JOINT BASE LEWIS-MCCHORD DESIGN STANDARDS

DIVISION 27 - COMMUNICATIONS

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

05/25

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D709 (2017) Standard Specification for Laminated Thermosetting Materials

BUILDING INDUSTRY CONSULTING SERVICE INTERNATIONAL (BICSI)

ANSI/NECA/BICSI 568- Standard for Installing Commercial Building

Telecommunications Cabling

ANSI/BICSI 005- Electronic Safety and Security (ESS) System Design

and Implementation Best Practices

ANSI/BICSI 003- Building Information Modeling (BIM) Practices

for Information Technology Systems

ANSI/NECA/BICSI 607- Telecommunications Bonding and Grounding Planning

and Installation Methods for Commercial Buildings

Telecommunication Distribution Methods Manual (TDMM)

Information Technology Systems Installation Methods Manual (ITSIMM)

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECA 310-E (2005) Cabinets, Racks, Panels, and Associated Equipment 2.4.5

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596 (2016) Fiber Optic Premises Distribution Cable

ICEA S-90-661 (2012) Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION (NECA)

NECA/BICSI 568- Standard for Installing Building Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66 (2013) Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

NEMA Standards Publication VE 2-2006 Cable Tray Installation Guidelines

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12. TIA 17-13; TIA 17-14) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-1152 (2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

TIA-455-21 (1988a; R 2012) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices

TIA-526-14 (2015c) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

TIA-526-7 (2015a) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

TIA-568-C.0 (2009; Add 1 2010; Add 2 2012) Generic Telecommunications Cabling for Customer Premises

TIA-568-C.1 (2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard

TIA-568-C.2 (2009; Errata 2010; Add 2 2014; Add 1 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standards

TIA-568-C.3 (2008; Add 1 2011) Optical Fiber Cabling Components Standard

TIA-569 (2015d) Commercial Building Standard for Telecommunications Pathways and Spaces

TIA-570 (2012c) Residential Telecommunications Infrastructure Standard

TIA-606 (2017c) Administration Standard for the Telecommunications Infrastructure

TIA-607 (2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

TIA-598 (2014D; Add 2 2018) Optical Fiber Cable Color Coding

TIA-604-10 (2002a) FOCIS 10 Fiber Optic Connector Intermateability Standard - Type LC

TIA-604-12 (2000) FOCIS 12 Fiber Optic Connector Intermateability Standard Type MT-RJ

TIA-604-2 (2004b; R 2014) FOCIS 2 Fiber Optic Connector Intermateability Standard

TIA-604-3 (2004b; R 2014) Fiber Optic Connector Intermateability Standard (FOCIS), Type SC and SC-APC, FOCIS-3

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68 Connection of Terminal Equipment to the Telephone Network (47 CFR 68)

UNDERWRITERS LABORATORIES (UL)

UL 1286 (2008; Reprint Jan 2018) Office Furnishings

UL 1666 (2007; Reprint Jun 2012) Test for Flame Propagation Height of

Electrical and Optical-Fiber Cables Installed Vertically in Shafts

UL 1863 (2004; Reprint Sep 2016) UL Standard for Safety Communication Circuit Accessories

UL 444 (2008; Reprint Apr 2015) Communications Cables

UL 467 (2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment

UL 50 (2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 514C (2014; Reprint Dec 2014) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL 723 (2008; Reprint Dec 2017) Test for Surface Burning Characteristics of Building Materials

UL 969 (2017) UL Standard for Safety Marking and Labeling Systems

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1753F-201 Acceptance Test of Telecommunications Plant (PC-4)

U.S. DEPARTMENT OF DEFENSE (DoD) UNITED FACILITIES CRITERIA (UFC)

UFC 3-580-01 (21 November 2024), Information and Communications Technology Infrastructure Planning and Design

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP), apply to this section with additions and modifications specified herein.

Equipment and materials for Secret Internet Protocol Router Network (SIPRNET) systems shall comply with applicable requirements of UFC 3-580-01, 4-2.2 and Army Regulation AR 190-16 Physical Security, (Chapter 5).

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA-606 and IEEE 100 and UFC 3-580-01 herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. International expression for main cross-connect (MC).

