CLEMSON UNIVERSITY

Master Format Division 27 - Communications

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CCIT Network Services and Telecommunications
Revised 10-2013

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27 00 00 COMMUNICATIONS

Scope

These guidelines identify and define the Clemson University requirements and policies for designing and installing the *Information Transport System* (ITS) or telecommunications infrastructure and substructure at all Clemson University facilities, the intent of this document is to provide a standard specification that will be used for all Clemson University facilities requiring structured cabling installation. This document provides a list of approved components and systems comprising a complete structured cabling system that shall accommodate Clemson University's requirements in excess of ten years. Buildings are dynamic. Over the life of a building, or campus, both the telecommunications equipment and the cabling will change dramatically. The infrastructure for the *Information Transport System* (ITS) must be capable of handling these changes. The information transport system is more than just voice and data. It also encompasses many building systems including environmental controls, security, audio, television, sensing, alarms and paging. The information transport system includes all low voltage signal systems that convey information within or between buildings.

In order to have a building, or campus, successfully designed, constructed, and provisioned for telecommunications, it is imperative that the information transport system design be incorporated during the preliminary architectural design phase. To accomplish this, the architect must work closely with the designated CCIT staff via the project manager for Clemson University.

Use of, and compliance with these guidelines is mandatory for Clemson University personnel, and for architects, engineers, and installation contractors working on Clemson University projects.

Design Guidelines

The Clemson University Telecommunications Infrastructure Standards are based upon the code requirements and telecommunications industry standards contained in the following documents. These guidelines will not duplicate the information contained in those references, except where necessary to provide guidance, clarification or direction. It is imperative that Clemson University personnel, architects, engineers, and installation contractors working on Clemson University projects become familiar with these guidelines and the industry telecommunications standards referenced.

In instances where several technical alternatives may be available to provide a design solution, these guidelines will identify the preferred solution to meet Clemson University needs. However, each facility and project is unique. Design for new construction will differ from design for retrofit of existing facilities. These guidelines will differentiate certain design approaches and solutions to be applied to new construction versus existing facilities, and different types of Clemson University facilities. However, designers and installers shall always use sound engineering judgment in order to comply with the requirements of the codes and standards identified in this section. Design or installation questions shall be referred to CCIT via The University Facilities project manager for resolution.

Reference Standards

Adherence to, and compliance with, the codes and standards referenced, and the Clemson University unique requirements and design solutions identified in the manual, is mandatory. Requests to deviate from the industry standards and design solutions prescribed in these guidelines may be submitted, on a case-by-case basis, in accordance with the instructions in the Policy and Procedures section of these guidelines. No deviation from the requirements of the National Electrical Code will be allowed.

Architects, Consultants and Contractors shall always reference the most recent standards available.

Codes, Standards, References, and Applicability

The cabling system described in this specification is derived in part from the recommendations made in the current editions of these industry standard documents. The list of documents below is incorporated by reference:

Reference Standards

1. Design, manufacture, test, and install data distribution systems per manufacturer's requirements and in accordance with NFPA 70 (National Electric Code), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following specifications.

2. This Technical Specification and Associated Drawings.
3. TIA-526-7 (OFSTP-7)-2002+A1:2008, *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant*. This standard specifies singlemode optical loss measurement methods between two passively connected points using an optical source and power meter.
4. TIA-526-14-B-2010 (OFSTP-14), *Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement*. This standard is used to measure the optical loss between any two passively connected points, including end terminations, of a multimode optical fiber cable plant. – The optical fiber cable plant, as the term is used here, may consist of optical fiber cables, connectors, mounting panels, jumper cables, and other passive components, but it may not include active components. This standard includes an encircled flux launch condition metric for measuring cable plant. Additionally, this standard includes the description of using an optical time domain reflectomer (OTDR) for total attenuation measurement and measurements of individual component loss.
5. ANSI/TIA-568-C.0–2009+A1:2010+A2:2012, *Generic Telecommunications Cabling for Customer Premises.* This standard specifies requirements for generic telecommunications cabling. It specifies requirements for cabling system structure, topologies and distances, installation, performance, and testing. The purpose of this standard is to enable the planning and installation of a structured cabling system for all types of customer premises. This standard specifies a system that will support generic telecommunications cabling in a multiproduct, multi-vendor environment.
6. ANSI/TIA-568-C.1–2009+A1:2012, *Commercial Building Telecommunications Cabling Standard.* This standard specifies requirements for telecommunications cabling within a commercial building and between commercial buildings in a campus environment. It

defines terms, specifies cabling topology, lists cabling requirements, establishes cabling distances, sets telecommunications outlet/connector configurations, and provides additional useful information. The purpose of this standard is to enable the planning and installation of a structured cabling system for commercial buildings. This standard establishes performance and technical criteria for various cabling system configurations for accessing and connecting their respective elements.

7. ANSI/TIA-568-C.2–2009+A1:2010, *Balanced Twisted-Pair Telecommunications Cabling and Components Standard*. This standard specifies minimum requirements for balanced twisted-pair telecommunications cabling (e.g., channels, permanent links) and components (e.g., cable, connectors, connecting hardware, patch cords, equipment cords, work area cords, jumpers) that are used up to and including the telecommunications outlet/connector and between buildings in a campus environment. This standard also specifies field test procedures and applicable laboratory reference measurement procedures for all transmission parameters.
8. ANSI/TIA-568-C.3–2009+A1:2011, *Optical Fiber Cabling Components Standard.*
9. This standard is applicable to premises optical fiber cabling components. Specified in this standard are requirements for components such as cable, connectors, connecting hardware, and patch cords. The purpose of this standard is to specify cable and component transmission performance requirements for premises optical fiber cabling.
10. ANSI/TIA-568-C.4–2011, *Broadband Coaxial Cabling and Components Standard.* This standard is limited to coaxial cable and components related to the broadband transport industries.
11. ANSI/TIA-569-C–2012, *Telecommunications Pathways and Spaces.* This standard is limited to the telecommunications aspect of commercial building design and construction, encompassing telecommunications pathways and spaces. Telecommunications pathways are designed for installation of telecommunications media, and telecommunications spaces are the rooms and areas where media is terminated and telecommunications equipment is installed. Both single- and multi-tenant buildings are recognized by this standard.
12. Building Industries Consulting Services International (BICSI) *Telecommunications Distribution Methods Manual* (TDMM)
13. TE CONNECTIVITY Design and Installation Contractor Agreement
14. TE CONNECTIVITY Undercarpet Cabling Planning and Installation Manual 409-5566

15. Determine and adhere to the most recent edition of these specifications when developing responses.

16. Specifications as provided by Clemson Computing and Information Technologies, Clemson Telecommunications and University Facilities and any other special codes that may apply:

17. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the contractor is responsible to determine and adhere to the most recent release when developing the proposal for installation.

27 01 00 Operation and Maintenance of Communications Systems

1.01 POLICY AND PROCEDURES

Management of Clemson University's Campus Network is the responsibility of the Clemson Computing and Information Technology (CCIT) staff. This includes network design, operations, performance monitoring, optimization, troubleshooting, and disaster recovery. The CCIT staff at Clemson University is also responsible for the planning and development of operational and design standards for local area networks (LANs) and voice communication systems at all Clemson University facilities, including the telecommunications infrastructure and substructure.
Clemson University CCIT staff will be responsible for installation and support of LAN hardware, software, data communications and voice system backplane hardware.

2.01 DESIGN PHILOSOPHY

Clemson University requires that the telecommunications infrastructure and substructure be designed and installed in accordance with applicable codes and industry standards. Due to the unique physical characteristics of many Clemson University facilities, some technical design solutions are better suited than others. These guidelines identify which design solutions are appropriate and approved for the various types of buildings and areas in Clemson University facilities.

3.01 PRELIMINARY ARCHITECTURAL DESIGN PHASE

Clemson University requires that the telecommunications design be incorporated during the preliminary architectural design phase of new construction, renovations or remodeling. This will insure that the building(s) will be successfully designed, constructed, and provisioned for telecommunications.

4.01 CCIT ROLE IN CAMPUS BUILDING PROJECTS

Clemson University requires the architect and designers to work closely with the Clemson University CCIT designated staff as a team throughout the entire project life cycle, starting at the preliminary architectural design phase.

5.01 NEW CONSTRUCTION

All new construction projects shall contain a telecommunications infrastructure designed and installed in accordance with the requirements of these guidelines.

6.01 RENOVATION TO EXISTING STRUCTURES

All Clemson University facilities undergoing renovation or remodeling shall incorporate a telecommunications infrastructure designed and installed in accordance with the requirements of these guidelines.

7.01 UPGRADING TELECOM INFRASTRUCTURE TO NEW STANDARDS

Every effort should be made to upgrade existing telecommunications infrastructure at any Clemson University facility, during renovation, to meet the standards and specifications of these guidelines.

8.01 DESIGN PROCEDURES

In order to have a building successfully designed, constructed, and provisioned for telecommunications, it is imperative that the telecommunications design be incorporated during the preliminary architectural design phase. To accomplish this, the architect must work closely with the designated Clemson University CCIT staff.

9.01 APPROVAL FOR ALTERNATIVE DESIGN SOLUTIONS

This guideline identifies specific design solutions that are intended to meet the technical requirements of Clemson University telecommunications and information technology systems. Requests to deviate from industry standards or Clemson University design solutions will be considered on a case-by-case basis. Any request to deviate from the requirements of the National Electrical Code will not be accepted.

Requests to apply alternative design solutions shall be submitted to the Clemson University Project Manager for consideration. Approval will only be granted in writing.

The request must include: A complete description of the proposed alternative design solution identifying: The type of facility; the conditions at the facility; the approved design solution contained in these guidelines and the relevant standards identified in section 27 01 00; the proposed alternative design; identify all standards referenced in these guidelines which the alternative design will not be in compliance with, and the effect of non-compliance, both short and long term; and the reason for wishing to use the alternative design.

10.01 PROCUREMENT AND INSTALLATION POLICY

In larger construction projects, the telecommunications infrastructure installation will be part of the general construction contract. A competitive acquisition should still be pursued with the contractors listed by CCIT as approved contractors. The procurement and installation of the telecommunications infrastructure in large construction projects will be a combined effort between the Clemson University IT and Clemson University Facilities staff.

