



**NATIONAL GUARD BUREAU  
3501 FETCHET AVENUE  
JOINT BASE ANDREWS MD 20762-5157**

16 Aug 2024

MEMORANDUM FOR DISTRIBUTION

FROM: NGB/A4

SUBJECT: Air National Guard Engineering Technical Letter (ANGETL) 24-01-05: Electrical and Communications Engineering

REFERENCES: See Attachment 1, References

**1. SYNOPSIS:**

1.1. This ANGETL provides guidance in implementing the electrical design policy.

1.2. **APPLICABILITY:** Mandatory requirements are defined in specific paragraphs and in referenced publications.

1.3. **EFFECTIVE DATE:** This document is effective as of the date of signature.

1.4. **INTENDED USERS:** Base Civil Engineers (BCE), base level and commercial electricians and linemen, and architect-engineering consultants (A-E).

1.5. This ANGETL shall be applicable for all new designs, designs for which NGB/A4I formal approval of the Type A-2 Concept Development Submittal has not yet been issued and for all code and criteria review. Application of this ANGETL for projects that have obtained formal approval of the Type A-2 Submittal shall be on a case-by-case basis and as directed by the NGB/A4I Project Manager.

**2. GENERAL**

2.1. The electrical systems including lighting, interior and exterior power distribution, and telecommunication systems shall follow the guidelines set in Unified Facilities Criteria (UFC) Series 3-500: Electrical and referenced criteria.

2.2. Deviation from the minimum criteria, where a valid need exists and where an alternate solution involving equivalent concept and sound engineering is available, may be considered. Any deviation from minimum criteria must have written approval from NGB/A4I.

2.3. Should approval be granted, it shall apply only to the specific request under consideration and not to cases with similar circumstances.

### 3. FUNDING

3.1. For all projects, non-real property installed equipment such as electrical equipment (e.g., uninterruptible power supplies [UPS]) will not be funded with project funds in accordance with DAFI 32-9005, “Real Property Accountability”.

3.2. For Sustainment, Restoration, and Modernization (SRM) projects, communication cable & installation (e.g., telephone, data, PA, CCTV, fiber optics, etc.) shall be funded through NGB A2/6. During the programming of SRM projects, the BCE shall notify base communications and the regional Cyber Systems Integrator, base level (CSI-B) to secure these Communications funds so they are available at construction award.

### 4. ELECTRICAL

#### 4.1. POWER SYSTEMS

4.1.1. Building power distribution, grounding, and service entrance metering shall meet UFC 3-520-01, “Interior Electrical Systems” and AFMAN 32-1065 “Grounding & Electrical Systems”. The 400Hz distribution and direct current systems (28VDC) shall meet UFC 3-555-01, “Aircraft Point-of-Use Power Systems”. Exterior electrical distribution and building service transformers shall meet UFC 3-550-01, “Exterior Electrical Power Distribution”.

#### 4.2. FACILITY METERING

4.2.1. IAW EO 14057 “Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability” and Department of the Air Force (DAF), “Electrification of Installations, Standard Building Operations, Flightlines, and Non-Tactical Vehicles (NTV),” 12 February 2024, Air National Guard “Implementation of the Department of Defense Electrification of Installations, Standard Building Operations, Flightlines, and Non-Tactical Vehicles (NTV)” 1 May 2024, UFC 1-200-02, “High Performance and Sustainable Building Requirements”, and DAFMAN 32-1061, “Providing Utilities to Department of the Air Force Installations” all facilities shall have AMRS compliant smart meters installed. This requirement is for all energized facilities and buildings with an estimated electrical requirement in excess of 2,000 KWH per year. Cost effectiveness should not be considered as an argument against installing meters. A copy of the ANG Electrification Memo is provided as attachment 5.

4.2.2. All facilities meeting the above criteria shall be metered by 30 September 2028. This date will establish a firm baseline load dataset and provide critical information to accurately electrify all facilities by the 2045 deadline.

4.2.3. Smart meters shall be installed at the Point of Demarcation (PoD) on the facility. See 4.6, Points of Demarcation for details. If the appropriate PoD does not exist, it must be installed in addition to the smart meter to meet compliance.

4.2.4. Smart meters are considered Operational Technology (OT) and require connectivity to be considered fully functional. Meters shall meet the requirements as set forth in DAFMAN

32-1032, the Air Force Meter Data Management Plan (MDMP) April 2022, and AFPAM 32-10144, “Implementing Utilities at U.S. Air Force Installations”. Conflicts between documents are to be resolved by publication date, with the most recent publication taking priority. A copy of the MDMP is provided as Attachment 4.

4.2.5. All OT systems require an Authority to Operate (ATO) and will require coordination with unit Cybersecurity/Comm Squadron in order to be fully stood up. The system does not need to be a live session and shall be built with potential extended downtime while being able to record data. Modern smart meters are capable of holding multiple years’ worth of data between sessions. This feature is critical in ensuring proper reporting, trend analysis, and early indicators of maintenance issues.