1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

Entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with the campus distributor at the center or hub of the star. The interbuilding backbone system provides connectivity between the campus distributors and is specified in Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP). Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM The telecommunications The contractor shall coordinate with Joint Base Lewis McChord (JBLM) personnel (such as COE, DPW, JBLM NEC, YTC NEC, and 627CS. JBLM NEC controls access to telecommunications spaces on JBLM (Lewis). YTC NEC controls access to telecommunications spaces at YTC. 627CS controls access to telecommunications spaces on JBLM (McChord)) in areas concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort within the telecommunications spaces with JBLM personnel.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation. The JBLM NEC project team shall perform a technical review of all telecommunications submittals and requests for information (RFI) for each project and provide review comments to the Government project team.

Submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Prior to the government's approval of telecommunications cable cutover plan submittals, the government project team shall have the JBLM NEC project team's technical review comments and approval. This is necessary because of the coordination required for outside agency approval processes and scheduling of service interruptions to minimize the impact on the services JBLM NEC provides to its customers. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings; G

Telecommunications Space Drawings; G

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in

accordance with paragraph SHOP DRAWINGS. Telecommunications shop drawings

shall be performed and stamped by an RCDD in accordance with the UFC 3-580-01.

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G

Patch panels; G

Telecommunications outlet/connector assemblies; G

Equipment supports frame; G

Connector blocks; G

Spare Parts; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing; G, NEC

Test reports shall be provided in accordance with UFC 3-580-01, TIA-568-

C.1 and TIA-568-C.2.

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Manufacturer Qualifications; G

Test plan; G, NEC

Test plan shall be provided in accordance with UFC 3-580-01

SD-09 Manufacturer's Field Reports

Factory reel tests; G

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G

SD-11 Closeout Submittals

Record Documentation; G

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings shall be a minimum of 279 by 432 mm 11 by 17 inches in size using a minimum scale of one mm per 100 mm 1/8 inch per foot, (preferably in electronic form). Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Drawings

Provide registered communications distribution designer (RCDD) approved, drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the

drawings. Drawings shall depict final telecommunications installed wiring system infrastructure in accordance with TIA-606. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's[, BD's], and FD's to the telecommunications work area outlets. Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, CD's, BD's, FDs, and the EF and ER for telecommunications keyed to floor plans by room number. Mount the laminated schematic in the EF telecommunications space as directed by the Contracting Officer. Tables 2-1 and 2-2 list expected submissions and when they are due in the process. These timeframes may be adjusted for fast-tracked or other delivery mechanisms to align with design processes.

NOTE: There are six types of drawings in the TIA-606-A backward-compatible drawing scheme that apply to Information and Communications Technology (ICT) systems. They are: (T0, T1, T2, T3, T4, and T5). The T6 series drawings referenced in UFC 3-580-01, Tables 2-1 and 2-2 apply to Operational Technology (OT) systems and Facility related Control Systems (FRCS).

The following drawings shall be provided as a minimum:

a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.

b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID’S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.

c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings in accordance with TIA-606 that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building

protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks.

Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years. Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services international (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 5years experience in the installation of the specified copper and fiber optic cable and components.

They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing

telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity. Indicate that all key persons are currently employed by the telecommunications contractor or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer. Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the successful experience offered. Any substitutions for the telecommunications contractor's key personnel require approval from the contracting Officer.

Building telecommunications infrastructure and cabling shall be installed in accordance with NECA/BICSI 568-2006, Standard for Installing Commercial Building telecommunications Cabling. Workmanship shall conform to the practices described in the BICSI Information Transport System Installation Methods Manual (ITSIMM) and the UFC 3-580-01.

1.6.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years' experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the UTP and optical fiber components and accessories 60 days prior to the proposed test date. Include procedures for certification, validation, and testing. Provide evidence of current equipment calibration and test technician qualifications. A Registered Communications Distribution Designer (RCDD) shall review, stamp and approve both the test plan and test report (UFC 3-580-01).

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 and UFC 3-580-01 unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, excluding the manufacturers' factory or laboratory tests, is furnished.

1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to the date of delivery to site shall not be used, unless specified otherwise.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in

storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient for the installation of the equipment in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data Package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration.

