

# **Telecommunications Standards & Design Guidelines Release 15**

DENISON UNIVERSITY  
Information Technology Services (ITS)

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# Design Guidelines

Telecommunications, Cabling, and Other  
Technologies

## Change Control Form

Date	Description	Initials
9/17/2001	DRAFT COPY ISSUED v0.1a	CGM
9/26/2001	FINAL COPY ISSUED v1.0	CGM
1/7/2002	Draft of proposed changes issued v2.0b	CGM
3/11/2002	SECOND RELEASE ISSUED v2.0	CGM
8/29/2002	THIRD RELEASE ISSUED v3.0	CGM
10/30/2002	FOURTH RELEASE ISSUED v4 (Bid Package Copy)	CGM
6/15/2004	FIFTH RELEASE ISSUED v5.0	CGM
11/30/2005	FIFTH RELEASE ISSUED v.6.0	RCL
5/1/2009	8 <sup>th</sup> RELEASE ISSUED v8.0	RCL
2/8/2010	8 <sup>th</sup> Release with minor correction to part numbers v8.1	TLB
4/26/2010	8th Release updated with new Appendix A (parts) and format update.	KRHO
5/15/2011	9th Release updated with new drawings and content.	KRHO
4/20/2016	All updates stored in Google Drive - Network Engineer folder. v10.0	DSW

8/23/18	Changed to OM3 fiber for interior fiber runs. Outside fiber will be Singlemode.	DSW
1/15/20	Added standard for blue cat6a patch cable	DSW
7/16/20	Updated copper patch cord color code	DSW
6/7/21	Updated Appendix A patch panel part number and Cat 6 cabling	DSW
1/26/24	Updated the dual sided cable managers, horizontal cable managers, and also revised and removed wyr-grid to the new Wire Basket Tray. In addition,updated appendix and the parts list.	AJP

# Design Guidelines for Structured Cabling, and Other Technologies

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# 17000 GENERAL

## -010 Basic Communication Requirements

**Includes:** Global items required that are not associated with specific technology requirements. These items are often covered in Division 1.

### A. Referenced Standards

1. The design of the system and the selected equipment shall conform to the following standards where applicable.
  - a) American National Standards Institute (ANSI)
  - b) American Society for Testing and Materials (ASTM)
  - c) American Standards Association (ASA)
  - d) Building Industries Consulting Services International (BICSI) Telecommunications Wiring Standards
  - e) Building Officials and Code Administrators (BOCA) International Inc. Basic Building Code, BOCA Basic Plumbing Code, BOCA Basic Mechanical Code
  - f) Electronics Industry Association/ Telecommunication Industries Association (EIA/TIA) 568/569/606/607
  - g) FCC Codes and Regulations
  - h) Institute of Electrical and Electronics Engineers (IEEE), especially IEEE 802.2 and 802.3, 1100-19992 (Powering and Grounding)
  - i) International Telecommunications Union (ITU)
  - j) National Board of Fire Underwriters (NBFU)
  - k) National Bureau of Standards (NBS)
  - l) National Electric Code (NEC)
  - m) National Fire Protection Association (NFPA) 101 Life Safety Code
  - n) State Electrical Code and/or National Electrical Code (NEC)
  - o) State Building Code
  - p) Rural Electric Association - Telephone Division Standards
  - q) Underwriter's Laboratories, Inc. (UL), Federal Specifications
  - r) Williams-Steiger Occupational Safety and Health Act of 1970 (OSHA) - Public Law 91-596

### B. Manufactured Products

1. Materials and equipment provided shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are

available.

2. When more than one unit of the same type of equipment or material is required such units shall be the products of a single manufacturer.
3. Equipment Assemblies and Components
  - a) All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to ITS.
  - b) Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - c) Components shall be compatible with each other and with the total assembly for the intended service.
  - d) Constituent parts, which are similar, shall be the product of a single manufacturer.
4. All factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
5. The Contractor(s) shall furnish or cause to be furnished all material, labor, construction, tools, parts, supplies, etc., required for performance of the Work and shall provide, design (or designs supplied by Owner), lay out, install, test, and cutover all the necessary material, equipment, services and miscellaneous hardware to serve the specified facilities of Owner. This includes provision of all equipment (hardware and software), interconnection to Owner facilities and existing services, placement, restoration, distribution components, connectors, and all associated equipment as applicable unless specified otherwise.
6. Each hardware product shall conform to all specifications published or provided by Contractor or manufacturer, including, but not limited to, physical characteristics, operating characteristics, space requirements, power requirements and maintenance.
7. All equipment proposed must be new and unused. All hardware and software must be of the latest general release (not in the alpha or beta testing phases) offered by the manufacturer at the time of installation.

#### C. Substitutions

1. The Contractor is expected to use all skills and resources available to assure that Owner receives a System or Systems that is efficient in both cost and operation and that satisfies all of the functional and performance requirements established in this document. If a Contractor has any questions as to whether a proposed modification to this document would be acceptable, such questions must be presented to Owner prior to the cut-off date for document inquiries in writing.
2. Where manufacturers and or model numbers are specified, these are required. In particular, all equipment and cable under this procurement shall be manufactured by CommScope and Panduit. However, in light of the preceding paragraph, other products may be considered by other vendors, provided technical specifications, samples, and test results are submitted.

3. Suggested substitutions must be approved in advance (at least two (2) weeks) of the bid date, by Physical Plant and ITS Departments and may not be employed in the bid without prior written approval.
4. Substitutions subsequent to award of contract will be considered only on written grounds to ITS.
5. Acceptable grounds for substitution include the discontinuance of the product, or that the substitution would meet or exceed the relevant testing results for the named product and the substitution would be of advantage to the Owner.
6. Any substitution requires written authorization by The Owner Physical Plant and ITS Departments.

D. Guarantee/Warranty

1. All work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the work of all other Trades resulting from activities of the Contractor shall be replaced or repaired as directed by the Owner's representative for the duration of the stipulated guarantee periods.
2. The Contractor shall provide to the Owner a written guarantee that the installation, including controls and all other equipment covered under each section of the specifications, performs in an efficient and satisfactory manner.
3. The Contractor shall warrant all phases of the system (including, but not limited to, software, hardware, peripheral equipment) for a period of fifteen (15) years from the date of written final acceptance against defective materials, design and workmanship. The Contractor shall include all preventive maintenance, parts, and servicing required for the systems provided under this document to be continuously operational. Upon receipt of notice from the Owner of failure of any part of the warranted system, the Contractor, with the assistance of the supplier, shall promptly restore the defective component to provide an acceptable system at no cost to the Owner.
4. The Contractor shall for a period of one (1) year from System Acceptance have total responsibility for all maintenance of the System. Maintenance shall be defined as labor, parts and supplies, technical support, and System diagnostics, whether on site or remote.
5. The warranty period shall commence upon signed final acceptance by the Owner. Acceptance tests and procedures shall be developed by the Contractor and accepted by the Design Professional/Owner. Warranty period must meet or exceed fifteen (15) years.
6. During the warranty period, there shall be no charges to the Owner for service calls (mileage, labor, travel, expense, etc.) for warranty or maintenance work.
7. Contractor shall pass through to Owner all manufacturer's and supplier's warranties for any products, not owned by Contractor that are furnished to Owner by Contractor under this Agreement. Contractor shall, upon Owner's request, execute each and every document that is necessary or appropriate to effectuate Owner's obtaining and enjoying the benefit of any such pass-through warranty.

8. Where applicable, Contractor should provide a Panduit Certification Plus System Warranty on the entire installation. Such warranty to be for a period of at least 15 years, and to include applications requirements.

E. Coordination Drawings

1. Coordinate location of equipment and provide necessary conduits to insure all wiring and equipment are adequately protected.
2. Routing shall be laid out in advance. The Contractor shall develop detailed coordination drawings to identify use of chases, spaces above ceiling and Mechanical/Electrical/Electronic Equipment Rooms. Routing shall be located so as not to affect structural sections such as ribs or beams.  
(See also 17130)

F. Storage And Protection Of Materials

Contractor shall be responsible for storing and securing all materials before installation in environmental conditions acceptable to the materials. For project performed in winter, cable shall be at room temperature during installation to avoid being damaged. Contractor shall coordinate with owner on securing materials on-site.

G. Protection And Cleaning Of Systems And Equipment

1. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage.
2. During construction, cap the top of all conduits and raceway installed vertically.
3. During installation, equipment shall be protected against entry of foreign matter on the inside; and be vacuum cleaned both inside and outside before testing, operating and painting.
4. Damaged equipment, as determined by the Design Professional/Owner, shall be repaired or replaced and returned to operating condition.
5. Painted surfaces shall be protected at all times and protection removed prior to final inspection.
6. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

H. Cutting And Patching

1. Contractor shall do all cutting, fitting, or patching of its work that may be required to make its several parts come together properly and fit it to receive, or be received by work of other



Contractors or Subcontractors shown upon, or reasonably implied by, drawings and specifications for the completed work.

I. Surface conditions

1. Prior to any work, the contractor shall carefully inspect the installed work of all other trades and verify that all such work is complete to the point where his installation may properly commence.

J. Installation

1. Install all equipment in accordance with the manufacturer's recommendations.
2. Secure equipment using fasteners suitable for the use, materials, and loads encountered. Submit evidence of suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
3. Equipment location shall be as close as possible to locations shown on contract drawings or as directed by the owner. The contractor shall provide wall, console, furniture, millwork mounted or ceiling mounted devices as directed by the design professional at no additional cost to the owner.
4. Working spaces shall be not less than specified in the national electrical code for all voltage specified.
5. All equipment shall be installed in location and manner that will allow for convenient access for maintenance and inspection.
6. Where required by owner exposed equipment and materials, including screws and other fasteners, shall be tamperproof.
7. Cover plates shall have beveled edges.

## Administrative Requirements

**Includes:** Contractual, legal, compliance, process and other administrative requirements.

### A. Project Meetings

1. The Contractor must attend weekly project meetings, and provide status reports to the Owner's Project Manager or general contractor. Reports should detail work performed since last report, resolution or status of past problem areas, new problem areas, scheduled meetings, tasks to be performed, etc. Contractor shall produce and maintain project management documents tracking progress of the implementation in electronic format.