11.01 STRUCTURED CABLING SYSTEM WARRANTY AND CERTIFICATION.

Clemson University requires a warranty on the installation of the Structured Cabling System of at least one year from building acceptance. In addition, Clemson University requires that 100% of the cables and termination equipment installed be tested and certified at the designed and intended performance level.

12.01 INSTALLER QUALIFICATIONS

Clemson University's cabling infrastructure requires an TE CONNECTIVITY Systems structured cabling system. The cabling system shall be backed by a TE Connectivity 25-Year System Warranty. The system warranty shall be facilitated by the Contractor and be established between Clemson University and TE Connectivity.

The successful cabling contractor must meet the following three requirements;

1. Must be an AMP-authorized NETCONNECT Design & Installation Contractor (ND&I) and maintain current status with the warranting manufacturer AMP, including all training requirements, for the duration of the Cable Infrastructure Project. The contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the TE CONNECTIVITY 25-Year System Performance Warranty requirements. Prior to installing any cable on the site, the contractor must submit copies of the training certificates for the installation crew to the Clemson University Project Manager. After installation, the Contractor shall submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, and to apply for said warranty on behalf of Clemson University. The system warranty will cover the components and labor associated with the

repair/replacement of any failed link as a result of a defective product when a valid warranty claim is submitted within the warranty period.

2. Must be a current member in good standing of the Corning Cable Systems' LANscape® Network of Preferred Installers (NPI). Members of the selective Network of Preferred Installers are, subject to the applicable contract terms, able to install products eligible for Corning Cable Systems' warranty of up to 25 years for LANscape Fiber Optic Cabling Solutions and up to 10 years for Intelligent Traffic Systems (ITS) networks through the Corning Cable Systems LANscape Solutions Extended Warranty℠ Program (EWP). The warranty covers product components of the Corning Cable Systems solution including fiber optic cables, hardware and connectivity, including preterminated systems. Each member-company must meet Corning's stringent requirements for technical experience, financial strength, and proven dedication to quality. EWP installers must demonstrate ongoing commitment to extensive factory training and are required to update training at least once every two years. Corning Cable Systems guarantees to repair or replace defective products free of charge after installation. Prior to installing any cable on the site, the contractor must submit copies of the training certificates for the installation crew to the Clemson University Project Manager.

3. Must have a BICSI® certified RCDD review the drawings and meet with University representatives from Facilities and the CCIT to discuss the project and to ensure that a structured cabling system is installed that provides a comprehensive telecommunications infrastructure.

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27 05 00 Common Work Results for Communications Systems

27 05 13 Communications Services

Clemson Computing and Information Technology (CCIT) is tasked with designing, specifying, deploying and maintaining all devices related to networking and telephony on the Clemson campus. This includes but is not limited to all fiber optic and copper cabling, connectors and terminating hardware, network devices such as switches, routers, and wireless access points. CCIT is also the resource for information on deploying VoIP and traditional telephone handsets as well as emergency phones. All other communications systems such as fire alarms, card access, A/V systems, and building automation systems are designed, specified, deployed and maintained by the system provider.

27 05 26 Grounding and Bonding for Communications Systems

A #6 AWG insulated stranded copper cable shall be provided from the ER to the building main electrical service ground electrode. A Telecommunications Main Grounding Busbar (TMGB) shall be installed in the ER. All metallic conduits entering the ER, all equipment racks in the ER, and all exposed non-current carrying metal parts of telecommunications and information technology equipment in the ER must be bonded to the TMGB.

27 05 28 Pathways for Communications Systems

DESIGN CRITERIA FOR INSIDE PLANT CONDUIT

Telecommunications conduit must be properly designed and installed. The design and installation practices for telecommunications conduit have some unique requirements beyond those normally seen in standard electrical conduit. The following items are required to be included in the design and installation of interior telecommunications conduit:

Conduits must be designed and installed in the most direct route possible from the telecommunications closet to the work area.

27 05 14 COMMUNICATIONS CABLES INSIDE BUILDINGS

The maximum length of LAN copper horizontal distribution cable is 90 meters (295 ft) from the work station outlet to the TC patch panel, no exceptions. Where this length would be exceeded the designer will add additional TCs as required.

Telecommunications cabling is always installed in a home-run fashion with individual cables running from the work area all the way to the telecommunications closet. Splices in horizontal distribution cable are not allowed.

Factory-manufactured sweeps which meet ANSI/TIA/EIA569-A bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable. Standard electrical elbows shall not be used. This sweep radius is necessary to insure that the conduits can

accept future fiber optic cables. All horizontal conduits will be tested by the conduit installation contractor with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run

Each telecommunications outlet box shall have an individual conduit routing to the telecommunications closet, or to the pull box or pulling point, connecting to a major cable pathway routing to the telecommunications closet. Box shall be located in serviceable space. Looping, or "daisy-chaining," of conduits between outlet boxes is not allowed.

All conduit ends shall have plastic bushings installed before the cable is pulled into the conduit.

Conduits will not be run next to hot water lines, steam pipes, or other utilities that may present a safety hazard or cause a degradation of system performance.

Conduits entering the Telecommunications Closet should be designed and located allowing for the most flexibility in the routing and racking of cables.

Conduits or conduit sleeves entering through the floor of the Telecommunications Closet shall terminate four (4) inches above the finished floor.

All metallic telecommunications conduits entering the Telecommunications Closet, Equipment Room, or Entrance Facility shall be bonded together, and bonded to the Telecommunications Main Grounding Busbar with a #6 AWG ground cable.

All in-use and spare conduits entering the Telecommunications Closet, Equipment Room, or Entrance Facility shall be sealed to prevent the intrusion of water, gasses, and rodents throughout the construction project. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

All conduits and cables that penetrate fire rated walls or floors must be fire stopped.

All outside plant (OSP) conduits and innerduct, used and spare, shall be plugged with watertight plugs at both ends to prevent the intrusion of water, gasses, and rodents throughout the construction project. All OSP conduits shall have pull lines rated at a minimum of 90 kg (200 lb) pulling tension installed. The pull lines must be re-pulled each time an additional cable is installed. Prior to releasing the conduit for the installation of cables, all OSP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. All OSP conduits must be tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

27 05 28.29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

Hangers and cable support mechanisms must be designed to easily accommodate current and future high-performance cabling upgrades, eliminating the need to replace infrastructures when more cable is added

Products such as Caddy Cat Links or equivalent are designed for aerial cable support system. They provide a wide bend radius that reduces cables friction and offers less vertical cable compaction. These cable supports come in several sizes.

27 05 28.33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

Pull boxes used with telecommunications conduits in interior locations shall be ratedNEMA-1. Pull boxes used in damp or wet locations such as plumbing chases or out of doors shall be rated NEMA-3R. Pull boxes shall be installed in conduits at an interval no greater than every 100 feet. A pull box shall be installed in conduit runs whenever there are two 90°sweeps, or a total of 180°of sweeps, in a conduit run. Any deviations from these criteria must have prior approval from CCIT.

27 05 28.36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

The Inside Plant (ISP) telecommunications substructure are the cable pathways and support structures necessary for routing telecommunications cabling between telecommunications closets, and from the telecommunications closet to the work area. There are numerous different products and methods that can be employed to build the substructure. Some of these methods include: Enclosed conduit system, Open or enclosed cable trays, Routing above a false ceiling using cable supports, and in-slab floor ducts.

Cooper B-Line's FLEXTRAY® Cable Management provides value through jobsite flexibility and labor savings. The systems combine **strength, lightweight construction, depth,** and **unmatched adaptability** to support cables in a fast and economical way.

FLEXTRAY® is a flexible, field-adaptable way to manage cables throughout the project. The tray itself can be cut and bent to the needs of the installer on the jobsite, allowing cable runs to be adjusted as needed. The wide range of sizes offered by Cooper B-Line makes Flextray a great choice for everything from a small cable drop to a large trunk of cables, 12 to 24 inch wide by 2 inch high is the preferred size for Clemson buildings. The tray has the market-preferred "T" weld safety edge, protecting both the cable and the installer during cable installation. Flextray is also UL Classified as an equipment grounding conductor.

The conduit system shall be routed inside ceilings, floors, and walls to the greatest extent possible. Surface mounted conduit shall be used only when there is no other route to provide service to the desired location.

For the main floor in, “slab on grade constructed buildings”, conduit will route in walls and ceilings not in or under the slab. If this design is not possible, an alternate must be presented and approved following the “Approval for Alternate Design Solutions” process detailed in section 27 01 00. If an under slab route solution is approved, the conduit must be installed with at least 1” of concrete encasement around all sides of the conduit. Exceptions occur in cases of modular furniture installation. In which in slab conduit routing is sometimes necessary; design should work in conjunction with modular furniture.

Telecommunications outlets shall be located to minimize the length of patch cord required to connect the computer or telephone to the outlet.

All outlets shall have a minimum one inch conduit. Increase the conduit size as necessary for the quantity of cables to be installed. Cable fill shall not exceed 40%.

All wall outlets shall be mounted in a minimum four (4)-inch by four (4)-inch by two and one-half (2 ½)-inch deep double gang outlet box.

An electrical outlet shall always be located within three (3) feet of a telecommunications outlet.

Telecommunications cable and conduit shall maintain the minimum separation distance from power as listed below.

For power systems operating at 480V or greater, including electrical distribution panels, step down devices or transformers, maintain a minimum separation distance of 6 m (20 ft) from all telecommunications cross-connects.

For power systems operating at 480V or greater, maintain a minimum separation distance of 3 m (10 ft) from all telecommunications cabling. Pathways should cross perpendicular to electrical power cables or conduits.

For large electrical motors or transformers, maintain a minimum separation distance of 1.2 m (4 ft) from all telecommunications cabling

For lightning protection system conductors (NEC 800-13), maintain a minimum separation distance of 1.8 m (6 ft) from all telecommunications cabling

For power systems operating at less than 480V, including all conduit and cables used for electrical power distribution, maintain a minimum separation distance of 0.6 m (2 ft) from all telecommunications cabling. Pathways should cross perpendicular to electrical power cables or conduits.

For fluorescent lighting, maintain a minimum separation distance of 12 cm (5 in) from all telecommunications cabling. Pathways should cross perpendicular to fluorescent lighting.

For branch circuits (secondary) power (120/240V, 20A) where electric light or power circuits coexist with telecommunications cabling, maintain a minimum separation distance of 0.50 mm (2 in).

