Vanderbilt University
Intrabuilding Communications Wiring
Specifications

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<td>Dec. 1, 2006</td>
<td>• Update of horizontal cabling (inside wiring) from two Cat 6 and one Cat 3 cables pulled to each faceplate to three ‘universal cables’ (three Cat 6) (pages 9, 25)</td>
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<td>• Increased CER and BER sizes to accommodate floor space usage (voice cabling will be rack-mounted) (page 4)</td>
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<td>• Revised overhead and rack elevation drawings to reflect changes in wiring termination type and migration to rack (pages 29, 41-46)</td>
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<td>• Updated wording prohibiting cable tray design through occupied spaces such as labs, offices and classrooms (page 14)</td>
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<td>• Updated wording requiring card access installation on some CER/BER doors (to be determined by NCS/ITS) (page 6)</td>
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<td>• Change of multi-mode fiber optic cable to be 50micron instead of 62.5micron (page 16)</td>
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<td>• Update of Systimax part numbers (pages 19, 25-26)</td>
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<td>• Addition of Variance form (page 52)</td>
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<td>• Update of patch cable color chart to add wireless AP color code (page 20)</td>
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<td></td>
<td>• Addition of paragraph (page 3) stating the necessity of including Division 17 components in project documentation and pricing.</td>
<td></td>
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<tr>
<td>Aug. 24, 2007</td>
<td>• Update of patch cable color chart to remove “VOIP” from the orange description (page 20)</td>
<td>Wiring Std. Committee</td>
</tr>
<tr>
<td></td>
<td>• Added four-post rack part number (page 48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Change in fiber termination, add table (page 35)</td>
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</tbody>
</table>
GENERAL DESCRIPTION

The information in this document shall be used as a guideline for the design of all intrabuilding communications wiring. It is intended for use by Architects, Engineers, and Contractors to guide the design, placement, size and quantity of communications connections, faceplates, conduit, cable trays, raceways, CERs and BERs. All projects will require custom design of these components to meet the specific architectural program for the building with representatives from ITS and/or NCS for University and/or Medical Center projects, respectively.

All telecommunications components must be included in the project by the Contractor.

The Communications Sub-Contractor must be on the approved vendor list determined by and available through Information Technology Services (ITS) and Network Computing Services (NCS). ITS manages the voice and data networks for the University and the voice network for the Medical Center. NCS manages the data network for the Medical Center.

Pathways (i.e. conduit, cable tray, raceway) and supporting spaces (i.e. Building Entrance Room, Communications Equipment Rooms) shall be designed to support three communications connections for every 75 net assignable square feet. Exceptions will be considered when they are cost effective such as in lab or theater environments, child care, housing or athletic facilities with appropriate approval by an authorized representative of the Owner.

For any information that is not covered in the following guidelines, refer to the appropriate industry standard as listed below.

STANDARDS
American National Standards Institute, Inc. (ANSI)
National Electrical Safety Code
X3T9.5

Federal Communications Commission (FCC) Publications
FCC Rules and Regulations - Part 15
FCC Rules and Regulations - Part 68

Occupational Safety and Health Act of 1970 (OSHA)
Public Law 91 - 596

Insulated Cable Engineers Association (ICEA) Standard
ICEA S - 80 - 576

National Fire Protection Association (NFPA)

Institute of Electrical and Electronics Engineers, Inc. (IEEE)
National Electrical Safety Code
800 Series Standards

Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)
RS Series Standards

International Telecommunications Union (ITU), formally CCITT
I Series Standards

VOICE AND DATA COMMUNICATIONS ROOMS

DESCRIPTION

The Building Entrance Room is the room in which the joining of the intrabuilding and the interbuilding cabling takes place. All incoming cable, both voice and data will be terminated in this room. The Entrance Distribution Frame (EDF) for voice services shall be located in this room. This room may also function as a Communications Equipment Room. If this is the case, then all of the specifications for a Communications Equipment Room will join with the specifications for a Building Entrance Room as applicable to the shared facility.

The Communications Equipment Room (CER) is a centralized space for the telecommunications equipment, data equipment and network interface devices that serve the occupants of the building. For flexibility as well as serviceability, it is desirable to have a Communications Equipment Room on each floor.

EXECUTION

A CER shall be less than 285 wiring feet from the communications faceplate that it will serve.

The size of building entrance communications rooms shall be determined by the following:

<table>
<thead>
<tr>
<th>Building Entrance Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Size (Gross Square Footage Served)</td>
</tr>
<tr>
<td>Up to 100,000 sq. ft.</td>
</tr>
<tr>
<td>100,001 to 200,000</td>
</tr>
<tr>
<td>200,001 to 400,000</td>
</tr>
<tr>
<td>400,001 to 500,000</td>
</tr>
<tr>
<td>500,001 to 600,000</td>
</tr>
<tr>
<td>600,001 to 800,000</td>
</tr>
</tbody>
</table>

Note that special use buildings (i.e. labs, theater environments, child care and athletic facilities) may be sized with more flexibility. This will be determined during the design phase by representatives from ITS and NCS.

Communications Equipment Room

The minimum size of a CER shall be 10 feet by 14 feet, preferably on each floor; however, the communications equipment that is actually required for the building may increase the size of the CER or allow for one CER to
support multiple floors with the approval of ITS and/or NCS. Due to the physical space requirements for patch cords and electronics, the maximum number of work area spaces that any given CER can handle is 384. This translates to 28,800 square feet of net assignable square footage based upon a standard of 3 communications connections for each 75 net assignable square foot. Some buildings will be designed with less density of communications outlets due to the building’s function. These special function buildings shall be reviewed by the architect, engineer and ITS/NCS representative for special design. A larger CER or multiple CERs will be necessary if this number is exceeded. Also, a floor may require multiple equipment rooms if, based on the wiring pathway, any communications faceplate is more than 285 wiring feet from the Communications Equipment Room.

Note: Any future equipment needs shall be included in the sizing of the Communications Equipment Room. Any additional equipment such as security panels, Matrix equipment or servers that is planned for the CER may necessitate a larger room. For Medical Center buildings the final room size shall be determined during design with Information Technology Services (ITS) and Network Computing Services (NCS). For University buildings the final room size shall be determined during design with ITS.

The minimum height of the ceiling in Communications Equipment Rooms shall be no less than 8 feet 6 inches. There shall be no false ceilings within the Building Entrance Room and Communications Equipment Room. Obstructions such as lighting fixtures, air ducts and cable trays shall be no less than 90 inches from the floor throughout the rooms. Cable tray shall be placed no more than 12 inches from the top of the equipment racks and cabinets. There shall be no obstructions within 12 inches of the top of the cable tray. The walls of the room shall have a minimum 1 hour-rating.

The Building Entrance Room shall be located close to where the voice and data cables actually enter the building; it must connect to both the entrance cable pathway and the building backbone pathway. The ideal location would be within 50 feet of the building cable entrance point (may be 50 feet from the point that the cable exits the continuous entrance conduit) and situated on either the ground floor or in the basement. This location should provide accessibility for the delivery of large equipment. The BER shall have a minimum 1 hour-rating.

The Communications Equipment Room(s) shall be vertically aligned with the building’s vertical riser(s) system. This room should be located in the center of the space that it serves to minimize wiring distances from the room to the communications faceplates. The room must be connected to the building backbone pathway. The location shall provide accessibility for the delivery of large equipment. These rooms shall be
used for the communications equipment only; it is to be separate from
the spaces used for such things as building electrical services,
building mechanical services, janitorial services and general storage.
Access to Communication Equipment Rooms shall not be through any other
room.