### B. Coordination With Owner

1. Owner shall designate an authorized Project Manager ("Project Manager", "Owner Project Manager") to deal in all matters with Contractor, including, but not limited to, questions, clarifications, proposal procedures, inspection, and implementation. Owner shall provide the Contractor in writing with the names, titles, and responsibilities of such representatives. Instructions from anyone other than duly authorized Owner Project Managers shall not bind Owner in any way, and the Contractor shall not rely on or act pursuant to instructions of persons other than duly authorized Owner Project Managers.
2. All Work pertaining to the installation of the System shall be closely coordinated with Owner via the Owner Project Manager.
3. The Project Manager shall be the conduit and sole point of contact between Owner and the Contractor except in areas related to construction, demolition, and the like. Physical Plant and ITS may collectively act without conferring with the Owner Project Manager. Any such instructions should be accepted by the Contractor without hesitation and without confirmation from the Owner Project Manager.
4. Project Inspectors will be assigned as needed by the Project Manager and written e-mail or mailed notification will be given to the Contractor Site Manager.
5. Owner's Project Manager will coordinate all work outside of normal working hours, storage of materials, work in occupied areas, etc.
6. Interruptions, outages, tie-ins, and relocation of any other utilities shall be coordinated with owner's Project Manager with sufficient notice of intent and requirements.

### C. Submittals

1. All submittals shall identify the project and include the name and address of the contractor and subcontractors.
2. The contractor shall provide manuals and as-builts in the following quantities in both electronic and hard copies:
  - One (1) set of applicable information to be kept in the switch room
  - One (1) complete set for the Owner's telecommunications office
  - One (1) complete set to Owner's Facilities Department
  - One (1) complete set to Owner's Technical Services Department

D. Coordination Drawings

E. Shop Drawings and Manufacturer's Data

F. Product Data And System Information

G. Provide all technical data sheets and manufacturers' cut sheets for products proposed.

H. Submittal list

1. The Contractor shall provide 10 copies of the proposal and all submittals on reproducible bond with final drawings submitted in AutoCAD format. All specifications shall be submitted in either MS Word, or Google Docs format. All worksheets shall be submitted in MS Excel, or Google Sheets format.
2. Submit Contractor, sub-Contractors, Technical Installation Personnel Qualifications Construction Schedule, Technical proposal and system demonstration procedures in compliance with Section I and Section II of this document.
3. Submit all samples as outlined in this document.
4. Submit a list of all spare parts recommended and provided as outlined in this document.
5. Submit an example of the Maintenance and Warranty contracts as outlined in this document.

I. Implementation Plan

1. As part of the proposal, the Contractor must provide a preliminary Installation Plan including the process to be followed for installing the systems. Consideration must be given relative to minimal disruption of Owner's daily operations during cutover.
2. Within thirty (30) working days after contract award, the Contractor must provide a final Implementation Plan addressing in detail all of the items above as well as other applicable sections of this document.

3. Any variation of any provision of the preliminary Implementation Plan from the Response to this document must be noted and will require the written consent of Owner. The final System design must be approved by Owner prior to commencement of installation.
4. Owner shall have ten (10) days to review the final Implementation Plan. In the event that the Plan is not acceptable to Owner, Owner shall notify the Contractor of the deficiencies in the Plan and other required changes. The Contractor shall then have seven (7) days to revise and re-submit the Plan. If the final Implementation Plan is still not acceptable to Owner, the Contractor may be required to further revise the Plan until it is acceptable to Owner, or Owner may terminate the Contract without cost or obligation and receive a full refund of all amounts paid to the Contractor (less any amount allocable to equipment Owner elects to retain after the termination) within ten (10) days after the termination. If a final Implementation Plan is agreed upon, it shall become part of the contract. ( See also 17030 Scheduling)

J. Service And Technical Assistance

1. Provide a list of equipment servicing requirements.
2. Provide a list of typical component or system failures and the type of personnel required to correct the failures.
3. Provide a summary of the service and technical support that the Contractor team can supply including hardware and software personnel. The Contractor shall provide business phone and fax numbers, addresses and expected response time in the event of an equipment failure.

K. System Test Procedures

1. Provide a list of test procedures that will be developed for testing all proposed systems in accordance with the applicable sections of the Technical Specifications and Requirements.
2. Describe the test instruments required, the conditions of tests, when the tests are to be conducted and who will perform each test for all devices, cabling, end-to-end testing of all systems, and video standard conformance testing.
3. All systems and components shall be adjusted for optimum performance under local conditions particular to the project.

L. Special Tools And Materials

1. Provide a list of all special tools, equipment and materials necessary to maintain the proposed systems.

M. Manuals & Technical Documents

1. Contractor shall provide to Owner all required warranties, parts lists, plans, comprehensive operating manuals, etc., for all hardware and software provided to Owner prior to final payment. All of the above shall be updated as required for as long as the System is in service at no additional cost to Owner.

2. Contractor shall supply a comprehensive operations manual for each hardware product, and in the case of custom-developed deliverables, shall also provide a manual describing the functions, characteristics and operating capabilities that may be expected of such deliverables.

N. Statement Of Warranty

1. Documentation must include the Manufacturer's Certificate of Warranty for all equipment. Warranty shall be obtained for at least one (1) year as defined elsewhere in this document.
2. Contractor shall pass through to Owner all manufacturer's and supplier's warranties (to the extent Contractor has the right to do so) for any Software Products, hardware or equipment not owned by Contractor that is furnished to Owner by Contractor under this Agreement. Contractor shall, upon Owner's request, execute each and every document that is necessary or appropriate to effectuate Owner's obtaining and enjoying the benefit of any such pass-through warranty.

O. Record Drawings

P. As-Built Drawings

1. All as-builts shall be provided in both hard copy and electronically (AutoCad). As-builts elevation views of all racks (front and back) shall also be provided to customer and shall be modeled on the sample drawing given in Appendix B.
2. As-built diagrams shall show cable designation, termination points (including outlet locations), cable size, cable type, # of pairs, and cable labels.
3. Provide as-built drawings of the placement and installation of all communications spaces (equipment rooms, switch rooms, closets, etc.) where the Contractor has place switching or termination equipment (except telephones) showing the placement of the equipment, electrical connections, grounding, etc.
4. Two weeks prior to occupation, Contractor shall provide to Owner preliminary "as built" drawings of the complete installation to allow Owner's personnel time to connect and test owner provided equipment.
5. Final as-builts shall be delivered in three (3) sets of volumes of standard 8-1/2" x 11" three ring binders within four (4) weeks of acceptance. Large drawings too bulky to be folded into 8-1/2" x 11" shall be separately rolled in 3 inch tubes, cross referenced and indexed with the manuals.

Q. Contract Administration

1. Contractor shall verify all requirements. No extra charges or compensation shall be allowed as a result of the failure to verify requirements before ordering materials or fabricating items.
2. Contractor shall supply sufficient labor, material, plant and equipment, and pay when due any laborer, Subcontractor, or supplier for supplies furnished and otherwise pursue the Work with diligence to prevent any work stoppage and ensure completion of the Work within the time specified.

R. Permits, License Inspections And Fees

1. Contractor hereto represents and warrants that, before the commencement of the Work, (i) it will have obtained all necessary approvals, consents and authorizations of third parties and Governmental Authorities to enter into this Agreement and to perform and carry out its obligations hereunder; (ii) the persons executing this Agreement on its behalf have express authority to do so, and, in so doing, to bind the party thereto; (iii) the execution, delivery, and performance of this Agreement does not violate any provision of any bylaw, charter, regulation, or any other governing authority of the party; and (iv) the execution, delivery and performance of this Agreement has been duly authorized by all necessary partnership or corporate action and this Agreement is a valid and binding obligation of such party, enforceable in accordance with its terms.
2. Contractor shall be responsible for obtaining and paying for all necessary permits and licenses legally required for the performance of the work. Contractor shall post all notices required by law and comply with all laws, ordinances, regulations or other legal requirements of any Governmental Authority bearing on the conduct of the work as specified.
3. Certifications for any work that requires an inspection certificate or certificates by a Governmental Authority, National Board of Fire Underwriters or any other shall be obtained and paid for by Contractor. Contractor is responsible for procuring all necessary certificates of acceptance or completion required and issued by the state, municipal, or other Governmental Authority and delivering these to Owner. Owner may withhold any payments that are due or that may become due to Contractor until the necessary certificates are procured and delivered to Owner.

S. Rights Of Ways

T. Alternates

U. Substitutions

1. Whenever in any of these specifications any article, device, or material is designated by the name of the manufacturer or Contractor or by any proprietary or trade name, that is the required solution unless such name is followed by the words "or approved equal," "or as approved" or preceded by the words "similar and equal to." Then, and only then, will the standard products of manufacturers other than those specified be accepted and only when, prior to the ordering or use thereof, it is proven to the satisfaction of ITS that they

are equal in design, strength, durability, usefulness and convenience for the purpose intended. Any changes required in the details and dimensions indicated in the drawings for the substitution of standard products other than those called for shall be properly made as approved by ITS at the expense of the Contractor requesting the substitution or change.

2. No substitutions shall be permitted for components of extensions to existing installations when, in the opinion of the ITS, the named manufacturer must be provided in order to ensure compatibility with the existing installations.

#### V. Changes In Work

1. Owner, by written order, may authorize changes in or additions to work to be performed or materials to be furnished pursuant to the provisions of the contract.
2. The amount of any adjustment in the contract price for authorized changes shall be agreed in writing by Owner before such change becomes effective and shall be determined as follows:
  - a) By an acceptable lump sum proposal from Contractor and Subcontractor. Itemized breakdowns shall include a listing of each item of material with unit prices and number of hours of labor for each task.
  - b) By unit prices contained in Contractor's original proposal as modified in negotiations leading to award.
3. Within sixty (60) days of site cutover, Owner may adjust the equipment requirements and provide for the return of any unused equipment without incurring any restocking charges. Unused equipment shall include equipment that has been opened, removed from its original packaging, and used by Owner as long as it is undamaged and is returned with the original warranty cards (if any) and other packaging material.
4. Minor software configuration changes such as class of service, forwarding, line/button assignment, pick-up group, etc. that are required for fine-tuning the System and/or individual station design shall be performed by the Contractor at no charge to Owner for a period of 120 days after cutover.
5. No pleas as to acts, orders or supervision of Owner (or any other person) shall be submitted in justification of any errors in construction or departure from terms of the contract, except for duly executed change orders or supplemental contracts, in writing, signed by Owner's Procurement Services and specifically designated on its face as a "change order" or "supplemental contract" as the case may be.