27 05 43 Underground Ducts and Raceways for Communications Systems

TELECOMMUNICATIONS SUBSTRUCTURE—OUTSIDE PLANT

The Outside Plant Substructure is the physical pathway used to distribute backbone cabling between buildings, and to bring the entrance cable from the nearest campus backbone access point across Clemson University property to the Entrance Facility. Underground conduit is the standard method of distribution between buildings on campus. Input from CCIT and University Facilities staff must be incorporated in developing the initial and on-going construction schedules. This input is especially important when an early or phased turn-up of buildings is required. Timing on the construction of the main telecommunications room and building, and the backbone cable plant connecting it to key buildings, would be a vital consideration in bringing key buildings online at required dates. In new construction, the outside plant substructure must be sized to accommodate all low voltage services planned for initial installation, plus a minimum of 25% growth capacity.

UNDERGROUND DISTRIBUTION

Underground distribution of low voltage services on Clemson University property will consist of appropriately sized conduits and telecommunications manholes or handholes. Telecommunications services (voice and data) and other low voltage services such as fire alarm, security systems, and CATV distribution shall not share the same underground distribution conduits and manholes as electrical power distribution.

UNDERGROUND CONDUIT

Direct burial of telecommunications cable is not desired, and will only be approved under unique circumstances on a case-by-case basis. Requests to direct bury cable must follow the "Approval for Alternative Design Solutions" process described in section 27 01 00. The major cost in placing underground utilities is the labor for digging the trench. Therefore, underground telecommunications distribution to permanent facilities shall always be placed in conduit to facilitate the easy installation of additional future cables. Key requirements for underground conduit installation include:

OSP conduit quantity and size shall be determined based on the requirements for the initial installation of cable **and a realistic prediction of future expansion in the are**a.
Always provide a minimum of 25% spare capacity above the initial installation requirements and known growth.

OSP conduit quantities shall be based on a maximum of 40% cable fill per conduit.

All OSP telecommunications conduit installations shall have a minimum of two spare conduits.

University Facilities will specify the products to be used for OSP telecommunications conduits. Typically these will consist of Schedule 40 or Schedule 80 Rigid Nonmetallic conduit, Polyvinyl Chloride (PVC), and must meet the requirements of NEMA TC 6. All conduit sections shall be glued with PVC pipe glue to form a watertight joint. All schedule 40 pipes to be embedded in sand. Spacers are required to maintain proper separation between multiple conduits in a run.

All OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.

Factory-manufactured sweeps which meet ANSI/TIA/EIA569-A bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable. Standard electrical elbows shall not be used.

All campus distribution conduits must be buried a minimum of 24 inches below grade, with preferred depth of 36 inches.

All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.

All OSP conduits and innerduct, used and spare, shall be plugged with watertight plugs at both ends to prevent the intrusion of water, gasses, and rodents throughout the construction project. All OSP conduits shall have quarter (1/4)-inch polypropylene pull ropes installed. The pull ropes must be re-pulled each time an additional cable is installed. All OSP conduits must be tested with a mandrel to prove compliance with the bend radius requirements throughout the conduit run. Within five days of releasing the conduit for the installation of cable, the conduit installation contractor shall prove all conduits to be clean and dry.

In new construction and new conduit, fiber optic backbone cables shall always be installed in fiber optic innerduct. Normally, three to four innerduct can be placed in a four (4)-inch conduit. Where fiber optic cable is installed into existing conduits, the use of fiber optic innerduct is preferred if space is available. Innerduct is used to separate and segregate cables, and to prevent the tangling of cables in a conduit. Types of textile maxcell innerduct may be used.

Splices in backbone fiber optic cable are not allowed, design OSP conduit accordingly.

TELECOMMUNICATIONS MANHOLES

Telecommunications manholes shall be placed in outside plant conduit runs at an interval no greater than every 500 feet. Conduits routing between two telecommunications manholes, or between a manhole and a building, shall contain no more than two 90°sweeps or a total of 180°of sweeps. If additional conduit sweeps are required, place additional manholes as needed. Telecommunications manholes are typically constructed in pre-fabricated cast concrete, and contain a floor section, wall section, and top section. Manholes are sized based on the ultimate duct structure and equipment that will be located in the manhole. Minimum size of any manhole shall be 6'X8'X7'. Key requirements for telecommunications manhole installation include:

Telecommunications manhole sections must be installed with a watertight joint sealer between the sections of the manhole.

Telecommunications manholes must be equipped with a pre-cast concrete floor section. Bare earth for the floor of a manhole is not allowed. The floor section must contain a sump to facilitate the use of a submersible pump for de-watering the manhole.

Telecommunications manholes must be equipped with steel pulling eyes pre-cast in the walls opposite to each duct bank to facilitate able-pulling apparatus.

Telecommunications manholes must contain 18 hole or 37 hole cable racks for dressing and securing cables that route through the manhole. Must contain at least two sets per manhole wall.

Telecommunications manholes over five (5) feet deep must have permanently installed ladders.

All telecommunications manholes shall have a minimum of one grounding rod.

All metal hardware in the manhole or handhole (racks and ladders) must be grounded to the bonding tabs pre-cast in the manhole, with the bonding tabs bonded to the ground rod.

The cover of all telecommunications manholes must be a minimum of one (1) inch above the finished grade after all landscaping is completed. If manholes are located in paved areas, the pavement must be tapered up to the manhole cover.

TELECOMMUNICATIONS HANDHOLE

A handhole is similar to a miniature manhole that is used solely as a pulling point to expedite the installation of cable in conduit runs over 500 feet or with more than two 90°sweeps. Maximum size of handhole is 4X4X4. The following rules apply to the use of handholes:

A handhole shall not be used if the ultimate or total requirements exceed the capacity of two four (4)-inch conduits, in and out.

Where more than two four (4)-inch conduits are used in a duct bank, telecommunications manholes must be used in lieu of handholes.

A handhole shall not be utilized for splicing cables together.

Conduit entering the handhole shall be aligned on opposite walls of the handhole at the same elevation.

27 05 53 Identification for Communications Systems

To be consistent with ANSI/TIA/EIA standards and industry practices, it's important that both labeling and color coding be applied to all telecommunications infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall telecommunications infrastructure of the facility.

Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, telecommunications closets, and other telecommunications spaces.

In order to create a consistent environment, CCIT maintains a campus wide numbering scheme for voice and data outlets and patch panels.

Voice and data outlets shall use the following labeling sequence:

1W1A1

1= Floor
W= campus orientation of telecom room (North, South, East or West)
1= rack (numeric)
A= patch panel (A-Z)
1= port number (1-24)

A label must be affixed to both the top and bottom label holder in the faceplate.

Example: 4 port single gang faceplate labels
Top label – 1W1 A1 A2
Bottom label – 1W1 A3 A4

When more than one patch panel is needed per rack, the numbering scheme shall start over at with panel B, port one and so on.

Outlet numbers shall be labeled on each cable at the outlet and at the TC.

Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.

Outside plant labels shall be totally waterproof, even when submerged.

All labels shall be machine printed.

Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.

Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacturer.

Color Coding – Cable Termination Fields

Industry standard (ANSI/TIA/EIA 606) color coding shall be applied to all cable termination fields in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. Color coding may also be used to

identify specific cables in a pathway, or the function of specific equipment racks or equipment. The same color is always applied to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the plywood backboard behind the termination block, may be the color of a plastic cover on a termination block, or may be the actual color of the insert label on a termination block or patch panel. The following color code shall be used in all Clemson University facilities:

Orange – Reserved for identification of the telecommunication service demarcation point (demarc).Orange may only be used by the telephone company.

Green – Used to identify the termination of network connections on the customer (Clemson University) side of the demarc.

Purple – Used to identify cables originating from common equipment, such as the telephone PBX, LAN hubs, or multiplexer.

White – Used to identify the first-level backbone telecommunications media termination in the building containing the main cross-connect. The main cross-connect is usually in the Equipment Room. In buildings that do not contain the main cross-connect, white may be used to identify the second-level backbone terminations.

Gray – Used to identify the second-level backbone telecommunications media termination in the building containing the main cross-connect.

Blue – Used to identify the termination of horizontal distribution cables routing from the Telecommunications Closet or Equipment Room to the Work-Area. A blue color coding is only required at the TC or ER end, not at the work-area end of the cable.

Brown – Used to identify interbuilding backbone cable terminations.

Yellow – Used to identify termination of auxiliary circuits, alarms, maintenance, security, and other miscellaneous circuits.

DRAWINGS

Drawings are used to illustrate different stages of telecommunications infrastructure planning, installation, and administration.

Installation or Construction Drawings

Installation or construction drawings are the plans that show the installer how the infrastructure is to be installed. The quality of the installation can be directly impacted by the level of detail in the installation drawings and written specifications. Installation drawings for Clemson University projects shall, at a minimum, show pathway locations and cable routing. Drawings shall indicate which telecom room cables should terminate in and the cable count in each telecom room. CCIT will provide drawings showing the configuration of telecommunications spaces including backboard and equipment rack configurations.

As-built Drawings

The as-built drawings graphically document the installed telecommunications infrastructure through floor plan, elevation, and detail drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or

the scale of the drawings. As-built drawings are a vital component of the telecommunications administration system, and must be kept current as adds, moves, and changes take place. Clemson University CCIT requires the installer to provide a complete and accurate set of as-built drawings.

27 06 00 Schedules for Communications

CRITICAL DELIVERABLES EXPECTED FROM TELECOMMUNICATIONS CONTRACTOR

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During construction **the cabling contractor must contact CCIT** to inspect the work at the following milestones:

1. Prior to anchoring the telecom equipment racks to the floor to ensure they are positioned in the proper location.
2. While pulling horizontal cable from TR to wall outlet locations, when pathways are open and exposed. CCIT representative must witness some portion of cabling installation.
3. During termination of the horizontal cabling in the TR on the patch panels, 10% of terminations must be witnessed by CCIT representative. The TR and patch panels will be inspected again for proper labeling and workmanship at the end of the project.
4. During wall outlet terminations, 10% of cable termination must be witnessed by CCIT representative during the project.
5. When testing and labeling faceplates, 10% of testing must be witnessed by CCIT representative. Wall outlets must be tested with the faceplate installed in the outlet.

