alarm, Zone 3 Supervisory Alarm. Zone 4 Fire Carbon Monoxide Alarm.
c. Contractor shall design, provide, and install a complete fully functional, Tested and Certified fire alarm system to include any and all related components. Interior fire alarm and mass notification system must be a complete, supervised, noncoded, analog/addressable fire alarm and mass notification system conforming to NFPA 72, UL 864, UL 2017, and UL 2572 as applicable or most update date requirements of UFGS 28 31 76. The System shall be compatible with the following Government furnished Contractor installed panels:

    (1) Fire-Lite, Model ES-50X (50 points)
    (2) Fire-Lite, Model ES-200X (200 pionts)
    (3) Fire-Lite, Model 9600LS (636 points)
    (4) Silent Knight 6820 (1100 points)

    Contractor shall furnish and install compatible devise and accessors and notify the Government 60 days in advance for panel procurement or requisition.
d. When MNS is required per UFC 4-021-01 the fire alarm system and mass notification system shall be combined, and housed in separate panels, utilizing combined strobes and speakers. Strobes shall be white with clear lens, marked as "ALERT". MNS panels shall be Contractor furnished, and shall be industry-standard open protocol. Preferred manufacturers are FireLite, Potter, Wheelock, or other panels with equivalent specifications to those listed.

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 in such manner 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 of 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.

e. 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. Strobe specifications as well as Textual Signage will be in accordance with UFC 3-600-01.

f. 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. Any training, certification, or licensing required by DPW personnel shall be provided prior to final acceptance of the project.

g. Design and install the fire system in accordance with NFPA 72, 70, 101, and UFC 3-600- 01, UFC 4-520-01, 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, carbon monoxide detectors, Kingfisher transmitter, 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(s) 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 and in accordance with UFC 4-250-01.

(6) Whenever possible, all associated panel boxes shall be keyed alike, hex type keys are prohibited on manual pull stations.

(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 if the facility is equipped with MNS, for facilities not equipped with MNS requirements shall be 48 hour secondary (supervisory), and 15 minutes in alarm. It is the contractor responsibility to coordinate battery test with Fort Campbell Fire Department Fire Prevention Section and DPW EDB.

(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. Alarm activation shall annunciate at the fire alarm panel and transmit to the fire department via the Kingfisher transmitter.

e. Smoke detectors shall be connected to the building fire alarm notification system.

f. 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.

(27) Remote status and alarm indicator and magnetic test stations when detector is above accessible ceiling or below accessible floor, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the duct smoke detector, smoke detector, or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

(28) The alert signal portion of the voice alarm message for carbon monoxide detection must be a 520 Hz temporal 4 (T-4) signal. The alert signal must repeat twice before the voice announcement. Carbon Monoxide message is as follows: (Temporal 4 Alert Tone) "Attention….Attention….Carbon monoxide has been detected in the building. Please leave the building by the nearest exit." (Temporal 4 Alert Tone)

(29) Fire alarm voice message shall be: Temporal 3 Alert Tone) "May I have your attention please. May I have your attention please? A fire emergency has been reported in the building. Please leave the building by the nearest exit or exit stairway. Do not use the elevators". <provide a 2 second pause> "May I have yourattention please..." (repeat the message). Fire single story buildings remove

“do not use the elevators”.

4-6. Mass Notification System (MNS)

a. Fire alarm and MNS shall be combined systems, housed in separate panels.

b. The MNS shall have the ability 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. The mass notification messages shall be programmed in male/female voice as specified by UFC 3-600-01 for message type and occupancy. Messages for "Special Occupancies" (CDC, Medical, Hangar) shall be in accordance with UFC. Verify messages with DPW and Fire Department prior to programming.

e. The Mass Notification messages will be generated by the text-to-speech system Speechify, Nuance, 2005 as used by NOAA for weather information and Emergency Alert System messaging. The voices used will be "Tom" and "Donna" as identified for each message type in UFC 3-600-01. The current Nuance text-to-speech product is Vocalizer 5.0, Nuance 2013.

Update all messages:

- **Fire Emergency:** “MAY I HAVE YOUR ATTENTION PLEASE. MAY I HAVE YOUR ATTENTION PLEASE. A FIRE EMERGENCY HAS BEEN REPORTED IN THE BUILDING. PLEASE LEAVE THE BUILDING BY THE NEAREST EXIT OR EXIT STAIRWAY. DO NOT USE THE ELEVATORS.” For single-story facilities, delete “OR EXIT STAIRWAY. DO NOT USE THE ELEVATORS”.

- **Carbon Monoxide:** “CARBON MONOXIDE HAS BEEN DETECTED IN THE BUILDING; PLEASE LEAVE THE BUILDING BY THE NEAREST EXIT”.

- **Shelter In Place:** “A SHELTER IN PLACE EMERGENCY HAS BEEN DECLARED; PLEASE TAKE SHELTER IN A DESIGNATED SAFE AREA IMMEDIATELY”.

- **Weather:** “A WEATHER EMERGENCY HAS BEEN DECLARED; PLEASE TAKE SHELTER IN A DESIGNATED SAFE AREA IMMEDIATELY; DO NOT USE THE ELEVATORS.” For single-story facilities, delete “DO NOT USE THE ELEVATORS”.

- **Evacuate:** A FORCE PROTECTION EMERGENCY HAS BEEN DECLARED; PLEASE LEAVE THE BUILDING BY THE NEAREST EXIT".

- **Test:** "TEST, TEST, TEST, THIS IS AN EMERGENCY NOTIFICATION AUDIO SYSTEM TEST, YOU MAY CONTINUE NORMAL OPERATIONS, TEST, TEST, TEST".

- **All Clear:** "THE EMERGENCY HAS BEEN RESOLVED; RETURN TO NORMAL OPERATIONS."

4-7 Fire Alarm Transmitters

a. Provide a fire alarm system compatible with Kingfisher transmitter.

b. The fire alarm transmitter shall be government furnished, contractor installed and shall consist of the transmitter, antenna, batteries, and lightning arrestors. Coax cable and any ancillary work shall be provided by the contractor. All equipment shall be installed per manufacturer's recommendations.

4-8 Fire Protection Engineering Services

a. Major Projects require the design, review and oversight services of a Qualified Fire Protection Engineer (QFPE). A QFPE must be involved in every aspect of the design, construction and testing/commissioning as it relates to fire protection and life safety. This includes, but is not limited to, building code analysis, life safety code analysis, fire protection design analysis (as applicable), design of automatic fire alarm, detection and suppression systems, water supply analysis, a multi-discipline review of the entire project, and periodic construction inspections as needed. Fire protection shop drawings will be prepared either by the QFPE, NICET IV certified technician in Fire Alarm Systems, or NICET III or IV certified technician in Water-Based Systems as applicable to the project. All Shop drawings will be reviewed and stamped by the QFPE. NICET III level technician for fire alarm and water based suppression systems (as applicable), must monitor the installation of and be on-site for final acceptance of: the fire alarm system, suppression system, or commercial cooking system. The final acceptance test will be scheduled and witnessed by the Fort Campbell Fire Prevention Section, and DPW-EDB.

NICET fire alarm and water-based systems technicians shall only perform items commensurate with the specific category of certification held. NICET certified Fire Alarm Technicians shall perform the installation of the fire alarm system. A NICET Level III Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level II or higher Fire Alarm Technician shall: remove fire alarm

panels/transmitters from service, and restore to normal operation, install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level I Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment being installed.

b. This requirement is applicable to engineering services for design-bid-build projects as well as all phases of design-build projects including RFP development, design development, and construction.

c. Projects requiring the design and oversight services of a QFPE will be those as determined by UFC 3-600-01 to be a "Major Project".

d. For Major Projects, a QFPE must monitor the installation of the fire alarm system, suppression system, or commercial cooking system, and certify in writing that the fire alarm system has been constructed and operates as intended in the design plans and specifications. The final acceptance test will scheduled and witnessed by the Fort Campbell Fire Prevention Section, and DPW-EDB.

e. For other than Major Projects, Fire protection shop drawings will be prepared either by a QFPE, NICET IV certified technician in Fire Alarm Systems, or NICET III or IV certified technician in Water-Based Systems as applicable to the project. A NICET III level technician for fire alarm and water based suppression systems (as applicable), must monitor the installation of and be on-site for final acceptance of: the fire alarm system, suppression system, or commercial cooking system. The final acceptance test will be scheduled and witnessed by the Fort Campbell Fire Prevention Section, and DPW-EDB.

NICET fire alarm and water-based systems technicians shall only perform items commensurate with the specific category of certification held. NICET certified Fire Alarm Technicians shall perform the installation of the fire alarm system. A NICET Level III Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level II or higher Fire Alarm Technician shall: remove fire alarm panels/transmitters from service, and restore to normal operation, install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level I Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment being installed.

4-9 Fire Protection Design Analysis.

Where applicable, discuss the following minimum fire protection provisions (include required vs. provided):

a. Identification of all fire protection and life safety related codes and standards applicable to the project, including the edition. This includes Host Nation

requirements.

b. Building code analysis (e.g., type of construction, height and area limitations, building separation, exposure protection, etc.).

c. Classification of occupancy (both IBC and NFPA 101).

d. Requirements for fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions, compartmentation and special hazard protection (both horizontal and vertical). Include the associated fire resistance rating.

e. Requirements for protection of horizontal and vertical penetrations and openings as well as the associated fire resistance rating.

f. Separation from hazards per NFPA 101.

g. Interior finish ratings.

h. Means of egress provisions and components (occupant load, exit capacity, exit width, travel distance, common path of travel, dead-end corridors, use of suites, etc.).

i. Water supplies, water distribution, location of fire hydrants, Fire Flow calculations.

j. Location of fire department connections (FDCs).

k. Location of post indicator valves (PIVs) and other control or isolation valves.

l. Analysis of automatic sprinkler and suppression systems and protected areas. Include supporting calculations used to establish system performance requirements such as hydraulic analysis of water demand or agent concentration and quantity.

m. Standpipe systems.

n. Portable fire extinguishers.

o. Fire detection (the type of detection and type/location of detectors).

p. Fire alarm system (the type of alarm system, location of the fire alarm equipment and mass notification).

q. Smoke management or control methods.

r. Connection to and description of base Fire Alarm Reporting System.

s. Coordination with security and antiterrorism requirements, including connection to Installation-wide Mass Notification System, if applicable.

t. Fire department access.

4-10 Life Safety Plan Analysis.

Where applicable, the following minimum fire protection provisions must be included on the life safety plans:

a. All minimum fire protection provisions listed above, on a separate code summary sheet.

b. Capacity and number of occupants using each major means of egress component (e.g., stairs, stair doors, exterior doors, assembly exit doors).

c. Maximum travel distance, dead-end corridor, common path of travel, accessible means of egress and exit components for each floor and occupancy classification. When suites are used, indicate type, location, area and arrangement.

d. IBC and NFPA occupancy classification of each room, area or compartment (on the drawings or in tabular form). Include occupant load of each room, area or compartment. Similar occupancies can be grouped together for occupant load calculations.

e. Location and rating of all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions (both horizontal and vertical). Barriers requiring fire resistance rated supporting construction must be specifically identified for coordination with the structural design.

f. Location of hazardous materials storage, handling and use that exceed the maximum allowable quantities.

g. Structural fireproofing locations and associated ratings.

4-11. 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 of all initiating and notification devices 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 (Major Project) or NICET level IV technician (other than Major Project).

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.

4-12. 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

4-13. 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 to include intelligibility testing results shall be provided to Fort Campbell Fire Department Prevention and Inspection Section and DPW-EDB seven days before Final Test and Inspection to be witnessed by this section, coordinate through COR. Final acceptance is not to be scheduled until all preliminary requirements have been accomplished.

c. 100% of alarm devices shall be tested for correct operation and resetting. Tester shall provide typed spread sheet format listing address, device description, and date tested, pass, fail and date corrected columns as a minimum. Tester's shall sign and date report. Report to be given to fire department and DPW EDB prior to scheduling acceptance testing. Kingfisher transmitter is an integral part of the system, pre-testing and final commissioning shall include verifying all components and functions of Kingfisher transmitter. Any issues found during system status testing shall be corrected prior to requesting final acceptance.

d. Wiring runs shall be tested for continuity, short circuits and grounds before any system devices are installed or energized.

e. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72. At least one NICET Level III Technician Certified in Fire Alarms Systems, and NICET Level III or IV (as applicable) certified in Inspection and Testing of Water-Based Systems will be on site to oversee all preliminary and final acceptance testing of the fire alarm system and suppression system. Audibility testing shall not be conducted until all doors, windows, walls, ceilings, and carpeting are in place. The Designer of Record of the fire alarm, suppression and any associated life safety system shall be present during all pre-testing and final commissioning.

f. Computer/labeler generated labels with the address number only will be installed on the exterior of each initiating/notification device as long as the background is white with black lettering and installed in a quality manner. This will assist in the inspection, testing, maintenance, and trouble-shooting of the system.

g. All Smoke detectors shall be commissioned using canned smoke or a method that will functionally test the smoke chamber. The use of Magnets for commission testing of smoke detectors is Strictly Prohibited.

h. The installing contractor shall make instruments, tools and labor required to conduct the system tests available.

The following equipment shall be a minimum for conducting the tests:

1. Ladders, scaffolds, or lifts as required to access all installed equipment.
2. Multimeter for reading voltage, current and resistance.

3. Two-way radios, flashlights, screwdrivers, measuring tapes, intelligibility meter.
4. A manufacturer recommended device for measuring airflow through air duct smoke detector sampling assemblies.
5. Calibrated decibel meter.
6. Adequate number of personnel on site, the government is not responsible for conducting testing activities, government personnel will witness and verify system status. Fire prevention section personnel and DPW-EDB will be present for final acceptance.

At minimum the following tests shall be conducted and documented:

1. Operate each sprinkler control valve completely and verify proper supervisory alarm at the FACP.
2. Flush, hydrostatically test, and inspect sprinkler piping according to NFPA 13. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat as needed until satisfactory results are obtained. Coordinate preliminary sprinkler testing with fire prevention section and DPW EDB through COR.
2. Verify activation of all flow switches under approved flowing conditions.
3. Open initiating device circuits and verify that the trouble signal actuates.
4. Open and short signaling line circuits and verify that the trouble signal actuates.
5. Open and short Notification Appliance Circuits and verify that trouble signal actuates.
6. Ground all circuits and verify response of trouble signals.
7. Check presence and audibility of tone throughout building spaces. This includes measuring dBA levels.
8. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test feature.
9. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
10. The intelligibility of an emergency communication system is considered acceptable if at least 90 percent of the measurement locations within each ADS have a measured STI of not less than 0.45 (0.65 CIS) and an average STI of not less than 0.50 STI (0.70 CIS).
11. Battery calculations shall be verified to operate system under required specifications.

4-14. Electromagnetic Door Holders

a. Where indicated on drawings, provide electromagnetic 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 electromagnetic 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.

4-15 Final Acceptance Testing

A. Fire Alarm/Mass Notification System

1. At least one NICET Level III Technician Certified in Fire Alarms Systems, NICET Level III or IV (as applicable) in Inspection and Testing of Water-Based Systems will be on site to oversee all preliminary and final acceptance testing of the fire alarm system. The Designer of Record of the fire alarm, suppression and any associated life safety system shall be present during all pre-testing and final commissioning. This section details criteria for commissioning inspections by AHJ's and the owner. Testing shall be scheduled with all parties minimum 7 working days in advance. A date for final acceptance will not be set until all preliminary testing requirements and documentation have been received and reviewed by the Fire Prevention Office, and DPW. Contractor COR's will facilitate the receiving of these items as needed.

2. A Record of Completion shall be provided to the inspector prior to starting this testing. If during the testing, it is reasonably determined by the commissioning inspector that the systems are not ready for final acceptance, testing will stop and be re-scheduled. Upon, resolving any deficiencies the contractor will request another final inspection through the COR, meeting 7 working day notice and documentation requirements of item 2.

3. The contractor is responsible for testing all components in accordance with the manufacturers required and suggested procedures and in accordance with all applicable NFPA and UFC criteria. Contractor is responsible to provide all necessary equipment, tools, meters, manpower, and radios to conduct testing. Contractor shall provide at a minimum two certified individuals to conduct testing of fire alarm systems.

4. A program matrix shall be provided by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.

5. The commissioning inspector shall use the system record drawings and other documents required during the testing procedure to verify operation as programmed. In conducting the commissioning test, the inspector shall request demonstration of any or all input and output functions.

6. All Smoke detectors shall be commissioned using canned smoke or a method that will functionally test the smoke chamber. The use of magnets for commission testing of smoke detectors is strictly prohibited. New detectors that show to be dirty through system sensitivity testing shall be replaced.

7. The items tested shall include but not be limited to the following:

a. System wiring shall be tested to show the following results and the systems subsequence operation:

1) Open, Shorted or Grounded Circuits.

2) Primary and Battery power disconnected.
3) End-of-line voltage readings on notification circuits.

b. System notification circuits and appliances operate as programmed. Audibility and visual levels meet required standards.

c. A minimum of 15 dBA above ambient shall be obtained in every occupiable space (throughout) per NFPA 72. This includes storage rooms, electrical rooms, telephone rooms, and any other occupiable space.

d. Intelligibility of mass notification systems to also be verified via subjective means by commissioning inspector as well as verifying all previously performed testing. It is the contractors responsibility to provide all equipment required for testing. The intelligibility of an emergency communication system is considered acceptable if at least 90 percent of the measurement locations within each ADS have a measured STI of not less than 0.45 (0.65 CIS) and an average STI of not less than 0.50 STI (0.70 CIS).

e. System shall demonstrate the correct messages at the FACP and any remote annunciator.

f. System off-site reporting shall be verified for alarm, trouble, and supervisory conditions.

g. Fire suppression contractor shall be present to operate any required valves or devices electronically monitored by the fire alarm system.

h. System shall be tested for stand-by battery backup for 48 hours on standby and 15 minutes in alarm, stand-by requirements will be 72 hours and 15 minutes in alarm when the facility is equipped with a Mass Notification System.

Fire Suppression

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
B. Verify that specified tests of piping are complete.
C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
E. Adjust operating controls and pressure settings.
F. Provide required Test Certificate for Aboveground Piping as applicable per NFPA 13. This certification is to be approved and signed by authorized representative. Contractors are not authorized to sign as the owner of these systems.
F. Coordinate with fire alarm tests. Operate as required.

5. Knox Box

5-1. Ordering Information

(1) Provide 3200 series, dark bronze, hinged door recess or surface mounted, depending on the application, “Knox Box” manufactured by “The Knox Company”.

(2) 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. Top of box shall be installed no higher than 5 feet nor lower than 4 feet from the adjacent ground level. Coordinate location with Fire Prevention Section prior to installation.

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. KNOX BOX is not required to be monitored by the fire alarm system, unless otherwise determined by the AHJ.

f. Variances to location, due to obstacles, may be approved by the Fire Prevention Office.

6. Portable Fire Extinguishers

(1) Install portable dry chemical (Class ABC) fire extinguishers in accordance with all applicable NFPA, UFC, and IBC code criteria including the manufacturer recommendations.

(2) 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.

(3) Fort Campbell color ***preference*** for fire extinguisher cabinets is white.

(4) Install fire extinguishers along the path of egress in clear view.

(5) Where visual obstructions cannot be avoided, provide signage to indicate the extinguisher location.

(6) Provide minimum two-liter size wet chemical portable fire extinguishers mounted in recess or semi-recess cabinets in all commercial and kitchenette cooking areas.

(7) 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.

(8) Install all portable fire extinguishers in accordance with NFPA 10 requirements.

7. Heating, Ventilation, Air Conditioning (HVAC)

(1) 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. Install smoke detectors listed for use in air distribution systems shall be located as follows:

(a) 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.

(b) 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.

(c) 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.

(d) Duct smoke detectors shall be furnished by the fire alarm company.

(2) Hardwire all duct smoke detectors to the air handler unit that the duct detector is monitoring.

(3) Where duct smoke detectors are installed in concealed locations, they shall be mounted where as to be reasonably accessible, 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.

(4) Shut down all HVAC units on any fire alarm utilizing the hardwired duct smoke detector and the HVAC computer program.

(5) 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.

(6) Provide smoke detection in room(s) and or areas where air handler unit(s) less than 2000- cfms 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.

(7) "Emergency HVAC Shut Down" Switch.

(a) Shut down all HVAC units that distributes outside air within a facility when

"Emergency HVAC Shut Down" switch is activated.

(b) Close all required dampers in accordance with UFC 4-010-01 when "Emergency HVAC Shut Down" switch is activated.

(c) Emergency Stop buttons located within public access and in mechanical rooms shall have switch guards instated to prevent unintentional stopping of equipment.

(d) Protective covers shall be installed on emergency HVAC shut down switches located in areas accessible to the public.

8. Elevator Hoist Ways and Machine Rooms

(1) 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.

(2) All hoist ways and machine rooms will be 2-hour fire rated.

(3) 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.

(4) Heat detector shall have both a lower temperature rating and a higher sensitivity as compared to sprinklers.

(5) Heat detectors shall activate prior to sprinkler activation and shut down elevator power.

(6) 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.

(7) 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

(1) Install emergency lighting in accordance with NFPA 101, UFC 3-600-01, and all applicable codes except as modified herein.

(2) Provide emergency lighting in all windowless locations to include but not limited to restrooms, mechanical rooms, and elevator machine rooms.

(3) Provide exterior emergency/egress lighting, with backup power to illuminate the pathway to public way.

(4) Install emergency lighting in all facilities regardless of occupancy.

(5) Emergency lighting batteries shall not be installed above hard ceilings unless provided with a means of access (access door) or remotely located to an area with access.

10. Exit Signage (Means of Egress)

(1) 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.

(2) Install Exit signs at main exterior exit doors that are readily visible from any direction of exit access.

(3) Install Exit signs at all exit access and exterior doors leading to public way.

(4) 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

(1) 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.

(2) Must have 30" or more of head clearance at point of access into attic space.

(3) Access Hatch not less 20" by 30" in size.

(4) 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

(1) 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.

(2) 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.

(3) 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.

(4) 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.

(5) Stairways with roof hatches that do not meet these requirements must be labeled as "NO ROOF ACCESS".

13. Stairs

(1) Stairs and handrails shall comply with NFPA 101 Life Safety Code.

14. Doors

(1) 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

(1) Symbols used on all shop and as-built drawings shall comply with NFPA 170.

16. 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:

Radon Mitigation specification covers the requirements for constructing radon mitigation systems in new buildings, existing buildings and facilities, including constructing radon mitigation systems enclosures, when required.

All new 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 after 30 days of occupied conditions. The testing firm must be EPA accredited and approved to perform work in the State of Tennessee (Kentucky). A list of accredited testing and mitigation firms, by state, can be obtained. 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 additional testing. Consult UFGS 31 21 13 Radon Mitigation for details.

Qualified contractor, in addition to the requirements at paragraph 3.0 of ANSI/AARST RMS-LB 2018 and RMS-MF 2018 (or most recent edition[s]), shall:

- Have a minimum of five years' experience in installation of radon mitigation systems in schools, large buildings and multifamily buildings as part of a larger complex of buildings (i.e. military installations, major school campuses, multifamily housing complexes).
- Have a minimum of five years' experience in radon measurement in schools, large buildings and multifamily buildings as part of a larger complex of buildings (i.e. military installations, major school campuses, multifamily housing complexes).
- Have National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB) approved training in radon measurement and mitigation in karst areas and a minimum of three years' experience with radon measurement and mitigation in areas of karst topography.

The person responsible for mitigation design, diagnostic testing, construction and on-site supervision, must have successfully completed the requirements of and maintaining a current certification issued by either the National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB) as a qualified mitigation professional/qualified measurement professional, as appropriate. Fort Campbell is subject to duel state authority and elects to adopt the State of Kentucky legislation requiring mandatory credentialing for this work as required for all radon work performed on the installation in Kentucky or in Tennessee.

Evidence showing successful completion of the requirements of the NRPP or the NRSB must include copy of current certification document, and, documentation issued by the State as required. In addition, the use of certified and licensed electricians, from any state, in compliance with CAM Regulation 420-4, is mandatory for obtaining electrical permits and inspections.

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 (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 a radon mitigation 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 3000-5000 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 the Contractor damages any utility lines after being marked or does not get them marked, the Contractor shall 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. No additional charges shall be occurred to the Government. 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 or 4 to a customer for the contract duration. For any major planned outages, Contractor shall notify appropriate Ft. Campbell personnel to coordinate public notification 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 shall be considered as the preferable option for installation of utilities under existing roadways and or paved areas.** Pavement cutting shall only be allowed if necessary and done with sound engineering practices. When underground utilities are sleeved either under roadways, railways, and or runways, sleeves shall extend a minimum of 10 feet beyond the pavement or aggregate edge on both sides for added protection.

Instructions to Designers:

1. Designers shall coordinate with DPW utility personnel or the appropriate utility agency of Fort Campbell prior to project design for estimated utility locations and or any other pertinent information. 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. Construction projects requiring soil borrow material should be coordinated with: DPW Environmental Division, Pollution Prevention Branch, Building 5134, 2nd & Wickham Ave. Point of Contact – Building 5134, 270-798-9767/9786. Contractor shall provide copy of permit to the COR.

----- 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 DPW Pest Control Bldg. 5111 and 5112 @ 270-798-3110.

2. See **Appendix A** for environmental requirements.

4. Specifications section UFGS 31-31-16.19 Termite Control Barrier System, 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-----

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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.

3. 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.

------ 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

Follow requirements in Section 01 57 20.00 10 Environmental Protection Part 3.1 Protection of Trees and shrubs where trees or shrubs are present in or near (300 feet) the project area.

Instructions to Designers:

1. Design, contract drawings, and specifications shall include each of the above features as they apply to the project.

2. 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 90 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 17 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).

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 31 13
Chain Link Fences and Gates

Ft. Campbell Requirements:

Security Fences and Gates shall be IAW UFGS 32 31 13.
High Security Chain Link fences and Gates shall be IAW UFGS 32 31 13.53.
UFC 4-740-14 Design Child Development Centers, and ASTM F1487-17 and ASTM 2049.

Fence Fabric:

1. Fencing fabric must be minimum 9-gage wire mesh and mesh openings must be not be greater than 2-inches (51 mm) per side. Fence fabric material will be galvanized

steel, PVC coated steel fabric (use PVC coated if located in corrosive environment or where aesthetics are of prime importance), or aluminum coated steel fabric (use aluminum coated if located in corrosive environment). The fencing fabric must be extended to within 2 inches (51 mm) of firm ground and anchored, if required by service requirements, using horizontal bottom rails, tension wires, concrete curbs, sills, sheet piling, piping, or other inexpensive materials.

a. CDC or Playground Fencing shall be PVC Coated Brown fabric with Self Locking Fabric Bands. Aluminum Hook Ties or Tie Wires are prohibited.
b. Bottom rails should be considered for all CDC play areas.
c. There shall be no parts of the fence or gate that is a protrusion hazard located less than 54 in. (1372 mm) above grade. Protrusion of any kind for CDC or Playground fencing is prohibited. All bolts must be cut within 2 threads of bolts and filed smooth. Protrusion must pass the projection test gauge outlined in ASTM F1487-17 - A1.10, A1.12 Ref. Para 6.3, 6.3.2, 6.4.1.1, 6.4.3 and 6.4.4. Bolt cap or Stainless Steel Acorn Hex Cap Nuts are prohibited for covering threads. Adding Acorn cap will not pass the projection or protrusion tests.