4.2.6. For wired OT, all wiring, such as CAT 5e or CAT6, shall be violet/purple clad to differentiate it from other forms of connectivity such as NIPR and SIPR. OT cables shall be labeled at connection point in the facility comm room with their appropriate designation (ex. Elec. for electrical, WTR for water etc.).

### **4.3. BACKUP POWER CONNECTION POINTS, TESTING, AND UNIT BACKUP POWER SUPPLIES**

4.3.1. All facilities which are not authorized a Real Property Installed Equipment (RPIE) for a fixed auto start generator IAW AFMAN 32-1062, “Electrical Systems, Power Plants and Generators” 14 Feb 2024 may be provided with a backup power connection point IAW 1.9.12 of the same AFMAN with approval of the BCE. The connection point shall include a receptacle compatible with the system used at the installation, grounding, and manual transfer switch (MTS) and be collocated in the electrical room of that facility. The MTS in these locations shall be open transition (break-before-make) to limit potential damage to microgrids currently installed or expected to be installed on critical facilities and provide full neutral disconnect. A connection point is not a guarantee of generator support during an outage, but rather a contingency factor to allow for maximum flexibility during an outage event at the discretion of Installation Command.

4.3.2. All facilities with a connection point shall be tested annually alongside standard generator tests IAW AFMAN 32-1062. Test shall be done during normal business hours to ensure that loads can be met, and connections have not deteriorated. Tests must occur for at least 1 continuous hour. Alternate power sources that are compatible with the generator connection point, such as portable battery banks, may be used to reduce carbon generation reduction requirements IAW EO14057, so long as it does not conflict with any of the other power requirements of that facility. Non-generator backup power sources shall generate a true sine wave to eliminate the possibility of damage to systems within the building.

4.3.3. Facility managers with unit-owned equipment 25KW or less IAW DAFMAN 32-1084, “Facility Requirements Standards” 14 Feb 2024 shall maintain appropriate training with the local CE squadron to be permitted use of the connection point. The local CE at its discretion may substitute the unit owned equipment in annual testing. The facility manager of such a facility is required to work with and comply with the requirements of the local CE to ensure

proper testing procedures. Equipment-level backup power must also meet the requirements as stated in 4.4.2.

4.3.4. Power Conditioning and UPS. Where required due to the sensitive nature of connected equipment (e.g., mainframe computer systems), special conditioning and UPS systems shall be installed. The users shall fund both the installation and maintenance of the UPS. Designers shall coordinate with the users for infrastructure requirements. Refer to UFC 3-580-01, “Telecommunications Interior Infrastructure Planning and Design” & DAFMAN 32-1062.

#### **4.4. ELECTRICAL SERVICES LOCATING**

4.4.1. The placement of all exterior facility and site electrical service items (e.g., lighting systems and supports) shall be architecturally coordinated. Transformers and switch gear shall be located at appropriately accessible locations but as unobtrusively as possible for maintenance. Placement shall not rely on landscaping for concealment.

4.4.2. Design for and require contractor to coordinate placement of all electrical equipment and components with other trades.

4.4.3. Install a raised concrete pad, minimum 3-1/2” high, for all floor mounted electrical equipment.

4.4.4. Provide provisions for photovoltaics panels for all buildings. Refer to ANGETL 15-01-01, “Sustainable Design, Development, and Resource Conservation” or if available, it’s revision.

#### **4.5. POINTS OF DEMARCATION (PoDs)**

4.5.1. In order to divide labor more effectively in the rapidly changing environment, the following are established points of demarcation for electrical systems. The points of demarcation are intended to migrate as systems are updated to a final location of PoD 1, so proper coordination is critical during construction projects. This is intended as a primer for installations that are non-privatized; Installations that are privatized are exempt from this policy but are recommended to adopt this policy to standardize these points across the Air National Guard.

4.5.2. PoD 1, Current Transformer Cabinet: This is the standard point of demarcation for all facilities on installations. The CT cabinet itself and everything downstream are considered part of the associated facility. The conductors entering the cabinet belong to the Utility Provider for installations that are privatized. Meters and shadow meters are to be installed at this location.

4.5.3. PoD 2, Nearest Transformer: This is a typical current situation on installations. The conductors between the Main Distribution Panel or Power Distribution Panel and the low side of the facility transformer or junction box are part of that facility. This is not ideal, as most electricians are not trained as linemen and coordination for any full-building shutoffs or repairs are significant burdens to all parties. Hard-wired systems also present a hazard to Firefighters,

who must disconnect the facility at the transformer or enter the facility and shut off power at the Main Distribution Panel.

4.5.4. PoD 3, Exterior Facility Shutoff: (Rare) This is a facility shutoff that is between the nearest transformer and the Main Distribution Panel within the building. It does not have the capability of adding metering as required in section 4.2.