Building Entrance Rooms and Communication Equipment Rooms have special
power and HVAC requirements. For details on these requirements, see
section 16740 and 16800.

A ¾ inch conduit shall be provided from the main building grounding
electrode to the Building Entrance Room and to each Communications
Equipment Room from the Building Entrance Room. A #6 AWG wire shall be
installed to the main building grounding electrode and terminated on a
bus bar mounted in the Building Entrance Room. This bus bar shall be
the Telecommunications Main Grounding Busbar (TMGB) and have minimum
dimensions of 6 mm thick x 100 mm wide and variable in length depending
on the number of connections required. A #6 AWG wire shall be
installed from the TMGB in the building entrance room to a bus bar in
each CER. This bus bar shall be the Telecommunications Grounding Bus
bar (TGB) and have minimum dimensions of 6mm thick x 50 mm wide and
variable in length to meet the application requirement with
consideration of future growth. All bus bars shall be predrilled with
standard NEMA bolt hole sizing and spacing for the type of connectors
to be used. Position the ground bus bars horizontally, low on the
telecommunications backboard without obstructing the path of future
riser or station cables. Route ground wire near the edges of the
backboard preserving unobstructed mounting surfaces for other use. The
exact location of the TMGB and the TGBs are to be shown on shop
drawings provided to the Project Manager 30 days prior to construction
start.

BERs and CERs shall be keyed as per ITS/NCS requirements. Some CERs
and BERs may require card reader access and this will be determined
during the design development (DD) phase of the project by ITS/NCS. If
decided that the door will not be constructed with card reader access
initially, all doors shall have the capability of adding card readers
and electronic door strikes.

Rooms requiring card access must have passive door hardware (lockset
with storeroom function) installed such that the lock can be disabled
upon the activation of the card reader system. Rooms not requiring
card access must have rigid door hardware installed such that the lock
is always engaged. When adding a door to the card access system, the
rigid door hardware shall be replaced with passive door hardware
(lockset with storeroom function).

Doors to access the rooms shall be as follows:

The Building Entrance Room shall have double doors, each a
minimum of 36 inches wide and 80 inches high and constructed
without a doorsill or a center post. The Communications
Equipment Rooms shall have a single 36 inch wide door.

All doors providing access to the CER/BER shall be hinged to swing
outward or the room size increased to accommodate interior door swing
to allow greater usable floor space.

The floors, walls and ceiling shall be painted or sealed to eliminate dust. The flooring materials should have anti-static vinyl tile. False ceilings shall not be used.

Adequate RF shielded fluorescent lighting shall be provided.

Appropriate fire detection and suppression equipment shall be provided.

All state and local codes must be followed.

Shop drawings shall be presented to the Owner that provide equipment room layouts at least 30 days prior to the start of work.

BACKBONE PATHWAYS

DESCRIPTION
The Backbone Pathway is comprised of all the connecting paths between buildings, the Communications Equipment Rooms and the Building Entrance Room. In support of redundant cabling, there may be multiple paths between the various Communications Equipment Rooms. The Backbone Pathway includes the access path to the Building Entrance Room.

All buildings shall be designed as to accommodate dual entrance points of fiber. A single entrance shall be made in those buildings considered non-patient care with provisions for a second entrance for diversity from another building or area. The entrance point shall be separate as to provide the physical as well as logical redundancy.

EXECUTION
Telecommunications voice cables installed in the backbone shall be sized based on either:

- a. ten pairs per 1000 net assignable square feet
- b. the exact amount of cable pairs required based on known and future requirements, plus ten percent.

Note: The size of cable shall be determined by the method that yields the larger cable.

All conduit sizes, quantities and paths for entrance cables must be determined during building design. A general guideline follows:

<table>
<thead>
<tr>
<th>Entrance cable size (pairs)</th>
<th>Conduit quantity and size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1000</td>
<td>One 4”</td>
</tr>
<tr>
<td>1001-2000</td>
<td>Two 4”</td>
</tr>
<tr>
<td>2001-3000</td>
<td>Three 4”</td>
</tr>
<tr>
<td>3001-5000</td>
<td>Four 4”</td>
</tr>
<tr>
<td>5001-7000</td>
<td>Five 4”</td>
</tr>
<tr>
<td>7001-9000</td>
<td>Six 4”</td>
</tr>
</tbody>
</table>
There must be a minimum of three additional 4" conduits installed for other services (one for data, one for the local service provider and one spare). The above is only a guide, all cable plans must be approved by ITS (University) or NCS and ITS (Medical Center).

When linking Communications Equipment Rooms and/or the Building Entrance Room, a minimum of two four inch conduits or sleeves for every 50,000 net assignable square feet serviced shall be installed for voice and data plus one additional four inch conduit for spare. If a slot/chase is used, it must provide comparable capacity.

The Vertical Riser shall be within or adjacent to a Communications Equipment Room or a Building Entrance Room.

The Backbone Pathway shall not be located in an elevator shaft or stairwell.

HORIZONTAL PATHWAYS

DESCRIPTION
Horizontal Closet-tie Pathways provide a function similar to the Vertical Riser. This pathway is required when:
1. There are multiple Communications Rooms on a single floor that are not all serviced by a Vertical Riser.
2. All Communications Rooms are not vertically stacked.

The Horizontal Distribution Pathways to the workstations are the facilities to support the communications cabling from its final distribution point to the communications connector.

PRODUCTS
For j-supports, use Erico Caddy CableCat Wide Base Cable Support, Cat 12, or equivalent approved by the Vanderbilt Wiring Standard Committee.

For cable tray specifications, see section 16114, Cable Trays.

EXECUTION
The Horizontal Closet-tie Pathway shall be a minimum of one four inch conduit for every 50,000 net assignable square feet serviced for voice and data plus one additional four inch conduit for spare. If an open cable tray is used, it must provide comparable capacity.

The Horizontal Distribution Pathway shall be a system of trough-type trays with louvered bottom openings, spreading outward from the distribution point to cover the entire area of service. Where hard ceiling is designed, continuous conduit must be provided through the inaccessible section from one accessible ceiling area to the next. This design must be approved by NCS and ITS representatives and noted on as-builts.

The design of the Horizontal Distribution Pathway shall provide a grid that efficiently services all designated areas. The minimum requirement for this pathway is a system of corridor cable trays beginning at the CER/BER, connected by a series of “J-Hooks” (located on 48 to 60 inch
centers) to the 1” conduit stub-out from the outlet box to the ceiling above the outlet box. An alternative to the above plan is 1” continuous conduit from the corridor cable tray all the way to the outlet box. Requirements for placing continuous 1” conduit from the cable tray to the outlet box are noted below. Each project’s horizontal distribution pathway system shall have the approval of the Wiring Standard Committee.

1. Horizontal distribution pathways that house cables associated with patient monitoring
2. Horizontal distribution pathways potentially exposed to a high level of electromagnetic interference
3. Horizontal distribution pathways in an area with non-accessible ceilings
4. Any horizontal distribution pathway defined as requiring conduit by the Project Manager or the Wiring Standard Committee

Cable tray sizing shall be calculated using one square inch of cross-sectional area of tray per 75 net assignable square feet.

Where transitions to conduit are required, the capacity of the conduit shall match the capacity of the cable tray on either side so as not to create a bottleneck.

The minimum density for communications wiring should be calculated at a rate of one faceplate for every 75 net assignable square foot. One faceplate shall have three Cat 6 communications cables. Exceptions to this density of outlets and configuration of faceplates are acceptable in special use buildings with the approval of ITS/NCS.