Top and Bottom Selvages:

2. The selvage may be knuckled or twisted depending on application. Knuckled selvage is defined as the type of selvage obtained by interlocking adjacent pairs of wire ends and bending the wire back into a loop. Twisted selvage must be provided on the top of the fence fabric to deter climbing. Twisted selvage must be provided at the bottom of the fence fabric to deter borrowing unless the fence has a bottom rail, is buried, or encased in concrete.

c. CDC and Playground area requirements to be Knuckled x Knuckled.

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

(6) When areas of the site are raked prior to hydro seeding or for leveling of topsoil to rid the

site of mounds, clods and / or ruts, the Contractor shall ensure that no clods larger than 1” are left on the site. Contractor shall restore the site to a condition and appearance similar or equal to existing before the damages occurred. Such restoration work will not be considered complete until accepted by the COR after 90% stabilization has been achieved. The Government will not accept sites that have not been raked and restored to this standard. If sod is installed, the Contractor shall replace installed sod at their expense up to six (6) month period; that is not healthy, established, and vigorous because of lack of water and adequate fertilization.

Instructions to Designers:

- For Building renovations or exterior renovations, Engineer or Designer shall have all Trees and Shrubs removed 20” from around or near any and all building foundations. Remove all vegetation from or near sidewalks and streets. All cut trees or shrubbery shall include grubbing and root removal. Infill any low areas with clean fill, hydro seed area until 2” growth.
- No new landscaping shrubs or trees unless in high profile area and is approved by DPW for DPW owned facilities.
- Plantings shall be of native variety to Kentucky or Tennessee.
- A 30 year growth canopy shall be taken into consideration for nearby structures.
- **See Appendix M** for Power line restrictions.

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

CHAPTER 3
Technical Requirements and Instructions
Division 33
Utilities

Section 33 11 00

Ft. Campbell Requirements:

Water Distribution

The Fort Campbell water distribution was privatized in 2003. The owner of the system is now JACOBS. All additions/alterations to the system must be done in accordance with the JACOBS Design Manual. Contact 931- 431-2015 or -5677 to obtain current JACOBS 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 JACOBS. All additions/alterations to the system must be done in accordance with the JACOBS Design Manual. Contact JACOBS 931-431-2015 or -5677 to obtain current JACOBS Design and Construction Standards.

https://www.lrl.usace.army.mil/Portals/64/docs/Engineering/Guides_FTC/ftcWater.pdf

Utilities and their distribution lines shall follow existing road corridors and shall not exceed 15' from edge of pavement until a point of embarkation to a facility, unless otherwise stated in contract requirements. Master Planning and /or Engineer Design Branch Site approval is required prior to deviating.

------ 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 by 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 https://hdsc.nws.noaa.gov/

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 that 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 f*or 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

Utilities and their distribution lines shall follow existing road corridors and shall not exceed 15' from edge of pavement until a point of embarkation to a facility, unless otherwise stated in contract requirements. Master Planning and /or Engineer Design Branch Site approval is required prior to deviating.

Section 33 56 10
Factory-Fabricated Fuel Storage Tanks

Ft. Campbell Requirements:

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, and 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.

1.0 Normal Venting for aboveground Tanks:

1.1 Venting requirements shall be in accordance with current Unified Facilities Guide Specifications, Section 13202, and 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.

1.2 Prevent the development of vacuum or pressure sufficient to exceed the design pressure due to filling or emptying and the atmospheric temperature changes.

1.3 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.

1.4 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.

1.5 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

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, and 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 a 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.
- **No Photographs are to be taken in or around the 160th SOAR compound without the direct authority by the 160th Regimental Engineer or 160th base operations security S-2.**

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 ≥ 1,000V and ≤ 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:

Utilities and their distribution lines shall follow existing road corridors and shall not exceed 15' from edge of pavement until a point of embarkation to a facility, unless otherwise stated in contract requirements. Master Planning and /or Engineer Design Branch Site approval is required prior to deviating.

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.

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

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Section 33 71 01.00 40
Overhead Transmission and Distribution

Ft. Campbell Requirements:

3.31. NORMAL REPAIR

- Reserved

3.32. EMERGENCY REPAIR

- Reserved

3.33. UNDERGROUND vs. OVERHEAD

- Where possible, feasible and practicable new electrical distribution lines shall be installed underground.

3.34. OIL-FILLED EQUIPMENT

- Fort Campbell prefers Envirotemp™ FR3™ fluid
- Mineral oil may be used as a coolant in oil-filled equipment

3.35. 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.

3.36. 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.

3.37. 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.

3.38. UTILITY POLE PROFILE

- Reserved

3.39. 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.

3.40. UTILITY POLE HARDWARE

- Use eye bolts, bolt eyes, eyenuts, 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.

3.41. STEEL POLE & SWITCH PLATES

- Steel poles shall be supplied with factory, bolted, grounding connections.
- All steel poles shall be installed with a separate ground round 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.

3.42. 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.

3.43. GUYING

- Calculations shall be performed using appropriate software for all guy placements (NESC)
- Guy strands shall be either 3/8" or ½" 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.

3.44. 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).

3.45. MOUNTING HARDWARE

- All equipment mounting brackets shall be aluminum.

3.46. 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

3.47. OVERHEAD SWITCHES AND CUT-OUTS

- All overhead switches and cut-outs shall be of the load break type
- Insulators shall be polymer

3.48. OVERHEAD LINES

- Overhead lines shall be ACSR
- Copper (CU) shall not be used as overhead distribution conductors

3.49. POLE MOUNTED METERS AND DISCONNECTS

- Conductors from meter base to service equipment inside shall be copper (CU).
- Conductors from the transformer(s) down to meter base shall be copper (CU).
- Conductors from the transformer(s) down to disconnect shall be copper (CU).

3.50. 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.

3.51. UTILITY POLE IDENTIFICATION PLACARD/TAG

- In conjunction with DPW engineers and the Equipment Identification System, contractors shall install a 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.

3.52. 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.

3.53. SIGN AND PLACARD REQUIREMENTS

3.53.1. 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 expect 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.

3.53.2. 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:

Utilities and their distribution lines shall follow existing road corridors and shall not exceed 15' from edge of pavement until a point of embarkation to a facility, unless otherwise stated in contract requirements. Master Planning and /or Engineer Design Branch Site approval is required prior to deviating.

3.54. NORMAL REPAIR
- Reserved

3.55. EMERGENCY REPAIR
- Reserved

3.56. 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.

3.57. 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).

3.58. CABLE TAGS
- Cables shall be tagged IAW the UFGS.

3.59. UNDERGROUND MARKING
- All Electric Lines, Cables And Conduit Installed Underground Shall Be Marked With Magnetic Tape.

3.60. SERVICE ENTRANCE
- Underground service entrance conductors shall be copper installed in conduits.

3.61. 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).

3.62. 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.

3.63. DISTANCE BETWEEN SPLICES OR JOINTS IN MEDIUM VOLTAGE CABLE

- Cables shall have no more than one (1) splice per manhole.

3.64. 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:

3.65. OIL-FILLED EQUIPMENT

- Fort Campbell prefers Envirotemp™ FR3™ fluid
- Mineral oil may be used as a coolant in oil-filled equipment

3.66. MATERIAL

- Transformer windings shall be copper.
- Aluminum windings shall not be used.

3.67. DEAD FRONT CONSTRUCTION

- Transformers with a medium-voltage compartment shall be dead-front construction.

3.68. kVA RATING

- The nameplate rating for the transformer shall not be less than 90 percent of the KVA demand load calculated for the transformer.

3.69. DELTA

- Delta transformer banks shall not be provided for transformer stations.

3.70. TRANSFORMER FEEDS

3.70.1. 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.

3.70.2. Underground Secondary Feeds

- Transformers (single and three phase) whose secondary feeds run underground into a building or facility shall be pad-mount type.

3.71. 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:

3.72. 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.

3.73. 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:

3.74. 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

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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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: https://home.army.mil/campbell/index.php?cID=875

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 generators, boilers, spray booths, aggregate storage piles, etc. Air permit information will be provided by the project POC or source operator 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. Contact the Air Quality Program Manager with information needed to determine record keeping and permitting requirements. 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. Data includes but in not limited to manufacturer, model number, engine serial number and emissions test data available. Please contact the Air Quality office if a new emergency generator is going to be installed prior to construction.

A-2.5 Ft. Campbell is in an attainment area for Ozone and therefore General Conformity Rule (GCR) Analysis will no longer be required for projects. The Air Quality Program will no longer require the GCR Checklist or issue a Record of Non-Applicability (RONA) for projects.

A-2.6 Ft. Campbell Air Quality POC, 270-798-9603 or 270-798-9598

ISSUE	STATEMENT TO BE INCLUDED
Booths	Specifications for any booth that has the potential to release emissions into the ambient air must be submitted to the Air Quality Office for review prior to construction. The Air Quality Program will determine the permit and/or record keeping requirements, Booth examples include spray booths, composite reset booths, blasting booths, etc.
Generators	Specifications for emergency or prime generators must be submitted to the Air Quality Office for review prior to installation. The Air Quality Program will determine the permit and/or record keeping requirements,
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.

AIR QUALITY ISSUES CONCERNING CONSTRUCTION PROJECTS
FORT CAMPBELL

Figure A-2-7

--- END OF SECTION---

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A-3 Clean Water Act:

A-3.1 Ft. Campbell POC, 270-798-9858.

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 JACOBS (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 JACOBS (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 19 Temporary 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:

Environmental
Division, PW 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.

Return to Chapter 2 **Return to Storm-Drainage System** **Return to Appendix A**

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-JACOB (Chris Semler 931-980-7223).

A-4.2 Backflow prevention is required on domestic water only and must be approved by state of Tennessee or JACOBS.

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 non-potable 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 values that are two inches in diameter or larger

DoD employees responsible for oversight of new construction and / or repairs of plumbing system 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 Nation Standards Institute (ANSI) Standard 372 and NSF/ANSI Standard 61, Annex G. Both these 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: https://www.nsf.org/certified-products-systems

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

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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 is required for working personnel in accordance with OSHA requirements.

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A-5.2 Radon:

A-5.2.1 New building design must have Radon protection features. In the specifications, Contractors are required to test the building for radon after construction is complete.

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

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A-6 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA):

A-6.1. Fort Campbell has an approved Pesticide Use List (PUL). The (PUL) is updated annually or on as a needed basis. A copy can be acquired from the Pest Management Coordinator.
The current approved (PUL) will be used in the preparation of the appropriate contract documents. All insecticide and pesticide work on Fort Campbell must comply with the Integrated Pest Management Plan.

A-6.2. Contractors will submit a report of the pesticides used, type and amounts, on Ft Campbell to the Integrated Pest Management Coordinator. 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 60% 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 270-798-9771.

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 60% 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 Fort Campbell Recycling & Convenience Center located at 6802 A Shau Valley Rd, Fort Campbell, KY 42223.

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, floor tile, mastics containing asbestos, 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 exceeds 20CY. These materials shall not be contaminated with other non- masonry/concrete/asphalt materials, such as doors, windows, piping, PVC items, toilet partitions, plumbing fixtures, floor tile, mastics containing asbestos, 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.

Reduction of concrete using jackhammers or hydraulic devices with spiked or toothed attachments cause abrading, reducing category 1 ACM to become RACM.

NOTE: EPA Applicability Determination Index Control Number: A010002,

--Response #4; “Jackhammering grinds and abrades the material, therefore the vinyl asbestos tile and mastic become RACM.”

---Response #5; “It is recognized that when nonfriable ACM is subject to certain forces, i.e., mechanical forces, weather or aging, it can be weakened to the point where it can become friable, i.e., crumbled, pulverized or reduced to powder by hand pressure and can thereby release asbestos fibers.

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 60% 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.

A-7.4.3 Haul/ Borrow Permit: Soil material to be brought in from Fort Campbell, designated borrow area or spoil material is to be transported away from the construction limits of the project to Fort Campbell-designated borrow areas, a haul/borrow area permit can be obtained at:

- DPW Environmental Division, Pollution Prevention Branch, Building 5134, 2nd & Wickham Ave.

WOODLAWN C & D LANDFILL

HOURS	
Monday-Thursday	0730-1515 hours
Friday	0730-1200 hours
Saturday, Sunday, and Holidays	Closed

All users shall make every effort to divert materials from the landfill through recycling and/or reuse of the materials.

ACCEPTABLE MATERIALS

- All building materials (wood, drywall, tile flooring, windows, door, insulation, shingles, contaminated cardboard only, and carpet)
- Non metal Plumbing materials
- Non metal Electrical materials **EXCEPT** fluorescent tubes, ballasts, PCB containing materials
- Non Metal HVAC materials **EXCEPT** refrigerants/coolants, oils, mercury thermostats
- Soils other than contaminated soils
- Concrete, brick, and masonry materials (24"x36"x18" or smaller) **NO METAL PROTRUDING OVER 4 INCHES, NO DIRT IN CONCRETE**, These materials must be segregated from other materials
- Asphalt pavement
- Asbestos, if properly containerized and properly documented

MATERIALS NOT ACCEPTED

- RECYCLABLE METALS

- Cardboard
- Compressed gas cylinders
- Tires (whole or shredded)
- Dead animals
- Household waste
- Lunch waste
- Recyclables
- Fluorescent lighting
- Hazardous materials, POLm PCB. Amt-freeze, WD-40 cans, etc..
- Automotive parts
- Liquids
- Appliances
- Computer equipment .
- Yard waste (grass clippings & leaves)
- Tree stumps, trunks, & branches
- Land clearing debris
- Crossties & utility poles

Materials not listed will be approved for disposal only by the Landfill Supervisor, POC (270- 956-2468) or Environmental Division (270-798-9771). A landfill Access Pass is required for use of the landfill. An access Pass can be obtained from Environmental Division, Building 5134.

------ 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 has 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 Hazardous Waste Program Manager.

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). Any items not known to be PCB free must be removed, packaged and marked for proper disposal.

A-8.5 Fluorescent ballast in buildings to be demolished may contain PCB's and must be removed for proper disposal. All fluorescent ballasts will be turned into the Environmental Division Pollution Prevention Operations Center for disposal.

A-8.6 Transformers as well as all fluorescent ballasts and HVAC/Electrical capacitors to be removed may contain PCB's and must be packaged and marked for proper disposal. All capacitors will be turned into the Environmental Division Pollution Prevention Operations Center for disposal.

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. PCB and non-PCB items will be packaged and marked separately to facilitate proper disposal.

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

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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.

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

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A-10. National Emission Standards for Hazardous Air Pollutants (NESHAP)

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 email, mail with postmark, fax and follow-up with a mailing, or deliver the NESHAP notice 10 working days before demolition begins even if the operation only involves removal of "non-regulated" ACM, in any amount, OR even if the operation involves no ACM.

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 be included on the demolition notice, so that only one notice need be sent. In this case, include the additional notice lead times as identified in paragraphs 2. a. through 2.d.

a. If the contractor is using a long-term (annual) notification and the RACM is less than 260 LF, 160 SF or 35 CF, the contractor needs to notify the state at

least 24 hours befor removal begins.

b. The Contractor will email, mail with postmark, fax and follow-up with a mailing, or deliver the NESHAP notice 10 working days prior to disturbance 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 will provide to the State by email, mail with postmark, fax, deliver, or by phone a courtesy notice to be received at least 24 hours before disturbance if the operation involves non-regulated ACM in any amount.

d. The Contractor will email, mail with postmark, 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: (see online email options)

Cory Groover (subject to change)
Kentucky Division for Air Quality
Asbestos Branch, Paducah Region
130 Eagle Nest Drive
Paducah, Kentucky 42003-9435
(270) 898-8468 Office (270) 898-8640 Fax

All Tennessee notifications are sent to:

Mr. Randal Harrison (subject to change)
Tennessee Division Air Pollution Control
9th Floor, L & C Annex, 401 Church St.
Nashville, Tennessee 37243-1531
(615) 532-6828 Office
(615) 532-0596 Fax

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

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APPENDIX B
Revision Status

Revision 05
27 July 2023

Division/Section or Appendix	Title	Revision Date	Current
			SME
Chapter 1	General Information and Administrative Requirements		
Chapter 2	General Requirements and Instructions		
Chapter 3	Technical Requirements and Instructions		
Division 00	Procurement and Contracting Requirements		
Section 00 22 13	Supplementary Instructions to Bidders	FEB 2023	
Division 01	General Requirements		
Section 01 14 00	Work Restrictions	Current	
Section 01 35 26	Government Safety Requirements	MAR 2021	
Section 01 50 00	Temporary Construction Facilities and Controls	Current	
Section 01 57 20.00 10	Environmental Protection	Current	
Section 01 57 23	Temporary Storm Water Pollution Control	July 2023	
Section 01 58 00	Project Identification	Current	
Section 01 74 19	Construction and Demolition Waste Management	Current	
Section 01 78 00	Closeout Submittals	Current	
Division 02	Existing Conditions		
Section 02 41 00	Demolition and Deconstruction	Current	
Section 02 42 91	Removal and Salvage of Historic Building Materials	Current	
Section 02 82 00	Asbestos Remediation	APR 2022	
Section 02 83 00	Lead Remediation	JUL 2022	
Section 02 84 16	Handling of Lighting Ballasts and Lamps Containing PCB's and Mercury	2018	
Section 02 84 33	Removal and Disposal of Polychlorinated Biphenyls (PCB's)	2018	
Section 02 85 00	Mold Remediation	2018	
Division 03	Concrete		
Section 03 30 00	Cast-in-Place Concrete	OCT 2022	
Section	Concrete for Minor Structures	Current	
Section 03 33 00	Cast-in Place Architectural Concrete	Current	
Division 04	Masonry		

Section 04 20 00	Masonry	Current	
Division 05	Metals		
Section 05 50 13	Miscellaneous Metal Fabrications	Current	
Section 05 52 00	Metal Railings	Current	
Division 06	Wood, Plastics, and Composites		
Section 06 20 00	Finish Carpentry	Current	
Section 06 61 16	Solid Polymer (Solid Surfacing) Fabrications	Current	
Division 07	Thermal and Moisture Protection		
Section 07 24 00	Exterior Insulation and Finish Systems	Current	
Section 07 31 13	Asphalt Shingles	Current	
Section 07 42 13	Metal Wall Panels	Current	
Section 07 51 13	Built-Up Asphalt Roofing	Current	
Section 07 52 00	Modified Bituminous Membrane Roofing	Current	
Section 07 53 23	Ethylene-Propylene-Diene-Monomer Roofing (EPDM)	Current	
Section 07 61 14.00 20	Steel Standing Seam Roofing	Current	
Division 08	Openings		
Section 08 33 23	Overhead Coiling Doors	Current	
Section 08 34 59	Vault Doors and Day Gates	Current	
Section 08 36 13	Sectional Overhead Doors	Current	
Section 08 71 00	Hardware	Current	
Section 08 81 00	Glazing	AUG 2021	
Division 09	Finishes		
Section 09 06 90	Color Schedule	Current	
Section 09 90 00	Paints and Coatings	Current	
Section 09 67 23.15	Fuel Resistive Resinous Flooring, 3- Coat System	Current	
Section 09 68 00	Carpet	Current	
Division 10	Specialties		
Section 10 14 01	Exterior Signage	MAR 2021	
Section 10 14 02	Interior Signage	MAR 2021	
Section 10 21 13	Toilet Compartments	Current	
Section 10 28 13	Toilet Accessories	Current	
Division 11	Equipment		
Section 11 44 00	Food Cooking Equipment	Current	
Section 11 48 00	Cleaning and Disposal Equipment	Current	
Division 13	Special Construction		
Section 13 34 19	Metal Building Systems	Current	

Division 22	Plumbing		
Section 22 00 00	Plumbing, General Purpose	Current	
Division 23	Heating, Ventilating and Air Conditioning		
Section 23 00 00	Air Supply, Distribution, Ventilation, and Exhaust Systems	6/23/22	
Section 23 08 00.00 10	Commissioning of HVAC Systems	FEB 23	
Section 23 09 23	Lon-works Direct Digital Control for HVAC and Other Building Control Systems	Current	
Section 23 09 53.00 20	Space Temperature Control Systems	AUG 2022	
Section 23 35 00.00 10	Overhead Vehicle Tailpipe (and Welding Fume) Exhaust Removal Systems	Current	
Section 23 52 00	Heating Boilers	Current	
Section 23 64 10	Packaged Water Chillers, Vapor Compression Type	Current	
Section 23 81 00.00 20	Unitary Air Conditioning Equipment	AUG 2022	
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Section 23 81 29	Variable Refrigerant Flow HVAC Systems	FEB 2023	
Section 23 82 01.00 10	Warm Air Heating Systems	AUG 2022	
Division 25	Integrated Automation		
Section 25 10 10	Lon-works Utility Monitoring and Control System	Current	
Division 26	Electrical		
Section 26 00 00.00 20	Basic Electrical Materials and Methods	4/14/2015	
Section 26 20 00	Interior Distribution System	4/14/2015	
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Section 26 32 14.00 10	Diesel-Generator Set, Stationary	4/14/2015	
Section 26 41 01.00 10	Lightning Protection System	4/14/2015	
Section 26 56 00	Exterior Lighting	4/14/2015	
Division 27	Communications		
Section 27 10 00	Building Telecommunications Cabling System	MAR 2021	
Division 28	Electronic Safety and Security		
Section 28 16 01.00 10	Small Intrusion Detection Systems (IDS)	Current	
Section 28 31 76	Interior Fire Alarm System and Mass Notification System	7/27/2023	
Division 31	Earthwork		

Section 31 21 13	Radon Mitigation	OCT 2021	
Section 31 23 00.00 20	Excavation and Fill	Current	
Section 31 31 16	Soil Treatment for Subterranean Termite Control	Current	
Division 32	Exterior Improvements		
Section 32 12 17	Hot Mix Bituminous Pavement	Current	
Section 32 13 11	Concrete Pavement for Airfields and Other Heavy-Duty Pavements	Current	
Section 32 16 13	Concrete Sidewalks and Curbs and Gutters	Current	
Section 32 17 23.00 20	Pavement Markings	Current	
Section 32 93 00	Exterior Plants	OCT 2021	
Division 33	Utilities		
Section 33 11 00	Water Distribution	Current	
Section 33 30 00	Sanitary Sewers	MAR 2021	
Section 33 40 00	Storm Drainage Utilities	Current	
Section 33 51 15	Natural Gas/Liquid Petroleum Gas Distribution	MAR 2021	
Section 33 56 10	Factory Fabricated Fuel Storage Tanks	Current	
Section 33 61 00	Prefabricated Underground Heating/Cooling Distribution System	Current	
Section 33 70 02.00 10	Electrical Distribution System, Underground	MAR 2021	
Section 33 71 01	Overhead Transmission and Distribution	MAR 2021	
Section 33 82 00	Telecommunications Outside Plant (OSP)	Current	
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)	Current	
	List of Appendices		
APPENDIX A	Environmental Topics		
Appendix A-1	Occupational Health Considerations	Current	
Appendix A-2	Clean Air Act	Current	
Appendix A-3	Clean Water Act	Current	
Appendix A-4	Safe Drinking Water Act	Current	
Appendix A-5	Toxic Substances Control Act (TSCA)	Current	
Appendix A-6	Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)	Current	
Appendix A-7	Solid Waste Disposal Act	SEP 2022	
Appendix A-8	Hazardous Waste Disposal Act	SEP 2022	
Appendix A-9	Emergency Planning and Community Right-To-Know Act	Current	
APPENDIX B	Revision Status	Current	
APPENDIX C	Digging/Excavation Permits	Current	
APPENDIX D	Building Interior and Exterior Finishes	APR 2022	
APPENDIX E	Fort Campbell Landscape Plant List	OCT 2022	
APPENDIX F	Utility Procedures	Current	

APPENDIX G	Mold and Humidity Control	Current	
APPENDIX H	Network Enterprise Center, Fort Campbell Requirements	Current	
APPENDIX I	Arms Room Requirements	Current	
APPENDIX J	Refuse Container Enclosures	Current	
APPENDIX K	Grinding of Concrete, Asphalt and Masonry Materials	Current	
APPENDIX L	Anti-Terrorism/Force Protection Barriers	Current	
APPENDIX M	Electrical Requirements	Current	
APPENDIX N	Accessibility for Disabled Persons	Current	
APPENDIX O	Sign Specifications	MAR 2021	

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

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.