4.5.5. All other PoDs (such as 5 feet from the building) are not recognized as valid. Any PoD shall be moved outward only to one of the three established PoDs, with the low side of the transformer (PoD 2) being the farthest point out for both government owned and privatized installations.

4.5.6. All facility projects shall conform to PoD 1 standards excepting life-safety devices such as fire suppression systems. Life safety devices will generally have PoD 2 as the standard.

4.5.7. Installations that intend to privatize shall apply these standards to the Privatization Contract, with PoD 1 being the standard result of modernization and PoD 2 or PoD 3 in cases of life-safety devices.

#### **4.6. LIGHTING SYSTEMS**

4.6.1. Exterior, interior, and emergency lighting and control systems shall meet UFC 3-530-01, "Interior and Exterior Lighting Systems".

4.6.2. To the greatest extent possible, standardize all lighting systems and devices in each facility with base wide systems. Standardization shall include manufacturer, type of lamp used, and color of devices and style of fixtures. For new facilities, coordinate with the BCE as to what standard lighting systems have been provided for other newly constructed facilities.

4.6.3. Provide motion sensor lighting systems in restrooms, locker rooms and other areas where energy savings are possible without causing safety concerns. Use of motion sensor lighting in mechanical, electrical, telephone room or other similar area where maintenance personnel may be working is prohibited. Comply with UFC 3-530-01 for all other scenarios.

4.6.4. Zone building lighting systems that have areas that are typically not used during non-unit training assembly such that they can be isolated and turned off.

4.6.5. Site lighting shall have a dedicated utility infrastructure and not fed from facility circuits where a base site lighting circuit is available. If a base site lighting circuit is not available, the site lighting circuit shall be sub-metered in accordance with section 4.2.

4.6.6. Apron lighting shall be controlled from a minimum of two locations (security forces/command post and flight line operations). Lighting intensity levels for loading and parking areas shall be in accordance with UFC 3-535-01, "Visual Air Navigation Facilities".

4.6.7. In major renovation, new construction of parking lots, roadways and other facilities requiring exterior lighting, use high efficiency lighting/LED where economically feasible.

4.6.8. Facility exterior mechanical, electrical and communications courtyards shall have exterior lighting provided.

#### **4.7. ENERGY EFFICIENCY, CONSERVATION, AND ELECTRIFICATION**

4.7.1. Energy efficiency shall be a part of all projects. Refer to UFC 1-200-02 High Performance and Sustainable Building Requirements, ANGETL 15-01-01, EO14057, DAF Memorandum 12 Feb 2024, & Air National Guard Electrification Memo 1 May 2024.

4.7.2. Due to Electrification requirements, particularly in Climate Zones 5-7, facilities shall disregard any right sizing electrical requirements until proper baseline data can be obtained on these facilities.

4.7.3. Only three installations in the ANG, Duluth, Eielson, and Elmendorf are in climate zones 7 (Very Cold) or 8 (Subarctic) where exceptions for electrification may be considered based on geographic location. All other installations are required to Electrify IAW Electrification Standards.

#### **4.8. ELECTRIC VEHICLE SUPPORT EQUIPMENT (EVSE)**

4.8.1. EVSEs, or Electric Vehicle Charging Stations (EVCFs) are both terms used for facilities installed for the purposes of charging electric vehicles. For the remainder of this ETL, EVSE will be used to maintain consistency.

4.8.2. IAW EO 14057 and DAF Memorandum 12 Feb 2024 Electrifying all Installations, Flightlines, and Non-Tactical Vehicles, EVSEs shall be installed at all installations.

4.8.3. EVSEs have their own Category Code (CATCODE), which are denoted by their charging level.

4.8.3.1. L1 – 120V up to 20A, CATCODE 812-410

4.8.3.2. L2 – 208/230V, up to 80A, CATCODE 812-420

4.8.3.3. L3 – DC Fast Charging, CATCODE 812-430

4.8.4. ANG facilities are not authorized any L3 EVSEs but may submit a waiver to A4I with documentation showing a tactical need for such a facility and why an L2 station with 80A capabilities will not suffice. A waiver shall consist of a memorandum signed by the installation commander and annotating with verifiable citations and appropriate mathematical analysis as to why L2 will not be sufficient, a Simplified Analysis of Alternatives (SAoA) that includes a cost analysis of current situation, additional vehicles to supplement the fleet and L3 charging as options, along with a Master Plan on how to limit the use of L3 systems as a primary source of charging. Early studies of L3 systems show shortened lifespans of vehicles with estimates between 15% and 30%, and primary use will significantly increase the cost to the government as well as reduce tactical effectiveness as vehicles prematurely fail.

4.8.5. EVSEs shall be installed as their own facility and draw power from the nearest transformer. EVSE facilities shall not draw power from a main distribution panel or subpanel located within a facility. Facilities will follow all real property procedures as directed by the local Real Property Office. The charging stations themselves are equipment not real property, only the infrastructure leading up to the pillar are considered part of the facility.

