FORT BENNING NETWORK ENTERPRISE CENTER

Inside/Outside Plant Infrastructure Installation Requirements

March 2026

Initial Tactics, Techniques, and Procedures (TTP)

2.1

Distribution: This TTP is intended for unrestricted dissemination and supersedes any previous versions.

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CHANGE LOG

This record shall be maintained throughout the life of the document. Each published update shall be recorded. Revisions are a complete re-issue of the entire document. A revision shall be made whenever the cumulative changes reach ten percent (10%) of this document's content.

CHANGE / REVISION / RECORD				
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INTRODUCTION

This document provides the additional requirements for the planning, design, and implementation of the Outside and Inside Plant Cabling local to the Fort Benning NEC ICAN. This document only covers Unclassified cabling installations. This is a living document and will be periodically reviewed, updated, and made available to users as part of the NEC responsibility for providing technical criteria for Fort Benning construction. All Outside Plant Cabling and Inside Plant Cabling will follow the Unified Facilities Criteria (UFC 3-580-01, 2024) regulations. The NEC Inside/Outside Plant Infrastructure Installation Requirements TTP will enhance the UFC standards to fit the Fort Benning NEC mission. Any standards not found, described or are incorrect in the UFC or NEC TTP should be brought to the attention of the NEC government POC. Any deviation from the standards must be approved the NEC government POC. If the NEC TTP conflicts with UFC, then this shall be brought to the NEC for necessary action moving forward.

NEC POC: James Woodworth 706-545-4811 or james.m.woodworth.civ@army.mil.

**** Items in RED are items of high importance****

FORT BENNING NEC VOICE AND DATA NETWORK

OUTSIDE PLANT REQUIREMENTS IN ACCORDANCE WITH UFC STANDARDS

PART I Fort Benning requirements in addition to UFC for OSP

1. LOCATING EXISTING UNDERGROUND UTILITIES

Locating, marking and protecting existing underground utilities shall be the responsibility of the Contractor performing the work, and shall be done at the Contractor's expense. Prior to the initiation of any digging, excavation, and or other activity that could possible impact utilities associated with the contract effort, the Contractor shall utilize the procedures outlined herein to have all utilities in the work area located and marked.

Procedures and responsibilities of Contractor performing the work when ***requesting a utility locate***:

Contractor shall call the Georgia One Call-Utilities Protection Center (UPC) at 1- 800-282-7411 and **request A LOCATE**. The UPC handles locate requests for off Post utilities to include electric, gas water and wastewater utilities. The UPC will issue a locate ticket number to the Contractor with the legal date to dig, ticket expiration date and date to renew if work not complete.

Locate call requires at least 72 hours advance notice. The Contractor's responsibility is to locate and to protect utilities from damage resulting from activity associated with the contract effort and is a continuing responsibility throughout the period of performance. The Contractor is responsible for initiating and maintaining an active utility locate ticket (dig permit) throughout the end of digging operations during any period of performance to include renewal of ticket with UPC. According to Georgia One-Call H.B. No. 1290 Section 1 25-9-3, the "tolerance zone" means the width of the utility facility plus 24 inches on either side of the outside edge of the utility facility on a horizontal plane. The Contractor is responsible for potholing, prior to digging, to physically locate underground utility.

The Contractor shall notify the Government immediately of damages to existing utilities caused by his or his subcontractor's employees. After the Government inspects all damages, the Contractor shall take immediate action to repair such damages at the Contractor's expense and in a manner that will result in minimal impact of utility users, with the quality of repair being subject to approval by the owner of the utility or utilities damaged. If the Contractor fails or refuses to repair the damages promptly, the Contracting Officer may have the necessary work performed and charge costs to the Contractor.

Only the Contracting Officer is authorized to relieve the Contractor from its responsibility to have utilities located and marked. NEC after duty, weekend and holiday contact number: **706-545-2178.**

2. NEC MAINTENANCE HOLES/HAND HOLES

The Fort Benning standard Maintenance Hole shall be of sizes **(new installs only)**:

- 6x12x7 Maintenance Hole reinforced concrete pre-cast 38Y
  - Splayed
  - "T" Type
- See Appendix B

The Fort Benning standard Hand Hole shall be of size **(new installs only)**:

- 4x6x4 Hand Hole reinforced concrete pre-cast
  - Splayed
  - "T" Type
- See Appendix C
- **Hand holes shall only be used in pathways where duct-banks do not exceed six conduits (not more than three in and three out).**

Pour in place MH/HH shall not be used unless approved by NEC.

All MH or Hand Holes shall include the following:

- **All HH or MH shall be installed with lockable covers, and the NEC shall receive the unlocking key or tool at end of project.**
- 30" Frame and Cover rated with H-20 load rating. 36" outside all nodes.
- Complete communication racking package including stand-offs, wall racks, steps and corner brackets.
- Quantity 1- 15" pre-cast collar or (grade ring). 1-10" ring and cover
- Collar must be centered with top of maintenance hole/hand hole and secured in place in such a manner that the collar cannot move during back filling and final grade restorations.
- Quantity 2- ¾"X10' copper ground rod in opposite corners. The bottom section of pre-cast maintenance hole/hand hole shall be core drilled and ground rod driven into the earth with a maximum of 4" + or – ½"of ground rod being exposed above floor level. After ground rod is placed, the floor shall be sealed with waterproof sealer around ground rod. A number 6 solid ground shall be bonded to existing bonding ribbon in pre-cast hole. Follow UFC 3-580-01 (Nov. 2024) standards for maintenance hole bonding procedures.

- Maintenance holes/hand holes shall be placed level and shall have a minimum of 24” cover over top of maintenance hole/hand hole.
- A minimum of 6” of number 57 crushed stone shall be placed in the bottom of the excavation before bottom half of maintenance hole is placed.
- Maintenance holes/hand holes shall be equipped with sump pump hole with cover
- Maintenance holes/hand holes shall be equipped with cable pulling eyes.
- Maintenance holes being installed shall be orientated with the T-portion of the maintenance hole pointing away from the DCO.
- **The use of Quazite reinforced concrete hand holes are not to be used unless it has been approved by the U.S. Government before installation.**
- A Fort Benning NEC representative will be on site before placing maintenance holes/hand holes. It is the contractor’s responsibility to notify the QA/QC with ample time to inspect the excavation before the maintenance holes/hand holes is installed.

POCs:

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3. MAINTENANCE HOLES/HAND HOLES NUMBERING

Maintenance hole/Hand hole numbers will be issued by the NEC. Contractors will meet with the NEC representatives accompanied with a set of prints for numbers to be issued. All newly installed maintenance holes/hand holes will be stenciled with a maintenance holes/hand holes number that will be provided by Ft. Benning, NEC. Stencil shall be 3” black lettering on white background.

4. LOCKING COVERS (ref UFC 3-580-01, Nov. 2024)

All maintenance holes/hand holes that contain Hut to Hut communication cable or to Command and Control buildings shall have locking covers installed. Contractor shall contact the NEC for specifications and installation before ordering or installing.

5. CONDUIT INSTALLATION (ref UFC 3-580-01, Nov. 2024)

In main duct runs a minimum of 6, 4” PVC conduits shall be placed between maintenance holes. A minimum of 2, 4” PVC conduits shall be placed from maintenance hole/hand hole to EUB’s.

Copper and Fiber OSP cabling shall be installed in separate conduits.

All OSP FOC installs shall include MAXCELL

If no MAXCELL is preexisting, all are MAXCELL cells are full or last cell is being used, a minimum of 1, 3 cell MAXCELL must be installed.

Examples of conduit types include the following:

- *DB-120* – for direct burial or encasement in concrete
- *Rigid Nonmetallic Conduit PVC Schedule 40* – for direct burial or encasement in concrete.
- *Rigid Metallic Conduit* – for direct burial or encasement in concrete conduit.
- *High Density Polyethylene (HDPE) 4" ID*– for directional drilling.
- Conduit systems not encased in concrete will be installed in layers with backfill installed around and between the ducts. Construction vehicles will not be driven over DB conduits.
- Ensure the integrity of the orientation of the duct bank between maintenance holes. Do not allow the ducts to twist or tangle between maintenance holes.

6. DUCTS TO BE INSTALLED IN TRENCHES

The type of duct for new installation will be PVC, Schedule DB, or Schedule 40. Schedule DB or Schedule 40 duct will be used for applications where the duct is DB or encased in concrete.