1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cutovers and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation, shall be provided. Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include the required data fields for each cable and complete end-to-

end circuit report for each complete circuit from the assigned outlet to the entry facility in accordance with TIA-606. Include manufacture date of cable with submittal.

b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with TIA-606. Documentation shall include the required data fields as a minimum in accordance with TIA-606.

1.10.3 Spare Parts

In addition to the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

PART 2 PRODUCTS

2.1 COMPONENTS

Components shall be UL, or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third-party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569, UFC 3-580-01, BICSI TDMM and BICSI ITSIMM. Where contradictions occur as they pertain to telecommunications, the criteria listed in UFC 3-580-01 take precedence .and as specified in Section 26 20 00 INTERIOR DISTRIBUTION. . Provide system furniture pathways in accordance with UL 1286.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and NFPA 70. Provide a labeling system for cabling as required by UFC 3-580-01, JBLM NEC Labeling Scheme, TIA-606 and UL 969. Ship cable on reels or in boxes bearing manufacture date for unshielded twisted pair (UTP) in accordance with ICEA S-90-661 and optical fiber cables in accordance with ICEA S-83-596 for all cable

used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Backbone Cabling

2.3.1.1 Backbone Copper

ICEA S-90-661, TIA-568-C.1, TrA-568-C.2, NEMA WC 63.1 ANSI/NEMA WC 66 and UL 444, copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, 200-pair UTP (Unshielded twisted pair), formed into 25 pair binder groups covered with a gray thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 3.3 feet. The word "FEET" or the abbreviation "FT" shall appear after each length marking. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70. Color coding shall comply with industry standards for 25 pair cables.

2.3.1.2 Backbone Optical Fiber

Provide in accordance with ICEA S-83-596, TIA-568-C.3, UL 1666 and NFPA 70. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 40 inches (1 meter). TIA-492CAAA, single-mode, 8/125-um diameter, 0.10 numerical aperture, tight buffered fiber optic cable. Provide nonconductive optical fiber general purpose cable (OFN or OFNG), nonconductive optical fiber plenum cable (OFNP), and nonconductive optical fiber riser cable (OFNR) rated cable in accordance with NFPA 70 and UL 910. Type OFNP or OFNR may be substituted for type OFN or OFNG and type OFNP may be substituted for type OFNR in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be in accordance with TIA-598.

2.3.2 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.1.

2.3.2.1 Horizontal Copper

Provide horizontal copper cable in accordance with TIA-568-C.2, UL 444, NEMA WC 63.1 ANSI/NEMA WC 66, CEA S-90-661 UTP (unshielded twisted pair), 100 ohm. Provide four each balanced twisted pair, solid untinned copper, 24 American Wire Gauge (AWG) conductors, Category 6, unshielded twisted pair (UTP) thermoplastic jackets colored as follows:

BLUE for NIPR data

WHITE for telephone

RED for SIPR data

YELLOW for JWICS data

GREEN for SCADA/DDC/METERING

ORANGE for high priority Users

PURPLE for Customer Owned Equipment Networks

BLACK for Specialty equipment (i.e.: projectors, interconnects, any off-network equipment requiring ethernet cabling. JBLM NEC Standard color codes. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 3.3 feet. The word "FEET" or the abbreviation "FT" shall appear after each length marking. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70.Cables in conduit installed inside or below slab-on-grade concrete floors shall be UL listed for wet locations. CAT6 data cables shall be terminated on rack-mounted modular patch panels. CAT6 voice cables shall be terminated on wall mounted 110-type connector blocks.

2.3.2.2 Horizontal Optical Fiber

Provide optical fiber horizontal cable in accordance with ICEA 8-83-596,TIA-568-C.3 and TIA-492CAAA, single-mode, 8/125-um diameter, 0.10 numerical aperture, tight buffered fiber optic cables. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 40 inches. Provide nonconductive optical fiber general purpose cable (OFN or OFNG), nonconductive optical fiber riser cable (OFNR) or nonconductive optical fiber plenum cable (OFNP) in accordance with NFPA 70. Type OFNP or OFNR may be substituted for type OFN or OFNG and type OFNP may be substituted for type OFNR in accordance with NFPA 70. The cable jacket shall be of single jacket

construction with color coding of cordage jacket, fiber, unit, and group in accordance with TIA-598.