4.8.6. Power sourcing for the EVSEs must be placed at a minimum of 7.62 meters (25 feet) and a maximum of 15.25 meters (50 feet) to the nearest EVSE station and be clearly visible from all EVSE locations. Each EVSE site shall contain at a minimum a CT Cabinet from the appropriate transformer with a minimum capacity of 2 CT Meters, a Main Distribution Panel with independent and full service shut offs, and appropriate safety features as stated in the NFPA 70, National Electric Code. Enclosures shall meet the outdoor requirements for the region as stated by the National Electrical Manufacturer's Association (NEMA) or Underwriters Laboratories (UL).

4.8.7. A minimum of 50% of all EVSEs by KW shall be placed in a publicly accessible location for non-tactical vehicles on base. These EVSE location shall not be reserved for any particular vehicle or position and must be located adjacent to the nearest road or intersection farthest away from the nearest building. Shared parking lots between buildings shall locate EVSEs reasonably spaced between all buildings and no space shall be reserved for one building over another. Utilization of existing parking is required for all EVSE locations. New parking is not authorized.

4.8.8. All EVSE sites must be sized at a minimum of 51KW, or three 80A charging pillars at 208V (L2 sized). Sites that cannot contain this capacity due to limited parking space must be serviced for 51KW and the additional infrastructure not installed. For example, if a squadron requires two pillars or four parking spaces for EVSEs or 34KW, a 51KW service shall be installed regardless, and two of the three branch circuits shall be run to the appropriate locations.

4.8.9. The following locations are authorized dedicated EVSEs for mission purposes:

4.8.9.1. Fire Stations sufficient to maintain full mission capability.

4.8.9.2. Logistics and Readiness Squadron Vehicle Maintenance Shops, with a capacity of 51KW or 5% of the installation fleet battery size in KW, whichever is greater.

4.8.9.3. Flight Line services located inside the restricted area, with 51KW or 50% of the flight line fleet battery size, in KW, whichever is greater. EVSEs placed in this location must also be located outside Foreign Object Debris/Damage (FOD).

4.8.9.4. Security Forces Squadrons, with 51KW or 20% of the SFS fleet vehicle capacity, in KW, whichever is greater.

4.8.10. EVSE sites must be consolidated when in close proximity to one another to reduce de facto ownership of EVSE services, with a minimum distance between sites of 200m (656 feet), centered on the EVSE facility entrance/main distribution panel for the site.

4.8.11. Installations are authorized up to 100 KW of EVSE with backup power connection points. These connections must be centrally located on the installation and freely accessible by all authorized personnel IAW section 4.8.7 of this ETL. Additional charging equipment, such as solar powered EVSEs and battery backups are considered equipment and not subject to these standards, however the purchasing unit is responsible for the upkeep, maintenance, and disposal of the equipment and must obtain a permit from the CE office for permanent (>90 days) placement in a designated location. Equipment will follow the same rules as laid out for permanent EVSE stations and shall not be reserved for a particular vehicle or position.

4.8.12. Signage for EVSEs must be prominently displayed at all stations and clearly visible from both the parking location and the nearest road. Signage will also indicate that vehicles must be moved upon completion of charging to a standard parking space. The local installations are responsible for maintaining charging and loitering policies, and corrective actions.

4.8.13. While installations are required to install infrastructure as stated above, the installation may at its discretion choose Government Owned, Government Operated (GOGO) or Government Owned, Contractor Operated (GOCO) options for handling utility costs associated with EVSEs. Each installation is also responsible for internally handling its POV charging at these locations. Initially, a blanket denial of POV use is recommended and a roadmap toward hybrid use as electrification moves toward the dominant form of energy is applied. Any policy permitting POV use must follow policies directing these procedures. All POV charging must be at a no-cost basis to the government. An installation that chooses a Contractor Owned, Contractor Operated (COCO) model for installation of EVSEs must follow the Utility Privatization protocols as set forth in AFPAM 32-10144 and FAR, Part 41.

#### **4.9. CATHODIC PROTECTION**

4.9.1. Provide cathodic protection wherever underground metallic structures (tanks and associated piping) will be used. Cathodic protection surveys and design shall be in accordance with the UFC 3-570-06, "Operation And Maintenance: Cathodic Protection Systems".

4.9.2. The preferred method of cathodic protection is sacrificial anode. Anodes do not require an impressed current/active electrical to maintain efficacy and replacement anodes need to be changed out infrequently, ranging from 10 to 25 years. Sacrificial anodes shall be annotated on local installation electrical maps and a copy provided to the real property office.