Ducts will be joined in such a manner as to be soil tight. Joints will form a sufficiently smooth interior surface between joining sections so that cables will not be damaged when pulled past the joint. Joints between dissimilar types of ducts (PVC, HDPE, galvanized steel pipe (GSP), EB, DB, etc.) will use the appropriate connectors designed for the purpose of providing a seal between the ducts and preventing damage to cables pulled through these joints.

7. BENDS AND SWEEPS IN TRENCHES (ref UFC 3-580-01, Nov. 2024)

Accomplished changes in direction of runs exceeding a total of 10 degrees, either vertically or horizontally, by long sweeping bends having a minimum radius of 7.62 m (25ft.). Long sweeps may be made up of one or more curved or straight sections and/or combinations thereof. Bends made manually will not reduce the internal diameter of the conduit. There will be no more than the equivalent of two 90 degree bends (180) degrees total) between pull points, including offsets and kicks with a curvature radius of less than 30 m (100 ft.). Back-to-back 90 degree bends will be avoided.

Where the radius is less than 12m (40ft.), 4.6m (15ft.) radius-manufactured bends must be used. If possible, the entire change in direction should be made with a single arc of 4.6-m (15ft.) radius. Manufactured bends may be used on subsidiary/lateral conduits at the riser pole or building entrance. Manufactured bends will have a minimum radius of 10 times the internal diameter of the conduit in accordance with NEC Chapter 9 and ANSI/TIA/SIA-758.

Bends and sweeps will be concrete-encased to protect the duct from the pressures developed while pulling cables. Where a duct enters a building and sweeps up through a floor slab or foundation wall galvanized RSC will be used. For ducts transitioning from the lower duct window of a maintenance hole to the nominal trench depth, the transition will be accomplished in no less than 9.1 m (30 linear ft.) from the maintenance hole in order to reduce the radius of the bends. The duct shall be concrete encased in the transition area.

8. SECTION LENGTHS AND FORMATIONS (ref UFC 3-580-01, Nov. 2024)

The section length of conduit will not exceed 183 m (600 ft.) between pulling points in main conduit runs without U.S. Government approval. The section length of subsidiary duct is limited mainly by the size of the cable to be pulled into it and the number of bends it will contain.

Ducts between the cable vault and the first maintenance holes will be based upon the size of the switch, the number of outside cable pairs served from the switch location, the fiber optic requirements, and future growth.

A main duct run includes the Maintenance holes and ducts from a DCO or node and provides the pathways for large feeder cables and/or core FOCs. New main duct runs will consist of a minimum of 6-way, 4-in duct banks. One of the ducts will contain a minimum of two runs of three-way MAXCELL inner duct.

A lateral duct run is defined as a minor branch run from the main duct run between maintenance hole/hand hole. New lateral duct runs will be a minimum of four-way, 4-in duct banks. One of the ducts will contain a minimum of two runs of three- way maxcell inner duct.

Entrance ducts are defined as ducts from the maintenance hole/hand hole to a EUB. New EUB entrance ducts shall be a minimum of three way, 4-inch duct banks. One duct shall be equipped with a minimum of one run of three-way maxcell inner duct. Installation of maxcell is dependent on duct

bank configuration. If duct is stacked maxcell will be placed in the top duct closest to the wall of the maintenance hole/hand hole.

Depth of Cover – At least 600 mm (24 in) of cover is required above the top of the duct bank. At least 457 mm (18 in) of cover is required under roads or sidewalks (if duct is concrete-encased). For ducts installed in solid rock, the cover will consist of at least 150 mm (6 in) of concrete. If rock is encountered below grade, the minimum cover above the concrete-encased duct will be 300 mm (12 in).

Trench Width – The contractor will engineer the trench width to the minimum width required to support the size of the duct bank being installed. For installing ducts, the trench width depends on the number of ducts, size of ducts, arrangement of ducts, and space around ducts (at least 50 mm [2 in]). Additional width may be required to work in deep trenches or with large count duct banks. Shoring of walls or sloping will be performed as required by the Occupational Safety and Health Administration (OSHA) and/or local requirements. The trench width for DB conduit will be wide enough to permit tamping of dirt on the sides of the conduit formation.

Concrete Encasement – The duct system will be concrete-encased in all main cantonment areas. **At a minimum, the duct system will be concrete encased under all traffic areas, where any bend/sweep exceeds 10 degrees in any direction and in any stream/drainage area subject to washing out.** Concrete-encased duct, galvanized RSC, or pipe casings will also be placed under all paved road surfaces and certain heavy traffic non-surfaced roads as documented in the site-specific SOR/EDP. The encasement/pipe will be extended a minimum of 1.8-m (6-ft) beyond the roadbed for all road crossings. Spacers will properly support concrete-encased ducts. Spacers will be installed every five feet. The duct will not be damaged, cracked, or crushed prior to or during installation. The contractor will use only one brand of Portland cement that conforms to ASTM C 150. The concrete will be a wet type mix and placed in such a manner as to ensure the concrete completely surrounds all ducts and that no air or voids are trapped in the mix. Concrete used to encase conduits will be a minimum 20,700 kPa (3,000 PSI) compressive strength. Duct systems to be concrete-encased shall be tied down to minimize, if not eliminate the duct system from moving during the placement of concrete. All sections of conduit systems to be concrete-encased shall be tied down every 10 ft.

Duct Placement – New ducts will be swept down and installed in the lowest available duct positions within the lowest available duct window in the maintenance hole/hand hole. Ducts placed under this project will not

prevent placement of future ducts in the upper duct positions. Ducts transitioning from the lower duct window of a maintenance hole/hand hole to the nominal trench depth, the transition shall be accomplished in no less than 30 linear ft. from the MH in order to reduce the radius of the bends. The ducts shall be concrete encased in the transition area.

Reinforcement of Existing Ducts – New ducts installed to reinforce an existing duct bank will be placed above the existing duct bank if the minimum top cover of 600 mm (24 in) can be maintained. If there is not sufficient top cover available, the new duct will be placed beside the existing duct bank.

Pull String/Rope/Tape – Once ducts have been mandrel tested to verify their integrity, a pull string, pull rope, or pull tape rated at not less than 890-newton (N) (200-lb) tensile strength will be installed in each new conduit and inner duct/sub duct. A minimum of 1.5 m (5 ft.) will be provided at each end of the conduit. The string/rope/tape will be coiled and secured at each end in such a manner as to prevent it from being accidentally pulled back into the duct.

Plugs – All ducts, sub ducts, and, inner ducts, whether main or subsidiary runs, will be plugged using universal screw type duct plugs in maintenance holes, hand holes and building entrances. Foam sealant is not acceptable in a building.

Duct Seals – The area between the entrance conduits and the penetrated floors and/or walls of a building or maintenance hole will be sealed to be waterproof or fire-stopped as appropriate. Use of hydraulic cement between the duct and wall is acceptable for waterproofing the duct entry point.

9. WARNING TAPE (ref UFC 3-580-01, Nov. 2024)

The materials in the warning tape will be chemically inert and will not degrade when exposed to acids, alkalis and other destructive substances found in soil.

Warning tape will be placed approximately 12 to 18 inches above new conduit installs to warn excavating crews of conduit below.

10. CONDUIT ROAD CROSSINGS (ref UFC 3-580-01, Nov. 2024)

For road crossings not using the cut and restore method, RSC or steel pipe casings will be used as specified in the site-specific SOW. The RSC and steel casings will be placed under the highway in a manner that does not damage the conduit or casing.

11. DIRECTIONAL BORING (ref UFC 3-580-01, Nov. 2024)

The contractor will provide a method of locating and tracking the drill head during the pilot bore and will ensure the proposed installation is installed as intended. All facilities will be installed in such a way that their location can be readily determined by electronic designation after installation. For non- conductive installations, this will be accomplished by attaching a continuous conductive material externally, internally, or integrally with the product. A copper wire line or a coated conductive tape may be used for this conductive material.

An HDD conduit will be placed with soil tight joints. Joints between dissimilar types of ducts (PVC, HDPE, GSP, DB, etc.) will use the appropriate connectors to provide a seal between the ducts and to prevent damage to cables pulled through these joints.

11.1 Crossing of and Parallel Running of Conduit

All conduit or piping that runs horizontal to or crosses Fort Benning NEC OSP conduit or direct buried cabling, will need a minimum of 8 to 10 inches separation.

