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INSTALLATION INFORMATION INFRASTRUCTURE MODERNIZATION PROGRAM (I3MP) GUIDE

FOR

FACILITIES REQUIREMENTS

OF

CORE COMMUNICATIONS NODES

JULY 2008

ENTERPRISE SYSTEMS ENGINEERING DIRECTORATE

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I3MP GUIDE FOR FACILITIES REQUIREMENTS OF CORE COMMUNICATIONS NODES

1.0 INTRODUCTION

1.1 Purpose

This document provides requirements for the planning, design, and implementation of the facilities to house core communications nodes for campus-wide telephone switching and/or data networking systems. It also identifies proven facilities construction techniques, defines common practices, and serves as an authoritative implementation guide. This I3MP guide does not replace the site-specific engineering survey and the development of site-specific requirements but provides the designer with the U.S. Army Information Systems Engineering Command (USAISEC) standard requirements for core node facilities. The site-specific requirements will be documented in the project's Engineering Design Plan (EDP) or Performance-Based Work Statement (PBWS).

1.2 Scope

The requirements in this I3MP guide apply to core communications node facilities housing campus-wide telephone switching and data networking systems. The facilities requirements for telecommunications rooms (TRs) within end user buildings (EUBs) which support intra-building communications are defined in the USAISEC *Technical Guide for Installation Information Infrastructure Architecture (I3A).* (Refer to Section 2.0.)

1.3 Supporting Appendices

This guide includes three appendices and a glossary:

- Appendix A: I3MP Guide Checklist for Core Node Facilities Requirements
- Appendix B: Standard Shelter Drawings
- Appendix C: Standard Fence Drawing
- Glossary: Acronyms and Abbreviations

2.0 REFERENCES

2.1 U.S. Government Publications

a. Joint Chiefs of Staff (JCS), Chairman, Joint Chiefs of Staff Instruction (CJCSI), CJCSI 6215.01C, *Policy for Department of Defense Voice Networks with Real Time Services (RTS),* 9 November 2007.

b. Department of Defense (DOD), Military Handbook (MIL-HDBK)-419A, *Grounding, Bonding, and Shielding for Electronic Equipments and Facilities,* 29 December 1987.

c. DOD, MIL-STD-188-124B, *Grounding, Bonding, and Shielding for Common Long Haul/Tactical Communication Systems Including Ground-Based Communications-Electronics Facilities and Equipments,* 1 May 1998.

d. DOD, *Department of Defense Networks Unified Capabilities Requirements 2007 (UCR 2007),* December 2007.

e. DOD, Unified Facilities Criteria (UFC) 1-200-01, *General Building Requirements,* November 27, 2007.

f. DOD, UFC 3-520-01, *Interior Electrical Systems,* June 10, 2002.

g. DOD, UFC 3-600-01, *Fire Protection Engineering for Facilities,* 26 September 2006.

h. Headquarters, Department of the Army (HQDA), Army Regulation (AR) 190-16, *Physical Security,* 31 May 1991 (Chapter 5).

i. HQDA, TM 5-689, Electrical Power Applications for Information Technology (IT) Equipment and Inspection at Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities, 28 April 2008.

j. U.S. Army Corps of Engineers, Standard Drawing (STD) 87-90-03, *Type FE6, Chain-Link Fence w/Barbed-Wire on Single Outrigger.*

k. USAISEC, *Technical Guide for Installation Information Infrastructure Architecture (I3A),* March 2006.

l. USAISEC, Technical Guide for Lightning Protection, Power Quality Analysis, Grounding, Bonding and Shielding (LPAGBS), Version 1.0, Nov 2006.

m. USAISEC, Fort Detrick Engineering Directorate (FDED), *Technical Guide for I3A and I3MP Grounding and Bonding, Version 2.2, S*eptember 2006.

n. USAISEC-FDED, TR No. AMSEL-IE-TI 08-001-7, *U.S. Army Information Systems Engineering Command (USAISEC) Worldwide Outside Plant Design and Performance Requirements (OSPDPR),* November 2007.

o. USAISEC, Technology Integration Center (TIC), TR No. AMSEL-IE-TI 06-001, *U.S. Army Campus Area Network Design Guide,* September 2006.

2.2 Non-U.S. Government Publications

a. Institute of Electrical and Electronics Engineers (IEEE Standard 1100-2005 (Emerald Book), *IEEE Recommended Practice for Powering and Grounding Electronic Equipment,* 2006.

b. National Fire Protection Association (NFPA), NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2007 Edition.

c. NFPA 70, *National Electrical Code (NEC),* 2008 Edition.

d. NFPA 72, *National Fire Alarm Code,* 2007 Edition.

e. NFPA 75, *Standard for the Protection of Information Technology Equipment,* 2003 Edition.

f. NFPA 220, *Standard on Types of Building Construction,* 2006.

g. NFPA 780, *Standard for the Installation of Lightning Protection Systems,* 1997.

h. NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2008 Edition.

i. Underwriters' Laboratories (UL), UL-752, *Standard for Bullet-Resisting Equipment,* September 9, 2005.

3.0 CORE NODE FACILITIES REQUIREMENTS

The facilities housing core communications nodes shall comply with the requirements listed herein. Core communications nodes include telephone Dial Central Offices (DCOs), Remote Switching Units (RSUs), data Main Communications Nodes (MCNs), Area

Distribution Nodes (ADNs) and server farms. Core communications nodes may be housed in separate stand-alone facilities or may be incorporated into larger facilities with other occupancies. These facilities requirements shall apply to the spaces housing the communications equipment and its support equipment when they are part of a larger facility.

3.1 General Requirements

3.1.1 Construction

The core node shall be an Information Technology Equipment Room as defined by NFPA 75 and Article 645 of the NEC. No windows shall be permitted in the core node. The facility housing the core node equipment shall be of noncombustible construction in accordance with (IAW) NFPA 220. All interior walls shall be of noncombustible or limited-combustible construction. The core node area shall be separated from other occupancies within the building by a minimum one-hour fire-resistance-rated construction (two hours is preferred). Fire-resistance-rated partitions shall extend from the foundation or floor below to the underside of the roof or floor deck above to provide a complete separation. All penetrations to the perimeter of the core node shall be protected and fire-stopped.

3.1.2 Personnel Access

Consideration should be given as to how the Directorate of Information Management (DOIM) personnel will access the core node when it is included in a larger, mixed-use facility. DOIM personnel may need 24-hour access for operation and maintenance of the core node equipment. The entrance door should be readily accessible from the exterior of the facility. Also, the building occupants should not have unescorted access to the core node equipment room.

3.1.3 Core Node Equipment Layout

When the equipment is first installed into a core node, the equipment layout shall not only be planned to allow for sufficient aisle space, but also to maximize future expansion capacity. Equipment and utilities not related to the support of the core node (e.g., piping, ductwork, etc.) shall not be installed in the core node area.

3.1.4 Damage Avoidance

Water, drain, or condensate lines to supporting equipment within the core node should not be routed above the core node equipment in order to avoid potential water damage to sensitive equipment in the event of a leak. Within larger facilities, water, drain, or condensate lines not associated with the core node should not be routed above the core node area.