Typically a 2-3 day notice sent via email to: NST TECHNICAL LIST (NST_TECH-L@CLEMSON.EDU) will be sufficient to schedule the inspections. If the cabling portion of the project is small in nature, some or all of the inspections may performed at the same time.

It is essential for CCIT to receive all test results and as-built drawings prior to job acceptance. The test results must adhere to the following specifications, formats and delivery conditions:

Specifications

Complete end-to-end test results for all copper UTP and fiber optic lines installed is required.

All fiber optic cable must be visually inspected upon delivery to the installation site.

During construction **the cabling contractor must contact CCIT** to inspect the work at the following milestones:

1. Prior to mounting the fiber termination panel to ensure its located in the proper location.
2. While pulling fiber optic cable when pathways are open and exposed. CCIT representative must witness some portion of fiber installation.
3. During termination in the TR of the OSP fiber, 10% of terminations must be witnessed by CCIT representative during the project. TR and fiber termination panel will be inspected again for proper labeling and workmanship at the end of the project.
4. When testing and labeling fiber, 10% of testing must be witnessed by CCIT representative.

Typically a 2-3 day notice sent via email to: NST TECHNICAL LIST (NST_TECH-L@CLEMSON.EDU) will be sufficient to schedule the inspections. If the cabling portion of the project is small in nature, some or all of the inspections may performed at the same time.

End to end test measurements shall be provided for singlemode and multimode fibers (2 wave lengths per test is required). Test results must be submitted for review as part of the installation inspection requirements. Test results shall be in paper form and electronic form, and must contain the names and signatures of the technicians performing the tests.

Testing shall be performed on 100% of the fibers in the completed end-to-end system.

1. TIA-526-7 (OFSTP-7)-2002+A1:2008, *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant*. This standard specifies singlemode optical loss measurement methods between two passively connected points using an optical source and power meter.
2. TIA-526-14-B-2010 (OFSTP-14), *Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement*. This standard is used to measure the optical loss between any two passively connected points, including end terminations, of a multimode optical fiber cable plant. – The optical fiber cable plant, as the term is used here, may consist of optical fiber cables, connectors, mounting panels, jumper cables, and other passive components, but it may not include active components. This standard includes an encircled flux launch condition metric for measuring cable plant. Additionally, this standard includes the description of using an optical time domain reflectomer (OTDR) for total attenuation measurement and measurements of individual component loss. Additionally, all fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.

100% of all pairs in backbone copper cables shall be tested for continuity and wire-map on the finished installation.

The transmission performance of a cabling system depends upon the characteristics of the horizontal cable, connecting hardware, patch cords, equipment cords, work area cords, cross-connect wiring, the total number of connections, and the care with which they are installed and maintained. The development of high-speed applications requires that cabling systems be characterized by transmission parameters such as insertion loss, PSNEXT loss, return loss, and PSELFEXT. System designers use these performance criteria to develop applications that utilize all four pairs in a cabling system for simultaneous bi-directional transmission. This Standard provides minimum cabling component performance criteria as well as procedures for component and cabling performance validation. Wall outlet terminations on the horizontal cabling must be complete and the faceplate attached to the wall prior to final testing.

Format

Test Results must be submitted in 2 formats. First, must be original file(s) down loaded from tester. Secondly as a .pdf file.

As Built drawings must be submitted with .dwg file extensions.

Delivery

Test Results may be electronically submitted to CCIT Telecommunications. Contact information will be provided after contract is awarded and before project completion.

27 08 00 Commissioning of Communications

SYSTEMS FUNCTIONAL PERFORMANCE TESTING:
The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under normal operating conditions. Upon completion of the

network equipment installation, CCIT network services technicians and engineers will perform system tests on the entire Information Transport Systems (ITS) to test system performance. Any evidence or cause for concern that the structured cabling system is not performing as designed will be brought to the installation contractors attention and a resolution determined before the system is accepted. The Contractor shall provide any required labor, materials, and test equipment identified in the testing process to confirm the structured cabling system is functioning properly. The Contractor shall provide machine generated cable test reports on 100% of installed cabling, both copper and fiber.

27 10 00 Structured Cabling

27 11 00 Communications Equipment Room Fittings

MAIN TELECOMMUNICATIONS EQUIPMENT ROOM (ER)

The Main Telecommunications Equipment Room (ER) is the central location in a building where the major telecommunications equipment is located. The ER typically contains the telephone demark, Distribution Layer data equipment and LAN switching equipment, the CATV "head end" distribution equipment, closed circuit TV and security systems, card access controllers and additional low voltage systems. To minimize both conduit and cable lengths, the ER shall be located as close as practical to the center of the building. ER shall be a minimum of 10' by 10'. In new construction, the ER shall be sized and provisioned to contain all major voice, data, and video equipment required to support the building, and all other computer based and networked low voltage systems. During renovation or remodeling of existing facilities, every reasonable effort shall be made to co-locate these systems in a common equipment room.

ER PLANNING, LAYOUT, AND SIZING

The first step in determining the size required for the ER is to identify the systems that will be installed into the ER. In this process, first identify the size of the area that will be served from the ER. Next, identify the quantity, size and variety of systems to be installed to support the area, and the space required for each of the systems. Once the size and quantity of systems are identified, they shall be laid out in a functionally efficient arrangement. Some equipment, such as voice cross connects, LAN switches and patch panels will require regular access and shall be located where they are easily accessible**. CCIT staff must be involved in the design phase and must approve the final space requirements and design layout for all equipment and racks as well as conduit paths in ER.** When laying out the arrangement of the ER, the following requirements and issues shall be addressed:

Groups of like equipment types shall be located together; i.e., voice, data for both LAN and video.

Wall space and equipment rack space must be designated for particular uses by particular people. Set aside specific backboard space and equipment rack space for the service providers demarc, and any associated equipment. Designate specific adjacent areas for each of the various service providers. Keeping all of the service providers on a common wall and row of equipment racks will limit their access to other areas of the equipment room.

Separate wall and equipment rack space is designated for the termination and cross connection of campus distribution cables, both copper and fiber optic. These areas shall be located adjacent to the equipment providing the services, such as the PBX, routers, and switches.

Careful design planning must be performed to ensure that all telecommunications cabling has the minimum setback distanced from all potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI), such as electric motors, power transformers, etc. Incorrect planning can result in expensive changes at a later date.

Equipment racks and rack mounted equipment must have a minimum of three (3) feet of unrestricted clearance in front and back for technician access. In smaller installations, wall mounted swing-out equipment racks can be used to save space, but must have three (3)-feet clearance to the front of the rack. Note that some LAN equipment may be large, or may require clearance at both the front and back, and wall mounted swing-out racks may not be appropriate.

Once an acceptable equipment layout is developed, the size of the equipment room can be calculated. Always provide a minimum of 25% spare space for future growth. With the size determined, the location of the equipment room can be selected.

EQUIPMENT ROOM CHARACTERISTICS

The characteristics of the ER have a significant impact on all other aspects of telecommunications design. Next to insuring adequate size, selecting a suitable location is the most critical step in planning the ER. The major factors that must be considered when planning and locating the ER are:

Access for delivery and installation of large equipment into the ER.

Access by Clemson University and service provider maintenance personnel.

Restrictions on unauthorized access.

Close proximity to electrical service.

The ER must be dedicated to the telecommunications and information technology function. Shared use of boiler rooms, washrooms, janitor closets, electrical closets, or storage rooms is **not allowe**d.

The floor, walls, and ceiling shall be sealed to reduce dust. Finishes shall be light in color to enhance room lighting. Flooring materials having antistatic properties shall be selected.

The room must be free of plumbing and electrical utilities not directly required to support the telecommunications functions.

Close proximity to service entrances for telecommunications and power.

Close proximity and centralized to the campus telecommunications distribution pathways (conduits and/or aerial distribution) to minimize the backbone cable lengths.

No pass thru to other rooms.

EQUIPMENT ROOM LOCATIONS

Unacceptable Room Locations: Any areas subject to water or steam infiltration, particularly basements. A floor drain is required if there is any risk of water entering the ER. Any areas exposed to excessive heat or direct sunlight. Any areas exposed to corrosive atmospheric or environmental conditions. Near or adjacent to any potential sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, or high power radio transmitting antennas.

This is a critical consideration, as EMI and RFI can render IT networks totally inoperable. No point within the ER shall be closer than 6 M (20 ft) to power panels or equipment rated at greater than or equal to 480 V that may cause Electrical Interference or equipment which may cause RFI or EMI.

ENVIRONMENTAL PROVISIONING

The following environmental provisions are required in the Main Telecommunications Equipment Room:

Heating, ventilation, and air conditioning (HVAC) shall be provided on a 24 hours-per-day, 365 days-per-year basis. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the ER.

The temperature and humidity shall be controlled to provide a continuous operating range of 64°F to 75°F, with 30% to 55% relative humidity.

Lighting shall be a minimum of 50 foot candles, measured three (3) feet above the finished floor in the middle of all aisles between equipment racks and cabinets.

Minimum clear height in the ER shall be eight (8) feet without obstructions.

Dry chemical fire suppression systems are preferred in the ER.

ELECTRICAL PROVISIONING

The following electrical provisions are required for the Main Telecommunications Equipment Room (ER):

A separate supply circuit serving the room shall be provided and terminated in its own electrical panel located in the ER. This power panel shall be designated as "ER Technical Power." The ER Technical Power panel shall be used exclusively for supplying power to electronics equipment in the equipment room.

If emergency generator power is available to the facility, the ER Technical Power panel must be linked to the emergency generator power supply. Sizing of electrical power is dependent upon the equipment types and equipment load, and must be calculated on a case by case basis, including sufficient spare capacity for future growth.

Each equipment rack and all major freestanding equipment shall be provided with two dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in a quad (4-plex) outlet. Technical power shall be identified with orange colored electrical outlets. These outlets shall be used exclusively for electronics equipment. Do not use Technical Power outlets for general-purpose or utility devices such as electric drills, vacuum cleaners, or coffeepots.

Some IT equipment, such as large LAN switches and routers, are ordered with dual power supplies. The placement of equipment with dual power supplies shall be identified and the appropriate racks must have three, separate, dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in separate quad (4-plex) outlets, and be appropriately marked to identify the separate circuit breakers.

Some major pieces of telecommunications equipment, such as PBX remote equipment, may require 208 or 220 VAC power. These systems must be identified, and power requirements determined, well in advance of the ER architectural and electrical design.