Note: Refer to section 16145 for details on cable termination and faceplate configurations.
GENERAL

COMMUNICATIONS MATERIAL STANDARDS
Supply communications equipment specified in Division 16 in accordance with the standards listed below.
- American National Standards Institute, Inc. (ANSI) X3T9.5
- Federal Communications Commission (FCC) Publications
  - FCC Rules and Regulations - Part 15
  - FCC Rules and Regulations - Part 68
- National Fire Protection Association (NFPA)
  - Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)

QUALITY ASSURANCE
Comply with applicable local, state, and federal codes.

STORAGE AND HANDLING
The Contractor shall be responsible for the receipt, safe storage and delivery of communications materials and equipment to the job site until the Owner accepts the equipment.

Ship and store all communications products and materials in a manner that will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement.

The Contractor shall not be provided payment for materials until a certificate of insurance is provided by the Contractor to the Owner, with the Owner as the insured.

PRODUCTS
All communications material and equipment furnished shall be new and unused and free from defects. They shall be clean and free of damage or corrosion and shall be of the best quality obtainable for the purpose intended.

All communications materials used shall be listed by the Underwriters' Laboratory, Inc. where available. When such listing is not available for a piece of equipment, it will be accepted provided it is furnished in accordance with submittals and is approved by the Owner.

Under carpet communication cabling systems shall not be used.

EXECUTION
The installation of communications equipment shall be in compliance with the requirements of the NEC, OSHA, EIA recommendations and the rules, regulations and requirements of the FCC.

The installation shall comply with federal, city, county and state laws, ordinances, regulations and codes applicable to the installation.
The Contractor shall assume all responsibility of unacceptable test results as noted elsewhere in these documents.

The Contractor shall submit proposed product information to the Project Manager within 30 days of construction start.
EXECUTION

Provide approved pathways for all communications wiring.

A conduit that will house communications conductors shall be at least 1 inch in size. The conduit should be sized appropriately in accordance with the EIA/TIA 569A.

A conduit that will house communications conductors shall not be longer than 100 feet or contain more than two 90-degree bends, or equivalent, between pull points or pull boxes. When pull boxes or junction boxes in the Horizontal Pathway are necessary, they should be positioned directly above the faceplate for predictability.

A conduit that will house communications conductors shall have an inside bend radius of at least six times the internal diameter of that conduit. For conduit sizes that are greater than two inches, the inside radius shall be ten times the internal diameter of the conduit.

A conduit that will house fiber optic conductors shall have an inside bend radius of at least ten times the internal diameter of the conduit.

A conduit that will house communications conductors shall be terminated with an insulated bushing to prevent damage to the conductor during installation.

All conduits and innerduct installed for communications cable must be installed with a nylon pull cord.

All communications cable, j-supports (J-Hooks), conduit and trays shall be supported to the structure, independent of other services.

Flexible conduit shall not be used for the installation of communications conductors without prior approval of the Owner.

All fiber optic cable and pathways shall be clearly identified as housing fiber optic cable at intervals not greater than 50 feet.

All conduits that are larger than two inches and will house fiber optic cable must be filled with innerduct or MaxCell equivalent cells prior to the installation of the fiber optic cable. See the following table:

<table>
<thead>
<tr>
<th>Conduit Size</th>
<th># of Innerducts</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” conduit</td>
<td>3-1” innerducts</td>
</tr>
<tr>
<td>4” conduit</td>
<td>3-1” plus 1-1¼” innerducts</td>
</tr>
<tr>
<td>5” conduit</td>
<td>3-1” plus 2-1¼” innerducts</td>
</tr>
</tbody>
</table>
GENERAL

SUBMITTALS
The Contractor should provide manufacturer's product data that consists of illustrations, standard schedules, performance charts, instructions, brochures and diagrams and other information furnished to illustrate a product, material or system.

Contractors shall submit shop drawings consisting of reproducible drawings and diagrams specially prepared for the work by the Contractor or any subcontractor, manufacturer, supplier or distributor to illustrate the path of the installed cable tray in the form of a detailed plan view. This submittal shall be in electronic format (AutoCAD or DXF file). This submittal shall be on the base plan as provided by the Architect or Owner.

The Contractor shall submit record drawings, which will consist of an update of the Owner's documents in the Owner's format.

PRODUCTS
Communications cable tray shall be trough-type with louvered bottom openings. Upper flanges of straight sections and fittings shall be rolled to protect cables. Louvered openings in bottom shall have continuous flange extending below and around the perimeter of each opening.

Cable tray sizing shall be calculated using a design of one square inch of cross-sectional area of tray per 75 net assignable square feet.

Increase the size of the cable tray to reflect increased capacity required to serve high-tech rooms and support spaces.

EXECUTION
The cable tray shall extend to the BER/CER and transition to ladder rack within these rooms and to the cabling rack(s).

Trays shall be supported from the structure at a maximum of five feet on center. The maximum deflection between supports shall be 0.33 inches when carrying a uniformly distributed load of 150 pounds per linear foot.

The location of the cable tray shall be coordinated with other trades in order to maintain working clearances on all sides of the tray. Ideally, a minimum of 12” access headroom shall be provided and maintained above a cable tray. Other building components shall not restrict access to the tray. If an obstruction is unavoidable, the restricted area of the cable tray shall be less than 36 inches in distance, and shall be approved by ITS and NCS (for Medical Center projects) or ITS (for University projects) during the design phase, or as soon as possible. The cable tray shall not be moved from the corridors into the adjacent program space (classrooms, offices, labs, etc.) if obstructions are encountered during construction.
Route the cable tray system for each floor of the building in public hallways to maximize shared use of tray and to keep conduits or j-support runs between the outlet boxes and tray as short as possible. If possible, cable trays should not be routed though private offices, labs, classrooms or restrooms unless the function of the space is better served by this design.

Conduits will be terminated in the cable tray and shall be supported by clips or clamps. The conduits shall be terminated with insulated bushings to protect the conductor.

All communications cable, j-supports (J-Hooks), conduit and trays shall be supported to the structure, independent of other services.

The inside of the tray shall be free of any obstruction, sharp edges, burrs or anything else that may damage the conductors to be installed in the tray.

Metal cable trays shall be bonded to the building ground in compliance with the NEC.

All fiber optic cable and pathways shall be clearly identified as housing fiber optic cable at intervals not greater than 50 feet.
WIRE AND CABLE (600 VOLTS AND BELOW)

RELATED WORK
Section 16122: Fiber Optic Cable
Section 16126: Communication Cable
FIBER OPTIC CABLE

GENERAL

DESCRIPTION
Fiber Optic cable may be used primarily for connecting buildings, Building Entrance Rooms and Communications Equipment Rooms.

Fiber Optic cable may be used as the wiring between the communications faceplate (data connection) and the Communication Equipment Room.

RELATED WORK
Section 16050: Basic Materials & Methods
Section 16120: Wire and Cable (600 volts and below)
Section 16126: Communications Cable
Section 16140: Wiring Devices
Section 16145: Communications Connector & Terminal Blocks
Section 16148: Non-Metallic Conductor Connections & Terminals

STANDARDS
National Fire Protection Association (NFPA)
Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)

SUBMITTALS
The Contractor shall be responsible for recording all test data. One printed copy and one electronic copy of all test results are to be submitted to NCS and ITS (Medical Center projects) or ITS (University projects) or their authorized representative. One copy will be given to the Owner to remain for their records. All test results must be received within 30 days of completion of work.

The Contractor shall submit record drawings that will consist of an update of the Owner's documents in the Owner's format.