All conduit or piping that runs vertical to or alongside Fort Benning NEC OSP conduit or direct buried cabling, will need a minimum of 12 to 16 inches separation.

12. RODDING of DUCT (ref UFC 3-580-01, Nov. 2024)

Fort Benning representative will be on site during mandrel testing. It is the Project manager's responsibility to notify the NEC before work begins.

Rodding a duct entail inserting or pushing a rod into the duct to:

• Determine the length of the duct

• Locate the other end of the duct

• Determine if the duct is usable or blocked

• Insert a pull string in the duct

• Mandrelling a duct consists of pulling a test mandrel or slug through the duct to ensure that the duct diameter is intact and ready for the installation of cables. Mandrelling can also be used to clean any mud, sand, or dirt out of the duct.

The mandrel's diameter, 13-mm (1/2-in) less than the duct's inside diameter, depends on the type and size of the ducts. New ducts in main and subsidiary duct runs will be mandrelled with a test mandrel (**non-flexible**) or slug that is approximately 300 mm (12 in) in length and 13 mm (1/2 in) less than the duct inside diameter. The test mandrel will be used to verify the integrity of the duct joints, to test for out-of-round duct, and to verify that sweeps are not so severe as to preclude the placement of large diameter cables. A 150-mm (6-in) length test mandrel may be used to test duct runs to buildings or riser poles. The mandrel test will be conducted in both directions. Flexible mandrels, wire

brushes, rubber duct swabs, leather washer duct cleaners, etc., may be used to clean the ducts.

13.1. USE OF INNERDUCT/FABRIC MESH (ref UFC 3-580-01, Nov. 2024)

For underground installation, each FOC shall be installed in fabric mesh (Maxcell) a minimum 3x1. Fiber optic cable shall not be installed directly in a 4-inch (100-mm) duct.

13.2. PULLING TENSION

When pulling cable into ducts, inner ducts, or sub-ducts, the manufacturer's specified pulling tension shall not be exceeded. A lubricant shall be used in the amount specified by the lubricant manufacturer. The lubricant shall be a pourable, water-based, slow-drying fluid that shall not stress-crack the low-density PE and shall not damage the cable jackets.

13.3. FOC SLACK

The installed length of a FOC shall include additional amounts of cable for slack. This slack shall be distributed throughout the cable run to provide extra cable for cut repairs, path relocations, splice loops, maintenance, etc.

Slack in an underground system shall be secured in loops, typically with plastic cable ties and placed so as to be out of harm's way and still be accessible.

The minimum amount of slack will be calculated as follows:

50 feet of slack will be coiled up in every other manhole along the fiber cable path pull.

13.4.CABLE ID/TAGGING (ref UFC 3-580-01, Nov. 2024)

Cable ID/Cable tags shall be installed at all termination points (terminals) and splices, including house cables. In MHs, all new and existing cables that are part of the project shall be tagged/retagged between the splice and the wall and on both sides of a splice loop or maintenance loop. When a cable is re-homed to a new node, DCO, x-connect box, etc.; all existing cable tags and terminal labels on the re-homed cable shall be re-tagged and re- labeled to reflect the new information. One tag is required for a copper cable pull-through, and two tags are required for a FOC pull-through. Labels in MHs and HHs shall be machined produced on a durable material suitable for the environment.

Handwritten labels are not acceptable. Contractors will meet with the NEC to receive proper cable identification and type of cable tags to be used.

Examples of Cable Tags:

CABLE NO.	**FOC 4488D**	**96 SM 1800-24**
SOURCE	**BLDG 4488**	**CA-4488-1**
DESTINATION	**BLDG 5510**	**1-1800**

FIBER COUNT 25-48

14. OSP CABLE INSTALLATION (ref UFC 3-580-01, Nov. 2024)

Cables shall be placed in such a manner as to avoid kinks and other sheath deformities. Cables shall be rated IAW the NEC for the environment that they will be installed in. When considering the use of indoor/outdoor rated cable the economics of the design shall be factored into the decision. It is the contractors' responsibility to perform reel tests on all cable before installation to verify the quality of the cable and to determine no damage occurred during shipping.

All NEC OSP Copper and Fiber Optic Cable shall be grounded using 4462-FN Series bonds.

All OSP FOC installed will be of OSP rated cable and will be armored.

All OSP FOC installs shall include MAXCELL if none are preexisting, all MAXCELL cells are full or last cell is being used.

15. SPLICING OSP CABLE (ref UFC 3-580-01, Nov. 2024)

15.1. OSP COPPER SPLICING (ref UFC 3-580-01, Nov. 2024)

Cable shall be spliced into one continuous length. All copper splices shall be of the fold-back type to facilitate future work in the splice. Completed splices shall meet similar performance and mechanical specifications of a single cable of the same overall length.

Self-piercing electrical filled connectors shall be used when splicing plastic-insulated conductors. The installer shall place and install connectors using a tool specifically designed to place those connectors. **3M 710 modules shall be used.** These same modules shall be used throughout the project and shall be consistent with previously installed connectors to preclude a requirement for a variety of installation tools. **B-wire connectors shall not be used**. Binder group integrity shall be maintained. Only 3M 710 modules shall be used when capping cable pairs.

Splice cases shall not be installed in such a manner that their weight is supported by the cables on the cable hooks in the maintenance hole. The preferred method for installing splice cases is to hang them from an overhead support, such as a pipe supported by the set of cable hooks above the splice case.

All underground and buried splice cases shall use re-enterable encapsulate-fillable closures and shall be filled with re-enterable encapsulate upon completion of the splice

IAW RUS Bulletin 345-72 (PE-74). Cable sheaths shall be bonded at all cable splices with bonding harnesses to assure sheath continuity.

The adding of cabling or the opening/closing to existing splice cases (Copper or Fiber) requires the case to be "Flash Tested" to ensure that it is properly sealed. The installation of any new copper or fiber splice cases will require the case to be "Flash Tested" to ensure that it is properly sealed. All "Flash Test" must follow manufactures recommended test procedures. All "Flash Test" must be validated by NEC Phone Operation technicians or Project Planners.

15.2. SPLICING OSP FIBER OPTIC CABLE (ref UFC 3-580-01, Nov. 2024)

All new OSP fiber cables shall be single mode. Fiber cable shall contain splice loops in trays IAW manufacturer's recommendations.

Splicing of FOC shall be accomplished using fusion splicing to weld the two fibers together. Fusion splices shall have insertion loss values of <0.03 dB **Mechanical splices shall NOT be used.**

16. OSP CABLE TERMINATION

16.1. COPPER CABLE ENTRANCE (ref UFC 3-580-01, Nov. 2024)

The OSP copper cable shield, armor, and metallic strength member shall be bonded to the lightning protection ground as close as possible to the building point of entrance with a No. 6 AWG or larger ground wire. All OSP copper cables shall be terminated on primary protector blocks, equipped with 5-pin solid state or gas protector modules. The protector blocks shall be bonded to the lightning protection ground with a No. 6 AWG or larger copper ground wire. Terminals and hardware shall be UL-listed, made of a flame-retardant construction, and equipped with a built-in splice chamber; 5-pin gas protector modules, locking cover, and output on 110 blocks. A copper backbone cable will be ran between the 110 block and the CAT6A patch panel. Only one single phone number or single copper phone pair shall be terminated on each of the CAT 6 patch panel ports. **All OSP Copper cabling installed will be outside rated cabling.**

16.2.CATV OUTSIDE PLANT INSTALLATION

Installation of CATV in government owned maintenance holes/hand holes has to be approved by the Regional Change Control Board, POC Patrick Latta Business Division Chief (706) 545-0388 (patrick.j.latta.civ@army.mil) and shall be racked, tagged and tie wrapped to racking system in accordance with government specifications. NEC representatives will be onsite for installation and all work performed will have to pass NEC inspection before acceptance. NEC will designate which duct will be used by CATV Organization. Duct used shall have MAXCELL inner duct placed in duct and cable pulled through the inner duct. Duct used will be sealed with foam sealant

in manholes/hand holes after installation. Duct entering communication closet shall be fire stopped IAW the NEC, local codes and the manufacturer's instructions.

16.3.CATV INSTALLATION GUIDELINES (ref UFC 3-580-01, Nov. 2024)

All OSP and ISP Drawings shall be submitted to the NEC Phone Operations department for approval. Drawings will be submitted a minimum of 7 working days prior to installation. Work will not commence without approval from the NEC.