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

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Appendix-D

Fort Campbell Preferred Equipment List and Exterior / Interior Finishes and Color Guidance

Section 04 50 00 CMU, Split Face CMU, Brick		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Brick	Palmetto Brick Co. Acme Brick Sioux City Brick	".75 Greystone" "Ko-Ko Brown" "Beige Grey Velour"
Accent Brick	Palmetto Brick Co. Acme Brick Sioux City Brick	"1.25 Greystone" "Ko-Ko Plus Chocolate" "Charcoal Grey Velour"
Split-Face CMU	Southland Supply	"Goldenrod, 24H"
CMU and Brick Sealer	Sinak Sealer, above or below grade.	Lithium compound solution, penetration reacts with mineral compounds or siliceous materials forming additional insoluble silicate and quart's structure. a. HLQ-125

Section 06 41 16.00 10 Plastic Laminate		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Vertical Surfaces	a. Wilsonart Type 107 b. Formica	Astro Strandz U.S. Federal Specification L-P 508H, April 9, 1977. a. 1500- Matt 60 Grey. 4940K-Matt 60 b. Aluminum 9318 Brush Texture. Sarum Twill 8827 Matt Texture

Section 06 61 16 Solid Surface Material		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Horizontal Surfaces Vertical Surfaces	a. Wilsonart	Solid homogeneous sheet blended with acrylic resins, ATH mineral fillers, and pigments, color throughout full thickness. a. Brooklyn concrete 9219GS ¼" and ½". Paris Fog 9110CS ¼" and ½" Angel Falls 9223SS ¼" and ½"

Section 07 42 13	**Metal Roof and Wall Panel**	
Exterior		
Korean era buildings: when remodeling Korean era buildings i.e. Hammer Heads, Administrative etc. The IPS standard shall be anodized dark brown window trim, insulated metal window panels, gutters, downspouts, and fascia trim. Window and insulated metal window panel configuration shall match existing design. All windows shall be 35% (translucent window panels are not to be used)		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Standing Seam Metal Roof (SSMR) Fascia, gutters and down spouts. **160th SOAR Brown Compound Color shall be White**	Ultra-Seam US 200 Kyner 500 or Polyviylidene fluoride (PVDF) PPG Duranar Coating	Min. live load (20psf) Deflection L/180. 12" to 18" wide Panel w/ stiffening ribs. Minimum thickness .032", aluminum or (24ga.) Galvalume Grade D Steel. UFC 3-110-03, PPG Medium Bronze, 20 Year watertight warranty.
Metal Siding vertical **160th SOAR Brown Compound Color shall be White**	Ultra-Seam US 200 Kyner 500 or Polyviylidene fluoride (PVDF) PPG Duranar Coating	Min. live load (20psf) Deflection L/180. 12" to 18" wide Panel w/ stiffening ribs. Minimum thickness .032", aluminum or (24ga.) Galvalume Grade D Steel. UFC 3-110-03, PPG Sandstone. 20 Year watertight warranty.
Section 08 71 00	**Hardware** **Fort Campbell Master System** **Insta-Key Interchangeable Core**	
Items	**Preferred Manufacturer**	**Salient Characteristics**
Door Lock Set Cylindrical Door Lock Set Mortise Panic	Yale Interior doors, AU Entry 4707LN AU Privacy 4707LN Mortise Dormitory or Exit 8822 AU X CN Lever Panic and Fire, 7000	ABA compatible, satin Chrome Plated lever handle, SFIC 7 pin insta key interchangeable core, latch bolts, deadlocking latch bolts 2-¾" backset ½" throw latch bolt. Mortise doors Sets 1-¾" to 3-¼" thick, 1" deadbolt throw stainless steel, Field reversible, UL/cUL-3 hour fire rating, 10 year mechanical warranty ANSI/BHMA Grade 1.
Deadbolt	Oak	Single Cylinder Deadbolt with Concealed screws, Grade 1, Function L/C, SFIC Part #; 1DB#-K-1-SC-626

Cylindrical Lockset	Oak	Cylindrical Lever Lockset, Grade 1, Classroom Function, SFIC Part # 1CLKX3-CL-1-R2-A-626
Cylindrical Lockset	Oak	Cylindrical Lever Lockset, Grade 1, Classroom Function, SFIC Hard return Part # 1CL3-CL-1-H2-A-626
Cylindrical Lockset	Oak	Cylindrical Lever Lockset, Grade 1, Classroom Function, SFIC Part # 1CKX3-CL-1-R2-A-626
Cylindrical Lockset	Oak	Cylindrical Lever Lockset, Grade 1, Privacy Function, SFIC Part # 1CL3-PR-0-H2-A-626
Cylindrical Lockset	Oak	Cylindrical Lever Lockset, Grade 1, Entry Function, SFIC Part # 1CL3EBC2A626
Knob Privacy	Oak	Knob Privacy LSDA, Grade 2, US 32D Latch type 2-3/4" Part # 027970
Knob Passage	Oak	Knob Passage LSDA, Grade 2, US 32D Latch type 2-3/4" Part # 027960
Knob Entry	Oak	Knob Entry LSDA, Grade 2, Less Core US 32D Latch type 2-3/4" Part # 287162
Knob Entry	Oak	Knob Entry LSDA, Grade 2, SFIC, US 32D Latch type 2-3/4" Part # 087162
Backsets 2-3/4	LSDA	Dead latch 2-3/4 stainless SS Part #009302
Backsets 2-3/8	LSDA	LSDA Dead latch 2-3/8 Stainless SS Part # 009295
Lever	Schlage CO100	SCHG Keypad CYL Lock SFIC Manual Programmed CO100CY70P RH06262BD
Exit Device	Schlage CO100	SCHG KEYPAD EXIT TRIM SFIC MANUAL PROGRAMMED CO100 993R70KP RHO626BD
Mortise Lock	Yale	Yale Mortise Lever lock, 8822FL ,626, LHR Corridor LK Function, 1-3/4" Door
Panic	Von Duprin Yale Precisions	33/35A Narrow stile heavy duty, Grade 1. None handed. AU Exterior handle, Satin Stainless Steel. Series 6000, Grade 1. None handed. AU Exterior handle, Satin Stainless Steel.
Door Closers	Yale 2700	Aluminum Painted, non-handed, Adjustable backcheck, closing and latching speed, Dimensions 2-⅞" x 13" x 2-⅛", Hold open @ 90° to

		180°.

Section 09 51 00	Grid Ceiling and Tile	
Items	**Preferred Manufacturer**	**Salient Characteristics**
2’ x 2’ Ceiling Grid	Rockfon Certain Teed Armstrong	1200 Exposed 15/16 White Bayonet and hook ends rails aluminum rated for Plater and Gypsum board, Ceilings, Acoustic Ceilings, Heating, Ventilating and Air Conditioning, Electrical Fixtures.
2’ x 2’ x ⅝” Acoustical Ceiling Panel (ACP)	a. Armstrong b. Certain Teed	a. Canyon, Smooth Texture with BioBlock Mold/Mildew Protection, 15/16 Beveled Tegular, Type III, 0.60 Acoustics NRC, Light Reflective 0.80, white painted surface b. Baroque, Fine Fissured square lay-in Square edge, non-directional mineral fiber panel, Type III, 0.60 Acoustics NRC, Light Reflective .80, White in color.
2’ x 2’ x ⅝” Acoustical Ceiling Panel (ACP) for high moisture areas	Certain Teed Armstrong	Aqua rock lay-in washable Vinyl face, or Kitchen Zone smooth texture, Moisture Resistant, Mold Resistant Core, withstand 95% humidity, square edge, White in color.

Section 09 65 00	Flooring	
Items	**Preferred Manufacturer**	**Salient Characteristics**
Cove Base 4”, and 6”	a. Flexco b. Mohawk	.080” Gauge Rubber a. 93 Graphite Thermoplastic Rubber Formulation. b. 099 Black Brown
Stair Treads	a. Mohawk	099 Black Brown, Round Rubber regular and Integrated tread and riser, 24’ x 10-1/4” w 3/8” toe x 0.080”
Tile Floor LVT 18” x 18” 12” x 24” 18” x 36”	a. J&J b. Patcraft	No Polish / Buff, 18” x 18” x ⅛”. Wear Layer 0.020”. Light Reflectance 45-49%. ASTM F 1700, Class III, Type B-Embossed Surface, Coefficient of Friction ≥ 0.5, Antistatic Properties ≤ 2.0 kV. a. Saga 1055, Legend 5mm b. CMYK 1426V Ivory 00130 20mil.

Items	**Preferred Manufacturer**	**Salient Characteristics**
Unfinished Concrete	No Skidding Aqua Tuff-78001 Sparkle Tuff Anti Slip System	High-Build Aliphatic Polyurethane floor coating, chemical and stain resistance, flexible coating added polymer traction grit, Matt finish. #60 Grit broadcast. (Clear)
Polished Concrete	All polished concrete shall be as follows: Diamond ground, stained and polished equal to the "Ardex Ultraflor Polished Concrete" system by Ardex and Diamatic. System to be of a Level 2 cut and a Level B sheen finish. Quest Mark Diamond Quest – Polished Concrete, submit color. Note that staining may be left out and use no color or stain. Contractor shall polish a sample of the floor and COR shall contact Government Project Engineer to determine use or non-use of stain. Remove all existing flooring as needed to polish concrete.	
Ceramic Tile	a. Mile Stone, Mfg. Clarksville TN. b. Floridatile	Fired Porcelain, -12" x 12" Mosaic, 6" x 24". 12" x 24" 8mm thick, Coefficient of friction ≥ 0.64 wet, V2 or V3 variation color. HDP M122, Break Strength ≥ 253 lbf, a. Heritage (White) or Breccia (Silver) b. Urban Foundry Alumina (FDY10)
Sheet Flooring	a. Johnsonite Tarkett	3.0 Homogeneous Flooring Polyurethane, Reinforced 0.080" think, wear layer 0.080" Aria 3.0 Diorite 0672.

Section 09 67 23.14	**Resistive Resinous Flooring 3-Coat System**	
Items	**Preferred Manufacturer**	**Salient Characteristics**
3-Coat System	Polyspec Tennant Stonhard Crawford Labs General Polymers Sparta Coat	(See UFGS Div. 9 Sec. 09-67-23.14 Table II Preapproved Materials) Areas: Halls, Company Bays. Color, Light Grey, Dark Grey and White Decorative Chip Broadcast. Areas: Hanger High Bay. Color, Solid White. Areas: Motor Pool Bays. Color, Solid White.

Section 09 67 23.15	**Fuel Resistive Resinous Flooring 5-Coat System**	
Items	**Preferred Manufacturer**	**Salient Characteristics**

5-Coat System	Polyspec Tennant Stonhard Crawford Labs General Polymers Sparta Coat	(See UFGS Div. 9 Sec. 09-67-23.16 Table II Preapproved Materials) Areas: Halls, Company Bays. Color, Light Grey, Dark Grey and White Decorative Chip Broadcast. Areas: Hanger High Bay. Color, Solid White. Areas: Motor Pool Bays. Color, Solid White.
Section 09 68 00	**Carpet Tile**	
Items	**Preferred Manufacturer**	**Salient Characteristics**
2' x 2' Tile 2' x 4' Tile	a. Patcraft b. J+J Flooring c. Mohawk	24" x 24" 100% solution dye, Ecoworx backing. Nylon 18 oz. Tufted yarn weight, monolithic pattern. Threaded Carpet Tile, w/Eco flex ICT backing Solution Dyed. . 22 oz. 0.219" total thickness, a. 10227 easy on the eye Presto-Chango 504, 10226 moving on up Presto-Chango 504 b. Impromptu Modular 7071, (2384 at first glance) or (2389 Impetuous) c. Renegade Riot BT355—358,Tufted, SD Nylon
Section 09 68 00	**Carpet Tile, High Traffic**	
24" x 24" for: Motor Pools Office Air Craft Hanger Office Foyers	a. J+J Flooring Kinetix	Polyester-applied, polyester cushion, 4.5 oz.-5.2 oz. total weight. 0.205 thick, Electrostatic < 3.0 kv. Water Repellency rating ≥ 0.4. Complies with ADA HFSI Certified High Traction. Coefficient of friction ≥ 0.65 a. Downtown 1850 Modular, 3153 Route 66.
Section 09 90 00	**Interior Paint**	
Items	**Preferred Manufacturer**	**Salient Characteristics**
Interior metal doors, frames and Trim	Farrell Calhoun	Grey 0533 "Techile" semi-gloss or RGB of 159,161,161
Wood Door Slab natural birch	Poly Coat Clear	Crystal Clear Polyurethane, Semi-Gloss
Drywall, CMU, Concrete Walls	Farrell Calhoun	Light Grey 0530 "Metro" eggshell or RGB of 212,213,218
Section 09 90 00	**Exterior Paint With Existing Anodized Aluminum Store Front Doors**	

Items	Preferred Manufacturer	Salient Characteristics
Exterior Metal Doors, frames and Trim	Farrell Calhoun Sherwin Williams PPG	0533 “Techile” semi-gloss or RGB 159,161,161
Exterior Primary Wall	Farrell Calhoun Sherwin Williams PPG	0293 “What Inheritance” Flat or RGB 232,215,188
Exterior Secondary Wall	Farrell Calhoun Sherwin Williams PPG	0188 “Baquette” Flat or RGB 204,187,171
Section 09 90 00 Exterior Paint With Existing Anodized Bronze Store Front Doors		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Exterior Metal Doors, frames and Trim	Farrell Calhoun Sherwin Williams PPG	0221 “Brown Suede” semi- gloss or RGB 91,79,65
Exterior Primary Wall	Farrell Calhoun Sherwin Williams PPG	0293 “What Inheritance” Flat or RGB 232,215,188
Exterior Secondary Wall	Farrell Calhoun Sherwin Williams PPG	0188 “Baquette” Flat or RGB 204,187,171
Exterior Stucco “Drivet” and Split Face CMU	Farrell Calhoun Sherwin Williams PPG	0293 “What Inheritance” Flat 100% Acrylic Paint, RGB 232,215,188
Section 10 21 13 HDPE Toilet Partitions		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Toilet Partitions	ASI Accurate Partitions General Partitions Bobrick	High Density Polyethylene homogenous color throughout floor anchored/overhead braced, 3/4” thick door and panels 55” high, pilasters 82” high. Stainless Steel foot Plate, Hinge gravity activated set in 30° increments. Dark Blue in Color. Orange peel Surface Texture.
Urinal Screens	ASI Accurate Partitions General Partitions Bobrick	High Density Polyethylene homogenous color throughout. 3/4” thick, 18” x 42”. Dark Blue in Color. Orange peel Surface Texture.
Section 10 28 13 Toilet Compartment Accessories		
Items	**Preferred Manufacturer**	**Salient Characteristics**

Shower Curtin	a. Bobrick	Opaque, matte white vinyl 0.008", containing antibacterial and flame retardant. 42", 70" with HDPE grommets. Bottom and sides hemmed. a. 204-2, 204-3
Shower Curtin Hooks	a. Bobrick	18-8, Type-304, 0.09" Stainless Steel for 1" or 1-¼" Shower Curtain Rods. a. 204-1
Shower Curtin Rod	a. Bobrick	18-8, Type-304, 18-gauge Stainless Steel tubing, satin finish, flanges 18-8, Type-304, 20 Gauge Stainless steel satin finish, One piece, die-formed. a. B-6047
Mirror w/ Stainless Steel	a. Bobrick	Frame-Type-430 Stainless Steel, ½" x ½ "x ½" channel Lock Tab, 90° mitered corners, Galvanized steel back. Mirror No. 1 quality, ¼" float glass, Silvering, electrolytically copper-plated by galvanic process, 15 year guarantee, supports 16 gauge roll steel. a. B-165
Items	**Preferred Manufacturer**	**Salient Characteristics**
Stainless Steel Shelf	a. Bobrick	Shelf-18-8 S, Type-304, 18 gauge Stainless Steel Satin Finish, return edges hemmed for safety. Brackets 18-8 S, Type-304, 16 gauge Stainless steel Satin Finish, welded to back. a. B-295
ABA Folding Shower Area Seat	a. Bobrick	Seat- One piece, 5/16" Solidly fused plastic laminate, matte finish melamine, Ivory color face, Frame-18-8, Type 304, Stainless steel, sati finish, 16 gauge square tubing, Baseplate-18-8, type-304 Heavy gauge stainless steel, Spring-17-7. Type-301, 24 gauge stainless steel.
Toilet Seat	a. Bemis	Elongated Open Front With or Without Cover, Commercial Fastening System, DuraGuard antimicrobial HDPE, 300 stainless steel hardware.
Toilet Tissue Dispenser	a. Bobrick	Flanges-18-8, Type-304, Satin Finish 22 gauge Stainless Steel, 16 gauge mounting brackets, Chrome plated Spindles.

		a. B-6867
Towel Bar Surface Mounted	a. Bobrick	Flanges-18-8, Type-304, 22 gauge Stainless Steel, 16 gauge flanged, Bar- 18-8, Type-304, Heavy gauge Stainless Steel Lockseam rolled ¾" square tubing. 24". a. B-6737
Paper Towel Dispenser	a. Bobrick b. Georgia Pacific	10" Automated Touchless Paper Towel Dispenser, Black or Bluein color. a. B-72974 b. 59462A

Section 12 21 00	Window Blinds	
Items	**Preferred Manufacturer**	**Salient Characteristics**
Metal Blinds (windows)	a. Levolor Riviera One.	1", 6 gauge heat treated spring tempered Premium aluminum Slats, Integrated Valance, Steel Headrail Components, wand draw 10 year Manufacture Warranty. a. Beacon Brown 368, or Ivory 201
Vertical Blinds (floor to ceiling windows)	a. Levolor	3-1/2" dust valance, wand draw, a. Plaza Ash 21770193, faux texture

Section 22 00 00	Plumbing Fixtures	
Must comply with buy American Act By Executive Order 13811 15 July 2019		
Items	**Preferred Manufacturer**	**Salient Characteristics**
Domestic Circulating Pump, Open Systems – Heating or Cooling	Wilo Taco Grundfos	Three Speed Wet Rotor. Bronze or Stainless steel Volute and Shaft body w/flanged in/outlet less than 0.25% Lead content. Application 'Potable water systems, Air-Conditioning Systems, Open Systems-Heating or Cooling, Water/Glycol concentrations up to 50%
Toilets – Manual flush valve Floor Mount (FM) Wall Mount (WM)	Kohler (FM) High cliff (WM) Kingston American Standard (FM) Madera (WM) Afwall Zurn (FM) Z5665 (WM) Z5615	ABA compliant elongated 1.6 gpf, 1-1/2" top spud, 2-1/8" fully-glazed trap way 10" or 12" rough-in. White in color.
Toilets – Tank Type Floor mount (FM)	Kohler Highline Classic American Standard Colony Zurn Z5555-K	ABA compliant elongated 1.6gpf, with 2-1/8" fully-glazed trap-way 10" or 12" rough-in. White in color.

Urinals – **Siphon Jet** Manual flush valve	Kohler Dexter American Standard Trimbrook Zurn Z5730	**Siphon Jet** ¾" top spud 1.0 gpf. ADA compliant @ 17" RI. White in color.
Faucet – lavatory 4" spread Less Pop up. 1-1/4" grid drain	Delta Classic American Standard Colony Soft Symmons Origins Wolverine Brass	Solid Brass Fabricated Body, Single handle LF centerset Less Pop Up. 1.2 gpm @ 60 psi, Threaded metal Shanks @ ½"-14 NPT, Chrome in color.
Faucet – Tub/Shower with **integral stops** No institutional shower heads	Delta Classic American Standard Colony Soft Symmons Origins Wolverine Brass	Temperature and pressure balanced, single handle with Integral stops. 1.75 gpm @ 80 psi, Solid Brass Forged Body, pull down tub spout. Chrome in color.
Faucet – Residential Kitchen 8" spread Less Spray	Delta Classic American Standard Colony Soft Symmons Origins Wolverine Brass	Solid Brass Fabricated Body, Single handle LF Long spout 360° 1.8 gpm @ 60psi Threaded metal Shanks @ ½"-14 NPT, Chrome in color
Faucet – Utility sink 4" or 8" spread Wall mount (WM) Mop sink Deck mount (DM) Utility or Bar sink	T&S (WM) B-0674 CR (DM) B-1110 Zurn (WM) Z-843L1 (DM) Z-812J1-XL	Full brass body, with vacuum breaker, ½" NPT 40°F-140°F garden hose male outlet, ceramic cartridges, integral stops. Chrome in color.
Condensing Gas Water Heaters Copper Fin Non Condensing Gas Water Heaters	Lochinvar Shield, Armor, Copper Fin II AO Smith XP, Cyclone Mxi, Genesis	Condensing type modulating down to 20% rate, turn down ration of 10:1@ 98% TE. Stainless steel heat exchanger. Digital Operating Control LCD Display. Cascade and Lead Lag capable. Copper fin tube non-Condensing type 85% TE. @4:1 turndown ratio. Hot surface ignition, LCD Display
Domestic hot water storage tanks	Lochinvar AO Smith NTS	Lock Temp, cement lined, glass lined or Epoxy lining with manway, sized to building occupancy. Magnesium Anodes, Jacketed W/ R-16 insulation,
Water Cooler – Wall Hung with bottle filler and filter.	Elkay LZS8WSSP Halsey Taylor HTHB_HACG8SS-WF Vandal-Resistant	8 gph filtered w/bottle filling station, ABA compliable, Visual Filter Monitor, certified to NSF 42-53 for lead. Stainless Steel.

Section 23 01 30.41 Integrated Automation

Items	Preferred Manufacturer	Salient Characteristics
Building Controls	Johnson Controls Honeywell	Must be Compatible with equipment used or installed. Voltage, 1 or 2 stage heating or cooling. No preprogram units. Simple cool/heat on/off.
Valve Linkage (DCA)	Honeywell Q5020A1003 Johnson Controls Belimo	Two-way and three-way modulating or two-position service. ¾" stroke ½" shaft, 25 to 175lb-in.
Actuators spring return Actuators non spring return	Belimo Ruskin Honeywell	24V AC/DC Proportional Spring Return -22° to 122°F, 35 in.-lb. 150 sec. Spring return 2 to 10 VDC 35lb @ 150 sec.
Variable Frequency Drives	ABB Driver Baldor Johnson Controls AYK 550 Air Modulator	Must be Compatible with equipment used or installed. HP, Phase, Voltage, Nema 1 enclosure, nonproprietary

		control panel PLC equipment. Variable speed AC/DC drive control.
Interface	Distech N-4 JACE	"Open Licensed for software connection" Must be compatible with Fort Campbell BACnet and LONWORKS platform, Building automation and energy management systems.
Plant Controller & AHU	Distech ECL-450	12 inputs 12 outputs 15 VDC (100 mA) 4 to 20 mA sensors, HOA switch with rotary potentiometer, real time clock with daylight savings time configuration. Must be compatible with Fort Campbell BACnet and LONWORKS platform, Building automation and energy Management systems.

Section 23 52 43.00 20 Mechanical Systems Heating

Items	Preferred Manufacturer	Salient Characteristics
Gas Boilers, Condensing	Lochinvar Cleaver Brooks	Modulating Combustion W/ 25:1 turndown. 96.2% TE, LCD Display, cascading sequencer up to 8 boilers, BMS integration 10 VDC, 316L Stainless Steel Fire Tubes
Gas Boilers, Copper Fin Non Condensing	Lochinvar AO Smith Genesis LARRS Pennnant	85% Thermal Efficiency, 4:1 turndown, Hot surface ignition or direct spark ignition, LCD display, cascading for up to 8 boilers, BMs 10 VDC, Three Pump Controls. Stainless Steel Burners
Buffer Tanks Hydraulic Separator Buffer Tanks Hydraulic Coalescing	American Wheatley Lochinvar Buffmax	14 gauge steel, R-14 2" think HCFC free polyurethane foam insulation, brass air eliminator, flanged inlet and outlet, paint film thickness of 0.70 mills.

Section 23 63 00 Mechanical Systems Cooling

Items	Preferred Manufacturer	Salient Characteristics
Air Compressors	Quincy QGD Ingersoll Rand Generation R	Tankless Rotary Screw Air Compressor 70-281 acfm @125 psig, sound level 66dBA or lower, w/Dryer
VRF, VTAC, PTAC, Mini Split, DX heat pumps, 5-ton capacity, or less.	Trane Carrier Mitsubishi P-Series Pioneer	16 or greater SEER rating Cooling (°F DB) 57~77 Heating (°F WB) 59~81
Chillers Water Cooled Single stage and two stage chillers	Trane Carrier	Centrifugal Compressor. HFC-134a or HFC/HFO-513a Heat recovery capabilities for dehumidification. VSD capabilities.
Chillers Air Cooled	Trane Carrier	Screw, Scroll or Reciprocating Compressors. Full-load performance and high part-load performance to reduce kwh rate charges. Thermostatically

		controlled immersion heater. 20-130 tons scroll, R-410A – 140-500 tons R-134A or R-513A Helical rotary screw. All units must be equipped with hail guards. VSD capabilities.
Furnaces, 200,000 BTU/hr. heat capacity, or less	Trane Carrier	92.1 % Afue. Fully modulating Gas Valve
Buffer Tanks Hydraulic Separator Buffer Tanks Hydraulic Coalescing	American Wheatley Lochinvar Buffmax	14 gauge steel, R-14 2" think HCFC free polyurethane foam insulation, brass air eliminator, flanged inlet and outlet, paint film thickness of 0.70 mills.

Section 26 05 00.00 40 Electrical

Items	Preferred Manufacturer	Salient Characteristics
Auto ON/OFF Occupancy Sensor Exhaust Fan Control	Leviton SmartExhaust	Vandal resistant, Auto ON/OFF 10A, 120/277VAC, 50/60hz, 180° view, Adjustable time delay 30s-30m, Light Sensor (Photocell) White in color.
LED Troffer Light Fixtures (Office) Emergency Troffer Light Fixtures 2x2 and 2x4	Independence Lumax Lighting	4000K or greater, 4900 Lumens 120/277VAC, ≥0.9 Power Factor, Acrylic lens , Dimming <20%-100%, Flat Back Lit Panel, Suitable for Damp Locations, Batt Backup, White in color.
Suspended Linear luminaire (Office) 4' and 8'	Lumax Lighting Tamlite Lighting	Direct/Indirect, 4000K or greater, 4900 Lumens, 120/277 VAC, Dimming <20%-100%, Batt Backup, Shite in color.
High Bay Low Bay Suspended (Hanger, Warehouse)	Lumax Lighting Tamlite Lighting	High Performance LED High Bay without lens, Luminaire 55° c 120-277VAC, 44° c 347-480 VAC. 5000 Kelvin, Minimum 50,300 Lumens.

Fire Panels and Equipment

See Section 28-31-76 interior Fire Alarm System and Mass Notification Systems.

APPENDIX E

Fort Campbell Landscape Plant List

For Cantonment Area

- **No shrubs / landscaping unless in high profile area and approved by DPW for DPW owned facilities.**
- **Trees shall be ones that grow locally.**
- **Trees must not be planted near the building to cause damage even after 30 years of growth.**
- **Trees must not be planted under power lines or too close to roads.**

Tree and Shrub Planting

Shrub Planting
Littleleaf and Common Boxwood
Kaleidoscope Abelia
Compacta Holly
Natchez Crepe Myrtle
Dynamite Crepe Myrtle
Pardon Me Daylily
Blue Star Juniper
Double Play Candy Corn Spirea
Parson's Juniper
"Silver Mist" Shore Juniper
Knockout Rose

FTCKY is in USDA Hardiness Sone 7

Tree Planting. Primary Trees for planting on FTCKY Cantonment Area.

SHADE TREES	ORNAMENTAL TREES	PRIVACY SCREENS
Nuttal Oak	Crepe Mytrle	Blue Spruce Tree
Willow Oak	Okame Cherry Tree	American Holly
Red Maple	Kwanzan Cherry Tree	Brodie Red Cedar Tree
Sugar Maple	Yoshino Cherry Tree	

Vegetation to Sustain the Natural Habitat XXXXXXXXXXXX

Native Plant Material (Native)

Conifers/Evergreens:

Botanical Name	Common Name
(Native) Tall Trees – (trees over 50 ft. at maturity)	
Pinus echinata	Shortleaf Pine
Tsuga canadensis	Eastern Hemlock
Taxodium distichum	Bald Cypress
(Native) Small Trees/Large Shrubs – (10 to 25 ft. at maturity)	
Juniperus virginiana	*Eastern Red Cedar*

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(Native) Deciduous:

Botanical Name	Common Name
(Native) Tall Trees– (trees over 50 ft. at maturity)	

Quercus alba	White Oak
Quercus stellata	Post Oak
Quercus bicolor	Swamp White Oak
Quercus michauxii	Swamp Chestnut Oak
Quercus prinus	*Chestnut Oak*
Quercus muehlenbergii	Chinkapin Oak
Quercus rubra	*Northern Red Oak*
Quercus falcata	Southern Red Oak
Quercus velutina	Black Oak
Quercus shumardii	Shumard Oak
Quercus coccinia	Scarlet Oak
Quercus phellos	Willow Oak
Acer rubrum	Red Maple
Acer saccharinum	Silver Maple
Acer negundo	Box Elder
Fraxinus pennsylvanica	Green Ash
Fraxinus americana	White Ash
(Native) Medium Trees – (trees 25 to 50 ft. at maturity)	
Quercus stellata	Post Oak
Quercus marilandica	Blackjack Oak
Ostrya virginiana	Eastern Hop Hornbeam

Amelanchier arborea	Downey Serviceberry
Ilex opaca	American Holly
Rhamnus caroliniana	Carolina Buckthorn
Aesculus glabra	Ohio Buckeye
Acer negundo	Box Elder
(Native) Small Trees/Large Shrubs – (10 to 25 ft. at maturity)	
Hamamelis virginiana	Witch Hazel
Carpinus carolinia	American Hornbeam
Kalmia latifolia	Mountain Laurel
Prunus americana	American Plum
Crataegus spp.	Hawthorn
Cercis canadensis	Eastern Redbud
Cornus florida	Flowering Dogwood
Euonymus atropurpurens	Eastern Wahoo
Cephalanthus occidentalis	Buttonbush
Sambucus canadensis	American Elder

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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
Deschampsic caespritosa	Tufted hairgrass
Dichanthelium sphaerocarpon	Roundseed panicgrass
Elymus hystrix var. hystrix	Eastern bottlebrush grass
Panicum virgatum	Switch grass
Festuca arundinacea	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
Hemerocallis middendorfii	Middendorfii Daylily	
Hemerocallis minor	Minor Daylily	
Sedum species	Sedum	Select appropriate species for the site.
Liriope species	Lillyturf	Select appropriate species for the site.