PRODUCTS

ACCEPTABLE MANUFACTURERS
Systimax

MATERIALS
Multi-mode fiber optic cable shall be 50/125 µm core/cladding diameter. It must be FDDI and ATM compliant and conform to all relevant ANSI and EIA/TIA standards. Plant Operations and Plant Services must be contacted for specific BAS fiber requirements.

Single-mode fiber optic cable shall be 8.3/125 µm core/cladding diameter. It must be FDDI and ATM compliant and conform to all relevant ANSI and EIA/TIA standards.
EXECUTION

INSTALLATION

Single and multimode fiber optic cable shall be installed for interbuilding backbone applications. A minimum 72SM outside plant cable shall be provided in the design. Specific fiber strand counts shall be provided by ITS (University) or NCS, Informatics (Medical Center).

Contractors shall provide a 50-foot service loop at each end on runs between buildings and a 20-foot service loop at each end on runs between Communication Equipment Rooms.

Pulling tension used on fiber optic cable shall not exceed 100 Newtons or 25 foot-pounds.

Any bend in any fiber optic cable at any point shall have a radius of not less than ten times the outside diameter of that cable.

The Contractor shall avoid cable stress from cable twist during installation and tension from suspended cable runs and from tightly cinched cable ties.

The Contractor shall install each station/backbone cable as an uninterrupted conductor section from the designated equipment room to the designated and appropriate user-end termination point.

All communications cable, j-supports, conduit and trays shall be supported to the structure, independent of other services.

All exposed horizontal cable at the terminal in the CER/BER shall be neatly secured to the fire-retardant plywood backboards or freestanding frames neatly field-terminated in the terminal and neatly run through the wire management rings. Slack shall be provided to enable future modifications when cable runs are being installed. Although the exact amount of slack required depends on the configuration of the CER/BER and the terminating hardware, the recommended minimum amount of slack is 10 feet.

When placing cable through floor sleeves or penetrations the vendor shall patch and seal all holes and gaps around the cable in accordance with floor fire rating.

All cables shall be supported as documented in section 16114 and shall be attached to walls where communications cable already exists. Where additional attachments are needed, the Contractor shall furnish and install the same type and quality of cable rack or ladder rack that is currently in use. The Contractor shall support the cable so that no passageways are obstructed and that no doors are prevented from closing. The vendor shall install no cable or attachments that inhibit access to any steam line, electrical or communications cable or device or mechanical equipment.

A minimum of twelve strands of multi-mode fiber shall be installed in a star topology from the Building Entrance Room to each Communications Equipment Room.
All fiber optic cable and pathways shall be clearly identified as housing fiber optic cable at intervals not greater than 50 feet.

Note for Outside Plant installations: When placing underground fiber optic cable, install a metallic wire for future locating purposes.

TESTING AND INSPECTION
System inspection shall be provided through performance of pre-installation, in-progress and final inspections by the Owner and/or authorized representative.

The Contractor shall perform the cable tests for all fiber optic communication cables specified as follows:

- a. All multi-mode fiber optic tests will be performed at the 850nm and 1300nm windows in both directions. All single mode fiber optic tests will be performed at the 1300nm and 1550nm windows in both directions.
- b. All connectors will be tested and the loss measured in dB; connectors shall have a loss of 0.5 dB or less to be accepted.
- c. All fiber optic links will be tested and the loss measured in dB/km.
- d. All fiber optic links will be tested with an OTDR (Optical Time Domain Reflectometer) and a hard copy of the display screen shall be provided by the Contractor to the Owner for each link. All events on the link, including return loss, shall be measured and shall comply with the ANSI/EIA/TIA 568B requirements for fiber optic circuits.
- e. The length of each fiber optic link shall be recorded.

Three copies of test results shall be submitted to the Project Manager in electronic form.
COMMUNICATIONS CABLE

GENERAL

DESCRIPTION
Horizontal cable is defined as the copper wiring between the work area communications faceplate and the cross-connect hardware in the Communications Equipment Room.

Backbone cable is defined as the wiring, either copper or fiber optic, between station cable distribution points, equipment rooms and entrance rooms.

RELATED WORK
Section 16050: Basic Materials & Methods
Section 16120: Wire and Cable (600 volts and below)
Section 16122: Fiber Optic Cable
Section 16140: Wiring Devices
Section 16145: Communications Connector & Terminal Blocks

STANDARDS
National Fire Protection Association (NFPA)
Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)

SUBMITTALS
The Contractor shall be responsible for recording all test data. One printed copy and one electronic copy of all test results are to be submitted to NCS and ITS (Medical Center projects) or ITS (University projects) or their authorized representative. One copy will be given to the Owner to remain for their records. All test results must be received within 30 days of completion of work.

PRODUCTS

MATERIALS

Telecommunication voice cables installed in the backbone shall be Systimax ARMM cable sized based on either:

a. ten pairs per 1000 net assignable square foot, or
b. the exact amount of cable required based on known requirements, plus ten percent.

The size of cable shall be determined by the method that yields the larger cable.

Cables
Communications cables installed to a connection shall be properly rated for the area in which they are to be installed per the NEC:

a. Systimax 1071 GigaSPEED Cable (yellow) for non-plenum areas (1071004), or
b. Systimax 2071 GigaSPEED Cable (yellow) for plenum areas (2071004AYL).

Systimax GigaSPEED patch cords shall be used and provided by the Vendor. The patch cords for the BER/CER shall be of proper length to complete a connection with little or no
slack, and should follow the color code chart noted below. The patch cord for the workstation end (data jack to NIC) shall be 15 feet in length and yellow.

<table>
<thead>
<tr>
<th>CAT-6 Patch Cords</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection Type</td>
<td></td>
</tr>
<tr>
<td>Ethernet</td>
<td>Yellow</td>
</tr>
<tr>
<td>Critical Care</td>
<td>Red</td>
</tr>
<tr>
<td>Cross-Over</td>
<td>White</td>
</tr>
<tr>
<td>UPS</td>
<td>Green</td>
</tr>
<tr>
<td>Server</td>
<td>Blue</td>
</tr>
<tr>
<td>Department Owned Hardware</td>
<td>Black</td>
</tr>
<tr>
<td>PoE Connections (Wireless)</td>
<td>Orange</td>
</tr>
<tr>
<td>Voice Connectivity</td>
<td>Gray</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fiber Patch Cords</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection Type</td>
<td></td>
</tr>
<tr>
<td>MM Fiber (62.5 micron)</td>
<td>Orange</td>
</tr>
<tr>
<td>MM Fiber (62.5 micron)</td>
<td>White</td>
</tr>
<tr>
<td>MM Fiber (50 micron)</td>
<td>Aqua</td>
</tr>
<tr>
<td>SM Fiber</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

Improper length and/or color patch cords may be removed at the discretion of Vanderbilt Cable Plant. If you need assistance in ordering or obtaining the correct length and/or color patch cord you may contact Vanderbilt Cable Plant at 2-1400.

**EXECUTION**

**INSTALLATION**

Pulling tension used on communication cable shall not exceed 100 Newtons or 25 foot-pounds.

Any bend in any cable at any point shall have a radius of not less than four times the outside diameter of that cable for station cables and not less than ten times the outside diameter for that cable for backbone cables.

The Contractor shall avoid cable stress from cable twist during installation and tension from suspended cable runs and from tightly cinched cable ties.

The Contractor shall install each station/backbone cable as an uninterrupted conductor section from the designated Communications Equipment Room to the designated and appropriate user-end termination point.

Any shielded cable shall be bonded and grounded where required. Copper
backbone cables shall be bonded to a building ground.