3.2 New Shelters

Shelters shall be pre-cast concrete communications shelters on concrete foundations. Shelters shall be sized to accommodate all required equipment and expansion capability. In some instances, the shelter may be site-constructed instead of a pre-cast module. Each shelter implementation shall include the following:

- Concrete foundation pad
- Concrete stoop at the entrance
- Sidewalk and hard surface parking for one service vehicle
- Site grading to allow for proper runoff/drainage of storm water
- Door canopy

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- Wind loading of 150 miles per hour (MPH)
- Floor loading of 300 pounds per square foot
- Insulation (minimum R-21 for walls and ceiling)
- Ballistic resistance IAW UL-752, Level 4, for the walls and ceiling (excluding doors)
- Vinyl anti-static floor tile
- Minimum 9-foot interior ceiling height
- Cable entrance conduit
- Fencing
- Alternating current (AC) electric service, including transformer, connection to the existing distribution system and electric meter
- Auxiliary power
- Grounding and lightning protection system
- Lighting and utility circuits
- Heating, ventilation, and air conditioning (HVAC)
- Fire suppression/detection/alarm system
- Alarms (intrusion detection, fire, HVAC, and power alarms)
- High-security key box on the exterior, adjacent to the entrance door.

3.2.1 Standard Sizes

New, pre-cast concrete shelters for core communications nodes shall be of the standard, nominal outside dimensions (width x length) listed below. The dimensions may vary slightly by manufacturer. Sample layout drawings are provided in Appendix B.

- Small Shelter: 11’-6” x 20’
- Medium Shelter: 11’-6” x 36’
- Large Shelter: 23’ x 36’
- Other: Project-specific

3.2.2 Exterior Finishes

The exterior walls of the shelter shall be similar to the surrounding buildings, typically a faux brick or exposed aggregate finish, or as required in the Installation Design Guidelines for the specific post. Exterior metal trim and doors/frames shall have a painted finish in a color IAW the Installation Design Guidelines. The Installation Design Guidelines are available from the post’s Directorate of Public Works (DPW).

3.2.3 Site Location

The site location of new shelters shall be coordinated with and approved by the local post’s DPW and Environmental Office. Any required setbacks from roads, parking, etc, shall be coordinated with and approved by the post’s Security Office. Local post procedures for review and approval of the sites shall be followed. Generally, sites chosen for new shelters should be level and clear with ready access to utility distribution systems and roads. Areas that are heavily wooded or that are environmentally or culturally sensitive should be avoided.

3.3 Site Work/Demolition/Disposal

The contractor shall be responsible for site work, demolition, and disposal. This work includes, but may not be limited to, site clearing and removal of vegetation and rocks; earthwork and excavation; grading and leveling; and interior demolition. The contractor shall dispose of all construction debris, including any excavated soil, at an approved facility, typically off-post. The contractor shall be responsible for obtaining digging permits and utility markings from the DPW and shall fully coordinate any utility service disruption with the DPW, the DOIM, and local service providers.

3.4 Interior Finishes

Interior walls and ceilings of core nodes shall be finished with painted gypsum board or other suitable interior finish. Floors shall be finished with anti-static vinyl tile flooring with vinyl base trim. Finishes should be light in color to enhance room lighting.

3.5 Doors

Exterior doors of new shelters and entrance doors to core node rooms shall be a minimum of 16-gauge metal doors (3'-0" x 7'-0") and frames with closers. Double doors, if used, shall have either no center posts or removable center posts. Exterior doors of shelters and entrance doors of core node rooms shall be provided with a cipher lock of the same type used on the existing core nodes. Door hinge pins should not be exposed to the exterior of the core node. If they are, they will be pinned, brazed, or spot–welded to prevent removal.

3.6 Floor Loading

The core node shall be designed for a minimum equipment floor loading of 300 pounds per square foot.

3.7 Outside Plant (OSP) Cable Entrance

The core node shall include a provision for an OSP cable entrance into the core node. Depending on the type and quantity of OSP cabling, the entrance may be either through a cable vault or may be made directly into the core node. The type of OSP cable entrance shall be as defined by the site-specific requirements of the project's EDP/PBWS.

3.7.1 Cable Vault

At core communications nodes that house telephone switching equipment, a cable vault is required to allow for proper distribution of the copper OSP cables. The cable vault shall be of reinforced concrete and shall be constructed under the main distribution frame (MDF) of the new shelter. The vault shall include pulling-in irons, ground bar, ventilation, and cable racks with hook spaces. The vault shall have minimum inside dimensions of 8 feet (width) x 8 feet (height), running the full width of the shelter. Core drills (4 inches in diameter and 8 inches on center) shall be provided through the floor of the shelter as required for copper cable installation to the MDF. Additionally, core drills shall be provided for fiber optic cable entrance into the core node. The fiber optic entrance holes shall be separate from those under the MDF. The quantity and location of the core drills shall be coordinated with the outside plant designer.

The OSP requirements shall be IAW the *OSPDPR* for I3MP projects and IAW the *Technical Guide for I3A* for all other Army programs. Thin concrete knockout sections shall be provided in the walls of the vault for terminating conduit ductbanks. A sump pit with automatic electric sump pump shall be constructed on one end of the vault. The floor of the

vault shall be sloped toward the sump pit. Vault entrance shall be by one lockable (pan lock) 36-inch round exterior vault entrance hatch or one lockable 36-inch square interior vault entrance hatch. The vault entrance shall have a metal access ladder to provide entrance into the cable vault. Safety measures shall be installed to prevent falls into the vault while the interior hatch is open. Fresh air venting shall be provided for the vault. Cable vaults shall be minimally equipped with the following alarm systems that shall provide an alarm condition and a remote connection to a dry contact: high water, toxic gas, explosive gas, intrusion, and smoke. Lighting, utility circuits, and grounding shall be provided in the vault to meet the current NEC for wet locations (NEC Articles 210, 250 and 410). Utility circuits shall have ground-fault circuit-interrupter protection for personnel.

3.7.2 Cable Entrance Ducts

In applications where a cable vault is not required, the OSP ductbank may enter directly into the core node. Typically, the cable entrance will be along a wall of the core node so that the cables may be racked on the wall or routed to overhead cable trays. The OSP requirements shall be IAW the *OSPDPR* for I3MP projects and IAW the *Technical Guide for I3A* for all other Army programs. The size, quantity, and location of the cable entrance ducts shall be coordinated with the outside plant designer.

3.8 Security Fence

A security fence consisting of 6-foot-high chain link fencing with 3 strands of barbed wire on angle arms and 2-inch posts at 10-foot on center shall be provided around new shelters and exterior equipment. Fencing shall comply with Standard Drawing STD 87-90-03. The fence shall be a minimum of 20 feet from the shelter walls IAW AR 190-16. Local requirements may dictate additional spacing between the structure and the fence. Each enclosure shall have a minimum of one (1) four (4)-foot wide pedestrian gate and one (1) twelve (12)-foot gate for vehicle access. All gates shall include a lockable security latch. Fencing shall be electrically grounded to the facility's ground system. (Refer to Paragraph 3.12 for the system grounding requirements.) The standard fence drawing is provided in Appendix C.

3.9 Paving

All paving shall be done IAW local post standards and requirements.

3.10 Utility Distribution

The requirements for connection to the existing utility distribution systems shall be coordinated with the DPW and utility providers (if privatized). The contractor shall be responsible for all utility connection permits and fees.

3.11 Electrical

All work shall be done IAW the NEC. The core node facility shall be serviced by a 120/208-volt (v) AC, 3-phase electrical service. All electrical loads within the core node shall be serviced from a single main panel within the core node. Subpanels for lighting and mechanical equipment may be used. The electric service for the core node shall be segregated from other occupancies, and circuits should not be extended beyond the core node to service other occupancies. Power circuits shall have dedicated neutral and ground conductors. The electrical service shall be sized to support the following: fully expanded solution of telephone and data systems; all supporting loads such as HVAC, lighting and

utility circuits; and a minimum of 25 percent spare capacity. The entire electrical load of the core node shall be supported by an auxiliary power system. (Refer to Paragraph 3.15 for the auxiliary power requirements.)

3.11.1 Surge Suppression

Power surge protectors shall be provided at the main distribution panel for system protection from lightning and transient voltages.