#### **4.10. LIGHTNING PROTECTION**

4.10.1. Lightning protection shall meet UFC 3-575-01, "Lightning and Static Electricity Protection Systems".

4.10.2. Design shall be based on AFMAN 32-1065. Lightning protection shall be provided for all buildings with a risk assessment of moderate or high as outlined in Appendix I of National Fire Protection Association (NFPA) 780, and for the following types of facilities: munitions facilities, weapons storage vaults, alert aircraft hangars, fuel cell and corrosion control hangars, refueler vehicle maintenance facilities, intelligence facilities, and remotely piloted aircraft



facilities. Additionally, munitions facilities shall have a ground loop around each building of the complex and the lightning protection down conductors shall be connected to the ground loop. Provide inspection in accordance with UFC 3-575-01, Lightning and Static Electricity Protection Systems.

#### **4.11. HAZARDOUS ZONES**

4.11.1. Hazardous zones are identified and classified in the National Electric Code (NEC, NFPA 70). Most of the areas encountered in ANG facilities are as identified below.

4.11.2. Where possible, mount equipment and wiring to avoid hazardous locations and use standard devices and wiring. Identify the classification and limits of each hazardous zone on the drawings.

Table 1 – Hazardous Zone Classifications

HAZARDOUS ZONE CLASSIFICATION				
LOCATION	CLASSIFICATION			NOTES
	NON-HAZARDOUS	CLASS I DIVISION I	CLASS I DIVISION II	
Battery Room	X			2
Bladder Maintenance Room	X			3,9
Blue Foam Storage Room (C130)			X	9
Carpenter Shop	X			9,11
Composite Materials Repair (Fiberglass)	X			9,11
Drop Tank Maintenance Room	X			3,9
Flammable Liquids Storage Room			X	14
Fuel Hydrant Pits		X		
Hangar - Maintenance, Alert and Load Crew		Floor Pits	X	4,5,13
Hangar - Weapons Calibration		Floor Pits	X	4,5,13
Hangar - Fuel Cell Maintenance		Floor Pits	X	4,5,6,13,19
Hazardous Storage Building			X	10
Hush House			X	4,5
Hydrazine Facility (Service)		X		9
Hydrazine Facility (Storage)			X	9
LOX Maintenance Shop	X			
LOX Storage Facility			X	7
Packing and Crating	X			9,11
Paint Spray Room		X		12
POL Lab			Below 48" AFF	3,9,16
POL Pump house - POL System		X		8,9
Refueler Vehicle Maintenance Bay		Floor Pits	X	1,3,6,15
Refueler Vehicle Parking Structure			X	1
Solvent Rooms (within 5 feet of tank)			X	NEC Art 516
Vehicle/Automotive Maintenance		Floor Pits	Below 18" AFF	17
Welding Area(s)	X			9

### Table 1 Notes

1. Classification area shall be from below height of overhead door, or below 5 feet above refueler vehicle, whichever is highest. The entire area within 5 feet (all directions) of the parked refueler vehicle and up to 3 feet above finish floor, shall be classified as Class I, Division II. Areas beyond 5 feet (all directions) of the parked refueler vehicle and above 3 feet from finish floor are not part of the Class I, Division II classification area. Wherever possible, do not locate electrical distribution or utilization equipment in zones classified as hazardous.
2. Interconnect charger with room exhaust fan. (Provide explosion proof fan with non- spark blades. Ventilate vertically to the extent possible. Exhaust duct shall be welded, drip-proof stainless steel. Exhaust duct shall be under negative pressure to the maximum extent possible (draw-through rather than blow-through)).
3. All electrical equipment, outlets, conduit and wiring shall be located within 24-inches of walls and a minimum of 48-inches above finish floor.
4. Classification area shall be in accordance with NEC Article 513 – Aircraft Hangars.
5. Locate all electrical elements within the Hangar bay zone within 24-inches of walls and above 48-inches above finish floor. Electrical receptacles shall not be provided in hangar bays unless required for equipment in support of the aircraft. Justification for mounting locations outside of this parameter shall be only when no other cost effective or feasible location can be identified. Wherever possible, do not locate electrical distribution or utilization equipment in zones classified as hazardous.
6. Trench drain exhaust fan shall be manually operated. Interconnect with the base energy management control system (EMCS). (Provide explosion proof fan with non-spark blades. Ventilate vertically to the extent possible. Exhaust duct shall be welded, drip- proof stainless steel. Exhaust duct shall be under negative pressure to the maximum extent possible (draw-through rather than blow-through)).
7. Classification area shall be up to 8 feet above grade.
8. Areas classified in accordance with current Air Force standards or American Petroleum Institute (API) requirements, whichever are more stringent.
9. Provide segregated area with exhaust system at laboratory hood. (Provide explosion proof fan with non-spark blades. Ventilate vertically to the extent possible. Exhaust duct shall be welded drip-proof stainless steel. Exhaust duct shall be under negative pressure to the maximum extent possible (draw-through rather than blow-through)).