2.3.3 Work Area Cabling

2.3.3.1 Work Area Copper

Provide work area copper cable in accordance with TIA-568-C .2, with a blue, thermoplastic jacket for data, a white thermoplastic jacket for telephone, a green thermoplastic jacket for DDC/metering, and a black thermoplastic jacket for specialty equipment (projectors, interconnects, any off-network equipment requiring ethernet cabling).

2.3.3.2 Work Area Optical Fiber

If applicable, provide optical work area cable in accordance with TIA-568-C.3.

2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA-606.

2.4.1 Backboards

Provide void-free, A/C interior grade plywood 3/4 inch thick 4 by 8 feet. Backboards shall be fire rated and stamped on the A-side. Backboards shall be provided on all walls in the telecommunication spaces. Do not paint backboards or cover the fire stamp on the backboard.

2.4.2 Equipment Support Frame

Provide in accordance with ECA 310, UL 50 and seismically rated or braced in accordance with the ICC IBC. a. Network equipment frames, floor mounted seismic two-post modular type, 16-gauge steel construction, minimum, treated to resist corrosion. Provide rack with 6-inch-wide double-sided vertical cable management channels and horizontal jumper management channels suitable for 4U high modules, top and bottom cable troughs, and grounding lug with a surge protected power strip with 6 duplex 20-amp receptacles. Rack shall be compatible with 19 inches panel mounting.

b. Cabinets, freestanding modular type, 16-gauge steel construction, minimum, treated to resist corrosion and seismically rated in accordance with the ICC IBC. Cabinet shall have removable and lockable side panels, front and rear doors, and have adjustable feet for

leveling. Cabinet shall be vented on the roof and rear door. Cabinet shall have cable access on the roof and base and be compatible with 19 inches panel mounting. Provide a cabinet with grounding bar, roof mounted 550 CFM fan with filter and a surge protected power strip with 6 duplex 20-amp receptacles. All cabinets shall be keyed alike.

c. Equipment cabinets, wall-mounted modular type, 16-gauge steel construction, minimum, treated to resist corrosion and seismically rated in accordance with the ICC BC. Cabinet shall have lockable front door, louvered side panels, 250 CFM roof mounted fan, ground lug, and top and bottom cable access. Cabinet shall be compatible with 19 inches panel mounting. All cabinets shall be keyed alike. A surge protected power strip with 6 duplex 20-amp receptacles shall be provided within the cabinet.

2.4.3 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare.

2.4.4 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on equipment racks, cabinets and telecommunications backboards. Mount cable guides with screws, or nuts and lock-washers.

2.4.5 Patch Panels

Provide 25- and 50-port patch panels with ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized optical fiber and copper patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified. Provide fiber optic patch cables with crossover orientation in accordance with TIA-568-C.3. Patch cords shall meet minimum performance requirements specified in TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3 for cables, cable length and hardware specified.

2.4.5.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.1 and TIA-568-2. Panels shall be third party verified and shall comply with TIA Category 6 requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be cabinet or rack mounted and compatible with an ECA 310 19 inches equipment cabinet or rack. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568A. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall

have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.4.5.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panels shall be constructed of 18-gauge steel or 11-gauge aluminum minimum and shall be cabinet or rack mounted and compatible with ECA 310 19 inches equipment rack. Each panel shall provide 12 single-mode adapters as ST in accordance with TIA-604-2 with metallic alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray, a minimum of 8 inches deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

2.4.6 Optical Fiber Distribution Panel

Rack mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with ECA 310 utilizing16 gauge steel or 11-gauge aluminum minimum. Panel shall be divided into two sections, distribution and user. The distribution section shall have strain relief, routing guides, splice tray and shall be lockable, the user section shall have a cover for patch cord protection. Each panel shall provide 12 single-mode pigtails and adapters. Provide adapters as SC with metallic alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68 TIA-568-C.1, and TIA-568-C.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568-C.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568A. UTP outlet/connectors shall comply with TIA-568-C.2 for 200 mating cycles. UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.