3.11.2 Disconnecting Means

A means shall be provided to disconnect power to all electronic equipment IAW Article 645 of the NEC. The control for the disconnecting means shall be identified and readily accessible at the principal entrance/exit doors of the core node. The disconnecting means should be provided with a protective cover to prevent accidental operation.

3.11.3 Power to Core Node Equipment

Direct current (DC)-powered voice communications equipment shall be provided with a -48 volts direct current (VDC) power system. (Refer to Paragraph 3.13 for the DC power system requirements.) AC-powered communications equipment shall be provided with an AC uninterruptible power supply (UPS). (Refer to Paragraph 3.14 for the UPS requirements.)

Note: The DC power and/or UPS power shall be installed in conjunction with the communications equipment. If the communications equipment is installed under a separate effort, then the installation of the DC power and/or UPS power equipment will not be within the scope of the facilities requirements.

3.11.4 Electric Meter

An electric meter shall be provided on stand-alone facilities/shelters. The meter requirements shall be coordinated with the local post DPW.

3.11.5 Lighting

Lighting in the core node shall be by ceiling-mounted or suspended fluorescent fixtures and shall provide a minimum of 50 foot-candles at 30 inches above the floor in the middle of all aisles between cabinets. The location of the lighting fixtures should be coordinated with the layout of communications equipment and cable trays to prevent shadows on the front of equipment. Automatic, rechargeable, battery-powered emergency lighting and exit markings shall be installed in accordance with NFPA specifications. Lighting shall be provided in the cable vault to provide a minimum of 30 foot-candles at 30 inches above the floor. Exterior security lighting controlled by photocell shall be provided at stand-alone shelters.

3.11.6 Utility Circuits

Utility circuits shall be provided with a minimum of one AC-duplex outlet (120V, 20 Ampere [A]) every 12 feet around the perimeter of the core node room, except in small shelters where a minimum of one per wall shall be provided. Utility circuits shall be provided in the cable vault with a minimum of one AC-duplex outlet (120V, 20A) every 12 feet around the perimeter of the vault. Utility circuits in the vault shall have ground-fault circuit-interrupter protection for personnel and shall meet the NEC requirements for wet locations (NEC Article 210).

3.11.7 Telecommunications

A minimum of one RJ11 telephone jack for a wall telephone shall be installed inside the core node near each entrance door. Where the core node is to include administrative positions, such as in a DCO, additional voice and data outlets may be required. Refer to the site-specific requirements in the project's EDP/PBWS. The quantity and location of the voice/data outlets shall be coordinated with the Site Point of Contact (POC).

3.12 System Grounding

The facility ground system shall consist of three electrically connected subsystems. These systems are the earth electrode subsystem (EES), signal reference (SR) subsystem and the fault protection (FP) subsystem. Additionally, lightning protection shall be provided for all new and existing huts/shelters. All work shall be in accordance with the most recent version of the NEC (NEC Article 250), the *Technical Guide for I3A and I3MP Grounding and Bonding*, the *Technical Guide for LPAGBS*, and as described herein. All grounding conductors shall be tagged, labeled, and color-coded in accordance with industry standards. All observed discrepancies that exist in the grounding, bonding, and/or electrical distribution system beyond the core node in the remainder of the multi-functional EUB shall be noted and reported to the Site POC.

Note: Upgrading the entire facility ground system and/or providing lightning protection to an existing large, multi-functional EUB that houses a core node is typically outside the scope of this guide. Refer to the site-specific requirements in the project's EDP/PBWS. If the contractor notes any deficiencies to the existing facility ground system that are outside the scope of the project, the contractor shall submit a written report detailing these deficiencies, the impact to the core node, and recommended corrective actions.

3.12.1 Earth Electrode Subsystem

Core nodes shall be provided with an earth electrode subsystem (EES). The EES shall obtain a resistance to earth of five (5) ohms or less as measured by the Fall-of-Potential method IAW MIL-HDBK-419A. The EES shall consist of driven ground rods uniformly spaced around the facility and placed between two and six feet from the outside wall of the structure, interconnected with a minimum #4/0 American Wire Gauge (AWG) bare copper cable buried a minimum of 18 inches below grade. Ground rods shall be copper-clad steel, ¾-inch in diameter by 10 feet long and spaced apart not more than 20 feet. The cable shall be connected to each ground rod by exothermic weld and close on itself to form a complete loop with the ends connected by exothermic weld. Connecting risers of appropriate size IAW NFPA 780 (Chapter 4) shall be provided for bonding the lightning protection subsystem down conductors and connecting cables required by the fault protection subsystem. A minimum of one ground test access point (test well) shall be provided.

3.12.2 Signal Reference Subsystem

Core nodes shall be provided with a signal reference (SR) ground. As a minimum, the SR ground shall consist of a copper ground bar, minimum size 1/4" thick x 4" wide x 20" long, pre-drilled and tapped for two-hole lugs, mounted 7'-0" above the finished floor with stainless steel mounting brackets and insulated standoffs. Connections to the ground bar shall be by exothermic weld or listed compression two-hole lugs. A properly sized copper ground conductor (not less than #4/0 AWG) shall be installed between the SR ground bar and the EES to maintain an effective ground path.

Note: To achieve the required impedance, multiple interconnected SR ground bars or an internal ground ring may be required. Refer to the *Technical Guide for I3A and I3MP Grounding and Bonding* and the *Technical Guide for LPAGBS*.

Note: For core nodes that house DC-powered equipment, the grounding conductor shall be sized IAW Paragraph 250.166 of the NEC, which states that the grounding electrode conductor shall not be smaller than the largest conductor supplied by the DC power system. If the design requirements of the shelter (or core node room) must be determined prior to the DC power system's being designed, the grounding electrode conductor should be generously sized to accommodate the future DC power system. Typically, provide a 500-thousand circular mils (kcmil) ground conductor for RSUs and a 750-kcmil ground conductor for DCOs.

3.12.3 Fault Protection Subsystem

Core nodes shall be provided with a fault protection (FP) subsystem. The FP subsystem shall consist of a separate grounding conductor "green" wire to provide personnel and equipment protection against power fault currents and static charge buildup. The Neutral-to-Ground (N-G) bonding topology shall follow those specified in NEC Article 250.30. Protection from lightning flashover shall be provided by grounding all non-current carrying metallic objects such as conduits, cable trays/ladders, wiring system enclosures, metallic cable sheaths, piping, tubing, supports thereof, motors, battery racks, and any other significant structural metallic facility components. All panelboard and switchboard equipment shall be listed and installed IAW the provisions of the NEC. All facility grounding shall conform to the requirements of Article 250 of the NEC.

3.12.4 Lightning Protection

Lightning protection, including roof-mounted air terminals, shall be provided for the facility in accordance with NFPA 780. All exterior fencing, ladders, lighting, stairways, antenna elements, air conditioning components, and other significant metallic structures shall be grounded directly to the earth electrode subsystem in accordance with the NEC and NFPA 780. Conductive outside plant cable sheaths shall be terminated within the cable vault or entrance manhole and be grounded directly to the earth electrode subsystem. A surge protection device shall be located at the main distribution panel to suppress lightning-induced voltage and current surges within the AC electrical distribution system. The surge suppressor shall be mounted directly beside its serving breaker.

3.12.5 OSP Grounding

An OSP ground bar (OSPGB) shall be installed in the cable vault or in the shelter adjacent to the cable entrance area. The OSPGB shall be a copper bar, a minimum of 1/4" thick x 2" wide x 12" long, pre-drilled and tapped for two-hole lugs, with stainless steel mounting brackets and insulated standoffs. Connections to the ground bar shall be by exothermic weld or listed compression two-hole lugs. A minimum #1/0 AWG grounding electrode conductor shall be installed between the OSPGB and the EES to maintain an effective ground path. The grounding electrode conductor shall be connected to the ground ring by exothermic weld. No connection shall be made between the SR ground bar and the OSP ground bar.