16.4.CATV INSTALLATION INSIDE PLANT

Installation of CATV in government owned Communications Closet shall be installed to UFC 3-580-01 specifications. A backboard of sufficient size (minimum 4'x4') or larger if needed to accommodate equipment shall be installed by CATV Organization. Plywood must be either Fire Retardant or have 2 coats of fire-retardant paint (white or grey color) on the side the equipment will be mounted on. Plywood shall be painted prior to installation of any equipment. When renovating an existing closet that does not have adequate space, the backboard must be sized as large as possible to accommodate the PET and 110-type blocks. **If using fire retardant wood, the fire-retardant stamp from the manufacturer must not be painted and clearly visible.**

CATV cabling shall be terminated as far as physically possible from NEC telecommunication equipment and components.

17. FIBER OPTIC CABLE ENTRANCE (ref UFC 3-580-01, Nov. 2024)

The FOC shield, armor and metallic strength member shall be bonded to the lightning protection ground as close as possible to the building point of entrance with a No. 6 AWG or larger ground wire. All strands of FOCs, both OSP and inside plant, will be properly terminated on FOPPs. Fusion splice to factory pre-terminated pigtails with a minimum of 10 feet (3m) of slack. The OSP plant FOC will be extended IAW the NEC standards into the main data closet/location of the building and terminated there. All FOPPs will be stenciled with the panel number and the cable count.

All OSP FOC installed will be of OSP rated cable and will be armored.

All terminations shall be made using LC type connectors.

All terminations shall be made using pre-terminated pigtails.

17.1.OTHER CONSIDERATIONS

The NEC/DPW may have special depth requirements for certain areas (i.e., tank trails, ranges, etc.), which will be provided in the site-specific SOR/EDP. **Fort Benning NEC representative will perform a final inspection of all manholes/hand holes installed and will provide contractor with a punch list of all deficiencies to be corrected.**

Contractor will provide Fort Benning QA/QC team with as-built drawings for inspection at project's end.

18. OSP CABLE TESTING

18.1.OSP COPPER CABLE TEST

Testing will consist of, but will not be limited to, the following cable tests: Insulation resistance, Shorts/crosses, Grounds, Opens, Reversals, Split, Transpositions Shield, continuity, Loop resistance and TDR test (with TDR test results provided to NEC). Final acceptance (Validation) testing of copper OSP cabling will be done by a TDR/continuity test or butt set talk test on all copper pairs. **All Outside Plant Copper and Fiber Optic cabling will be tested with an NEC representative present.**

A document of these test being performed needs to be included in the end of project documentation turned over with redline drawings.

18.2.OSP FOC TESTING (ref UFC 3-580-01, Nov. 2024)

Testing will consist of Optical Time Domain Reflectometer (OTDR) measurements for one strand in each 12-strand bundle of fiber and Power Source/Power Meter tests on every strand in all cables. Each strand of fiber cable not terminated at each end will be tested with the OTDR. While using the OTDR, measure the length of the strand and look for any circuit discontinuities and/or splice points. Allowable losses per event:

- Splice= <0.3db
- Connector= <0.75db
- Attenuation=
    - Outside cable= <0.3dB/km at 1310nm and 1550nm
    - Inside cable= <1.0 dB/km at 1310nm and 1550nm

Power Source/Power Meter: This test will consist of bi-directional, dual-window (1,300/1,550 nm) **testing of every fiber strand installed**.

18.3 OSP FOC TEST DOCUMENTATION

Final test documentation is required for all FOC installs or repairs. The NEC must review the OTDR and Power Source/Power Meter test results before network equipment can be installed. The documentation provided must be legible and in a format that the NEC can open (i.e. WORD, PDF, etc.). The test results will be part of the closeout documentation that is turned over to the NEC at the end of the project. OSP FOC OTDR and Power Source/Power Meter test results should at minimum contain the following information.

- Summary Page (See example Figure A-1)
    - Cable ID
        - Strand Number ID
    - PASS or FAIL
    - Standard being used
    - Length
    - Headroom
    - Time/Date
- Detailed Test Results Page (See example Figure A-2)
    - Cable ID
        - Strand Number ID
    - Time/Date
    - Cable Type
    - PASS or FAIL
    - Standards Being Used

19. BACKBOARD INSTALLATION (ref UFC 3-580-01, Nov. 2024)

A minimum of two walls shall be covered with rigidly fixed 3/4 in (20 mm) A-C plywood, preferably void free, 8 ft. (2440 mm) high, capable of supporting attached equipment. Plywood must be either Fire Retardant or have 2 coats of fire-retardant paint (white or grey color) on the side the equipment will be mounted on. Plywood shall be painted prior to installation of any equipment. When renovating an existing closet that does not have adequate space, the backboard must be sized as large as possible to accommodate the PET and 110-type blocks. **If using fire retardant wood, the fire-retardant stamp from the manufacturer must not be painted and clearly visible.**

(Example backboards Figure A-3 and A-4)

20. Final Redline Drawings

Throughout the installation process, the contractor shall maintain an up-to-date redline copy of all changes made to the original project design drawings. The contractor shall, upon completion of the final subsystem acceptance test, furnish one set of the redline project design drawings to show the routing of cables, size and cable ID, placement of terminals, all splice points, maintenance hole butterflies, number and size of conduit installed, concrete encasement, bores and bore logs and all major components. The redlined project drawings shall follow the same format as the drawings provided with the SOW. If electronic drawings are provided under the SOW, the contractor shall use these files as the basis for the final submission. The redline project design drawings shall be submitted as specified in the SOW. A copy of the drawings shall be provided to the QA Department for approval. **The contractor shall use AutoCAD or a fully compatible package to create or update the project design drawings that shall be provided as specified in the SOW.**

(Example Legend shown Figure A-7 and A-8)

FORT BENNING NEC VOICE AND DATA NETWORK

INSIDE PLANT REQUIREMENTS IN ACCORDANCE WITH UFC 3-580-01 STANDARDS

PART II Fort Benning requirements in addition to UFC for ISP

1. NEW BUILDINGS (ref UFC)

All new buildings and/or structures require the placement of CAT-6 Voice and Network wiring. Blue colored cable will be used for networking (except at Camp Rudder, where Green will be used for networking) and white will be used for voice. All CAT-6 cables will be punched down on Patch Panels. A separate CAT 3 voice extension shall be installed from the PET to a patch panel to extend the voice signal to the patch panel. One voice and one data will be pulled to each location unless approved by the government prior to implementation. Example: **Classrooms and Hospital Facilities may be an exception. Orange colored RJ45 keystones will be used as the standard color for data keystones (except at Camp Rudder, where Green will be used for networking) and Ivory colored RJ45 keystones will be used as the standard color for voice keystones.** All CAT-6 cabling, jacks and patch panels shall be Systimax approved and wired to 568 B standards. If alternate vendor parts are being used, they must be Systimax compatible and be manufactured approved and provide Systimax certification and warranty. The UFC 3-580-01 standard telecommunications room dimensions are 10 ft. by 8 ft. or 1.1percent of the area it serves. Provide a minimum of one TR per floor. Note: One TR may suffice for multi-story buildings in unique instances. Refer to section on Multi-Story Buildings in the UFC 3-580-01 standards. All **telecommunications rooms shall have their own dedicate HVAC system.**

Copper and Fiber cable installation standard for new brigade, battalion, company, barracks and dining facilities (DFAC) distribution is at a minimum the following:

- **Brigade-** 50 copper; 12 strands fiber.
- **Battalion-** 50 copper; 12 strands fiber.
- **Company-** 50 copper; 12 strands fiber.
- **DFAC-** 25 copper; 12 strands fiber
- **Barracks**-25 copper; 12 strands fiber.

Copper count can be changed depending on the number of occupants or if the structure to be built is not of standard design, but the NEC will make/approve final decision. The NEC requirement is to plan for 25% growth to all facilities. In the event of a combining of two or more facilities listed above, i.e. Company and DFAC, the copper and fiber cable requirement will be a total of the minimum requirement of each facility. New construction

standard requirement will be one (1) each voice drop, NIPRNET drop, SIPRNET drop, WIDS/WAPS.