The ER shall have 20-amp 110VAC general-purpose convenience electrical outlets placed at 6-foot intervals round the room. The general-purpose circuits must not originate from the ER Technical Power panel. The general purpose circuits shall be used for general purpose, utility devices such as power tools or vacuum cleaners. Do not use general purpose outlets for ER electronics equipment. White, gray, or beige colored outlets to match all other general purpose outlets in the building shall identify the general-purpose outlets.

The ER shall be equipped with a power disconnect switch. This switch shall be located near the main door of the ER. The switch shall disconnect power to all electronic equipment in the ER, and is to be used in the event of electrocution or fire in the ER. There shall also be a similar means to disconnect the power to all dedicated HVAC systems serving the ER and cause all required fire/smoke dampers to close. Refer to the National Electrical Code,
NFPA 70, Article 645-10.

TELECOMMUNICATIONS BACKBOARDS

All walls of the ER shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats of light colored, non-conductive fire retardant paint. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the "A" side exposed. Cutouts shall be provided around existing power and telecommunications outlets. In new construction, power and telecommunications outlets, and light switches in the ER shall be surface mounted on the plywood backboard.

TELECOMMUNICATIONS CLOSETS (TC)

The Telecommunications Closet(s) are located in each building, or each floor of a building, where backbone cables transition to horizontal distribution cables. These cables will be both fiber optic and copper, and will support voice, data, video, and other low voltage systems. The TC may also contain certain items of network electronics equipment such as routers or switching equipment. A large building, with large floors, may have multiple TCs on a floor. To minimize both conduit and cable lengths, the TC shall be located as close as practical to the center of the building where it is housed on each floor of the area to be served. TCs should be "stacked" one above the other for multiple floors. Close attention must be given to the maximum length (90m) on LAN copper horizontal distribution cable.

TELECOMMUNICATIONS CLOSET PLANNING, LAYOUT, AND SIZING

ANSI/TIA/EIA-569-A provides sizing formula for a TC in normal office buildings. The sizing is based on the "usable floor space," which is the space on a floor that can actually be used for office activities. TC shall be a minimum of 60 square feet. Spaces such as mechanical rooms, janitorial closets, and rest rooms cannot be used for office activities, and are not counted as usable floor space. The sizing formula assumes an average of 100 square feet of floor space for each person, or "work –area." Many Clemson University buildings are not traditional commercial or office buildings, and the sizing guidelines of ANSI/TIA/EIA-569-A must be adjusted to accommodate these buildings.

There shall be a minimum of one TC per building (may be ER). Additional TCs shall be added when the area to be served exceeds 10,000 square feet, or the cable length from the TC patch panel to the farthest work area outlet exceeds 90meters (295 feet). Cable length is not calculated on a straight-line distance. The distance must include the rises, drops, and bends that the cable will follow from the TC to the work area.

TELECOMMUNICATIONS CLOSET LOCATION

The TC in each building is the transition point between backbone cabling and horizontal distribution cabling.

The TC must be able to contain telecommunications equipment, cable terminations, and associated cable interconnection apparatus.

The TC shall be dedicated to the telecommunications function.

The TC shall not be shared with electrical installations other than those necessary for telecommunications.

The TC shall be located as close as practical to the center of the area to be served, preferably in the core area of the building, to minimize the cable length. The maximum length of copper horizontal distribution cable is 90 meters (295 ft) from the work station outlet to the TC patch panel, no exceptions. Where this length would be exceeded the designer will add additional TCs as required.

Multiple TCs on a floor shall be interconnected by a minimum of three spare conduits. Additional conduits shall be installed as necessary based on the quantity of services supported.

All fiber optic backbone cables shall home-run from each individual TC to the main telecommunications Equipment Room, which should be the location of the data switching equipment. Requests for exceptions to this policy must follow the process described in section 27 01 00.

TCs shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, radio transmitting antennas, etc. This is a critical consideration, as EMI and RFI can render IT LAN networks totally inoperable.

No point within the TC shall be closer than 6 M (20 ft) to power panels or equipment rated at greater than or equal to 480 V, that may cause electrical interference or equipment which may cause RFI or EMI.

TELECOMMUNICATIONS CLOSET SIZING AND LOCATION IN EXISTING FACILITIES.

Existing facilities present a unique challenge for sizing and locating the TC. Many buildings were designed and constructed only to support telephones. When planning the size and location of TCs in existing buildings, every reasonable effort shall be made to meet the requirements for telecommunications closets identified above. In certain instances, the only viable alternative will be the use of one or several telecommunications cabinets in lieu of closets.

TELECOMMUNICATIONS CABINETS FOR SMALL BUILDINGS WITH LIMITED SERVICES

Certain small buildings may not justify a separate room as the telecommunications closet. In existing buildings, sufficient space may not be available for a telecommunications closet. In such cases CCIT will determine the best possible solution for serving the building and allowing room for future growth. These telecommunications spaces must provide:

Physical security to protect the contents and prevent unauthorized access. The space shall be accessible, but also provide physical security.

All power and telecommunications cables for equipment should be routed in a manner so that no cables are exposed.

All power and telecommunications cables routed to or from the space must be contained in conduit, surface mounted raceway, or routed within the adjacent wall.

The space must contain a plywood backboard for mounting telecommunications hardware.

The space must provide a means of mounting electronics equipment, including a LAN switch. Acceptable means are rails for rack mounting, or adequate space on the plywood backboard for electronics equipment wall mounting brackets.

The space must have a minimum of one 20-amp 120 VAC quad (4-plex) electrical outlet on a dedicated circuit breaker from the electrical panel.. An available general purpose power panel may be used to support the telecommunications cabinet power outlet. The power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel must be located in close proximity to the cabinet.

There shall be at least one 20-amp 110VAC general purpose convenience outlet located within 6 feet of the space. The general purpose outlet shall not be used to power electronics equipment.

The backboard must have a telecommunications grounding busbar installed in accordance with the requirements listed in these guidelines.

The space shall not be located in or adjacent to areas containing sources of electromagnetic interference (EMI) or radio frequency interference (RFI) such as large electric motors, power transformers, arc welding equipment, radio transmitting antennas, etc. This is a critical consideration, as EMI and RFI can render IT WAN and LAN networks totally inoperable.

Standard EIA 19-inch open frame equipment racks as approved for use in the Main Telecommunications Equipment Room may be used in the TC (Please see appendix I Equipment Specifications for rack and components.). Floor standing racks must be securely bolted to the floor, and must be braced to the wall with cable ladder racking. Multiple racks in the same TC shall be interconnected with vertical cable managers.

Some IT equipment, such as large LAN switches, require an equipment rack with both front and rear mounting rails. Where space or equipment is limited, an open frame wall mounted equipment rack or enclosed equipment cabinet may be used. Wall mounted racks and cabinets must have two "swing-gates": one for the front access panel and a second for rear access. Provide 36" clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20" from the front rail to the wall; racks must have a minimum of 20" from the front rail to the rear isle workspace. All racks must be equipped with an appropriate number and type or horizontal and vertical wire management modules both front and rear with strain relief brackets to insure proper bend radius and that strain relief is maintained for all cables.

ENVIRONMENTAL PROVISIONING FOR TELECOMMUNICATIONS CLOSETS

Walls and ceiling shall be treated and sealed to eliminate dust. Finishes shall be light in color to enhance room lighting. The floors in all low voltage equipment rooms will be; light colored, fire retardant, slip resistant, and provide protection from electrostatic discharge (ESD). In TCs that contain active electronics equipment (routers, switches, etc.), an HVAC system shall be provided on a 24 hours-per-day, 365 days-per-year basis. If the building system cannot assure continuous operation, a stand-alone unit shall be provided for the TC. The temperature and humidity shall be controlled to provide a continuous operating range of 64°F to 75°F, with 30% to 55% relative humidity. Lighting shall be a minimum of 50-foot candles measures 3 feet above the finished floor in the middle of all aisles between equipment racks and cabinets. Minimum clear height in the TC shall be 8 feet without obstructions. Fire suppression sprinklers shall be equipped with wire cages under the sprinkler heads to prevent accidental discharge. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.

ELECTRICAL PROVISIONING FOR TELECOMMUNICATIONS CLOSETS

Each TC shall be equipped with a minimum of two 20-amp, 110VAC quad (4-plex) electrical outlets, each on its own dedicated circuit breaker. The outlets shall be colored orange, and identified as Technical Power. These outlets shall be used exclusively for electronics equipment. Do not use Technical Power outlets for general-purpose or utility devices such as electric drills, vacuum cleaners, or coffeepots.

The Technical Power circuits should originate from a dedicated power panel serving the TC. However, in small buildings where this may not be cost effective, an available general purpose power panel may be used. The power panel shall not be used to supply power to sources of electromagnetic interference such as large electric motors, arc welding, or industrial equipment. The power panel must be located in the TC, or in close proximity to the TC.

Some IT equipment, such as large LAN switches and routers, are ordered with dual power supplies. The placement of equipment with dual power supplies shall be identified and the appropriate racks must have three, separate, dedicated 20-amp 110VAC electrical circuits from the ER Technical Power panel, each terminated in separate quad (4-plex) outlets, and be appropriately marked to identify the separate circuit breakers.

The TC shall have 20-amp 110VAC convenience outlets placed at 6-foot intervals around the room. White, gray, or beige colored outlets to match all other general purpose outlets in the building shall identify general purpose outlets. These outlets shall not be used to power electronics equipment.

TELECOMMUNICATIONS BACKBOARDS

All walls of the TC shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats light colored, non conductive fire retardant paint prior to mounting anything on the backboard. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the "A" side exposed. Cutouts shall be provided around any existing power and telecommunications outlets. In new construction, power and telecommunications outlets, and light switches in the TC should be surface mounted on the plywood backboard.

CABLE SERVICE LOOPS

Horizontal distribution cables shall be installed with a service loop at one or both ends. The service loop shall have at least 10 feet of slack cable. Care must be exercised so that the service loop does not add excessive length to a cable run beyond the 295-foot distance limitation for horizontal distribution cable, or exceed the bending radius of the cable. The service loop shall be located in the most efficient location for future service depending on the type of cable raceway used. The necessary slack provided by a service loop can be achieved in several aesthetically pleasing methods, including but not limited to:

Routing cables the long way around a backboard or equipment rack.

Placing a service loop in the pull box of a closed conduit system.