#### W. Project Documentation

#### X. Photographs

Y. Scheduling

1. No claims for alleged delay or additional labor due to coordination problems shall be permitted.

Z. Implementation Plan

(See under Submittals above in this section.)

1. Submit for review and approval within 5 days of award of General contract, a critical path graph-type Construction Schedule on proposed work, before the start of work.
2. Contractor shall be responsible for laying out Contractor's own work and for any damage which may occur to work of any other Contractor because of errors or inaccuracies. Furthermore, Contractor shall be responsible for unloading, uncrating, and handling of all materials and equipment to be erected or placed by Contractor, whether furnished by Contractor or others. Layout of work by Subcontractors shall be coordinated with layouts of all general work. Unless otherwise directed by owner, salvage materials, waste and scrap resulting from such work shall be promptly removed from the site by the responsible Contractor.
3. Contractor shall coordinate all work with other trades, facilitating construction, preventing conflict, mutually assuring access, and completing tasks in a timely fashion to prevent delays to others.

AA. Cleanup

1. Each Contractor shall be responsible for the cost of their respective cleanup and removal from premises of all rubbish, debris, and dirt resulting from work and shall clean up as requested by Owner's Project Manager.
2. Contractor shall advise its Subcontractors of this provision, and the Contractor shall be fully responsible for leaving the premises in a finished state ready for use. Owner will hold Contractor responsible for the cleanup and removal from premises of all rubbish, debris, and dirt resulting from work of Subcontractors.
3. All buildings and premises shall be kept clean, safe, in a workmanlike manner and in compliance with OSHA standards at all times.
4. The Contractor shall be responsible for removing, at Contractor's costs, all of its debris, waste material, etc., on a daily basis and make a reasonable attempt to recover or recycle materials.
5. If dumpsters are to be used, it shall be the Contractor's responsibility to contract for their provision, emptying, and removal.
6. If this clean-up is not done to Owner's satisfaction, Owner will perform this work and charge the Contractor accordingly.



7. All bright metal or plated work shall be thoroughly polished. All pasted labels, dirt and stains shall be removed from the devices.

BB. Restoration

1. The Contractor must restore to the Owner Project Manager's satisfaction any damage to any buildings, grounds, or surfaces at no cost to Owner.
2. All restoration work shall be performed in a professional manner by trades people skilled in the required trade.
3. Contractor shall promptly inform Owner's Project Manager of any Contractor-related damage.
4. Owner shall have the right to direct the Contractor to specific products, materials, makes, models, colors, or types of items used for repairs. This includes, but is not limited to, paint brands and colors, grass seeds, soil, fill, masonry, patching material, etc.

CC. Project Closeout/ Completion

1. All systems shall be completed, operational and calibrated and all testing, start-up and cleaning work shall be complete at SUBSTANTIAL COMPLETION.
2. After all final tests and adjustments have been completed and approved by the Design Professional/Owner, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed.

DD. Operations And Maintenance

1. Maintenance Labor shall be defined to be all labor required to diagnose malfunctions in any System element and to repair that malfunction and shall be on site during regular business hours. Regular and scheduled preventive maintenance shall be performed in accordance with the manufacturer's specifications including, but not limited to, running diagnostic programs and tests, cleaning internal components of System elements, testing and servicing battery backup units, and cleaning, lubricating, and otherwise servicing all applicable components on a periodic basis in compliance with manufacturer's recommendations.
2. Maintenance Parts and Supplies shall be defined to be the stocking and supplying of any and all parts associated with any System element including, but not limited to, replacement circuit boards or cards, data interface units of all types, Contractor-provided cabling, patch panels and connectors and consumable materials.
3. The inventory of such parts and supplies to be stocked within one shipping day for standard delivery (i.e. Part can be on site in no greater than 24 hours for replacement). An emergency stockpile of all parts and supplies shall be maintained by the Contractor within six (6) transportation hours of (location) that shall include, besides at least five (5) of each part of supply stocked at other locations, at least one (1) of each of such normally

inconsumable System elements as cabinet interface cables and circuit board or card shelves.

4. In specific cases, where it is determined to be advantageous to the Owner, the Owner may maintain a stock of parts necessary or supplemental to any installation project. Such an arrangement shall be made between the Contractor and the Owner, and may be terminated at any time by the Owner without notice to the Contractor. Such circumstances do not, however, free the Contractor from meeting all requirements specified in this document.
5. This service shall consist of supplier's factory trained representative providing the following:
  - a) Personnel factory trained by the manufacturers of the system's components and recognized by the manufacturer as an "authorized distributor" with "certified maintenance personnel."
  - b) All spare parts to support the requirements of this specification. Spare parts will be stored at the Contractor's maintenance facility or in the Contractor's vehicles.
  - c) All tools and test equipment.
  - d) All technical support (remote and/or on-site as dictated by the nature of the problem) required from the Contractor to resolve any maintenance/warranty issue.
6. Service Requirements - Service response requirements shall include the following:
  - a) 8-hour phone number with live answering, and 24 hour emergency cell phone contacts.
  - b) Service organization shall have a site response time of not more than two (2) hours for major failures and eight (8) hours for minor failures after being notified. This service shall be on a 24x7x365 basis.
  - c) Shall maintain current set of system documentation (with duplicates on site) including but not limited to the following:
    - 1) Wiring diagrams.
    - 2) Operation and maintenance manuals.
    - 3) Software programs.
    - 4) Other documentation as required to provide assistance to the Owner's qualified technical representative on the operation and maintenance of the systems.
    - 5) All documents shall be made available to the Owner upon request.
7. Upon termination of maintenance agreement, all system documents, or copies of such, shall be furnished to the Owner for maintenance continuity.

#### EE. Acceptance

1. True Up
  - a) Due to the potential length of time between preparation of the response to this document by the Contractor and actual installation of the equipment, it is anticipated that product changes may occur.

- b) After cutover but prior to acceptance testing, the Contractor shall provide to ITS and its representative(s) a written account itemizing:
  - The contracted purchase price.
  - The contracted configuration.
  - The contracted unit prices.
  - An itemized accounting of each change order accepted in writing by owner listing components added and deleted by quantity, unit price (pre or post cut-over as applicable), and extended price.
  - The resulting mathematical calculation of the quantities and costs. (Net increase/decrease to cost.)
  - The revised price.
  - The revised configuration including bay-face maps for each node location.
- c) The final payment shall be adjusted according to the results of the “true-up” process.
- d) No allowance will be made for increases in manufacturer’s pricing on contracted quantities.
- e) In the event of price decreases, Contractor may pass these on to The Owner.
- f) Contractor shall specify in proposal discount rates for product bought by The Owner outside the scope of the contract in such a manner that Owner can determine the price from Manufacturer’s list price.

## 2. Acceptance Testing

- a) At least thirty (30) days prior to cutover, the Contractor and owner shall jointly develop a written plan acceptable to owner for acceptance testing. There shall be no provision for automatic acceptance. This plan shall include the methodology for testing:
  - All hardware and software installed and functioning properly.
  - All services functioning properly.
  - Restoration of buildings and grounds
  - Grounding
  - Redundancy
  - All other requirements of the contract.
- b) In order to be considered for acceptance testing, all systems must have operated “under load” for a minimum of thirty (30) consecutive days without major failure. Any such failure shall restart the testing period until such time as the System has operated for the full testing period without failure.
- c) All punch list items and operational reports must be completed, reviewed, and accepted by owner before Acceptance Testing commences.
- d) In the event that testing is not completed within 120 days from cutover, owner may, at its option, consider the failure a breach of contract and require that the System or the specific subsystem or component causing the delay of testing be removed and replaced.

- e) In addition to these provisions for testing, owner shall also perform an inspection of all equipment rooms, telephone closets, risers, etc., for cleanliness, labeling, and overall compliance. Complete and legible labeling of all cables and blocks shall be required.
- f) Owner shall also test at random assorted installations for overall operation, installation, labeling, etc.
- g) Deliverables, which must be received by owner prior to Acceptance, shall include:
  - As-built drawings
  - True-up information (contracted versus actual installed quantities)
- h) "Acceptance Date" shall be defined as the date upon which the installation has passed all site acceptance tests, all punch list items are completed, and all post-cutover documentation is received, training as contracted for is complete and considered adequate by owner, and owner delivers the written Notice of Acceptance of the installation to the Contractor.
- i) Final payment to the Contractor shall not be released until after all items are completed and not prior to the Acceptance Date.
- j) Title and risk of loss shall transfer from Contractor to Owner at acceptance.

#### FF. Quality Assurance

1. All work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the work of all other Trades resulting from it shall be replaced or repaired as directed by the Owner's representative for the duration of the stipulated guarantee periods.

#### GG. Inspection and Tests

1. While Owner and/or Owner's agents may have responsibilities for inspection, failure to observe any defect in materials or workmanship, any code or standards violation shall not relieve Contractor from responsibility to correct such at Contractor's cost and Owner's convenience.

#### HH. Owner Project Inspector/Manager:

1. Owner reserves the right to appoint one (1) or more Project Inspectors to review the Contractor's work and ensure compliance with the contract and specifications. The Project Inspector shall at all times have access to the work.
2. The Project Inspector shall be considered a duly authorized agent of the Owner Project Manager and shall have the right to stop or delay work if, in the Project Inspector's best judgment, the Work is not compliant with the contract or specifications, the continuation of the Work would threaten persons or property, or in any other manner jeopardize the Owner or the project. The work shall remain stopped until such time as the Project Inspector

states in writing that the problem has been resolved.