All exposed horizontal cable at the terminal in the CER/BER shall be neatly secured to the fire-retardant plywood backboards or freestanding frames neatly field-terminated in the terminal and neatly run through the wire management rings. Slack shall be provided to enable future modifications when cable runs are being installed. Although the exact amount of slack required depends on the configuration of the CER/BER and the terminating hardware, the recommended minimum amount of cable slack is 10 feet.

When placing cable through floor sleeves or penetrations, the vendor shall patch and seal all holes, slots, sleeves and gaps around the cable in accordance with floor fire rating.

In CERs, BERs and open area pathways, such as tunnels, all cables shall be supported in such a manner that there is only minor visible sag and will be attached to walls where communications cable already exists. Where additional attachments are needed, the Contractor shall furnish and install the same type and quality of cable rack and ladder rack that is currently in use. The Contractor shall support the cable so that no passageways are obstructed and that no doors are prevented from closing. The Vendor shall install no cable or attachments that inhibit access to any steam line, electrical or communications cable or device, or mechanical equipment.

TESTING AND INSPECTION
System inspection shall be provided through performance of pre-installation, in-progress and final inspections by the Owner and by Informatics and/or authorized representative.

Testing of wiring shall be performed prior to acceptance of work. 100 percent of the UTP station and riser cabling pairs shall be tested for opens, shorts, polarity reversals, transpositions and presence of AC voltage. Any cable or pair not passing the above test must be repaired or replaced and retested.

A channel test shall be conducted on each data cable at a frequency bandwidth of at least 250 MHz. It is required that all parameters of the autotest function on the approved test equipment pass. Test equipment must be approved for “Category 6” testing (Fluke DSP, Microtest Omni-scanner or equal). Any cable or pair not passing must be repaired or replaced and retested.

An application warranty shall be provided by the manufacturer of the wiring components. This warranty shall cover application performance at “Category 6” specifications.

A minimum of 10% of the pairs in each installed copper voice backbone cable shall have a measured loss of no greater than 1 dB. All pairs in each installed copper backbone cable will be tested end to end, determining continuity, shorts, reversed pairs, split pairs and grounds.

All circuit terminations will be verified for color code accuracy.

Test the continuity of all grounds and bonds.
Test 5 pairs per binder for impedance matching, between the backbone and station cable interfaces.
GENERAL

Provide pull and junction boxes of appropriate size and depth as specified.

Pull boxes shall not be used for splicing communications cables.

RELATED WORK

Section 16111: Conduits

PRODUCTS

Acceptable products shall be defined by codes and standards.

EXECUTION

A pull box shall be placed in a conduit run when any of the following conditions are met:
   a. the length of the conduit run is over 100 feet,
   b. there are more than two 90 degree bends, or
   c. there is a reverse bend in the run.

Pull boxes shall be placed in a straight section of conduit and not used to replace a bend. Conduit ends shall be aligned with one another to allow for ease of cable installation.

Pull boxes and junction boxes shall be placed in easily accessible locations.

When pullboxes are used in a conduit run to the outlet box, position the pullbox directly above the faceplate for predictability.

Pull box size shall be defined by the National Electrical Code.

Splice box size for communications cable must meet EIA/TIA 569 specifications.

All pull boxes containing fiber optic cable shall be appropriately labeled.

All pullboxes locations shall be shown on as-built drawings.
WIRING DEVICES

CHANGE SECTION UNDER EXISTING “DUPLEX CONVENIENCE RECEPTACLES” AS FOLLOWS:

Currently reads: “Dedicated electrical circuits provided for computers or other special equipment shall be Orange in color.
Should read: “Isolated ground electrical circuits shall be Orange in color.”

ADD SECTION UNDER EXISTING "SCOPE":

RELATED WORK
Section 16145: Communications Connector & Terminal Blocks
Section 16148: Non-Metallic Conductor Connections & Terminals
COMMUNICATIONS CONNECTOR & TERMINAL BLOCKS

GENERAL

DESCRIPTION
The Contractor shall furnish and install wiring devices and terminal blocks for all copper communication wiring. This shall include telephone connectors, terminal blocks, and data connectors and patch panels.

RELATED WORK
Section 16050: Basic Materials & Methods
Section 16122: Fiber Optic Cable
Section 16126: Communications Cable
Section 16140: Wiring Devices

STANDARDS
Federal Communications Commission (FCC) Publications
   FCC Rules and Regulations - Part 15 and Part 68

Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)

SUBMITTALS
Submit product data for review for products that are not specifically referenced.

The Contractor shall be responsible for recording all test data. Four copies of all test results (electronic copies) are to be submitted to the Owner or their authorized representative for review and remain with the Owner for their records.

The Contractor shall provide four copies of shop drawings, 30 days prior to the start of work, to the Owner showing the location and identification number of each voice and data connections in the project. The Owner shall provide one copy each to ITS (University projects) or NCS and ITS (Medical Center projects). Within thirty days of completion of work, the contractor will submit four copies of record drawings to the Owner with as-built information and finalized versions of the shop drawings. These submittals shall be on the base plan as provided by the Architect or Owner. This submittal shall be in two forms:
   a. one copies in reproducible print form, and
   c. in electronic format (AutoCAD or DXF file)

PRODUCTS

MANUFACTURERS
Systimax

MATERIALS
The typical office wall faceplate will consist of three universal communications connections for voice or data use. Other faceplate configurations may be available depending on the application. In this configuration the following products shall be used:
• Systimax MGS300BH1-123, T568A GigaSPEED Information Outlet

• Systimax M20AP-246, Information Outlet Dust Cover/Blank, quantity as needed

• Systimax M28L-246, Eight Port Dual Gang Faceplate (Ivory).

In the case of a wall phone location, the following materials shall be used:

• Standard type 630A communications faceplate, one per location.

The following materials shall be used for the data portion of these faceplates:

• Systimax MGS300BH1-123, T568A GigaSPEED Information Outlet, one per connection for standard data communications

• Systimax MGS300BH1-112, T568A GigaSPEED Information Outlet, one per connection for wireless data communications

• Systimax L2300-OR ICON insert must be installed on Systimax Patchmax Patch Panel in communications equipment room for all wireless horizontal stations.

In the case of an undercounter installation an equivalent Systimax surface mount faceplate shall be used with the information connectors previously specified. The outlet box shall be screw attached.

Termination of the universal communication cables in the equipment room shall be on RJ-45 patch panel hardware. The backbone cable shall be terminated with 110C-5 connectors. The station cables shall be terminated with 110C-4 connectors. All 110 type terminating hardware shall meet UL Category 6 specifications. Labels on 110 hardware should be colored white for riser cable. Systimax 188 wire management shall be used as shown in section 16740 (Figure A).

Termination of all of the communication copper cable in the equipment room and shall occur in a relay rack on the following equipment:

24 Port Patch Panels
• PM2160GS-24, T568A PatchMax™ Panels
• DM2160-GS, T568A Distribution Modules (4 are required for 24 port panel)
• R2100 – Front Retainer (5 for 24 port panel)
• R2200 – Rear Retainer (1 for 24 port panel)
• R2300 – 60” continuous strip Velcro wrap / 5 slotted strips (1 for 24 port panel)
• L2200-GY – Gray 8.5” x 11” label sheets with 6A circuit distribution module labels (1 for 24 panel)

48 Port Patch Panels
• PatchMax™ PM2160GS-48 – T568A Panels
• DM2160-GS – T568A Distribution Modules (8 are required for 48 port panel)
• R2100 – Front Retainer (10 for 48 port panel)
• R2200 – Rear Retainer (1 for 48 port panel)
• R2300 – 60” continuous strip Velcro wrap / 5 slotted strips (2 for 48 port panel)
• L2200-GY – Gray 8.5” x 11” label sheets with 6A circuit distribution module labels (2 for 48 panel)

EXECUTION

INSTALLATION

The Contractor shall provide and install fire retardant plywood backboards that are painted black in the equipment rooms for mounting slack loops for cables, outside plants splices and possibly outside plant protectors. The Contractor shall provide relay racks for the mounting of voice communication hardware.