Placing the service loop above the false ceiling before dropping down to the outlet location.

27 11 16 EQUIPMENT RACKS AND CABINETS

Planning of the ER layout must make allowances for proprietary equipment and racks, and allow expansion room for future equipment. CCIT has standardized on a general purpose open frame 19-inch wide EIA standard equipment rack with channels measuring 16.25". (Please see appendix I Equipment Specifications for rack and components.). Floor standing equipment racks must always be securely bolted to the floor. Some IT equipment, such as large LAN switches, may require an equipment rack with both front and rear mounting rails. Provide 36" clear work space front, rear, and at one end of each equipment rack for floor mounted racks leaving sufficient front and rear rack footprints for any equipment planned for installation. All racks must have a minimum of 20" from the front rail to the rear isle workspace. In cases of multiple rack installations all fiber optic terminations must be housed in left rack and all UTP terminations housed in right rack. Collaborations between architects, consultants, contractors and CCIT is necessary in planning and placement of all ER/ TC equipment and components.

Where space or equipment is limited, an open frame wall mounted equipment rack or enclosed equipment cabinet may be used. Wall mounted racks and cabinets must have two "swing-gates": one for the front access panel and a second for rear access. Provide 36" clear work space front, rear, and at one end of each equipment rack / cabinet line up for floor mounted racks / cabinets leaving sufficient front and rear rack / cabinet footprints for any equipment planned for installation. All cabinets must have a minimum of 20" from the front rail to the wall; racks must have a minimum of 20" from front rail to the rear isle workspace.

27 13 00 Communications Backbone Cabling

27 13 13 Communications Copper Backbone Cabling

All inter-building OSP Voice (telephone) backbone cable between buildings will be provided by the telephone company.

All intra-building voice backbone cable will consist of 24 AWG, 25, 50 or 100-pair UTP, UL/NEC CMR rated with a gray PVC jacket or CMP if required. Cable shall be third party verified to comply with TIA Category 3 requirements. A coupled bonding conductor will be installed within the riser bundle and bonded and grounded at each end. Voice backbone cabling must provide cabling to extend each single or business line circuit to any communications wall outlet.. A system using Belden/CDT BIX 25-pair multiplying connectors mounted in wall-mount frames will be used at the building demarc in the entrance facility to deliver voice circuits to each TR. A BIX frame with multiplying connectors will use Individual cross-connect jumpers to cross-connect voice circuits from the backbone cabling to the voice cabling cross-connect in each TR. A 25–pair Cat 3 cable will extend the voice circuits from the BIX connectors to RJ45 patch panels mounted in the racks. Standard patch cords will then be used to connect the voice circuit to the appropriate horizontal patch panel connector.

27 13 13.13 Communications Copper Cable Splicing and Terminations

No splices are allowed on any communications cables.

27 13 23 Communications Fiber Backbone Cabling

All intra-building data backbone cabling will consist of one or more of the following types of cable;

12 strand singlemode fiber or 12 strand multimode fiber or Category 6A UTP as specified by CCIT

CCIT's goal is to prepare facilities for migration of networks to Gigabit and higher backbone speeds. Fiber optic cable will be required to support most Gigabit and higher applications in the longer distances encountered in Clemson University networks. Note that cable distances listed in this section refer to the terminated cable length from the patch panel in each TC to the patch panel in the main ER. Specific Clemson University requirements for fiber optic backbones are:

All newly installed fiber optic cable and components for network equipment use must be rated and installed to comply with the IEEE 802.3z 1000Base-X Ethernet Gigabit Standard.
All fiber optic backbone cables shall home-run either through conduit, utilize an interlocking armor outer jacket or induct, from each individual TC to the Main Telecommunications Equipment Room (ER), which houses the data switching equipment.

The standard inter-building fiber optic backbone shall be to install singlemode fiber optic cable to all buildings. All OSP fiber optic cable with loose tube construction installed underground shall be gel filled or be constructed of appropriate waterproofing compounds.

The standard cable size for inter-building fiber optic backbones is 24-strands of singlemode fiber optic cable. Strand count may be increased for specific buildings as required. CCIT will determine the strand count during the design phase. All fiber optic backbones shall have a minimum of 20% spare capacity for all systems planned for use on the backbone.

All newly installed fiber optic cable shall be placed inside fiber optic innerduct. Where space is limited in existing conduit systems innerduct may be omitted. Innerduct shall be used to segregate and identify fiber optic cables in all telecommunications manholes and at all locations where fiber optic cable is exposed.

Fiber optic cables shall always have a minimum 20-foot service loop at the terminating ends and all approved splice points.

All strands of a fiber optic cable must be terminated with connectors and tested per previously sited standards.

CCIT must design the interfaces on the network equipment based on the actual lengths of the backbone cable runs between the telecommunications closets. CCIT must be given the estimated cable length between the fiber patch panels of each TC and the main ER fiber patch panel in the design phase, and the actual cable length as soon as possible in the construction and installation phase.

There shall be no splices in fiber optic cable unless specifically allowed in the CCIT project design and specifications. All splices approved by CCIT must be fusion splices, and there shall never be more than one splice per cable run between the ER and TC.

27 13 23.13 Communications Optical Fiber Splicing and Terminations

CCIT recognizes Corning Cables Systems LANscape solution cables, connectors and hardware as our preferred fiber optic cabling system. Any other fiber optic cable or component must be approved by CCIT before use. All fiber optic cable splicing must be performed by trained technicians using approved parts and procedures as described by Corning Cable Systems SRP's (standard recommended procedures). CCIT requires all singlemode fiber be terminated using LC type connectors. Legacy multimode cables may be terminated on SC or ST type connectors based on the system or equipment being used.

27 13 43 Communications Services Cabling

Other backbone cable installations, consideration shall be given to migrating other low voltage systems such as CATV, CCTV, fire alarm systems, EMS, emergency call boxes and facility control and monitoring systems to the common structured cabling system.

CATV specifics will be provided by current service provider. Necessary contacts will be arranged via CCIT Telecommunications Services.

27 15 00 Communications Horizontal Cabling

In all cases the Clemson University requires cable installed in the horizontal distribution cabling (HDC) environment to support low voltage systems including voice and data, and shall be rated to match the environment it is being installed, either plenum or PVC. Horizontal distribution cable is the cable that routes from the telecommunications closet to the work-area. The standard configuration for CCIT is to route a minimum of two (2) - 4 pair Category 6A UTP cables to each work area outlet. In all new installations, Category 6A UTP cable shall be used for both voice and data. Where additions are made to existing buildings, Category 6 UTP cable may be used for voice and data. Splitting cable pairs from one cable to two or more outlets to avoid adding an additional four (4)-pair cable is not allowed—no exceptions. The addition of spare Information Outlet jacks at any given work area, or the addition of spare Information Outlet locations on several walls of a room, is encouraged within the limitations of the project budget.

All horizontal distribution copper cable and components for LAN use at new or refurbished Clemson University buildings, and Clemson University-owned facilities, must be rated and installed to support the IEEE 802.3an Augmented Category 6 (Cat 6A) standard.

All horizontal cabling will consist of AMP Net Connect cable, patch panels and connectors as listed in the approved parts appendix A.

27 15 23 Communications Optical Fiber Horizontal Cabling

Clemson University does not currently use fiber optic cable for horizontal installations.

27 15 33 Communications Coaxial Horizontal Cabling

CCIT Network Services does not design, specify, deploy or maintain CATV coax cabling. System to be installed by others.

27 15 43 Communications Faceplate and Connectors

Standard faceplates are TE Connectivity SL Series faceplates and inserts or 110Connect single and double gang faceplates –either type is acceptable - standard color is almond. Communications outlets are typically within 3 feet of an electrical outlet and installed at the same height, unless otherwise specified. Communications outlets should be placed so that the work area or workstation cable does not exceed 5 meters (16 ft) in length. This length is figured into the total horizontal cabling length and must not be exceeded.

All modular jacks shall be unkeyed, unshielded, 4-pair, RJ-45, and shall fit in a .790" X .582" opening. Modular jacks shall terminate using 110-style pc board connectors, color-coded for both T568A and T568B wiring. Each modular jack shall be wired to T568B. The 110-style insulation displacement connectors shall be capable of terminating 22-24 AWG solid or 24 AWG stranded conductors. The insulation displacement contacts shall be paired with additional space between pairs to improve crosstalk performance. Modular jacks

shall utilize a secondary PC board separate from the signal path for crosstalk compensation. Each modular jack shall meet the Category 6A performance standards and the requirements. The jack color will be orange unless otherwise specified.

Modular jacks shall be compatible with the TE CONNECTIVITY SL Series Modular Jack Termination Tool part number 1725150-1. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination. Modular jacks shall be UL Listed under file number E81956. See approved parts list at end of document.

27 16 00 Communications Connecting Cords, Devices, and Adapters

27 16 19 Patch Cords, Station Cords and cross connect wire

Cross-connects in the TR will be done by using patch cords to connect a jack on the horizontal cabling system Category 6A patch panel to the appropriate service connector or electronics. Clemson University Network Services will install all data equipment cables and patch cords used in the TR for data connectivity and install them as well as the network equipment. The cost for the patch cables will be included in the total cost for all IT equipment specified by CCIT.

Voice cross-connects for dial tone will be made here using standard cross connect wire. All voice system cross-connects will be done by Clemson University Telecommunications technicians. Any other system cross-connects must be clearly labeled, identified and provided by that system provider.

Because UTP cable is protected from cross talk and immunity from EMI through the cables pair twist and lay configuration, care must be taken to maintain the minimum bend radius (4 times the cable diameter) of the copper patch cords. All patch cords must be certified by the manufacturer to match the cable type used in the horizontal distribution.

Field terminated patch cords are not acceptable. Previously, it has been common practice to assemble patch cords in the field using leftover solid-conductor cable. Field assembled patch cables will not perform to Category 6A standards, frequently do not perform to Category 5 standards, and cannot be tested for proper performance using currently available field testing equipment. Patch cables shall always be made from stranded copper wire to withstand the flexing associated with patch cords. **Any existing field assembled patch cords shall be replaced with factory assembled Category 6A patch cords. Do not attempt to use Category 5 patch cords for Category 6A connections.**

27 20 00 Data Communications

27 21 00 Data Communications Network Equipment

CCIT will specify and install all network equipment necessary for data communications. Budgetary estimate for network equipment and hardware will be determined during the design phase. If this equipment is to be ordered through the contract it must be pre-approved by CCIT Telecommunications Services.