3.13 DC Power Systems (-48VDC)

Where DC-powered equipment is to be installed, it shall be powered by a complete -48VDC power system which shall include all equipment, wiring, circuit/fuse panels, interfaces,

racks, cabling, mounting hardware, standby battery system, rectifiers, power boards, fuses, breakers, inverters, etc., necessary to support the full expansion size of the voice switching equipment and data equipment plus a minimum of 25 percent expansion capacity at each core node location. All work shall meet the requirements of IEEE 100 and NEC Article 250. The DC power conductors shall be tagged and labeled IAW industry standards.

3.13.1 Batteries

All new power/battery reserve systems shall consist of valve-regulated lead-acid (VRLA) batteries configured with thermal sensing units (TSUs) on each module to detect and report unacceptable rises in temperature, which could be related to a thermal runaway of the modules. All TSU alarms shall be integrated into the new alarm systems and the respective new rectifier and/or power board input control signal point. The new batteries shall be fitted with protective connectors/covers to prevent contact with live parts. The batteries provided shall be fully recharged within 24 hours after discharge. Where more than one string of batteries is provided, a maintenance by-pass shall be provided to allow for one string to be disconnected for maintenance while the other string remains connected.

3.13.2 DC Power Boards

The DC power boards shall be configured in an A/B configuration to provide each circuit for the DC-powered equipment with duplicate power feeds. Each of the “A” and “B” feeds shall be capable of supporting the total connected load so that either of the feeds may be disconnected for maintenance without loss of power to the electronic equipment. The DC power boards shall be populated with a sufficient number of circuit breakers to support the fully expanded solution and the required 25 percent growth.

3.13.3 Rectifiers

All new rectifiers shall be equipped with the functionality to interpret the TSU alarms and automatically adjust the rectifiers’ output voltage and current until the battery cell(s) return to an acceptable operating temperature. The rectifiers shall be installed in an N+1 survivable configuration.

3.13.4 Inverters

All inverters shall include a maintenance by-pass to commercial AC power and shall be configured to use DC power as the primary power source. A standard AC power panel shall distribute the inverted power. The panel shall be populated with a sufficient number of circuit breakers to support both the fully expanded solution of equipment to be connected to inverted power plus a minimum of 25 percent spare capacity. Additionally, a minimum of two (2) spare duplex inverted power AC receptacles shall be provided and installed in the equipment racks as approved by the Site POC. All inverted power AC receptacles shall be identified by labeling and color-coding.

3.13.5 DC Disconnect Switch

A manually-activated, keyed DC disconnect switch shall be installed between the batteries and the DC power board. The manual DC disconnect switch should have a keyed-switch appearance and shall be located adjacent to all entry points into the shelters or core node rooms.

3.13.6 Automatic Low-voltage DC Disconnect

An automatic low-voltage DC-power disconnect capability shall be provided (in addition to any potential low-voltage disconnect that may be provisioned in a switch system).

3.13.7 DC Power Reserve

The DC power plants shall be capable of powering the full expansion size system capacity and the required spare capacity of all powered electronic equipment for a minimum of eight (8) hours at host/end office (EO)/MCN locations; a minimum of four (4) hours at RSU/Private Branch Exchange (PBX) locations; and a minimum of two (2) hours at ADN locations. Core node locations that provide service to Special Command and Control (C2) users (as defined by CJCSI 6215.01C) shall be provided with eight (8) hours of battery backup regardless of the classification of the core node.

3.13.8 Battery Containment

Battery containment consisting of a barrier and absorber bags shall be provided around the batteries. The barrier and basin shall be painted with an epoxy-based paint.

3.13.9 Eyewash Fountain

A self-contained portable eyewash fountain shall be provided and installed near the batteries.

3.14 Uninterruptible Power Supply

Where AC-powered equipment is to be installed or maintained as legacy equipment and not supported by inverters from a DC power system, the equipment shall be powered by a rack-mounted, online, modular, 3-phase AC-output UPS battery back-up system. The UPS system shall include all equipment, wiring, circuit/fuse panels, interfaces, racks, cabling, mounting hardware, standby battery system, power boards, fuses, breakers, etc., necessary to support the full expansion size of the voice switching equipment and data equipment and a minimum of 25 percent expansion capacity at each core node location. The UPS system shall include a maintenance bypass. All work shall meet the requirements of the current NEC. The DC power conductors shall be tagged and labeled IAW industry standards.

3.14.1 UPS Battery Module Requirements

The UPS batteries shall be VRLA, modular style construction with the ability to be hot-swappable without the occurrence of any system downtime. The battery modules shall have the ability to be fully recharged within twenty-four (24) hours after complete discharge while simultaneously providing regulated power to the equipment load during the recharge period.

3.14.2 UPS Battery Back-up Power Reserve Capacity

The UPS system shall be sized to have the ability to support the maximum load of the fully-expanded data and voice system, with an additional 25 percent expansion capacity, at each building location. The UPS system shall be capable of powering the load for a minimum of eight (8) hours at host/EO/MCN locations and locations that provide service to Special C2 users (as defined by CJCSI 6215.01C); a minimum of four (4) hours at RSU/PBX locations; and a minimum of two (2) hours at ADN locations.

3.14.3 UPS Battery Back-up System Alarms

The new UPS battery back-up system shall have the ability to monitor and report the status of the UPS system. Alarms shall be reported both remotely and locally. A list of the alarm capabilities to be provisioned shall be submitted to and approved by the Government. All alarm functions shall be tested during system acceptance.

3.14.4 Equipment Terminations

The UPS system shall include a rack-mountable power distribution unit/panel to provide a means to install breakers and branch circuit conductors to power the equipment loads. The power distribution equipment shall be sized to supply the fully expanded load requirements and 25 percent spare capacity.

3.14.5 UPS Disconnect Switch

A manually-activated, keyed UPS disconnect switch shall be installed to disconnect power to all electronic equipment in each communications equipment room. The disconnecting means shall also disconnect the batteries from their load. The disconnect switch shall be located adjacent to all entry points into the core node rooms.

3.14.6 Battery Containment

Battery containment consisting of a barrier and absorber bags shall be provided around the batteries. The barrier and basin shall be painted with an epoxy-based paint.

3.14.7 Eyewash Fountain

A self-contained portable eyewash fountain shall be provided and installed near the batteries.

3.15 Auxiliary Power System

3.15.1 Auxiliary Power – New Shelters

The full electrical load of the core node, including all the data, transport, voice and other information technology (IT) equipment, lighting, HVAC, fire suppression/detection systems and required expansion, shall be supported by an engine generator auxiliary power system. The generator's fuel type (diesel, natural gas, or liquid propane (LP) gas) shall be coordinated with the local post DPW. The auxiliary power system shall automatically start and support the electric load upon failure of the commercial electric service. The system shall have a fuel capacity to operate the generator for a minimum of 48 hours at full load. The contractor shall provide the fuel for system testing, and the fuel tanks shall be completely filled before system acceptance. The generator set and associated fuel tank shall be installed on a reinforced concrete pad.

3.15.2 Auxiliary Power – Existing Locations

The full electrical load of the core node, including all the data, transport, voice, and other IT equipment, lighting, HVAC, and fire suppression/detection systems, shall be connected to the existing auxiliary power system when the existing auxiliary power system is sufficient. If the existing auxiliary power system is insufficient to support the new core node electrical load, the auxiliary power system shall be upgraded or replaced.