3. If the cause for delay is not the fault of the Contractor, the length of time the work has been delayed shall be added to the installation date.
4. If the cause for the delay is due to action or inaction by the Contractor or a Subcontractor, the problem shall be resolved at no cost to the Owner and no time shall be added to the schedule.
5. Although Owner's Project Manager is instructed to confer with the Contractor regarding interpretation and otherwise, such assistance shall not relieve the Contractor of any responsibility for the Work.
6. The fact that Owner's Project Manager has failed to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility for correcting such work without additional compensation.
7. If laws, ordinances, any public authority, any insurance rating bureau or these specifications require any work to be specifically tested or approved, the Contractor shall give Owner's Project Manager timely notice of the date fixed for such inspection. The Contractor shall bear the cost of any such tests and is responsible for scheduling and obtaining them.
8. Owner's Project Manager may require project coordination meetings that shall be attended by the appropriate Contractor, Subcontractors, and suppliers.
9. If any work is required to be specially tested or approved, Contractor shall give Owner's Project Manager timely notice of date for such inspection.

## II. Coordination with Existing Services

1. Contractor shall prearrange with Owner's Project Manager in case it becomes necessary for the interruption of any existing service to make connections, alterations or relocations and shall fully cooperate with Owner in doing work so as to cause the least annoyance and interference with the continuous operation of Owner.
2. The Contractor shall be aware that the outage/tie-in time and date is subject to approval by Owner's Project Manager. Contractors shall also be aware that most such outages/tie-in will be conducted during periods requiring premium time and that all such costs must be included in the Contractor's base proposal costs.
3. Contractors shall not commence any excavation without providing 48-hour advance notice to the local utilities and any others that are affected in writing, with a copy of such notification to Owner's Project Manager in charge of the project.

## JJ. Delineation Of Work

1. The Contractor shall provide all necessary supervision and coordination of information to any contractor who is performing work to accommodate this installation. Where the

Contractor is required to install items provided by others and Owner, they shall include for such items:

- a) The coordination of deliveries.
- b) Their unloading from delivery trucks driven in to any designated point on the project property line at grade level.
- c) Their safe handling and field storage to the time of final acceptance in the project.
- d) The correction of any damage, defacement or corrosion to which they may have been subjected.
- e) Their field assembly and internal connection as may be necessary for their proper operation.
- f) Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastening necessary to adapt them to architectural and structural conditions.
- g) Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

## Site Specific Requirements

**Includes:** Unique Site and Project requirements

### A. Safety of Persons and Property.

1. The Contractor shall provide adequate fire protection during all phases of the project which may pose a hazard to any person of the Owner community or visitors or their property and/or to Owner and Owner's property or to the property of other Contractors and Subcontractors. Such tasks include but are not limited to welding, cleaning with flammable solvents, and any other work with flammable materials.
2. In addition to the above, the Contractor shall conduct all work in a safe, orderly manner, keeping all corridors and passageways clear of material and debris and work in compliance with OSHA, NFPA, and accepted industry safety procedures.
3. Contractor shall not overload, or permit others to overload, any part of any structure during building operations.
4. During the performance of the Work, the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other safety and warning devices appropriately located on site which shall give proper and understandable warning to all persons of danger of entry onto land, structure, or equipment.
5. Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials installed, or to be installed by Contractor.
6. Contractor shall maintain at Contractor's own cost and expense adequate, safe and sufficient walkways, platforms, scaffolds, ladders, and hoists and all necessary, proper, and adequate equipment, apparatus and appliances useful in carrying on work and to make the place of work safe and free from avoidable danger as may be required by safety provisions of OSHA and any other applicable laws, ordinances, rules, regulations, and building and construction codes.
7. The Contractor shall indemnify and hold harmless the Owner from and against all liabilities, suits, damages, costs, and expenses (including attorney's fees and court costs) which may be imposed on the Owner because of the Contractor, subcontractor, or supplier's failure to comply with the regulations stated herein.
8. The Contractor shall comply with all building and grounds security requirements at all times.

B. Location and Protection of Utilities

1. Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials installed, or to be installed by Contractor.
2. Contractor shall be responsible for care of Contractor's finished work and must protect same from damage or defacement until acceptance by Owner. All damaged or defaced work shall be repaired or replaced to Owner's satisfaction, at expense of Contractor.

C. Asbestos and other Hazardous Materials Procedures

1. It is possible that materials containing asbestos, dust, lead, or other hazardous materials such as pipe and boiler insulation, floor tiles, acoustical or insulation material on building structures (ceilings, walls, beams, etc.) may be found in many areas of the work. All appropriate Federal, state, and municipal guidelines must be followed during work with asbestos-containing material. This includes OSHA requirements under 29 CFR 1910.1001 and EPA requirements under 40 CFR, Part 61, Subpart B.
2. If asbestos, lead paint, or any other hazardous material is encountered on any job, where such material must be removed or disturbed in any manner, all work in that area shall cease and the Owner Project Manager notified. The Owner Project Manager will make the necessary arrangements to address or avoid the problem. Contractors will not be held responsible for delays due to hazardous material removal or abatement except due to a Contractor's failure to notify Owner in a timely manner.
3. No asbestos material or lead paint product shall be used in any Owner construction project. This includes floor and ceiling tile, spackling, felt, etc. All pipe insulation is assumed to contain asbestos unless labeled "non-asbestos," or until proven "non-asbestos" by accepted analytical method.
4. If core drilling is required in areas floored with vinyl asbestos tile, the Owner Project Manager should be notified at least two (2) business days in advance, and Owner will arrange to have the tiles removed or tested.
5. Failure by Contractors or their employees to adhere to these hazardous materials handling guidelines will constitute a breach of contract and may cause the Contractor to be terminated. In such a case, the Owner will immediately hire a substitute Contractor for the work, and hold the terminated Contractor responsible for the cost of completing the work and any liability Owner may sustain pursuant to the terminated Contractor's work.

D. Confined Spaces

1. Owner shall determine if any spaces the Contractor will enter during the course of their work are PERMIT – REQUIRED CONFINED SPACES as defined and regulated by OSHA. Confined Space Permits shall be the responsibility of the Contractor, in accordance with their company's procedures.



E. Vehicular Access & Parking

1. Owner shall make special parking permits available for Contractor's vehicles while Contractor's personnel are performing deliveries, removals, or on-campus work. All arrangements must be made through the Owner's Project Manager and are at the sole discretion of the Owner. The Contractor hereby agrees to abide by all parking regulations and shall promptly pay all fines, tickets, etc. as the result of any parking infractions. All vehicles shall display appropriate identification while on-campus.

F. Identification

1. No project signs shall be erected without the prior written consent of the Owner Project Manager except for signs dealing with public safety.
2. All representatives and employees of The Contractor performing installation work shall wear materials providing the name and or logo of The Contractor while performing their installation duties

G. Product Delivery Requirements

1. The Contractor is expected to utilize just-in-time delivery methods and to stage, assemble, and perform pre-delivery testing at a Contractor's location to the greatest extent possible.

H. Product Storage Requirements

1. Only minimal on-campus storage will be available for The Contractor's materials and supplies.
2. Contractor shall limit operations and storage of material to designated areas, shall not encroach on neighboring property, and shall exercise caution to prevent damage to existing structures.

I. Access to Site

1. During the installation period, the Contractor shall have reasonable access to buildings, drawings, documents, equipment listings, and other pertinent information that will assist in the installation during regular business hours. It is the Contractor's responsibility to thoroughly survey all existing facilities, buildings, etc., that will require service.

J. Coordination with Occupants

1. It is the intent that all work be performed with a minimum of disruption to normal business activities.

2. The Contractor shall coordinate all work with the Owner's Project Manager so there shall be no prolonged interruption of existing equipment or services. Owner will inform Contractor prior to each interruption what it will consider "prolonged interruptions" under the circumstances.
3. Any existing telephone, plumbing, heating, ventilating, air conditioning, or electrical disconnections necessary, which affect portions of this project or building, must be scheduled with Owner's Project Manager to avoid any disruption of operation within the building or construction or other building or utilities. In no case shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities, either intentionally or accidentally, shall not relieve the Contractor responsible for the interruption from repairing and restoring the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.
4. Where the Contractor is required to work in and adjacent to areas in use, Contractor must coordinate its operations with those of Occupants through the Owner Project Manager to minimize interference with Occupant operations.
5. After starting work in such a facility, the Contractor shall work to completion as soon as possible with full crews of workmen during regular working hours. Contractor should be aware that some work may need to be performed out of normal hours. For purposes of pricing, Contractor should assume 10% of the work will be performed outside of the hours of 8AM – 4 PM. For work out of hours, consult the Owner Project Manager for directions, coordination, and access.

K. Use of Site

1. Owner will attempt to provide office space and telephone service (excluding long distance service) and attempt to find space for the Contractor's use when called for, as determined by Owner.
2. All Contractors and Subcontractors shall provide all associated personnel with a photo identification badge to be displayed at all times while in any Owner facility and a company uniform, company shirt, or some other method for easy identification to be worn at all times while on Owner property.
3. Contractor agrees to comply with all Owner rules and regulations including, but not limited to, no smoking policies, behavior guidelines, and dress requirements. A copy of these regulations can be obtained through the Owner Project Manager. Contractors are expected to ensure that all employees and subcontractors are aware of and comply with these regulations. Owner reserves the right to remove from the site any person who willfully or repeatedly violates Owner regulations.

L. Signage

1. No project signs shall be erected without the prior written consent of the Owner's Manager except for signs dealing with public safety as per 4.12.7., above.

2. During the performance of the Work, the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other safety and warning devices appropriately located on site which shall give proper and understandable warning to all persons of danger of entry onto land, structure, or equipment.

## Project Management and Quality Assurance Requirements

**Includes:** Services required to manage project installation and construction process and to provide quality assurance for all aspects of the project.