All exposed cable at the termination blocks in the equipment rooms and distribution closets shall be neatly secured to the fire retardant plywood backboards, freestanding frames or relay racks, neatly field-terminated on the block, and neatly run through wire management rings. Cable slack shall be provided to enable future modifications when cable runs are being installed. Although the exact amount of slack required depends on the configuration of the CER/BER and the terminating hardware, the recommended minimum amount of slack is 10 feet.

The Contractor shall provide and install relay racks in the BER/CER for mounting universal-cabling patch panels. All relay racks shall be grounded to the Telecommunications Grounding Bus bar with #6 AWG ground wire.

Install all communications device plates in full contact with the wall surface.

The Contractor shall maintain the pair twist of the cable as close to the point of termination as possible. The amount of untwisting of a pair shall not exceed 13mm (0.5 inch) for “Category 6” installations. The jacket of the cable shall only be removed as far as required to terminate the individual pairs.

The Contractor shall leave 12” cable slack in the outlet box.

Labels shall be permanent, waterproof, electronically generated and readable from a distance of two feet, with permanent lettering. The labels shall not be removable by normal device handling or normal operations. Hand written labels are not acceptable.

The Contractor shall label the communications faceplate in the following manner:

The jack (connection) number consists of twenty characters as follows:

AAAA-BBBBBBBBBBB-BDDD

AAAA: Building code; Campus Planning and Construction Standard
**BBBBBBBBBB**: Ten-character identifier; use space (room) number at time of assignment.

**DDD**: Three character unique number (i.e. 01A): “01” represents the first station cable associated with the identifier. “A” represents the first connection on this station cable. The initial installation shall increment clockwise from the entrance of the room.

**Example**: 0023-S3301-01A  “0023” – Jack is located in building 0023 (MCN)

“S3301”, The identifier. (this is room number at the time the jack (connection) was installed

“01” is the first station cable associated with S3301

One label consisting of the BUILDING-IDENTIFIER (AAAA-BBBBBBBBBBB) shall be placed at the top center of the faceplate. The Contractor shall place a label at the bottom center of the faceplate that identifies the equipment room in which the cable terminates. (See figure A.)
The Contractor shall label the communications terminal and patch panel in the following manner (see figure B):

The terminal/station number consists of fourteen characters as follows:

**BBB BBBBBBBB-BDD**

**BBB BBBBBBBB:** Ten-character identifier; use room number at the time of assignment

**DD:** two character unique number (i.e. 01) “01” represents the first cable

The patch panel shall have a label that identifies the originating and terminating BER and CER as depicted in the following manner:

**R A A A A B BBBBBB-EEEEEEE:**

‘R’ is for Riser

‘AAAA’ is the building code

‘BBBBBB’ is the originating BER/CER

‘EEEEEE’ is the terminating CER/BER

TESTING AND INSPECTION

Testing of all communications connections and terminations will follow the specifications as defined in Section 16126: Communications Cable. In addition, the Contractor shall test 100% of the station cable runs and any contractor-provided patch cables for the correct jack (connector) pin terminations as specified by this document and the manufacturer of the component.

The Owner or authorized representative or the Contractor may, at his/her discretion, perform tests in addition to those specified in the Contract Document if there is any reason to question the condition of the material as furnished and installed.

After installation is complete, in addition to any other required testing, and at such times as the Owner and/or authorized representative directs, the Contractor shall conduct an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be promptly corrected at the Contractor’s expense and the tests re-conducted. Operational testing is defined for the following circuit types:
Station Cable - Color code compliance, labeling, routing, workmanship and installed and tested in accordance with EIA/TIA 568B.

Backbone Cable - color code compliance, labeling, equipment room and distribution closet jumpers, patch cords, grounding/bonding, workmanship, continuity termination block layout and installation and routing.
GENERAL

DESCRIPTION
The Contractor shall furnish and install wiring devices and terminal blocks for all fiber communication wiring. This includes workstation faceplates and distribution patch panels and terminals.

RELATED WORK
Section 16050: Basic Materials & Methods
Section 16122: Fiber Optic Cable
Section 16126: Communications Cable
Section 16140: Wiring Devices
Section 16145: Communications Connector & Terminal Blocks

STANDARDS
American National Standards Institute, Inc. (ANSI)
X3T9.5

Federal Communications Commission (FCC) Publications
FCC Rules and Regulations - Part 15 and Part 68
Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)

SUBMITTALS
Submit product data for review for products that are not specifically referenced.

The Contractor shall be responsible for recording all test data. Four copies of all test results are to be submitted to the Owner or their authorized representative for review and remain with the Owner for their records.

The Contractor shall provide one copy of shop drawings, 30 days prior to the start of work, to the Owner showing the location and identification number of each voice and data connection in the project. Within thirty days of completion of work, the Contractor will submit an electronic copy of the record drawings to the Owner with as-built information and finalized versions of the shop drawings. These submittals shall be on the base plan as provided by the Architect or Owner. This submittal shall be in electronic format (AutoCAD, Visio or DXF file)

PRODUCTS
MANUFACTURERS
Systimax

MATERIALS
The wall faceplate that is used to terminate fiber optic cable shall use the following materials:
Systimax ST connectors (Note: The use of ST or STII connectors will be determined by Informatics (Medical Center projects) or Network Design and Engineering (University projects). When copper wiring is also terminated in the same faceplate, the materials specified in Section 16145 shall be used.

Termination of the communication fiber optic cable in the equipment room shall occur in a relay rack.

EXECUTION

Termination of the fiber optic cable shall comply with the table below. Where ST or LC connectors are called for, the wall plate at the workstation shall support ST to SC or LC to SC conversion so that SC connectors are used as the drop cable from the workstation to the wall plate.

<table>
<thead>
<tr>
<th>Fiber Type</th>
<th>Connector</th>
<th>Color Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.5µ Multi-Mode</td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td>50.0µ Multi-Mode</td>
<td>LC</td>
<td></td>
</tr>
<tr>
<td>9.0µ Single-Mode</td>
<td>SC</td>
<td></td>
</tr>
</tbody>
</table>

Note: Due to the density requirements of some installations, it may be necessary to terminate a fiber optic cable on a connector other than specified above. ITS and/or NCS will make a determination as to when a change to the standard is appropriate.

The wiring device should have cable management that will assure a minimum bend radius of 30mm (1.18 inch) and the ability to store at least 1m (3.28 feet) of fiber cable.

Labels shall be permanent, waterproof, electronically generated and readable from a distance of two feet with permanent lettering. These labels shall not be removable by normal device handling or normal operations. Hand written labels are not acceptable.

The Contractor shall label the communications faceplate in the following manner:

The jack number consists of twenty characters as follows:

AAAA-BBBBBBBBBBB-BDD

AAAA: Building code; Campus Planning standard.

BBBBBBBBBBBB: Ten-character identifier; use space number at time of assignment.

C: F for Fiber Optic Cable.
DD: Two character unique number (i.e.: 01; “01” represents the first station cable associated with the identifier.

Example: 0023-S3301-F01

“0023” this jack is located in building MCN

“S3301” is the identifier (this is the room number at the time the connection was installed)

“F” fiber optic cable

“01” is the first station cable associated with S3301.