Shrubs

Scientific Name	Common Name	Cultivars or Comments
Ilex glabra	Inkberry	Any appropriate cultivar for bio-retention size.
Itea japonica 'Beppu'	Beppu sweetspire	If there is a better cultivars for the site it should be used.
Juniperus communis 'Wiltonii	Blue Rug juniper	
Viburmnum dentatum	Arrowwood viburum	Any appropriate cultivar for bio-retention size.
Physocarpus opulifolius	Ninebark	Any appropriate cultivar for bio-retention size.
Buxus microphylla	Littleleaf boxwood	

Small Trees

Scientific Name	Common Name	Cultivars or Comments
Cercis candensis	Redbud	Cultivars should match conditions
Amelanchier canadensis	Serviceberry	Multiple stems

Medium / Large Trees

Scientific Name	Common Name	Cultivars or Comments
Chionanthus virginicus	Frindgetree	
Acer rubrum	Red maple	Has surface roots
Quercus palustris	Pin oak	
Quercus phellos	Willow oak	Has large surface roots
Liquidambar styraciflua	Sweetgum	Use fruitless varieties, has large surface roots Make sure site has appropriate soils.
Nyassa sylvatica	Black gum	Select appropriate cultivar for the site.
Platanus occidentalis	Sycamore	
Fraxinus pennsylvanica	Green ash	Select appropriate species for the site.
Taxodium distichum	Bald Cypress	
Betula nigra	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 / Small (4 to 5 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
Ilex glabra 'Chamzin'	Inkberry	When there is better cultivar for the site it should be used.
Viburnum opulus '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
Itea japonica 'Beppu'	Beppu sweetspire	If there is a better cultivar for the site it should be used.

Juniperus communis 'Wiltonii'	Blue Rug juniper	If there is a better cultivar for the site it should be used.
Physocarpus opulifolius 'Nana'	Dwarf Eastern Ninebark	If there is a better cultivar for the site it should be used.
Buxus microphylla	Littleleaf boxwood	
Spirea x bumalda	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
Fraxinus americana	White ash	'Autumn Purple'
Quercus bicolor	Swamp White oak	
Gleditsia triocanthos	Honeylocust	Use thorn less variety/cultivar inermis 'Shademaster'

Medium Trees (25 to 40 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
Ginko biloba	Ginko (Maiden Hair)	'Fastigiata',' Princeton' 'Sentry', 'Shangri-la'
Ostrya virginiana	American hophornbeam	
Zelkova serrata	Japanese zelkova	'Village Green'

Small Trees (10 to 25 feet at maturity)

Scientific Name	Common Name	Cultivars or Comments
Acer ginnala	Amur maple	
Cratageus crus-galli	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.

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

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Appendix F
Utility Procedures

PARAGRAPH

F-1 INTRODUCTION

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.

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:

JACOBS
Phone: 931-980-7223

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

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APPENDIX G

Mold and Humidity Control

PARAGRAPH

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 Polyicynene which effectively eliminates air infiltration and vapor transmission.

G-3 TIGHT BUILDINGS:

Leaks of unconditioned outdoor air brings 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 that 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 windblown 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 damp roofing, 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 set point 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 set point.

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 pain.

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 thatthe 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 UFC 4 721 01A Barracks Upgrade Program and UFC 3-410-014 Heating, Ventilation, and Air Conditioning. 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).

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

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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 (RNEC)-Ft Campbell
856 North Carolina Avenue
Fort Campbell, KY 42223-5000

Revised
JUNE 2020

NEC-SFB-DS

MEMORANDUM FOR Directorate of Contracting

SUBJECT: Appendix H to the Fort Campbell, Kentucky Technical Design Guide

1. References. Below are the IT regulations/standards used by the Fort Campbell Regional Network Enterprise Center (RNEC) to ensure compliance for all unclassified (NIPRNet) and classified (SIPRNet) and IT-related voice and data equipment/services and associated construction efforts:

2. “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 shall be used for Outside Plant (OSP) construction at Fort Campbell.

3. “Secret Internet Protocol Router Network (SIPRNET) Technical Implementation Criteria, Version 7”, dated, September 2013.

4. The Committee on National Security Systems (CNSSI) No. 7003, “Protective Distribution Systems (PDS)”, dated, September 2015.

5. CSNSAM TEMPEST/1-13 “Red/Black Installation Guidance”, dated 17 January 2014.

6. ANSI/TIA 569, Standards Update, Pathways & Spaces for Telecommunications, current.

7. Army Regulation 380-5, “Department of the Army Information Security Program”, dated, 22 October 2019.

8. Applicability: This policy applies to all persons who provide IT construction services to any facility located on Fort Campbell, Kentucky.

9. This memorandum supersedes “Information Technology (IT) Technical Design Guide, dated, September 2014.

10. Point of contact for this document is the, RNEC Plans/Architecture Branch located at 856 North Carolina Ave., Fort Campbell, KY 42223, 270/798-6238.

FIGURES

TABLES

CHAPTER 1

INTRODUCTION

PURPOSE AND SCOPE

This Appendix H provides requirements for the planning, design, and construction of telecommunications infrastructures. Common requirements are contained in Chapters 1, 2 and 3 of this document.

The scope includes telecommunications spaces, pathways, cabling and interconnecting components necessary to support the infrastructure for voice, data and video systems. “Video systems” includes the necessary infrastructure for Closed Circuit Television (CCTV), Community Antenna Television (CATV), generally referred to as Cable TV, and Video Teleconferencing (VTC).

APPLICABILITY

This Appendix H applies to all interior telecommunications infrastructure planning, design and installation in new or existing facilities. Waivers and exemptions must comply with the process identified in MIL-STD 3007. For Outside Plant (OSP) infrastructure requirements refer to “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.

GENERAL BUILDING REQUIREMENTS

Comply with Unified Facilities Criteria (UFC) 1-200-01, General Building Requirements. UFC 1-200-01 provides applicability of model building codes and government unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, high performance and sustainability requirements, and safety. Use UFC 3-580-01 in addition to UFC 1-200-01 and the UFCs and government criteria referenced therein.

GOVERNING CRITERIA FOR ELECTRICAL SYSTEMS

UFC 3-501-01 provides the governing criteria for electrical systems, explains the delineation between the different electrical-related UFCs, and refers to UFC 3-520-01 for interior electrical system requirements.

MODERNIZATION WITHIN EXISTING FACILITIES

Modernization of telecommunications systems within existing facilities solely for the purpose of meeting design criteria in this UFC is not required.

REFERENCES

Appendix A contains a list of references used in this document. The publication date of the code or standard is not included in this document. In general, the latest available issuance of the reference is used.

ACTIVITY SPECIFIC TELECOMMUNICATIONS MANAGERS

Throughout this document, the term “telecommunications manager” refers to the following:

For Army, the Regional Network Enterprise Center (RNEC).

GLOSSARY.

The glossary at the end of this document contains acronyms, abbreviations, and terms.

CHAPTER 2

DESIGN REQUIREMENTS

GENERAL GUIDANCE

Design interior telecommunications infrastructure to meet the needs of the activity and supporting facilities in accordance with this document. A/E contractor generated final drawings and specifications for design-bid-build and design-build projects must be stamped by a BICSI Registered Communications Distribution Designer (RCDD).

Note: Design and construction may be concurrent efforts in Design-Build projects, and multiple phases of construction may be approved. Therefore, the final documents for each construction phase must be stamped.

2-1.1 Government-Designed Projects

On government-designed projects (in-house design) the government designer must:

Obtain the approval of the service appointed telecommunications agent, prior to bid, in accordance with regulations, policies, memorandums, and guidance.

Ensure that the bid documents require an RCDD stamp on the contractor's telecommunications shop drawings submitted for approval.

2-1.2 Small Scale Projects

Small scale projects limited to adding work area outlets from existing telecommunications rooms do not require an RCDD stamp provided the work is being accomplished under the technical authority of an RCDD or the government telecommunications manager.

CLASSIFIED INFRASTRUCTURE

Classified Infrastructure is any infrastructure that is used to transmit unencrypted classified National Security Information (NSI). Examples would be the infrastructure to support classified networks such as Secret Internet Protocol Router Network (SIPRNET) and Joint Worldwide Intelligence Communications System (JWICS).

Coordinate the design of classified telecommunications infrastructure with the telecommunications manager and the Certified Tempest Technical Authority (CTTA) responsible for that area. The following documents may be applicable:

CNSSAM TEMPEST/1-13 (FOUO); defines the RED/BLACK installation guidance to consider during design and installation, and provides potential solutions.

CNSSI 7003 (U); provides guidance on Protected Distribution Systems.

2-3 SYSTEM OVERVIEW

Provide a complete, standards based, flexible telecommunications design including telecommunications spaces, pathways, outlets, connectors, cabling, grounding, bonding, and static protection in accordance with the following paragraphs.

TELECOMMUNICATIONS SPACES

2-4.1 Types of Spaces

Provide telecommunications spaces in accordance with Telecommunications Industry Association TIA-569-D. Refer to Figure 2-1.

Note: This document utilizes commercial terminology for spaces in accordance with the TIA-569-D Errata sheet (e.g. Telecommunications Room, Equipment Room versus Distributor Room A and B, and Telecommunications Enclosure versus Distributor Enclosure).

2-4.1.1 Telecommunications Entrance Facility (EF)

The entrance facility (EF) is defined as the space housing the point of entrance of the telecommunications service. The EF is also the space where the inter-building backbone and intra-building backbone facilities join. For this document, the term backbone refers to intra-building backbone unless specifically designated otherwise. Telecommunication- related antenna entrances and electronic equipment may also be located in the EF. The demarcation point between the outside plant (OSP) cabling and the inside plant (ISP) distribution cabling is known as the building entrance terminal (BET).

2-4.1.2 Telecommunications Room (TR)

A telecommunications room (TR) is defined as an architectural space designed to contain telecommunications equipment, cable terminations, and cross connect cabling. It contains the telecommunications equipment for connecting the horizontal cabling to the backbone cabling system. The TR may also function as the telecommunications entrance facility.

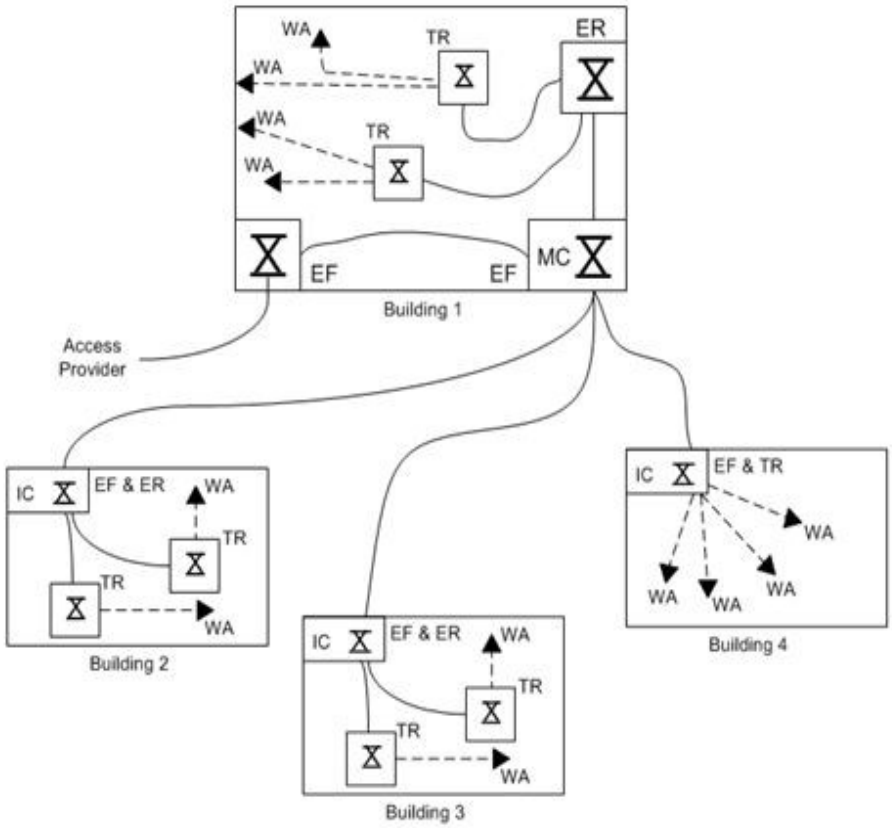
2-4.1.3 Equipment Room (ER)

An equipment room (ER) is defined as an environmentally controlled, centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect. Any or all of the functions of a telecommunications room or entrance facility may be provided by an equipment room.

2-4.1.4 Telecommunications Enclosure (TE)

A telecommunications enclosure (TE) is defined as a case or housing for telecommunications equipment, cable terminations, and cross-connect cabling.

Although TEs serve much in the same capacity as that of a TR, a TE must not replace a TR. The TE is also referred to as a Distributor Enclosure in TIA-569-D. TEs must meet the requirements for Distributor Enclosures in TIA-569-D.



Notes

1. This figure is not meant to be an all-inclusive representation of the telecommunications cabling system and is provided only as a typical example.
2. All cross-connects located in the telecommunications rooms (TRs) in this figure are horizontal cross-connects (HCs).
3. The equipment room (ER) for the point-of presence (POP) would be connected to the access provider as in Building 1 in the example.
4. In some cases an ER may contain the EF and serve as a TR. The TR may also contain the EF.

Legend

Entrance Facility	EF
Equipment Room	ER
Intermediate cross-connect	IC
Main cross-connect	MC
Telecommunications Room	TR
Work Area	WA
Telecommunications Outlet	▶
Cross-connect	⧖
Backbone Cabling	———
Horizontal Cabling	- - - - - - -

Figure 2-1 – Telecommunications Spaces and Cabling

2-4.2 Architectural Considerations

2-4.2.1 Location and Access

Locate telecommunications spaces central to the areas they serve and in such a manner that the maximum cable length from the patch panel through the structured cabling system to the furthest outlet does not exceed 295 feet (90 m). Telecommunications spaces must be dedicated spaces not shared with other non-telecommunications functions (i.e., electrical rooms, mechanical rooms, plumbing, etc.). When designing telecommunications spaces, avoid locations that are restricted by building components that may limit expansion such as elevators, outside walls, or other fixed building walls. Locate spaces in an accessible area of the building (e.g. common hallway) but limit access to personnel having a telecommunications requirement or mission. Accessibility for the delivery of equipment such as network switches, equipment racks and cabinets must be provided. Locate the telecommunications space away from sources of electromagnetic interference or design the space to mitigate the effects of this interference. Give special attention to electrical power supply transformers, motors and generators, X-ray equipment, and radio or radar transmitters.

In renovation projects, avoid rooms containing transformers, air handling units, and similar equipment types if at all possible. If shared facilities cannot be avoided, comply with TIA-569-D and maintain proper electrical/telecommunications cable separations and provide working clearances per the National Electrical Code (NEC).

2-4.2.2 Sizing and Quantity

Size ERs in accordance with TIA-568.1-E. Size each TR in accordance with TIA-568.1-E, except that the minimum TR size for DoD buildings is 10 feet x 8 feet (3m x 2.4m).

Generally, the TR should be sized to approximately 1.1 percent of the area it serves. For example, a 10,000 sq. feet (929 sq. m) area should be served by a minimum of one 10 ft. x 11 feet (3 m x 3.4 m) TR. Divide large floor areas into “serving areas” with TRs for each serving area. Each serving area can be no larger than 10,000 sq. feet (929 sq. m) as stipulated in TIA-568.1-E. TR sizing, power, and HVAC requirements may be substantially impacted if additional systems are required in the TR. Consult with the architectural designer or facilities engineer when additional systems requirements (audio visual systems, servers, disk storage arrays, etc.) are integrated into the TR. Consider utilizing an ER for areas that exceed 10,000 sq. feet (929 sq. m) or buildings that house substantial Information Technology (IT) electronics. Provide a minimum of one TR per floor. Provide additional rooms when the floor area is greater than 10,000 sq. feet (929 sq. m) and or the total cable distance to the outlet is over 295 feet (90 m).

Note: One TR may suffice for multi-story buildings in unique instances. Refer to section on Multi-Story Buildings below.

Provide adequate space in TRs to facilitate tenant owned data and telecommunications systems, and other low voltage systems such as fire alarm, CATV, CCTV, and electronic security systems (ESS). Support equipment requirements in tenant installed freestanding cabinets or racks. Total TR space as a percentage of the building's area must be scaled upward, to reflect the increased number of circuits in buildings with more than the standard number of circuits to each workspace.

2-4.2.3 Floors, Walls, and Ceilings

For floors, walls, and ceilings in telecommunications spaces, meet the requirements in TIA- 569-D. Do not install suspended ceilings in telecommunications spaces.

2-4.2.4 Doors and Windows

Doors must meet the requirements for TRs in TIA-569-D and NFPA 101. Telecommunications spaces must not have windows or other architectural window equivalents.

2-4.2.5 Multi-Story Buildings

Provide a minimum of one TR on each floor, sized in accordance with paragraph *Sizing and Quantity*. Serve all telecommunications outlets from the TR located on that floor.
Vertically align TRs on successive floors. In the case of small and unique facilities one TR may be sufficient for the entire facility. These facilities include but are not limited to air traffic control towers, firing ranges, and range and weapons towers.

2-4.3 Utility Considerations

2-4.3.1 Lighting

Design lighting for telecommunications spaces in accordance with UFC 3-530-01.

2-4.3.2 Power

Provide a dedicated electrical branch circuit panel board for each TR with the following minimum requirements: 120/208 volt, 3-phase or 120/240 volt, 1-phase, 24-(or 20 for 1- phase) space panel with a minimum 100 ampere (A) bus rated capacity. Feed all loads within the TR, except lighting, from this dedicated TR panel. Loads must include, but are not limited to, convenience receptacles, dedicated rack or cabinet receptacles, and HVAC systems (including exterior units for split systems). Provide 125V, 20A duplex convenience receptacles at 6 feet (1800mm) intervals on center around perimeter walls. When required by the Activity, provide an additional dedicated 125V, 20A circuit on the wall above the entry door for future electronic security system requirements. Coordinate with UFC 4-021- 02 with Change 1, Electronic Security Systems (ESS).

At a minimum, provide two multi-outlet power strips in each rack or cabinet. One power strip must be 240 or 208V, 1-phase; the other must be 120V 1-phase. To minimize accidental shut-off, equip power strips with indicator lights, but no integral on/off switch.
Provide matching (NEMA configured) twist-lock type receptacles fed from dedicated circuits in the TR panel to power each power strip. Install twist-lock receptacles above rack or cabinet, mounted to telecommunications cable tray or in ceiling space. As some rack or cabinet mounted equipment may require larger quantities of electrical power, the designer must consult with the local telecommunications group having jurisdiction to determine exact electrical power requirements for each TR.

2-4.3.3 Heating, Ventilation, and Air Conditioning (HVAC)

Design telecommunication spaces to meet the HVAC requirements of TIA-569-D, including the Class B requirements for temperature and humidity as outlined in ASHRAE TC 9.9.

2-4.3.4 Room Climate Control

Provide each TR with its own independent thermostat for climate control, capable of supporting year round ambient temperature control (24 hours/day, 365 days/year), to protect all installed electronic equipment as defined in TIA-569-D and TIA-569-D-1. The mechanical system designer of record must determine what type of system is necessary to meet the temperature and humidity requirements (e.g. zoned, dedicated, split core). Do not include heating and cooling systems on building time clocks or other temperature setback means for telecommunications spaces. Provide rooms with positive atmospheric pressure to minimize dust.

2-4.3.5 Room Contaminants

Do not install information systems equipment in spaces where moisture, liquid or gaseous spillage, or other contaminants may be present as defined in TIA-569-D.

2-4.4 Space Components

For all information transport system (ITS) components, provide manufacturer's standard catalog products that conform to the latest published industry and technical society standards at the date of contract award. Do not use shop or field fabricated components that are not manufacturer's standard catalog products or that do not conform to the industry and technical society standards.

2-4.4.1 Plywood Backboards

Provide backboards in accordance with TIA-569-D. Backboards must be fire-retardant-treated wood, bearing the manufacturer's stamp. **If painted, the manufactures fire rated stamp must remain visible**. Cover a minimum of two adjacent walls with backboards.

When renovating an existing TR that does not have adequate space, size the backboard as large as possible to accommodate wall mounted equipment.

2-4.4.2 Building Entrance Terminals

TIA-758 identifies two types of building entrance terminals (BET), protected and non-protected. Provide protected terminals in accordance with TIA-758-B. Equip protected terminals with modules to protect the inside plant cabling and equipment from power surges. Provide 110-type Insulation Displacement Connector (IDC) terminal blocks or cable stubs.

2-4.4.3 Equipment Racks

Provide 19 inch (475mm) floor mounted equipment racks located at or near the center of the telecommunication spaces. A minimum of 36 inches (900 mm) space both in front and in back of the rack, measured from the equipment, and a minimum side clearance of 24 inches (600 mm) on at least one end of the rack or row of adjacent racks is required. Coordinate with the telecommunications manager to determine the space requirements for the government provided active equipment. Provide 25% spare capacity within each utilized rack. Provide one spare rack for every four utilized racks with a minimum of one spare rack per telecommunication space.

In existing facilities with narrow or crowded telecommunication spaces, equipment racks may be wall-mounted with the approval of the telecommunications manager. Refer to Figure 2-2.

2-4.4.4 Equipment Cabinets

Provide equipment cabinets in lieu of racks:

1. Where identified by service specific chapters.
2. Where physical security is required, such as to mount secure or mission critical equipment.

In circumstances where separately controlled access is desired (when multiple systems are collocated within the room).

Provide a minimum of 24 inch (600 mm) wide cabinets with cooling fans and internal rails to support 19 inch (475 mm) equipment. Locate cabinets at or near the center of the telecommunication spaces. A minimum space of 36 inches (900 mm), both in front and in back of the cabinet, and a minimum side clearance of 24 inches (600 mm) on at least one end of the cabinet or row of adjacent cabinets is required. Coordinate with the telecommunications manager to determine the space requirements for the government provided active equipment. Provide 25% spare capacity within each utilized cabinet.

Provide one spare cabinet for every four utilized cabinets with a minimum of one spare cabinet per telecommunication space.

In existing facilities with narrow or crowded telecommunication spaces, equipment cabinets may be wall-mounted with the approval of the telecommunications manager. Where space is limited and clearances are affected, utilize swing out cabinets. Refer to Figure 2-2.

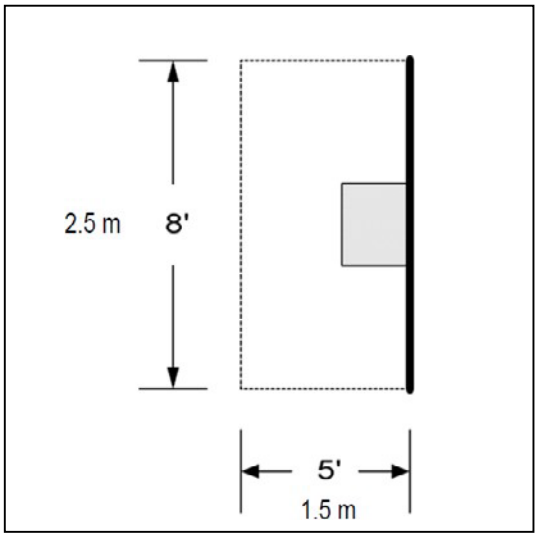


Figure 2-2 – Wall Mounted or Floor Mounted Cabinet Clearance

The workspace required around the cabinet/rack is still required even if the cabinet is mounted 6.5 feet (2.0 m) off the floor

2-4.4.5 Horizontal and Vertical Cable Management

Install horizontal cable management panels above and below each patch panel. The required ratio of horizontal cable management to patch panels is 1:1 Rack Unit (RU) space. Provide vertical cable management between racks and at the end of racks when required to protect, manage, and organize cables. Vertical cable management panels should be a minimum of 6-inch (150mm) wide.

2-4.4.6 Ladder and Wire Cable Tray

Utilize ladder type or welded wire cable tray in the telecommunication spaces to provide distribution between the plywood backboard, equipment racks, backbone conduits, and the distribution cable tray. Bond all metallic cable tray sections, and bond the cable tray system to the Telecommunications Grounding Busbar (TGB) or Telecommunications Main Grounding Busbar (TMGB).

2-4.4.7 Unshielded Twisted Pair Patch Panels

For patch panels, use 8-position, 8-contact (8P8C) modular jacks, with rear mounted 110- type IDC terminations, category rated for the Unshielded Twisted Pair (UTP) system being installed, and arrange in rows or columns on 19-inch (475 mm) rack mounted panels. For small projects (i.e., fewer than ten users) 19-inch (475 mm) TIA category-qualified wall mounted block or backboard patch panels may be utilized. Provide T568A jack pin/pair configuration per TIA-568.2-D. T568B jack pin/pair configuration may only be used if required to maintain uniformity in an existing facility. Provide modular jacks that conform to the requirements of TIA-568.2-D, and rated for use with the installed cable plant. Install UTP patch panels in the same rack or in the rack immediately adjacent to the LAN equipment in order to minimize patch cord lengths. Provide a minimum spare capacity of 25 percent.

2-4.4.8 Fiber Optic Patch Panels

Utilize patch panel connectors and couplers of the same type and configuration as used elsewhere in the system. Utilize duplex LC connectors on 19-inch (475 mm) rack mounted panels, unless otherwise directed. Provide a 3-foot (1-meter) slack loop of fiber within each panel, and include strain relief for cables within the panel. Provide proper termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection in all patch panels. Install fiber optic patch panels in the same rack or in the rack immediately adjacent to the LAN equipment in order to minimize patch cord lengths. Provide a minimum spare capacity of 25 percent.

In existing facilities, other connector types may be used to match the current infrastructure, with the approval of the telecommunications manager.

TELECOMMUNICATIONS PATHWAYS

A pathway is defined as a facility for the placement of telecommunications cable.

2-5. Backbone Pathways

Backbone pathways (sometimes referred to as “vertical” pathways) are defined as structures that conceal, protect, support, and provide access to cables between telecommunications spaces. Examples of backbone pathways consist of conduit, sleeves, slots, cable tray, telecommunication spaces, and miscellaneous support facilities.