3.16 Heating, Ventilation, and Air Conditioning

All work shall be in accordance with the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Criteria. Environmental control of core nodes shall

be maintained by a high-efficiency, computer room-type HVAC system, to include supply and return ducting as required, to provide the HVAC capacity to maintain required environmental levels throughout the core node. The system shall have N+1 redundancy in the number of HVAC units, and operation of the units shall cycle at regular intervals. If the operating system fails, the standby system shall automatically start and provide the required environmental control. The active and standby units shall automatically switch at least once a week so the active unit becomes the standby unit and the standby unit becomes the active unit.

The system shall be capable of providing temperature (heating and cooling) and humidity control. A potable water service with backflow preventer shall be required for the HVAC system to allow for humidity control. The HVAC system shall meet the optimum operating requirement of a maximum expandable size switch and maintain 72 +/- 2 degrees Fahrenheit (F) (dry bulb) and 45 +/- 5 percent relative humidity (rh) year round. Exterior condenser units shall be installed on reinforced concrete pads. The HVAC system shall be interconnected to the fire alarm system so that upon fire alarm detection, the HVAC system shall be automatically disconnected.

Note: The HVAC system design and the equipment floor plans should be coordinated so that airflow from the HVAC equipment travels in a direction parallel to the rows of equipment cabinets/racks.

3.17 Fire Protection

All work shall be in accordance with the NFPA. Core communications nodes shall be protected by an automatic fire suppression system and a fire detection/alarm system. Typically, unoccupied stand-alone electronic communications equipment shelters will be protected by a clean agent fire suppression system as this type of system, when activated, will not damage the communications equipment. When the core communications node is part of a larger, occupied mixed-use and fully-sprinklered facility, the fire suppression system shall be a water sprinkler system. When a water sprinkler system is provided, it shall be a preaction-type system to reduce the possibility of accidental water leakage onto the communications equipment.

Note: In accordance with UFC 3-600-01, all parts of a building's exterior must be within 350 feet of a fire hydrant, and at least one hydrant must be located within 150 feet of the fire department connection. Typically, the installation of fire hydrants will be outside the scope of work of I3MP/IMOD projects. For new shelters, the fire hydrant requirements should be coordinated with the local post DPW and fire department to ensure that the requirements for fire hydrants are met.

3.17.1 Key Box

To allow for rapid entry of Fire Department personnel, a high-security key box shall be installed on the exterior of the shelter(s) adjacent to the entrance door. Where practical, a recessed box is preferred. The key box shall be of the type employed by the installation and shall be keyed to the Fire Department master key.

3.17.2 Clean Agent System

The clean agent fire suppression system shall be a complete system, including canisters, agent, dispersion heads, piping, valves, alarm control panel, etc., to provide full coverage to the core communications node facility. The fire suppression system controls shall be fully

integrated into the fire detection/alarm system and shall include manual override, manual pull station at the exit, personnel alarm, and smoke/heat detectors. The system shall have pull stations to activate the clean agent suppression system and abort stations for manual cutoff.

Audible and visual alarms shall be provided to alert personnel of activation. Upon system activation, the fire detection/alarm system shall sound an alarm in the supporting fire station, the 911 Emergency Operations Center (EOC), and the Main DCO and shall be compatible with the existing alarm system at these locations. The HVAC system shall be interconnected to the fire alarm system so that upon fire alarm detection, the HVAC system shall be automatically disconnected.

When the suppression system is activated, all AC electrical services shall be automatically disconnected. A minimum of one fully-charged carbon dioxide (CO2) hand-held auxiliary extinguisher shall be included at each shelter. All new equipment shall be installed in accordance with the NFPA. The contractor shall perform all tests on the system and provide the proper material and test certificates through the Site POC to the local approving authority as required.

3.17.3 Preaction System

The preaction fire suppression system shall be a complete system, including connection to the water distribution system, standpipe, sprinkler heads, piping, valves, alarm control panel, etc., to provide full coverage to the core communications node facility. The fire detection/alarm system shall include manual override, manual pull station at the exit, personnel alarm, and smoke/heat detectors. The alarm system shall have pull stations to activate the suppression system, and abort stations for manual cutoff.

Audible and visual alarms shall be provided to alert personnel of activation. Upon system activation, the fire detection/alarm system shall sound an alarm in the supporting fire station, the 911 EOC, and the Main DCO and shall be compatible with the existing alarm system at these locations. When the system is activated, all AC and DC electrical services shall be automatically disconnected. A minimum of one fully-charged CO2 hand-held auxiliary extinguisher shall be included at each shelter. All new equipment shall be installed in accordance with the NFPA. The contractor shall perform all tests on the system and provide the proper material and test certificates through the Site POC to the local approving authority as required.

3.18 Intrusion Detection

An intrusion detection system (IDS) shall be provided for the core node to detect unauthorized entry. At a minimum, the IDS shall monitor all entry points into the core node. The IDS requirements shall be coordinated with the Site POC and local post DPW and security personnel. The IDS alarms shall be indicated at the 911 EOC or as required by local post requirements.

3.19 Alarms

All alarms shall be interconnected to the existing alarm monitoring system at the DCO. All alarms shall also be indicated at the existing remote annunciating panels located in the 911 EOC or other location as defined by the Site POC. The existing annunciator panels shall be expanded as necessary to accommodate the new alarm ports. At a minimum, the following alarms shall be provided:

a. Fire Alarm. Refer to Paragraph 3.17, Fire Protection.

b. HVAC Alarms. The HVAC system shall include alarm reporting for high/low temperature, high/low humidity, and HVAC failure.

c. AC-Power Failure Alarm. The AC-power failure alarm shall also be indicated at the Energy Management Operations Center.

d. Generator Run Alarm. The generator run alarm shall also be indicated at the Energy Management Operations Center.

e. Generator Trouble Alarm. The generator trouble alarm shall also be indicated at the Energy Management Operations Center.

f. UPS System Alarms. Refer to Paragraph 3.14.3, UPS Battery Back-up System Alarms.

g. Intrusion Detection Alarm. Refer to Paragraph 3.18, Intrusion Detection.

h. Vault High Water Alarm. These alarms shall be reported locally and in the DCO.

i. Vault Toxic Gas Alarm. These alarms shall be reported locally and in the DCO.

j. Vault Explosive Gas Alarm. These alarms shall be reported locally and in the DCO.

4.0 TELECOMMUNICATIONS ROOM (TR) FACILITIES REQUIREMENTS

The facilities requirements for TRs within EUBs which support inter-building communications are not included in this guide. Refer to the *Technical Guide for I3A* for the facilities requirements of TRs.

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APPENDIX A. I3MP GUIDE CHECKLIST FOR CORE NODE FACILITIES REQUIREMENTS

Table A-1. Core Node Facilities Requirements Checklist

Item	I3MP Guide Paragraph	Requirement	Comments
1	Not applicable (N/A)	Location: Post: _____ Building No.: _____ Room No.: _____	Complete the checklist for each core node facility.
2	3.0	Type of Node: ___ DCO/EO ___ RSU ___ MCN ___ ADN ___ Server Farm	Multiple core node types may be co-located in one facility.
3	3.0	Type of Facility: ___ new or ___ existing ___ shelter ___ within EUB	
4	3.1.1	Type of Construction: ___ noncombustible ___ min. 1-hr fire rating ___ full-height partitions ___ penetrations fire-stopped	All are required.
5	3.1.2	Personnel Access: ___ entrance door easily accessible from exterior of facility ___ DOIM access only	Direct access to exterior may be desired for core nodes within larger EUBs.
6	3.1.3	Equipment Layout: ___ room size adequate (Y or N) ___ room for expansion (Y or N)	
7	3.1.4	___ No water/drain pipes above core node area	
8	3.2	___ New shelter required (Y or N)	
9	3.2.1	Shelter size: ___ small (11'-6" x 20') ___ medium (11'-6" x 36') ___ large (23' x 36') ___ other _____	
10	3.2.2	Shelter exterior finish: ___ brick ___ exposed aggregate ___ other ___ color - _____	Coordinate with Site POC and DPW Master Planner.
11	3.5	Door locks – match existing ___ cipher lock ___other	Coordinate with Site POC.
12	3.7	___ Cable Vault (Y or N)	Coordinate type of entrance and number of ducts with OSP requirements.