1.1 SIPRNET (Secret Internet Protocol Router Network)

The NEC Projects and Cyber POCs shall be notified in the design and implementation of any SIPRNET installation. All SIPRNET will adhere to the CNSSI No.7003 and the CNSSAM TEMPEST_1-13 - RED_BLACK Installation Guidance. NEC point of contact for this action is Robert Clark (706) 545-2062 (robert.e.clark180.civ@army.mil) and James Woodworth (706) 545-4811 (james.m.woodworth.civ@army.mil).

1.2 WIRELESS

All CAT-6 cabling to these devices will be **YELLOW** in color for easy identification. The NEC Project branch shall be notified during the design and implementation of any WIRELESS installation. NEC point of contact for this action is James Woodworth (706) 545-4811 (james.m.woodworth.civ@army.mil).

2. EXISTING BUILDINGS (not under FULL remodel)

Existing buildings currently wired with CAT-5 E wiring shall remain and any additional wiring shall also be CAT-5 E. All wiring, patch panels and jacks shall be wired to 568 B standards. Any NEW wiring must meet the CAT6A standards.

Note:

Any existing cabling that has been re-terminated or re-punched down will require a copper test (with test results) as if it were a new cable.

3. MAXIMUM CABLE LENGTHS (ref UFC 3-580-01, Nov. 2024)

Within the permanent link, the maximum cable length shall be no more the 295 feet (90m) regardless of the type of transmission media used. Within the channel, the total length shall not exceed 328 feet (100m). In addition, the total combined length of flexible cabling (i.e., equipment cord, patch cords) within the channel shall not exceed 33 feet (10m).

4. PULLING TENSIONS (ref UFC 3-580-01, Nov. 2024)

The maximum pulling tension for a 4 pair horizontal cable is 25 LBF. This is the amount of force that may be exerted on a cable before transmission performance begins to deteriorate. Excessive pulling tension may occur during installation. This can result in damage to the cable geometry, torn jackets from snagging or excessive abrasion and in severe conditions, elongation of the copper conductor may occur.

5. MAXIMUM BEND RADIUS (ref UFC 3-580-01, Nov. 2024)

Exceeding the minimum bend radius can distort the cable geometry and result in degradation of transmission performance. There are two common places where exceeding the minimum bend radius may occur:

At the work station wall outlet. After the cable is terminated, it is not acceptable to jam or wrap the remaining cabling around itself into the wall outlet. The proper procedure is to gently work the excess cable length back through the wall outlet into the wall.

At the wiring closet. During routing of the cable to the terminal block or patch panel it is not recommended to make the cable appear form fitting or tight against a routing structure (cable tray or rack) as possible. An acceptable procedure is to incorporate gently sweeping curves along with a cable path, avoiding sharp bends or changes in direction.

The maximum bend radius is 4 times the cable diameter. Never exceed a 90 degree bending radius. Any kinking or twisting as a result of former cable dressing techniques may result in irreparable damage to the cable geometry, resulting in loss of transmission performance. Every effort should be made to ensure the path the cable follows has smooth gradual sweeps at any transmission point. A cable bending radius may be exceeded when the cable is installed in conduit with a sharp bend radius.

6. IN-SLAB OR BELOW GRADE PATHWAY (ref UFC 3-580-01, Nov. 2024)

For in-slab or below grade telecommunications conduit systems, comply with NFPA 70 and provide cables listed and rated for wet locations. **All cabling in-slab or below grade must be OSP rated cable.**

7. OVER STRESSING

Eliminate cable stress caused by tension in suspended cable runs and tightly cinched cable bundles. Excessive cable loading or stress can also occur if a cable is incorrectly suspended in a cable run. If the distance between supports, such as D Rings, J-Hooks or similar functioning hardware, is too great the weight of the cable and/or in combination with any other cables in the support may create excessive stress on the cable. Recommended cable support spacing is 48” to 60” centers for up to 50 cables. For 50 or more cables, special supports are required to support and distribute the additional weight. J-Hooks cannot exceed 50% fill ratio.

Cable bundles, which are cinched excessively tight to the point of jacket deformation, can result in distortion of cable geometry. Also, large cable bundles laid in a tray or duct can exert undue stress on the bottom layers of cables. Both instances can result in a loss of optimum transmission performance. Velcro and D-Rings or J-Hooks, when used correctly, offer excellent cable management. Avoid twisting of cable during installation.

Excessive twisting may result in distortion of cable geometry, and in severe cases tears pin the jacket.

ADDITONAL INSTALLATION REQUIREMENTS:

- Velcro shall be the method of wrapping cables together. **Tie Wraps are not acceptable**.
- Minimize amount of jacket twisting
- Buy the right UTP cabling: the higher the application being run, the higher the cable's performance should be.
- Keep maximum horizontal runs to 90 meters (295 ft.)
- When terminating cable, allow no more than ½" untwisting of the conductors in a pair. Keep the twists of each pair as close to the termination on the IDC as possible.
- Do not use any splices or bridge taps in the horizontal cabling, as they are not allowed.
- Provide 1 to 3 foot service loop at each work station to allow flexibility for moves, adds or changes.
- Remember to sleeve and fire stop when going through walls, floor or ceiling spaces.
- Remember to ground shielded systems to avoid potential voltage shifts. No shared sheath applications, running multiple applications under the same jacket; such as voice and data.
- Different punch down blocks or patch panels should be used for voice and data to facilitate moves, add or changes.
- Match patch cords and connecting hardware to the category grade of cable installed and color standards.
- Patch cords are often viewed as the weakest link. Keep them as short as possible to reduce potential problems.
- D-Rings, J-Hooks, or Velcro straps all offer acceptable cable management techniques without compressing the cable.
- Avoid cable runs near heat sources. These may negatively impact cable attenuation.
- Maintain minimum spacing between cables and sources of EMI, such as florescent lights or unshielded power lines. Refer to BICSI 2-44-2.6 2-45-2.7

• All internal drops, inside wall will be in 1” metal EMT conduit (with plastic rings on ends) with pull string from each jack location to cable tray or building demark.

7.1. BUILDING INFRASTRUCTURE

Design a complete telecommunications pathway system that provides a flexible, re-usable, expandable pathway for premise distribution of telecommunications services throughout the facility. The preferred pathway system is cable tray from the TER and TRs throughout the serving areas. The required pathway methods for distribution from the cable tray to the telecommunications outlet are conduit (preferred) and non-continuous support to a conduit stub-up.

7.1.1. CABLE TRAY (ref UFC 3-580-01, Nov. 2024)

Solid bottom, slotted bottom, or welded wire cable tray shall be used to provide a centralized cable management/distribution system. Cable tray shall be used for horizontal distribution to the maximum extent possible (80 percent to 90 percent of the horizontal cable length). Cable trays shall be designed to accommodate a maximum calculated fill ratio of 50 percent to a maximum inside depth of 6 inches (150 mm). For planning purposes, the maximum pathway fill shall be 40 percent. Provide 12 inches of clearance above cable trays for future access as per TIA/EIA-569-B, paragraph 4.5.6.2. Designers shall coordinate with other disciplines to ensure clearances can be achieved. Cable ladder shall not be used in lieu of cable tray.

7.1.2. CONDUIT (ref UFC 3-580-01, Nov. 2024)

Conduit for standard outlets shall be a minimum of 1 inch (27 mm) EMT conduit. When cable tray is not used, individual conduits shall be installed from the TR to each outlet. Conduit bend radii shall be coordinated with cable bend radius. Do not use metal flex conduit for telecommunications wiring except when installing floor-access boxes in a raised floor, where floor-access box shall be relocated within a specified service area: i.e., 15-20 ft. radius typical. The designer and installer shall follow the maximum allowable fill as defined in TIA/EIA-569-B table 9. Under no circumstances shall the designer exceed a fill capacity designated in the table.

7.1.3. PULL BOXES (ref UFC 3-580-01, Nov. 2024)

Pull boxes shall be placed in conduit runs where a continuous conduit length exceeds 100 feet, or where there are more than two 90-degree bends. Pull boxes shall be placed in straight runs of conduit and not be used in lieu of a bend.