10. Locate facility separately (detached) from main facility.
11. Provide dust tight fixtures.
12. Do not provide interior doors leading into hangar bay.
13. Reference NEC Article 513 – Aircraft Hangars. All adjacent and communicating areas not suitably cut off from the hangar bay and within 25 feet of travel distance from the hangar bay, shall be classified as Class I, Division II up to a level of 18-inches above the hangar bay floor. Wherever possible, do not locate electrical distribution or utilization equipment in zones classified as hazardous.
14. Flammable liquids shall be stored inside the building in approved containers or in grounded metal cabinets, up to the maximum amount identified in NFPA 30.
15. Do not provide doors leading to adjacent interior spaces. Provide exit doors (minimum 2) leading directly to the outside.
16. The entire area within 5 feet (all directions) of the laboratory exhaust hood shall be classified as Class I, Division 1.
17. To the greatest extent possible, locate all electrical elements above the hazardous classification zone.
18. Exhaust Barrier Pit from floor Level. Exhaust fan motor outside of air stream and use non-sparking blade.
19. Wall-mounted outlets shall be Class I, Division 1 or 2 (Zone 1 or 2). To ensure no unclassified tools or equipment are taken into the classified area around the aircraft, wall-mounted outlets are required to be classified, even though they are outside the classified area. Wall-mounted switches that are outside the classified area do not need to be Class I, Division 1 or 2; they do not affect tools or equipment brought into the area in accordance with Technical Order 1.1.3 Inspection and Repair of Aircraft Integral Tank and Fuel Cells.

## **5. SPECIAL SYSTEMS AND COMMUNICATIONS**

### **5.1. GENERAL**

5.1.1. These systems shall include telephone/intercom, computer/data, public address (PA), closed circuit television (CCTV), fire suppression/alarm, security, etc. Verify all requirements with Base Communications Officer, Visual Information Manager, Base Fire Chief, and Security Officer, as appropriate, through the Base Civil Engineer.

5.1.2. Telecommunications cabling systems are installed using a total network concept, supporting a multi-product, multi-vendor environment. The common thread among all installed equipment is performance specifications and interoperability. All components of the telecommunications system such as cabling, patch panels, patch panel cables, connectors, modular jacks, etc., shall be rated with the same level of performance specifications. The minimum grade of cable and termination hardware to be used within buildings is Category 6 (Cat 6) unshielded twisted pair (UTP). The user will provide additional performance specifications, if required. optical fiber may be used when supported mission dictates and or as deemed financially feasible. When optical fiber is used within the horizontal system, a 50/125 $\mu$ m OM3 (or better) two strand cable will be used and installed in accordance with referenced standards.

5.1.3. All telecommunications work shall be tested according to the standards in Attachment 1. Test results shall be provided to the BCE, Communications Flight, and Contracting Officer in electronic format prior to system acceptance. The test results must represent that the system is in complete working order.

### **5.2. EXTERIOR SYSTEMS**

5.2.1. Main Communications Distribution System. For all communications distribution systems a minimum duct size of 4 inches shall be used. When new construction demands an addition to the main ducting distribution system, the contractor shall provide a complete exterior raceway system comprised of six, 4 inches minimum diameter conduits, as well as hand holes, manholes, associated communication cables, splices, and terminations, from the selected information transfer node to the main telecommunications room in the building. It is required that the main telecommunications room for the facility be located in the building footprint as indicated elsewhere in this section.

5.2.2. Lateral Communications Distribution System. For new construction, provide a minimum of three, 4-inch conduit system and avoid direct burial. This is normal end building node (EBN). Provide at least one, 4-inch duct between co-located or composite facility construction. For buildings deemed as information transfer nodes (ITN) a minimum quantity of six, 4-inch ducts, shall be installed, if construction allows for a separate physical path, an additional quantity of six, 4-inch ducts, shall be either stubbed out or connected to the manhole duct system. See Attachment 2

5.2.3. All horizontal copper cabling will be tested per UFC 3-580-01. All outside plant telephone cable will be tested per United States Department of Agriculture Rural Utilities Service Bulletin 1753F-201(PC-4) upon installation.

5.2.4. Hand holes shall be a minimum of 48"Wx72"Lx48"H. In locations where large splices or heavy cable convergence exists, larger manholes will be required. Communication Duct System provided between manholes should not exceed 500ft and will not exceed 600ft.

### 5.3. INTERIOR SYSTEMS

5.3.1. Contractors shall be required to provide a complete cable system for all security, all communication systems, and all fire alarm systems, except as identified below.

5.3.2. Contractors shall provide a complete pathway system of open tray sized in accordance with Electronic Industries Alliance/Telecommunications Industry Association (TIA-569- E) and stub a minimum 1-inch conduit from each outlet box to within 1 ft. of the pathway system.

5.3.3. Outlet boxes shall be no smaller than 4-inches wide, 4-inches high and 2.5-inches deep. This box will accommodate one or two (1-inch) size conduits.