### A. Contractor And Contractor Personnel

1. Contractor should be a Panduit Certified Installer (PCI) , with a minimum of five (5) years experience on similar cabling systems and should have 1 RCDD certified staff members. All structured cabling designs submitted by the contractor shall be reviewed and approved by an RCDD. Denison reserves the right to dismiss a contractor that is not able to maintain their manufacturer certification status.
2. Contractor must have a home or regional office in Central Ohio.
3. Contractor shall be represented at the site by an assigned Site Manager from beginning of work until its final acceptance.
4. The Site Manager shall represent the Contractor on site and shall exercise full control over the project and all assigned Contractor personnel.
5. Owner requires that the Site Manager be assigned to the project for the entire duration of the project from project inception to acceptance and not be reassigned by the Contractor unless requested by Owner. The Site Manager may be assigned to other projects at the same time as they are assigned to the Owner project providing that all activities related to the Owner project are performed in a timely and workmanlike manner.
6. Owner reserves the right to approve the assigned Site Manager and, if in the sole opinion of Owner the Site Manager is not performing adequately in their assigned project roles, to request that that party be replaced on the project.
7. The Contractor Site Manager shall be a BICSI Certified RCDD and manufacturer-certified (Panduit) on any product installed.
8. Contractor Site Manager shall make him/herself familiar with the Owner's existing cabling infrastructure. Denison can approve contractors who do not hold these certifications only if contractor demonstrates equivalent certification knowledge/experience.
9. All technicians assigned to this project shall be BICSI registered technicians (at least 15%), installers (at least 55% technicians or installers), or apprentices and (excluding assistants, helpers, and apprentices) manufacturer-certified (Panduit) on any product on which they will work. Denison can approve technicians who do not hold these certifications only if contractor demonstrates equivalent certification knowledge/experience.
10. Copies of BICSI registrations must be submitted with the response. If contractors/technicians are not BICSI certified, Denison ITS will determine if vendor should be allowed to work on infrastructure cabling.

11. Manufacturer certified personnel shall be defined as those installation and repair personnel who have attended the manufacturer's training classes on the type and model product to be installed, who have the proper experience and licenses for the work to be performed, and who are recognized by the manufacturer as "qualified" technical support personnel.

B. Project Meetings/ Reports

1. Weekly Meetings

- a) The Contractor Site Manager must conduct weekly (or as agreed) project meetings, and provide status reports to Owner's Project Manager. Following at least alternate project meetings Site Manager shall make him/herself available for site walk-through with the Owner's representative.

2. Progress Reports

- a) Reports must detail work performed since last report, resolution or status of past problem areas, new problem areas, scheduled meetings, tasks to be performed, etc.

C. Quality Assurance Reports

1. Systems Certification

- a) The Contractor shall inspect, test and adjust all systems as required to meet the operational, performance and reliability requirements shown on contract documents.
- b) The Contractor shall submit complete Certifications and test results. Refer to Certification Forms and requirements included in this document and all other contract documents.
- c) The Contractor shall provide a separate certification for each system.
- d) The system certification shall attest that the system provided meets the operational criteria established by the Contract Documents and the requirement of codes, standards and regulations applicable for the system

D. Record Copy and As-built Documentation

- A. Contractor shall maintain accurate and current system drawings on-site throughout project.

## **-090 Cable Documentation System**

***Includes:*** Requirement for cable documentation including hard copy and electronic requirements as well as hardware and software systems.

- A. Hard Copy
- B. Line Cards
- C. Electronic copies - As stated before, the contractor is required to provide as-built drawings AutoCad format. The AutoCad draws shall include detailed floor plan views that allow the location of all cable drops. The Visio drawings shall provide detailed elevation views of the racks located in every telecommunications room for a given project.
- D. Fluke Test Results - As stated earlier, all cable test data shall be provided in their original, unmodified format. Cable records in this system shall be labeled in the same manner as cabling labeling given in this document.

## 17100 CABLE PLANT

The plant specified herein is designed to perform as the distribution media for voice and data. It should be noted that this section of the information transport and infrastructure specifications includes the cable itself (fiber and copper), placement of that cable, termination, protectors, ground rods, grounding clamps, cable ties, cable trays, jacks, backboards, terminal blocks, jumpers, testing, coring, and all other labor, materials and supervision for a fully operational, turn-key inside cable plant system.

- A. Cable must be handled according to manufacturers' specifications and recommendations, including, but not limited to, minimum bend radius, pulling tension, sheath wrinkling, etc., and in accordance with prudent standards of practice. Unsheathed cable located outside of buildings or underground must not be left exposed, and must be appropriately covered, encased, or protected.
- B. Contractor should exercise care in all operations around existing structures and equipment, and should be responsible for and should promptly repair all damage and defacement caused by their operations. All exposed new work must be painted to match walls or ceilings. All openings must be patched and fireproofed as required by code.
- C. Copper data location requirements:  
For student housing buildings we require at minimum 1 copper data location per student room. For office locations we require at minimum 1 data location per office space nearest the office desk. Each copper data location consists of 2 data connections.
- D. The Structured Cabling System shall be capable of supporting and/or integrating the following:
  - Digital voice applications
  - Data applications
  - Local area network services
  - Wide area network services
  - Video services
  - Local wireless services
  - Power over Ethernet
- E. The structured cabling system shall support 1 Gbps or higher speeds. Contractor is expected to demonstrate acceptable performance utilizing a current Level 2E or Level 3 Category 6 certified tester using the most recent firmware as provided by the manufacturer of the tester.
- F. The Structured Cabling System must support the addition of power over Ethernet as defined in the IEEE standard 802.3at-2009 for 25.5 watts.
- G. Panduit and CommScope equipment and cable shall be the sole product types installed. Other products may be considered, provided technical specifications, samples, and test results are submitted.

## Communication Equipment Rooms

**Includes:** Equipment and materials required to fit out the CER to allow it to support all associated serving zones and connect it to a CERB and/or Star Center.

### A. Telecommunication Room / data Closets

1. Telecommunication rooms shall be installed in a separate and secure area and requirements are covered under the architectural, electrical, and mechanical sections of this specification.
2. Telecommunication rooms shall be equipped with a lock core different from those of the rest of the building's non-infrastructure areas. Building users/inhabitants shall not have access to any telecommunication rooms
3. Closets are to be used exclusively for low voltage wiring (telephone, data, CATV, alarm, etc.).
4. Linear wall space for voice termination equipment must be lined with ¾" A/C grade plywood panels either painted or treated for fire resistance. These plywood panels must be installed a minimum 6" above finished floor and spaced 3 and ½ inches out from the wall. Anchors for plywood panels must be sufficient to support equipment apparatus. Voice termination equipment shall be mounted directly opposite data termination equipment with cable trays between, allowing for future simple migration of voice applications into voice over data applications using Panduit Part Number GPPC41GA/B 4 pair 110 block punch down to RJ45.
5. Overhead lighting to provide sufficient illumination for work at front and back of racks and on voice termination blocks.
6. All closets must have 24 x 365 HVAC to maintain operating temperatures in communications closets at all times.
7. There should be one dedicated 20 amp circuit for each rack as well as one circuit for service receptacles (placed every 6 linear feet of wall).

### B. Equipment Racks/Cabinets/Shelves

1. Contractor to install Panduit racks such as Panduit part number CMR19X84

### C. Cable management – Vertical & horizontal



1. Cable management solutions from Panduit shall be installed. Vertical Cable management shall be dual sided with front and rear vertical cable managers, and both sides of the rack. Horizontal cable management in between each patch panel and switch These shall include but are not limited to: Horizontal Cable management (Panduit part number PR2HF2) and Vertical Cable Management (Panduit part number PR2VD06 or PR2VD08) Fiber Routing.
2. All cable management systems shall be approved by ITS before installation
3. Both horizontal and vertical cable management shall be used in racks. Above and below every 48 terminations, one 2U cable management solution shall be installed.

#### D. Patch Panels

1. Termination components for data copper shall be selected Mini-Com All Metal Modular Patch Panels (part number CP24BLY, CP48BLY, CP24WSBLY, CP48WSBLY) used in conjunction with Mini-Jack TX6 Modular Jacks (part number CJ688TGGR or CJ688TGGR-24 for volume orders).
2. Terminations shall be color coded to follow the same scheme for copper patch cable sheeting: Green patch cable should be used with a green jack. Blue patch cable should be used with a blue jack, ETC.

#### E. Optical Fiber Panels

1. Termination components for fiber shall be the Opticom™ Fiber Optic/Multi-Media Interconnect Trays (Panduit part number FRME or FCE sized appropriately for location).

#### F. Termination Blocks

1. All termination blocks for voice must be category 6 rated, high-density, high-performance media termination devices from Panduit such as GPKBW24Y, GPKBW72Y standard density 110 blocks or GPKBW144Y or GPKBW432Y high density 110 blocks. Type-66 terminal blocks are not acceptable and shall not be used.
2. Each location to be labeled with the corresponding jack number as described in 17170.

#### G. Tie Wraps

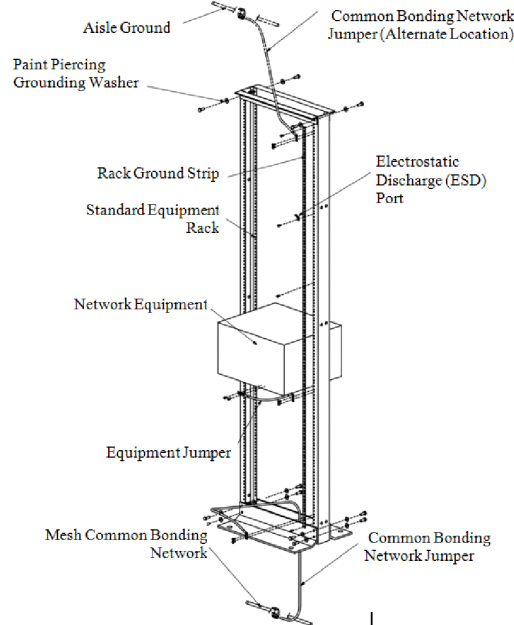
1. An improperly installed tie wrap can diminish cable performance by 15% or more. Over tight tie wraps shall not be permitted.