7.1.4. NON-CONTINUOUS CABLE SUPPORTS (ref UFC 3-580-01, Nov. 2024)

Provide suitable supports that provide a continuous accessible pathway for cables not supported by conduit or cable tray. Non-continuous cable supports shall not be used in place of the cable tray system. Non-continuous cable supports (J-hooks, etc.) shall be

specifically designed to support category rated cabling. Supports shall not exceed 20 cables or 50 percent of the fill capacity, whichever is less. **Spacing shall NOT exceed five feet between supports**. J-Hooks or other supporting hardware shall be placed so that the weight of the cable bundle is evenly distributed from one support to another. This can be best achieved by installing J-Hooks or other supporting equipment on as level of a plane as possible. Each J-hook containing cable shall have a Velcro strap to secure the cabling to the J-hook. Backbone and horizontal cable shall not coexist in J-hooks under any circumstances. It will be necessary to install a separate route for back bone cabling. J-hooks shall be routed to ensure proper clearance from all other utilities.

8. OPEN OFFICE WIRING

Systems Furniture Wiring

Design systems furniture wiring connections IAW TIA/EIA-569-B.

8.1. MULTI-USER TELECOMMUNICATION OUTLET ASSEMBLY (ref UFC 3-580-01, Nov. 2024)

The ANSI/TIA/EIA-568-B.1 allows MUTOAs in an open office environment. A multi-user telecommunications outlet assembly facilitates the termination of single or multiple horizontal cables in a common location within a furniture cluster or similar open area. The cables from MUTOAs to workstations in system furniture or open office are simply long work area cables supported by the systems furniture raceway. However, the distribution of work area cables from the MUTOA to the desktop shall be addressed and accounted for in the telecommunications and the furniture designs. Follow the guidance of ANSI/TIA/EIA- 568-B.1, Section 6.4.1 for MUTOA application and design. POC is James Woodworth (706) 545 4811.

8.2. CONSOLIDATION POINT (CP)

The CP is an interconnection point within the horizontal cabling using ANSI/TIA/EIA-568-B.2 or ANSI/TIA/EIA-568-B.3 compliant connecting hardware. It differs from the multi-user telecommunications outlet assembly in that it requires an additional connection for each horizontal cable run. The CP is limited to terminating a maximum of 12 users. Follow the guidance of ANSI/TIA/EIA-568-B.1, Section 6.4.2 for CP application and design.

8.3. DIRECT CONNECTION

This concept is one of a continuous home run from the TR to the furniture outlet. Testing of the installed cable plant is simplified by providing an end-to-end circuit, without an additional connection point. Follow the guidance of ANSI/TIA/EIA-569-B, Section 6.3.2 for direct connection application and design.

8.4. UNDER FLOOR CONDUITS (ref UFC 3-580-01, Nov. 2024)

Under floor conduits shall only be used if no other alternative exists for feeding systems furniture. Under floor conduits shall be designed and installed IAW TIA/EIA-569-B. Under floor outlet boxes shall contain a spare conduit for future expansion.

8.5. PROTECTION AND SEPERATION

The designer and implementer shall ensure the telecommunications cable is protected at all transition points, and that metallic separation is provided between telecommunication and power wiring in the power pole, under floor conduit, and/or systems furniture track IAW TIA/EIA-569-B and Article 800-52 of ANSI/NFPA 70.

9. TESTING REQUIREMENTS

The designer shall specify that all telecommunications cable, installed as part of a project, be tested to the commercial standards for that cable system.

9.1. UTP TESTS (ref UFC 3-580-01, Nov. 2024)

All metallic cable pairs shall be tested for proper identification (ID) and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color-coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective TCs. These tests shall be completed, and all errors corrected before any other tests are started.

9.2. CAT 6A CIRCUITS

All Cat 6A circuits shall be tested using a test set that meets the accuracy requirements of ANSI/TIA/EIA-568-B.1 and ANSI/TIA/EIA-568-B.2-1. All test requirements shall be completed as specified in ANSI/TIA/EIA-568-B.1 and ANSI/TIA/EIA-568-B.2-1.

9.3 ISP FOC/UTP TEST DOCUMENTATION

Final test documentation is required for all ISP FOC/UTP horizontal cable installs or repairs. The NEC must review the test results before network equipment can be installed. The documentation provided must be legible and in a format that the NEC can open (i.e. WORD, PDF, etc.). The test results should be part of the closeout documentation that is turned over to the NEC at the end of the project. ISP FOC/UTP horizontal cable test results should at <u>minimum</u> contain the following information.

- Summary Page (See Figure A-2, A-9 and A-10)
    - Cable ID
        - Strand Number ID
    - PASS or FAIL

    - Standard being used
    - Length
    - Headroom
    - Time/Date
- Detailed Test Results Page (See Figure A-2, A-9 and A-10)
    - Cable ID
        - Strand Number ID
    - Time/Date
    - Cable Type
    - PASS or FAIL
    - Standards Being Used

10. FIBER OPTIC CABLE (ref UFC 3-580-01, Nov. 2024)

All FOC on Fort Benning shall be terminated using LC type connectors. **UNICAM connectors will not be accepted.** Perform all required testing in accordance with ANSI/TIA-568 on the link. Test the link at both standard frequencies bidirectionally for single mode. The testing method must comply with TIA 526-7A using the single jumper method. Connectors shall be visually inspected for scratches, pits, or chips and shall be re-terminated if any of these conditions exist.

11. TELECOMMUNICATIONS ROOM

11.1 Telecommunications Room Ground. (ref UFC 3-580-01, Nov. 2024)

Bond all telecommunications spaces and infrastructure in accordance with TIA 607 where applicable. When building steel is used as a grounding (earthing) electrode, the ICT distribution designer must specify that the telecommunications busbars be installed as close as practicable to a structural steel member within the ER, TR, or EF.

11.2 Telecommunications Rack and Supporting Structure. (ref UFC 3-580-01, Nov. 2024)

All telecommunications racks and supporting structures (cable trays, ladders, conduits, and baskets) within a TR must be bonded to the TR signal ground plane, ring, or bus bar as defined in and TIA/EIA-569-B.

11.3.Cable Termination Racks (ref UFC 3-580-01, Nov. 2024)

All new installations of cable termination racks (patch panels) shall be mounted into some type of rack. This could consist of a floor mount cabinet, wall mount cabinet or two pole cabinet, but must be mounted into one of these. All racks shall have vertical and horizontal cable management panels (CMP) installed. CMPs shall be sized to accommodate the cables installed with 50% growth capability. Vertical CMPs shall support cables both front and rear. Patch cables shall be installed using the CMPs and neatly routed.

11.3-1 Lockable Equipment Cabinets (ref Appendix D)

Lockable equipment cabinets are applicable when the equipment, termination racks (patch panels), etc. are install into non-secure areas or when the telecommunication room is not a dedicated NEC telecommunication room. In these cases, due to physical security requirements in compliance with UFC-3-580-01, 2-5.8, a lockable equipment cabinet shall be required to secure all network switches and associated hardware. Each equipment cabinet requires a dedicated 120v/20amp quad receptacle mounted inside or very close to the cabinet. This receptacle shall be labeled with the panel number and circuit ID. Each cabinet requires a ground bar at the top of mounting rack bonded to the TMGB to ground network equipment. Each equipment cabinet shall be equipped with a ventilation fan to maintain airflow.

12. LABELING.

12.1.Outlet/Patch Panel Labels.

The telecommunications systems labeling must be done IAW TIA/EIA-606-A. All outlets and patch panel positions must be labeled as to their function and with a unique identifier code. All devices, outlet locations, and designations must also appear on the system drawings. As a minimum the following must be reflected in the outlet/ patch panel labeling:

1. **Security Level (if applicable)**
2. **Room Number**
3. **Alpha or Numeric Designator**
4. **Labeling must be a minimum of ¼-inch (6mm) high** (Handwritten labels must not be used for the final configuration)

12.2 Conformance to Existing Standards.

It is desirable that the labeling system conforms to any existing labeling, of the NEC Standards. Handwritten labels must not be used for the final configuration.

12.3 Telecommunications Outlet Labeling.

Outlet labeling must be done IAW TIA/EIA-606. Each outlet location must be labeled with a unique designator and level of classification, in sequence starting with “A” or “1” and proceeding clockwise around the room. The left or top 8-pin (RJ-45 type) Cat 6 or compliant connector should be designated for voice and be labeled "VOICE." The right or bottom 8-pin (RJ-45 type) Cat 6 compliant connector should be designated for data and be labeled "DATA.” All LAN components in the system must also be labeled with similar designations IAW TIA/EIA 606. For FO connections, the left or top FO connection should be labeled "A" and the right or bottom FO connection should be labeled "B."