2.5.2 Optical Fiber Adapters (Couplers)

Provide optical fiber adapters suitable for SC in accordance with TIA-604-2 with metallic alignment sleeves as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with TIA-455-21 for 500 mating cycles.

2.5.3 Optical Fiber Connectors

Provide in accordance with TIA-455-21. Optical fiber connectors shall be SC in accordance with TIA-604-2 with metallic ferrule, epoxy less crimp style compatible with 8/125 single-mode fiber. The connectors provide a maximum attenuation of 0.3 dB 1310 nm with less than a 0.2 dB change after 500 mating cycles.

2.5.4 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568-C.1, design constructed of high impact thermoplastic material ivory in color to match color of Receptacle/switch cover plates specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS. Provide labeling in accordance with the paragraph LABELING in this section.

2.6 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

Provide MUTOA(s) in accordance with TIA-568-C.1.

2.7 TERMINAL CABINETS

Construct of zinc-coated sheet steel, 36 by 24 by 6 inches deep or as indicated. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 5/8-inch backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with panelboards. Provide label and identification systems for telecommunications wiring and components consistent with TIA-606.

2.8 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA-607, UFC 3-580-01 and NFPA 70. Components shall be identified as required by TIA-606. Provide ground rods, bonding conductors, and grounding busbars as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.9 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.10 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.11 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, rack, relay, switch, and device as specified in TIA-606-A and the JBLM NEC labeling scheme. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inches thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style.

2.12 TESTS, INSPECTIONS, AND VERIFICATIONS

2.12.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with TIA-568-C.1, TIA-568-C.3, and TIA-526-7 for single mode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Building telecommunications infrastructure and cabling shall be installed in accordance with NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling. Workmanship shall conform to the practices described in the BICSI Information Transport Systems Installation Methods Manual (ITSIMM). Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with the UFC 3-580-01, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569-B, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network.
Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and in accordance with UFC 3-580-01, TIA-569, BICSI TDMM and BICSI ITSIMM. Where contradictions occur as they pertain to telecommunications, the criteria listed in UFC 3-580-01 takes precedence. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the

telecommunications cabling. Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment. Seismic specifications for telecommunications infrastructure and related facilities shall accommodate applicable seismic requirements per the AHJ, add these additional References: ANSI/TIA-569-D (12 Mar 2015), paragraph 6.3.6.1.9, seismic considerations, JBLM Design Standard Specification Section 13 48 00, SEISMIC BRACING FOR MISCELLANEOUS EQUIPMENT, UFC 3-310-04, SEISMIC DESIGN FOR BUILDINGS, International Code Council (ICC), International Building Code (IBC)

3.1.1 Cabling

Install Category 6 UTP, and optical fiber telecommunications cabling system as detailed in the UFC 3-580-01, TIA-568-C.1, TIA-568-C.2, and TIA-568-C.3. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 6 UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Install horizontal CAT6 and fiber optic cables in EMT from the cable backbone distribution system to each outlet. Conduit shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of conduits parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Plenum cable shall be used where open cables are routed through plenum areas. Plenum cables shall comply with flammability plenum requirements of NFPA 70.

3.1.1.2 Backbone Cable

a. Copper Backbone Cable. Install intrabuilding backbone copper cable, in indicated pathways, between the campus distributor, located in the telecommunications entrance facility or room, the building distributors and the floor distributors located in

Telecommunications rooms and telecommunications equipment rooms as indicated on drawings.

b. Optical fiber Backbone Cable. Install intrabuilding backbone optical fiber in indicated pathways. Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 250 mm 10 inches leaving strength members exposed for approximately 250 mm 10 inches. Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with manufacturer's recommendations.

3.1.1.3 Horizontal Cabling

Install horizontal cabling as indicated on drawings between the telecommunications room and the telecommunications outlet assemblies at workstations. Do not untwist Category 6 UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide cable slack in the form of a figure eight (not a service loop} on each end of the cable, 10 feet in the telecommunications room or telecommunications enclosure, and 12 inches at the work area outlet. Horizontal cable shall be installed in accordance with TIA-568-C.l and TIA-568-C.2. Do not exceed cable bend radius and pulling tensions recommended by the manufacturer. Plenum cable shall be provided where open cables are routed through plenum spaces. Plenum cables shall comply with flammability requirements of NFPA 70.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70. Provide building pathway as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.3 Service Entrance Conduit, Overhead

Provide service entrance overhead as specified in Section 26 20 00 INTERIOR

DISTRIBUTION SYSTEMS.