27 30 00 Voice Communications

27 32 13 Telephone sets

CCIT will work with building owner to specify and install all telephone equipment necessary for voice communications. Budgetary estimate for telephone equipment and hardware will be determined during the design phase. If this equipment is to be ordered through the contract it must be pre-approved by CCIT Telecommunications Services.

27 32 23 Elevator Telephones

Contact Clemson University Telecommunications for information on elevator phones.

27 32 26 Ring-Down Emergency Telephones

Contact Clemson University Telecommunications for information on emergency phones.

27 40 00 Audio-Visual Communications

CCIT Network Services and Telecommunications does not design, specify or install Audio-Video Communications systems or devices. Contact CCIT Classroom Technologies for information on A/V systems.

Appendix A - Approved parts list

The following table lists the most commonly used components of the TE CONNECTIVITY Category 6A copper horizontal cabling system and the CORNING Cable Systems LANscape fiber backbone system. Both systems contain too many parts to list them all in this document. Consult the manufacturer's web sites for the most current item descriptions and part numbers. For campus compatibility, commonly used structured cabling system components such as racks, ladder rack, cable tray, J-Hooks, cable management and other associated hardware should be manufactured by Cooper B-Line. Any substitutions must be approved by Clemson University.

Manufacturer	Description	Part Number
TE Connectivity	***CAT 6A SHIELDED MATERIALS***	
	Cat 6A Plenum Shielded Cable 1000ft	TE640PF-BL02
	Cat 6A Non-Plenum Shielded Cable 1000ft	TE640RF-BL02
	Cat 6A Shielded Patch Panel 24 port	1933319-2
	Cat 6A Shielded Patch Panel 48 port	1933320-2
	Cat 6A Shielded Jack Modular W/O dust cover	1711342-2
	Cat 6A Shielded Jack Modular W/ dust cover	1711160-2
	Cat 6A Shielded Patch cord 568B 4ft	TCPC-6ARFVB-BL04F
	Cat 6A Shielded Patch cord 568B 7ft	TCPC-6ARFVB-BL07F
	Cat 6A Shielded Patch cord 568B 10ft	TCPC-6ARFVB-BL10F
	Cat 6A Shielded Patch cord 568B 25ft	TCPC-6ARFVB-BL25F
	Cat 6A Shielded Patch cord 568B 50ft	TCPC-6ARFVB-BL50F
	CAT 6A UN-SHIELDED MATERIALS	
	Cat 6A Plenum Cable 1000ft	TE640P-BL02
	Cat 6A Non-Plenum Cable 1000ft	TE640R-BL02
	Cat 6A Patch Panel 24 port	2111570-1
	Cat 6A Patch Panel 48 port	2111571-1
	Cat 6A Jack Modular Almond	1933476-1
	Cat 6A Jack Modular Black	1933476-2
	Cat 6A Jack Modular Orange	1933476-5
	Cat 6A Jack Modular Blue	1933476-6
	Cat 6A Jack Modular Violet	1-1933476-0
	Cat 6A Jack Modular Ivory	1-1933476-1
	Cat 6A Jack Modular White	1-1933476-3
	Cat 6A Patch cord 568B 4ft	TCPC-6ARUVB-BL04F
	Cat 6A Patch cord 568B 7ft	TCPC-6ARUVB-BL07F
	Cat 6A Patch cord 568B 10ft	TCPC-6ARUVB-BL10F
	Cat 6A Patch cord 568B 25ft	TCPC-6ARUVB-BL25F
	Cat 6A Patch cord 568B 50ft	TCPC-6ARUVB-BL50F
	CAT 6 MATERIALS	
	Cat 6 Plenum Cable 1000ft	TE620P-BLII
	Cat 6 Non-Plenum Cable 1000ft	TE620R-BLII
	Cat 6 Patch Panel 24 port	1375014-2
	Cat 6 Patch panel 48 port	1375015-2
	Cat 6 Jack Modular (X-denotes color)	1375055-X
	Cat 6 Patch Cord 568B 4ft (XX-Denotes color)	TCPC-6RUVB-xx04F
	Cat 6 Patch Cord 568B 7ft (XX-Denotes color)	TCPC-6RUVB-xx07F
	Cat 6 Patch Cord 568B 10ft (XX-Denotes color)	TCPC-6RUVB-xx10F
	Cat 6 Patch Cord 568B 25ft (XX-Denotes color)	TCPC-6RUVB-xx25F
	Cat 6 Patch Cord 568B 50ft (XX-Denotes color)	TCPC-6RUVB-xx50F
	UNIVERSAL PRODUCTS Shielded & Non-Shielded	
	24 port Patch Panel EMPTY	1933307-1
	1 port Faceplate (X-Denotes Color)	2111008-X
	1 port Wall Phone Plate w/Luggs White	1-1479152-3
	2 port ANGLED Faceplate (X-Denotes Color)	1375155-X
	2 port Faceplate (X-Denotes Color)	2111009-X
	3 port Faceplate (X-Denotes Color)	2111010-X

	4 port ANGLED Faceplate (X-Denotes Color)	406185-X
	4 port Faceplate (X-Denotes Color)	2111011-X
	4 port Faceplate Dual Gang (X-Denotes Color)	83935-X
	6 port Faceplate Dual Gang (X-Denotes Color)	83936-X
	12 port Faceplate Dual Gang (X-Denote Color)	2111015-X
	Extender Kit - Single Gang (X-Denotes Color)	2111201-x
	Surface Mount Box Dual Gang (X-Denotes Color)	569499-X
	2 port 106 Mounting Kit (X-Denotes Color)	116618-X
	4 port 106 Mounting Kit (X-Denotes Color)	1339120-X
	2 port Furniture Faceplate 569-B Standard	558106-2
	2 port Surface Mount Box (X-Denotes Color)	1933668-X
	Blanks (X-Denotes Color)	1116412-X
	F-Connector Coupler (X-Denotes Color)	1499855-X
	Vertical Manager - 10" Wide	1933535-1
	Horizontal Wire Manager 2U Front/Back	1933533-1
	Category 6 UTP Cable, 4-Pair, Riser (CMR) rated, 23AWG, **Blue**, reel-in-box	219560-6
	Category 6 UTP Cable, 4-Pair, Plenum (CMP) rated, 23AWG, **Blue**, reel-in-box	219567-6
	Category 6 SL Series 110Connect Modular Jack, Unshielded (x=color) 2=Black, 3=White, 4=Gray, **5=Orange**, 10=Violet, Standard color is -5 - Orange	1375055-x
	Category 6 SL Series 110Connect Modular Jack, Shielded, 180° (Rear) Entry Shield	1375188-x
	Category 6 SL Series 110Connect Modular Jack, Shielded, 90° (Side) Entry Shield	1479552-x
	SL Series Patch Panel, Category 6, 24-port, 1U (1.75"), Universal Wiring (T568A/T568B)	
	SL Series Patch Panel, Category 6, 12-port, Universal Wiring (T568A/T568B)	
	SL Series Modular Jack Termination Tool	1725150-1
Corning Cable Systems	Closet Connector Housing, 2U tall	CCH-02U
	Wall-Mountable Connector Housing, accepts up to two CCH connector panels	WCH-02P
	Wall-Mountable Connector Housing, accepts up to four CCH connector panels	WCH-04P
	Closet Connector Housing (CCH) Panel, LC adapters, Duplex, UPC, 24 F, Single-mode (OS2)	CCH-CP24-A9
	Closet Connector Housing (CCH) Panel, LC adapters, Duplex, 12 F, 62.5 µm multimode (OM1)	CCH-CP12-A8
	UniCam® High-Performance Connector, ST® Compatible, 62.5 µm multimode (OM1), ceramic ferrule, logo, single pack, amber housing, beige boot	95-000-51
	Closet Connector Housing (CCH) Panel, pigtailed, ST ® Connectors, MM, 62.5 (OM1)	CCH-CP06-5T-P03KH
	UniCam® High-Performance Connector, LC, Single-mode (OS2), ceramic ferrule, logo, single pack, blue housing, blue boot	95-200-99
	Closet Connector Housing (CCH) Panel, pigtailed, LC Connectors, UPC, 24F, SM (OS2)	CCH-CP12-A9-P03RH
Cooper B-Line	7 and 8 foot tall, 19 inch wide, free-standing racks, Aluminum with black finish	
	36 and 48 inch high x 19 inch wide wall-mount racks	
	Horizontal and vertical cable management	
	Ladder rack, cable tray, basket tray and other cable support hardware	
	Clamps, brackets, J-hooks and miscellaneous hardware	

1.01 DEVIATION FROM LISTED SPECIFICATIONS OR MANAFACTURES MUST BE PRE-APPROVED BY CCIT AS PER SECTION 27 01 00. 2.01 NOT ALL OF THE FOLLOWING ITEMS WILL BE APPLICABLE TO ALL PROJECTS. PRIOR TO ORDER CONTRACTOR MUST SUBMIT, FOR APPROVAL FROM CCIT, A COMPLETE LIST OF MATERIALS FOR THE PROJECT. 3.01 OTHER ITEMS MAY BE REQUIRED FOR SPECIFIC CONTRACT; IF ITEM IS NOT ON FOLLOWING LIST IT MUST BE PRE-APPREOVED BY CCIT.

Faceplates

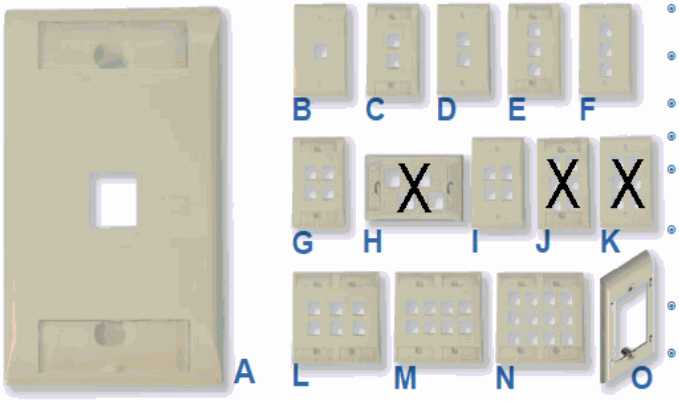
With its new modern design, Tyco Electronics faceplates improve the appearance of outlet areas that house data, telephony and A/V connectors in everything from classrooms and hospitals to offices and homes. Our new faceplates offer more color options than ever before, molded icon slots and convex labels for maximum visibility in low density areas.