#### H. D rings and T Posts

1. All Horizontal and Vertical Cable systems shall be properly supported by D rings every four to six feet.

I. Grounding Bars

1. Each switching system cabinet and all associated equipment of the telecommunications System must be properly grounded and bonded in accordance with all applicable codes and standards. Ground must be achieved by attachment of the associated frames, protection equipment, etc. to a buss bar and/or rod ground located at or near the building cable entrance. The grounding buss bar must be solid copper at least 6 mm thick and 100 mm wide with pre-drilled NEMA bolt holes, and must be connected to a grounding rod or to building steel. Grounding to metallic domestic water lines is not acceptable due to use of underground plastic service. Also, grounding to gas pipe lines or power company neutral is not allowed.
2. Grounding of the racks, cable pathways, and structured cabling system shall be completed by the cabling contractor. The Electrical Contractor shall be responsible for installing a grounding bus bar in each telecommunication room and connecting this bus bar to the electrical system ground and building steel. The picture below illustrates grounding in a typical telecommunication room.



3. The switching equipment, all inside and outside plant cable, and peripheral equipment installed in each telephone equipment room must be grounded in common to the grounding bus. Each grounding attachment must be tested with a megometer and the readings recorded to be included with the final "as-built" drawings and documentation to be presented to the Owner by the Contractor prior to Final System Acceptance.
4. All grounding within buildings installed under this contract must be REA Type NOD, 1 conductor, 6 AWG insulated with (green) THHN polyvinyl chloride. Conductors must be tinned solid copper. Switching system (main and remote node) and

MDF/Telecommunications Main Bus Bar grounding to the main building grounding bus and/or rod must utilize a minimum of 2 AWG tinned solid copper.

5. All grounding must comply with EIA/TIA 607, the National Electrical Code identification tagging, the applicable state Electrical Code, and the applicable City/town codes. If conflicts exist between the codes or between any code and this RFP, the most stringent shall apply. If the Contractor discovers any situation which might prevent compliance with this section, the issue must be brought to the attention of Owner for resolution.
6. The Contractor must provide and install grounding mats or grounding straps in the work areas immediately adjacent to all switching system cabinets. Grounding mats/straps must also be provided and installed in the work areas immediately adjacent to any peripheral electronic equipment located in the telephone equipment rooms. Ground potential between the grounding mats and equipment cabinets must be zero (0).

J. Power Strips

1. All electronic equipment not plugged directly into a rack mounted UPS will be plugged into a Power Strip. Power Strips shall be approved by Denison University ITS prior to installation.

K. Rack Mounted UPS

1. Where requested by Denison University ITS, a rack mounted UPS will be installed. The manufacturer, make, and model shall be decided upon by Denison University ITS.

L. Copper Patch Cords

1. Standard lengths (1,3,5,7,10,14,20 feet).
2. Non-Standard lengths will be ordered as needed.
3. The following table specifies the type of user and the category of cable to determine the color and the Panduit color code.
4. No patch cords bought today will be less than CAT5e 350 MHz (No CAT5 or 5e 250 MHz). CAT6 is recommended when costs allow, and required for CAT6 network segments. CAT5E patch cords/jumpers are permitted only with the express consent of ITS.

M. Fiber Patch Cords

1. Multimode patch cords shall be duplex LC-LC Fiber Optic Patch Cords (Existing ST-SC, SC-SC, SC-LC patch cords shall be grandfathered in until such time that the existing terminations are replaced with LC connectors).
2. Singlemode patch cords shall be duplex LC-LC Fiber Optic Patch Cords.

## Main Distribution Frames and Service Entrances

*Includes:* Equipment and Materials required at a building entrance and at a main distribution frame.

### A. Entrance Facilities

1. Two 4" conduits with flexible inner duct to carry fiber optic cable only shall be run to the building entrance, per EIA/TIA specifications.
2. A 600 Foot maximum distance between pull points shall be permitted, with a maximum of 180 total degrees of bend between pull points.
3. Trace cable shall be provided in all conduit housing outside plant fiber.

### B. Lightning Protection

1. All outside plant copper cabling entering a building shall be equipped with facilities for lightning protection, surge suppression, and suppression of transient voltages. All protection shall be of the gas tube and cascading diode variety.

## Interior Communication Pathways

**Includes:** Interior pathway and opening requirements to support technology cable plant and systems.

### A. General

1. Contractor shall determine exact routing of cables in the field as approved by the Architect.
2. Routing shall be laid out in advance. The Contractor shall develop detailed coordination drawings to identify exact routing, use of chases, spaces above ceiling and Mechanical/Electrical/Electronic Equipment Rooms. Routing shall be located so as not to affect structural sections such ribs or beams.
3. Structural Penetrations: Where conduits, wireways, and other raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight and completely fill clearances between raceways and openings. Firestop material shall be in accordance with reference codes standards, regulations, and contract documents.
4. Floor, exterior wall and roof seals shall be watertight. Walls and floors, which are cored for installation of conduit, shall be sleeved with steel tubing, grouted and the space between the conduit and sleeve filled as required by Codes and Standards.
5. Tubing shall extend one (1) inch minimum above finished floor.
6. Hangers and other supports shall support only equipment and materials and provide not less than a safety factor of 5, which shall conform to any specific requirements as shown on the drawings or in the specifications.
7. Mounting height: In case of reuse of existing outlet box and wire mold or conduit, or if replacing an existing outlet, mount in the approximate location and height as the original. In the case of new locations utilize the following mounting heights:
  - a) Standard outlet: Center should be 15" AFF (above finished floor)
  - b) (Handicapped) wall phone/security phones: Center should be 48" AFF.
8. Tel/data outlets shall not be placed in a back-to-back location, but shall be separated a minimum of 12" (24 inches separated fire-rated walls).
9. All wall boxes for voice and data should be single gang boxes unless otherwise specified.
10. The General Contractor or Electrical Contractor will prepare each location with 1" metallic conduit with pull strings from each outlet box to a stub above the wall header.
11. Cable must be routed over doorways.
12. No cable may droop over 8" in any length of run.

13. Cable may not touch any light fixture or other electrical device.
14. Cable installation in the proximity of electrical motors, transformers, and other high EMI/RFI output devices must be shielded for cable that terminates in such areas, or provide a galvanized and grounded metal conduit for cable that passes through such areas. It is the Contractor's responsibility to identify these areas in coordination with ITS.
15. Cables must be concealed to the maximum extent possible.
16. OWNER may choose to provide (or have the Contractor provide) cable tray or troughs. If provided, such enclosures must be used. All such enclosures (no matter who provides them) must be in compliance with EIA/TIA 569, and 1990 NEC Section 318, Article 334, Section 320-6, Section 300-19, and Table 300-19(a).
17. Cables may only be installed without the use of cable enclosures (troughs, trays, or conduit) in corridors, if a drop ceiling separates the cables from the public space below. If cabling is installed above a drop ceiling, D-rings, J-hooks, or other approved attachment device must be used, providing support every 4 to 5 feet (adhering to item 12 in this section). Cabling may not be placed directly on the ceiling tiles and may not be attached to utility piping, other cabling, or affixed in any way to anything other than approved cable hangers.
18. Cables, when installed in open corridors (corridors without drop ceilings) must be installed in conduit or enclosed metal troughs or trays.
19. Cables, when installed in stairways, must be installed in conduit or enclosed metal trays or troughs.
20. All openings for cables that penetrate exit corridors and stairways must be sealed to maintain the integrity of corridors and stairways as a safe means of egress in compliance with federal, state and local codes.
21. Any new pull boxes or cabinets required shall be securely attached to the structural members of the building at locations accessible for servicing. Provide access doors at locations where access is not readily available.
22. Equipment Enclosures: Install and coordinate with the Owner at approved locations. Ventilate to maintain the environmental conditions specified by the equipment manufacturers.
23. Label pull boxes. Indicate the system's use of the enclosed cabling. The labeling shall be made with indelible computerized labeling system. The Design Professional shall approve labeling of pull boxes visible to detainees.

#### B. Conduits

1. All new construction and any buildings (or sections thereof) with interior wall construction of sheetrock over studs or plaster/lathe require recessed outlet boxes and concealed, behind the wall conduit, stubbed up into the ceiling plenum far enough to permit attachment of bushing or cap. (minimum conduit size: 1") All use of surface mount products must be specifically approved by ITS and Physical Plant.

2. Six conduits of 4" diameter must connect non-stacked communications rooms. A maximum total of 180 degrees of turn between pull boxes is allowed.
3. Turn radius for inside curve of 4" conduit is 40".

C. Wireways

1. Sleeves

- a) Six sleeves of 4" diameter must connect stacked communications rooms. Where rooms are not stacked, see "Conduit." Sleeves must extend between 2" and 3" above the finished floor.

2. Surface Raceways (Metallic or Non-Metallic)

- a) Wherever possible, inside plant wiring must be concealed. Panduit surface mounted raceway and surface mounted outlet boxes are permitted in all buildings with interiors constructed of cinder block, glazed block or other hard wall construction. Surface mount must be of the non-adhesive variety. See Appendix A for details on allowed products.

3. Cable Trays

- a) All cable tray shall be Panduit Wire Basket Tray. See Appendix for details.
- b) Tray will be 18" or 24" wide by as the site requires. (Length as required.) Tray will be mounted using trapeze mounting to ceilings at 6' intervals. The overhead cable tray routing system shall consist of pathway sections, splice connectors, sidewalls, waterfalls, mounting brackets, and accessories designed to route and manage copper, fiber optic, or power cables. The pathway sections shall be provided in various widths: 4", 6", 8", 12", 18", 24". The baskets come in various wall heights: 2", 4", and 6" heights. Trapeze, cantilever, and wall mount brackets are available to support the system. Baskets, accessories, and components are available in black, electro zinc, and white.