3.1.4 Service Entrance Conduit, Underground

Provide service entrance underground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.5 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only [CMP] [and] [OFNP] type cable shall be installed in a plenum.

3.1.6 Work Area Outlets

3.1.6.1 Terminations

Terminate UTP cable in accordance with TIA-568-C.l, TIA-568-C.2 and wiring

configuration as specified.

3.1.6.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.6.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 304 mm (12 inches) of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.6.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.6.5 Multi-User Telecommunications Outlet Assembly (MUTOA)

Run horizontal cable in the ceiling or underneath the floor and terminate each cable on a MUTOA in each individual zone. MUTOAs shall not be located in ceiling spaces, or any obstructed area. MUTOAs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure. MUTOAs shall be located in an open work area so that each furniture cluster is served by at least one MUTOA. The MUTOA shall be limited to serving a maximum of twelve work areas. Maximum work area cable length requirements shall also be taken into account. MUTOAs must be labeled to include the maximum length of work area cables. MUTOA labeling is in addition to the labeling described in TIA-606, or other applicable cabling administration standards. Work area cables extending from the MUTOA to the work area device must also be uniquely identified and labeled.

3.1.7 Telecommunications Space Termination

Install termination hardware required for Category 6 and optical fiber system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.7.1 Connector Blocks

Connector blocks shall be wall mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

3.1.7.2 Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 25 percent spares.

a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel as recommended by the manufacturer to prevent movement of the cable.

b. Fiber Optic Patch Panel. Fiber optic cable loop shall be provided as recommended by the manufacturer. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7.3 Equipment Support Frames

Install in accordance with TIA-569:

a. Racks, floor mounted modular type. Permanently anchors rack to the floor in accordance with manufacturers' recommendations and to meet seismic requirements. Expansion or bonded anchors shall comply with ASTM E 488 and be fitted with 2 nuts each.

b. Cabinets, freestanding modular type installed to meet seismic requirements. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets (unless needed to meet physical security requirements). Mount rack mounted fan in roof of cabinet.

c. Cabinets, wall-mounted modular type. Mount cabinet to plywood backboard in accordance with manufacturer's recommendations and to meet seismic requirements. Mount cabinet so height of highest panel does not exceed 78 inches above floor.

3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00

FIRESTOPPING.

3.1.9 Grounding and Bonding

Provided in accordance with TIA J-STD-607, NFPA 70, UFC 3-580-01, RUS 1755.200, and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS. Bond exposed

noncurrent-carrying metallic parts of telephone equipment, cable sheaths, cable splices and terminals. Incoming cable shields shall not be bonded across the splice to the cable stubs.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA-606 and JBLM NEC Labeling Scheme. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process or laser printer. See Attachment 27 10 00-A for JBLM NEC Telecommunications Labeling System standards.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA-606.

3.3 FIELD APPLIED PAINTING

Painting electrical equipment as required to match the finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

Backboards shall not be painted.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

Test Plan.

The contractor must submit for a USG review of a test plan of all proposed cabling and equipment being installed under the project. After the contractor has completed the installation and testing of the information technology system, the contractor must submit a test report for all fiber and copper cabling. The contractor’s Registered Communications

Distribution Designer (RCDD) must approve both the test plan and the test report before submitting it to the USG.

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with UFC 3-580-01 (chapter 2-6), TIA-568-C.l, TIA-568-C.2, TIA-568-C.3. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.5.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third-party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for correct pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA568-C.2, TIA-568-C.3. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested using TIA-568-C.2 and RUS Bull 1753F-201 for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connected. For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source. Perform Method B, Optical Time Domain Reflectometer {OTDR), testing to isolate optical disparities only in fiber links that fail Method A testing.

3.5.1.3 Performance Tests

Perform testing for each outlet and MUTOA as follows:

a. Perform Category 6 link tests in accordance with TIA-568-C.1 and

TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with TIA-568-C.3.

3.5.1.4 Final Verification Tests

Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

a. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

End of Section