For intra-building backbone distribution, provide a minimum of two 4-inch (103 mm) conduits between TRs located on the same floor or pathway that provides equivalent capacity (e.g. cable tray installed to support backbone and horizontal distribution). In multistory buildings, provide a minimum of three 4-inch (103 mm) conduits, sleeves, or an equivalent sized slot between stacked TRs on successive floors in accordance with TIA- 569-D.

2-5.1 Horizontal Pathways

Horizontal pathways are defined as structures that conceal, protect, support, and provide access to cables between the telecommunications spaces and the work area outlet.
Examples of horizontal pathways consist of conduit, cable trays, ceiling distribution, access floors, and non-continuous cable supports (J-hooks).

There are many methods to distribute cable from the telecommunications space to the work area and many buildings may require a combination of two or more types of pathway systems to meet all the distribution needs. The DoD required horizontal pathway is a ceiling distribution system employing a centralized cable tray system originating in the telecommunications space and continuing out into the serving areas. Utilize cable tray for horizontal distribution to the maximum extent possible (80 to 90 percent of the horizontal cable length). The remaining pathway to the work area outlet may be implemented in a variety of ways combining conduit, non-continuous cable supports, and stub-ups/outs.

2-5.1.1 Open Office Wiring

Open office wiring refers to work area spaces that are divided by modular furniture and partitions rather than by fixed walls. The electrical designer, the architect, and the interior designer must coordinate the layout of all furniture with electrical and telecommunications outlets during the design process. Furniture is typically specified and ordered when construction is nearing completion; therefore, if proper coordination has not occurred earlier in the design process, field interface problems will occur.

2-5.1.1.1 Systems Furniture

Utilize architectural columns and perimeter walls to the maximum extent possible for telecommunications distribution to systems furniture workstations. In the absence of architectural columns or when systems furniture is located away from perimeter walls, utilize utility columns where permitted. Only if no other alternative exists, utilize under-floor conduits that are designed and installed in accordance with TIA-569-D. Include a spare conduit to under-floor outlet boxes for future expansion. Design systems furniture wiring connections in accordance with TIA-568.1-E and TIA-569.1-E.

2-5.1.1.2 Protection and Separation in Systems Furniture and Utility Columns

Ensure that the cable is protected at all transition points, and that metallic separation is provided between telecommunication and power wiring in the utility columns and systems furniture track in accordance with TIA-569-D and NFPA 70.

2-5.2.2 Horizontal Distribution in Small Facilities and Renovations

In new construction involving small, mixed use (non-administrative) facilities, or construction projects involving renovation of existing buildings, use of J-hooks, flexible cable tray, and alternative support systems specifically certified for Category 6 cable is permissible, though not desirable. 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, surface mounted non-metallic raceway may be used.

2-5.3 Pathway Components

2-5.3.1 Cable Tray

Utilize solid bottom, slotted bottom, or welded wire cable tray to provide a centralized cable management/distribution system.

Use the cable tray for horizontal distribution to the maximum extent possible (80 percent to 90 percent of the horizontal cable length).

Design cable trays to accommodate an initial calculated fill ratio of 25 percent

(*Note: This allows for future growth within the cable tray. Due to random placement of cables and space between the cables, a 25 percent fill ratio means that in reality the tray is half filled.)*

The maximum fill ratio of any cable tray is 50%.

The maximum fill depth of any cable tray is 6 inches (150 mm).

Do not use ladder cable trays for horizontal distribution due to possible cable deformation with large cable quantities.

Provide and maintain a minimum of 12 inches (300 mm) access headroom above a cable tray system or cable runway.

Coordinate with other disciplines to ensure that building components (e.g., air conditioning ducts) do not restrict access and that proper clearances can be achieved.

2-5.3.2 Conduit

Design conduit systems in accordance with TIA-569-D. Install electrical metallic tubing (EMT) conduit from the cable backbone distribution system, whether cable tray or enclosed duct, to each outlet unless a conduit-less system is approved by the telecommunications manager. Provide a minimum of 1 inch (27 mm) EMT conduit for standard outlets. When cable tray or enclosed duct is not used, install individual conduits from the TR to each outlet. Coordinate conduit bend radii with cable bend radius. Arrange conduit entries at outlet and junction boxes so that cables passing through the box enter and exit at opposite sides of the box.

Do not use flexible metal conduit for telecommunications wiring except when installing floor-access boxes in a raised floor, where the floor-access box may be relocated within a specified service area. In this case the length of the flexible metal conduit \1\ must /1/ not exceed a length of 20 feet (6 m) for each run per TIA-569-D. Avoid using in- slab and below grade conduit systems for interior telecommunications designs as these systems provide the least flexible horizontal distribution system. If an in-slab or below grade conduit system is utilized in the telecommunications design, comply with NFPA 70 and utilize cables that are listed and rated for wet locations. Do not use plenum or riser rated cable, gel-filled OSP, and unlisted cables in such an environment. Consider that cables rated for a wet location typically have a larger outside diameter and this may affect conduit fill rates and conduit sizing. Larger conduit sizing in the slab may affect the structural integrity of the structure. For in-floor conduit systems, provide home runs back to the TR serving that area. Serve all telecommunications outlets from the TR located on that floor.

Use an optimal conduit fill ratio of 40 percent for conduit sizing. Do not exceed a fill ratio of 50 percent. Do not install more than four, four-pair cables in a 1 inch (27 mm) conduit. Do not use conduit in family housing projects unless it is a high-rise apartment building.

2-5.3.3 Non-continuous Cable Supports

Non-continuous cable supports are not allowed in the following locations:

1. In place of the cable tray system or as the sole distribution system in place of home-run conduit. Design non-continuous cable supports to support the category-rating of the cable. Supports must not exceed 20 cables or 50 percent of the fill capacity, whichever is less.
2. That exceed 50 feet (15 meters) total length through a non-continuous cable support system.
3. Ceilings in which Infection Control protocol affects ceiling tile removal
4. In areas where the cable must be protected.
5. When utilizing non-continuous cable supports, provide in accordance with TIA-569-D.

2-5.3.4 Pull and Splice Boxes

A pull box is defined as a housing located in a pathway run used to facilitate the placing of wire or cables. A splice box is defined as a box located in a pathway run intended to house a cable splice. Place pull and splice boxes in conduit runs in accordance with TIA-569-D.

TELECOMMUNICATIONS CABLING

Provide horizontal and backbone cabling in a hierarchical star configuration in accordance with TIA-568.1-E. The paragraphs in this section pertain to copper and fiber optic backbone and horizontal cabling. Cable to support Closed-Circuit Television (CCTV) and Community Antenna Television (CATV) is covered in the section titled *Other System Requirements*.

2-6.1 Backbone Cabling

The following subparagraphs pertain to copper and fiber optic intra-building backbone cable. Use no more than two hierarchical levels of cross-connects (main and intermediate) for the intra-building backbone. Use copper backbone cable only for voice circuits. Use fiber optic cable for data backbone circuits.

2-6.1.1 Copper Backbone Cabling

Comply with the following:

1. Provide multi-pair voice backbone cable that meets the requirements of Insulated Cable Engineers Association **{XE** "ICEA: Insulated Cable Engineers Association"**}** (ICEA) S-80-576 and TIA-568.1-E for riser-rated unshielded twisted pair **{**XE "UTP: unshielded twisted pair"**}** (UTP) cable.
2. Use solid untinned copper, 24 American Wire Gauge **{XE** "AWG: American Wire Gauge"**}** (AWG) conductors.
3. Coordinate the copper backbone design with the telecommunications manager in order to minimize the amount of copper deployed.
4. Utilize minimal copper backbone to support traditional two-wire phones and legacy systems as the transition to an all-fiber backbone occurs.
5. For facilities that will utilize unified communications (i.e., voice, video, and data over Internet Protocol **{**XE "IP: Internet Protocol"**}** (IP), provide a minimum 25-pair copper backbone to each TR. Provide additional cable counts to support actual legacy system requirements.
6. For facilities utilizing legacy systems, provide copper backbone cables sized to support no more than 1.5 pairs for every outlet connected to the serving TR.

2-6.1.2 Copper Termination

Terminate outside plant (OSP) cable on a protected entrance terminal (PET). Terminate the copper backbone cable originating in the main telecommunications room **{**XE "TR: telecommunications room"**}** (TR) or main cross-connect in each TR on 110-type, insulation-displacement wiring blocks mounted on the backboard. Provide 110-type terminal blocks on the same backboard as the PET and in each TR for copper backbone distribution. Utilize intermediate cross-connects when required by the telecommunications manager.

2-6.1.3 Fiber Optic Backbone Cable

Provide a minimum of 12 strands single mode fiber optic cable between the main telecommunications room, and main cross connect and each TR. Where required by NFPA 70 or by local regulations, fiber optic cable must be plenum rated.

Indicate the proper color coding of optical fiber cabling on design drawings. Use the TIA-598-C jacket color coding scheme for fiber optic (FO) cable on military projects as follows:

Single-mode (ranges between 8 and10um) (OS1)	Yellow
Multimode 62.5/125um (OM1)	Slate
Multimode 50/125um (OM2)	Orange
Multimode 50/125um Laser Optimized (OM3)	Aqua

2-6.1.3.1 Fiber Optic Termination

Terminate backbone FO cabling, at each end, on cabinet/rack-mounted patch panels with LC type connectors. \1\ do not use ST or MT-RJ fiber optic adapters and connectors for new construction unless specifically required for interface with existing equipment reused on installations. Provide fiber optic adapters and connectors in accordance with the appropriate TIA-604 Fiber Optic Connector Intermateability Standard (FOCIS). Fusion- splice backbone fibers to factory produced pigtails. /1/

2-6.2 Horizontal Cabling

The following subparagraphs pertain to copper and fiber optic horizontal cabling.

2-6.2.1 Copper UTP Horizontal Cabling

2-6.2.1.1 Category 6 (CAT6) Cabling

Provide one CAT6 unshielded twisted pair (UTP) cable to each standard 8-pin modular jack. Use only cable that has passed the UL LAN certification program and is labeled with UL acceptable markings. Provide plenum rated cables in accordance with NFPA 70, or when directed by the facility safety officer or UFC 3-600-01 with Change 4. Do not use Category 3, 5, or 5e rated cabling in new construction or rehabilitation projects.

Note: When specifically required by other criteria, Activities may utilize screened or shielded twisted pair (ScTP or STP) cabling (such as in Europe or secure areas).

2-6.2.1.2 Category 6A (CAT6A) Cabling

Category 6A (CAT6A) and higher rated cabling is not adopted for general use in this Appendix due to the increase in cable diameter, weight, cost, and additional testing requirements. The increased cable diameter and weight adversely affects the cable tray fill and loading for larger projects. Selection of CAT6A and higher cable must be based upon validated user requirements. Coordinate any use of CAT6A and higher rated cabling and associated cost changes with all stakeholders, technical reviewing authority, telecommunications manager, building occupants and other service specific authorities. Components used in a CAT6A system (i.e. outlets, patch panels, and patch cables) must also be CAT6A rated. When the requirements warrant the use of CAT6A and funding permits, activities may utilize shielded twisted pair (STP) cabling as this reduces the probability of alien crosstalk.

2-6.2.1.3 CAT6 Termination

Perform terminations of the UTP cabling at the work area outlet and patch panel using an 8-pin, RJ45 type modular jack, rated for the category of the installed cable. Terminate horizontal cables in the telecommunications spaces on Category 6 rack-mounted patch panels. Facilities with minimal outlet requirements (normally less than 12) may use a small cabinet or backboard mounted CAT6 patch panel. Terminate cables from the same outlet on the same patch panel and individually identify the cables. Wire all terminations to the TIA 568.2-D, T568A configuration. Do not use the T568B wiring configurations unless specifically requested by the user and approved by the authority having jurisdiction. Do not split copper cables between multiple modular connectors.

Note: Coordinate with telecommunications manager to determine if it is necessary to separately identify and differentiate “voice” and “data” systems.

2-6.2.1.4 CAT6 UTP Patch Cables

Provide 4-pair, minimum size 24 AWG stranded UTP copper patch cables rated for Category 6, with 8-pin modular plugs at each end. Due to performance and testing requirements utilize factory manufactured pre-connectorized patch cords. Provide patch cables of various lengths to terminate all required connections.

2-6.2.2 Fiber Optic Horizontal Cabling 2-6.2.2.1 Fiber Optic Cable

Provide fiber optic cable to each outlet only when required by the mission and approved by the telecommunications manager. Provide 50/125-um diameter laser optimized (OM3) multi-mode when the user requires fiber optic cable. When the telecommunications manager requires it, single-mode fiber optic cable (OS1), 50/125-um diameter (OM2) or 62.5/125-um diameter (OM1) multimode fiber may be substituted. Provide plenum cables in accordance with NFPA 70, or when directed by facility safety officer or UFC 3-600-01 with Change 4.

For in-slab or below grade telecommunications conduit systems, comply with NFPA 70 and provide cables listed and rated for wet locations. Do not use plenum or riser rated cable, gel-filled OSP, and unlisted cables in such an environment.

2-6.2.2.2 Fiber Optic Termination

Terminate FO cable in cabinet/rack-mounted patch panels, and at the outlet using LC type connectors in accordance with the appropriate TIA-604 series document. Do not use ST or MT-RJ fiber optic adapters and connectors for new construction unless specifically required for interface with existing equipment reused on installations. Provide fiber optic adapters and connectors in accordance with the appropriate TIA-604 Fiber Optic Connector Intermateability Standard (FOCIS). Provide individual patch panels and distribution panels with 12 duplex LC, SC or MT-RJ adapters or 24 ST adapters maximum.

2-6.2.2.3 Fiber Optic Patch Cables

Utilize fiber optic patch cable types and connectors of the same type as the patch panels to which they are interconnecting. Use duplex patch cables. Due to performance and testing requirements utilize factory manufactured pre-connectorized patch cords. Provide sufficient fiber optic patch cables, of various appropriate lengths, to terminate all fiber optic patch panel appearances plus 25 percent spare.

2-6.2.3 Cable Length

In accordance with TIA 568.2-D, limit copper data cable length to 295 feet (90 m) from patch panel termination in the TR to the data outlet termination. If permitted by the agency specific chapters, system architectures such as collapsed backbones or passive optical networks (PON) may exceed the 295 foot (90 m) length.

WORK AREA

A work area is defined as the building space where the occupants interact with the telecommunications terminal equipment. In this Appendix, consolidation points (CP) and a Multi- User Telecommunications Outlet Assemblies (MUTOA) are included within this area.

2-7.1 Work Area Outlets

The following requirements apply to telecommunications outlets in the work area.

2-7.1.1 Wall-mounted Outlet Box

Provide double gang electrical boxes, minimum standard size 4-11/16 inches (100mm) square and 2-1/8 inches (54 mm) deep with plaster ring for connection of single gang faceplate. Design outlet box for recess mounting with the faceplate flush with the wall surface, at the same height as the electrical outlets. Locate a quadruplex electrical outlet within 6 inches (152 mm) of all work area outlets to serve telecommunications loads associated with that outlet.

For the power outlet circuits, assume that each location of two duplex receptacles will power one personal computer with a monitor along with typical office appurtenances such as task lights, and assume that there will be no diversification of this load.

2-7.1.2 In-floor Outlet Boxes

Use in-floor outlet boxes only if no other alternative exists for feeding systems furniture, classroom desks, lecterns in lecture halls, and other free standing furniture. In some instances, an in-floor grid type system may be required to provide necessary flexibility.

2-7.2 Telecommunications Faceplates

2-7.2.1 Work Area Outlet Faceplate

Provide single gang, four position, modular, faceplate for each work area outlet. Standard configuration is two RJ-45 modular jacks and two blanks for future applications as shown in Figure 2-3. Provide other copper and fiber optic configurations to support special or legacy telecommunications systems when required.

Figure 2-3 – Typical Faceplate Configuration

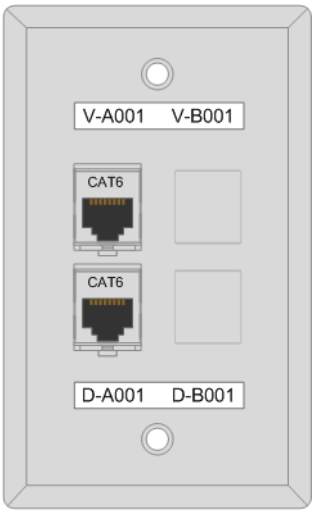


Figure 2-3 represents a single gang faceplate with two CAT6 modules, two blanks, and sample labeling. As the infrastructure converges to voice over internet protocol (VoIP), there will be no difference or distinction between voice or data modules.

2-7.2.2 Wall-Mounted Telephone Faceplate

Provide single gang, single position modular faceplate with one wired modular jack and mounting lugs for each wall-mounted phone.

2-7.2.3 Coaxial Faceplate

Provide single gang**,** single position modular faceplate with one F-type coaxial adapter.

2-7.3 Modular Jacks, Connectors and Adapters

The following requirements pertain to copper, fiber optic and coaxial cable jacks, connectors, and adapters. For copper systems, utilize the same category rating for cable, jacks, and patch panels throughout the entire system.

Note: Category rating for copper cabling and components to the work area at Fort Campbell shall meet Category 6 rating in accordance with TIA-568.2-D unless otherwise approved by the telecommunications manager (RNEC).

2-7.3.1 Copper Modular Jack

Provide un-keyed Category 6 (CAT6) modular jacks in accordance with TIA-568.2-D, terminated per T568A configuration. Telecommunications manager approval is required for:

1. Use of T568B configuration to maintain existing system uniformity
2. Use of keyed modular jacks where required to maintain system uniformity, security, or other user specified reasons.

2-7.3.2 Fiber Optic Connectors and Adapters

Provide un-keyed duplex LC connectors and adapters in accordance with TIA-568.3-D. Terminate fiber optic cabling at both ends utilizing duplex LC connectors, and utilize adapters at faceplates and patch panels to align and connect fiber optic cables.

Telecommunications manager approval is required for:

1. Use of other types of connectors and adapters such as SC, ST, and MT-RJ that are required to support existing systems.
2. Use of small form factor connectors and adapters with high density patch panels. This may offer a potential cost reduction in facilities with a high outlet concentration.

2-7.3.3 Coaxial Connectors and Adapters

Provide F-type adapters and crimp on connectors in accordance with TIA-568.4-D.

Terminate coaxial cabling at both ends using threaded, crimp-on connectors for CATV or other systems. The use of any other connectors, such as BNC, requires telecommunications manager approval. Coordinate with the cable service provider where franchise agreements are in place.

2-7.4 Outlet Types and Density

The number of work area outlets per square area (outlet density) required in a building varies greatly depending on the type of facility. Table 2-1 identifies facility space categories, work area outlet types, and densities commonly used in military construction projects. The outlet configuration options identified in Table 2-1 must be selected by the proponent and the telecommunications manager. The outlet types do not cover all possible user required configurations. Provide user-defined outlets that have a corresponding valid requirement, such as multiple levels of classification or dedicated systems. Provide outlet configurations that comply with this Appendix and the current versions of TIA-568.2-D and TIA-569-D. Outlet densities are provided for

planning purposes when actual outlet locations are not known and cannot be determined with available information. Actual designs must include outlets in work areas, office automation outlets, private office outlets, conference rooms, and wall or access phones as necessary.

Outlet densities are based on gross area (i.e. overall building footprint without deducting for areas such as hallways, equipment rooms, and restrooms). Outlet configurations, densities, and locations for all special-purpose spaces not identified in Table 2-1 must be determined by the user and the telecommunications manager. The above requirements can be modified if it is validated (documented in writing, signed and dated by the telecommunications manager) that mission operations require a quantity, configuration or design other than specified herein.

Table 2-1 Outlet Types

Facility Space Category	Outlet Configuration	Planning Area (SF(SM)) per Outlet
Administrative space, to include private offices, conference rooms, Classrooms, Medical/Clinics, Headquarters and Special Users	Two 8-pin modular (RJ45 type) outlet/connector OR One 8-pin modular and one Duplex fiber optic connector OR Two duplex fiber optic connectors in a single gang outlet faceplate.	80(7.5) with a minimum of two (2) dual outlets on different walls for private offices
Systems Furniture	Two 8-pin modular (RJ45 type) outlet/connector OR One 8-pin modular and one Duplex fiber optic connector OR Two duplex fiber optic connectors in a modular furniture outlet faceplate with outlet box extender.	See *Systems Furniture* paragraph below
Non-Admin Spaces (CDCs, Chapels, Rec-centers, etc.)	Two 8-pin modular (RJ45 type) outlet/connector OR One 8-pin modular and one Duplex fiber optic connector OR Two duplex fiber optic connectors in a single gang outlet faceplate.	500(46.5)
Barracks or Dormitory Space/Bachelors Quarters	Refer to *Barracks, Dormitory, Bachelor Quarters* paragraph below	See paragraph below
Warehouse space	Two 8-pin modular (RJ45 type) outlet/connector OR One 8-pin modular and one Duplex fiber optic connector OR Two duplex fiber optic connectors in a single gang outlet faceplate.	5000(465)

Wall and Pay Phone Outlet	One 8-pin modular (RJ45 type) connector in a single gang outlet faceplate with mounting lugs.	As needed
Family Housing units	Refer to Family Housing Units paragraph below	See paragraph below

2-7.4.1 Systems Furniture

Provide a minimum of one systems furniture work area outlet per single occupancy cubicle and a minimum of two systems furniture outlets per cubicle designated for additional scanners, printers, copiers or fax machines.

2-7.4.2 Barracks, Dormitory, Bachelor Quarters

Provide one CAT6 modular jack (RJ-45 type) in each bedroom and common area (living room) of the suite configured per TIA-570-D.

2-7.4.3 Family Housing Units

Provide a complete structured telecommunications system throughout housing unit in accordance with TIA-570-D. Provide Grade 1 wiring outlets (one telephone outlet and one CATV outlet) as required by TIA-570-D and any other logical location deemed appropriate, including attached garages. UTP cabling and modular jacks must be a minimum CAT6.

2-7.4.4 Utility Rooms

Provide at least one wall mounted telecommunications outlet in each utility room (e.g. electrical, mechanical and telecommunications spaces) to accommodate energy management systems.

2-7.4.5 Elevators

Provide a standard work area outlet to the elevator machine room for each elevator.

2-7.4.6 Safety, Courtesy, & Convenience

Provide wall-mounted telephone outlets at all logical locations to support safety, courtesy, and convenience. Examples include the following:

a. Safety: barracks hall, laundry room.

b. Courtesy: building lobby/entrance.

c. Convenience: break rooms, rear (unmanned) entrances.

2-7.4.7 Multi-user Telecommunications Outlet Assembly (MUTOA)

A Multi-user Telecommunications Outlet Assembly (MUTOA) is defined as a grouping in one location of several telecommunications outlet/connectors. TIA-568.1-E allows MUTOAs in an open office environment. This option provides greater flexibility in an office that is frequently reconfigured.

A MUTOA facilitates the termination of single or multiple horizontal cables in a common location within a furniture cluster or similar open area. The cables from MUTOAs to work stations in system furniture or open office are supported by the systems furniture raceway and the length must be calculated in accordance with TIA-568.1-E when establishing the total channel length. MUTOAs do not include an additional connection, and are limited to terminating a maximum of 12 users. Locate MUTOAs and route cables within systems furniture in accordance with TIA-568.1-E.

2-7.4.8 Consolidation Point (CP)

A Consolidation Point (CP) is defined as an interconnection point within the horizontal cabling using TIA-568.2-D or TIA-568.3-D compliant connecting hardware. It differs from the MUTOA in that it requires an additional connection for each horizontal cable run. A CP may be useful when reconfiguration is frequent, but not so frequent as to require the flexibility of the MUTOA. CP’s are limited to terminating a maximum of 12 users. Locate CPs in accordance with TIA-568.1-E.

OTHER SYSTEM REQUIREMENTS

2-8.1 Closed-Circuit Television (CCTV) System

When closed-circuit television requirements are identified, provide either a 75-ohm broadband quad-shield coaxial cable, single-mode fiber optic cable, or a category rated cable system. Refer to the paragraphs above for fiber optic and category rated cable. Ensure the correct cable is used in CCTV systems. Provide plenum cables in accordance with NFPA 70, UFC 3-600-01 with Change 4, or when directed by the facility technical reviewing authority. CCTV cable distances are affected by multiple variables such as signal strength at the source, signal loss of cable, and CCTV components.

For CCTV security systems coordinate with \1\ UFC 4-021-02. With Change 1.

2-8.2 Community Antenna Television (CATV) System

Community Antenna Television Systems are generally referred to as Cable TV. Provide a complete system to be owned and maintained by the government consisting of backboards/cabinets, cable, conduit, and outlets with jacks in all offices and other user required locations. Coordinate with the local CATV service provider. Include amplifiers, splitters, combiners, line taps, cables, outlets, tilt compensators and all other parts, components, and equipment necessary to provide a complete and usable system. Include the headend amplifier as part of the system when required by the local provider. Passive CATV devices must support 1 gigahertz bandwidth.

2-8.2.1 System Requirements

Provide a TIA-568.1-E, TIA-568.4-D, and NFPA 70 compliant system. Use a star topology distribution system with each CATV outlet connected to a TR with a feeder cable or a drop cable and each TR connected to the head end equipment with a trunk cable. Provide a high quality signal to all outlets with a return path for interactive television and cable modem access. System must operate within the 5 to 1000 Megahertz bandwidth using 1000 MHz passive devices and a minimum of 750 MHz active devices. Provide a minimum signal level of 0 decibel millivolts (dBmV) (1000 microvolts) and a maximum of 15 dBmV at 55 and 750 MHz at each outlet.

2-8.2.2 Cabling

Utilize either a 75-ohm broadband quad-shield coaxial cable or single-mode fiber optic cable system. For fiber optic cables, follow horizontal and backbone cabling requirements. For coaxial systems less than 295 feet (90 m) from headend equipment to the TR, or from TR to TR, provide RG-11 coaxial trunk cable. For systems exceeding 295 feet (90 m) from the headend equipment to the TR or from TR to TR, consider utilizing 625 series cable to reduce system losses. Utilize RG-6 coaxial cables for drops from the TR (or headend) to the wall outlet. Do not use RG-59 for CATV projects.

2-8.3 Wireless Access Points (WAP)

When a wireless local area network (WLAN) system or a wireless intrusion detection system (WIDS) is required, design in accordance with TIA Telecommunications Systems Bulletin 162-A (TSB-162-A) Telecommunications Cabling Guidelines for Wireless Access Points. TSB-162-A recommends the use of category 6A (or higher) twisted-pair and OM3 (or higher) optical fiber cabling to support higher data rates and, in the case of twisted-pair cabling, lower temperature rise when remote power is

applied. However, the determination of whether a Category 6A (or higher) twisted-pair or OM3 (or higher) optical fiber cabling is used must be based on the following:

a. Complexity of maintaining multiple cabling systems (Category 6 for work area outlets and Category 6A or optical fiber for support of WAPs)
b. Funding constraints to procure and maintain multiple cabling systems and test equipment.
c. Space to accommodate hardware associated with multiple cabling systems. For example, a Category 6A cabling system installed to support a wireless system must be terminated on Category 6A patch panels.