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Table A-1. Core Node Facilities Requirements Checklist (continued)

Item	I3MP Guide Paragraph	Requirement	Comments
13	3.8	Security Fence: ___ chain link ___ other – _____	Coordinate with DPW to ensure a chain link fence meets local post requirements.
14	3.10	Electrical: Distribution system: ___ government-owned, or ___ privatized Transformer: ___ pad-mounted, or ___ aerial Distribution voltage: _____ Transformer size: _____ AC panel size: _____	Calculate transformer size and AC panel size based on estimated communications equipment load, plus required environmental systems, lighting, utility circuits and expansion.
15	3.10.1	___ Electrical surge suppression (Y or N)	
16	3.10.2	___ Disconnecting means (Y or N)	
17	3.10.4	___ Electric meter (Y or N)	
18	3.10.5	Lighting: ___ lighting levels sufficient (Y or N) ___ emergency lighting (Y or N) ___ exterior lighting (Y or N)	
19	3.10.6	___ Utility circuits are sufficient (Y or N)	
20	3.10.7	___ Telecommunications outlets are sufficient (Y or N)	
21	3.11	Grounding: ___ If existing facility, grounding system meets current requirements (Y or N)	If no, note deficiencies.
22	3.11.1	Earth Electrode Subsystem: ___ ground ring around facility (Y or N) ___ resistance of 5 ohms or less (Y or N)	
23	3.11.2	Signal Reference Subsystem: ___ main ground bar (Y or N) size of main ground conductor – _____	Verify that the main ground conductor is sized larger than the largest power conductor.
24	3.11.3	___ Fault Protection Subsystem – Are all metallic objects (conduits, racks, cable trays, etc.) grounded? (Y or N)	Required for new facilities.
25	3.11.4	Lightning Protection Subsystem: ___ Does existing facility have lightning protection system? (Y or N)	Required for new facilities.

Table A-1. Core Node Facilities Requirements Checklist (continued)

Item	I3MP Guide Paragraph	Requirement	Comments
26	3.11.5	OSP Grounding: ___ ground bar in vault or adjacent to cable entrance? (Y or N) size of ground conductor – _____	
27	3.12	DC Power System: ___ required (Y or N) ___ new or ___ existing ___ sized for full expansion, plus 25% (Y or N)	
28	3.12.1	Batteries: ___ VRLA ___ wet cell	If existing, note type, manufacturer, model, volts per cell, quantity, ampere-hour rating, date installed, and condition.
29	3.12.2	DC Power Boards	If existing, note total capacity (DC amperes), total existing output (DC amperes), and output voltage (DC volts).
30	3.12.3	Rectifiers: ___ existing: - size/quantity – _____ ___ new ___ N+1 redundancy (Y or N)	
31	3.12.5	___ DC Disconnect Switch (Y or N)	
32	3.12.6	DC Power Reserve: ___ 2 hours ___ 8 hours ___ other – _____	
33	3.12.8	___ Battery Containment (Y or N)	
34	3.12.9	___ Eyewash (Y or N)	
35	3.13	UPS: ___ required (Y or N) ___ existing ___ new ___ sized for full expansion, plus 25% (Y or N)	If existing, note type, manufacturer, model, quantity, size, and date installed.
36	3.13.2	UPS Reserve Capacity: ___ 2 hours ___ 8 hours ___ other – _____	
37	3.13.5	___ UPS Disconnect Switch (Y or N)	
38	3.13.6	___ Battery Containment (Y or N)	
39	3.13.7	___ Eyewash (Y or N)	
40	3.14	Auxiliary Power: ___ new, or ___ existing – size _____	If existing, note manufacturer, model, and size.
41	3.14	Auxiliary Power: ___ dedicated to core node, or ___ shared with other loads	

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Table A-1. Core Node Facilities Requirements Checklist (continued)

Item	I3MP Guide Paragraph	Requirement	Comments
42	3.14	Generator fuel type: ___ diesel fuel ___ natural gas ___ LP gas	
43	3.15	HVAC: ___ computer room units (Y or N) ___ humidity control (Y or N) ___ redundant unit(s) (Y or N) ___ HVAC system interconnected to fire alarm system (Y or N)	
44	3.16	Fire Protection: ___ automatic suppression system (Y or N)	Coordinate fire alarm reporting requirements with Fire Department.
45	3.16	Fire Protection – Fire Suppression: ___ clean agent, or ___ preaction sprinkler	
46	3.16	Fire Protection – Fire Alarm Transmission: ___ FM radio, or ___ telephone line	
47	3.17	Intrusion Detection	Coordinate IDS requirements with Site POC and Security Officer.
48	3.18	Alarms: ___ Fire Alarm ___ HVAC Alarms ___ AC-Power Failure Alarm ___ Generator Run Alarm ___ Generator Trouble Alarm ___ UPS System Alarms ___ Intrusion Detection Alarm ___ Vault High Water Alarm ___ Vault Toxic Gas Alarm ___ Vault Explosive Gas Alarm	Coordinate location of alarm monitoring stations with Site POC and Security Officer. Note manufacturer and model of existing alarm monitoring equipment.

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APPENDIX B. STANDARD SHELTER DRAWINGS

The Small Shelter size is 11’-6” x 20’ as shown in Figure B-1.