5.3.4. Where a larger conduit is required, the box size shall be increased accordingly.

5.3.5. Raceway systems shall be separate and dedicated, one each, for fire and security and PA systems but may be combined for telephone, CCTV, fiber optic, DDC/EMCS, etc. stubbing raceways only into ceiling space is not an acceptable practice. Approved conduit may be run to area serving telecom room or cable tray.

5.3.6. Cable trays of the centrally hung, two side loading type shall be utilized in all facility systems, except for fire and security systems. Cable tray design and layout shall allow cable tray system to only be located over corridors.

5.3.7. Fire detection and alarm systems as well as all security systems, may not be mixed with other communications systems nor routed in facility cable tray systems. Fire detection and alarm system wiring shall be installed in separate dedicated metal raceway (conduit) complete from device to fire and control panel (FACP). Security system wiring shall be installed in separate dedicated metal raceway (rigid conduit).

5.3.8. Raceway Identification. Communication system type (e.g., telephone, PA, CCTV, data, fiber optics, intrusion detection system (IDS), etc.) shall be clearly identified on the raceway by frequent color-coding and labels. Identification shall be at 10 foot maximum spacing and at every change in direction and wall penetration. Coordinate identification with the BCE. Each system shall be clearly identified with engraved plastic or metal labels fastened to each device, junction box, pull box, terminal, and panel. Coordinate identification systems with the posted operations instructions and operations & maintenance (O&M) manuals and TIA-606-D.

5.3.9. Government shall provide all communications instrumentation and equipment unless otherwise indicated. IDS and fire detection systems shall be turn-key by the contractor.

#### 5.4. VOICE/DATA/IMAGERY SYSTEMS

5.4.1. Provide all of the following features at the main telecommunication room. Refer to TIA-569-E series, "Telecommunications Pathways and Spaces" and UFC 3-580-1, "Telecommunications Building Cabling Systems Planning and Design" for complete construction criteria. Consideration should be given to having a minimum 10 ft high ceiling. Minimum quantity four, 4-inch sleeves are recommended. Provide heating, ventilation, and air conditioning (HVAC) that will maintain a temperature and humidity level in accordance with Telecommunications Industry Association (TIA), Building Industry Consulting Services International (BICSI), and ANGETL 15-01-04, "Mechanical Engineering" for equipment rooms.

5.4.2. A dedicated ground wire (MILSTD-188) from building signal ground to Telecommunications Ground Bus Bar (TGBB) at plywood back board shall be provided. Telecommunications rooms (TR) shall be controlled via lock and key or cipher lock. Walls should be lined with AC grade or better, void-free plywood, 8 ft high with a minimum thickness of  $\frac{3}{4}$  in. Cover with two coats of fire-retardant white paint (if fire rated plywood is used, do not cover the rating stamps). The plywood should be installed with the grade "C" surface facing the wall with bottom at 6-inches above finished floor (AFF).

5.4.3. There must be at least one TR or equipment room (ER) per floor unless pre-approved for small buildings.

5.4.4. Work area cabling and termination is critical to a well-managed distribution system. Provide a minimum of two telecommunications outlet arrays with four, modular type jacks (four RJ-45) per office, conference room, or training area; on opposing walls. Higher density may be considered via Building Industry Consulting Service International/Telecommunications Distribution Methods Manual (BICSI/TDMM) guidelines if the environment is deemed to be a cubical farm area. When the mission dictates it, there shall be 2-strand multimode 50/125um OM3 or better fiber cable terminated using LC-type connectors at each jack location. In addition, in large admin areas where the length of walls between corners exceeds 15 ft. provide additional outlets so that the maximum separation between outlets does not exceed 10 ft. Each four pair cable shall be terminated in an eight-position modular jack. The eight-position jack pin/pair assignment shall be T568A (according to National Communication System (NCS), FTR 1090-1997) in new construction and re-wire projects, however the authority having jurisdiction may grant a waiver if the majority of the facility is wired T568B. Specify, identify, and label all cables, jacks and patch panels, including all spare conductors in accordance with TIA-606-D. See Attachment 3.

5.4.5. When concrete slab floors are used, install under-floor ducts, multi-channel raceway, trench-duct systems, or floor-to-ceiling columns in large areas (such as conference and training rooms, amphitheaters, or any other large rooms) to support connectivity. Establish an outlet density of two outlets per every 100 square feet of work area. Extend ducts or raceways into any adjoining audio/visual support rooms. If the design allows, a cellular floor should be considered.

Pathways in ground floor slab shall be considered wet locations in accordance with TIA and NEC standards, and cables used in them shall be rated for such environment.

5.4.6. External raceway or wire molding shall not be used without the permission of the Base Communication Officer. No exposed wires shall be permitted in any work area under any circumstances. If external raceway is the only practical means that a system can be deployed and is approved, it shall be sized accordingly and wrap the walls as to not detract from the esthetics of the room.

5.4.7. Provide copper backbone cable with minimum 30% spare pairs for system installation from main telephone terminal board (exterior/copper distribution) to telephone closets. Provide fiber backbone cable per referenced standards.