Provide two twisted-pair cables, Category 6 or 6A terminated on standard 8-pin modular connectors or two fiber multimode optical fiber strands, OM3 or higher for each wireless access point. Install the WAP cabling infrastructure in the same manner as other telecommunications outlets required in this document. Include the cable tray and conduit or J- hooks to support the cable connected to the WAP. The use of “J” hooks, flexible cable tray(s), and alternative support systems specifically certified for the cable utilized is permissible to support the WAPs from the cable tray. Do not exceed a 50 percent fill ratio for the “J” hooks. Support horizontal cabling to distribution areas in cable tray(s).

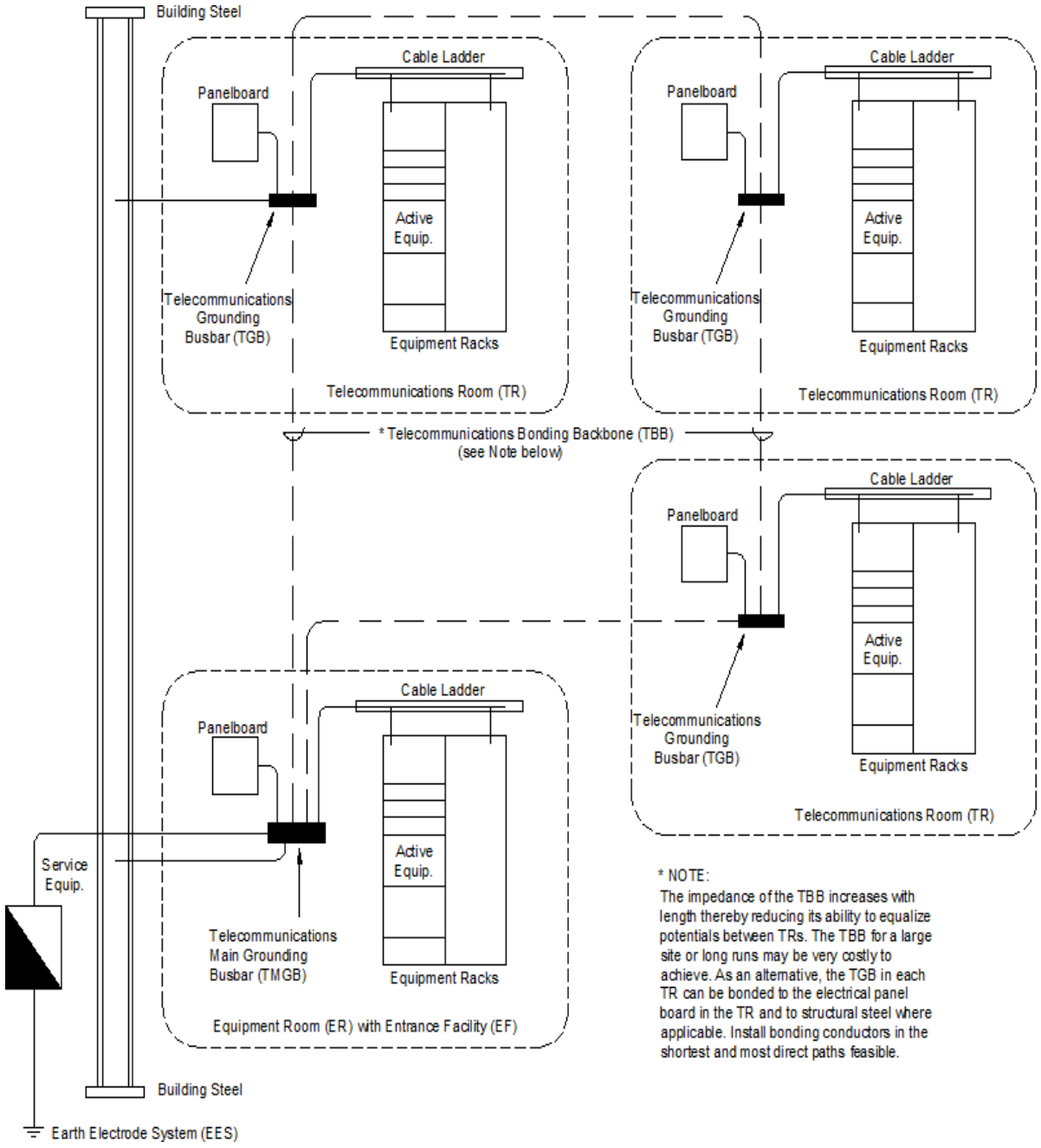
Note: When funding permits, activities may utilize shielded twisted pair (STP) cabling for WAPs. Shielded cables reduce the probability of alien crosstalk and also help to dissipate heat when the cable is used to provide power.

GROUNDING, BONDING, AND STATIC PROTECTION

Comply with NFPA 70 for grounding and bonding requirements. Provide a telecommunications bonding and grounding system in accordance with TIA-607-C. Refer to Figure 2-4 below. Building grounding systems are covered in UFC 3-520-01with Change 1 Interior Electrical Systems.

Note: The TIA-607-C identifies a bonding conductor known as the telecommunications bonding backbone (TBB) which is intended to equalize potentials between TRs. It should be recognized that the impedance of the TBB increases with length, thereby reducing its ability to equalize potentials between TRs. The ITS designer must consider that the TBB for a large site may be very costly to achieve. As an alternative, the TGB in each TR can be bonded to the electrical panel board in the TR and to structural steel where applicable. Install bonding conductors in the shortest and most direct paths feasible.

Figure 2-4 – Telecommunications Grounding and Bonding Infrastructure



2-9.1 Cable Entrance Grounding

Connect all metallic shields and strength members for outside plant cable entering a building to the electrical service grounding electrode system in accordance with NFPA 70, Article 800. Bond the OSP cable shield, armor, and metallic strength member to the main building ground as close as possible to the building point of entrance with a No. 6 AWG or larger ground wire. Use a non-bonded splice case for the transition from OSP rated cable

to interior rated cable. If the designer extends the OSP cable past 50 feet (15 m), bond the metallic strength member to the TMGB with a No. 6 AWG or larger copper ground wire, as close to the conduit egress point as possible.

2-9.1.1 Protected Entrance Terminals

Terminate all incoming OSP copper cables on UL-listed primary protector blocks, located within the building entrance terminal cabinet. Provide protector blocks equipped with 5-pin solid state, gas, or hybrid protector modules for the number of pairs terminated. Bond the protector blocks to the main electrical service ground via the TMGB or TGB with a No. 6 AWG or larger copper ground wire.

2-9.2 Telecommunications Spaces Bonding and Grounding

Bond all telecommunications spaces and infrastructure in accordance with TIA 607-C where applicable.

2-9.3 Telecommunications Rack and Supporting Structure

Bond all telecommunications racks and supporting metallic structures (cable trays, ladders, conduits and baskets) in accordance with TIA-607-C. Non-continuous distribution systems (i.e. stub-ups, J-hooks) do not require bonding.

TELECOMMUNICATIONS SYSTEM ADMINISTRATION

Provide administration for the complete telecommunications system in accordance with TIA-606-C. Determine the minimum class of administration by evaluating the size and complexity of the premise infrastructure. Ensure the format for identifiers is backwards-compatible with TIA-606-C for installations in existing facilities or per ISO/IEC TR4763-1 for new facilities unless otherwise directed by telecommunications manager. Coordinate with telecommunications manager and appendices at the end of this document for any additional service-specific labeling or administration requirements. Color-coding of telecommunications infrastructure and components is recommended, but not required.

TELECOMMUNICATIONS SYSTEM TESTING

All installed backbone and horizontal telecommunications cabling and connecting hardware must meet minimum performance requirements and be tested in accordance with TIA-568.1-E. Provide report of all tests results and certifications to the proponent and telecommunications manager upon completion.

2-11.1 Unshielded Twisted Pair (CAT6) Cabling and Connecting Hardware

Perform all required testing to insure minimum performance requirements are met in accordance with ANSI/TIA/EIA-568.1-E.

2-11.2 Fiber Optic Cabling and Connecting Hardware

Perform all required testing to insure minimum performance requirements are met in accordance with TIA-568.1-E for cabling and TIA-568.3-D for connecting hardware.

2-11.3 Coaxial Cabling and Connecting Hardware

Perform all required testing to insure minimum performance requirements are met in accordance with TIA-568.4-D.

2-11.4 Test Plan

The contractor must submit for Government review a draft test plan of all proposed cabling and equipment being installed under the project. Upon the draft's approval, the contractor must prepare a finalized test plan to the Government. After the contractor has completed the installation and testing of the ITS, the contractor must submit a test report for all fiber and copper cabling. The contractor's RCDD must approve both the test plan and the test report before submitting to the government.

Note: Test plans for small scale projects as delineated in paragraph 2-1.2 do not require RCDD approval.

The test plan must include, along with all testing system reports, a complete project test summary spreadsheet with indexed room numbers, outlet labels, jack labels and the pass/fail status, and causes for failures along with a total number of outlets installed, jack's/cable runs installed and the total number of jacks/cable runs that passed and failed the tests. All failed tests, require the contractor to correct the failures prior to turnover of the system. Tier 2 testing, data, analysis is required by the government at the contractor's expense if Tier 1 testing does not prove adequate for identifying causes of failures, and if the government is responsible for paying for any repairs not within the original scope of contract.

CHAPTER 3

ARMY SPECIFIC REQUIREMENTS

3-1 INTRODUCTION

3-1.1 Purpose

This chapter provides additional requirements and guidance for Department of Army projects.

Army Technical Authority

3-2 SPECIFIC REQUIREMENTS

3-2.1 Government-Designed Projects

Government-designed (in-house) projects require the approval of the service appointed telecommunications agent, prior to bid, IAW regulations, policies, memorandums, and guidance.

3-2.2 Classified Infrastructure

Use the following documents for projects that include Secret Internet Protocol Router Network (SIPRNET) requirements:

SIPRNET Technical Implementation Criteria, U.S. Army Information Systems Engineering Command (AKO Login Required)

https://www.us.army.mil/suite/files/5744948

UFGS 27 05 29.00 10 Protective Distribution System (PDS) for SIPRNET Communication Systems

www.wbdg.org

3-2.3 Telecommunications Spaces

3-2.3.1 Collocation of other telecommunication systems

It is permissible to collocate CATV, CCTV, fire alarm and electronic security systems (ESS) inside the TR. Final decision authority is the US Army Network Enterprise Technology Command (Army NETCOM).

3-2.3.2 Multi-Story Buildings

Approved Standard Designs may deviate from stacked TRs when no other solution is feasible.

3-2.3.3 Barracks, Dormitory, and Bachelor Quarter TR Sizing Considerations

Standard TIA-569-D TRs are normally too large for these types of facilities. Provide an 8-foot by 10-foot main TR on the first floor, and provide a minimum of one 6-foot by 8- foot TR on subsequent floors. Provision the TRs in these facilities in accordance with TIA-569-D. Telecommunication enclosures are acceptable in barracks with non-linear designs. Treat floors, walls, and ceilings to eliminate dust as defined in TIA-569-D.

3-2.4 Telecommunications Pathways

3-2.4.1 Direct Connection of Systems Furniture

There are two possible solutions for direct wiring to the systems furniture. One possible solution is a continuous home run from the telecommunications space to the furniture outlet. Continuous runs are not recommended, and should only be used in open office environments that cannot be readily reconfigured. Testing of the installed cable plant is simplified by providing an end-to-end circuit, without an additional connection point.

Follow the guidance of TIA-569-D, for direct connection application and design.

3-2.4.2 Conduit-less Systems

Where allowed by the Activity, local codes and the telecommunications manager, a conduit-less system may be utilized from the centralized cable tray to the work area outlet. In this type of horizontal distribution, no conduit is installed from the cable tray to the work area outlet. Use non-continuous supports (J-hooks) to support the cable from the centralized cable tray to the top of the wall containing the work area outlet, then install the cable in the wall cavity to a low voltage mounting bracket.

3-2.5 Fiber Optic Backbone Cable

The *DISN Enterprise Network Installation and Campus Area Network (ICAN) Design and Implementation Standards and Specifications* dictates the use of single mode fiber cables for building backbones on Army projects.

3-2.6 Work Area

3-2.6.1 Work Area Outlets

3-2.6.1.1Wall-mounted Low Voltage Brackets

When utilizing a conduit-less system provide double gang low voltage brackets or backless outlet boxes at the work area location. The backless low voltage outlet box accommodates bend radius requirements of low voltage cabling.

3-2.6.2 Outlet Types and Density

3-2.6.2.1Barracks, Dormitories, Bachelor Quarters

For Army Barracks, provide two CAT6 modular jacks (RJ-45 type) in a single gang outlet faceplate. Provide CATV outlets with “F” type jacks. Located CATV outlets in the kitchen, living room, family room, and all bedrooms adjacent to a duplex electrical receptacle.

3-2.6.3 General Range Information Infrastructure Design

Follow the general provisions of this Appendix H for telecommunications sections of new range construction and renovation projects. Several distinct types of information networks are present in a range environment: administrative, range control, and tactical. The administrative networks support telephone and data requirements to the occupants of the range buildings, and safety telephones. The special Range Control networks control downrange targets, sensors, and monitors and transport this information to off-site locations. The tactical networks support the unit training requirements in a field environment. Security and alarm networks may also be present.

3-2.6.4 Inter-Building and Outside Plant Requirements

Comply with Chapter 3 of the I3A Technical Criteria until UFC 3-580-02 is published.

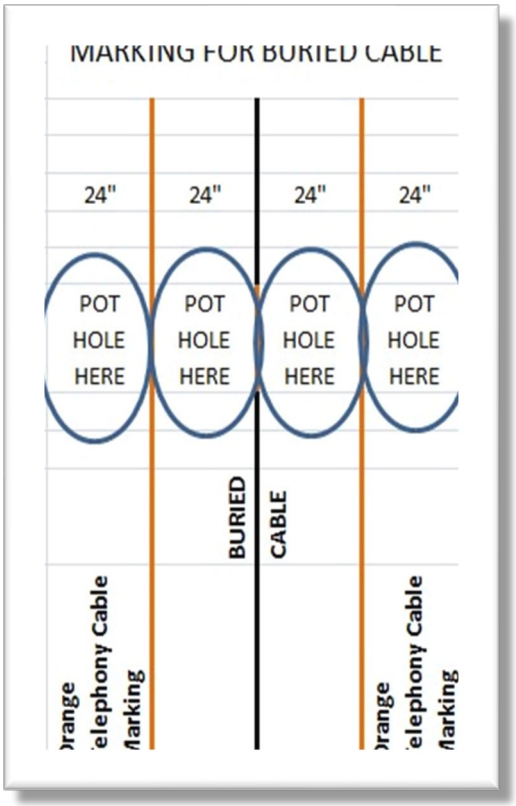
3-3 Utility Location

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!

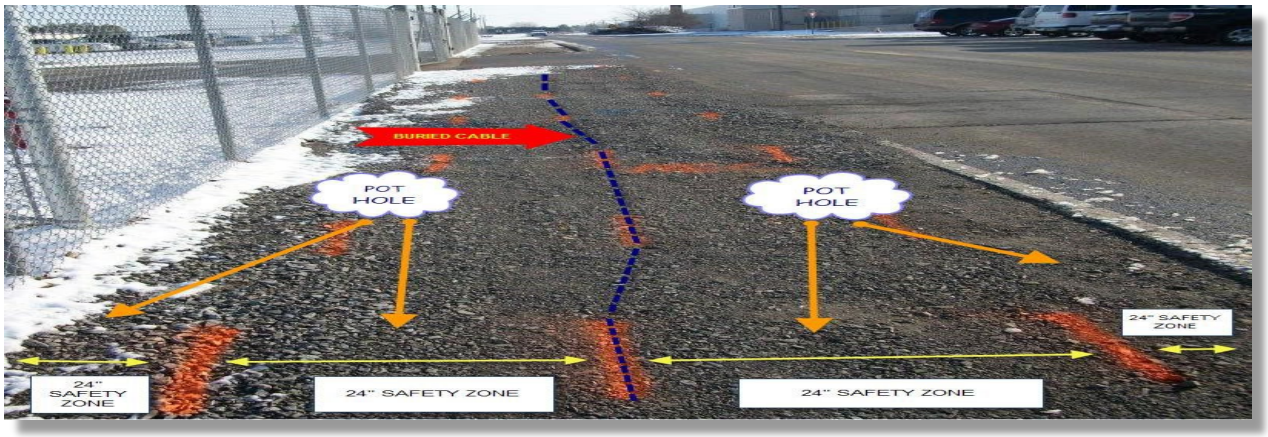
JUSTIFICATION: This practice is being done to cut down on the amount of cables and other utilities cut during the project.



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.

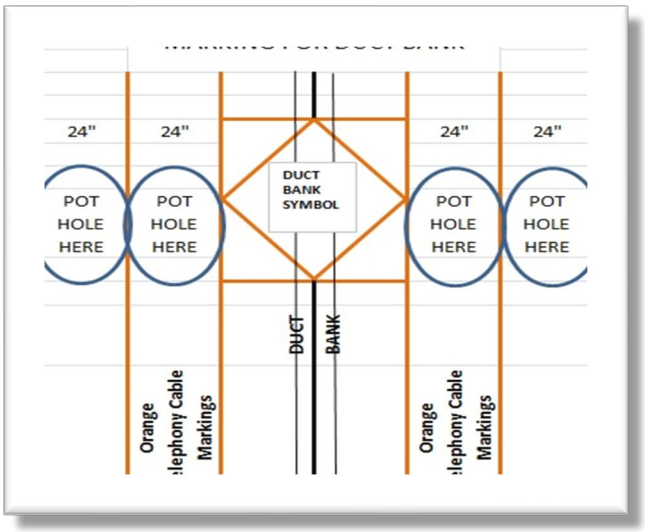
Actual NEC Utility Marking indicating a Buried Cable

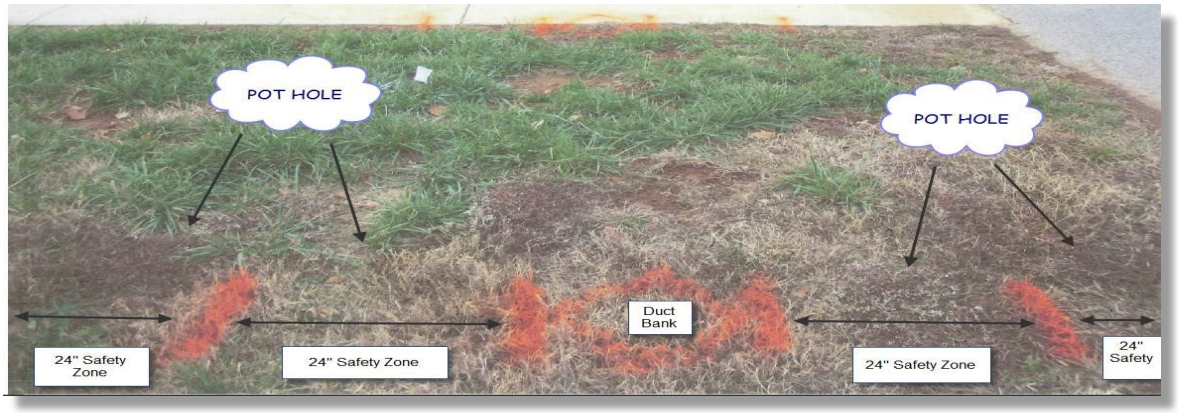


PERMITS DO NOT RELIEVE LIABILITY.

CALL TENNESSEE ONE-CALL BEFORE
YOU DIG. DIAL 811 OR 1-800-351-1111.
IF PERMIT EXPIRES-CALL AGAIN.

NOTIFY THE RNEC IMMEDIATELY IF A CABLE IS CUT OR DAMAGED OR IF AN UNMARKED CABLE IS UNEARTHED.
DIAL RNEC Operations Cell at 270-798-4900
After Hours, Weekends or Holidays
Dial RNEC Operations Cell at 931-220-7616
Business Division Chief at 270-798-6308 or 931-624-8697
Or Network/ Infrastructure Division Chief at 980-4763





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.

3-4 Grass

All grass surfaces shall be leveled and Hydroseeded 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.

ALL grass areas will be leveled and either place new sod, use of a mesh ground cover or Hydro spray will be used to prevent erosion of soil.

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.

3-4.1 Finish grade

When areas of the site are raked prior to hydro seeding or for leveling of topsoil to rid the site of mounds, clods and / or ruts, the Contractor shall ensure that no clods larger than 1" are left on the site. Contractor shall restore the site to a condition and appearance similar or equal to existing before the damages occurred. Such restoration work will not be considered complete until accepted by the COR after 90% stabilization has been achieved. The Government will not accept sites that have not been raked and restored to this standard. If sod is installed, the Contractor shall replace installed sod at their expense up to six (6) month period; that is not healthy, established, and vigorous because of lack of water and adequate fertilization.

3-5 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_1751F640.pdf), 641 (http://www.usda.gov/rus/telecom/publications/1751f641.pdf), 642 (http://www.usda.gov/rus/telecom/publications/1751f642.pdf) and TIA/758-A, 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)

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 RNEC.

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.

3-6 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.

Aerial cable will not be engineered. Aerial cable is subject to thermal in the air and also has been torn down by heavy equipment and large vehicles.

APPENDIX - H
REFERENCES

Note: The most recent edition of referenced publications applies, unless otherwise specified.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

C2-2012, National Electrical Safety Code

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION AND INTERNATIONAL ELECTROTECHNICAL COMMISSION

ISO/IEC 11801, Information Technology – Generic Cabling for Customer Premises

ISO/IEC 14763-1, Information Technology – Implementation and Operation of Customer Premises Cabling, Part 1: Administration

ISO/IEC 14763-2, Information Technology – Implementation and Operation of Customer Premises Cabling, Part 2: Planning and Installation

ISO/IEC 14763-3, Information Technology – Implementation and Operation of Customer Premises Cabling, Part 3: Testing of Optical Fiber Cabling

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70, National Electrical Code, National Fire Protection Association, Inc.

Note: The NEC must be effective for new design projects awarded after January 1 of the year following the issuance of a revised edition unless specifically identified otherwise in contract documents

NFPA 780, Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568.1-E, Commercial Building Telecommunications Cabling Standard.

TIA-568.2-D, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

TIA-568.3-D, Optical Fiber Cabling Components Standard.

TIA-569-D, Telecommunications Pathways and Spaces

TIA-570-D, Residential Telecommunications Infrastructure Standard.

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

TIA -526-14-B, Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant.

TIA-606-C, Administrative Standard for the Telecommunications Infrastructure.

TIA J-STD-607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure

TIA-862-B, Building Automation Systems Cabling Standard

TSB-162-A, TIA Systems Bulletin Telecommunications Cabling Guidelines for Wireless Access Points

DEPARTMENT OF DEFENSE

MIL-STD-188-124B, Grounding, Bonding and Shielding for Common Long Haul/Tactical Communication Systems Including Ground Based Communications- Electronics Facilities and Equipment's.

MIL-HDBK-419A Grounding, Bonding, and Shielding For Electronic Equipment and Facilities

CNSSAM TEMPEST/1-13 Red/Black Installation Guidance

ICD/ICS 705 (U) Technical Specifications for Construction and Management of

Sensitive Compartmented Information Facilities

ICS 705-1 Physical and Technical Security Standards for Sensitive Compartmented Information Facilities

ICS 705-2 Standards for the Accreditation and Reciprocal Use of Sensitive Compartmented Information

NSTISSP 300 (U) National Policy on Control of Compromising Emanations

UFC 1-300-01 Criteria Format Standard

UFGS-27-10-00 Building Telecommunications Cabling System

UFC 1-200-01 General Building Requirements

UFC 4-010-05 Sensitive Compartmented Information Facilities Planning, Design, and ConstructionMIL-HDBK-1012/3 Telecommunications Premises Distribution Planning, Design, and Estimating

I3A Army Installation Information Infrastructure Architecture

GLOSSARY

Abbreviations and Acronyms:

10G 10-Gigabit Ethernet
10GPON 10-Gigabit Symmetrical Passive Optical Network
AC Alternating Current
ADN Area Distribution Node
AFH Army Family Housing
AHJ Authority Having Jurisdiction
ANSI American National Standards Institute
APC Angled Physical Contact
A/V Audio Visual
AWG American Wire Gauge
BATB Base Area Transport Boundary
BEQ Bachelor Enlisted Quarters
BET Building Entrance Terminal
BICSI Building Industry Consulting Service, International, Inc.
BOQ Bachelor Officers Quarters
CATV Community Antenna or Cable Television
CCB Construction Criteria Base

CCTV Closed-Circuit Television
CP Consolidation Point
CTTA Certified TEMPEST Technical Authority
DAA Designated Accreditation Authority
dBmV Decibel (reference to millivolt)
DC Direct Current
DCO Dial/Digital Central Office
DDC Direct Digital Controller
DOIM Directorate of Information Management
DOIM Directorate of Information Management
DoD Department of Defense
DODISS Department of Defense Index of Specifications and Standards
DPW Directorate of Public Works
EES Earth Electrode Subsystem
EF Entrance Facility
EMT Electrical Metallic Tubing
ER Equipment Room
EUB End User Building
FO Fiber Optic
FOCIS Fiber Optic Connector Intermateability Standard
FOPP Fiber Optic Patch Panel
FOUO For Official Use Only
Gbe Gigabit Ethernet
GE Grounding Equalizer
GHz Gigahertz
GPON Gigabit Passive Optical Network
HVAC Heating, Ventilation and Air Conditioning
I3A Installation Information Infrastructure Architecture
ICDS Installation Communications Distribution System(s)
IDF Intermediate Distribution Frame
IMA Information Mission Area
IS Information System
ISP Inside Plant Wiring
ITS Information Transport System
ITU International Telecommunications Union
LAN Local Area Network
LATB Local Area Transport Boundary(s)
LC Lucent Connector
MCN Main Core Node
MDF Main Distribution Frame
MHz Megahertz
MILCON Military Construction
MRI Magnetic Resonance Imaging
MTBF Mean Time Between Failures
MUTOA Multi-User Telecommunication Outlet Assembly
NEC National Electrical Code
NESC National Electrical Safety Code

NFPA National Fire Protection Association, Inc.
NGEN Next Generation Enterprise Network
NSI National Security Information
ODN Optical Distribution Network
OLT Optical Line Terminal
ONT Optical Network Terminal
OSP Outside Plant
PDS Protected Distribution System
PET Protected Entrance Terminal (sometimes referred to as BET)
POL Passive Optical LAN
PON Passive Optical Network
POTS Plain Old Telephone Service
RCDD Registered Communications Distribution Designer
RU Rack Unit
SEBQ Senior Enlisted Bachelor Quarters
SFP Small Form Pluggable
SIPRNET Secret Internet Protocol Router Network
SMF Single Mode Fiber
TBB Telecommunications Bonding Backbone
TDMM BICSI Telecommunications Distribution Methods Manual (Latest Edition)
TE Telecommunications Enclosure
TEF Telecommunications Entrance Facility
TGB Telecommunications Grounding Busbar
TIA Telecommunications Industry Association
TMGB Telecommunication Main Grounding Busbar
TR Telecommunications Room
UCR Unified Capabilities Requirements (Latest Edition)
UFC Unified Facilities Criteria
UL Underwriters Laboratory, Inc.
UPC Ultra Physical Contact
USACE United States Army Corps of Engineers
UTP Unshielded Twisted Pair
VTC Video Teleconference
WAO Work Area Outlet
WAP Wireless Access Point

Terms

Intra-Building Backbone – Connectivity for the voice, video, and data networks between the entrance facility and equipment room, to a telecommunications room.