12.3.1 Outlet Faceplates

Use a full (double gang) faceplate for standard administrative outlet locations, with connectors for all copper and, if used, FOC. Standard administrative outlets may, by specific user request, use single gang outlet faceplates in conjunction with a reducing ring. For single gang outlet boxes, use a single gang outlet faceplate with appropriate connector locations and, if required, mounting lugs for wall telephones. Outlet faceplate shall include two blank positions for future applications.

12.3.1.1 Visibility and Durability

The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure.

Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light), and should have a design life equal to or greater than that of the labeled component. Face plates shall be of thermal plastic material and have Lexan covers that lock in to place over the printed label. See Figure A-1.

12.4. Telecommunications Patch Panel Labeling

Patch panel labeling must be done IAW TIA/EIA 606. Each position must be labeled with a unique designator corresponding to the outlet location. In addition to TIA/EIA-606-A requirements, the top or left 8-pin (RJ-45 type) Cat 6 compliant port for each outlet location should be designated for voice and be labeled "VOICE." The bottom or right 8-pin (RJ-45type) Cat 6 compliant port for each outlet location should be designated for data and be labeled "DATA." Fiber optic port labeling must be done IAW TIA/EIA 606. The left or top connection should be labeled "A." The right or bottom connection should be labeled "B." Color-coding IAW TIA/EIA-606-A may be added to the labeling.

12.5. Ground Labeling Requirements

The telecommunications main ground bar shall be labeled (TMGB) along with the conductor as to its origin. All metallic components in the TR shall be bonded to the TMGB using a #6 AWG conductor. Grounding conductors shall be labeled at TMGB to stipulate the component bonded within the TR. These labels shall be machine generated and not handwritten.

13.0 CAT 6 COLOR CODING:

Jacket Color	Keystone Color
Grey--Phone	Ivory/White--Phone
White--Phone	Orange--Data
Black--OSP network cable	Yellow--Aruba Wireless

Green--CPOF/Intranet
Purple--DPW UMCS
Red--Secure NASE
Blue--Unclassified NASE
Yellow--Aruba Wireless

Red --Secure NASE

14.0. NEC Switch Installation/Removal Guidelines

14.1. Switch Installation Guidelines

Fort Benning requirements stipulate the use of ONLY Juniper Switches and Components. In conclusion this statement means that all networks that utilize the NASE (Fort Benning Network) will use the above-mentioned equipment. Point of Contact for any additional information is Jason Ketchum (706) 545-6224 (jason.ketcham2.civ@army.mil).

14.2. Switch Removal Guidelines

All Fort Benning Fire Alarm utilize the NEC network switches for notification of alarms to the Directorate of Emergency Services (DES) Emergency 911 Center (E911). If the network switch is not required for Fire Alarm functionality during any type of construction, it is the responsibility of the Project Manager (i.e. USACE, DWP, UNIT) to notify the below listed people so that the switch can be removed. This notification is required before the demolition phase of the project starts and the **NEC requires a two day lead time on this.** If the switch is required for the Fire Alarm then Project Manager must take steps to ensure the security and health of the switch from construction damage/debris.

Who to contact for switch removal:

1) Open a ticket for removal of switch through the enterprise service desk and assign to Network Ops.

2) Notifying the NEC POC through email
   a. NEC POC:
      i. James Woodworth (james.m.woodworth.civ@army.mil)
      ii. Jason Ketcham (jason.ketcham2.civ@army.mil)

3) Notifying the DES (so they can put building in local mode)
   b. DES POC:
      i. Joseph M. LaBranche (joseph.m.labranche.civ@army.mil)
      ii. Javier Gonzales (javier.e.gonzales.civ@army.mil)
      iii. Vanessa Jackson (vanessa.d.jackson.civ@army.mil)
   c. Garrison Command POC:

i. Kenya King (kenya.c.king.civ@army.mil)

FORT BENNING NEC VOICE AND DATA NETWORK

MILSTONES / INSPECTIONS / VARIANCES

PART III Fort Benning Project Milestones/Inspections/Standard Variances

1. QA/QC Inspection

1.1. Milestones for Inspections, Documentation or Meetings

Pre-Construction

1. Review of telecommunication drawings.
2. Pre-Construction meeting.

OSP Work

3. Maintenance hole/Hand hole cable splice completion.
    a. NEC shall inspect the splice cases and cable installation/racking.
4. Maintenance hole/Hand hole installation
    a. NEC shall inspect the maintenance hole/hand hole installation prior to backfill of dirt.
5. Installations of any conduit
    a. NEC shall inspect all conduit runs.
    b. This is to include penetrations into the maintenance hole/hand hole and entrance facility.
    c. NEC shall inspect trenched conduit runs prior to backfill.
6. Any of the OSP inspections can be combined as long as items are still available to be viewed.

ISP Work

7. Completion of telecommunication backboard, rack install and all ISP copper termination.
    a. NEC shall inspect the telecommunication room backboard, rack install, all OSP /ISP copper/FOC termination and labeling.
    b. This is to include viewing of the BET and fiber dressing.
    c. End to end TDR test/continuity test must be witnessed by NEC representative.
8. Completion of all ISP cabling/termination.
    a. NEC shall inspect the telecommunication room ISP cabling, terminations and labeling.
    b. NEC shall inspect all above ceiling horizontal runs prior to ceiling closure.

Pre-Switch Install

9. Prior to authorization of the installation of the NEC network switch or authorization of the reinstallation of the NEC network switch, the following information will be required by the NEC:
    a. OSP
        i. Completed and accepted OTDR test OSP FOC
            1. 1 strand per 12
            2. A copy must be given to the NEC 48 hours prior for review.
            3. The date for results given to the NEC shall be no more than 30 days from validation.
        ii. Completed and accepted power source/light meter tests of OSP FOC
            1. All fiber will be tested with passing results
            2. A copy must be given to the NEC 48 hours prior for review.
            3. The date for results given to the NEC shall be no more than 30 days from validation.
        iii. Completed and accepted copper TDR/continuity test for OSP copper
            1. All pairs of copper are required to be TDR/continuity tested and must pass.
            2. A copy of the TDR test results must be provided to NEC prior to NEC coming on site.
            3. Must have an NEC representative present.
        iv. OSP Validation of testing
            1. Once the NEC has accepted the test results, the contractor must schedule a time with an NEC representative to test ALL fiber with the power source/light meter in front of the NEC representative.
            2. The date for results given to the NEC shall be no more than 30 days from validation.

    b. ISP
        i. Completed and accepted power source light meter tests of ISP FOC fiber tie cable (if applicable)
            1. All fiber will be tested with passing results.
            2. A copy must be given to the NEC 48 hours prior for review.
            3. The date for results given to the NEC shall be no more than 30 days from validation.
        ii. Completed and accepted copper end to end TDR/continuity test for ISP voice copper tie or backbone cable (if applicable)
            1. All pairs of copper are required to be TDR/continuity tested and must pass.
            2. A copy of the TDR test results must be provided to NEC prior to NEC coming on site.
            3. Must have an NEC representative present.
        iii. Completed and accepted horizontal CAT6A copper test for ISP copper cable (if applicable)
            1. All CAT6A cables must be tested and must pass

2. Test results must be given to NEC 48 hours prior to validation testing
3. The date for results given to the NEC shall be no more than 30 days from validation.
4. Must have an NEC representative present.

c. ISP Validation of testing

1. ISP FOC Tie Cable
    a. Once the NEC has accepted the test results, the contractor must schedule a time with an NEC representative to validate ALL ISP fiber with the power source/light meter in front of the NEC representative.
    b. Any failures will require a retest following cleaning and rapid troubleshooting of the failure. If failure continue to occur after 3 attempts, the validation will result in a failure.
    c. If a validation results in a failure, 100% power source/light meter test will be conducted and results will be sent to the NEC. Upon acceptance of the results the NEC will revalidate the results.

2. ISP CAT 6 UTP
    a. 10% CAT6A UTP cables must be tested and must pass.
    b. Must have an NEC representative present.
    c. Any failures will require a retest following cleaning and rapid troubleshooting of the failure. If failure continue to occur after 3 attempts, the validation will result in a failure.
    d. If a validation results in a failure, 100% power source/light meter test will be conducted and results will be sent to the NEC. Upon acceptance of the results the NEC will revalidate the results.