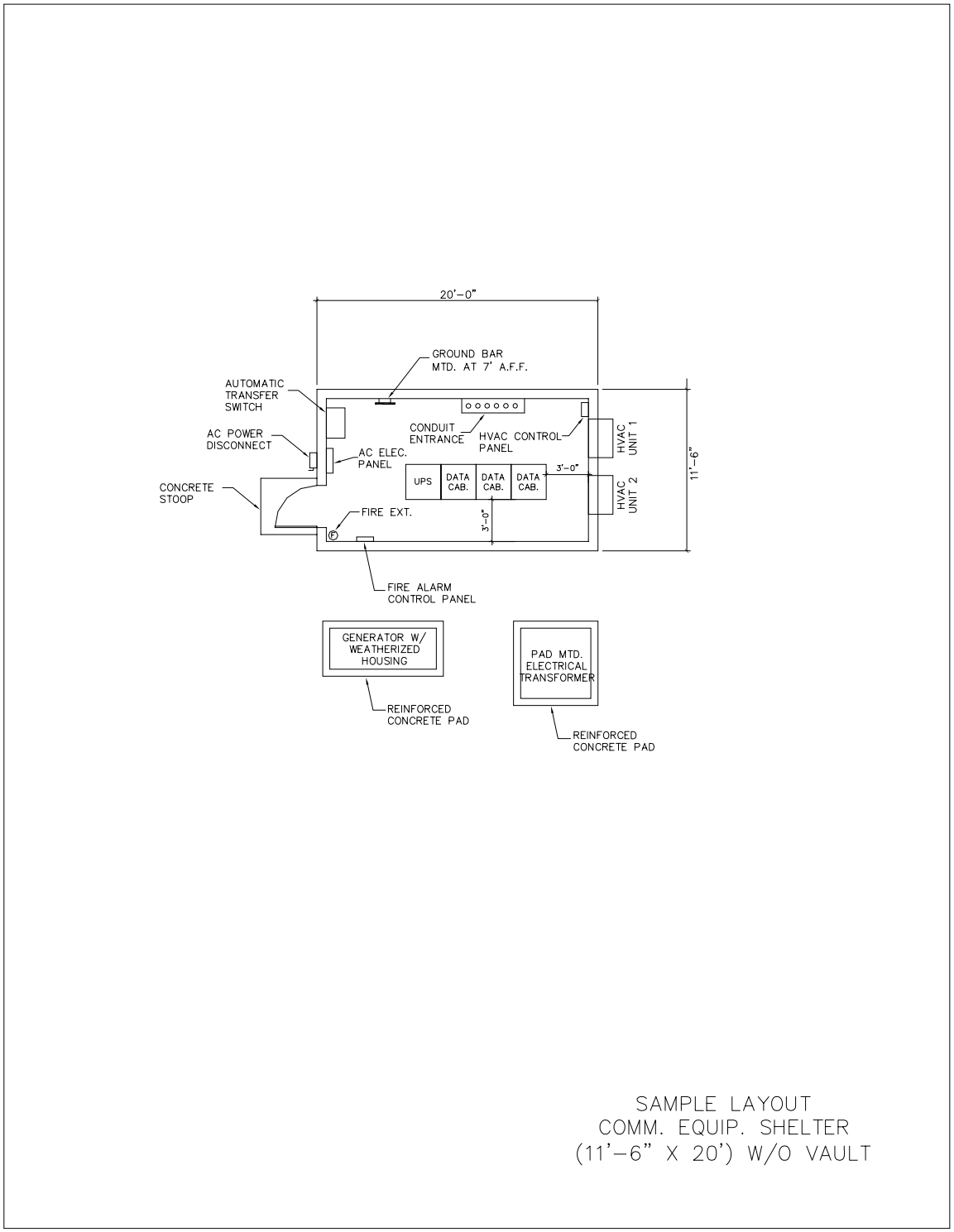

Figure B-1. Small Shelter

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The Medium Shelter size is 11’-6” x 36’ as shown in Figure B-2.

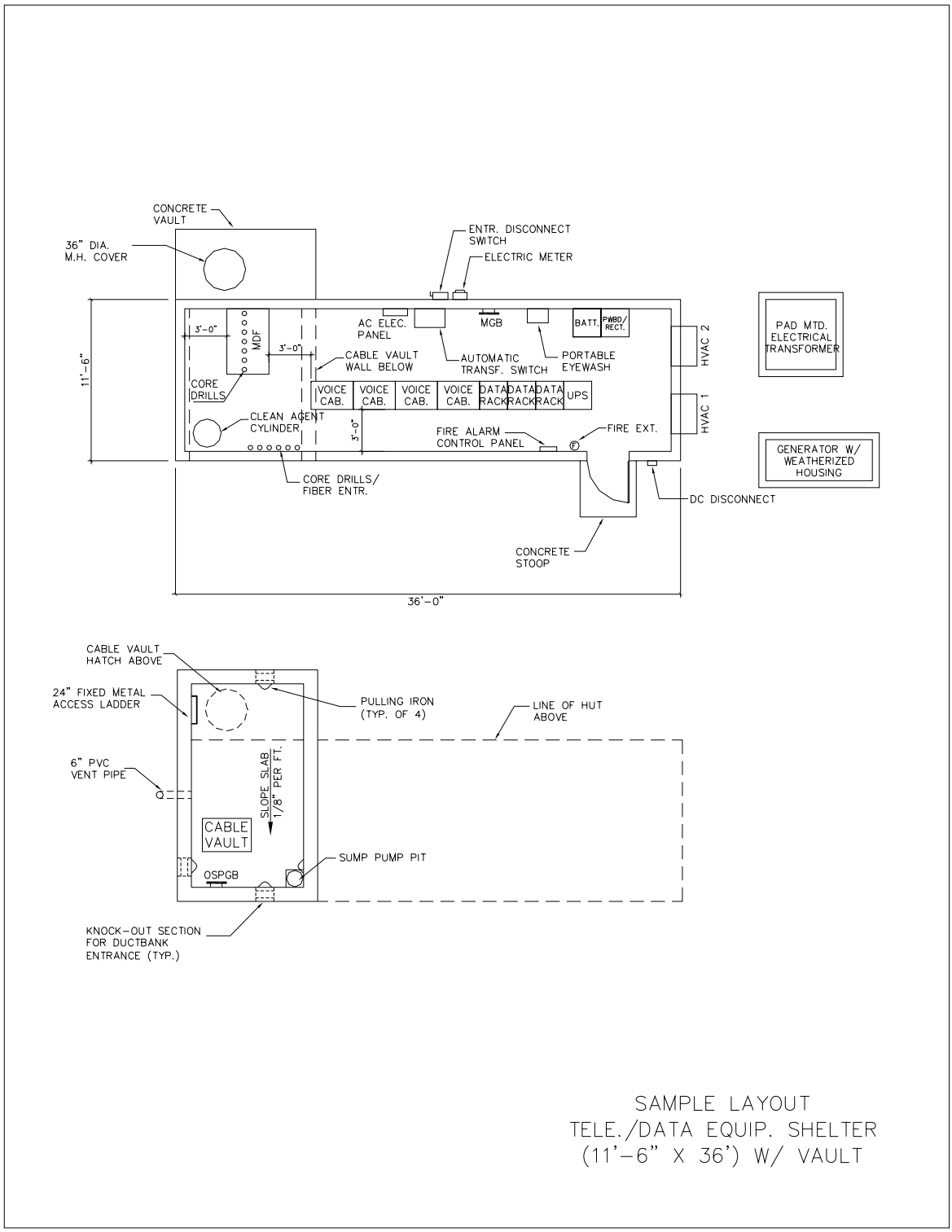

Figure B-2. Medium Shelter

The Large Shelter size is 23’ x 36’ as shown in Figure B-3.