Inter-Building Backbone - Connectivity between buildings, also referred to as part of Outside Plant (OSP) will be defined in UFC 3-580-02.

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

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.

- Contractor will run and tag all wires and provide all materials except as noted.
- Contractor will provide the ICIDS Administrator the As-Built to the ICIDS protected area(s) during the inspection of the conduit and wiring.
- 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.

- 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.

- 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.

- 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.

- 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.

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.

Note: 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 ⅙-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.

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

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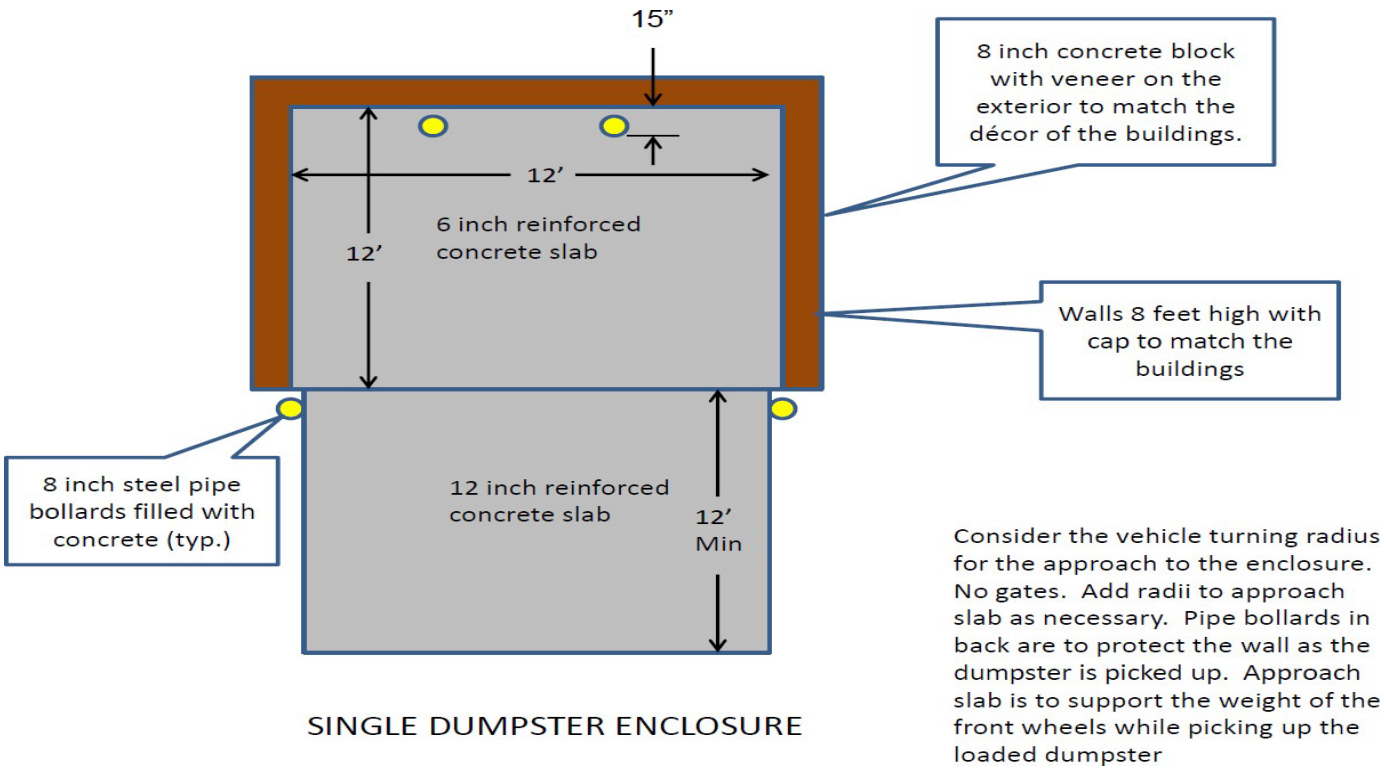
APPENDIX J

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



SINGLE DUMPSTER ENCLOSURE

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

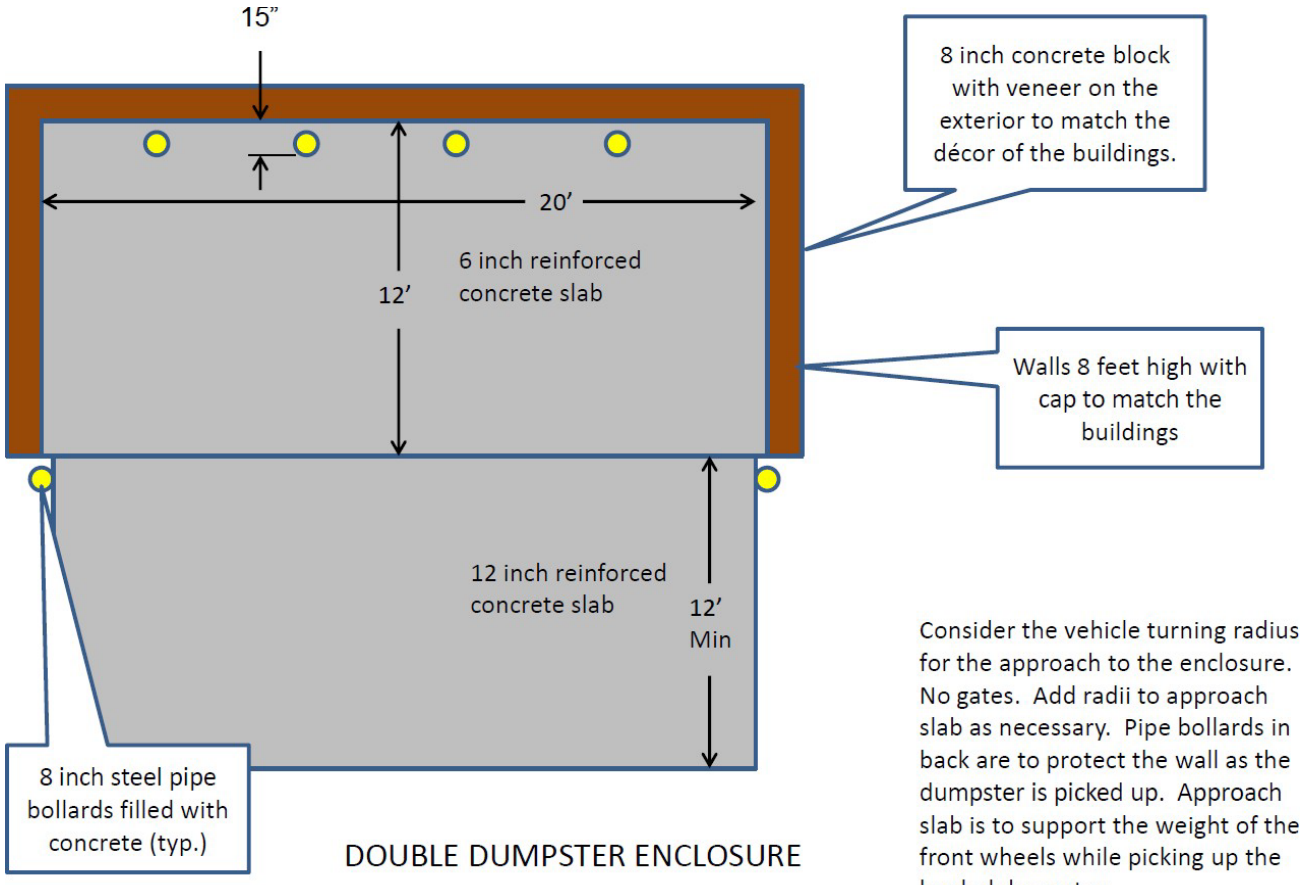
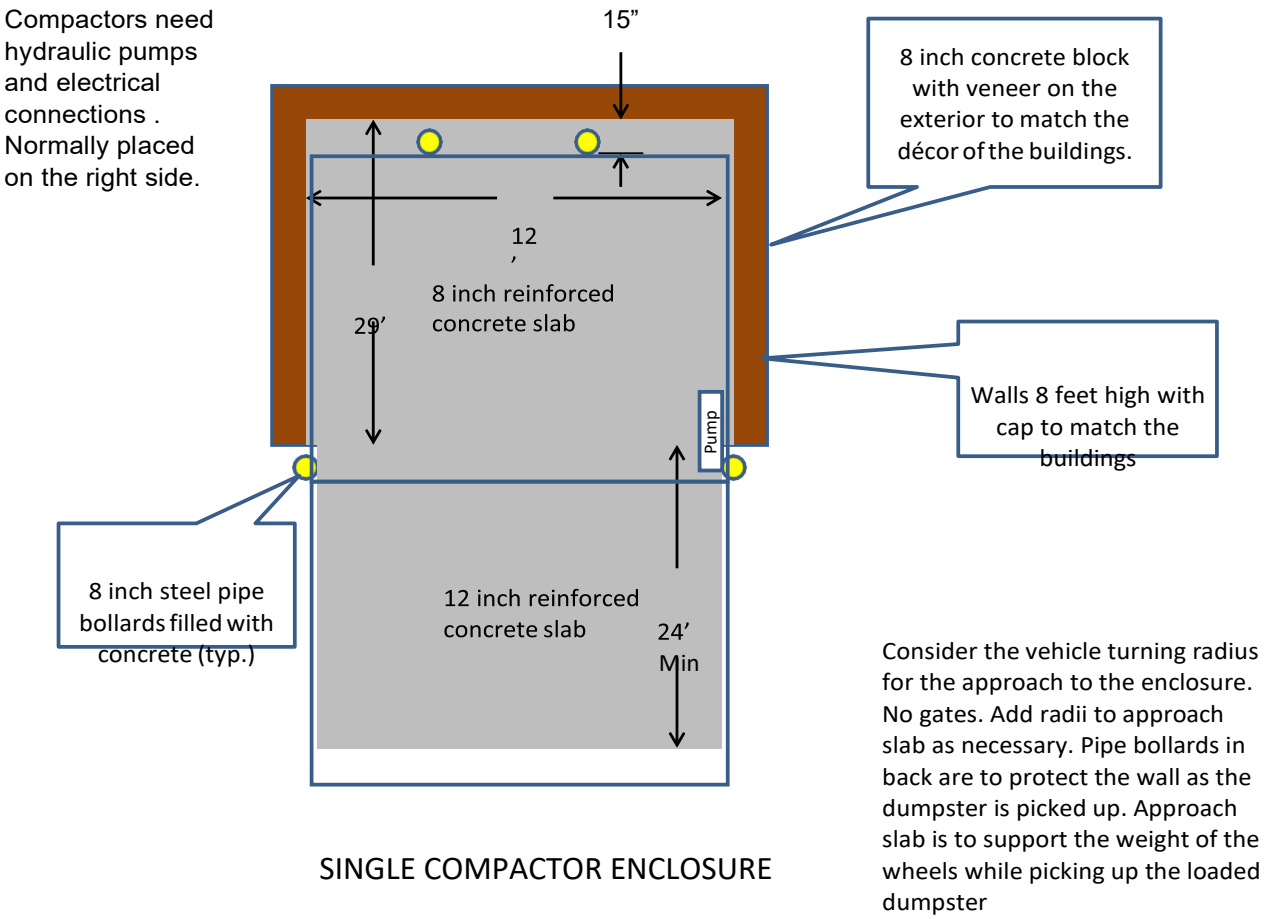

15”
8 inch concrete block with veneer on the exterior to match the décor of the buildings.
20’
6 inch reinforced concrete slab
12’
Walls 8 feet high with cap to match the buildings
12 inch reinforced concrete slab
12’ Min
Consider the vehicle turning radius for the approach to the enclosure. No gates. 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 front wheels while picking up the loaded dumpster
8 inch steel pipe bollards filled with concrete (typ.)
DOUBLE DUMPSTER ENCLOSURE

Figure K-2



SINGLE COMPACTOR ENCLOSURE

Figure K-3

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

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Appendix K

Grinding of Concrete, Asphalt and Masonry Materials

Concrete Grinding will be conducted at the Fort Campbell Woodlawn Construction/Demolition Landfill. All haled material must be no greater than 1x2x3 foot and striped of any and all rebar exceeding 6” protrusion. The Contract in place shall perform Concrete Grinding at the Fort Campbell Land Fill of one hundred percent (100 %) of any concrete, asphalt and masonry materials (hereafter “ground concrete”). Contractors may conduct Concrete Grinding on site and 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 at Woodlawn Landfill. 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 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.

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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 (AT) Standards for Buildings.
b. UFC 4-020-01, DoD Security Engineering Planning Manual.
c. UFC 4-022-01, Security Engineering: Entry Control/Access Control Points.
d. UFC 4-022-02, Selection and Application of Vehicle Barriers.
e. UFC 4-022-02FA, Security Engineering - Concept Design.
f. USACE PDC List: DoD Anti-Ram Vehicle Barriers.
g. PDC-TR 10-02 Blast Resistant Design Methodology for Window Systems Designed Statically and Dynamically.
h. Fort Campbell Threat Assessment.

NOTE: All references mentioned above and herein are to be applied with updated versions as published.

PURPOSE: This document is not intended to limit the scope for AT Construction requirements outlined in UFC 4-010-01. It represents the worst-cases of the applicable threat severity levels for each applicable tactic for a given asset. The initial design basis threat may be changed during the design process based on detailed risk analysis as described in UFC 4-020-01. It will also be used to assess vulnerabilities in the case of existing facilities. Will address any notions that normally lead outside of the UFC.

1. This document follows the guidelines of Installation Specific Requirements as defined in UFC 4-010-01 and provides the basis to support the installation's antiterrorism plan. Further, UFC 4-020-01 must be used to validate the design basis threat and level of protection for individual projects. A detailed risk and threat assessment must be executed using UFC 4-020-01 for buildings containing critical assets. Determining the Design Basis Threat is an installation function requiring programmers, antiterrorism officers, and members of the threat working group. Determining the facility Design Basis Threat is the first step in planning antiterrorism requirements. However,

without a defined level of protection, only the minimum standards apply. The Design Basis Threat and level of protection are unique for each individual facility and are based on the threat likelihoods and the values of the assets in the building. Use UFC 4-020-01 to determine the Design Basis Threat and level of protection for individual projects. The process outlined in UFC 4-020-01 will determine if the minimum AT standards are adequate or if additional protective measures are required.

2. The Fort Campbell Installation Antiterrorism Officer (ATO) in coordination with Director of Public Works (DPW), Master Plans ATOs, reviews construction plans and ensures that the appropriate AT standards for buildings are integrated into construction projects in order to ensure compliance with current Unified Facilities Criteria (UFC) and the installation's specific Design Basis Threat.

3. DPW Master Planning Division assigned Project Managers are responsible to ensure that their MILCON project undergo the TAB G Design Criteria, Risk and Threat Assessment during the 1391 programming phase. This process is then documented in the DD Form 1391 for Higher Headquarters review. Criticality will be documented during this step.

4. DPW - Engineering Division (ED) will ensure compliance with UFC 4-010-01 DOD Minimum AT Standards for Buildings. DPW - Engineering Design Branch (EDB) will work closely with the Master Plans Risk Assessment Team to determine appropriate Levels of Protection on all projects as required to per UFC 4-010-01, particularly paragraphs 1-5, in order to comply with AT for SRM (Sustainment, Restoration and Modernization) Projects.

1-5.1 - New Construction, all new construction projects will comply with this standard.
1-5.2 - Existing Buildings, will follow as required.
1-5.2.1 - Major Investments, only required when project costs exceed 50% of the replacement cost (DPW renovation projects rarely exceed this limit).
1-5.2.2 - Change of Occupancy Level, may be required if there is a significant change in occupancy (i.e. warehouse converted to office space with over 11 people).
1-5.2.3 - Window, Skylight, Glazing, and Door replacement, will comply whenever replacing or installing new windows (it is noted the new standards for this is less than in the past).
1-5.2.4 - HVAC, will comply when replacing or modifying HVAC units with outside air intakes.
1-5.2.5 - Building Additions, will comply with this requirement.

5. Fort Campbell's position is that all required elements of the UFCs, Fort Campbell Design Basis Threat, and DoDEA standards shall be met. Implementation of these standards is mandatory for all new construction, and existing buildings, when triggered by: major Investments, occupancy changes, window projects, HVAC upgrades, reductions of high speed vehicle approaches regardless of funding sources. Contact the DPW, Master Planning Division, Planning Branch Chief for further information.

Decision Flow-Chart For Protective Barriers

BEGIN

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.

Note: UFC & USACE references mentioned herein are to be applied with updated versions as published.

Entry into a fire-lane

Is the building an Installation Critical Asset or High Population Facility?

- YES → Use a 12' wide drop arm beam or swing arm (gate). Protection Rating - K: 4 , L: 2
- NO → Use an ≥ 12' wide drop arm beam or swing arm (gate). Protection Rating - K: N/A , L: N/A (no rating required)

Entry into a drop-off lane

Is the building an Installation Critical Asset or High Population Facility?

- YES → Use a 12' wide drop arm beam or swing arm (gate). Protection Rating - K: 4 , L: 2
- NO → Use an ≥ 12' wide swing arm or drop arm beam (gate). Protection Rating - K: N/A , L: N/A (no rating required)

Travel onto side-walks / foot-paths

Is the path used dual purpose as a fire lane?

- YES → Go to: "Entry into a fire-lane."
- NO → Is the building an Installation Critical Asset or High Population Facility?
  - YES → Use a fixed bollard system. K: See Note L: See Note
    Note: Use standard in UFC 4-022-02, 8 JUN 2009 Change 1, 9 AUG 2010, para 6-2.1.1.
  - NO → Use a fixed bollard system. Prot Rating - K: N/A , L: N/A (no rating required)

From a parking lot into the ATFP zone

Is the building an Installation Critical Asset or High Population Facility?

- YES → Use an 8" to 12" high vertical curb at the final curbed perimeter along the ATFP Perimeter.
  - OR → Install Steel Cable Barriers along the ATFP Perimeter.
- NO → Use an ≥ 6" high curb at the final curbed perimeter along the ATFP Perimeter.

K & L protection ratings are specified by DoD. Corresponding ASTM rated products (with M & P ratings) can be used also. Refer to USACE PDC List: DoD Anti-RAM Veh Barriers.

Notes:

a) Spacing between bollards is 4' on edge and not to exceed to 4.5'.

b) For all critical facilities, the ATFP perimeter will be tied-in to prevent gaps of > 4.5'. Passive barriers (non-active) will be used to impede vehicle travel to within the ATFP perimeter. Examples are: ditches, raised berms with plants and large boulders, soil filled containers, etc. Ref is: UFC-022-02, Selection and Application of Veh Barriers w/change 1, 9 AUG 2010.

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", ref is: UFC 4-022-02FA, Security Engineering - Concept Design (8 JUN 2009), para 3.c.(1) titled, "Perimeter Barriers for the Stationary Veh Bomb Tactic."

POC this document: Bill Fedak, AT, POD, DPTMS, Fort Campbell, KY, (270) 798-5006

FOUO/LIMDIS

Updated: 30MAR20

Using Protection Requirements for Selecting Protective Barrier Products

Protection Requirements

DOS/DoD Active Barrier Ratings	
K4	15K# @ 30 mph
K8	15K# @40 mph
K12	15K# @50 mph
DOS/DoD Penetration of veh beyond barrier	
L1	20 - 50 ft
L2	3 - 20 ft
L3	< 3 ft
ASTM Penetration Ratings	
P1	≤ 1 m (3.3 ft)
P2	1.01 to 7 m (3.31 to 23 ft)
P3	7.01 to 30 m (23.1 to 98.4 ft)
P4	30 m (98 ft) or greater

Barrier Rating Condition Designations		*Speed*	*Designation*
Sm Passenger Car (2430#)	C	40 mph	C40
		50 mph	C50
		60 mph	C60
Pickup Truck (5070#)	P	40 mph	P40
		50 mph	P50
		60 mph	P60
Medium Duty Truck (15,000#)	M	50 mph	M50
		65 mph	M65
		80 mph	M80
Heavy Goods Vehicle (65,000#)	H	30 mph	H30
		40 mph	H40
		50 mph	H50

Table Summaries: UFC 4-022-02, Selection and Application of Vehicle Barriers, 8 June 2009.

Barrier Products

DoD Anti-Ram Vehicle Barriers

Barrier Type: Active Drop-Arm Beam

Barrier Rating	*Penetration Rating*	*Barrier Model/Description*
K4	L3	CRB-240 Drop Gate
K4	L3	Bosik Bar VBS Deep Foundation Barrier (SP VBB) K4
K4	L2	IP500 Transportable Beam for Quick Deployment
K4	L2	TT212EC Drop Arm Beam Barrier System
K8	L3	VPL-CB-24
K12	L3	VPL-CB-24
M50	P1	CRB-K12-2 Drop Arm Gate Barrier
K12	L3	Bosik Bar VBS Deep Foundation Barrier (SP VBB) K12
M50	P3	Drop Arm Vehicle Barrier - KBVB
K12	L3	DSC 7000 Barrier
K12	L2	NMSB XII Crash Beam Barrier - 12 ft

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).

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------ 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. 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)
dBA	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 Request for Proposal – graded on technical, experience, management, cost details
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 M-1 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.

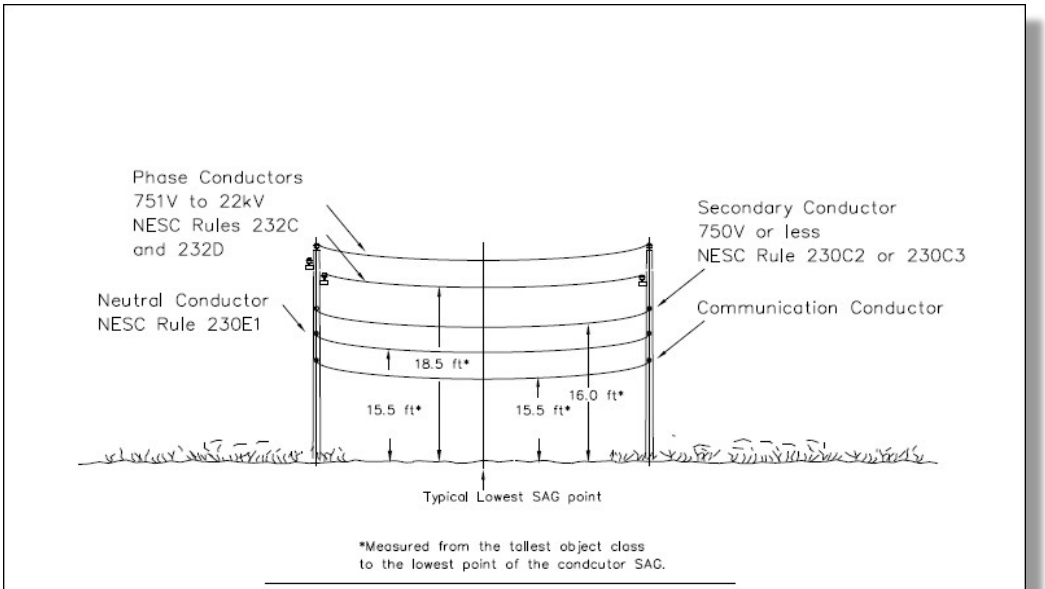
CONDUCTOR INFORMATION	Number	Size	Insulation Type	Temp	Total Length	
Conductor (1):						
Conductor (2):						
Conductor (3):						
Conductor (4):						
Conductor (5):						

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):		

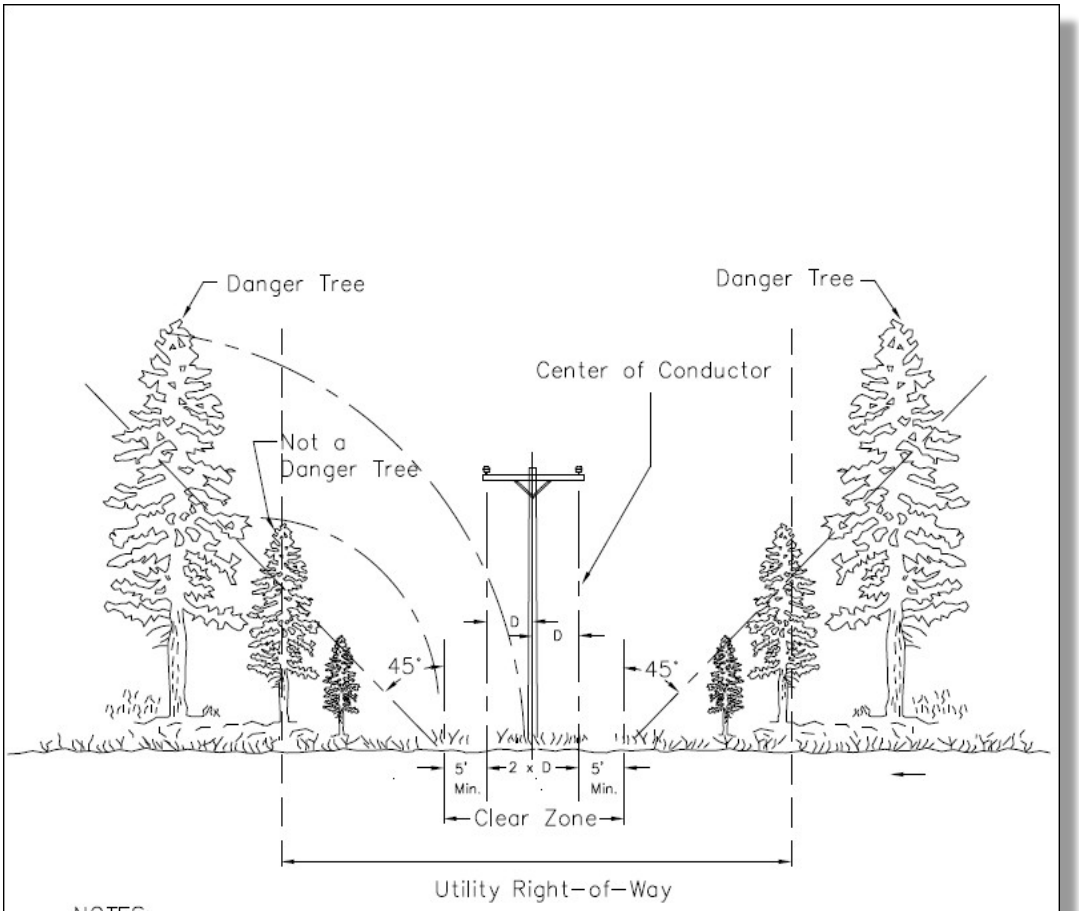
Form M-1



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 Utilties Serivce (RUS) bulletins including 1724E–154: Distribution Conductor Clearances and Span Limitations.
5. Contact the DPW engineer/technican, or a qualified engineer under DPW direction, for further guidance if the requirements are in question.

Figure M-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 condcutor, plus at least 5 feet (5').