## Backbone Cabling Requirements

**Includes:** Copper, fiber and coax, inside and outside plant requirements

### A. General

1. "Riser cables" are those cables that connect the Main Communication cross-connect to various ICCs in telecommunication and equipment rooms within a building. Contractor should use the nearest convenient riser chase.
2. While it is not required that all riser cables be in conduit, it is required that all conduit, sleeves, and other passageways for the carrying of riser cables between telecommunication and equipment rooms, whether containing cables or spares for future expansion, must be plugged with an approved fire-retarding plugging compound at each telecommunication or equipment room entry point. Approved metal caps may be used to plug unused metal conduit where applicable. Either intermediate metal conduit (IMC) or electrical metallic tubing (EMT) should be used for all interior conduit runs.
3. The ends of each component within a riser cable must be terminated on an appropriate distribution frame, patch panel, or terminal block. Tied-back or otherwise unterminated components are not permitted.

### B. Fiber Backbone - Inside Plant

1. Riser Distribution Fiber shall be 12 strands of OM3 50/125 multimode(CommScope) and 6 strands of 8.3/125  $\mu\text{m}$  singlemode (CommScope) See Appendix A for approved products.
2. Where required, Plenum Distribution Fiber shall be 12 strands of enhanced OM3 50/125 multimode (CommScope) and 6 strands of 8.3/125  $\mu\text{m}$  singlemode (CommScope) See Appendix A for approved products.
3. Maximum bending radius and maximum pulling tension of the cable as set forth by industry and Manufacturer guidelines (whichever is more stringent) shall be adhered to during handling and installation.
4. A 100 Foot maximum distance between pull points shall be permitted, with a maximum of 180 total degrees of turn between pull points.
5. No splices are allowed in an intra-building fiber cable.

### C. Copper Backbone – Inside Plant



1. Minimum copper riser size is 50 pairs which must support no more than 18 stations (20 stations x 2 pairs per station x 1.3 overbuild = 50 pairs).
2. No splices are allowed in an intra-building copper riser cable

D. Fiber Backbone - Outside Plant

1. Outside Plant Fiber shall be 24 strands of 8.3/125  $\mu\text{m}$  singlemode (CommScope) Single Jacket Single Armor Outdoor Cable. See Appendix A for approved products.
2. Maximum bending radius and maximum pulling tension of the cable as set forth by industry and Manufacturer guidelines (whichever is more stringent) shall be adhered to during handling and installation.
3. A 600 Foot maximum distance between pull points shall be permitted, with a maximum of 180 total degrees of turn between pull points.
4. Trace cable shall be provided in all conduit housing outside plant fiber.
5. No splices are allowed in an inter-building fiber cable.

E. Copper Backbone - Outside Plant

1. To be provided under the direction of Denison University Telephone Services and Physical Plant.

F. Fiber Connectors

1. Fiber connectors shall be standard LC connectors for Singlemode fiber, and LC connectors for Multimode fiber. All fiber shall be terminated.

## Horizontal Cabling Requirements

**Includes:** TR (Telecommunications Room) to Workstation or Device cable plant from existing TR termination equipment

1. Most existing Category 5 and Category 5e installations used blue as the standard color for their cabling. In order to distinguish it from these earlier installs, all new Category 6 installs will use green/teal colored sheathing. Otherwise, with approval from Owner, Contractor must use industry standard EIA/TIA color code and maintain consistent coding throughout the system installation. All copper cable shall be terminated to the TIA 568B standard's pinout.
  2. All new wireless access point installations shall use Category 6a cabling, which shall be blue. Each AP data install location shall contain 2 data connections.
  3. In renovation projects, contractor is responsible for all furniture moves and relocations required to place station wiring and outlets. No claims for excess labor will be permitted. In new building installs, contractor will complete work before furniture is installed.
- A. CAT 6 Plenum Cable
1. All cabling must be unshielded twisted pair certified to Category 6 (ANSI/TIA/EIA 568-B.2 and/or ISO/IEC 11801)) and must be stamped with the "UL Approved" mark.
  2. All cabling for use in the Owner horizontals must be fire retardant and approved for installation in air plenums as NEC Article 800 type CMP CommScope 75O4 Green/Teal sheath, in reels of 1000'. Inside plant cabling and wiring installations must comply with specifications outlined in REA PE-71. Any cable other than CommScope must be approved by Denison ITS.
  3. Unattached wire drops from ceiling are not acceptable.
  4. No splices are allowed in an intra-building station wiring.
  5. Each cable run including service loops is to be less than 250 ft.
- B. Connectors/Couplers/Adapters
1. No couplers or connectors shall be installed in non designated locations (for example in the ceiling)
- C. CAT 6 Non-Plenum Cable
1. All cabling must be unshielded twisted pair certified to Category 6 (ANSI/TIA/EIA 568-B.2 and/or ISO/IEC 11801)) and must be stamped with the "UL Approved" mark.

2. All cabling for use in the Owner non-plenum horizontals must be CommScope 75N4 Green/Teal sheath, in reels of 1000'. Inside plant cabling and wiring installations must comply with specifications outlined in REA PE-71. Any cable other than CommScope must be approved by Denison ITS.
3. Unattached wire drops from ceiling are not acceptable.
4. No splices are allowed in an intra-building station wiring.
5. Each cable run including service loops is to be less than 250 ft.

#### D. Faceplates/Jacks

1. Station cabling must terminate at the user end on eight-conductor 8P8C (RJ-45) jacks, Panduit Mini-Jack TX-6 Modular Jacks wired to the T568-B standard.
2. CAT6 Mini-Jacks shall be color coded to follow the same scheme for copper patch cable sheeting: Green patch cable should be used with a green jack. Blue patch cable should be used with a blue jack, ETC..
3. A minimum of 12" of slack but sheathed cable must be left on each run.
4. Faceplates must be labeled with colored icons and/or words to designate the type of outlets. (see section 17170 for cable labeling standards).
5. Faceplates shall be Panduit Classic series with labels. Color should be selected to best match existing electrical outlet faceplates, or color indicated by interior designer for new builds. White is encouraged.
6. Where floor boxes are required, preference is given for Panduit products, but floor box models and manufacturers will be selected on a per-application basis. No floor boxes may be used without the express written consent of Denison University Computing Services.
7. Panduit modular wall plates must be used where wall telephones are located. Any marks or disfigurement left from previous telephone equipment must be covered by the wall plates or repaired.

#### E. Copper Station Cords

1. Standard lengths (1,3,5,7,10,14,20 feet) for CAT 6.
2. Non-Standard lengths (over 20 feet) will be ordered as needed.
3. The following table specifies the color of the patch cord based on performance and purpose.

Connection Type	CAT 6	CAT 6a
Data/Phone Port	Green (GR)	NA
Wireless APs	NA	Blue (BU)
Surveillance Camera	Yellow (YL)	NA
Fire Panels / HVAC / Other Facilities Systems	Red (R)	NA

4. No patch cords bought will be less than CAT5e 350 MHz (No CAT5 or 5e 250 MHz). CAT6 is recommended when costs allow for CAT5e installations, and required for CAT6 network segments. CAT5E patch cords/jumpers are permitted only with the express consent of ITS.
5. Legacy cords shall be grandfathered in and replaced as early as is feasible, or in conjunction with horizontal cable upgrades or user system upgrades. Make note that earlier patch cable color rules of thumb are: Red – Student, Pink/Red - Crossover, Gray – Crossover, Gray – Admin / Staff / Faculty, Yellow – Student., but no level of consistency can be expected.

## -170 Testing, Identification and Administration

**Includes:** Labeling and documentation requirements for cable plant infrastructure and pathways.

### A. General

1. BICSI RCDD certification or sufficient experience to manage a project of this scope is required for the on-site project manager.
2. The Owner will be the sole judge of such qualification.

### B. Testing CAT 6

1. The System shall be installed at Owner's premises and fully tested at least three (3) weeks prior to cutover and the Contractor must certify in writing that the System has been thoroughly tested and is ready for cutover. The Owner reserves the right to have a representative present for all testing and/or to verify the results of all tests. (See also 270 and 370)
2. All locations must be tested after installation and a written accounting identifying the test results must be maintained by Contractor and delivered to the Owner. Testing must consist of (but is not limited to) continuity, polarity, and loop resistance.
3. Visual and operational inspections must be made to ensure that each location is free of defects.
4. Testing must include all tests and to standards required by EIA/TIA standards for Category 6 cable, cable manufacturer (CommScope), and cabling system manufacturer (Panduit) whichever is most stringent.
5. Any cable not meeting these standards shall be corrected or replaced at no cost to the Owner.
6. The Fluke handheld tester is the preferred testing tool for horizontal cable installations on campus
7. Results of all testing shall be submitted prior to acceptance in electronic (original Fluke data file).
8. In specific situations determined advantageous to the Owner, the Owner may enter into an agreement with the Contractor detailing specific procedural methodologies to be used by the Contractor when testing and providing test results to the Owner. Such an agreement does not free the Contractor from meeting all requirements outlined by this document.

### C. OTDR requirements

1. Testing must include all tests and to standards required by EIA/TIA standards, cable manufacturer (CommScope), and cabling system manufacturer (Panduit), whichever is most stringent.
2. Cables shall be tested at 850 nm and 1300 nm for multimode optical fiber cables. Cables shall be tested at 1310 nm and 1550 nm for singlemode optical fibers.
3. Testing procedures shall utilize "Method B" - One jumper reference.
4. Bi-directional testing of optical fibers is required.
5. Any cable not meeting these standards shall be corrected or replaced at no cost to the Owner.
6. Results of all testing shall be submitted prior to acceptance.

D. Large Cable count test results

1. If copper interbuilding cable contains more than 0.5% bad pairs, cable shall be replaced at no cost to the Owner.

E. Light Meter and Source

F. Labeling

1. All outlets must be marked with outlet ID according to a numbering plan as set forth by owner (see below).
2. Each cable, terminal enclosure, IDF appearance, cross connect panel, splice case, pull box and other equipment associated with the distribution system must be permanently imprinted with an identification tag. No handwritten or non-permanent labels are allowed. The cable identification plan must be distinct and provide color coding for each separate cable medium. Identification tags must be installed within 2 feet of each end of each cable.
3. Wire and cable identification must consist of self-laminating markers and all other identification must consist of approved high-performance materials. All labels must meet the performance requirements of UL 969 and conform to the labeling standards included in TIA-606.
4. All Owner locations covered by these information transport and infrastructure specifications must be labeled as follows:
  - a) Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.