## **5.5. COMPUTER CABLE SYSTEM.**

5.5.1. Data cable shall be a minimum of CAT 6 UTP cable. Fiber cable should be considered if deemed financially feasible. When fiber is used it shall be 50/125 $\mu$ m OM3 or better multimode. All CAT 6 cable and connecting hardware shall have transmission parameters characterized to a minimum of 250 MHz and meet TIA-568-.0-E-1. Performance testing will meet these standards.

5.5.2. CAT 6 cables shall be fully terminated in patch panels. All racks shall meet referenced standards and be provided finished in black or gray powder coat. Racks shall be securely bolted to the floor.

5.5.3. High pair count (greater than 4-pair) copper riser cable for voice grade services shall have a minimum rating of Category 3 (CAT 3).

5.5.4. PA System. Provide associated transformers, power supplies, interface equipment, system cabling, speakers, speaker grills and volume controls. Transformer impedance shall match that of the amplifier. PA amplifier and microphone shall be Government provided. Wiring (18-gauge S-R Insulated) shall be specified as tinned copper, S-R PVC insulated, conductors cabled with aluminum-polyester shield and 20 AWG stranded tinned copper drain wire (trade number 9418).

5.5.5. Closed Circuit Television/Community Access Television (CCTV/CATV). Contractor shall provide all taps, splitter and amplifiers as required as part of complete cable system and rebalance any existing system that is affected. Horizontal Cable shall be minimum RG 6 2200 MHz quad shield for use up to 250 ft. unless video over internet protocol (IP) is deployed.

5.5.6. RF Distribution over Category Cable. If facility will utilize an RF Broadband Video Distribution System that distributes CATV/HDTV, satellite, internally generated video, video on demand (VOD) services, and IP video over twisted pair/Category cable, contractor shall provide telecommunications outlets as prescribed in 7.4.3.



5.5.7. Fire Suppression/Alarm System: Refer to UFC 3-600-01, "Fire Protection for Facilities" and ANGETL 24-01-03, "Fire Protection Design Guidance".

## 5.6. SECURITY SYSTEMS:

5.6.1. Refer to ANGETL 24-01-02, "SCIF & AT Guidance".

5.6.2. Intrusion Detection Security System (IDS) and information security. The provided design shall be in accordance with DoD 5200.1-R, "Information Security Program" and shall include all security program requirements. Comply with ICD-705, Sensitive Compartmented Information Facilities when applicable.

5.6.3. System Equipment. The contractor shall provide a complete (turnkey) IDS system including instrumentation and equipment. System equipment shall not be Joint-Services Interior Intrusion Detection System equipment (J-SIIDS) but shall be equipment that is commercially available and locally maintained that meets or exceeds J-SIIDS requirements.

5.6.4. System Layout. Locate the IDS control panel (and all IDS control switches) in the alarmed area, and the annunciator panel at the security forces 24-hour duty station. Secondary alarm capability may be provided to alarm at the command post. Provide an authorized entry phone at the entry to the alarmed area. The first level of IDS shall be infrared motion detection. The second level, if required (I.E. small arms storage, Category I & II munitions), shall be door/window contacts and vibration sensors on all walls and ceiling (and floor, if not reinforced concrete floor located at grade). Provide a duress button in small arms vaults and munitions storage facilities, which alarm at the security forces 24-hour duty station and at the base command post.

5.6.5. Raceway system shall be minimum 3/4 in. rigid conduit, continuous, complete, and separate from all other systems.

5.6.6. Cable system shall include cable from control panel to telephone closet.

## **5.7. INFORMATION TRANSFER NODES (ITNS)**

5.7.1. ITNs shall be designed as large Telecommunications Equipment Rooms. Refer to and comply with ANGH 32-1084 Section 4.3 for details.

## **5.8. TELECOMMUNICATIONS ROOM (TR)**

5.8.1. All ANG facilities shall have dedicated telecommunications room(s). Refer to UFC 3-580-1 for basic TR requirements.

5.8.2. All Entrance Facility TR's must be located within 50 ft. of outside plant cable building entrance.

## **5.9. POINT OF CONTACT**

5.9.1. The point of contact for this ANGETL is CETB Electrical Engineer, NGB/A4IC at (701) 857-4398, DSN 344-4398, [MinotANG-NGB.A4IC.Workflow@us.af.mil](mailto:MinotANG-NGB.A4IC.Workflow@us.af.mil)

CHAD R. CALLAN, GS-15, DAF, P.E.  
Associate Director, Engineering  
National Guard Bureau

### Attachments:

1. Reference Documents
2. Lateral Communications Distribution System
3. Typical Premise Wire Diagram
4. AF Meter Data Management Plan
5. ANG Electrification Memo
6. Current ANGETL Index

### Distribution:

ANG BCEs  
NGB USPFOS