Figure M-2

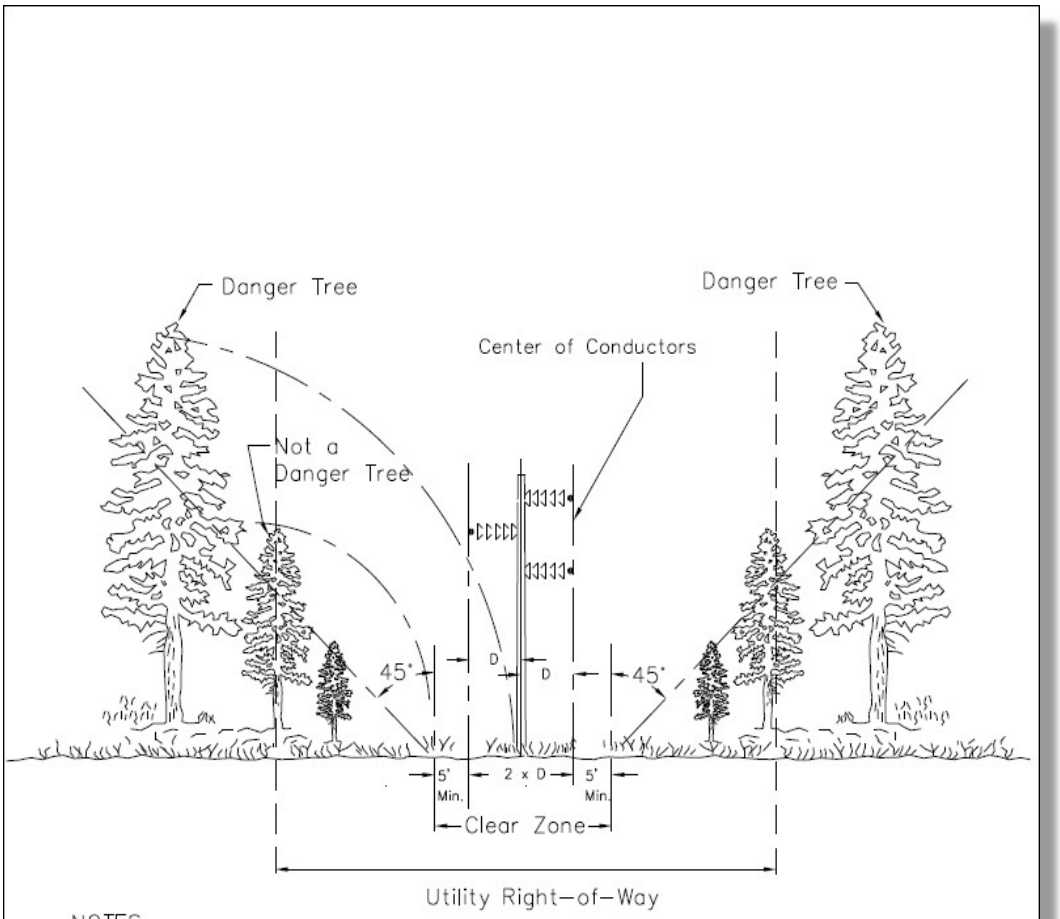


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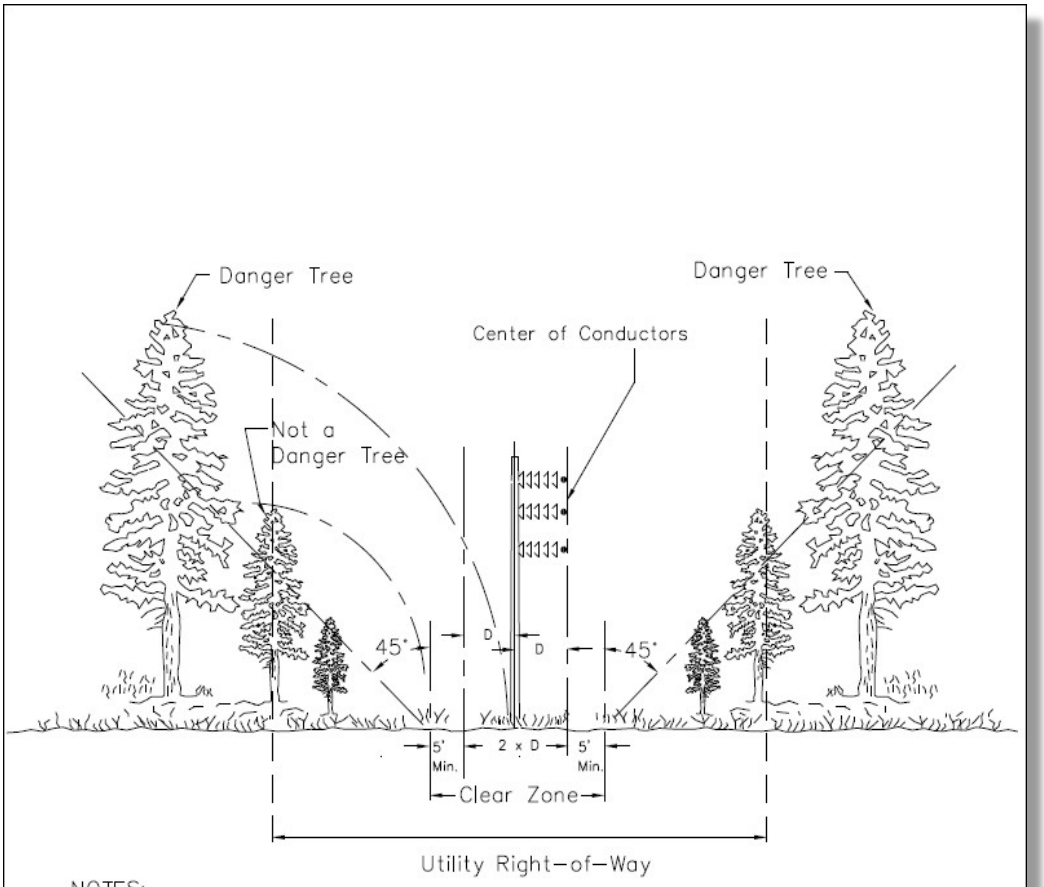
Figure M-3



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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 condcutor, plus at least 5 feet (5').

Figure M-4

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APPENDIX N

Accessibility 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.

It is the goal of the Department of Defense (DoD) to make its facilities accessible to persons with disabilities. To achieve that goal, the Department intends to go beyond the minimum requirements of law. Even if a facility is exempt from coverage under the Architectural Barriers Act of 1968 (ABA), compliance with the standards identified in this memorandum is recommended to the maximum extent that is reasonable and practicable without degrading the facility's military utility.

The United States Access Board has issued an update of the ABA and Americans with Disabilities Act (ADA) guidelines as a single rule published at Part 1191 of title 36, Code of Federal Regulations, which contains scoping provisions specifying what must be accessible and technical requirements specifying how access is to be achieved. The rule is divided into three parts: a scoping document for ABA facilities (ABA Chapters 1 and 2), a scoping document for ADA facilities (ADA Chapters 1 and 2), and a common set of technical criteria referenced by both scoping documents (Chapters 3 through 10).

DoD hereby adopts 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. Such recipients include only those private sector programs and activities covered by Section 504 of the Rehabilitation Act. Most DoD contractors are not covered but will likely be subject to the Americans with Disabilities Act.

Access for People with Disabilities

1. GENERAL. This attachment describes the manner in which facilities designed, constructed (including additions), altered, leased, or funded by the Department of Defense (DoD) are to be made accessible to people with disabilities in accordance with the Architectural Barriers Act of 1968 (ABA), as amended, 42 U.S.C. § 4151, et seq., and Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794. On July 23, 2004, the United States Access Board issued updated accessibility guidelines for newly constructed, altered, and leased facilities covered by the ABA and Americans with Disabilities Act of 1990 (ADA), 42 U.S.C. § 12101, et seq. These guidelines were published in the Federal Register on July 23, 2004 (69 FR 44083), and are online at http://www.access-board.gov/.1

Requirements for new construction, alterations, and leased facilities vary and are specified in these new DoD Standards. In general, worldwide, all facilities designed, constructed, altered, leased, or funded by DoD that are open to the public, or to limited segments of the public, or that may be visited by the public, or by limited segments of the public, in the conduct of normal business, shall be designed and constructed to be accessible to persons with disabilities. The types of facilities to which these DoD Standards apply include, but are not limited to, the following:

(a) All housing, including military family housing and unaccompanied personnel housing.

(b) All morale, welfare, and recreation facilities, including non-appropriated fund facilities available to dependents or retirees.

(c) All hospitals and facilities for the care or rehabilitation of persons who are sick or injured.

(d) All relocatable facilities, including those acquired as "personal property." Relocatable facilities, including those acquired as "personal property," shall be evaluated, for purposes of applying these DoD Standards, as though they are permanent facilities.

(e) All manufacturing facilities, administrative facilities, educational facilities, and any other facilities where civilian workers may be employed, including facilities constructed under other than military construction authorizations and including contractor-owned facilities where DoD is funding all or part of the construction.

The Department of Defense shall require as part of the joint venture agreement in all public-private ventures which include facilities, including privatized housing, that those facilities be designed and constructed in accordance with these DoD Standards.

In addition to these DoD Standards, facilities of all types shall comply with any applicable provision of law and regulation which may include the following:

i. The Fair Housing Amendments of 1988, 42 U.S.C. §§ 3601-3620, which prohibit discrimination on the basis of disability in multi-family housing, including military family housing, and require elimination of architectural barriers in common areas and construction of accessible units on a percentage basis.

ii. The Americans with Disabilities Act of 1990, 42 U.S.C. § 12101, et seq., which prohibits discrimination in, among other things, public accommodations and commercial facilities and may apply to some entities that occupy space on DoD property or are housed in DoD or DoD-funded facilities. Entities that might be covered include State and local governments, banks, childcare centers, and fast food stores. In addition, standards for nondiscrimination in employment under this Act apply to Federal employment under Section 501 of the Rehabilitation Act. This includes standards for elimination of architectural barriers.

iii. Section 501 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 791(b), and implementing regulations at 29 CFR 1614.203, which prohibit discrimination in Federal civilian employment against a qualified person with a disability and require elimination of architectural barriers for employees and applicants with disabilities.

2. PRIMARY FUNCTION AREAS. Requirements for alterations (Section F202.4 of ABA Chapter 2) and leased facilities (Section F202.6.2 of ABA Chapter 2) refer to "primary function areas." DoD

defines a primary function area as an area that contains a major activity for which the facility is intended. This includes areas in which a DoD entity or a recipient of DoD financial assistance provides services to the public or limited segments of the public, as well as offices and other work areas in which the activities of a DoD entity or a recipient of DoD financial assistance are carried out.

In accordance with Section F202.4 of ABA Chapter 2, an alteration that affects or could affect the usability of or access to an area containing a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the altered area, including the rest rooms, telephones, and drinking fountains serving the altered area, is readily accessible to and usable by individuals with disabilities, unless such alterations would increase the cost and scope of the overall alteration by more than twenty percent. If the costs of providing an accessible path of travel to the altered area would increase the cost and scope of the overall alteration by more than twenty percent, the path of travel shall be made accessible to the extent possible at least up to that twenty percent increase. Priority should be given to those elements that will provide the greatest access in the following order:

(a) An accessible route and accessible entrance to connect the altered area and site arrival points;

(b) An accessible restroom for each sex or a single unisex restroom;

(c) Accessible telephones;

(d) Accessible drinking fountains; and

(e) Accessible parking spaces.

In facility planning, if a series of alterations will be made to areas containing a primary function, and those alterations together will not provide an accessible path of travel to the altered areas, the total costs of the alterations planned within the three-year period after the initial alteration shall be considered when determining obligations to provide an accessible path of travel in accordance with this paragraph.

3. EXCLUSIONS. The following facilities need not comply with these DoD Standards:

(a) Facilities, or portions of facilities, on a military installation that are designed and constructed for use exclusively by able-bodied military personnel.

(b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense that are designed and constructed for use exclusively by able-bodied military personnel.

(c) Facilities obtained in emergencies such as natural disasters or in an area where contingency operations are being conducted. Nevertheless, since the intended use of such excluded facilities may change with time or in emergencies, compliance with these DoD Standards is recommended to the maximum extent that is reasonable and practicable without degrading the facility's military utility.

4. WAIVERS. Any other deviation from these DoD Standards shall be made only through the waiver or modification process. Requests for waivers or modifications are to be forwarded through the chain of command for approval by the Principal Deputy Under Secretary of Defense (personnel and Readiness), who represents DoD on the United States Access Board. Waivers and modifications will be considered on a case-by-case basis and granted only if the waiver or modification is clearly necessary

5. 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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APPENDIX O

Sing Specifications

For further clarification on wayfinding signage both interior and exterior for Fort Campbell visit link to the following.

https://wbdg.org/FFC/DOD/UFC/ufc_3_120_01_2014_c3.pdf

Type	Description	Colors	Dimensions	Font	Sample
Real Property Marker – DPW – Real Property without a facility.	Facility Number assigned by DPW used for accountable Real Property, where there is no Facility to attach signage – attached on top of 5/8" rebar (Aluminum).	N/A.	**RBD5325 - 3 1/4" Domed Survey Marker for 5/8" Rebar (Aluminum).** Marker will be attached to 5/8" x 24" rebar and sunk flush to ground.	1/8" letters and Numbers. 	
Real Property Marker – DPW – Training, Impact, or Firing Range.	Facility Number assigned by DPW used for accountable Real Property, where there is no facility to attach signage and is affixed to a Concrete Blocker and/or Marker.	N/A	**C35D - 3 1/2" Domed Concrete Survey Marker (Aluminum)** Embed into top of monument style 10" x 10" x 18" concrete block 	1/8" letters and Numbers 	 4" Domed Concrete Marker (Aluminum
Building Number Signs (Type C8).	Facility Number assigned by DPW used for facility tracking and emergency response.	White letters on standard brown background, single sided.	1 ft X 3 ft. Sign will be placed 7' from ground, on building corner no further than 6" from edge. Placed on the bldg sides visible from primary traffic routes.	Upper case helvetica medium, 8-inch capital letter height. Copy – centered. Average line length – 5 characters per line.	

Area Identification Sign, (Bde, Grp) (Type A2).	Identifies the Bde, Group “Area of Operations”.	Complimentary letters on standard brown brick background, double sided.	4-foot X 10-foot. Placed perpendicular to primary access road for the Bde , Grp “Area of Operations”.	Upper case helvetica medium, 8-inch capital letter height. Heraldry: 1’6” x 1’6” proportional to size and lettering.	

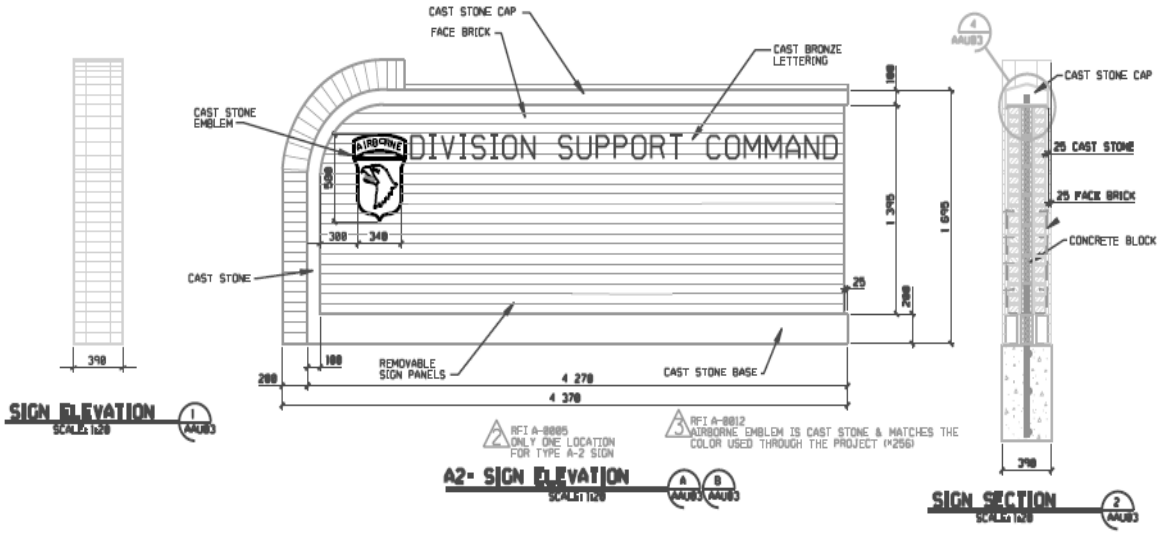
Type	Description	Colors	Dimensions	Font	Sample
Unit Identification Sign, (Bde, BN, Directorate) (Type B2 & B3).	Identifies individual Bde, BN, Directorate facilities.	White letters on standard brown background, double sided. Heraldry positioned in upper right hand corner.	30-inches X 72-inches. Placed within close proximity to facility identified.	Upper and lower case helvetica medium, 6-8 inch capital letter height. Heraldry graphic not to exceed 10” proportional.	
Unit Identification Sign (Company, Motor-pool, etc) (Type C1 & C3).	Identifies subordinate Company and other Operations facilities, not headquarters. No Heraldry authorized.	White letters on standard brown.	24-inches X 30-inches. Placed within close proximity to facility identified.	Upper and lower case helvetica medium, 6-8 inch capital letter height.	
Sign Plaque	Identifies the current Command Personnel only “Commander” and “CSM or 1SG”	White letters on standard brown background, double sided.	5-inch X 30-inch. Affixed under Type I-1 & I-2 signs only.	Upper and lower case helvetica medium, 4-inch capital letter height.	
Directional and Wayfinding Signs.	Assists drivers to locate major facilities and help visitors find their destinations more easily	White letters, arrows, and rules (reflectivity mandatory) on a bronze background. Hospital Bars are to be finished with a blue background. Graphics should appear on only one side of the sign since the sign is placed in	5 feet in width for interior signs and 7 feet in width for gate entrance signs made of 2 ¼” deep, extruded aluminum bars. The bottom of the directional sign is no less than 2 feet from ground level. Each individual directional sign is 6” in height for interior signs and 8’’ in height	Upper and lower case Helvetica medium, 6’’ capital letter height for interior signs and 8’’ capital letter height for gate entrance signs, flush left to arrow.	

		advance of an intersection and viewed only by traffic moving in that direction.	for gate entrance signs.		

Signage Fabrication Detail Sheet

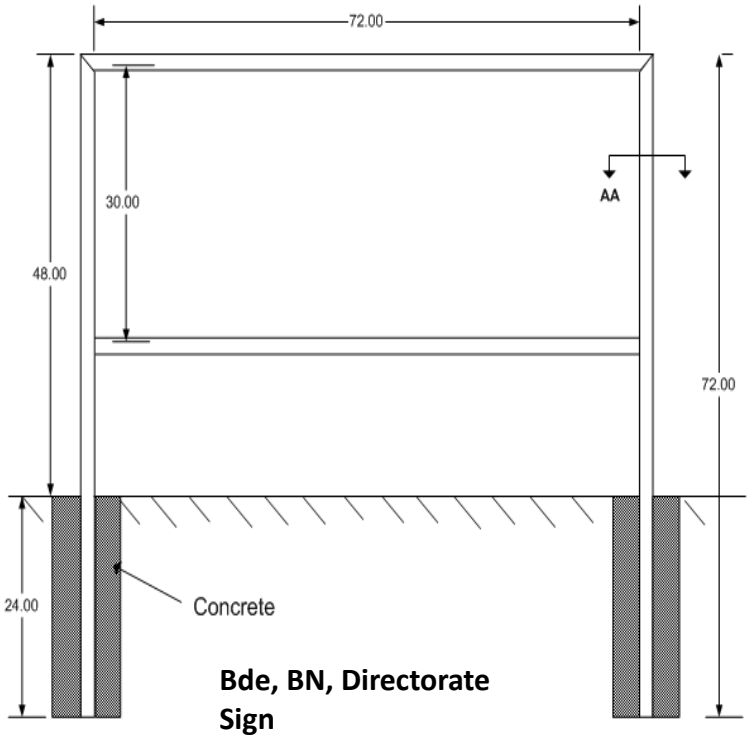
Real Property Marker (3 ½" and 3 ¼"):

Type A2 Sign:

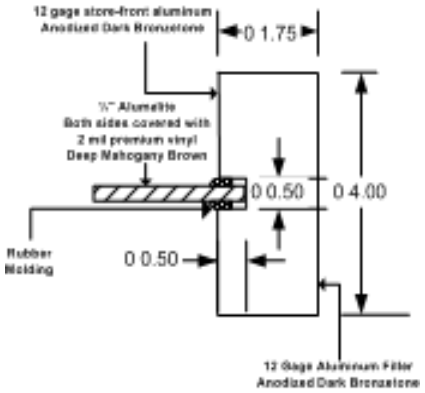


Measurement is in metric (mm)

Type B2 & B3 Sign:

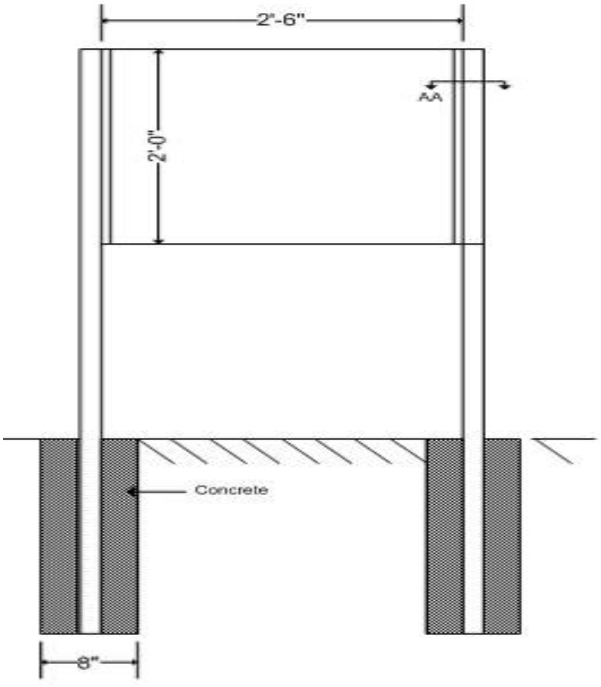


Bde, BN, Directorate Sign

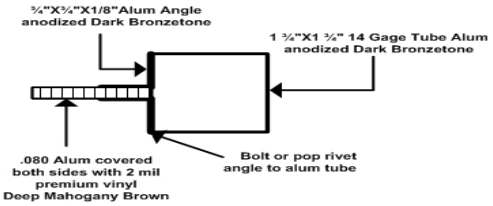


Detail AA

Type C1 & C3 Sign:

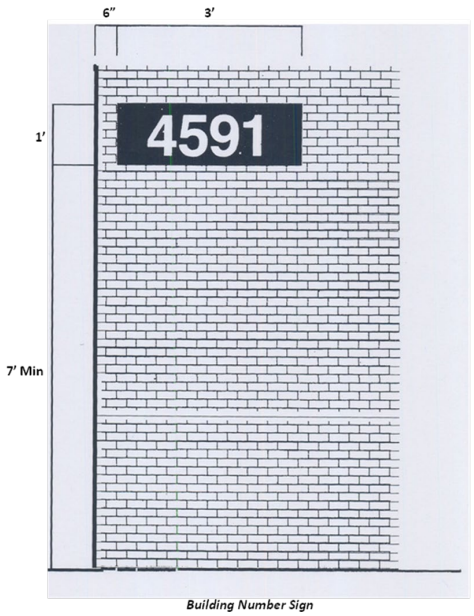


Company or TEMF Identification Sign



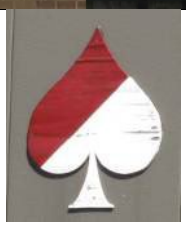
Section AA

Type C8 Sign:



Building Number Sign

Examples of Motivation Signage



Glossary
Section I
Abbreviations

ACP
Access Control Point

ASCE
American Society of Civil Engineers

BASOPS
Base Operations

DES
Directorate of Emergency Services

DPW
Directorate of Public Works

ECF
Entry Control Facility

FC Reg
Fort Campbell Regulation

GC
Garrison Commander

IAW
In Accordance With

IPS
Installation Planning Standards

MUTCD
Manual of Uniform Traffic Control Devices

TDG
Technical Design Guide:

TEMF
Tactical Equipment Maintenance Facilities

UFC
Unified Facilities Criteria

Section II
Terms

Installation Planning Standards
The Installation Planning Standards (IPS) capture the installation's guidelines for development of sustainable and efficient facilities. It provides a clear set of guidelines to ensure that Fort Campbell's vision and planning objectives for development are achieved.
http://www.campbell.army.mil/SiteAssets/DPW/20141124_FTCKY_Installation_Planning_Standards.pdf

Installation Identification Sign Types

Extracted from TM 5-807-10.
Sign type A1: Main Installation entrance sign, identifies the principal visitor entrance.
Sign type A2: Secondary entrance sign, identifies entry points with relatively high volumes of visitor traffic.
Sign type A3: Limited installation access entry gate signs, identifies entry points with limited public access.
Sign type B1: Installation headquarters, identifies the central administration of the installation.
Sign type B2: Command, division, and brigade headquarters sign.
Sign type B3: Battalion headquarters sign.
Sign type C1: Centralized primary facilities sign, multiple service units or a complex of buildings.
Sign type C2: Centralized secondary facility sign.
Sign type C3: Primary facility sign.
Sign type C4: Secondary facility sign.
Sign type C5: Primary entrance sign.
Sign type C6: Secondary entrance sign.
Sign type C7: Restricted facility sign.
Sign type C8: Building number.

Memorial

A **memorial** is an object which serves as a focus for memory of something, usually a person (who has died) or an event. Popular forms of **memorials** include landmark objects or art objects such as sculptures, statues or fountains and parks.

Memorialization

Naming a facility, building, road, etc, in the honor of a distinguished deceased person.

Memorialization Board

A board or group of individuals that considers and advises the approval authority on memorialization acts. If it is determined that a memorialization board takes on the characteristics of a committee, the proponent of the committee will follow all the requirements of AR 15–1 for establishing and continuing the group as a committee. Local procedures are outlines in CAM Reg 1-3.

Monument

A monument is a type of—usually three-dimensional—structure that was explicitly created to commemorate a person or event, or which has become relevant to a social group as a part of their remembrance of historic times or cultural heritage, due to its artistic, historical, political, technical or architectural importance. Examples of monuments include statues, (war) memorials, historical buildings, archeological sites, and cultural assets.

Motif

A design or figure that consists of recurring shapes or colors, as in architecture or decoration

Motivational Symbol

A design, figure or symbol that consists of objects or symbols that will activate or energize a goal-oriented behavior (see Appendix C for examples).

Personal Property (Fixed)

Personal property consists of capital equipment and other equipment of a movable nature which has been fixed in place or attached to real property, but which may be severed or removed from buildings without sever structural damage.

Technical Design Guide

The document contains mandatory criteria, policies, and procedures that apply to all design and construction at Fort Campbell. http://www.campbell.army.mil/SiteAssets/DPW/FTC_TDG_24_Apr_17.pdf

Appendix P

IMCB-PWE
Borrow/Spoil Permit

DPW Environmental Division, Pollution Prevention Branch, Building 5134, 2nd & Wickham Ave. Point of Contact – Building 5134, 270-798-9767/9786. Contractor shall provide copy of permit to the COR.

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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