Pre-Final Inspection

10. The NEC will be invited to all pre-final inspections that involve telecommunication work.
11. NEC will submit to the project manager all discrepancies found.

Final Inspection

12. The NEC will be invited to all final inspections that involve telecommunication work.
13. NEC will check all prior discrepancies found to ensure they are resolved.

1.2 Test Equipment Calibration

Calibration ensures accurate measurements, which are foundational to the quality, safety and innovation of most products and services we use and rely on every day. All test equipment shall be recalibrated/updated per the manufacturer's recommendations. This is usually an annual requirement but may vary slightly by each manufacturer. **The NEC requires ALL test equipment calibrations to be no later than 18 months out from the last calibration date otherwise test results will not be accepted.**

1.3. Standards Variance

Per NEC director, Standards Variances are no longer allowed.

FORT BENNING NEC VOICE AND DATA NETWORK

Integrated Commercial Intrusion Detection System (ICIDS)

PART IV Fort Benning ICIDS ARMAG Telecommunication Cabling

1. Introduction

These are the supplemental telecommunication standards that will be used for planning, designing, and installing telecommunication cabling to support the Fort Benning Directorate of Emergency Services (DES) Integrated Commercial Intrusion Detection (ICIDS) System communication to ARMAG containers. This is a living document and will be periodically reviewed, updated, and made available to users as part of the NEC responsibility for providing technical criteria for Fort Benning construction. All Outside Plant and Inside Plant Cabling will follow the latest version of the Unified Facilities Criteria (UFC 3-580-01) and the NEC Inside/Outside Plant Infrastructure Installation Requirements TTP standards. Any standards not found, described or are incorrect in the UFC or NEC TTP should be brought to the attention of the NEC government POC. If the NEC TTP conflicts with UFC, then this shall be brought to the NEC for necessary action moving forward.

2. Functionality

The Fort Benning Directorate of Emergency Services (DES) Integrated Commercial Intrusion Detection (ICIDS) System is a consists of Commercial Off-The-Shelf (COTS) equipment that reports any unauthorized intrusion into the interior of a secure ARMAG container. This communication is accomplished over a Fort Benning NEC ICAN analog telecommunication connection.

3. Requirements

1. Telecommunication cabling will be run to the closest Fort Benning NEC telecommunication room.
2. The conduit size minimums will be:
    - ¾” for up to 2 telecommunication cables
    - 1” for up to 4 telecommunication cables
    - 1 ½” for up to 6 telecommunication cables

3. For the wiring standards pertaining to the ARMAG Intrusion Detection System (IDS) panel, the following requirements must be met to ensure the system is Fully Mission Capable (FMC):
    - For every IDS (ICIDS) panel, the system requires a minimum of one pair of copper wire to operate. This provides communication back to the central IDS (ICIDS) servers.
    - The OSP copper will terminate on a Building Entrance Termina (BET) and will be of OSP rated copper cabling (minimum 24 AWG) as stated in the OSP section of this TTP.
    - The ISP copper will extend from the BET to the IDS (ICIDS) panel and will be of CAT6A UTP type as stated in the ISP section of this TTP.
    - For every pair of wires **required** for active monitoring of the IDS panel, an equivalent number of pairs are **required** for standby or backup purposes.
    - For instance, if the IDS panel necessitates two pairs of wires for active monitoring, a minimum of two additional pairs must be reserved for standby.

This redundancy ensures that the system remains operational and reliable under all conditions.

Failure to meet these minimum requirements will result in non-connectivity from the NEC till the minimum standard are met.

3.1. Aerial – Above Ground (See Figure A-12 & 14)

1. Telecommunication cabling will be run in EMT conduit
2. Will be suspended in a way to prevent sagging
3. The minimum height for suspended conduit supporting the ICID system is 15.5 feet.
4. The cabling will be of CAT6A UTP **inside** plant non-plenum rated cabling.
5. The jacket color for the CAT6A UTP inside plant non-plenum rated cabling will be white.
6. All EMT connectors used will be water resistant to prevent water penetration.

3.2. Buried - Below Ground (See Figure A-13 & 15)

1. Telecommunication cabling will be run in EMT conduit until 1 foot above the ground where it will transition to PVC or underground rated conduit.
2. All conduit (EMT/PVC/Underground Rated conduit) connectors used will be water resistant to prevent water penetration.
3. The minimum depth for the conduit shall be 24 Inches.
4. There shall be at a minimum 1 waterproof EMT pull set-screw elbow connector fitting at 1st 90 (leaving the building) and the last 90. Additional waterproof EMT pull set-screw elbow connector fittings may need to be install depending on conduit routing. This is to facilitate easy pull of the cabling and reduce pull tension of cabling.
5. The cabling will be CAT6A UTP **outside** plant rated cabling.
6. The jacket color for the CAT6A UTP **outside** plant rated cabling will be white.

3.3. Inside the Telecommunication Room

1. The CAT6A UTP cabling will be terminated in the Fort Benning NEC telecommunication room on a CAT6A rated patch panel. A Jumper from the patch panel will connect to either 110 Block (if BET is not in same room) or directly to the BET.

3.4. Outside the Telecommunication Room

Outside the Telecommunication Room

1. When the telecommunication cabling leaves the telecommunication room, if it the cabling is required to be routed throughout the building before exiting the building on its way to the ARMAG, it shall:
    - Be run above ceiling or ceiling grid.
    - If the telecommunication cabling cannot be run above ceiling or ceiling grid, it must be run in surface mounted EMT.
    - All Unified Facilities Criteria (UFC 3-580-01) regulations and NEC Inside/Outside Plant Infrastructure Installation Requirements TTP shall be required to be met for running/supporting ISP cabling.

Outside the Building

1. The wall penetrations where the telecommunication cabling is to leave the building must be a sleaved penetration. This will reduce any potential damage to the cabling.
2. All wall penetrations will have sealant on both sides (inside/outside) of the penetration to prevent water penetration.
3. All conduit suspended above the ground will be marked with high visibility tape or paint to alert personnel to the conduit.

3.5. Inside ARMAG

1. All telecommunication cabling inside the ARMAG is to meet Unified Facilities Criteria (UFC 3-580-01) regulations and NEC Inside/Outside Plant Infrastructure Installation Requirements TTP s for running/supporting ISP cabling.
2. The telecommunication cabling inside the ARMAG supporting the ICID system will be ran to the ICID system panel, a two-foot maintenance coil maintenance loop will be left. The DES ICID system technician will take the maintenance loop, cut to length, and make the connection between the telecommunication cabling and ICID system in the ARMAG.

FORT BENNING NEC VOICE AND DATA NETWORK

MILSTONES / INSPECTIONS / VARIANCES

PART V Fort Benning Project Telecommunication Drawings

1. Introduction

("T" Series) Telecom drawings are crucial in architectural services, as they provide a visual representation of telecommunication infrastructure. These drawings are used by architects, engineers, and contractors to design and construct buildings that are suitable for hosting telecommunication equipment. Telecom drawings are technical illustrations that represent telecommunication infrastructure. These drawings are created using computer-aided design (CAD) software and show the layout of equipment such as antennas, cables, and base stations. They also include details about the placement of telecommunication equipment, as well as the wiring and cabling that connect them. **T drawings will not be incorporated into E drawings.**

The following is a sample list of the general types of drawings that will be required (but not limited to) for Telecommunication Projects:

1.1 T0 – Site Plans

Shows physical and logical connections, such as actual building locations, exterior pathways and inter-building backbone cabling on plan view drawings and major system nodes and related connections on the logical system drawings.

1.2 T1 – Layout of complete building per floor

Layout of complete building per floor. The drawing indicates location of serving zones, communication equipment rooms, access points, pathways and other systems that need to be viewed from the complete building perspective.

1.3 T2 – Serving Zones Drawings

The building is divided up by its serving zones. Drawing indicates drop locations, communication equipment rooms, access points and detail callouts for communication equipment rooms and other congested areas.

1.4 T3 – Communication Equipment Rooms

Detailed look at communication equipment room. Drawing indicates technology layout (racks, ladder racks, etc.), mechanical/electrical layout, rack elevation and backboard elevation. May also be an enlargement of a congested area of T1 or T2

1.5 T4 – Typical Detail Drawings

Detailed drawings of symbols and typical such as faceplate labeling, faceplate types, installation procedures, detail racking, and raceways.