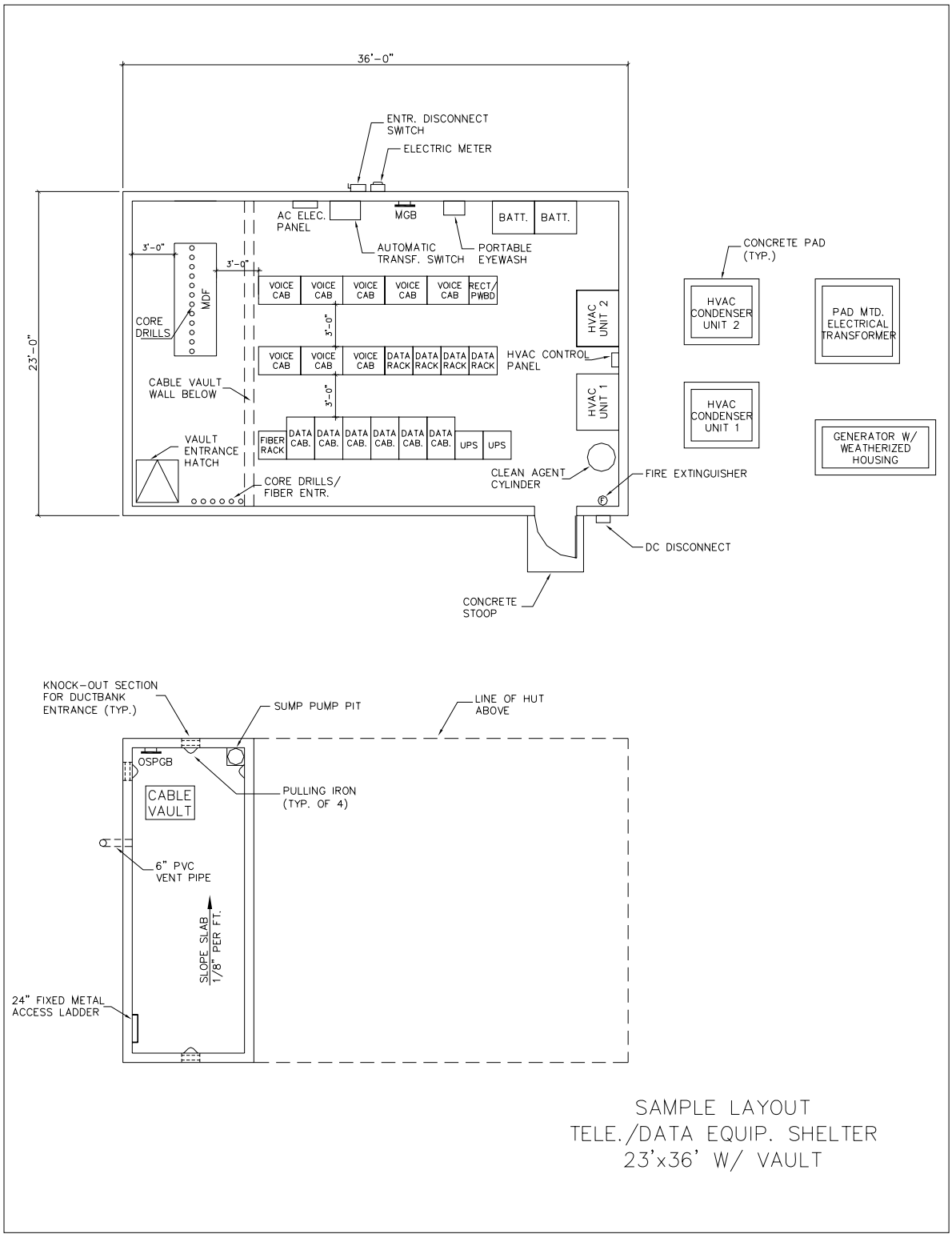

Figure B-3. Large Shelter

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APPENDIX C. STANDARD FENCE DRAWING

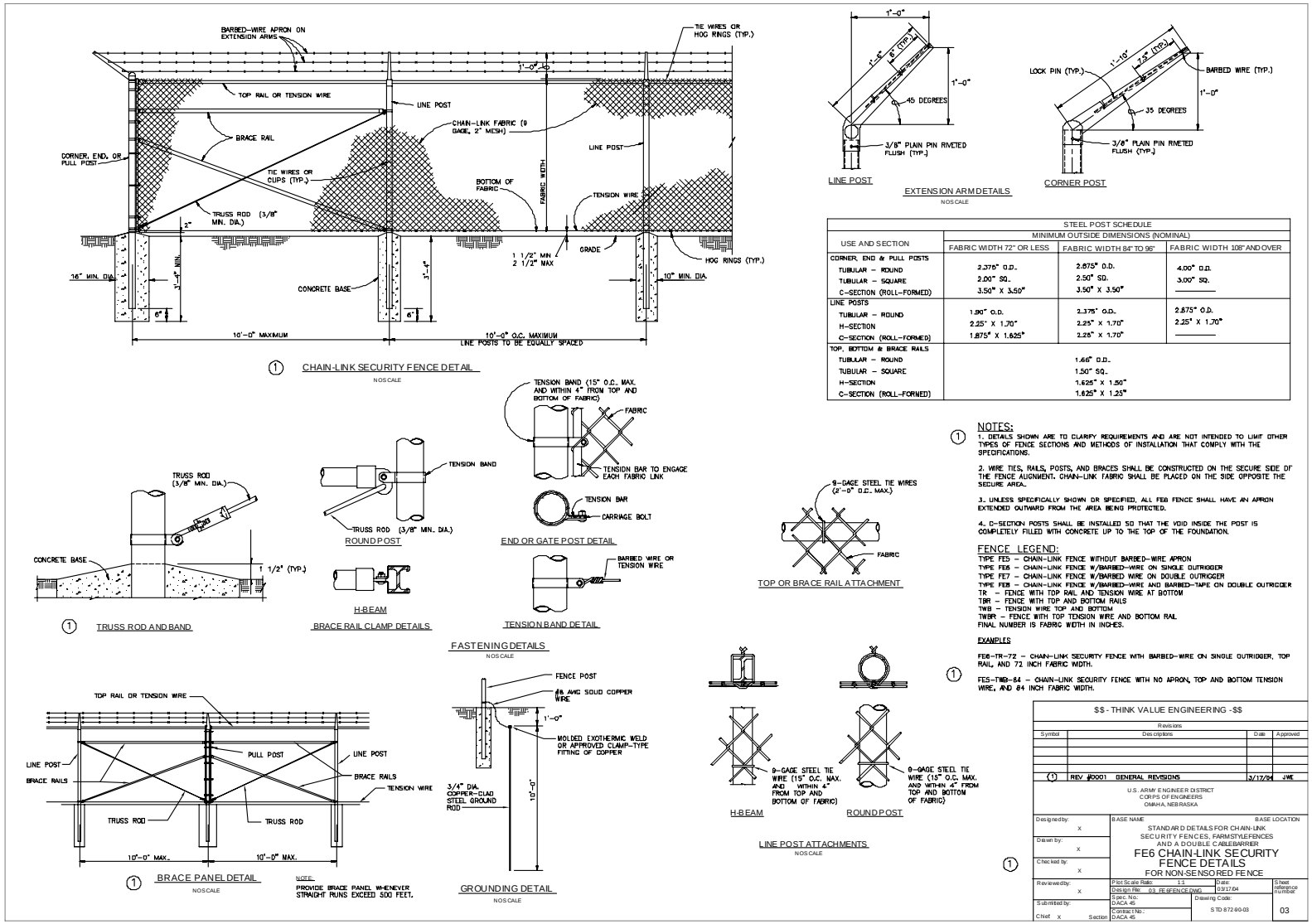

Figure C-1. Standard Fence Drawing

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GLOSSARY. ACRONYMS AND ABBREVIATIONS

A	Ampere
AC	alternating current
ADN	Area Distribution Node
AR	Army Regulation
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AWG	American Wire Gauge
C2	Command and Control
CJCSI	Chairman, Joint Chiefs of Staff Instruction
CO2	carbon dioxide
DC	direct current
DCO	Dial Central Office
DOD	Department of Defense
DOIM	Directorate of Information Management
DPW	Directorate of Public Works
EDP	Engineering Design Plan
EES	earth electrode subsystem
EO	end office
EOC	Emergency Operations Center
EUB	end user building
F	Fahrenheit
FDED	Fort Detrick Engineering Directorate
FP	fault protection
HQDA	Headquarters, Department of the Army
HVAC	heating, ventilation, and air conditioning
I3A	Installation Information Infrastructure Architecture
I3MP	Installation Information Infrastructure Modernization Program
IAW	in accordance with
IDS	intrusion detection system
IEEE	Institute of Electrical and Electronics Engineers
IMOD	Infrastructure Modernization
IT	information technology
kcmil	thousand circular mils
LP	liquid propane
MCN	Main Communications Node
MDF	main distribution frame
MIL-HDBK	Military Handbook

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MIL-STD	Military Standard
MPH	miles per hour
NEC	National Electrical Code
NFPA	National Fire Protection Association
N-G	Neutral-to-Ground
OSP	Outside Plant
OSPDPR	Outside Plant Design and Performance Requirements
OSPGB	OSP ground bar
PBWS	Performance-based Work Statement
PBX	Private Branch Exchange
POC	point of contact
rh	relative humidity
RSU	Remote Switching Unit
SOR	Statement of Requirements
SR	signal reference
TIC	Technology Integration Center
TR	telecommunications room
TSU	thermal sensing unit
UCR	Unified Capabilities Requirements
UFC	Unified Facilities Criteria
UL	Underwriters' Laboratories
UPS	uninterruptible power supply
USAISEC	U.S. Army Information Systems Engineering Command
v	volt
VDC	volts direct current
VRLA	valve-regulated lead-acid