One label consisting of the BUILDING-IDENTIFIER (AAAA-BBBBBBBBBBB) shall be placed at the top center of the faceplate. The F and unique number shall be placed near the corresponding connection point (jack).

The Contractor shall label the communications terminal and patch panel in the following manner:

The terminal/station number consists of fourteen characters as follows:

BBBBBBBBBB-BBBB

BBBBBBBBBB: Ten-character identifier; use room number at the time of assignment.

C: F for Fiber Optic Cable.

DD: Two character unique number (i.e.: 01; “01” represents the first connection associated with this identifier.

TESTING AND INSPECTION
Testing of all communications connections and terminations will follow the specifications as defined in Section 16122: Fiber Optic Cable.

The Owner or authorized representative or the Contractor may, at his/her discretion, perform tests in addition to those specified in the Contract Document if there is any reason to question the condition of the material as furnished and installed.

After installation is complete, in addition to any other required testing, and at such times as the Owner, and/or authorized representative directs, the Contractor shall conduct an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be promptly corrected at the Contractor's expense and the tests re-conducted. Operational testing is defined for the following circuit types:
Fiber Optic Cable - Labeling, patch panel connections, loss measured in dB/km, workmanship, splice loss, connector loss, workmanship and circuit length.
COMMUNICATIONS

GENERAL

DESCRIPTION
Currently there are five primary types of communication lines on the Vanderbilt Campus as follows:

1. Energy Management System (EMS) (fire alarm, security)
2. Informatics, NCS (data)
3. BellSouth Telecommunications (voice, data, security)
4. Vanderbilt University ITS (voice, data, CATV)
5. Communications Carriers

The appropriate Vanderbilt Manager must approve any design or implementation of these lines.

For questions concerning any of the types of communications lines, contact the Project Manager.

RELATED WORK
Section 16001: Design Information
Section 16111: Conduits
Section 16114: Cable Trays
Section 16120: Wires and Cable
Section 16122: Fiber Optic Cable
Section 16126: Communications Cable
Section 16140: Wiring Devices
Section 16145: Communications Connector & Terminal Blocks
Section 16148: Non-Metallic Conductor Connections & Terminals
Section 16740: Telecommunications Wiring Components
Section 16800: Data Communications Systems

STANDARDS
American National Standards Institute, Inc. (ANSI)
National Electrical Safety Code
X Series

Federal Communications Commission (FCC) Publications
FCC Rules and Regulations - Part 15
FCC Rules and Regulations - Part 68

Occupational Safety and Health Act of 1970 (OSHA)
Public Law 91 - 596

Insulated Cable Engineers Association (ICEA) Standard
ICEA S - 80 - 576

National Fire Protection Association (NFPA)

Institute of Electrical and Electronics Engineers, Inc. (IEEE)
National Electrical Safety Code
800 Series Standards

Electronics Industries Association (EIA/TIA 568B, 569A, 606, 607)
RS Series Standards
International Telegraph and Telephone Consultative Committee (CCITT)  
I Series Standards

GENERAL REQUIREMENTS
Where security systems or elements are required, all design shall be coordinated and campus tie-in determined on a case-by-case basis through the Project Manager with the University Police and/or Energy Management Systems.

Data and Computer Services are carried by private, Vanderbilt-owned networks. The design of cable distribution shall be coordinated with the Project Manager for ITS (University) or Informatics, NCS (Medical Center).

Telephone service is carried by the private, Vanderbilt-owned Telecommunications Network. The design of cable distribution shall be coordinated with the Project Manager and ITS.
GENERAL

DESCRIPTION
This section addresses any items that have not been addressed in the sections identified under RELATED WORK. These items include:
- Telecommunications Backboards
- Relay Racks
- PBX Power
- HVAC

RELATED WORK
Section 16001: Design Information
Section 16050: Basic Materials & Methods
Section 16111: Conduits
Section 16114: Cable Trays
Section 16120: Wires and Cable
Section 16122: Fiber Optic Cable
Section 16126: Communications Cable
Section 16131: Pull & Junction Boxes
Section 16140: Wiring Devices
Section 16145: Communications Connector & Terminal Blocks
Section 16148: Non-Metallic Conductor Connections & Terminals
Section 16700: Communications

PRODUCTS

MATERIALS
Telecommunications backboards shall be 3/4 inch fire retardant plywood backboards painted black and covering all walls up to 8’ height.

Relay Racks shall be the Mid Atlantic Metals, part number MK1945 for equipment and patch panels and XLBET frames as needed for 110 terminations and outside plant protectors.

SUBMITTALS
The Contractor shall provide proposed Building Entrance Room and Communications Equipment Room layouts and backboard elevations for approval to the Project Manager 30 days prior to construction start.

EXECUTION

INSTALLATION
The Contractor shall provide and install fire retardant plywood backboards that are painted black for the communications terminals. The quantity of backboard to be installed shall be installed on all walls of the CERs and BERs from the floor to a height of eight feet.

The backboards shall be located in the room so that the backbone pathway terminates at one corner of the backboard. Care shall be taken that the routing of the backbone wiring will not block or impede the placement of terminal equipment.

The backboards shall be attached to the wall in such a manner that they will be capable of supporting wall/backboard-mounted equipment.
The backboards shall be mounted so that the 8-feet length begins 12 inches from the floor and extends to the top of the wall.

When installing backboards to provide a contiguous surface, the Contractor shall place and mount the backboards so that there is only a minimal (less than 1/8 inch) gap between the boards.

The backboard shall be a ¾” AC-grade plywood, void-free and either fired rated or coated on all sides with two coats of fire resistant black paint.

The Contractor shall provide and install a bus bar on the backboard, which is connected with the main building grounding electrode via, minimally, a #6 AWG copper conductor. (Refer to 16001 for details).

The Contractor shall provide and install relay rack(s) in all rooms and closets as specified by this document or the construction drawings.

Cable management shall be installed between adjacent racks.

The relay rack shall be secured to the floor in such a manner that the rack will remain stable when loaded with communications equipment.

The relay rack shall be located within the room as not to block access to any existing equipment or backboard space. The rack shall be located so that there will be a minimum of 36 inches of access to both the front and rear of the rack (after loaded with equipment).

The relay rack shall be properly grounded.

If a telecommunications PBX system will be installed in the Building Entrance Room, provide a 208V/120V panel board rated at 200 amps fed from the building power system. It shall have built-in isolated grounds. In this panel, provide two 40 amp 208 volt breakers and one 20 amp 120 volt breaker. If emergency power (generator) is available, this panel shall be capable of being automatically transferred to emergency power. Each 208 volt circuit shall be extended to a 4”x4” junction box (one each) mounted at a wall location in the equipment room designated by ITS. The circuit shall be capped off with wire nuts for future connection to the PBX rectifiers. The 120-volt circuit shall be extended to a wall outlet having 4 receptacles; exact location to be designated by the ITS. All circuits shall be clearly labeled with identification numbers.

The Building Entrance Room and Communications Equipment Room(s) must have continuous (24 hour, 7 days) HVAC capable of maintaining a temperature between 64° F and 75° F and humidity levels within 30% to 55%. The heat generated by telecommunications equipment in a Building Entrance Room is approximately 136,000 BTU/hour. The A/C control shall be in the CER or BER and separate from the building A/C control.
with a PBX.