Engineered for residential and commercial applications, our sleek, updated faceplates offer several features not available with traditional models. For starters you get a wide range of port configurations, including single gang in 1, 2, 3, 4 and 6-port configurations and double gang in 6, 8 and 12-port configurations.

Modern, Sleek Design

Our new faceplates come with a sleek 2 ¾ x 4 ½ profile. They accommodate AMP-TWIST and SL Series jacks including unshielded and shielded versions. And they also accept SL Series multimedia inserts and SL Series fiber inserts (MT-RJ, LC).

Faceplates



- Compatible with AMP-TWIST jacks, SL Series jacks, MT-RJ outlet jacks and SL Series inserts
- Faceplate dimensions: 2.75 in [69.85 mm] x 4.5 in [114.30 mm] x 0.22 in [5.59 mm]
- Models available with and without labeling options
- Labeling models feature mold-over icon and leveling
- Improved label viewing area is larger with integrated, convex label covers that flip down and snap in place
- Larger radius on the faceplate edge and the convex shape of the label covers allow labels to be more easily viewed from above when faceplates are behind furniture
- Extender kits are used to add 0.5 inches of space between the mounting surface and the faceplate
- Extender kit dimensions: 5.21 in [132.33 mm] x 2.89 in [73.50 mm] x 0.50 in [12.70 mm]

Port Count	Footprint	Integrated Labeling Options	Orientation	Figure	Part Number					
					Almond	Black	White	Gray	Electrical Ivory	Alpine White
1	Single Gang	Label Covers and Icons	Vertical	A	2111008-1	2111008-2	2111008-3	2111008-4	1-2111008-1	1-2111008-3
		None	Vertical	B	2111021-1	2111021-2	2111021-3	2111021-4	1-2111021-1	1-2111021-3
2	Single Gang	Label Covers and Icons	Vertical	C	2111009-1	2111009-2	2111009-3	2111009-4	1-2111009-1	1-2111009-3
		None	Vertical	D	2111022-1	2111022-2	2111022-3	2111022-4	1-2111022-1	1-2111022-3
3	Single Gang	Label Covers and Icons	Vertical	E	2111010-1	2111010-2	2111010-3	2111010-4	1-2111010-1	1-2111010-3
		None	Vertical	F	2111023-1	2111023-2	2111023-3	2111023-4	1-2111023-1	1-2111023-3
4	Single Gang	Label Covers and Icons	Vertical	G	2111011-1	2111011-2	2111011-3	2111011-4	1 2111011-1	1 2111011-3
			~~Horizontal~~	~~H~~	~~2111203-1~~	~~2111203-2~~	~~2111203-3~~	~~2111203-4~~	~~1-2111203-1~~	~~1-2111203-3~~
		None	Vertical	I	2111024-1	2111024-2	2111024-3	2111024-4	1-2111024-1	1-2111024-3
6	~~Single Gang~~	~~Label Covers and Icons~~	~~Vertical~~	~~J~~	~~2111012-1~~	~~2111012-2~~	~~2111012-3~~	~~2111012-4~~	~~1-2111012-1~~	~~1-2111012-3~~
		~~None~~	~~Vertical~~	~~K~~	~~2111025-1~~	~~2111025-2~~	~~2111025-3~~	~~2111025-4~~	~~1-2111025-1~~	~~1-2111025-3~~
	Double Gang	Label Covers and Icons	Vertical	L	2111013-1	2111013-2	2111013-3	2111013-4	1-2111013-1	1-2111013-3
8	Double Gang	Label Covers and Icons	Vertical	M	2111014-1	2111014-2	2111014-3	2111014-4	1-2111014-1	1-2111014-3
12	Double Gang	Label Covers and Icons	Vertical	N	2111015-1	2111015-2	2111015-3	2111015-4	1-2111015-1	1-2111015-3
Extender Kit				O	2111201-1	2111201-2	2111201-3	2111201-4	1-2111201-1	1-2111201-3

typical Clemson faceplate color

NOTE:
use of single gang faceplates with 6 or more ports is not recommended

AMP NETCONNECT

Tyco Electronics
Our commitment. Your advantage.

Home < Products < Outlets, Faceplates, and Accessories < Faceplates, Faceplate Modules and Mounting Straps < Faceplates < 2111011-X

2111011-X Cut Sheet

Faceplate, 4-Port, Single Gang, with Label Covers and Icons

1st floor
North
Rack 1
Panel A
positions 1 & 2

1st floor
North
Rack 1
Panel A
positions 3 & 4

Typical Clemson labeling scheme

1st floor
North
Rack 1
Panel A
positions 1 & 2

1st floor
North
Rack 1
Panel A
positions 3
& Panel N
position 23

Typical Clemson labeling scheme w/added cable later on

Part Number Information

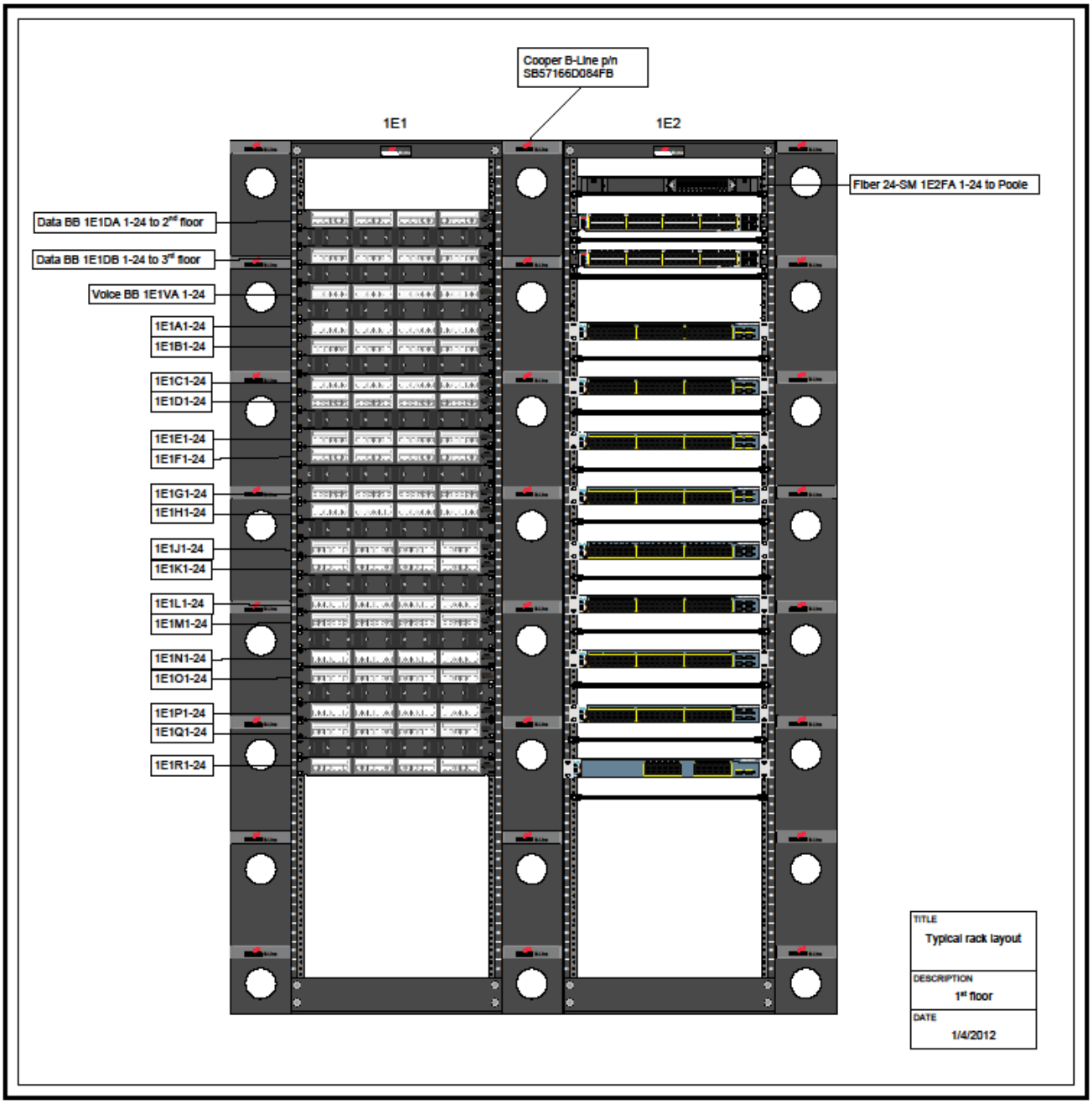
Detail	Data	
Description	Faceplate	
Port Count	4	
J-Box Width	Single Gang	
Labeling Options	with Label Covers and Icons	
Variation Description	Color	RoHS Compliance
2111011-1	Almond	ALWAYS EU ROHS/ELV COMPLIANT
2111011-2	Black	ALWAYS EU ROHS/ELV COMPLIANT
2111011-3	White	ALWAYS EU ROHS/ELV COMPLIANT
2111011-4	Gray	ALWAYS EU ROHS/ELV COMPLIANT
1-2111011-1	Electrical Ivory	ALWAYS EU ROHS/ELV COMPLIANT
1-2111011-3	Alpine White	ALWAYS EU ROHS/ELV COMPLIANT

Technical Data

Detail	Data
Materials	Faceplate - Polycarbonate molding compound, colored Screws - Zinc plated carbon steel Label Cover - Polycarbonate molding compound, clear Label - White index paper
Height	4.5 in [114.3 mm]
Width	2.75 in [69.85 mm]

Need Help?
Inside the USA: Call 800.553.0938 or email us
Outside the USA: AMP NETCONNECT Worldwide

Typical telecom room rack layout



ATTENTION ELECTRICIANS, TELECOMMUNICATIONS AND FURNITURE CONTRACTORS

Tombstones
Polk-Throughs
In floor boxes
Modular Furniture
Careful consideration must be taken when purchasing these items.
Not all bezels are compatible with Tyco TE Connectivity modular jacks. Do not install incompatible fixtures where Telecommunications outlets are required.

END OF DIVISION 27