- b) Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
    - 1) Inside receptacle box at the work area.
    - 2) Behind the communication room patch panel.
  - c) Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.
  - d) Use black text on white backgrounds for all labeling.
  - e) Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.
5. Distribution hardware (MCC and ICC) must be identified with pre-printed, adhesive letters.
  6. Distribution frames and station blocks must be marked and identified for all associated cable dpairs and media terminations.
  7. Labeling of horizontal cable must use the following format:

**FPD-C**

P - Patch Panel Letter Sequence A,B,C etc.]

F - [Floor 0 = Basement, Floor 1 = 1st Floor, etc.]

C – [Cable Identifier - Sequential, each additional cable gets new ID number]

D - [ telecommunication room Number - if multiple telecommunication room per floor]

**EXAMPLE:**

1A1-48

“1st Floor Patch Panel A telecommunication room 1 - port 48”

8. Labels shall be placed on both the termination (for port numbers) and faceplate sides.
  9. Labeling of riser cable ( telecommunication room to telecommunication room) shall identify the source and destination of the cabling.
  10. Inter-building/OSP cable and fiber shall be labeled as to the remote building associated and patch panel/jack number or termination block in that building’s entrance facility.
- G. Documentation/As-builts/Records
1. Both hard copies and electronic copies of floor plans showing conduit and cable pathways, outlet location, telecommunication room locations, cable densities, and where possible, port labels shall be provided upon the completion of installation work.
  2. The Owner will provide existing floor plans for markup with installations and additions.

## Cutover & Training

**Includes** : Requirements for migration and first use.

### A. Cutover

1. The Contractor shall submit a tentative cutover plan as part of the Implementation Plan.
2. Cutover shall be accomplished as quickly as possible so as to provide minimum disruption to the normal business activities of Owner. No disruption shall be permitted in critical areas.
3. Upon completion of successful cutover, the Contractor shall:
  - a) Immediately correct any problems and complete any installation tasks outstanding.
  - b) Complete any temporary work, re-route temporary cable, remove any rigging or temporary supports, etc.
  - c) Prepare a punch-list of any outstanding items to be addressed and submit said punch-list for the Owner's approval.
4. Once these tasks are completed and the punch-list approved by the Owner, the Contractor may request that the System be considered to be "substantially complete" and ready to begin the Acceptance Testing process (start the 30-day clock).

### B. Acceptance Testing

1. The Contractor shall provide at least three (3) weeks prior to cutover, a written plan acceptable to the Owner for final acceptance testing. **There shall be no provision for automatic acceptance.** This plan shall include the methodology for testing:
  - a) Plant installation including spare capacity.
  - b) Tone, test and label from the IDF to each station (continuity and polarity)
  - c) Restoration of buildings and grounds
  - d) Proper placement of cables
  - e) Grounding
  - f) Protection (surge and lightning)
  - g) Coring and wall penetration including proper fire stopping
  - h) Cable termination
  - i) Any other requirements of the contract.
2. In addition to the above, the Owner shall also perform an inspection of all equipment rooms, telephone closets, risers, etc., for cleanliness, labeling, and overall compliance.
3. The Owner shall also test at random assorted installations for overall operation, installation, labeling, etc.
4. "Acceptance Date" shall be defined as the date upon which the installation has passed all acceptance tests, all punch list items are completed, and all post-cutover documentation is received and the Owner delivers Notice of Acceptance of the installation to the Contractor.



### C. Training

1. After all final tests and adjustments have been completed and approved by the Design Professional/Owner, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. The Contractor shall supply qualified personnel to continuously operate all equipment for a period of 30 days to assure that Owner's Representatives are qualified to take over operation and maintenance procedures. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Manufacturer's representative shall conduct training on specialized electronic systems as described in Section 2 Special Technical Requirements.

## Support & Warranty

**Includes:** Defines support and warranty requirements for components and systems

### A. Support

1. Certified personnel shall be defined as those installation and repair personnel who have attended the manufacturer's training classes on the type and model equipment installed on premises, who have the proper experience and licenses for the work to be performed, and who are recognized by the manufacturer as "qualified" technical support personnel.
2. Only certified personnel as described above shall be considered as an adequate response to a failure.
3. The Contractor shall provide and update as necessary the list of applicable manufacturer certified installation/repair personnel. (See also 290 and 390)

### B. Warranty Data

1. The entire cabling system shall be warranted for a period of fifteen (15) years, such warranty to bind both the Contractor and manufacturer.

### C. Spare Parts

1. The inventory of such parts and supplies to be stocked within fifty (50) airline miles of (location) shall include at least two (2) of every field-replaceable component in the System plus additional quantities of those parts and supplies that have a higher than industry average mean time between failure rate or use rate. An emergency stockpile of all parts and supplies shall be maintained by the Contractor within six (6) transportation hours of (location) that shall include, besides at least ten (10) of each part of supply stocked at other locations, at least (2) of each of such normally inconsumable System elements as cabinet interface cables and circuit board or card shelves. (See also 290, 390, 490 - Spare Parts)

The following listing of campus standard parts is not to be considered as exclusive. As need dictates, and pending approval from Denison University Physical Plant and ITS, a more appropriate product from Panduit, CommScope, or another vendor may be used in a project. No substitutions will be allowed without approval of the Denison University ITS.

## Appendix A – Product Requirements

Denison has established pricing and package part numbers accessible through our Account Representative at Accu-Tech.

Area	Application	Required Product	Part Number
<b>Work Area</b>			
	Surface Mount Raceway	Panduit Pan-way	T-45 product line
	Office Furniture Raceway	Panduit Pan-way	Office product line
	Faceplates	Panduit Mini-Com Classic	CFPSL*IGY
<b>Horizontal Copper Cable Subsystem</b>			
	Cable CATEGORY 6 PLENUM RATED CABLE (1,000' REEL)	CommScope	7504 Green
	CATEGORY 6 NON-PLENUM PATCH RATED CABLE (1,000' REEL)	CommScope	75J4 Green
	CATEGORY 6 NON-PLENUM RATED CABLE (1,000' REEL)	CommScope	75N4 Green
	Racks 4 post (data or voice/data)	Panduit 4 Post (MDF)	AR4P

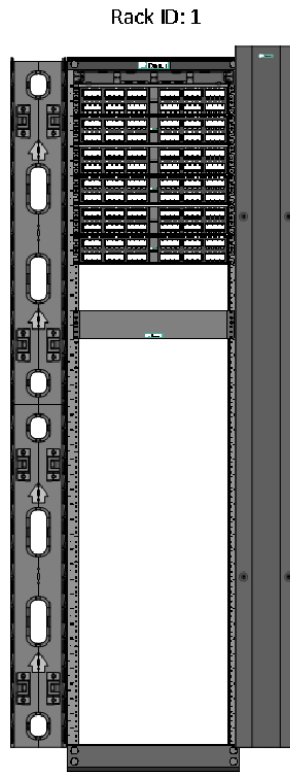
	2 post (IDF or MDF)	Panduit 2 Post (IDF)	R2P
	Patch Panels	Panduit Flush Mount Angled Patch Panels	CPP48FMWBLY CPP24FMWBLY
	Terminations (Jacks)	Panduit Min-Com (CAT6)	CJ688TG*  Mini-Com® UTP RJ45 Cat 6 TG Jack Module. *To designate color, add suffix: IW (Off White), replace IW suffix with WH (White), EI (Electric Ivory), WH (White), IG (International Gray), AW (Arctic White), BL (Black), BU (Blue), RD (Red), YL (Yellow), GR (Green), OR (Orange), VL (Violet), BR (Brown), GD (Gold), LB (Light Blue).
	Vertical wire management Dual Sided front and rear	Panduit Patch Runner 2	PR2VD06 or PR2VD08
	Horizontal wire management	Panduit Patch Runner	PR2HF2
	Cable Management accessories	Panduit J-Pro	J-Pro
	Cable Ties	Panduit Ultra-Cinch or Contour-Ty as applicable	UCT*S-X0 CBR2S-M
	Cable Tray & Raceway	Panduit Wire Basket Tray: The overhead cable tray routing system shall consist of pathway sections, splice connectors, sidewalls, waterfalls, mounting brackets, and accessories designed to route and manage copper, fiber optic, or	PWB4X18BL 18"x4" PWB4X24BL 24"x4" PWBSPLBL Bolt on Splice PWB^BL Trapeze Bracket. ^=Width

		power cables. The pathway sections shall be provided in the various widths: 4", 6", 8", 12", 18", 24". The baskets come in various wall heights: 2", 4", and 6" heights. Trapeze, cantilever, and wall mount brackets are available to support the system. Baskets, accessories, and components are available in black, electro zinc, and white	
	Strain Relief Bar	1 per patch panel installed	SRB19BL
	Ladder rack	Any as required	
	Patch cords (CAT6) - CAT 6 24AWG	24 AWG Copper Patch Cords. *Feet lengths: 1-50 feet (every 1 ft.) 50-130 (every 5 ft.) ^Color: BU (Blue), GR (Green), RD (Red), YL (Yellow)  Example: 10ft blue patch cable 5ft blue patch cable	UTPSP*^Y  UTPSP10BUY UTPSP5BUY

<b>Fiber Optic Distribution cable</b>			
	*Single Mode Fiber	CommScope	
	*Use OM3 Multimode Fiber	CommScope	
	Fiber Optic Enclosures	Panduit	FCE1U
<b>Grounding</b>			
	CBN Jumper Kit	Panduit	RGCBNJ660P22
	Rack Grounding Strip	Panduit	RGS134-1Y
	Equipment Jumpers	Panduit	GJS660U
	Retrofit Grounding	Panduit	RGRB19U

## Appendix B: Typical TR Drawing

Note:  
Panels should be labeled  
alphanumerically starting  
with "A" as the top panel.  
Thus, the very top panel in  
Rack 1 is "1A"



### Drawing Information

Building	<i>Building Name</i>
Floor	<i>Floor # such as 001</i>
Room	<i>Room ID #</i>
Contractor	<i>Contractor Name</i>
Drawing Date	<i>5-9-2011</i>