Figure H details part numbers

Scale: 3/8" = 1'

Universal Cabling Configuration
CER Overhead

Figure C
GENERAL

DESCRIPTION
This section addresses any items that have not been addressed in the sections identified under RELATED WORK. These items include:
   - Relay Racks
   - Power
   - HVAC

RELATED WORK
Section 16001: Design Information
Section 16050: Basic Materials & Methods
Section 16111: Conduits
Section 16114: Cable Trays
Section 16120: Wires and Cable
Section 16122: Fiber Optic Cable
Section 16126: Communications Cable
Section 16131: Pull & Junction Boxes
Section 16140: Wiring Devices
Section 16145: Communications Connector & Terminal Blocks
Section 16148: Non-Metallic Conductor Connections & Terminals
Section 16700: Communications

PRODUCTS

MATERIALS
Relay Racks used for cable termination equipment shall be Mid Atlantic Metals part number MK1945 or MKR4CN-4536B

EXECUTION

INSTALLATION
The contractor shall provide and install two relay racks in all Building Entrance Rooms and Communications Equipment Rooms. Note that the rack part number decision will be designed based on individual project requirements.

The relay rack shall be secured to the floor in such a manner that the rack will remain stable when loaded with communications equipment.

The relay rack shall be located within the room as not to block access to any existing equipment or backboard space. The rack shall be located so that there will be a minimum of 36 inches of access to both the front and rear of the rack (after loaded with equipment).

The relay rack shall be properly grounded.

Cable management shall be installed between adjacent racks and between the rack and wall.

The Building Entrance Room and the Communications Equipment Room(s)
shall have a separate supply circuit that shall be terminated in its own electrical panel. Automatic switch over capability to the emergency power shall be provided if available. A dedicated 20 amp, 110 volt AC duplex electrical outlet with isolated grounds shall be installed on each wall. Two 208 volt 30 amp NEMA L6-30R electrical outlets with an isolated ground shall be provided for equipment power on emergency power outlets. Additionally, two 208 volt 30 amp NEMA L6-30R electrical outlets with an isolated ground on normal power shall be provided. Surge protection and battery support is recommended for equipment. In addition, all rooms shall have convenience duplex outlets and shall be placed, at least, one per wall on each wall, at a height of 18” above the floor.

The Building Entrance Room and Equipment Room(s) must have continuous (24 hour, 7 day) HVAC capable of maintaining 64° F and 75° F and humidity levels within 30% to 55%. The heat generated by data equipment is approximately 35,000 BTU/hour.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ac</td>
<td>alternating current</td>
</tr>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
</tr>
<tr>
<td>amp</td>
<td>amperes</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
</tr>
<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
</tr>
<tr>
<td>BER</td>
<td>Building Entrance Room</td>
</tr>
<tr>
<td>BICSI®</td>
<td>Building Industry Consulting Service Int’l</td>
</tr>
<tr>
<td>Btu</td>
<td>British thermal unit</td>
</tr>
<tr>
<td>CER</td>
<td>Communications Equipment Room</td>
</tr>
<tr>
<td>CSI</td>
<td>Construction Specifications Institute</td>
</tr>
<tr>
<td>dB</td>
<td>decibel</td>
</tr>
<tr>
<td>EDF</td>
<td>Entrance Distribution Frame</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
</tr>
<tr>
<td>EMS</td>
<td>Emergency Management System</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FDDI</td>
<td>Fiber Distribution Data Interface</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>HVAC</td>
<td>heating, ventilation and air-conditioning</td>
</tr>
<tr>
<td>ICEA</td>
<td>Insulated Cable Engineers Association</td>
</tr>
<tr>
<td>IDF</td>
<td>Intermediate Distribution Frame</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>ITS</td>
<td>Information Technology Services</td>
</tr>
<tr>
<td>ITU</td>
<td>International Telecommunications Union</td>
</tr>
<tr>
<td>NCS</td>
<td>Network Computing Services</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electrical Code</td>
</tr>
<tr>
<td>NESC</td>
<td>National Electrical Safety Code</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PBX</td>
<td>private branch exchange</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinylchloride</td>
</tr>
<tr>
<td>TGB</td>
<td>telecommunications grounding busbar</td>
</tr>
<tr>
<td>TIA</td>
<td>Telecommunications Industry Association</td>
</tr>
<tr>
<td>TMGB</td>
<td>telecommunications main grounding busbar</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratory</td>
</tr>
<tr>
<td>UPS</td>
<td>uninterruptible power supply</td>
</tr>
<tr>
<td>utp</td>
<td>unshielded twisted pair</td>
</tr>
</tbody>
</table>
GLOSSARY

**Backboard** - A wooden panel used for mounting telecommunications equipment and hardware, typically a ¾” AC-grade plywood, void-free and either fired rated or coated on all sides with two coats of black fire resistant paint.

**Backbone Cable** – The cabling that originates in the building entrance room and runs to the communications equipment room or any other building.

**Backbone Pathway** – The support structure for the backbone cabling between the entrance facility and the communications equipment room or between buildings.

**Building Entrance Room** – (BER) The space in which the joining of the intrabuilding (riser and station) or main feeder cable and the interbuilding cabling takes place. All incoming cable, voice and data, is usually terminated in this room.

**Communications Equipment Room** – (CER) A centralized space for communications equipment that serves the occupants of the building. Usually a minimum of one per floor, however, the actual number is based on the net assignable square footage of the area being served.

**Connection** (in a faceplate) – Communications jack.

**Equipment Rack** - A metallic free standing rack, usually 7’ in height, that is used to mount voice/data communications related electronic equipment and patch panels.

**Horizontal Closet-tie Pathway** – The pathway that connects equipment rooms which are located on the same floor.

**Horizontal Distribution Pathway** – The pathway which supports the cabling from the last distribution/cross-connect point to the communications faceplate.

**Innerduct** – Conduit that is placed to enable pulling of future or multiple cables through a larger diameter conduit.

**Net Assignable Square Footage** – The sum of all areas on all floors of a building assigned to or available for assignment to an occupant or specific use. Assignable area is measured from the inside faces of surfaces that form the boundaries of the designated areas.

**Outlet Box** – A 4”x4” metallic form which houses communications cabling and is covered by a communications faceplate.
Owner - Vanderbilt University/Vanderbilt University Medical Center

Patch Panel - A device, located in the CER or BER, in which temporary or semi-permanent connections can be made between incoming and outgoing lines. Used to connect data equipment to a user faceplate, to connect test equipment, etc.

Raceway – Any path designed for holding wires and cables.

Riser Cable - Telecommunications cable which provides the connection between the EDF and IDF locations.

Station Cable – The horizontal cable that runs between the last distribution point and the work area faceplate.

Telecommunications Grounding Busbar – (TGB) A busbar placed on the Telecommunications backboard and bonded to the TMGB.

Telecommunications Main Grounding Busbar – (TMGB) Provided by the building contractor, this is the busbar that is connected directly to the main building grounding system via a #6 ground.

Terminating Hardware – A device used to connect cable or wires which will be used at that point or extended to another piece of equipment via cross-connect wires.
Wiring Standards Variance Agreement Form

To request an exception to the VUMC/VU Intrabuilding Wiring Standard, complete this form and submit to the NCS/ITS team member for the project. The appropriate NCS/ITS representatives will review your request within one week of receipt of your request, approve or deny and contact the Project Manager. Deviation from the VU/VUMC Wiring Standard will not be allowed without the Infrastructure Design team approval.

Project name or description   ____________________________________________

Building Name

Associated Project Manager (CPC/S&FP/Plant Ops/Plant Services/Real Estate)
_________________________

Date Variance Requested  _________________________

Requesting Agency   _________________________

Requesting Individual Name, Extension, Email __________________________
________________________________________________________________

Variance Requested:
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
______________________________________________(Submit sketches if necessary)

Reason for Variance Request:
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

ITS/NCS Infrastructure Design Group’s Approval:
________________________________________________________________
________________________________________________________________

Date Approved: ______________________________